Final Environmental Assessment and Finding of No Significant Impact/Record of Decision

Amazon Prime Air
Drone Package Delivery Operations in Lockeford, California

November 2022

United States Department of Transportation
Federal Aviation Administration

Washington, D.C.

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Cover Image: Amazon Prime Air

DEPARTMENT of TRANSPORTATION

Federal Aviation Administration

Washington, D.C.

Notice of Availability of the Final Environmental Assessment and Finding of No Significant Impact/Record of Decision for Amazon Prime Air's Drone Package Delivery Operations in Lockeford, California

The Federal Aviation Administration (FAA) hereby gives Notice of Availability (NOA) for the Final Environmental Assessment (EA) and Finding of No Significant Impact/Record of Decision (FONSI/ROD) following the FAA's evaluation of the potential effects of the FAA decision to authorize Amazon Prime Air (Prime Air) to conduct unmanned aircraft (UA) commercial package delivery operations from one Prime Air Drone Delivery Center, or "PADDC," in Lockeford, California.

Prime Air is seeking to amend its Part 135 Air Carrier Operations Specifications (OpSpecs) to include package delivery operations from its PADDC in Lockeford to eligible delivery locations within four miles of the PADDC. The federal action subject to this EA is the requested FAA approval of Prime Air's amended OpSpecs to include a paragraph with descriptive language about the operating area boundaries, which includes the specific locations and operational profile in Amazon's request.

The Final EA has been prepared in accordance with the requirements set forth in the Council on Environmental Quality (CEQ) regulations at Title 40, Code of Federal Regulations (CFR), parts 1500-1508, *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act* and FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*. The Final EA reflects consideration of comments received during the public comment period for this EA, which was open from September 9, 2022 through September 22, 2022.

The Final EA and FONSI/ROD are available to view/download electronically at https://www.faa.gov/uas/advanced_operations/nepa_and_drones/

CONTACT INFORMATION: For any questions or to request a copy of the EA, please email 9-FAA-Drone-Environmental@faa.gov.

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DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

Finding of No Significant Impact/Record of Decision for Final Environmental Assessment for Amazon Prime Air Drone Package Delivery Operations in Lockeford, California

Introduction

The Federal Aviation Administration (FAA) prepared the attached Environmental Assessment (EA) to analyze the potential environmental impacts that may result from the FAA's amendment of the Part 135 air carrier Operations Specifications (OpSpecs) requested by Amazon Prime Air (Prime Air) to conduct drone package delivery operations in and around Lockeford, California, as a Part 135 air carrier (described in more detail in the Proposed Action section below). The requested approval would, among other things, add descriptive language to Prime Air's OpSpecs about operating area boundaries. This approval would enable Prime Air to conduct unmanned aircraft (UA)[1] commercial delivery operations from its Prime Air Drone Delivery Center (PADDC) to approved delivery locations within a radius of four miles from the PADDC. Operating boundaries are depicted in Figure 1 of the EA. The approval of Prime Air's OpSpecs amendment to include this operating area is considered a major federal action subject to National Environmental Policy Act (NEPA) review requirements.

The FAA prepared the EA in accordance with the National Environmental Policy Act of 1969, as amended (42 United States Code [U.S.C.] § 4321 et seq.); Council on Environmental Quality's (CEQ) NEPA implementing regulations (40 Code of Federal Regulations [CFR] parts 1500 to 1508); FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*; and FAA Order 1050.1F Desk Reference.

After reviewing and analyzing available data and information on existing conditions and potential impacts, and completing the EA, the FAA has determined that the proposed action will not significantly affect the quality of the human environment. Therefore, the preparation of an Environmental Impact Statement is not required, and the FAA is issuing this Finding of No Significant Impact (FONSI) and Record of Decision (ROD). The FAA has made this determination in accordance with applicable

[1] Drone and UA may be used interchangeably.

environmental laws and regulations. The EA is incorporated by reference into and supports this FONSI/ROD.

Purpose and Need

The FAA has multiple approvals associated with Prime Air's commercial delivery operations for the operating area. However, the FAA issuance of the OpSpecs is the approval that will ultimately enable UA commercial delivery operations in this area (as depicted in Figure 1 of the EA). Prime Air's OpSpecs request for operations in Lockeford requires FAA review and approval.[2] The FAA has a statutory obligation to review Prime Air's request to review the OpSpecs amendment request and determine whether the amendment would affect safety in air transportation or air commerce and the public interest. After making this determination, the FAA must take an action to amend the OpSpecs.

The purpose of Prime Air's request is to conduct its UA commercial deliveries under Part 135 operating conditions and demonstrate that it can conduct operations safely and meet its compliance obligations. The approval could also help Prime Air to further gauge public demand for UA commercial delivery services and evaluate whether scalable and cost-effective UA delivery expansion is possible in the area. Prime Air has determined that it needs the OpSpecs approval in order to safely conduct its commercial package delivery operations in Lockeford. Prime Air's request for OpSpecs and other approvals is needed so that Prime Air can conduct UA commercial delivery operations in the Lockeford operating area.

See Section 1.3 of the EA for further information.

Proposed Action

In order for Prime Air to conduct UA commercial package deliveries in a new location, it must receive a number of approvals from the FAA, such as a Certificate of Waiver or Authorization (COA) and amended OpSpecs. Prime Air has requested that the FAA approve its OpSpecs amendment in its Part 135 air carrier certificate; this is the FAA approval that ultimately would enable the commercial delivery operations in the operating area. The proposed action is the FAA amendment of the OpSpecs for Prime Air's B050 OpSpec, *Authorized Areas of En Route Operations, Limitations, and Provisions*, specifically a reference section titled Limitation, Provisions, and Special Requirements. The approval would include a paragraph with descriptive language about the operating area boundaries (depicted in Figure 1 of the

[2] Prime Air's Part 135 air carrier certificate was issued in August 2019.

attached EA), including the specific locations and operational profile proposed in Prime Air's request. The operating area is also the study area for the EA.

Under the scope of the proposed action (discussed in Section 2.1 of the attached EA), Prime Air projects operating a maximum of approximately 200 delivery flights per operating day, during daylight hours up to five days per week from the Lockeford PADDC. The Lockeford PADDC will support four sectors, with each sector having one takeoff and landing pad with its own dedicated operating area that can support up to five flights per hour. Only one aircraft in each sector can be airborne at any time.

The OpSpecs will restrict Prime Air to the operating areas identified in Figure 1 of the EA. The FAA's analysis was completed for the known PADDC location identified in Figure 1 of the EA. Any future expansion beyond the authorization and limitations for the area of operations described in the B050 OpSpec, or beyond the current 1:1 pilot to aircraft ratio described in Prime Air's A003 OpSpec, *Airplane/Aircraft Authorization*, will require additional OpSpec amendments from the FAA and will receive appropriate NEPA review at that time.

See Section 2.1 of the EA for further information.

Alternatives

Alternatives analyzed in detail in the EA include the proposed action and the no action alternative. Under the no action alternative, the FAA would not issue the approvals necessary to enable Prime Air to conduct UA commercial delivery operations in the Lockeford operating area. Under the no action alternative, Prime Air would not be authorized to conduct package delivery flights from the Lockeford PADDC. This alternative does not support the stated purpose and need.

See Section 2.2 of the EA for further information.

Environmental Impacts

The potential environmental impacts from the proposed action and no action alternative were evaluated in the attached EA for each of the environmental impact categories identified in FAA Order 1050.1.F. Section 3 of the attached EA describes the physical, natural, and human environment within the project study area, and identifies those environmental impact categories that are not analyzed in detail, explaining why the proposed action would have no potential effects on those environmental impact categories. Those categories are Air Quality; Climate; Coastal Resources; Farmlands; Hazardous Materials, Solid Waste, and Pollution Prevention; Land Use; Natural Resources and Energy Supply;

Socioeconomic Impacts and Children's Environmental Health and Safety Risks; Visual Effects (Light Emissions Only); Water Resources (Wetlands, Floodplains, Groundwater, and Wild and Scenic Rivers).

Section 3 also provides detailed evaluations of the potential environmental consequences for each of the remaining environmental impact categories and documents the finding that no significant environmental impacts would result from the proposed action. A summary of the documented findings for each category, including requisite findings with respect to relevant special purpose laws, regulations, and executive orders, is presented below:

- **Biological Resources (including Fish, Wildlife, and Plants), EA Section 3.2.** Biological resources include plant and animal species and their habitats, including special status species (federally listed or state-listed threatened or endangered species, species proposed for listing, species that are candidates for federal listing, marine mammals, and migratory birds) and environmentally sensitive or critical habitat. The Endangered Species Act (ESA) of 1973 requires the evaluation of all federal actions to determine whether a proposed action is likely to jeopardize any proposed, threatened, or endangered species or proposed or designated critical habitat. Federal agencies are responsible for determining if an action "may affect" listed species or critical habitat, which determines whether formal or informal consultation with the U.S. Fish and Wildlife Service (USFWS) and/or the National Marine Fisheries Service (NMFS) is needed. If the FAA determines that the action will have no effect on listed species, consultation is not required. If the FAA determines that the action may affect listed species, consultation with the USFWS must be initiated.

  The Migratory Bird Treaty Act of 1918 protects migratory birds, including their nests, eggs, and parts, from possession, sale, purchase, barter, transport, import, export, and take. The USFWS is the federal agency responsible for the management of migratory birds as they spend time in habitats of the U.S. The Bald and Golden Eagle Protection Act of 1940 prohibits anyone from "taking" a bald or golden eagle, including their parts, nests, or eggs, without a permit issued by the USFWS. The USFWS National Bald Eagle Management Guidelines, provide for additional protections against "disturbances." Similar to take, "disturb" means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, injury to an eagle or causes either a decrease in its productivity or nest abandonment due to a substantial interference with breeding, feeding, or sheltering.

Additionally, the California Fish and Game Commission lists species as endangered or threatened under the California Endangered Species Act (CESA). The California Fish and Game code prohibits the "take" of endangered or threatened species unless an incidental take permit is issued by the California Department of Fish and Wildlife. Under CESA "take" means to hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill. The proposed action will not require any incidental take permits under CESA. The proposed action will not involve ground construction or habitat modification, as the landing and take off locations are in places that are already developed. The operations will be taking place within airspace, and typically well above the tree line and away from sensitive habitats. The average number of daily operations and altitude of the flights (between 160 feet and 180 feet above ground level) are not expected to significantly influence wildlife behavior in the study area.

The EA identifies several special status bird species that could breed in the study area, including the Bald Eagle (see the U.S. Fish and Wildlife Service Information for Planning and Consultation report, or IPaC report, and official species list in Appendix A of the EA). Prime Air has stated to the FAA that it will monitor the operating area for any active Bald Eagle nests that may occur. If Prime Air identifies a Bald Eagle nest or is notified of the presence of a nest, Prime Air will establish an avoidance area such that there is a 1,000 feet vertical and horizontal separation distance between a vehicle's flight path and the nest. This avoidance area will be maintained until the end of the breeding season or until a qualified biologist indicates the nest has been vacated.

There is one ESA-listed mammal species and two insect species that could be present in the study area: the Riparian Brush Rabbit (*Sylvilagus bachmani riparius*), an endangered species, the Monarch Butterfly *(Danaus plexippus*), a candidate species, and the Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*), a threatened species. Additionally, the Giant Garter Snake (*Thamnophis gigas*), a threatened species, and the California Tiger Salamander (*Ambystoma californiense*), a threatened species, are identified in the official species list as having the potential to occur in the study area. There is no critical habitat within the operating area for any species.

The Monarch Butterfly, a candidate for federal listing, and the Valley Elderberry Longhorn Beetle, a threatened species, have the potential to occur in the operating area. Information regarding drone impacts on insects is limited and there have been no widespread negative

impacts identified in the scientific literature. Some research shows that Monarch Butterflies are not commonly observed at altitudes where Prime Air is proposing to operate. Valley Elderberry Longhorn Beetles are found in riparian habitat only in the vicinity of their host plant, the elderberry (Sambucus species such as the Sambucus mexicana). Prime Air would not be expected to conduct deliveries within close proximity to elderberry habitat and thus would have no effect on this species or its environment. Therefore, based on the information available and the limited scale of operations, the action is expected to have *no effect* on the Monarch Butterfly, Valley Elderberry Longhorn Beetle, or any other insect populations.

The Riparian Brush Rabbit, an endangered species, has the potential to occur in the operating area. While this species is typically found within the dense understory of oak forests along riparian corridors, there is a chance that, due to keen hearing capabilities of this species, they may be able to sense the UA if it were to fly over their habitat. Due to the typical altitudes where UA operations will take place, and the infrequent operations over any single point in the operating area, the FAA has determined that vehicle operations *may affect, but are not likely to adversely affect*, the Riparian Brush Rabbit. The FAA initated Section 7 consultation with the USFWS Sacramento Field Office regarding this determination, and received a response on November 8, 2022 concurring with the FAA's determination.

The Giant Garter Snake, a threatened species, and the California Tiger Salamander, a threatened species, also have the potential to occur in the operating area. However, due to the the limited ability of reptiles and amphibians to perceive air-borne noise, and because the noise levels produced by the UA would not be expected to produce ground vibrations, the FAA determined that there is no plausible route of effects to these species. As a result, the FAA has determined that the proposed action will have *no effect* on the Giant Garter Snake or California Tiger Salamander.

CESA-listed bird species may display disturbance behaviors towards drones, such as fleeing or attack maneuvers; however, the aircraft would complete its ascent and descent outside of forested areas, managed grasslands, and riparian habitat, and with a flight plan of 160-180 feet AGL would be well above the tree canopy and thus not a threat to nesting, roosting, or foraging habitat. Due to the limited scale of operations and the altitude of overflights, no significant impacts to state-protected bird species are expected. As the CESA definition of "take" does not include harassment, no state take permit is required.

- **Department of Transportation (DOT) Act, Section 4(f) Resources, EA Section 3.3.** Section 4(f) of the DOT Act protects significant publicly-owned parks, recreational areas, wildlife and waterfowl refuges, and public and private historic sites. Section 4(f) states that, subject to exceptions for de minimis impacts[3]: "The Secretary may approve a transportation program or project requiring the use of [4(f) resources]…only if—(1) there is no prudent and feasible alternative to using that land; and (2) the program or project includes all possible planning to minimize harm to the park, recreation area, wildlife and waterfowl refuge, or historic site resulting from the use." The term "use" includes both direct or physical and indirect or "constructive" impacts to Section 4(f) resources.

  The FAA identified several properties that could meet the definition of a Section 4(f) resource within the operating area, including Harmony Grove Church and Lockeford Memorial Park. There are several historic sites within each of the study areas, as identified on the California SHPO website; however, these sites are considered for architectural or other purposes that will not typically be affected by UA operations. There are no wildlife or waterfowl refuges within the study area.

  There will be no physical use of Section 4(f) resources under the proposed action. The FAA has determined that infrequent UA overflights as described in the proposed action would not cause substantial impairment to Section 4(f) resources, and therefore would not be considered a constructive use of any Section 4(f) resource. As described in the Section 3.5 of the EA and the Noise Analysis Report (Appendix C of the EA), noise and visual effects from Prime Air's occasional overflights are not expected to diminish the activities, features, or attributes of any resources in the study area. There will be no significant impacts to Section 4(f) resources as a result of the proposed action.

- **Historical, Architectural, Archaeological, and Cultural Resources, EA Section 3.4.** Section 106 of the National Historic Preservation Act (NHPA) of 1966 [54 U.S.C. § 306108] requires federal agencies to consider the effects of their undertakings on properties listed or eligible for listing in the National Register of Historic Places (NRHP). This includes properties of traditional religious

[3] The FAA may make a de minimis impact determination with respect to a physical use of Section 4(f) property if, after taking into account any measures to minimize harm, the result is either: (1) a determination that the project would not adversely affect the activities, features, or attributes qualifying a park, recreation area, or wildlife or waterfowl refuge for protection under Section 4(f); or (2) a Section 106 finding of no adverse effect or no historic properties affected. See 1050.1F Desk Reference, Paragraph 5.3.3

and cultural importance to an American Indian/Alaska Native (AI/AN) tribe or Native Hawaiian organization that meets the NRHP criteria. Compliance with Section 106 requires consultation with the State Historic Preservation Officer (SHPO) and applicable other parties, including AI/AN tribes and Native Hawaiian organizations. The FAA identified historic sites that were listed on the California SHPO website, which includes NRHP-listed and eligible properties as well as other properties of interest to the state. There are three properties listed on the NRHP within the operating area: Locke House and Barn, Locke's Meat Market, and Harmony Grove Church.[4] In accordance with 36 CFR § 800.4(a)(1), the FAA consulted with the California SHPO and with Buena Vista Rancheria of Me-Wuk Indians of California, California Valley Miwok Tribe, and the Tule River Indian Tribe of the Tule River Reservation Tribal Historic Preservation Officers (THPO) because they may potentially attach religious or cultural significance to resources in the APE. The FAA did not receive any responses or objections from the California SHPO or from the tribes. The FAA's tribal and historic outreach letters can be found in Appendix B of the EA.

Based on the nature of potential UA effects on historic properties - namely limited to non-physical, reversible impacts – as well as the limited number of daily flights in conjunction with the FAA's noise exposure analysis in Appendix C that concluded noise levels would not exceed Day-Night Average Sound Level DNL 45 in any location within the study area other than the PADDC property and a few properties immediately surrounding the PADDC, and in the immediate vicinity of locations that may receive a delivery, the FAA has determined that no historic properties or cultural resources would be affected by the proposed action.

- **Noise and Noise-Compatible Land Use, EA Section 3.5 and Appendix C.** The FAA has issued requirements for assessing aircraft noise in FAA Order 1050.1F, Appendix B. The FAA's required noise metric for aviation noise analysis is the yearly DNL metric. A significant noise impact is defined in Order 1050.1F as an increase in noise of DNL 1.5 decibel (dB) or more at or above DNL 65 dB DNL noise exposure or a noise exposure at or above the 65 dB level due to a DNL 1.5 dB or greater increase. While DNL is the primary metric the FAA uses to determine noise impacts, the agency also accepts the Community Noise Equivalent Level (CNEL) in California. CNEL adds a three times weighting (equivalent to a 4.77 dBA adjustment) for noise events occuring during the evening hours from 7:00 p.m. to 10:00 p.m. Since the proposed action will occur in California, and Prime Air plans to conduct a maximum of roughly 1,361 delivery operations per

[4] California Historic Resources. Available: https://ohp.parks.ca.gov/listedresources/. Accessed July 22, 2022

year between 7:00 p.m. to 10:00 p.m., the noise analysis results are presented in CNEL for average annual day (AAD) CNEL equivalent operations. The proposed action is not anticipated to result in any significant changes in the overall noise environment within the affected area. There is no construction and therefore no construction noise that will result from the proposed action. The maximum noise exposure levels within the study area will occur at PADDC property, a few properties immediately surrounding the PADDC, and in the immediate vicinity of locations that may receive a delivery. The maximum noise exposure levels within the study area will occur at the PADDC site; where noise levels at or above CNEL 45 dB would extend approximately 1,150 feet from the Lockeford PADDC and noise levels at or above CNEL 65 dB would extend approximately 100 feet from the PADDC. The extent of CNEL 45 dB and greater noise exposure for the PADDC is shown in Figure 4 of the EA.

For delivery operations, the estimated noise exposure for the anticipated maximum number of deliveries at a delivery location, including en route overflights, would be CNEL 58 dB. The noise exposure for delivery operations is presented in Table 3-2 of the EA.
For en route operations, the estimated noise exposure for en route flight paths would not exceed DNL 45 dB at any location within the study area.

Based on FAA's noise analysis, the proposed action will not have a significant noise impact.

- **Environmental Justice, EA Section 3.6.** Executive Order (EO) 12898, *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations*, Section 1-101 requires all federal agencies, to the greatest extent practicable and permitted by law, to make achieving environmental justice part of its mission by identifying and addressing disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations.

  Based on census block data, obtained through the FAA's Aviation Environmental Design Tool (AEDT), the percentage of low-income individuals residing within the study area at the census block group level is approximately 8.38 percent as compared to 14.75 percent in the reference community. Since the percentage of low-income individuals was lower in the study area than the reference community, the FAA determined there was not a low-income population present.

  The percentage of minority individuals residing within the study area at the census block group level, approximately 43.25 percent, is lower than that of the reference community, which is

approximately 67.38 percent. Based on the analysis, the FAA determined that there was not a minority population present since the percentage of minorities residing within the study area is both less than 50 percent and is not meaningfully greater than the percentage of minorities residing within the reference community.

The FAA's AEDT analysis data is included in Appendix F of the EA.

The proposed action will not result in adverse impacts in any environmental resource category. In particular, as noted in Section 3.5, *Noise and Noise-Compatible Land Use*, the UA's noise emissions could be perceptible in areas within the operating area but will stay well below the level determined to constitute a significant impact. As described in Section 3.7, *Visual Effects (Visual Resources and Visual Character)*, there are not expected to be significant adverse visual impacts since any UA en route would be observable only for a short time by an observer on the ground. Additionally, since the FAA did not identify a low income or minority population in the study area, the FAA determined that the proposed action would not result in a disproportionately high and adverse effect on a low-income or a minority population.

Visual Effects (Visual Resources and Visual Character), EA Section 3.7. Visual resources and visual character impacts deal with the extent to which the proposed action would result in visual impacts to resources in the operating area. Visual impacts can be difficult to define and evaluate because the analysis is generally subjective, but are normally related to the extent that the proposed action would contrast with, or detract from, the visual resources and/or the visual character of the existing environment. Impacts to visual resources from the proposed action are not expected to be significant. The proposed action makes no changes to any landforms, or land uses, thus there would be no effect to the visual character of the area. The proposed action is unlikely to result in visual impacts anywhere in the study area, including sensitive areas such as Section 4(f) properties where the visual setting is an important resource of the property. However, the short duration that each UA flight could be seen from any particular resource in the operating area combined with the low number of proposed flights per day minimizes any potential for significant impacts. Accordingly, any potential impacts of the proposed action on visual resources and visual character will not be significant.

- **Water Resources (Surface Waters), EA Section 3.8.** Surface water resources generally consist of oceans, wetlands, lakes, rivers, and streams. The Clean Water Act (CWA) established the

National Pollutant Discharge Elimination System (NPDES) program, which regulates the discharge of point sources of water pollution into waters of the United States and requires a permit under Section 402 of the CWA. Waters of the United States are defined by the CWA and are protected by various regulations and permitting programs administered by the Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers.

Approximately 0.46 square miles of surface waters occur within the operating area, based on the EJSCREEN report for this proposed action (Appendix E). As there are no construction activities occurring under the proposed action that could impact surface waters, the proposed action would not be expected to result in impacts to surface water resources. While it is highly unlikely for one of Prime Air's aircraft to crash, and even less likely for a crash to happen within a surface water, the EA considers the potential effects of a drone crashing into surface waters covered by the CWA. Prime Air is a certificated Part 135 air carrier and must comply with all applicable regulatory requirements. This includes compliance with requirements to notify the FAA and/or NTSB in accordance with regulatory requirements in the event of an aircraft accident. Prime Air's FAA-accepted checklists include procedures to notify local emergency services in the event of an accident or incident. In accordance with 14 CFR Part 135.23(d), Prime Air is required to locate and secure any downed aircraft pending guidance from the FAA or NTSB. In addition, the lithium-ion battery packs are well-secured within the aircraft, and are not expected to detach from the aircraft or become lost in the event of an incident. For these reasons, the proposed action would not have the potential to exceed water quality standards established by federal, state, local, and tribal regulatory agencies; or contaminate public drinking water supply such that public health may be adversely affected.

The proposed action would not be anticipated to result in cumulative impacts to environmental resources within the operating area.

Public Involvement and Coordination

The Draft EA was made available for public review. The public Notice of Availability (NOA) was distributed on September 9, 2022 to local interest groups, government officials, Section 4(f) resource authorities, community points of contact as provided by Amazon, and the SHPO and THPOs (see section 5.0 of the EA). The Draft EA was available of the FAA's website and was open for comment from

September 9, 2022 through September 22, 2022. The FAA received several comments during the comment period for this EA. Appendix G in the EA contains the public comments and FAA responses.

Finding

The FAA finding is based on a comparative examination of environmental impacts for each of the alternatives studied during the environmental review process. The EA discloses the potential environmental impacts for each of the alternatives and provides a full and fair discussion of those impacts. Based on the FAA's review and analysis and consideration of comments, it has determined that there would be no significant impacts to the natural environment or surrounding population as a result of the proposed action.

The FAA believes the proposed action best fulfills the purpose and need identified in the EA. In contrast, the no action alternative fails to meet the purpose and need identified in the EA. An FAA decision to take the required actions and approvals is consistent with its statutory mission and policies supported by the findings and conclusions reflected in the environmental documentation and this FONSI.

After careful and thorough consideration of the facts contained herein and following consideration of the environmental impacts described, the undersigned finds that the proposed federal action is consistent with existing national environmental policies and objectives as set forth in section 101(a) of the National Environmental Policy Act of 1969 and other applicable environmental requirements and will not significantly affect the quality of the human environment or otherwise include any condition requiring consultation pursuant to Section 102(2)(C) of NEPA.

Decision and Order

The FAA recognizes its responsibilities under NEPA, CEQ regulations, and its own directives. Recognizing these responsibilities, I have carefully considered the FAA's goals and objectives in reviewing the environmental aspects of the proposed action to approve Prime Air's request to conduct its UA commercial delivery operations in the four operating areas. Based upon the above analysis, the FAA has determined that the proposed action meets the purpose and need.

The environmental review included the purpose and need to be served by the proposed action, alternatives to achieving them, the environmental impacts of these alternatives, and conditions to preserve and enhance the human environment. This decision is based on a comparative examination of the environmental impacts for each of these alternatives. The attached EA provides a fair and full discussion of the impacts of the proposed action. The NEPA process included appropriate consideration

for avoidance and minimization of impacts, as required by NEPA, the CEQ regulations, and other special purpose environmental laws, and appropriate FAA environmental orders and guidance.

The FAA has determined that environmental concerns presented by interested agencies and the general public have been addressed in the EA. The FAA believes that, with respect to the proposed action, the NEPA requirements have been met. FAA approval of this environmental review document indicates that applicable federal requirements for environmental review of the proposed action have been met.

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

Issued on: November 10, 2022

MARK GIRON Digitally signed by MARK GIRON
Date: 2022.11.10 14:46:08 -05'00'

Mark Giron
Aviation Safety
Manager, Operations Group
General Aviation and Commercial Division
Office of Safety Standards, Flight Standards Service

Right of Appeal

This FONSI/ROD constitutes a final agency action and a final order taken pursuant to 49 U.S.C. §§ 40101 et seq., and constitutes a final order of the FAA Administrator which is subject to exclusive judicial review by the Courts of Appeals of the United States in accordance with the provisions of 49 U.S.C. § 46110. Any party having substantial interest in this order may apply for a review of the decision by filing a petition for review in the appropriate U.S. Court of Appeals no later than 60 days after the order is issued in accordance with the provisions of 49 U.S.C. § 46110.

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1.0 PURPOSE AND NEED

1.1 Introduction

Amazon Prime Air (Prime Air) is seeking to amend its air carrier Operations Specifications (OpSpecs) and other Federal Aviation Administration (FAA) approvals necessary to begin unmanned aircraft (UA) commercial package delivery operations from one Prime Air Drone Delivery Center (PADDC) located in Lockeford, California, using its 87-pound MK27-2 UA.[1] The Prime Air UA can carry packages weighing up to five pounds, and has a maximum takeoff weight of approximately 92 pounds. Prime Air projects operating a maximum of approximately 200 delivery flights per operating day over 260 operating days per year, for a total of roughly 52,000 annual delivery operations from the Lockeford PADDC based on the scope of the proposed action, discussed in Section 2.1. The operating area is divided into four sectors, with each sector having a maximum of approximately 50 delivery flights per operating day. Operations from the Lockeford PADDC would occur during daylight hours up to five days per week.[2] The FAA's amendment to Prime Air's OpSpecs to include this new operating area is considered a major federal action subject to environmental review requirements.

This Environmental Assessment (EA) is being prepared by the FAA to evaluate the potential environmental impacts that may result from FAA's approval of the proposed action, which would enable UA commercial delivery operations from a PADDC located at 12405 East Brandt Road, Lockeford, CA. The circle-shaped operating area has a radius of four miles from the PADDC, and is approximately 50.26 square miles in area. The operating area, which is also the study area for this EA, is depicted in Figure 1 (the study area).

The FAA has prepared this EA pursuant to the National Environmental Policy Act of 1969 (NEPA) [42 United States Code (U.S.C.) § 4321 et seq.] and its implementing regulations (40 Code of Federal Regulations (CFR) §§1500-1508)). Under NEPA, federal agencies are required to consider the environmental effects of proposed federal actions and to disclose to decision-makers and the interested public a clear and accurate description of the potential environmental impacts of proposed major federal actions. Additionally, under NEPA, federal agencies are required to consider the environmental effects of a proposed action, the reasonable alternatives to the proposed action, and a no action alternative (assessing the potential environmental effects of not implementing the proposed action). The FAA has established a process to ensure compliance with the provisions of NEPA through FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures* and the FAA Order 1050.1F Desk Reference.

1.2 Background and Location

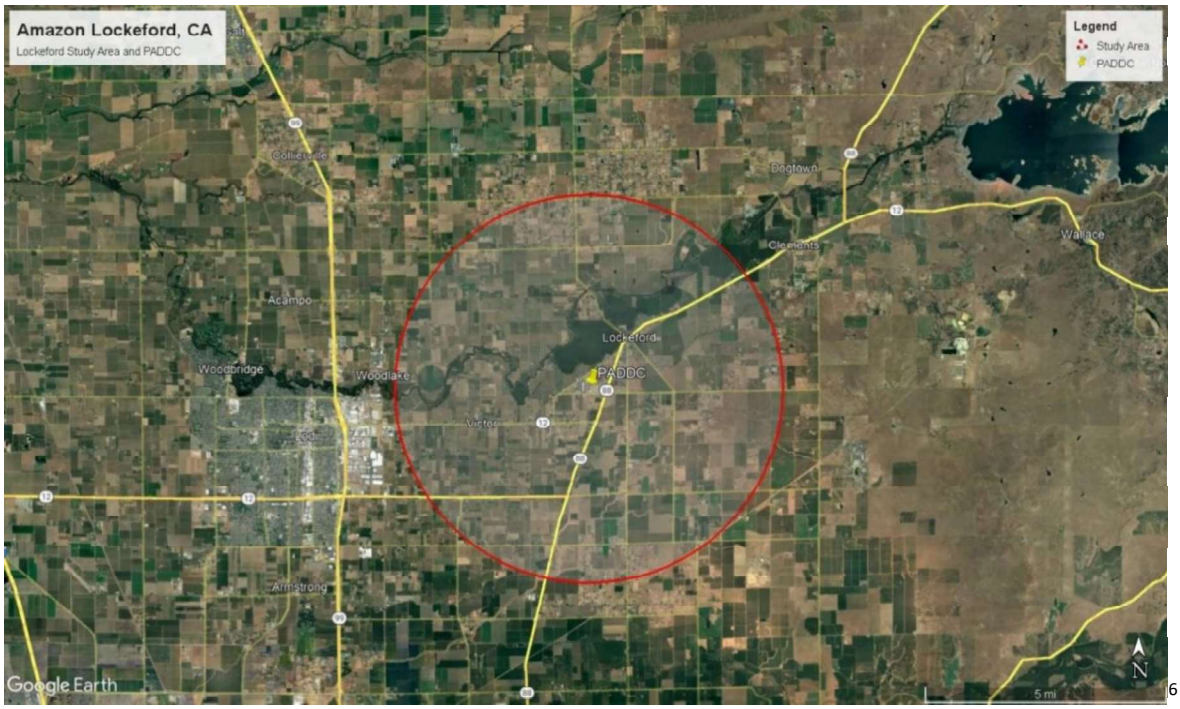
In 2012, Congress first charged the FAA with integrating unmanned aircraft systems (UAS) into the National Airspace System (NAS).[3] The FAA has engaged in a phased, incremental approach to integrating UAS into the NAS and continues to work toward full integration of UAS into the NAS. Part of that approach involves providing safety review and oversight of proposed operations to begin commercial UA delivery in the NAS.[4]

[1] An Amazon PADDC is a ground based service area where UA are assigned and where flights originate and return.
[2] Daylight hours of operation include approximately 30 min before sunrise to approximately 30 min after sunset.
[3] 49 U.S.C. 44802; FAA Modernization and Reform Act of 2012, Pub. L. No. 112-95, Sec. 332. 126 Stat. 11, 73 (2012).
[4] The terms UA and drone may be used interchangeably.

Over the past several years, Prime Air has been working under various FAA programs, including the Partnership for Safety Plan (PSP) Program,[5] as well as the FAA's established processes to bring certificated commercial UA delivery into practice. Participants in these programs are among the first to prove their concepts, including package delivery by UA, through the use of current regulations and exemptions and waivers from some of these regulatory requirements.

In 2020, Prime Air received its Part 135 air carrier operating certificate, which allows it to carry the property of another for compensation or hire. The certificate contains a stipulation that operations must be conducted in accordance with the provisions and limitations specified in its OpSpecs. Prime Air's current request for OpSpecs to specify an area of operations, in conjunction with other related FAA approvals, such as a Certificate of Waiver or Authorization (COA), would enable commercial delivery operations in the operating area.

The operating area will include parts of Lockeford, Lodi, Victor, and Acampo, California, and is shown in Figure 1 below. The operating area is outlined in red and the PADDC location is identified using the yellow pin. The western side of the operating area extends just to the edge of the City of Lodi, and the eastern side of the operating area is approximately 0.75 miles from Clements Road. State Route 88 runs through the operating area from the northeast corner to the southwest corner. The northern edge of the circle just overlaps East Jahant Rd by approximately 405 feet and the southern edge of the circle is approximately 0.72 miles from Live Oak Road. There are no airports or heliports in the operating area. The operating area is the study area for the purposes of this EA.



[6]

Figure 1 Study Area with PADDC in the Center

[5] https://www.faa.gov/uas/programs_partnerships/psp/

[6] Image: Google Earth, as modified by the FAA

1.2.1 PADDC Location

The PADDC is located in an industrial area in Lockeford, CA, within San Joaquin County. The PADDC facility includes a warehouse building with office space, restrooms, mother's room, ground control station, aircraft maintenance area, battery storage area, parking, truck loading areas, landscaped grounds, paved departure and arrival pads, and perimeter fencing. The PADDC site is zoned as General Industrial (I-G) per the San Joaquin County Zoning Code. The PADDC is located near the intersection of Brandt Road and Locke Road with State Route 88 approximately 2,000 feet east of the site. The properties adjacent to the PADDC are a mix of privately-owned industrial, agricultural, commercial, and residential uses. The closest residential neighborhood is approximately 0.5 miles from the site. Prime Air proposes to conduct deliveries from this PADDC location to vetted delivery sites such as private residences and commercial facilities.[7] See Figures 2 and 3 below.

[8]

Figure 2 Prime Air's PADDC Location in Lockeford, CA

[7] Each delivery site is deemed eligible by Amazon to ensure that the area is capable of receiving deliveries.

[8] Image: Google Earth, as modified by the FAA

[9]

Figure 3 Closer View of Prime Air's PADDC Location in Lockeford, CA

1.3 Purpose and Need

As described in FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*, the Purpose and Need section of an EA briefly describes the underlying purpose and need for the proposed federal action. It presents the problem being addressed and describes what the FAA is trying to achieve with the proposed action.

1.3.1 FAA Purpose and Need

Prime Air is seeking to amend its Part 135 air carrier OpSpecs and other FAA approvals necessary to begin UA commercial package delivery operations in Lockeford. The FAA has multiple approvals associated with the operations in the Lockeford region; however, the FAA amendment of the OpSpecs is the approval that will ultimately enable UA commercial delivery operations in this area. Prime Air's request for OpSpecs to add a new area of operations requires FAA review and approval.

The FAA has a statutory obligation to review Prime Air's request to amend the OpSpecs and determine whether the amendment would affect safety in air transportation or air commerce and whether the public interest requires the amendment. In general, Congress has charged the FAA with the safety of air commerce in the United States and to encourage the development of civil aeronautics. 49 U.S.C. § 40104.

In addition, the FAA has specific statutory and regulatory obligations related to its issuance of a Part 135 certificate and the related OpSpecs. The FAA is required to issue an operating certificate to an air carrier when it "finds, after investigation, that the person properly and adequately is equipped and able to operate safely under this part and regulations and standards prescribed under this part." 49 U.S.C. § 44705. An operating certificate also specifies "terms necessary to ensure safety in air transportation;

[9] Image: Google Earth, as modified by the FAA

and (2)…the places to and from which, and the airways of the United States over which, a person may operate as an air carrier." *Id*. Also included in air carrier certificates is a stipulation that the air carrier's operations must be conducted in accordance with the provisions and limitations specified in OpSpecs. 14 CFR § 119.5(g),(l). The regulations also specify that a Part 135 certificate holder may not operate in a geographical area unless its OpSpecs specifically authorize the certificate holder to operate in that area. 14 CFR § 119.5(j). The regulations implementing Section 44705 specify that an air carrier's approved OpSpecs must include, among other things, "authorization and limitations for routes and areas of operations." 14 CFR § 119.49(a)(6). An air carrier's OpSpecs may be amended at the request of an operator if the FAA "determines that safety in air commerce and the public interest allows the amendment." 14 CFR § 119.51(a); see also 49 U.S.C. § 44709. After making this determination, the FAA must take an action on the OpSpec amendment.

1.3.2 Amazon Prime Air's Purpose and Need

The purpose of Prime Air's request is to begin UA commercial delivery service in Lockeford, CA, which, in its business judgment, Prime Air has determined is an appropriate market for commercial delivery operations. Prime Air's requested OpSpec amendments are needed so that Prime Air can begin UA commercial delivery operations from its Lockeford PADDC location. The approval will offer Prime Air an opportunity to further assess the viability of the UA commercial delivery option under real world conditions and demonstrate that it can conduct operations safely and meet its compliance obligations. The approval could also help Prime Air gauge public demand for UA commercial delivery services and evaluate whether scalable and cost-effective UA delivery expansion is possible in this area. In addition, the approval could provide an opportunity to assess community response to commercial delivery operations in this area.

1.4 Public Involvement

The Draft EA was made available for public review. The public Notice of Availability (NOA) was distributed on September 9, 2022 to local interest groups, government officials, Section 4(f) resource authorities, community points of contact as provided by Prime Air, and the SHPO and THPOs (see section 5.0 of the EA). The Draft EA was available on the FAA's website and was open for comment from September 9, 2022 through September 22, 2022. The FAA received several comments during the comment period for this EA. Appendix G contains the public comments and the FAA's responses.

2.0 PROPOSED ACTION AND ALTERNATIVES

FAA Order 1050.1F, Paragraph 6-2.1(d) states that, "[a]n EA may limit the range of alternatives to the proposed action and no action alternative when there are no unresolved conflicts concerning alternative uses of available resources." The FAA has not identified any unresolved conflicts concerning alternative uses of available resources associated with Prime Air's proposal. Therefore, this EA only considers the proposed action and the no action alternative.

2.1 Proposed Action

In order for Prime Air to conduct UA commercial package deliveries in a new location, it must receive a number of approvals from the FAA, such as a COA and amended OpSpecs. Prime Air has requested the FAA to approve its OpSpec amendment so that they can begin UA commercial delivery operations in this new operating area. The OpSpec amendment is the FAA action that ultimately would enable commercial delivery operations in the operating area, located in central California. Initial operations would be conducted within visual line of sight using visual observers (VOs); however, with subsequent certifications of its detect and avoid technology anticipated in the future, Prime Air intends to operate beyond visual line of sight (BVLOS). The analysis in this EA includes any effects from operating BVLOS within the operating area.

The B050 OpSpec, *Authorized Areas of En Route Operations, Limitations, and Provisions*, includes a reference section titled Limitations, Provisions, and Special Requirements. The FAA's approval of this OpSpec amendment – including the paragraph in the B050 OpSpec's reference section with descriptive language about the operating area boundaries, including the specific location and operational profile proposed in Prime Air's request – is the proposed federal action for this EA. The B050 OpSpec will restrict Prime Air to this particular location; any future expansion beyond the authorization and limitations for the area of operations described in the B050 OpSpec, or beyond the current 1:1 pilot to aircraft ratio described in Prime Air's A003 OpSpec, *Airplane/Aircraft Authorization*, will require additional OpSpec amendments from the FAA and will receive appropriate NEPA review at that time.

2.1.1 Description of Proposed Operations

Prime Air projects operating a maximum of approximately 200 delivery flights per operating day, up to five days per week, from the Lockeford PADDC. These operational levels would result in a projected total of approximately 260 operating days and 52,000 delivery operations per year based on the scope of the proposed action. The Lockeford PADDC will support four sectors, with each sector having one takeoff and landing pad with its own dedicated operating area that can support up to five flights per hour. Only one aircraft in each sector can be airborne at any time. The operations would occur during daylight hours up to five days per week. Delivery flights may occur during evening hours, but not before nighttime and never after 10 p.m. No nighttime deliveries are anticipated or requested under the proposed action. Delivery operations are anticipated to be distributed rather evenly across the four PADDC sectors.

2.1.2 Description of UA

The UA has a maximum takeoff weight of 91.5 pounds, including a maximum payload of five pounds. It is a hybrid multicopter-fixed wing drone that uses electric power from rechargeable lithium ion batteries. It is launched vertically using powered lift, and converts to using wing lift during en route flight.

2.1.3 Description of Delivery Operations

After launch, Prime Air's UA will rise to an altitude below 400 feet above ground level (AGL) and follow a preplanned route to its delivery site. Aircraft will typically fly en route at approximately 160-180 feet AGL, except when descending to drop a package. Packages are carried internally in the aircraft's fuselage, and are dropped by opening a set of payload doors on the aircraft. When making a delivery, the UA descends and packages are dropped to the ground from approximately 13 feet AGL. Prime Air's aircraft will not touch the ground in any other place than the PADDC (except during emergency landings), since it remains airborne while conducting deliveries. After the package is dropped the UA then climbs vertically and follows the preplanned route to return for landing at the PADDC.

2.2 No Action Alternative

The alternative to the proposed action is the no action alternative, in which the FAA would not issue the approvals necessary to enable Prime Air to conduct UA commercial package delivery operations in the Lockeford operating area. Council on Environmental Quality (CEQ) regulations at 40 CFR § 1502.14(c) require agencies to consider a no action alternative in their NEPA analyses. Under the no action alternative, Prime Air would not be authorized to conduct package delivery flights from the Lockeford PADDC. This alternative does not support the stated purpose and need.

3.0 AFFECTED ENVIRONMENT and ENVIRONMENTAL CONSEQUENCES

This section provides a description of the environmental resources that would be affected by the proposed action, as required by the CEQ regulations and FAA Order 1050.1F. The level of detail provided in this section is commensurate with the importance of the impact on these resources (40 CFR § 1502.15). The study area for each resource is the entire area within the red-lined boundary of Figure 1 in this report. As required by FAA Order 1050.1F, this EA presents an evaluation of impacts for the environmental impact categories listed below.

- Air Quality
- Biological Resources (including Fish, Wildlife, and Plants)
- Climate
- Coastal Resources
- Department of Transportation Act, Section 4(f) Resources
- Farmlands
- Hazardous Materials, Solid Waste, and Pollution Prevention
- Historical, Architectural, Archaeological, and Cultural Resources
- Land Use
- Natural Resources and Energy Supply
- Noise and Noise-Compatible Land Use
- Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks
- Visual Effects (Light Emissions)
- Water Resources (including Wetlands, Floodplains, Surface Waters, Groundwater, and Wild and Scenic Rivers)

For each of the resources covered in this section, the following information is provided:

- Regulatory Setting
- Affected Environment
- Environmental Consequences

3.1 Resources Not Analyzed in Detail

This EA does not analyze potential impacts on the following environmental impact categories in detail, for the reasons explained below:

- **Air Quality and Climate** – The drone is battery-powered and will not generate emissions that could result in air quality impacts or climate impacts. Electricity consumed for battery charging at the PADDC and for overall PADDC operation will be minimal, especially for the limited scope

of these operations. Electricity consumed for the proposed action will come from the power grid, with an emergency generator at the PADDC location for backup.

- **Coastal Resources** – The proposed action would not directly affect any shorelines, change the use of shoreline zones, or be inconsistent with any National Oceanic and Atmospheric Administration (NOAA)-approved state Coastal Zone Management Plan (CZMP) since there are no coastal zones or shorelines in the area of operations.

- **Farmlands** – The proposed action will not involve the development or disturbance of any land regardless of use, nor would it have the potential to convert any farmland to non-agricultural uses.

- **Hazardous Materials, Solid Waste, and Pollution Prevention** – The proposed action will not result in any further construction or development or any physical disturbances of the ground, beyond what was already constructed without the need for FAA approval. Therefore, the potential for impact in relation to hazardous materials, pollution prevention, and solid waste is not anticipated. Additionally, each Prime Air UA is made from recoverable materials and will be properly managed at the end of its operating life in accordance with 14 CFR Part 43. There were no Superfund sites identified in the study area.

- **Land Use** – The proposed action will not involve any changes to existing, planned, or future land uses within the area of operations.

- **Natural Resources and Energy Supply –** The proposed action will not require the need for unusual natural resources and materials, or those in short supply. Prime Air's aircraft will be battery powered and will not consume fuel resources.

- **Socioeconomic Impacts and Children's Environmental Health and Safety Risks** – The proposed action will not involve acquisition of real estate, relocation of residents or community businesses, disruption of local traffic patterns, loss in community tax base, or changes to the fabric of the community. Executive Order (EO) 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, requires federal agencies to ensure that children do not suffer disproportionately from environmental or safety risks. The proposed action will not affect products or substances that a child would be likely to come into contact with, ingest, use, or be exposed to, and would not result in environmental health and safety risks that could disproportionately affect children. Additionally, Prime Air's proposal includes avoiding operations near schools during operational hours, which will help reduce the potential for environmental health or safety impacts to children.

- **Visual Effects (Light Emissions Only)** – The proposed action will not result in significant light emission impacts because flights will not be conducted during the nighttime.

- **Water Resources (Wetlands, Floodplains, Groundwater, Wild and Scenic Rivers)** – The proposed action will not result in any further construction of facilities and would not encroach upon areas designated as navigable waters or directly impact wetlands. The proposed action will not encroach upon areas designated as a 100-year flood event area as described by the Federal Emergency Management Agency (FEMA). The proposed action will not result in any changes to existing discharges to water bodies, create a new discharge that would result in impacts to surface waters, or modify a water body. The proposed action does not involve land acquisition or ground disturbing activities that would withdraw groundwater from underground aquifers or reduce infiltration or recharge to ground water resources through the introduction of new

impervious surfaces. The proposed action would not affect any river segments in the Wild and Scenic River System (WSRS) as there are no WSRS river segments nearby. Additionally, the proposed action would not affect any river segments in the Nationwide Rivers Inventory (NRI) as the nearest NRI river segment is the Cosumnes River that is approximately 10.4 miles from the operating area boundary.

3.2 Biological Resources (Including Fish, Wildlife and Plants)

3.2.1 Regulatory Setting

Biological resources include plant and animal species and their habitats, including special status species (federally listed or state-listed threatened or endangered species, species proposed for listing, species that are candidates for federal listing, marine mammals, and migratory birds) and environmentally sensitive or critical habitat. In addition to their intrinsic values, biological resources provide aesthetic, recreational, and economic benefits to society.

Threatened and Endangered Species

The Endangered Species Act (ESA) of 1973 [16 U.S.C. § 1531 et seq.] requires the evaluation of all federal actions to determine whether a proposed action is likely to jeopardize any proposed, threatened, or endangered species or proposed or designated critical habitat. Critical habitat includes areas that will contribute to the recovery or survival of a listed species. Federal agencies are responsible for determining if an action "may affect" listed species, which determines whether formal or informal consultation with the U.S. Fish and Wildlife Service (USFWS) and/or the National Marine Fisheries Service (NMFS) is needed. If the FAA determines that the action will have no effect on listed species, consultation is not required. If the FAA determines that the action may affect listed species, consultation with the USFWS must be initiated.

A significant impact to federally-listed threatened and endangered species would occur when the USFWS or NMFS determines that the proposed action would be likely to jeopardize the continued existence of a federally-listed threatened or endangered species, or would be likely to result in the destruction or adverse modification of federally-designated critical habitat. An action need not involve a threat of extinction to federally-listed species to meet the NEPA standard of significance. Lesser impacts including impacts on non-listed or special status species could also constitute a significant impact.

Migratory Birds

The Migratory Bird Treaty Act (16 U.S.C. §§ 703-712) protects migratory birds, including their nests, eggs, and parts, from possession, sale, purchase, barter, transport, import, export, and take. The USFWS is the federal agency responsible for the management of migratory birds as they spend time in habitats of the U.S. For purposes of the Migratory Bird Treaty Act, "take" is defined as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect" (50 CFR § 10.12). The Migratory Bird Treaty Act applies to migratory birds identified in 50 CFR § 10.13 (defined hereafter as "migratory birds").

Bald and Golden Eagles

The Bald and Golden Eagle Protection Act prohibits anyone from "taking" a bald or golden eagle, including their parts, nests, or eggs, without a permit issued by the USFWS. Implementing regulations (50 CFR § 22), and USFWS guidelines as published in the National Bald Eagle Management Guidelines, provide for additional protections against "disturbances." Similar to take, "disturb" means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, injury to an eagle or causes

either a decrease in its productivity or nest abandonment due to a substantial interference with breeding, feeding, or sheltering. A permitting process provides limited exceptions to the Bald and Golden Eagle Protection Act's prohibitions. The USFWS has issued regulations for the permitting process in 50 CFR Part 22, which include permits for the incidental take of Bald Eagles. Such permits are only needed when avoidance of incidental take is not possible. According to federal guidelines, if conservation measures can be implemented such that no aircraft are flown within 1,000 feet of a nest, incidental take of Bald Eagles is unlikely to occur and no permit is needed.[14]

3.2.2 Affected Environment

This section describes the existing biological environment of the operating area. The operating area is in the Northern Terraces and Lodi Alluvium ecoregions within the Central Valley of California. The Northern Terraces ecoregion is characterized by sloping terraces and is mostly rolling grassland and the Lodi Alluvium ecoregion is characterized by generally sloping floodplains and is mostly cropland with some urbanized land on the eastern edge of Lodi.[15]

The proposed action would take place over mostly rural farmland, with some urban and commercial areas. These areas provide habitat for many of the more common and ubiquitous bird and mammal species in the region including gophers, mice, moles, shrews, badgers, squirrels, bats, songbirds, raptors, waterfowl, and insects.[16]

Special Status Species

Federally Listed Species

The potential for impacts to federally-listed species was assessed using the USFWS Information for Planning and Consultation (IPaC) map tool and reports. The study area covered the entire operating area, outlined in red in Figure 1 of this EA. The IPaC report and official species list are included as Appendix A.

Based on the official species list, there is one ESA-listed mammal species and two insect species that could be present in the study area: the Riparian Brush Rabbit (*Sylvilagus bachmani riparius*), an endangered species, the Monarch Butterfly *(Danaus plexippus*), a candidate species, and the Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*), a threatened species. Additionally, the Giant Garter Snake (*Thamnophis gigas*), a threatened species, and the California Tiger Salamander (*Ambystoma californiense*), a threatened species, are identified in the official species list as having the potential to occur in the study area.

There is no critical habitat in the operating area for any ESA-listed species.

State Species of Concern

The California Fish and Game Commission lists species as endangered or threatened under the California Endangered Species Act (CESA).[17] The California Fish and Game code prohibits the "take" of endangered

[14] U.S. Fish and Wildlife Service. 2007. National Bald Eagle Management guidelines. Available: https://fws.gov/migratorybirds/pdf/management/nationalbaldeaglenanagementguidelines.pdf. Accessed: February 4, 2022.
[15] U.S. Geological Survey. 2016. Ecoregions of California. Available: https://pubs.er.usgs.gov/publication/ofr20161021. Accessed: July 20, 2022.
[16] iNaturalist. San Joaquin County, US, CA Species. Available: https://www.inaturalist.org/places/san-joaquin-county#taxon=1. Accessed July 20, 2022.
[17] California Department of Fish and Wildlife. California Endangered Species Act (CESA). Available: https://wildlife.ca.gov/Conservation/CESA. Accessed: August 29, 2022.

or threatened species unless an incidental take permit is issued by the California Department of Fish and WIldlife.[18] Under CESA "take" means to hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill.[19] The proposed action will not require any incidental take permits under CESA.

The state-listed species include gastropods, crustaceans, insects, fishes, amphibians, reptiles, birds, and mammals. The FAA has determined that there are five state-listed birds and one state-listed mammal listed in California's Threatened and Endangered Species list that have the potential to occur within the study area.[20] The list can be viewed in Table 3-1 below.

Based on the potential for effects to the nesting lifecycle of these five state-listed bird species, the FAA has conducted further analysis into the nesting habits of the Swainson's Hawk and Tricolored Blackbird. The Swainson's Hawk typically builds its nest near the top of a solitary tree, in a small grove of trees along a stream, or in shelterbelts or other trees located near agricultural fields and pastures where they feed.[21] The Tricolored Blackbird nests almost exclusively in triticale fields, especially those with invasive mustard or mallow plants, and typically close to freshwater with plenty of concealing vegetation. Females build nests in vegetation from just above ground level up to about 8 feet.[22] The FAA found that triticale is grown at the Lockeford Plant Materials Center, which is in the north-central part of the operating area and is a part of the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service.[23]

Table 3-1 California State Endangered and Threatened Species with Potential to Occur in Study Area

Listed Species	**Common Name (Scientific Name)**
Birds (State Endangered)	Willow Flycatcher (*Empidonax traillii*)
Birds (State Threatened)	Swainson's Hawk (*Buteo swainsoni*)
	Greater Sandhill Crane (*Grus canadensis tabida*)
	Bank Swallow (*Riparia riparia*)
	Tricolored Blackbird (*Agelaius tricolor*)
Mammal (State Endangered)	Riparian Brush Rabbit (*Sylvilagus bachmani riparius*)

Migratory Birds

Migratory bird species found within the operating area will vary throughout the year. During certain weeks in the spring and fall, hundreds of species of songbirds, raptors, and waterfowl may potentially pass through the operating area. Additionally, several dozen species of birds may potentially nest in the operating area at certain times of the year.

[18] California Department of Fish and Wildlife. Incidental Take Permits. Available: https://wildlife.ca.gov/Conservation/CESA/Permitting/Incidental-Take-Permits#50033467-applications. Accessed: August, 29, 2022.
[19] Fish and Game Code. Chapter 1 §86. Available: https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=FGC&sectionNum=86.&highlight=true&keyword=pursue. Accessed: August 29, 2022.
[20] California Department of Fish and Wildlife. 2022. Threatened and Endangered Species. Available: http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=109405&inline. Accessed July 20, 2022.
[21] Available: https://www.allaboutbirds.org/guide/Swainsons_Hawk/lifehistory. Accessed: August 29, 2022.
[22] Available: https://www.allaboutbirds.org/guide/Tricolored_Blackbird/lifehistory. Accessed: August 29, 2022.
[23] Available: https://www.nrcs.usda.gov/wps/portal/nrcs/detail/ca/home/?cid=NRCSEPRD613206. Accessed: August 29, 2022.

The IPaC report identifies 11 Birds of Conservation Concern (BCC) that could occur in the operating area, along with information on the likelihood that they may be nesting in the area (see Appendix A). Habitat used by BCC species listed in the study area would occur mostly in grasslands, forested areas, and riparian environments.

The Bald Eagle (*Haliaeetus leucocephalus)* is not listed by USFWS as a BCC in the operating area; however, it is protected under the Bald and Golden Eagle Protection Act. Bald Eagles could nest in areas near bodies of water such as the Mokelumne River, North Paddy Creek, or Middle Paddy Creek in the operating area. The National Bald Eagle Management Guidelines state that aircraft should stay at least 1,000 feet from Bald Eagle nests during the breeding season unless the aircraft is operated by a trained wildlife biologist.[24]

3.2.3 Environmental Consequences

There will be no further ground construction or habitat modification associated with the proposed action, beyond what Prime Air has already completed at their PADDC site. Earlier construction was not part of the proposed action reviewed by the FAA, and any future ground construction at the PADDC site will not require approval or authorization by the FAA.

Prime Air's aircraft will not touch the ground in any other place than the PADDC (except during emergency landings), since it remains airborne while conducting deliveries. The operations will be taking place within airspace, and typically well above the tree line and away from sensitive habitats. After launch, Prime Air's UA will rise to a cruising altitude between 160 feet and 180 feet AGL and follow a preplanned route to its delivery site. The pre-planned route is optimized to avoid terrain and object obstructions, areas of high aircraft traffic, and areas where people may gather in large numbers such as highways, parks, and schools.

Aircraft will typically stay at 160-180 feet AGL or higher except when descending to drop a package. When making a delivery, the aircraft descends and packages are dropped to the ground from approximately 13 feet AGL. Packages are carried internally in the aircraft's fuselage, and are dropped by opening a set of payload doors on the aircraft. After the package is dropped the UA then climbs vertically to approximately 160-180 feet and reverses the path taken, returning to the takeoff/landing pad at the PADDC. The low number of daily operations and nature of the flights are not expected to significantly influence wildlife behavior in the study area.

Special Status Species

The Monarch Butterfly, a candidate for federal listing, and the Valley Elderberry Longhorn Beetle, a threatened species, have the potential to occur in the operating area. Information regarding drone impacts on insects is limited and there have been no widespread negative impacts identified in the scientific literature. Some research shows that Monarch Butterflies are not commonly observed at higher AGL altitudes, and would not be expected to frequently occur at the altitudes where Prime Air is proposing to operate.[25] Valley Elderberry Longhorn Beetles are found in riparian habitat only in the vicinity of their host plant, the elderberry (*Sambucus* species such as the *Sambucus mexicana*).[26] Prime

[24] U.S. Fish and Wildlife Service. 2007. National Bald Eagle Management Guidelines. Available: https://www.fws.gov/sites/default/files/documents/national-bald-eagle-management-guidelines.pdf. Accessed: October 19, 2021.
[25] Altitudes attained by migrating monarch butterflies, *Danaus p. plexippus* (Lepidoptera: Danaidae), as reported by glider pilots. Available: https://cdnsciencepub.com/doi/abs/10.1139/z81-084. Accessed April 25, 2022.
[26] Available: https://www.epa.gov/sites/default/files/2013-08/documents/elderberry-lh-beetle_0.pdf. Accessed: September 2, 2022.

Air would not be expected to conduct deliveries within close proximity to elderberry habitat and thus would have no effect on this species or its environment. Therefore, based on the information available and the limited scale of operations, the action is expected to have no effects on the Monarch Butterfly, Valley Elderberry Longhorn Beetle, or any other insect populations.

The Riparian Brush Rabbit, an endangered species, has the potential to occur in the operating area. While this species is typically found within the dense understory of oak forests along riparian corridors,[27] there is a chance that, due to keen hearing capabilities of this species, they may be able to sense the UA if it were to fly over their habitat. The Mokelumne River is within the historic range of the riparian brush rabbit; however, there is currently no riparian brush rabbit population in or near the area, and the species could not propagate to this area naturally from its only known locations in southern San Joaquin County and northern Stanislaus County. All of the properties surrounding the Mokelumne River and its narrow riparian corridor are heavily managed agricultural lands. Additionally, due to the typical altitudes where UA operations will take place, and the infrequent operations over any single point in the operating area, the FAA has determined that vehicle operations *may affect, but are not likely to adversely affect*, the Riparian Brush Rabbit. In September 2022, the FAA initiated Section 7 consultation with the USFWS Sacramento Field Office regarding this determination, and, following additional clarification in October 2022, the FAA received concurrence on the determination from USFWS on November 8, 2022. The Section 7 consultation letters can be found in Appendix A.

The Giant Garter Snake, a threatened species, and the California Tiger Salamander, a threatened species, also have the potential to occur in the operating area. However, due to the limited ability of reptiles and amphibians to perceive air-borne noise,[28] and because the noise levels produced by the UA would not be expected to produce any ground vibrations the FAA determined that there is no plausible route of effects to these species. As a result, the FAA has determined that the proposed action will have *no effect* on the Giant Garter Snake or California Tiger Salamander.

The FAA has looked at the potential effects of wildfires that may be caused by the proposed action. While the Prime Air UA has been evaluated for airworthiness and is considered to be safe for the proposed operations over the operating area, the FAA acknowledges that a crash may occur and could result in a wildfire. However, Prime Air's FAA-accepted checklists include procedures to notify local emergency services in the event of an accident or incident. In accordance with 14 CFR § 135.23(d), Prime Air is required to locate and secure any downed aircraft pending guidance from the FAA or National Transportation Safety Board (NTSB). The FAA understands that Prime Air would immediately notify local emergency fire response services if one of its UA were to crash, and that fire responders would be be able to manage any wildfire that could occur before the wildfire could cause significant impacts to biological resources in the operating area.

CESA-listed bird species may display disturbance behaviors towards drones, such as fleeing or attack maneuvers; however, the aircraft would complete its ascent and descent outside of forested areas, managed grasslands, and riparian habitat, and with a flight plan of 160-180 feet AGL would be well above the tree canopy and thus not a threat to nesting, roosting, or foraging habitat. Due to the limited scale of operations and the altitude of overflights, no significant impacts to state protected bird species are expected. As the CESA definition of "take" does not include harassment, no state take permit is required.

[27] Available: https://ecos.fws.gov/ecp/species/6189. Accessed: September 2, 2022.
[28] Field Guide to Amphibians and Reptiles of California: Revised Edition. Available: https://books.google.com/books?hl=en&lr=&id=PpkvEAAAQBAJ&oi=fnd&pg=PR11&dq=Giant+California+Salamander+Hearing&ots=pr470poXva&sig=FE39Izpz74LM6qIKyMolK22eulo. Accessed: September 2, 2022.

Migratory Birds

Prime Air has stated to the FAA that it will monitor the operating area for any active Bald Eagle nests that may occur. Bald Eagle nests are typically very conspicuous, usually five to nine feet in diameter, with a vertical depth up to eight feet, and Prime Air should be able to visually identify any nests that may be present in the area.[29] Online resources such as iNaturalist may also be used to identify Bald Eagle nests that may be active in the operating area. If Prime Air identifies a Bald Eagle nest or is notified of the presence of a nest by a state regulator or naturalist group, Prime Air will establish an avoidance area such that there is a 1,000 feet vertical and horizontal separation distance between the vehicle's flight path and the nest. This avoidance area will be maintained until the end of the breeding season (January 1 through August 31 in study area) or a qualified biologist indicates the nest has been vacated.[30]

The other BCC species identified in the official species list also have the potential to occur in the operating area. However, these bird species typically nest in forests, managed grasslands, and riparian corridor environments that are not within close proximity to locations where the Prime Air UA will be completing is ascent and descent. Additionally, the UA's en route overflights are not expected to result in significant disturbance to the nesting lifecycle of these species.

Due to the limited operating area and proposed number of daily operations, occasional drone overflights at approximately 160-180 feet AGL are not expected to impact critical lifecycles of wildlife species or their ability to survive.

Our analysis finds that the proposed action is not expected to cause any of the following impacts:

- A long-term or permanent loss of unlisted plant or wildlife species, i.e., extirpation of the species from a large project area;
- Adverse impacts to special status species (e.g., state species of concern, species proposed for listing, migratory birds, bald and golden eagles) or their habitats;
- Substantial loss, reduction, degradation, disturbance, or fragmentation of native species' habitats or their populations; or
- Adverse impacts on a species' reproductive success rates, natural mortality rates, non-natural mortality (e.g., road kills and hunting), or ability to sustain the minimum population levels required.

3.3 Department of Transportation Act, Section 4(f) Resources

3.3.1 Regulatory Setting

Section 4(f) of the Department of Transportation (DOT) Act [codified at 49 U.S.C. § 303(c)] protects significant publicly owned parks, recreational areas, wildlife and waterfowl refuges, and public and private historic sites. Section 4(f) states that, subject to exceptions for de minimis impacts[31]: "The

[29] USFWS Midwest Region: Identification of Large Nests. Available: https://www.fws.gov/midwest/eagle/Nhistory/nest_id.html. Accessed: December 13, 2021

[30] See IPaC report in Appendix A for Bald Eagle breeding dates in the study area.

[31] The FAA may make a de minimis impact determination with respect to a physical use of Section 4(f) property if, after taking into account any measures to minimize harm, the result is either: (1) a determination that the project would not adversely affect the activities, features, or attributes qualifying a park, recreation area, or wildlife or waterfowl refuge for protection

Secretary may approve a transportation program or project requiring the use of [4(f) resources]…only if—(1) there is no prudent and feasible alternative to using that land; and (2) the program or project includes all possible planning to minimize harm to the park, recreation area, wildlife and waterfowl refuge, or historic site resulting from the use."

The term "use" includes both direct or physical and indirect or "constructive" impacts to Section 4(f) resources. Direct use is the physical occupation or alteration of a Section 4(f) property or any portion of a Section 4(f) property. A constructive use does not require direct physical impacts or occupation of a Section 4(f) resource. A constructive use would occur when a proposed action would result in substantial impairment of a resource to the degree that the protected activities, features, or attributes of the resource that contribute to its significance or enjoyment are substantially diminished. The determination of use must consider the entire property and not simply the portion of the property used for a proposed project.[32]

Section 4(f) resources where a quiet setting is a generally recognized feature or attribute receive special consideration. In assessing constructive use, FAA Order 1050.1F, Appendix B, page B-11, requires that the FAA "…must consult all appropriate federal, state, and local officials having jurisdiction over the affected Section 4(f) properties when determining whether project-related impacts would substantially impair the resources." Parks, recreation areas, and wildlife and waterfowl refuges that are privately owned are not subject to Section 4(f) provisions.

A significant impact would occur pursuant to NEPA when a proposed action either involves more than a minimal physical use of a section 4(f) property or is deemed a "constructive use" based on an FAA determination that the proposed action would substantially impair the 4(f) property, and mitigation measures do not eliminate or reduce the effects of the use below the threshold of significance.

3.3.2 Affected Environment

The FAA identified properties that could meet the definition of a Section 4(f) resource within the operating area, including public parks and historic sites. Section 4(f) resources within the Lockeford operating area include Harmony Grove Church and Lockeford Memorial Park.

There are several historic sites within the operating area listed on the California SHPO website; however, these are considered for architectural or other purposes that will not typically be affected by UA operations. Also, as discussed in Section 3.4, *Historical, Architectural, Archaeological, and Cultural Resources*, the FAA has consulted with the California SHPO and three THPOs to determine whether historic and traditional cultural properties would be affected by the proposed action.

3.3.3 Environmental Consequences

There will be no physical use of Section 4(f) resources because there will be no construction on any Section 4(f) resource. The FAA has determined that infrequent UAS overflights as described in the proposed action are not considered a constructive use of any Section 4(f) resource, and will not cause substantial impairment to any of the Section 4(f) resources in the operating area. As described in Section 3.5, Noise and Noise-Compatible Land Use, and the Noise Analysis Report (Appendix C), the proposed operations will not result in significant noise levels at any location in the operating area. Noise and visual

under Section 4(f); or (2) a Section 106 finding of no adverse effect or no historic properties affected. See 1050.1F Desk Reference, Paragraph 5.3.3

[32] Federal Highway Administration (FHWA) Section 4(f) Policy Paper. (Note: FHWA regulations are not binding on the FAA; however, the FAA may use them as guidance to the extent relevant to aviation projects.) Available: https://www.environment.fhwa.dot.gov/legislation/section4f/4fpolicy.pdf. Accessed: February 2, 2021

effects from Prime Air's occasional overflights are not expected to diminish the activities, features, or attributes of the resources that contribute to their significance or enjoyment.

Additionally, Prime Air identifies areas where open air gatherings of people typically occur, such as open air concert venues and school yards, and avoids these properties through the creation of no-fly areas via Prime Air's route planning software, which prepares an optimized flight path from the PADDC to each designated delivery site. The software ensures that each route integrates and respects all of the restrictions entered into the database, and including Section 4(f) properties, which can be automatically avoided based on the time of day and other factors. The FAA has determined that there will be no significant impacts to Section 4(f) resources as a result of the proposed action.

3.4 Historical, Architectural, Archaeological, and Cultural Resources

3.4.1 Regulatory Setting

Section 106 of the National Historic Preservation Act (NHPA) of 1966 [54 U.S.C. § 306108] requires federal agencies to consider the effects of their undertakings on properties listed or eligible for listing in the National Register of Historic Places (NRHP). This includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization that meets the NRHP criteria. Regulations related to this process are contained in 36 CFR Part 800, Protection of Historic Properties. Compliance with Section 106 requires consultation with the State Historic Preservation Officer (SHPO) and applicable other parties, including Indian tribes.

Major steps in the Section 106 process include identifying the Area of Potential Effects (APE), identifying historic and cultural resources within the APE, consulting with the SHPO and any THPO that is identified as potentially having traditional cultural interests in the area, and determining the potential impacts to historic properties as a result of the action.

The FAA has not established a significance threshold for this impact category; however, the FAA has identified a factor to consider when evaluating the context and intensity of potential environmental impacts for historical, architectural, archeological, and cultural resources. A factor to consider in assessing significant impact is when an action would result in a finding of adverse effect through the Section 106 process. However, under 36 CFR § 800.8(a), a finding of adverse effect on a historic property does not necessarily result in a significance finding under NEPA.

3.4.2 Affected Environment

The APE for the proposed action is the entire operating area where Prime Air is planning to conduct UA package deliveries, as shown in Figure 1 in this EA. The FAA identified historic sites that were listed on the California SHPO website, which includes NRHP-listed and -eligible properties as well as other properties of interest to the state.[33] There are three properties listed on the NRHP within the operating area: Locke House and Barn, Locke's Meat Market, and Harmony Grove Church.

In accordance with 36 CFR § 800.4(a)(1), the FAA consulted with the California SHPO and three THPOs for tribes that may potentially attach religious or cultural significance to resources in the APE. The FAA sent a consultation letter to the California SHPO on April 26, 2022 and did not receive any response or objections. The FAA also sent letters on April 26, 2022 to the THPOs from the Buena Vista Rancheria of Me-Wuk Indians of California, California Valley Miwok Tribe, and the Tule River Indian Tribe of the Tule River Reservation, and did not receive any responses or objections.

[33] California Historic Resources. Available: https://ohp.parks.ca.gov/listedresources/. Accessed July 22, 2022.

The FAA's tribal and historic outreach letters are included as Appendix B.

3.4.2 Environmental Consequences

The nature of UA effects on historic properties is limited to non-physical, reversible impacts (i.e., the introduction of audible and/or visual elements). The limited number of daily flights that Prime Air is proposing – up to approximately 200 delivery operations per day for a maximum of roughly 52,000 annually from the Lockeford PADDC, divided into four separate sectors – means that any historic or cultural resource would be subject to only a small number of overflights per day, if any.

Additionally, the FAA's noise exposure analysis for the proposed action concluded that noise levels are not likely to exceed DNL 45 dB in any location within the study area other than the PADDC property, a few properties immediately surrounding the PADDC, and in the immediate vicinity of locations that may receive a delivery. Based on a review of the proposed action and the nature of the historic properties identified in the APE, the FAA has determined that no historic properties or cultural resources will be affected by the proposed action, in accordance with 36 CFR § 800.4(d)(1). The proposed action will not have a significant impact on historical, architectural, archaeological, or cultural resources.

3.5 Noise and Noise-Compatible Land Use

3.5.1 Regulatory Setting

Aircraft noise is often the most noticeable environmental effect associated with any aviation project. Several federal laws, including the Aviation Safety and Noise Abatement Act of 1979, as amended (49 U.S.C. §§ 47501-47507) regulate aircraft noise. Through 14 CFR Part 36, the FAA regulates noise from aircraft.

FAA Order 1050.1F, Appendix B, Paragraph B-1.3 requires the FAA to identify the location and number of noise sensitive areas that could be significantly impacted by noise. As defined in FAA Order 1050.1F, Paragraph 11-5b, a noise sensitive area is "[a]n area where noise interferes with normal activities associated with its use. Normally, noise sensitive areas include residential, educational, health, and religious structures and sites, and parks, recreational areas, areas with wilderness characteristics, wildlife refuges, and cultural and historical sites."

Sound is measured in terms of the decibel (dB), which is the ratio between the sound pressure of the sound source and 20 micropascals, which is nominally the threshold of human hearing. Various weighting schemes have been developed to collapse a frequency spectrum into a single dB value. The A-weighted decibel, or dBA, corresponds to human hearing accounting for the higher sensitivity in the mid-range frequencies.

To comply with NEPA requirements, the FAA has issued requirements for assessing aircraft noise in FAA Order 1050.1F, Appendix B. FAA's primary noise metric for aviation noise analysis is the yearly Day-Night Average Sound Level (DNL) metric. The DNL metric is a single value representing the logarithmically average aircraft sound level at a location over a 24-hour period, with a 10 dB adjustment added to those noise events occuring from 10:00 p.m. and up to 7:00 a.m. the following morning. A significant noise impact is defined in Order 1050.1F as an increase in noise of DNL 1.5 dB or more at or above DNL 65 dB noise exposure or a noise exposure at or above the 65 dB level due to a DNL 1.5 dB or greater increase. While DNL is the primary metric the FAA uses to determine noise impacts, the agency also accepts the Community Noise Equivalent Level (CNEL) in California. CNEL adds a three times weighting (equivalent to a 4.77 dBA adjustment) for noise events occuring during the evening hours from 7:00 p.m. to 10:00 p.m. Since the proposed action will occur in California, and Prime Air plans to conduct a maximum of

roughly 1,361 delivery operations per year between 7:00 p.m. to 10:00 p.m.,[34] the noise analysis results are presented in CNEL for average annual day (AAD) CNEL equivalent operations.

3.5.2 Affected Environment

The study area is approximately 50.26 square miles, and the estimated population within the area is roughly 7,482. The population density is approximately 148 persons per square mile.[35] There are no airports in the study area, and existing aviation noise is not expected to be significant. The study area is depicted in Figure 1.

3.5.3 Environmental Consequences

Human perception of noise depends on a number of factors, including overall noise level, number of noise events, the extent of audibility above the background ambient noise level, and acoustic frequency content (pitch). UA noise generally has high acoustic frequency content, which can often be more discernable from other typical noise sources.

To ensure that noise would not cause a significant impact to any residential land use or noise sensitive resource within the study area, the FAA initiated an analysis of the potential noise exposure in the area that could result from implementation of the proposed action. Away from the actual PADDC property, the industrial properties surrounding the PADDC location are likely to experience the highest noise levels as a result of the proposed action. This is due to noise from UA departures and arrivals, as well as more concentrated en route noise from the aircraft.

Noise Exposure

Utilizing the operational projections defined in Sections 1 and 2, the noise analysis methodology detailed in Appendix C was then used to the estimate CNEL levels for the proposed Prime Air Lockeford operations. Noise levels were calculated for each flight phase and are presented in the following three sub-sections:

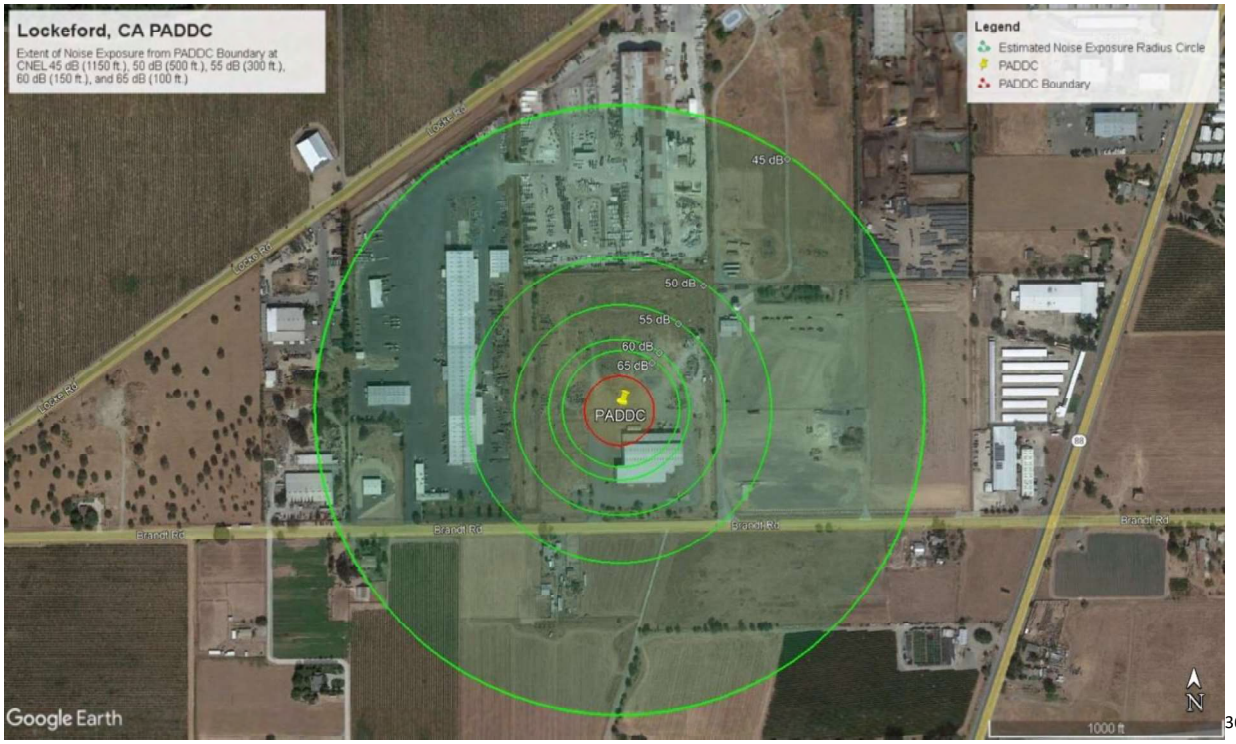
- Noise Exposure for PADDC Operations
- Noise Exposure for En route Operations
- Noise Exposure for Delivery Operations

Noise Exposure for PADDC Operations

Based on the anticipated average daily maximum number of deliveries provided by Prime Air, the extent of CNEL 45 dB associated with PADDC operations is shown in Figure 4. This region was determined based on a review of the layout of the Lockeford PADDC location, and using the noise level information presented in referencing Table 7 of Appendix C.

[34] As stated in Section 1.1, Amazon's daylight hours of operation include approximately ~30 min before sunrise to ~30 min after sunset.

[35] Environmental Protection Agency's (EPA) Environmental Justice Screening Tool (EJSCREEN). Available: https://www.epa.gov/ejscreen. Accessed: March 10, 2022



[36]

Figure 4 CNEL Noise Exposure at Lockeford PADDC Location

Noise Exposure for En route Operations

Based on the information provided by Prime Air, it is anticipated that the UA will typically cruise at altitudes between 160-180 feet AGL at an airspeed of 50-60 knots during en route flight. The noise exposure was calculated assuming operations at roughly 160 feet AGL and at an airspeed of 52.4 knots. As described in the Noise Analysis Report (Appendix C), the UA is expected to typically fly the same outbound flight path between the PADDC and the delivery point and inbound flight path back to the PADDC. Therefore, each location under the en route path would be overflown twice for each delivery served by the respective overhead en route path. The en route noise exposure can be determined by referencing Table 8 and 9 of Appendix C. This analysis shows that en route noise levels would not exceed CNEL 45 dB in any location within the study area.

Noise Exposure for Delivery Operations

Due to the inherent uncertainty of the exact delivery site locations, the noise analysis developed a minimum and maximum representative distribution of deliveries in the study area based on data provided by Prime Air. The noise analysis conservatively assumes the minimum and maximum distribution of average daily deliveries that could occur at a single delivery location. The distribution of average annual daily deliveries based on the projections provided by Prime Air range from 0.4 to 4.5 deliveries per operating day. The CNEL values include the decelerating transition maneuver from en route horizontal flight to vertical flight at en route altitude, the delivery maneuver, and the accelerating transition maneuver from vertical flight at en route altitude to horizontal en route flight as discussed in noise analysis report. The noise exposure for delivery operations also includes en route overflights at the

[36] Google Earth, as modified by the FAA

lower end of the typical operating altitude of 160 feet AGL for operations associated with deliveries to other locations.

A conservative estimate of delivery noise exposure can then be determined by referencing Table 9 and 10 of Appendix C. The estimated delivery CNEL includes values at the minimum and maximum distribution of CNEL equivalent deliveries based on the distributions provided by Prime Air at various distances from the delivery point. They include the minimum listener distance from the delivery point at 16.4 feet, which is representative of the closest distance a person may approach before the aircraft takes automated actions to safely cancel the delivery. This is in addition to the minimum measured distance from the UA for which noise measurement data was available for a delivery, which is 32.8 feet. Values were also calculated at distances of 50 feet, 75 feet, 100 feet, and 125 feet from the delivery point, and are representative of distances from which nearby properties may experience noise from a delivery based on the average lot size for sold homes as reported in the 2021 US Census.[37] The CNEL for the minimum and maximum distribution of average annual daily CNEL deliveries are presented below in Table 3-2.

Table 3-2 CNEL for a Delivery Location Based on the Minimum and Maximum Distribution of Deliveries

Annual Average Daily CNEL Equivalent Deliveries	Annual CNEL Equivalent Deliveries	Estimated Delivery CNEL (dB) at 16.4 feet (Minimum Possible Listener Distance)	Estimated Delivery CNEL (dB) at 32.8 feet (Minimum Measured Listener Distance)	Estimated Delivery CNEL (dB) at 50 feet	Estimated Delivery CNEL (dB) at 75 feet	Estimated Delivery CNEL (dB) at 100 feet	Estimated Delivery CNEL (dB) at 125 feet
0.4	163.8	48.9	46.5	46.0	45.2	44.4	44.0
4.5	1638.4	57.7	54.1	53.1	51.5	49.3	47.6

Table 3-2 shows that, with the maximum number of average annual daily deliveries at a single location, including overflights, noise levels at or above CNEL 45 dB could extend beyond 125 feet from the delivery location and may reach adjacent properties. However, these noise levels would not exceed the FAA's significance threshold for noise of CNEL 65 dB in any of the areas where Prime Air anticipates providing deliveries.

Total Noise Exposure Results

The maximum noise exposure levels within the study area will occur at the PADDC site; where noise levels at or above CNEL 45 dB would extend approximately 1,150 feet from the Lockeford PADDC. Noise levels at or above CNEL 65 dB would extend approximately 100 feet from the PADDC, although this is within the PADDC property. Additionally, the estimated noise exposure for en route operations would not exceed CNEL 45 dB at any location within the study area, and the estimated noise exposure for

[37] The 2021 US Census national average lot size for single-family sold homes was 15,218 square feet. This is representative of a property with dimensions of a 123.36 x 123.36 foot square. 125 feet represents a 125 foot lateral width of the parcel rounded up to the nearest 25 feet. Available: https://www.census.gov/construction/chars/xls/soldlotsize_cust.xls. Accessed: August 17, 2022.

delivery operations, including en route overflights, would not have the potential to exceed CNEL 58 dB at any location in the study area and is below the FAA's threshold of significance for noise.

Based on the FAA's noise analysis, the proposed action will not have a significant impact.

3.6 Environmental Justice

3.6.1 Regulatory Setting

Executive Order (EO) 12898, *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations*, Section 1-101 requires all federal agencies to the greatest extent practicable and permitted by law, to make achieving environmental justice part of its mission by identifying and addressing disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations.

The DOT Order 5610.2C defines a minority person as a person who is Black; Hispanic or Latino; Asian American; American Indian and Alaskan Native; or Native Hawaiian and other Pacific Islander. A minority population is any readily identifiable group of minority persons who live in geographic proximity, and if circumstances warrant, geographically dispersed/transient persons (such as migrant workers or Native Americans) who will be similarly affected by a proposed DOT program, policy, or activity.

The DOT Order 5610.2C defines a low-income person as a person whose median household income is at or below the Department of Health and Human Services poverty guidelines. A low-income population is any readily identifiable group of low-income persons who live in geographic proximity, and, if circumstances warrant, geographically dispersed/transient persons (such as migrant workers or Native Americans) who will be similarly affected by a proposed DOT program, policy, or activity.

While the FAA has not established a significance threshold for environmental justice, Section 4-3.3, Exhibit 4-1 of FAA Order 1050.1F outlines the FAA's factors to consider in determining the significance of impacts to environmental justice communities. As stated in Exhibit 4-1, the FAA should consider whether the action would have the potential to lead to a disproportionately high and adverse impact to an environmental justice population, i.e., a low-income or minority population, due to: significant impacts in other environmental impact categories; or impacts on the physical or natural environment that affect an environmental justice population in a way that the FAA determines are unique to the environmental justice population and significant to that population. If a significant impact would affect low income or minority populations at a disproportionately higher level than it would other population segments, an environmental justice issue is likely.

A disproportionately high and adverse effect on minority or low-income populations means an adverse effect that:

1. Is predominately borne by a minority population and/or a low-income population; or
2. Will be suffered by the minority population and/or low-income population and is appreciable more severe or greater in magnitude than adverse effects that will be suffered by the non-minority population and/or low-income population.

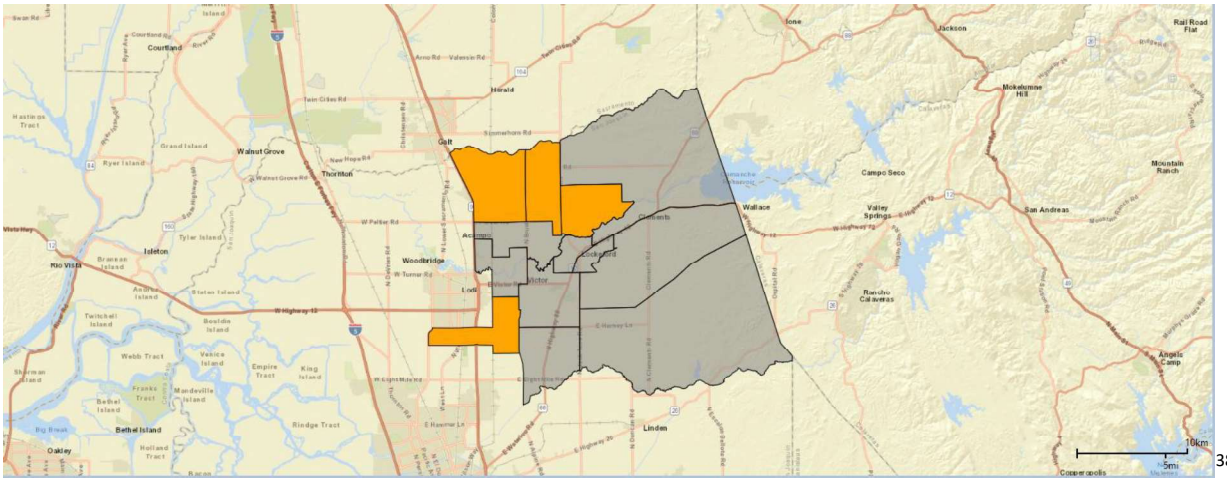
3.6.2 Affected Environment

Minority and low-income populations were mapped at the Census Block Group level using 2020 American Community Survey (ACS) 5-year estimates from the U.S. Census Bureau. The analysis was performed using the Aviation Environmental Design Tool (AEDT). The FAA utilized a combination of the *fifty-percent analysis* and *meaningfully greater analysis* to complete the analysis for the study area. Low-

income populations in the study area were identified by using *the Low-Income Threshold Criteria* analysis. The census block group data used for the analysis is provided in Appendix F.

Minority Population Fifty-Percent Analysis

As depicted in Figure 5, there are four census block groups out of 13 that have minority populations at or above 50 percent. The percentage of minority individuals residing within the study area at the census block level is below 50 percent at approximately 43.25 percent.



[38]

Figure 5 Census Block Groups in the Study Area with Minority Populations ≥ 50 Percent

Minority Population Meaningfully Greater Analysis

The minority population in the study area at the census block group level was compared to the reference community, which is the percentage of minority individuals residing within San Joaquin County. Because the study area is within part of San Joaquin County, the FAA determined that it would be an appropriate geographical region for comparison.

The percentage of minorities residing within the study area at the census block group level, approximately 43.25 percent, is lower than that of the reference community, which is approximately 67.38 percent. Based on the analysis, the FAA determined that the percentage of minorities residing within the study area is both less than 50 percent and is not meaningfully greater than the percentage of minorities residing within the reference community.

Low-Income Threshold Criteria Analysis

The low-income population in the study area at the census block group level was compared to the reference community, which is the percentage of low-income individuals residing within San Joaquin County. Because the study area is within part of San Joaquin County, the FAA determined that it would be an appropriate geographical region for comparison.

The percentage of low-income individuals residing within the study area at the census block group level is approximately 8.38 percent as compared to 14.75 percent in the reference community. Therefore, because the percentage of low-income individuals is lower in the study area than the reference

[38] Image: AEDT, as modified by the FAA.

community, the FAA determined there was not a low-income population present in the study area. The FAA's AEDT analysis data is included in Appendix F.

3.6.3 Environmental Consequences

The proposed action would not result in adverse or significant impacts in any environmental resource category. As noted in Section 3.5, *Noise and Noise-Compatible Land Use*, and the Noise Analysis Report in Appendix C, the drone's noise emissions could be perceptible in areas within the study area, but will stay well below the level determined to constitute a significant impact. Using the fifty-percent analysis and meaningfully greater analysis, the FAA determined that there was not a minority population present. Since the percentage of low-income individuals was lower in the study area than the reference community, the FAA determined there was not a low-income population present. Additionally, since the proposed action would not result in effects that would be predominately or uniquely born by an environmental justice population, the FAA determined that the proposed action would not result in a disproportionately high and adverse effect on a low-income or a minority population.

3.7 Visual Effects (Visual Resources and Visual Character)

3.7.1 Regulatory Setting

Visual resources and visual character impacts deal with the extent to which the proposed action would result in visual impacts to resources in the operating area. Visual impacts can be difficult to define and evaluate because the analysis is generally subjective, but are normally related to the extent that the proposed action would contrast with, or detract from, the visual resources and/or the visual character of the existing environment. In this case, visual effects would be limited to the introduction of a visual intrusion – a UA in flight – which could be out of character with the suburban or natural landscapes.

The FAA has not developed a visual effects threshold of significance similar to noise impacts. Factors FAA considers in assessing significant impacts include the degree to which the action would have the potential to: (1) affect the nature of the visual character of the area, including the importance, uniqueness, and aesthetic value of the affected visual resources; (2) contrast with the visual resources and/or visual character in the study area; or (3) block or obstruct the views of visual resources, including whether these resources would still be viewable from other locations.

3.7.2 Affected Environment

The proposed action would take place over mostly rural properties. As noted in Section 3.3, *DOT Act Section 4(f) Resources*, there are two public parks that could be valued for aesthetic attributes within the study area. Prime Air's proposal is to avoid overflights of large open-air gatherings of people during the scope of the proposed action, which includes public parks and other public properties that may be covered under Section 4(f).

3.7.3 Environmental Consequences

The proposed action makes no changes to any landforms, or land uses, thus there would be no effect to the visual character of the area. The operations will be happening in airspace only. The FAA estimates that at typical operating altitude and speeds, the UA en route would be observable for approximately 3.6 seconds by an observer on the ground. The proposed action involves airspace operations that are unlikely to result in visual impacts anywhere in the study area, including sensitive areas such as Section 4(f) properties where the visual setting is an important resource of the property. This is due in part to Prime Air's flight planning system discussed above. Additionally, the short duration that each drone

flight could be seen from any resource in the operating area – approximately 3.6 seconds while the drone is traveling en route at 52.4 knots – and the low number of proposed flights per day spread throughout the 50.26-square mile operating area, would minimize any potential for significant visual impacts at any location in the study area. Any visual effects are expected to be similar to existing air traffic in the vicinity of the operating area.

3.8 Water Resources (Surface Waters)

3.8.1 Regulatory Setting

Surface water resources generally consist of oceans, wetlands, lakes, rivers, and streams. Surface water is important for its contribution to the economic, ecological, recreational, and human health of a community. The Clean Water Act established the National Pollutant Discharge Elimination System (NPDES) program, which regulates the discharge of point sources of water pollution into waters of the United States and requires a permit under Section 402 of the Clean Water Act. Waters of the United States are defined by the Clean Water Act and are protected by various regulations and permitting programs administered by the Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers. An action would be considered significant to surface waters when it would: (1) exceed water quality standards established by federal, state, local, and tribal regulatory agencies; or (2) contaminate public drinking water supply such that public health may be adversely affected.

3.8.2 Affected Environment

Approximately 0.46 square miles of surface waters occur within the operating area, or approximately one percent of the area, based on the EJSCREEN report for this proposed action (Appendix E). Notable surface waters include Mokelumne River, North Paddy Creek, Middle Paddy Creek, Bear Creek, and Pixley Slough.

3.8.3 Environmental Consequences

While it is highly unlikely for one of Prime Air's aircraft to crash, and even less likely for a crash to happen within a surface water, this EA considers the potential effects of a drone crashing into surface waters covered by the Clean Water Act.

Prime Air is a certificated Part 135 air carrier and must comply with all applicable regulatory requirements. This includes compliance with requirements to notify the FAA and/or NTSB in accordance with regulatory requirements in the event of an aircraft accident. Prime Air's FAA-accepted checklists include procedures to notify local emergency services in the event of an accident or incident. In accordance with 14 CFR Part 135.23(d), Prime Air is required to locate and secure any downed aircraft pending guidance from the FAA or NTSB.

In the event of an in-flight malfunction or deviation, the Operator in Command can initiate two commands: urgent land, or return to PADDC. In addition, the lithium-ion battery packs are well-secured within the aircraft, and are not expected to detach from the aircraft or become lost in the event of an incident.

There will be no further construction activities associated with the proposed action. Prime Air's Part 135 operations will not require a NPDES permit or any other authorization under the Clean Water Act. The proposed action would not have the potential to adversely affect natural and beneficial water resource values to a degree that substantially diminishes or destroys such values, or to adversely affect surface waters such that the beneficial uses and values of such waters are appreciably diminished or can no

longer be maintained and such impairment cannot be avoided or satisfactorily mitigated. For all of these reasons, the proposed action would not cause an exceedance of water quality standards established by federal, state, local, and tribal regulatory agencies, and the proposed action would not contaminate public drinking water supply such that public health may be adversely affected. Therefore, the potential for impacts to surface waters is not significant.

3.9 Cumulative Impacts

Consideration of cumulative impacts applies to the impacts resulting from the implementation of the proposed action along with other actions. The CEQ regulations define cumulative impact as "effects on the environment that result from the incremental effects of the action when added to the effects of other past, present, and reasonably foreseeable actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time." (40 CFR § 1508.1(g)(3))

As discussed in Section 1.2, there are no airports or heliports in the study area, and existing aviation noise is not expected to be significant. Additionally, because these are the first commercial package delivery operations by drone within the operating area, and due to airspace safety constraints that will limit the number of package delivery drones operating within the same airspace without further safety and environmental reviews, the proposed action would not be anticipated to result in cumulative impacts to environmental resources within the operating area.

4.0 LIST OF PREPARERS and CONTRIBUTORS

Table 4-1 lists the principal preparers, reviewers, and contributors to this EA.

Table 4-1. List of Preparers and Contributors

Name and Affiliation	Years of Industry Experience	EA Responsibility
Mike Millard, Flight Standards, FAA Aviation Safety	41	Flight Standards Environmental Specialist and Document Review
Christopher Couture, FAA Aviation Safety	16	Program Management, Environmental Science, and Document Review
Shawna Barry, FAA Office of Environment and Energy	16	NEPA Subject Matter Expert, Biological Resources, and Document Review
Adam Scholten, FAA Office of Environment and Energy	11	Noise Analysis and Document Review
Contractor Contributors		
Jodi Jones, FAA Aviation Safety, PrimCorp, LLC	13	NEPA Subject Matter Expert, Research, and Document Review
Brad Thompson, FAA Aviation Safety, Science Applications International Corporation (SAIC)	8	NEPA Subject Matter Expert, Research, and Document Review

5.0 LIST of AGENCIES CONSULTED

Federal Agencies

U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office

State Agencies

California Office of Historic Preservation

Tribes

Buena Vista Rancheria of Me-Wuk Indians of California

California Valley Miwok Tribe

Tule River Indian Tribe of the Tule River Reservation

Appendix A

USFWS Official Species List and Section 7 Consultation Letters

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
Phone: (916) 414-6600 Fax: (916) 414-6713

In Reply Refer To:
Project Code: 2022-0036416
Project Name: Lockeford, CA

July 06, 2022

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)

(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see https://www.fws.gov/birds/policies-and-regulations.php.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures see https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds.php.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/birds/policies-and-regulations/executive-orders/e0-13186.php.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
(916) 414-6600

Project Summary

Project Code: 2022-0036416
Event Code: None
Project Name: Lockeford, CA
Project Type: Drones - Use/Operation of Unmanned Aerial Systems
Project Description: Commercial drone operation
Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@38.1482052,-121.16511344942589,14z

Counties: San Joaquin County, California

Endangered Species Act Species

There is a total of 10 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Riparian Brush Rabbit *Sylvilagus bachmani riparius* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6189	Endangered

Reptiles

NAME	STATUS
Giant Garter Snake *Thamnophis gigas* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/4482	Threatened

Amphibians

NAME	STATUS
California Tiger Salamander *Ambystoma californiense* Population: U.S.A. (Central CA DPS) There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/2076	Threatened

Fishes

NAME	STATUS
Delta Smelt *Hypomesus transpacificus* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/321	Threatened

Insects

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate
Valley Elderberry Longhorn Beetle *Desmocerus californicus dimorphus* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/7850	Threatened

Crustaceans

NAME	STATUS
Conservancy Fairy Shrimp *Branchinecta conservatio* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/8246	Endangered
Vernal Pool Fairy Shrimp *Branchinecta lynchi* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/498	Threatened
Vernal Pool Tadpole Shrimp *Lepidurus packardi* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/2246	Endangered

Flowering Plants

NAME	STATUS
Fleshy Owl's-clover *Castilleja campestris ssp. succulenta* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/8095	Threatened

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

IPaC User Contact Information

Agency: Federal Aviation Administration
Name: Jodi Jones
Address: 800 Independence Ave SW
City: Washington
State: DC
Zip: 20591
Email jodi.a-ctr.jones@faa.gov
Phone: 2022670509

IPaC **U.S. Fish & Wildlife Service**

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Project information

NAME

Lockeford, CA

LOCATION

San Joaquin County, California

DESCRIPTION

Some(Commercial drone operation)

Local office

Sacramento Fish And Wildlife Office

(916) 414-6600
(916) 414-6713

Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Log in to IPaC.
2. Go to your My Projects list.
3. Click PROJECT HOME for this project.
4. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

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1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).

2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Riparian Brush Rabbit *Sylvilagus bachmani riparius* Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6189	Endangered

Reptiles

NAME	STATUS
Giant Garter Snake *Thamnophis gigas* Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/4482	Threatened

Amphibians

NAME	STATUS
California Tiger Salamander *Ambystoma californiense* There is **final** critical habitat for this species. The location of the critical habitat is not available. https://ecos.fws.gov/ecp/species/2076	Threatened

Fishes

NAME	STATUS
Delta Smelt *Hypomesus transpacificus* Wherever found There is **final** critical habitat for this species. The location of the critical habitat is not available. https://ecos.fws.gov/ecp/species/321	Threatened

Insects

NAME	STATUS

Monarch Butterfly Danaus plexippus — Candidate
Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/9743

Valley Elderberry Longhorn Beetle Desmocerus californicus dimorphus — Threatened
Wherever found
There is **final** critical habitat for this species. The location of the critical habitat is not available.
https://ecos.fws.gov/ecp/species/7850

Crustaceans

NAME	STATUS

Conservancy Fairy Shrimp Branchinecta conservatio — Endangered
Wherever found
There is **final** critical habitat for this species. The location of the critical habitat is not available.
https://ecos.fws.gov/ecp/species/8246

Vernal Pool Fairy Shrimp Branchinecta lynchi — Threatened
Wherever found
There is **final** critical habitat for this species. The location of the critical habitat is not available.
https://ecos.fws.gov/ecp/species/498

Vernal Pool Tadpole Shrimp Lepidurus packardi — Endangered
Wherever found
There is **final** critical habitat for this species. The location of the critical habitat is not available.
https://ecos.fws.gov/ecp/species/2246

Flowering Plants

NAME	STATUS

Fleshy Owl's-clover Castilleja campestris ssp. succulenta — Threatened
Wherever found
There is **final** critical habitat for this species. The location of the critical habitat is not available.
https://ecos.fws.gov/ecp/species/8095

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

THERE ARE NO CRITICAL HABITATS AT THIS LOCATION.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Birds of Conservation Concern https://www.fws.gov/program/migratory-birds/species
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON (IF A BREEDING SEASON IS INDICATED FOR A BIRD ON YOUR LIST, THE BIRD MAY BREED IN YOUR PROJECT AREA SOMETIME WITHIN THE TIMEFRAME SPECIFIED, WHICH IS A VERY LIBERAL ESTIMATE OF THE DATES INSIDE WHICH THE BIRD BREEDS ACROSS ITS ENTIRE RANGE. "BREEDS ELSEWHERE" INDICATES THAT THE BIRD DOES NOT LIKELY BREED IN YOUR PROJECT AREA.)
Allen's Hummingbird Selasphorus sasin This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9637	Breeds Feb 1 to Jul 15
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Jan 1 to Aug 31
California Thrasher Toxostoma redivivum This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jan 1 to Jul 31
Common Yellowthroat Geothlypis trichas sinuosa This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/2084	Breeds May 20 to Jul 31

Lawrence's Goldfinch Carduelis lawrencei — Breeds Mar 20 to Sep 20
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9464

Nuttall's Woodpecker Picoides nuttallii — Breeds Apr 1 to Jul 20
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/9410

Oak Titmouse Baeolophus inornatus — Breeds Mar 15 to Jul 15
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9656

Olive-sided Flycatcher Contopus cooperi — Breeds May 20 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3914

Tricolored Blackbird Agelaius tricolor — Breeds Mar 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3910

Wrentit Chamaea fasciata — Breeds Mar 15 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Yellow-billed Magpie Pica nuttalli — Breeds Apr 1 to Jul 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9726

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (▪)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

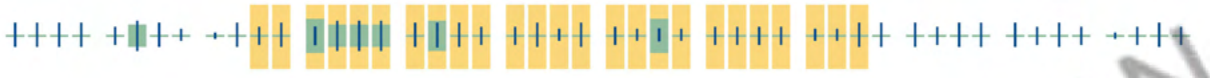
No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

▪ probability of presence ▪ breeding season | survey effort – no data

Common Yellowthroat BCC - BCR (This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA)

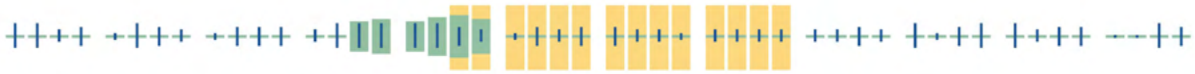
Lawrence's Goldfinch BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



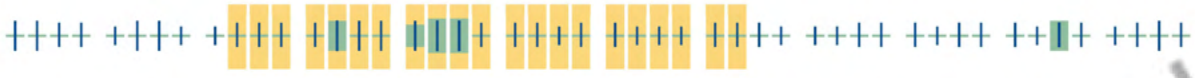
Nuttall's Woodpecker BCC - BCR (This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA)

Oak Titmouse BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

Olive-sided Flycatcher BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Tricolored Blackbird BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Wrentit BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

Yellow-billed Magpie BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin

Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be

confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Coastal Barrier Resources System

Projects within the John H. Chafee Coastal Barrier Resources System (CBRS) may be subject to the restrictions on federal expenditures and financial assistance and the consultation requirements of the Coastal Barrier Resources Act (CBRA) (16 U.S.C. 3501 et seq.). For more information, please contact the local Ecological Services Field Office or visit the CBRA Consultations website. The CBRA website provides tools such as a flow chart to help determine whether consultation is required and a template to facilitate the consultation process.

THERE ARE NO KNOWN COASTAL BARRIERS AT THIS LOCATION.

Data limitations

The CBRS boundaries used in IPaC are representations of the controlling boundaries, which are depicted on the official CBRS maps. The boundaries depicted in this layer are not to be considered authoritative for in/out determinations close to a CBRS boundary (i.e., within the "CBRS Buffer Zone" that appears as a hatched area on either side of the boundary). For projects that are very close to a CBRS boundary but do not clearly intersect a unit, you may contact the Service for an official determination by following the instructions here: https://www.fws.gov/service/coastal-barrier-resources-system-property-documentation

Data exclusions

CBRS units extend seaward out to either the 20- or 30-foot bathymetric contour (depending on the location of the unit). The true seaward extent of the units is not shown in the CBRS data, therefore projects in the offshore areas of units (e.g., dredging, breakwaters, offshore wind energy or oil and gas projects) may be subject to CBRA even if they do not intersect the CBRS data. For additional information, please contact CBRA@fws.gov.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS AT THIS LOCATION.

Fish hatcheries

THERE ARE NO FISH HATCHERIES AT THIS LOCATION.

Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

FRESHWATER POND
Palustrine

RIVERINE
Riverine

A full description for each wetland code can be found at the National Wetlands Inventory website

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

U.S. Department of Transportation
Federal Aviation Administration

Office of Aviation Safety

800 Independence Ave., SW.
Washington, DC 20591

Sacramento Fish and Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846

SUBJECT: Endangered Species Act, Section 7, Informal Consultation for Drone Package Delivery Operations in Lockeford, California

Dear Sir or Madam:

In accordance with Section 7 of the Endangered Species Act (ESA), the Federal Aviation Administration (FAA) is requesting concurrence from the U.S. Fish and Wildlife Service (USFWS) that the FAA decision to authorize Amazon Prime Air (Prime Air) to conduct limited unmanned aircraft (UA) commercial package delivery operations from one Prime Air Drone Delivery Center, or "PADDC," in Lockeford, California that ***may affect, but is not likely to adversely affect*** the Riparian Brush Rabbit (*Sylvilagus bachmani riparius*), a federally-listed species that could be present in the operating area. A brief background, description of the proposed project, and discussion of potential effects to federally listed species is provided below.

Background

In 2020, Prime Air received its Part 135 air carrier operating certificate from the FAA. The certificate contains a stipulation that operations must be conducted in accordance with the provisions and limitations specified in its Operations Specifications (OpSpecs). Prime Air has requested that the FAA review and approve an amendment to its OpSpecs to specify a new area of operations in Lockeford, California (see operating area in Figure 1). The FAA is using an environmental assessment (EA) to evaluate the potential effects of the FAA decision to authorize Prime Air to begin UA commercial package delivery operations in this new location.

Project Description

Prime Air proposes to operate from one PADDC located at 12405 East Brandt Road, Lockeford, CA using its 91.5-pound MK27-2 UA. The circle-shaped operating area has a radius of four miles from the PADDC, and is approximately 50.26 square miles in area. The Lockeford operating area is outlined in red in Figure 1 below. The PADDC location is identified using the yellow pin.

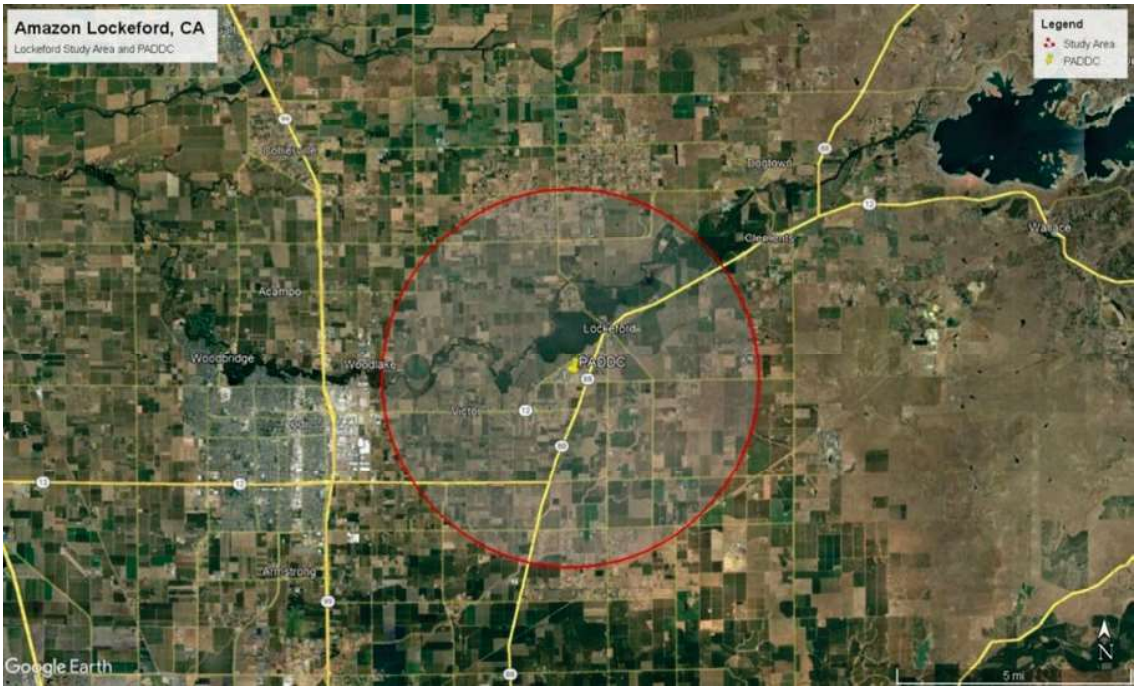


Figure 1 PADDC and Operating Area in Lockeford, CA

The proposed action will not result in any construction, development, or physical disturbances of the ground. Therefore, no habitat modification is associated with the proposed action. Earlier construction at the PADDC site was not part of the proposed action reviewed by the FAA, and any future ground construction at the PADDC site will not require approval or authorization by the FAA. Prime Air's aircraft will not touch the ground in any other place than the PADDC, since it remains airborne while conducting deliveries. The operations will take place within airspace, and typically well above the tree line and away from sensitive habitats.

After launch, Prime Air's UA will rise to a cruising altitude between 160 feet and 180 feet above ground level (AGL) and follow a preplanned route to its delivery site. Aircraft will typically stay at 160-180 feet AGL or higher except when descending to drop a package. When making a delivery, the aircraft descends and packages are dropped to the ground from approximately 13 feet AGL. Packages are carried internally in the aircraft's fuselage, and are dropped by opening a set of payload doors on the aircraft. After the package is dropped, the UA then climbs vertically to approximately 160-180 feet and reverses the path taken, returning to the takeoff/landing pad at the PADDC.

Operations from the Lockeford PADDC would occur during daylight hours up to five days per week. Prime Air projects operating a maximum of approximately 200 delivery flights per operating day, with no flights on weekends or at night. The operating area is divided into four quadrants, and there would only be a maximum of approximately 50 drone deliveries per day in each quadrant. The actual number of daily operations is expected to be considerably lower for the foreseeable future.

A copy of the Draft EA with additional information on the proposed action can be found at the following location: https://www.faa.gov/uas/advancedoperations/nepaanddrones/amazon-prime-air-drone-package-delivery-operations-lockeford

Action Area

The action area is defined as all areas to be affected directly or indirectly by the proposed action and not merely the immediate area involved in the action. The action area is the PADDC site and a 4-mile radius (Figure 1). The noise generated by the UA during en route flight and deliveries represents the potential for impacts.

Federally-Listed Species in the Action Area, and Potential for Effects

The FAA used the USFWS's Information for Planning and Conservation (IPaC) system to identify federally listed species and critical habitat in the action area. There is no critical habitat in the action area for any federally-listed species.

Table 1: ESA-listed Mammals, Reptiles, Amphibians, and Insects in Study Area

ESA Listed Species	Common Name (Scientific Name)
Amphibians (Threatened)	California Tiger Salamander (*Ambystoma californiense*)
Reptiles (Threatened)	Giant Garter Snake (*Thamnophis gigas*)
Insects (Candidate)	Monarch Butterfly *(Danaus plexippus*)
Mammals (Endangered)	Riparian Brush Rabbit (*Sylvilagus bachmani riparius*)
Insects (Threatened)	Valley Elderberry Longhorn Beetle *(Desmocerus californicus dimorphus*)

[1] The USFWS species list also includes Fish, Crustaceans, and Flowering Plants. See discussion below table for reason why these five species are not considered in the analysis.

In addition to the five species listed in Table 1, IPaC identifies five other federally-listed species: Delta Smelt (Hypomesus transpacificus), Conservancy Fairy Shrimp (Branchinecta conservatio), Vernal Pool Fairy Shrimp (Branchinecta lynchi), Vernal Pool Tadpole Shrimp (Lepidurus packardi), and Fleshy Owl's-clover (Castilleja campestris ssp. Succulenta). However, because the proposed action will not involve development or disturbance of any land or water resources, these species are not considered in this effects analysis.

California Tiger Salamander

The California tiger salamander is found in aquatic environments such as seasonal natural ponds and vernal pools and in upland areas like grasslands (USFWS, 2014). They spend a majority of their life in upland habitats and are dependent on the burrows of California ground squirrels and pocket gophers for shelter and protection from predators (USFWS, 2014).

There is suitable habitat for the California tiger salamander within the study area that includes wetland environments and upland grasslands (USDA 2021). However, California tiger salamanders are nocturnal animals that will only emerge at night to feed and to migrate to their breeding ponds (USFWS, 2003). They will spend the summer and fall months in a state of dormancy underground in their burrows (USFWS, 2003). Because delivery operations will take place during the day when the salamanders are not active and underground, the FAA determined the proposed action would have no effect on the California tiger salamander.

Valley Elderberry Longhorn Beetle

The Valley Elderberry Longhorn Beetle is found only in association with the elderberry (Sambucus spp.), a shrub that grows in riparian areas and in foothill oak woodlands in California (USFWS, 2019)

According to the vegetation map analyzed on Biogeographic Information and Observation System (BIOS), there were no elderberry shrubs occurring in the study area (CDFW, 2018). Because there is no suitable habitat within the study area, the FAA determined the proposed action would have no effect on the Valley Elderberry Longhorn Beetle.

Giant Garter Snake

The Giant Garter snake is found in California and lives in a variety of habitats that include natural wetlands such as marshes, sloughs, ponds, small lakes and streams and artificial waterways and agricultural wetlands (USFWS, 2020a). The species is more abundant in rice growing regions since rice fields and drainage canals provide a mix of habitat that the snakes can use throughout the year (USFWS, 2020a). The snakes need tall vegetation growing along the banks in order to escape predators and will spend the winters in the burrows that were made by small animals like squirrels and rodents (USFWS, 2020a).

There is suitable habitat for the giant garter snake within the study area that includes creeks, ponds, and wetlands (USFWS, n.d.), and there are also some agricultural rice fields within the study area that could provide suitable habitat for the species (USDA, 2021). However, as described in Section 3.5.3 in the Draft EA, noise levels produced by the UA would not be expected to be significant at any location beyond the PADDC property, and the noise levels would not be expected to produce any ground vibrations. Therefore, the FAA determined that there is no plausible route of effects, and the proposed action would have no effect on the Giant Garter Snake.

Riparian Brush Rabbit

The riparian brush rabbit is found in riparian areas that contain willow thickets (*Salix spp.*), California wild rose (*Rosa californica*), Pacific blackberry (*Rubus vitifolius*), wild grape (*Vitis californica*), Douglas' coyote bush (*Baccharis douglasii*) and various grasses (USFWS, 2020b). The rabbits have small home ranges that are limited by the size of available brushy habitat.

Based on the FAA's analysis, the narrow riparian corridor along the Mokelumne River may have the potential to provide suitable habitat for the riparian brush rabbit, as the riparian corridor includes willow thickets, wild grapes, and various grasses (CDFW, 2018). However, while the Mokelumne River is within the historic range of the riparian brush rabbit, there is currently no riparian brush rabbit population in or near the area, and the species could not propagate to this area naturally from its only known locations in southern San Joaquin County and northern Stanislaus County. All of the properties surrounding the Mokelumne River and its narrow riparian corridor are heavily managed agricultural lands. While it is unlikely that the riparian brush rabbit would be reintroduced into this area in the foreseeable future, the species is considered for potential effects.

The hearing capabilities of rabbits is generally much sharper than humans; studies have found that rabbit hearing ranges from 360 to 42,000 Hz (Yuan et al., 2019). While the en route drone noise has been found to be not significant, and Prime Air will not be expected to make deliveries in close proximity

to riparian brush rabbit habitat, there is a chance that, due to keen hearing capabilities of this species, they may be able to sense the UA if it were to fly over their habitat. However, due to the typical altitudes where UA operations will take place, and the infrequent operations over any single point in the operating area, the FAA has determined that proposed action *may affect, but is not likely to adversely affect*, the Riparian Brush Rabbit.

Conclusion

The FAA has determined in the Draft EA that the proposed action will not cause significant noise or visual impacts. Additionally, as stated above, the FAA has determined that the proposed action ***may affect, but is not likely to adversely affect***, the riparian brush rabbit, and will have ***no effect*** on other ESA-listed species in the action area.

The FAA appreciates your review of the proposed project and requests your concurrence with our effects determination for the riparian brush rabbit. If you have any questions, please contact Mr. Mike Millard, of my staff, at 202-267-7906 or at Mike.Millard@faa.gov.

Sincerely,

MICHAEL JAY MILLARD

Digitally signed by MICHAEL JAY MILLARD
Date: 2022.10.18 08:40:23 -04'00'

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United States Department of the Interior
FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Suite W-2605
Sacramento, California 95825-1846
SFWO_mail@fws.gov

In Reply Refer to:
2023-0012332-S7-001

November 8, 2022

Mike Millard
Aviation Safety Inspector, Flight Standards Environmental Specialist
Federal Aviation Administration, Office of Aviation Safety
800 Independence Ave., SW.
Washington, D.C. 20591
mike.millard@faa.gov

Subject: Informal Consultation on Drone Package Delivery Operations in Lockeford, California

Dear Mike Millard:

This letter is in response to the Federal Aviation Administration's (FAA) September 22, 2022, request for initiation of informal consultation with the U.S. Fish and Wildlife Service (Service) on the action by the U.S. Department of Transportation, Federal Aviation Administration's authorization of Amazon Prime Air (Prime Air) unmanned aircraft commercial package delivery (proposed project) in Lockeford, California. At issue are the potential effects of the proposed project on the federally endangered Riparian brush rabbit (*Sylvilagus bachmani riparius*) (brush rabbit). This response is provided under the authority of the Endangered Species Act of 1973, as amended (16 U.S.C. § 1531 *et seq*.)(Act), and in accordance with the implementing regulations pertaining to interagency cooperation (50 CFR 402).

The federal action on which we are consulting is the proposed unmanned aircraft (UA) commercial package delivery operations from an Amazon Prime Air (Prime Air) drone delivery center (PADDC), in Lockeford, California. Pursuant to 50 CFR 402.12(j), you submitted a biological assessment for our review and requested concurrence with the findings presented therein. These findings conclude that the proposed project may affect, but is not likely to adversely affect the brush rabbit. The proposed project is not within designated or proposed critical habitat for any federally listed species.

In considering your request, we based our evaluation on the following information: (1) an initial biological assessment, received by the Service on September 22, 2022; (2) a consultation request letter received by the Service on September 22, 2022; (3) additional e-mail correspondence between the Service and FAA; and (4) additional information available to the Service.

Project Description

The proposed project includes operation and evaluation of Prime Air UA commercial package delivery operations from one PADDC in Lockeford, California. The UA model MK27-2 weighs 91.5 pounds and is a hybrid multi-copter fixed wing drone using electric power from rechargeable lithium-ion batteries. The action area has a radius of four miles from the PADDC and has an approximate area of 50.26 square miles. The proposed action will not result in any construction, development, or physical ground disturbances. Therefore, no habitat modification is associated with the proposed project. Prime Air's UA will not ground outside of the designated PADDC, and operations will take place within airspace, typically well above the tree line and away from potential sensitive habitats.

After an initial UA launch, Prime Air's aircraft will rise to an altitude between 160 and 180 feet above ground level (AGL) and follow a pre-planned route to its delivery location. When making the delivery, the aircraft will descend, and the package will be dropped to the ground from approximately 13 feet AGL. After the package is dropped, the UA then climbs vertically to approximately 160-180 feet and reverses the path taken, returning to the takeoff/landing pad at the PADDC. Prime Air operates a maximum of approximately 200 delivery flights per operating day. The proposed project area is divided into four sectors, with each sector having a maximum of approximately 50 delivery flights per operating day. Operations from the Lockeford PADDC would only occur during daylight hours with no delivery's occurring at night. The noise generated by the UA during flight could potentially impact brush rabbit behavior. Noise exposure analysis within the PADDC shows that noise levels would not exceed Community Noise Equivalent Level (CNEL in California) 45 dB in any location within the proposed project area. A significant noise impact is defined in FAA Order 1050.1F as more at or above Day-Night average sound level (DNL) 65 dB.

The proposed project area primarily consists of industrial property, rural communities, and heavily managed agricultural lands. Within the proposed project area, there is a very narrow riparian corridor along the Mokelumne River that may have the potential to provide moderately suitable habitat for the brush rabbit. The riparian corridor includes willow thickets, wild grapes, and various grasses (CDFW 2018). However, while the Mokelumne River is within the historic range of the brush rabbit, there are no active brush rabbit populations within or near the action area. According to the California Natural Diversity Database (CNDDB), the closest documented occurrences of brush rabbit are approximately 25 miles south of the proposed project site in southern San Joaquin county and northern Stanislaus county, with the latest observed in 2004 (CNDDB 2022). The adjacent properties surrounding the riparian corridor are heavily managed agricultural lands. The project site generally provides relatively poor habitat for brush rabbit and low foraging opportunities because of the predominance of developed lands and highly disturbed agricultural areas.

The Prime Air UA flight will not be expected to make deliveries near brush rabbit habitat. However, due to keen hearing capabilities of this species (hearing ranges from 360 to 42,000 Hz (Yuan et al., 2019)), they may be able to sense UA flight if it were to fly over potential habitat within the proposed project area. Due to the typical altitudes where UA operations will take place, and the infrequent operations over any single point in the operating area, it is unlikely that brush rabbit will be responsive to flight noise disturbance. Due to the highly industrial proposed project area and disturbed adjacent agricultural lands, it is highly unlikely that riparian brush rabbit will be present in the area.

Conclusion

The Service concurs with your determination that the proposed project may affect but is not likely to adversely affect the Riparian brush rabbit. Because the proposed project area consists of a highly industrial and rural environment surrounded by disturbed agricultural lands, individuals around these areas would be unlikely to disperse and forage on the project site. Although brush rabbit has keen hearing capabilities, noise exposure within the PADDC will not exceed into significant noise impact levels. There has been no recent evidence of occupancy by the Riparian brush rabbit and no individuals have been documented within the area. Based on the low amount of suitable habitat found on the proposed project site and lack of recent occurrence, the Riparian brush rabbit are highly unlikely to move into the proposed project area to be potentially affected by UA noise disturbance.

This concludes the Service's review of the proposed project. No further coordination with the Service under the Act is necessary at this time. Please note, however, this letter does not authorize take of listed species. As provided in 50 CFR §402.14, initiation of formal consultation is required where there is discretionary Federal involvement or control over the action (or is authorized by law) and if: 1) new information reveals the effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this review; 2) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this review; or 3) a new species is listed or critical habitat designated that may be affected by the action.

If you have questions regarding this action, please contact Angel Sprague, Fish and Wildlife Biologist, at (angelica_sprague@fws.gov), or at (916) 414-6720, or me (patricia_cole@fws.gov) at the letterhead address.

Sincerely,

PATRICIA COLE

Digitally signed by PATRICIA COLE
Date: 2022.11.08 13:50:03 -08'00'

Patricia Cole
Supervisor, San Joaquin Valley Division

ec:
Craig Bailey, California Department of Fish and Wildlife, Fresno, California

LITERATURE CITED

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Appendix B

Tribal and Historic Outreach Letters

U.S. Department
of Transportation
**Federal Aviation
Administration**

Aviation Safety

800 Independence Ave., S.W.
Washington, DC 20591

Office of Historic Preservation
1725 23rd Street, Suite 100
Sacramento, CA 95816

Via electronic submission to calshpo.ohp@parks.ca.gov

To whom it may concern:

The purpose of this letter is to inform you of a proposal under consideration by the Federal Aviation Administration (FAA) for the approval of a Certificate of Waiver and/or Exemption for an Unmanned Aircraft System (UAS) delivery operation in Lockeford, CA. The FAA has determined that this proposed action is a Federal undertaking as defined in 36 CFR § 800.16 (y). Therefore, the FAA is initializing consultation with the State Historic Preservation Officer (SHPO) pursuant to § 800.11 (d).

Proposed Activity Description
The FAA has been asked to approve waivers and/or exemptions to aeronautical regulations, thereby approving the UAS operation in the area depicted below. FAA approval of the UAS operation in the area is an undertaking subject to regulations pursuant to the National Historic Preservation Act.

The UAS operation will be flown by an MK-27 unmanned aircraft at approximately 250 feet, and but no more than 400 feet above ground level (AGL) within a 4 mile radius in the vicinity of Lockeford, CA (see attached operations area map). The purpose is for package delivery, consisting of no greater than approximately 200 flights each day, with each flight lasting approximately 15 minutes. Flights will occur primarily Mon-Fri, no holidays, with operating hours from 8 am until 5 pm, daylight hours. The dimension of the UAS area defines the Area of Potential Effect (APE). According to the National Park Service online database of the National Register of Historic Places, three registered historical places were identified within the proposed APE. The three registered historical places are the Locke House and Barn, Locke's Meat Market and Harmony Grove Church. The UAS operation will have no affects to the ground. All flights will takeoff from, and return to a drone delivery center in Lockeford, CA.

Consultation
Based on a review of the area, as well as our increasing knowledge with respect to the level of environmental impacts from drone operations, FAA has determined that this new approval has no potential to effect historic properties. FAA expects that drone operations will continue to grow and that we all will continue to learn more about this emerging

technology. FAA would be amenable to trying to answer any questions you may have generally on this new technology. Your response over the next 30 days will greatly assist us in incorporating your concerns into our environmental review of the operation.

If you have any comments or questions or need additional information regarding the proposed operation, please do not hesitate to contact Mr. Mike Millard, in writing at: FAA, AFS-800, 800 Independence Ave., S.W., Washington, D.C. 20591; by telephone: (202) 267-7906; or by email: 9-AWA-AVS-AFS-ENVIRONMENTAL@faa.gov.

Sincerely,

David Menzimer

Digitally signed by David Menzimer
Date: 2022.04.26 10:00:46 -07'00'

David Menzimer
Manager, General Aviation Operations Section
General Aviation and Commercial Division
Office of Safety Standards, Flight Standards Service

Enclosure

U.S. Department
of Transportation
**Federal Aviation
Administration**

Aviation Safety

800 Independence Ave., S.W.
Washington, DC 20591

Chairperson Rhonda Morningstar-Pope
Buena Vista Rancheria of Me-Wuk Indians
1418 20th Street, Suite 200
Sacramento, CA 95811

Dear Chairperson Morningstar-Pope:

The purpose of this letter is to initiate formal government-to-government consultation regarding a proposal under consideration by the Federal Aviation Administration (FAA) for the approval of a Certificate of Waiver and/or Exemption, or Operations Specifications for an Unmanned Aircraft System (UAS) operation area in Lockeford, CA. We wish to solicit your views regarding potential effects on tribal interests in the area.

Proposed Activity Description
The FAA has been asked to approve waivers and/or exemptions to aeronautical regulations, thereby approving the UAS operation in the area depicted below. FAA approval of the UAS operation in the area is an undertaking subject to regulations pursuant to the National Historic Preservation Act.

The UAS operation will be flown by an MK-27 unmanned aircraft at approximately 250 feet, and but no more than 400 feet above ground level (AGL) within a 4 mile radius in the vicinity of Lockeford, CA (see attached operations area map). The purpose is for package delivery, consisting of no greater than approximately 200 flights each day, with each flight lasting approximately 15 minutes. Flights will occur primarily Mon-Fri, no holidays, with operating hours from 8 am until 5 pm, daylight hours. The dimension of the UAS area defines the Area of Potential Effect (APE). The UAS operation will have no affects to the ground. All flights will takeoff from, and return to a drone delivery center in Lockeford, CA.

Consultation
The FAA is soliciting the opinion of the tribe(s) concerning any tribal lands, or sites of religious or cultural significance that may be affected by the proposed operation area. Based on a review of the area, as well as our increasing knowledge with respect to the level of environmental impacts from drone operations, FAA has determined that this new approval has no potential to effect historic properties. FAA expects that drone operations will continue to grow and that we all will continue to learn more about this emerging technology.

FAA would be amenable to trying to answer any questions you may have generally on this new technology. Your response over the next 30 days will greatly assist us in incorporating your concerns into our environmental review of the operation.

If you have any comments or questions or need additional information regarding the proposed operation, please do not hesitate to contact Mr. Mike Millard, in writing at: FAA, AFS-800, 800 Independence Ave., S.W., Washington, D.C. 20591; by telephone: (202) 267-7906; or by email: 9-AWA-AVS-AFS-ENVIRONMENTAL@faa.gov.

Sincerely,

David Menzimer

Digitally signed by David Menzimer
Date: 2022.04.26 09:59:53 -07'00'

David Menzimer
Manager, General Aviation Operations Section
General Aviation and Commercial Division
Office of Safety Standards, Flight Standards Service

Enclosure

U.S. Department
of Transportation
**Federal Aviation
Administration**

Aviation Safety

800 Independence Ave., S.W.
Washington, DC 20591

Chairperson Silvia Burley
California Valley Miwok Tribe
1487 Avenida Central
La Grange, CA 95329

Dear Chairperson Burley:

The purpose of this letter is to initiate formal government-to-government consultation regarding a proposal under consideration by the Federal Aviation Administration (FAA) for the approval of a Certificate of Waiver and/or Exemption, or Operations Specifications for an Unmanned Aircraft System (UAS) operation area in Lockeford, CA. We wish to solicit your views regarding potential effects on tribal interests in the area.

Proposed Activity Description
The FAA has been asked to approve waivers and/or exemptions to aeronautical regulations, thereby approving the UAS operation in the area depicted below. FAA approval of the UAS operation in the area is an undertaking subject to regulations pursuant to the National Historic Preservation Act.

The UAS operation will be flown by an MK-27 unmanned aircraft at approximately 250 feet, and but no more than 400 feet above ground level (AGL) within a 4 mile radius in the vicinity of Lockeford, CA (see attached operations area map). The purpose is for package delivery, consisting of no greater than approximately 200 flights each day, with each flight lasting approximately 15 minutes. Flights will occur primarily Mon-Fri, no holidays, with operating hours from 8 am until 5 pm, daylight hours. The dimension of the UAS area defines the Area of Potential Effect (APE). The UAS operation will have no affects to the ground. All flights will takeoff from, and return to a drone delivery center in Lockeford, CA.

Consultation
The FAA is soliciting the opinion of the tribe(s) concerning any tribal lands, or sites of religious or cultural significance that may be affected by the proposed operation area. Based on a review of the area, as well as our increasing knowledge with respect to the level of environmental impacts from drone operations, FAA has determined that this new approval has no potential to effect historic properties. FAA expects that drone operations will continue to grow and that we all will continue to learn more about this emerging technology.

FAA would be amenable to trying to answer any questions you may have generally on this new technology. Your response over the next 30 days will greatly assist us in incorporating your concerns into our environmental review of the operation.

If you have any comments or questions or need additional information regarding the proposed operation, please do not hesitate to contact Mr. Mike Millard, in writing at: FAA, AFS-800, 800 Independence Ave., S.W., Washington, D.C. 20591; by telephone: (202) 267-7906; or by email: 9-AWA-AVS-AFS-ENVIRONMENTAL@faa.gov.

Sincerely,

David Menzimer

Digitally signed by David Menzimer
Date: 2022.04.26 10:01:24 -07'00'

David Menzimer
Manager, General Aviation Operations Section
General Aviation and Commercial Division
Office of Safety Standards, Flight Standards Service

Enclosure

U.S. Department
of Transportation
**Federal Aviation
Administration**

Aviation Safety

800 Independence Ave., S.W.
Washington, DC 20591

Chairperson Neil Peyron
Tule River Indian Tribe
P.O. Box 589
Porterville, CA 93258-0589

Dear Chairperson Peyron:

The purpose of this letter is to initiate formal government-to-government consultation regarding a proposal under consideration by the Federal Aviation Administration (FAA) for the approval of a Certificate of Waiver and/or Exemption, or Operations Specifications for an Unmanned Aircraft System (UAS) operation area in Lockeford, CA. We wish to solicit your views regarding potential effects on tribal interests in the area.

Proposed Activity Description
The FAA has been asked to approve waivers and/or exemptions to aeronautical regulations, thereby approving the UAS operation in the area depicted below. FAA approval of the UAS operation in the area is an undertaking subject to regulations pursuant to the National Historic Preservation Act.

The UAS operation will be flown by an MK-27 unmanned aircraft at approximately 250 feet, and but no more than 400 feet above ground level (AGL) within a 4 mile radius in the vicinity of Lockeford, CA (see attached operations area map). The purpose is for package delivery, consisting of no greater than approximately 200 flights each day, with each flight lasting approximately 15 minutes. Flights will occur primarily Mon-Fri, no holidays, with operating hours from 8 am until 5 pm, daylight hours. The dimension of the UAS area defines the Area of Potential Effect (APE). The UAS operation will have no affects to the ground. All flights will takeoff from, and return to a drone delivery center in Lockeford, CA.

Consultation
The FAA is soliciting the opinion of the tribe(s) concerning any tribal lands, or sites of religious or cultural significance that may be affected by the proposed operation area. Based on a review of the area, as well as our increasing knowledge with respect to the level of environmental impacts from drone operations, FAA has determined that this new approval has no potential to effect historic properties. FAA expects that drone operations will continue to grow and that we all will continue to learn more about this emerging technology.

FAA would be amenable to trying to answer any questions you may have generally on this new technology. Your response over the next 30 days will greatly assist us in incorporating your concerns into our environmental review of the operation.

If you have any comments or questions or need additional information regarding the proposed operation, please do not hesitate to contact Mr. Mike Millard, in writing at: FAA, AFS-800, 800 Independence Ave., S.W., Washington, D.C. 20591; by telephone: (202) 267-7906; or by email: 9-AWA-AVS-AFS-ENVIRONMENTAL@faa.gov.

Sincerely,

David Menzimer

Digitally signed by David Menzimer
Date: 2022.04.26 10:02:13 -07'00'

David Menzimer
Manager, General Aviation Operations Section
General Aviation and Commercial Division
Office of Safety Standards, Flight Standards Service

Enclosure

Appendix C

Noise Analysis Report

Noise Assessment for Amazon Prime Air Proposed Package Delivery Operations with Amazon Prime Air MK27-2 Unmanned Aircraft

In support of U.S. Code of Federal Regulations Title 14, Part 135

Final

HMMH Report No. 309990.003-7

August 19, 2022

Prepared for:

JD RoVolus, LLC
121 Pearl Street
Ypsilanti, MI 48197

Federal Aviation Administration
Aviation Safety, Flight Standards Service
Office of Environment and Energy
Policy, Engineering, Analysis, and Research (PEARS II)
693KA9-18-D-00005

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Noise Assessment for Amazon Prime Air Proposed Package Delivery Operations with Amazon Prime Air MK27-2 Unmanned Aircraft

In support of U.S. Code of Federal Regulations Title 14, Part 135

Final

HMMH Report No. 309990.003-7

August 19, 2022

Prepared for:

JD RoVolus, LLC
121 Pearl Street
Ypsilanti, MI 48197

Federal Aviation Administration
Aviation Safety, Flight Standards Service
Office of Environment and Energy
Policy, Engineering, Analysis, and Research (PEARS II)
693KA9-18-D-00005

Prepared by:

David Crandall
Paul Krusell
Brandon Robinette

HMMH
700 District Avenue, Suite 800
Burlington, MA 01803
T 781.229.0707

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Contents

Figures

Tables

1 Introduction and Background

This document presents the methodology and estimation of noise exposure related to proposed Unmanned Aircraft (UA) package delivery operations conducted by Amazon Prime Air (Amazon) as a commercial operator under the provisions of 14 CFR Part 135. Amazon is proposing to perform small package delivery operations at multiple potential locations in the continental United States.

Amazon is proposing to conduct operations with the Amazon Prime Air MK27-2 UA. This UA features a multi-rotor design with six propellers mounted on equally spaced arms extending horizontally from a center frame. The UA can transition between vertical and horizontal flight. According to data provided by Amazon, the maximum allowable takeoff weight of the UA is 91.5 pounds, its empty weight (including battery) is 86.6 pounds, and its maximum allowable package weight is 4.9 pounds.[1] The package is carried in an internal cargo bay.

Figure 1 depicts the UA considered in this report.

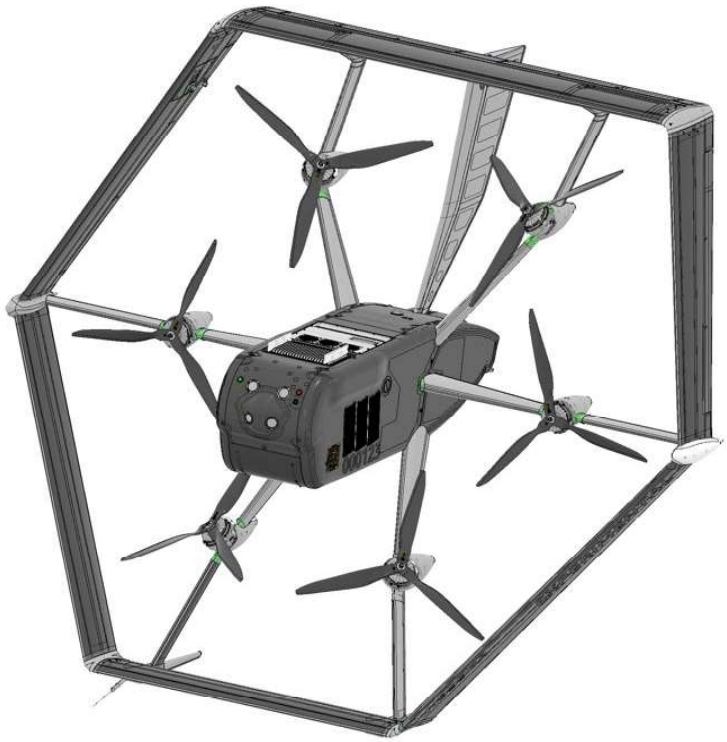

Figure 1: Amazon Prime Air MK27-2 Unmanned Aircraft

Source: Amazon

Amazon's UA package distribution sites are known as Prime Air Drone Delivery Centers (PADDCs). Each PADDC supports multiple sectors, with each sector having a dedicated launch and landing pad. A single

[1] Amazon January 13, 2022. Converted from data originally presented in kilograms.

PADDC is expected to have four sectors and each sector will have no more than one UA operating at a time. Operations in adjacent sectors do not overlap, though sector boundaries may change over time.

PADDCs and routes will be implemented in areas as determined by business and operational needs utilizing Amazon internal procedures that consider various factors.

The MK27-2 can climb and descend vertically, hover, and fly upright with its propellers facing forward like a fixed-wing aircraft for en route flight. Airspeeds during normal en route flight are expected to be approximately 52 knots. Typical flights begin with the UA ascending vertically from a PADDC launch pad at ground level to an en route altitude of between 160 and 180 feet Above Ground Level (AGL). The UA then flies a pre-assigned route between 160 and 180 feet AGL and 52 knots to a selected delivery point. Once near the delivery point, the UA decelerates and descends vertically over the delivery point. The UA descends to 13 feet AGL, drops the package, and ascends back to en route altitude. Once back at en route altitude, the UA accelerates to 52 knots and follows a predefined track to return to its originating PADDC. When the UA arrives at the PADDC, it decelerates and vertically descends to its sector's assigned landing pad. Once it lands, the UA is serviced and prepared for the next delivery.

The methodology proposed in this document provides quantitative guidance to FAA Environmental Specialists to inform environmental decision making on UA noise exposure from proposed Amazon package delivery operations. The methods presented here are suitable for review of Federal actions under the requirements of the National Environmental Policy Act (NEPA) and other applicable environmental special purpose laws or other federal environmental review requirements at the discretion and approval of the FAA. In particular, this report is intended to function as a nonstandard equivalent methodology under FAA Order 1050.1F, and as such, would require prior written approval from FAA's Office of Environment and Energy (AEE) for each individual project for which a NEPA determination is sought.[2]

The methodology has been developed with data provided by Amazon and FAA to date and, therefore, is limited to Amazon operations with the Amazon Prime Air MK27-2 UA and the flight phases and maneuvers described herein. The noise analysis methodology and estimated noise levels of the proposed activities are based upon noise measurement data provided by Amazon and processed by FAA.[3] Results of the noise analysis are presented in terms of the Yearly Day-Night Average Sound Level (DNL) based on varying levels of operations for areas at ground level below each phase of the flight. The Community Noise Equivalent Level (CNEL) may be used in lieu of DNL for FAA actions in California. Discussion of modification of this process for use of the CNEL is discussed in Section 3.1.

Section 2 of this document describes the relevant noise and operations data provided by Amazon and FAA. Section 3 describes the methodology to develop noise exposure estimates for the various UA flight phases associated with typical operations using available data. Section 4 presents the estimated DNL levels for various flight phases based on varying levels of typical operations as described to date.

[2] Discussion of the use of "another equivalent methodology" is discussed in FAA Order 1050.1F, July 16, 2015, Appendix B, Section B-1.2, available online at https://www.faa.gov/documentLibrary/media/Order/FAA_Order_1050_1F.pdf#page=113

[3] FAA's Memorandum, "Estimated Noise Levels for Amazon Prime Air MK27-2 UA," dated August 4, 2022.

2 Unmanned Aircraft Delivery Operations and Noise Measurement Data Set Descriptions

Six data sets form the basis of the noise assessment for the proposed Amazon delivery operations. The data sets include three Amazon provided documents titled "Prime Air Drone Delivery Center (PADDC) Concept of Operations", "MK27-2 Concept of Operations" Rev 3.0 dated January 13, 2022, and "FAA Request for Unmanned Aircraft Operational Data from Amazon Prime Air -- in Support of Environmental Analysis of 14 CFR Part 135 Operations in College Station, Texas and Lockeford, California", all marked "Amazon Confidential and Propriety Trade Secret Information." Amazon also provided a July 12, 2022 document titled "NEPA RFI_071222_Final.docx" marked "Amazon Confidential." Amazon also provided various figures displayed in this document in August 2022. The FAA's Memorandum, "Estimated Noise Levels for Amazon Prime Air MK27-2 UA," dated August 4, 2022, was also used in support of the noise assessment and is provided with this report as Attachment A.[4]

2.1 Operations, Flight Paths, and Flight Profile Data

Operations and flight profile data for the UA provided by Amazon and FAA were reviewed to determine the characteristics of typical operations for a proposed operating area. Based on this review, the following subsections describe the assumptions made about the operations and flight profiles that were used to inform the development of the estimated noise exposure and the methodology for the noise analysis.

2.1.1 Operations

The methodology presented in this report can be used to assess UA noise over a range of proposed activity levels; however, FAA review and approval of its use at specified activity levels is required. The activity ranges shown in Section 4 represent what FAA considers low to moderate activity levels, and as appropriate for consideration with this methodology. At higher activity levels, this methodology may not be sufficient to inform an environmental determination and further consideration or refinements at the discretion of the FAA may be needed.

This report provides variations to the methodology that can be used with either DNL or CNEL, provided that the proper equivalent operations are calculated.

- The DNL noise levels presented in this report are all shown consistent with effective daytime (7 AM to 10 PM) operations levels. For consideration of nighttime (10 PM to 7 AM) noise levels, a ten times operational weighting (equivalent to 10-decibel [dB] increase) should be applied.
- The CNEL noise levels presented in this report are all shown consistent with effective daytime (7 AM to 7 PM) operations levels. For consideration of evening time (7 PM to 10 PM) a three times operational weighting (equivalent to 4.77-dB increase) should be applied and for consideration

[4] Most of these documents have various markings indicating that the contents are "Confidential & Proprietary". Only elements required to support the noise analysis methodology have been disclosed in this report.

of nighttime (10 PM to 7 AM) noise levels, a ten times operational weighting (equivalent to 10-dB increase) should be applied.

Section 3.1 provides techniques to apply the operational weighting necessary to calculate effective operations for analysis with the DNL and CNEL metrics.

2.1.2 Flight Paths and Profiles

The UA will fly a predefined flight path between sites chosen and approved by Amazon. Amazon's PADDC and delivery sites are entirely customer driven, and Amazon has internal procedures for developing routes.

The UA takeoff pads are 4 meters by 4 meters and landing pads are 8 meters by 8 meters. Both are contained within a launch area that will generally be 35 meters by 45 meters. Figure 2 presents a diagram of a representative PADDC.

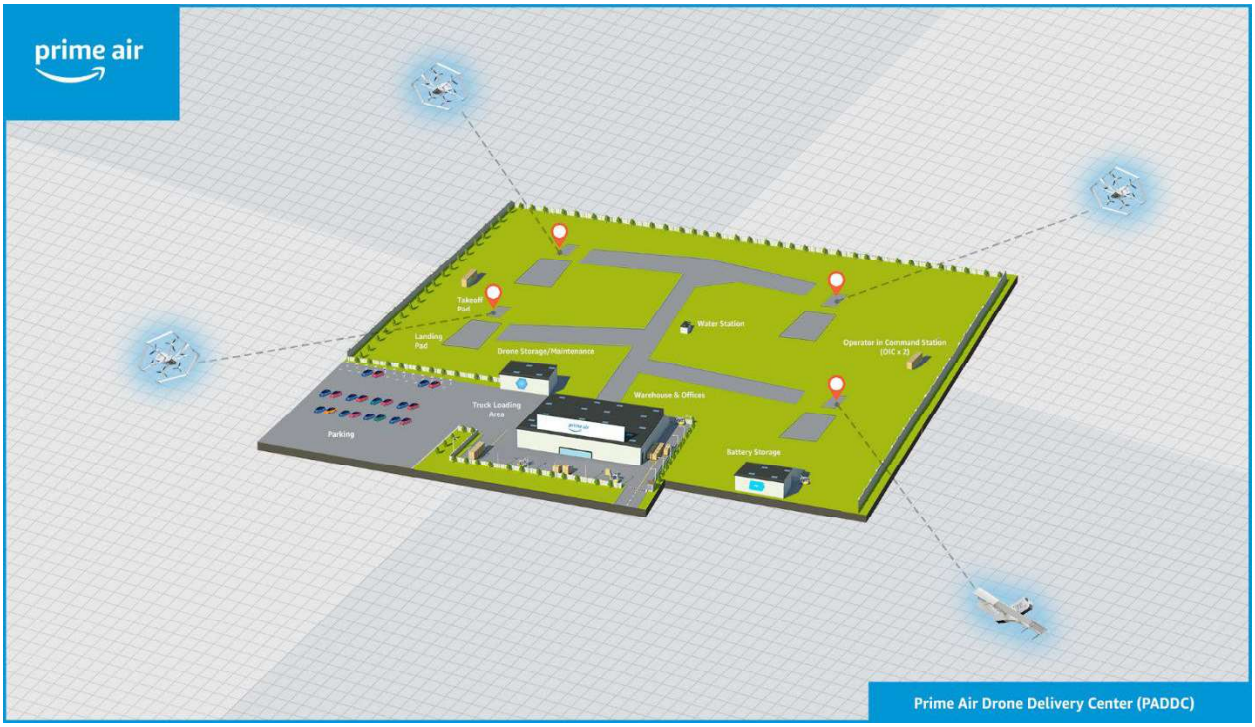

Figure 2: Representative PADDC Layout

Source: Amazon, August 2022

Analysis of flight profile data provided by Amazon and the FAA describes that a typical operation profile of the UA can be broken into five general flight phases: takeoff, transitions to and from vertical to horizontal flight, en route, delivery, and landing.

These five general flight phases can be combined to represent a typical operational profile further identified as:

1. Takeoff and vertical ascent
2. Transition and climb outbound
3. Fixed-wing cruise outbound
4. Delivery descent and transition
5. Backyard descent, delivery, and ascent
6. Transition and climb inbound
7. Fixed-wing cruise inbound
8. Landing descent and transition
9. Vertical descent and landing

These phases are shown in Figure 3 and are representative of the typical flight profile that Amazon is expected to use for delivery operations. The subsections that follow provide a narrative description of each of the nine flight phases.

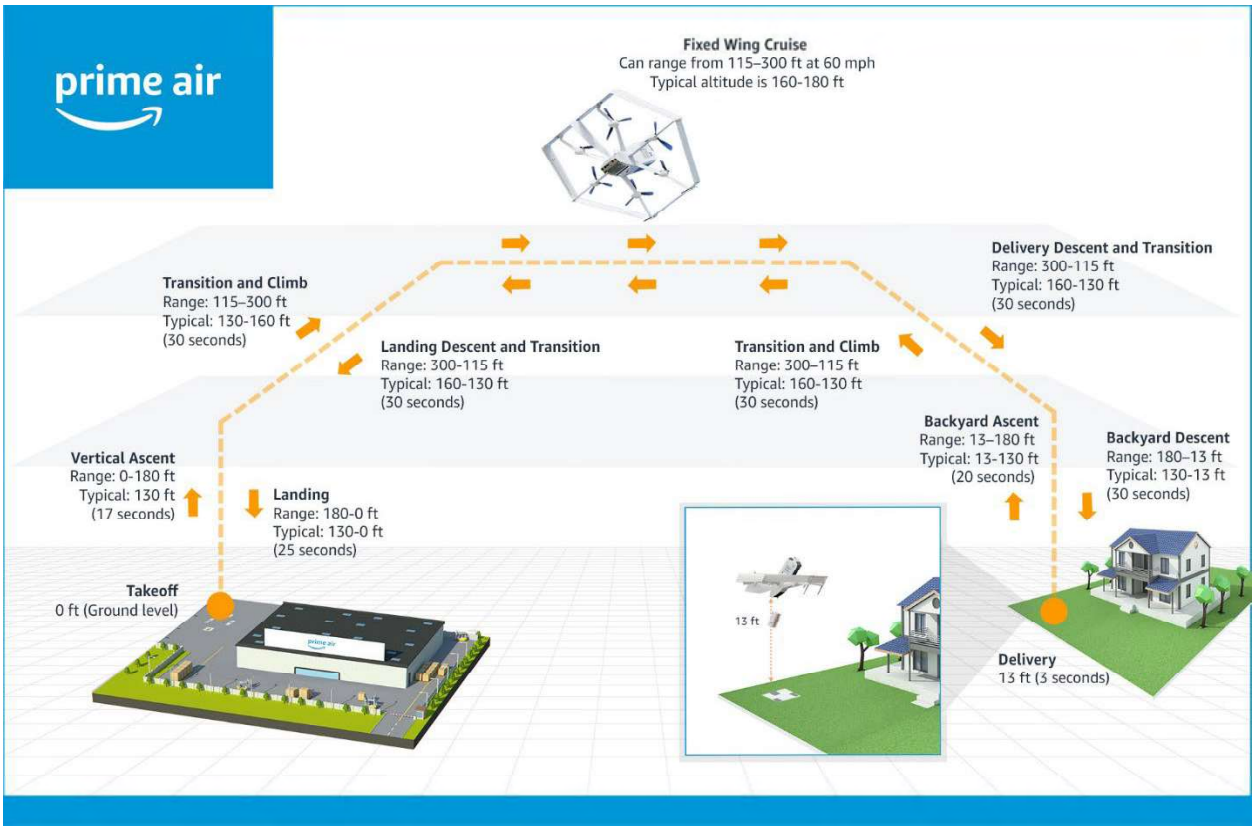

Figure 3: Graphical Depiction of the Proposed Amazon Prime Air MK27-2 Flight Profile to a Destination

Source: Amazon, August 2022

2.1.2.1 Takeoff and vertical ascent

For takeoff, the UA starts at the launch pad. Once it is cleared for takeoff, the UA takes off from the ground vertically to the en route altitude (165 feet AGL) in vertical flight mode (pointed upward).[5]

2.1.2.2 Transition and climb outbound

Once at the en route altitude of 165 feet and still above the launch pad, the UA transitions from zero speed to cruise speed (52.4 kts) while changing from vertical flight mode to horizontal flight mode.

2.1.2.3 Fixed-wing cruise outbound

The UA continues to fly at en route altitude of 165 feet and en route speed of 52.4 knots to the delivery point.

2.1.2.4 Delivery descent and transition

The UA decelerates from 52.4 knots in horizontal flight and transitions to vertical flight mode, coming to a position over the delivery point with zero speed.

2.1.2.5 Backyard descent, delivery, and ascent

The UA vertically descends from en route altitude to 13 feet AGL delivery altitude while maintaining position over the delivery point. Once at 13 feet AGL, the UA drops the package and then proceeds to climb vertically back to en route altitude. The closest that any person could be from the delivery point during this manuver is 16.4 ft.[6]

2.1.2.6 Transition and climb inbound

Once at the en route altitude of 165 feet and still above the delivery point, the UA transitions from zero speed to cruise speed (52.4 kts) while changing from vertical flight mode to horizontal flight mode.

2.1.2.7 Fixed wing crusie Inbound

The UA continues to fly at en route altitude of 165 feet and en route speed of 52.4 knots towards the PADDC.

[5] En Route altitude will be assumed to be 165 feet AGL, corresponding to the measurement data reviewed in FAA's August 4, 2022 memorandum (Attachment A).

[6] Amazon's July 12, 2022 document mentions that: "Note: As the aircraft descends below 40m, it is searching for a clear descent path, under 25m and in a 5m radius cylinder the aircraft's perception system is looking for people, animals, or other obstacles. At any time, if the delivery area becomes unclear, the vehicle will automatically perform a backyard abort, terminate the delivery, and return home with its package."

2.1.2.8 Landing descent and transition

The UA decelerates from 52.4 knots in horizontal flight and transitions to vertical flight mode, coming to a position over its assigned landing pad with zero speed.

2.1.2.9 Landing

While in vertical flight mode, the UA descends over its assigned landing pad down to the ground and shuts down its motors.

Table 1 provides a summary of the prior subsections and includes the assumptions regarding altitude, ground speed, and durations.

Table 1. Amazon Prime Air MK27-2 Typical Flight Profile

Source: FAA August 4, 2022 (Attachment A)

Phase	Description	Altitude (ft AGL)	Ground Speed (knots)	Duration (s)
Takeoff and Vertical Ascent	Vertical launch from PADDC on ground to en route altitude (165 ft AGL) in vertical flight mode (pointed upward)	Ascend from 0 to 165'	0	21
Transition and Climb Outbound	Transition from zero speed above PADDC at en route altitude to cruise speed (52.4 kts) while changing from vertical flight mode to fixed-wing flight mode (pointed horizontally)	165'	0 to 52.4	20
Fixed-wing Cruise Outbound	Flying at operational altitude (165 feet AGL) and speed (52.4 kts) to delivery point	165'	52.4	Variable
Delivery Descent and Transition	Transition from cruise speed at en route altitude and fixed-wing flight mode to zero speed above delivery point at en route altitude and in vertical flight mode	165'	52.4 to 0	20
Backyard Descent, Delivery, and Ascent	Vertically descend from en route altitude to 13 ft AGL delivery altitude	Descend from 165' to 13'	0	32
	Drop a package	13'	0	2
	Vertical ascent back to en route altitude in vertical flight mode	ascend from 13' to 165'	0	24
Transition and Climb Inbound	Transition from zero speed above delivery point to en route altitude to cruise speed while changing from vertical flight mode to fixed-wing flight mode	165'	0 to 52.4	20
Fixed-wing Cruise Inbound	Fixed-wing flight mode at operational en route altitude and cruise speed	165'	52.4	Variable
Landing Descent and Transition	Transition from cruise speed at en route altitude and fixed-wing flight mode to zero speed above PADDC's landing pad at en route altitude and in vertical flight mode	165'	52.4 to 0	20
Landing	Descend from en route altitude to landing pad on ground in vertical flight mode	Descend from 165 to 0'	0	38

2.2 Acoustical Data

Noise measurements of the Amazon Prime Air MK27-2 UA were collected at the Pendleton UAS Range located at the Eastern Oregon Regional Airport (KPDT) in Pendleton, Oregon in April 2021. The FAA then processed and analyzed the measurement data to calculate estimated noise levels for each of the five flight phases (takeoff, transitions to and from vertical to horizontal flight, en route, delivery, and

landing) described in Section 2.1.2. The summarized acoustical data used in this report is included as Attachment A. The following tables show either the A-weighted Sound Exposure Levels (SELs) or formulas to calculate the estimated SELs used for this analysis as detailed in Attachment A, which can be matched to each flight phase detailed in Table 1. The formula is based on Equation (1) presented below.

$$SEL = m \times \log_{10}(d) + b(dB) \quad (1)$$

Where:

- *d is the distance along the ground in feet between the UA and the receiver*
- *m and b are parameters provided in the tables below*

Table 2 presents the parameters to use within Equation (1) to estimate SEL areas associated with takeoff as a function of distance from the launch pad, located within the PADDC boundary, to the receiver.

Table 2. Parameters for Estimating Sound Exposure Level for Takeoff versus Distance

Source: FAA, August 4, 2022 (Attachment A)

Range for d (ft from launch pad)	m	b
32.8 to 49.2	-9.09	109.47
49.2 to 65.6	-16.41	121.86
65.6 to 85.3	-26.39	140
85.3 to 142.2	-27.79	142.71
142.2 and greater	-23.39	134.99
Notes: a) Distance is along ground from launch pad to receiver.		

Table 3 presents the parameters to use within Equation (1) to estimate SEL areas associated with landing as a function of distance from the landing pad, located within the PADDC boundary, to the receiver.

Table 3. Parameters for Estimating Sound Exposure Level for Landing versus Distance

Source: FAA, August 4, 2022 (Attachment A)

Range for d (ft from landing pad)	m	b
32.8 to 49.2	-9.26	108.81
49.2 to 65.6	-8.8	108.05
65.6 to 85.3	-17.1	123.12
85.3 to 142.2	-24.56	137.53
142.2 and greater	-23.39	134.99
Notes: a) Distance is along ground from landing pad to receiver.		

Table 4 presents the parameters to use within Equation (1) to estimate SEL areas associated with delivery, as described in Section2.1.2.5, as a function of distance from the delivery point to the receiver.

Table 4. Parameters for Estimating Sound Exposure Level for Delivery versus Distance

Source: FAA, August 4, 2022 (Attachment A)

Range for d (ft from delivery point)	m	b
32.8 to 49.2	-5.85	105.35
49.2 to 65.6	-7.2	107.64
65.6 to 85.3	-16.92	125.3
85.3 to 142.2	-26.31	143.42
142.2 and greater	-21.9	133.91
Notes: a) Distance is along ground from delivery point to receiver.		

Table 5 presents the estimated SELs associated with the transition between vertical flight mode to horizontal flight mode. The values in this table are for distances relative to the point under the vertical flight path. Table 5 is applicable to all transitions discussed in Sections 2.1.2.2, 2.1.2.4, 2.1.2.6, and 2.1.2.8. These levels should be combined with those from appropriate phases of flight (e.g., to estimate maximum possible landing noise combine the transition noise from Table 5 with the landing noise from Table 3.)

Table 5. Estimated Sound Exposure Levels from Transition Phase of Flight Profile at 165 Feet Above Ground Level

Source: FAA, August 4, 2022 (Attachment A)

Distance from launch pad, landing pad or delivery point (ft)	SEL (dB)
0	69.9
100	70.6
200	70.3
400	69.4
800	68.2
1600	67.7
3200	67.7

Table 6 presents the en route sound exposure levels for en route SEL.

Table 6. Estimates of En Route SEL

Source: FAA August 4, 2022 (Attachment A)

Aircraft Config	Reference air speed (KTS)	Reference Altitude (ft AGL)	SEL (dB)
Max Weight	52.4	165	67.7

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3 Methodology for Data Analysis

The previously described data sets were used to develop a method to estimate community noise exposure that could result from Amazon delivery operations. These would be operations originating from a single PADDC within each proposed area of operations and occurring daily between the hours of 7:00 AM and 10:00 PM. Numbers of daily and equivalent annual delivery operations would vary for different operating areas. There are currently no standardized tools or processes in place to conduct a noise assessment for the proposed operational scenario and UA. Therefore, HMMH, with detailed technical guidance from the FAA Office of Environment and Energy, developed a customized noise exposure prediction process based on the available data to conduct this analysis. The process was developed around FAA's understanding of typical use of the UA by Amazon. The following subsections describe the noise analysis methodology.

3.1 Application of Operations

The DNL metric applies a 10 dB weighting for operations between 10 PM and 7 AM. The 10 dB weighing is mathematically equivalent to 10 times the number of operations. Therefore, the operations near point *i* can be weighted to develop a daytime equivalent number of operations ($N_{equiv,i}$). The generalized form is expressed in Equation (2).[7]

$$N_{Equiv,i} = W_{Day} \times N_{Day,i} + W_{Eve} \times N_{Eve,i} + W_{Night} \times N_{Night,i} \quad (2)$$

Where:

- $N_{Day,i}$ is the number of user-specified operations between 7 AM and 7 PM local time
- $N_{Eve,i}$ is the number of user-specified operations between 7 PM and 10 PM local time
- $N_{Night,i}$ is the number of user-specified operations between 10 PM and 7 AM local time
- W_{Day} is the day-time weighting factor, which is 1 operation for DNL
- W_{Eve} is the evening weighting factor, which is 1 operation for DNL
- W_{Night} is the night-time weighting factor, which is 10 operations for DNL

For the DNL metric, the number of DNL daytime equivalent operations, $N_{DNL,i}$ simplifies to

$$N_{DNL,i} = N_{Day,i} + N_{Eve,i} + 10 \times N_{Night,i} \quad (3)$$

In practice, Equation (2) can be further simplified by defining the user-defined operations between 7 AM and 10 PM as a single value, rather than tracking $N_{Day,i}$ and $N_{Eve,i}$ separately.

[7] Equation (2) includes the three time periods of day, evening, night for consistency with other FAA documents that discuss the development of time averaging metrics such as DNL from individual SELs. Presentation of Equation (2) also allows the practitioner to modify this process for the CNEL metric for use in California.

For the CNEL metric, which may be used in California, the number of CNEL daytime equivalent operations, $N_{CNEL,i}$ simplifies to:

$$N_{CNEL,i} = N_{Day,i} + 3 \times N_{Eve,i} + 10 \times N_{Night,i} \quad (4)$$

3.2 PADDC Infrastructure

As noted in Section 1 and Section 2.1.2, Amazon operates UAs from a central PADDC. A single PADDC is anticipated to support four sets of launch and landing pads, with each set of pads serving a sector. For the purpose of the noise analysis, only one PADDC is assumed to be considered at a time. All the operations for the PADDC (all the launch and landing pads) can be conservatively represented at the nearest single launch or landing pad closest to the noise sensitive location(s) under consideration. If the nearest single launch or landing pad location is not known, then the respective PADDC boundary should be used.

3.3 Application of Acoustical Data

The DNLs can be estimated with a summation of the SELs. SEL values for the Amazon UA operations covered in this report are detailed in FAA's August 4, 2022 Memorandum and provided with this report as Attachment A.

For calculating SEL, five specific activities are considered:

- The UA taking off from the PADDC
- The UA transitioning from either vertical to horizontal flight or horizontal to vertical flight
- En route travel of the UA in horizontal flight between the PADDC and the delivery point
- Delivery
- The UA landing at the PADDC

3.3.1 General Assumptions

This analysis is based on the tables presented in Section 2.2. Table 5 presents noise exposure values at discrete increments relative to the UA's vertical profile from 0 to 3,200 feet. If additional values between 0 to 3,200 feet are needed, then SEL values at intermediary distances can be approximated by linear interpolation.

SEL values at distances less than 32.8 feet for takeoff, landing, or delivery should not be extrapolated because the deviation of the method of estimation value increases closer to the source.

3.3.2 Takeoff

The process for calculating SELs for the takeoff profile described in Section 2.1.2.1 are presented in Section 2.2, specifically Equation (1) combined with the parameters presented Table 2.

Application of the SEL should be based on the position of the launch pad at a PADDC. If the exact location of the launch pad is not known, then using an outer boundary of the PADDC, at a point closest

to the receiver, would be slightly conservative. It should be noted that the SEL values provided only include climb to altitude and do not include transitioning to horizontal flight or accelerating to en route speed that would occur after climb.

3.3.3 Transitions between Vertical and Horizontal Flight Modes

The available SELs for transitioning between vertical and horizontal flight modes are presented in Section 2.2, specifically Table 5. Table 5 presents noise exposure values at discrete increments relative to the UA's vertical profile's ground location for distances from 0 to 3,200 feet. If additional values between 0 to 3,200 feet are needed, then SEL values at intermediary distances can be approximated by linear interpolation. Application of these values are suitable for the UA in level flight at 165 feet AGL and either accelerating or decelerating between 0 knots and 52.4 knots over the course of 20 seconds.

3.3.4 En Route

Typical flight speed of the UA in still air is anticipated to be 52.4 knots, with a typical cruise altitude of 165 feet AGL. Sound exposure level for a given point i (SEL_i) with the aircaft flying directly overhead at altitude (Alt_i) in feet and a ground speed (V_i) in knots, will be calculated based on the guidance in *14 CFR Part 36 Appendix J, Section J36.205 Detailed Data Correction Procedures*.[8] It should be noted that the equations presented in this section are only applicable for a UA that is moving relative to a stationary receptor. The discussion of the variables are presented in the context of the application of this methodology.

In particular, the sound exposure level adjustment for the altitude of a moving UA, is presented here as Equation (5).

$$\Delta J_1 = 12.5 \times \log_{10}\left(\frac{H_A}{H_T}\right), dB \quad (5)$$

Where ΔJ_1 is the quantity in decibels that must be algebraically added to the measured SEL in order to estimate the SEL for a level flight path at an altitude differing from the altitude corresponding to the measured SEL; H_A is the reference height, in feet, corresponding to the measured SEL; H_T is the altitude at which an estimate of the SEL is being made; and the constant (12.5) accounts for the effects on spherical spreading and duration from the off-reference altitude. The value of ΔJ_1 is 0 if H_T is equal to H_A and can be negative if H_T is greater than (higher altitude) than H_A.

The sound exposure level adjustment for speed is presented here as Equation (6).

$$\Delta J_3 = 10 \times \log_{10}\left(\frac{V_R}{V_{RA}}\right), dB \quad (6)$$

Where ΔJ_3 is the quantity in decibels that must be algebraically added to the measured SEL noise level to estimate the SEL of the UA at speed V_{RA} when the measured SEL corresponds to the UA traveling at a reference speed V_R. This adjustment represents the influence of the different speed on the duration of

[8] 14 CFR Part 36 Noise Standards: Aircraft Type and Airworthiness Certification available at https://www.ecfr.gov/current/title-14/chapter-I/subchapter-C/part-36

the overflight at the stationary receptor. If the UA is to be estimated at a speed V_{RA} that is greater than the reference speed V_R of the measured SEL, then the correction ΔJ_3 will be negative. The value of ΔJ_3 is 0 if V_R is equal to V_{RA}. Conversely, if the estimated speed is less than the reference speed, the estimated SEL will be greater than the measured SEL. This stands to reason because a slower moving UA will result in a greater time exposure of its emitted noise at a stationary receptor on the ground.

As shown in Table 6, the SEL is 67.7 dB when the UA is at maximum weight, at 165 feet from the ground receiver and traveling at approximately 52.4 knots; therefore, adapting that to the maximum weight (outbound) en route condition when the UA is flying at an altitude of Alt_i feet AGL and ground speed of V_i knots can be made using Equation (7) to arrive at an estimate $SEL_{maximum\ weight}$ dB for that respective phase of flight.

$$SEL_{maximum\ weight} = 67.7 + 12.5 \times \log_{10}\left(\frac{165}{Alt_i}\right) + 10 \times \log_{10}\left(\frac{52.4}{V_i}\right), dB \quad (7)$$

For the purpose of this noise analysis, it should be assumed that Equation (7) is applicable for all en route activity. This will be a conservative assumption since it is based on the highest average level measured beneath the UA during level flyovers.[9]

3.3.5 Delivery

The available SELs for delivery are presented in Section 2.2, specifically in Equation (1), with the appropriate parameters presented in Table 4 for the delivery profile described in Section 2.1.2.5. Application of the SEL should be based on the distance of the receiver relative to the position of the delivery point. The minimum distance that should be used for calculation between the delivery point and a person is 16.4 feet.[10] The values in Table 4 are valid for distances from the delivery point of 32.8 feet or greater.

Figure 4 provides comparisons of the delivery profile and a constant speed passby. The delivery profile has a distance compared to time for a given receiver similar to the constant speed passby represented by Equation (5).

[9] FAA August 4, 2022, included as Attachment A, Section 1.3

[10] According to Amazon, there should not be an person, animal or object within 5 meters of the delivery point. If the UA detects an person, animal or object within 5 meters of the delivery point, it will abort the delivery.

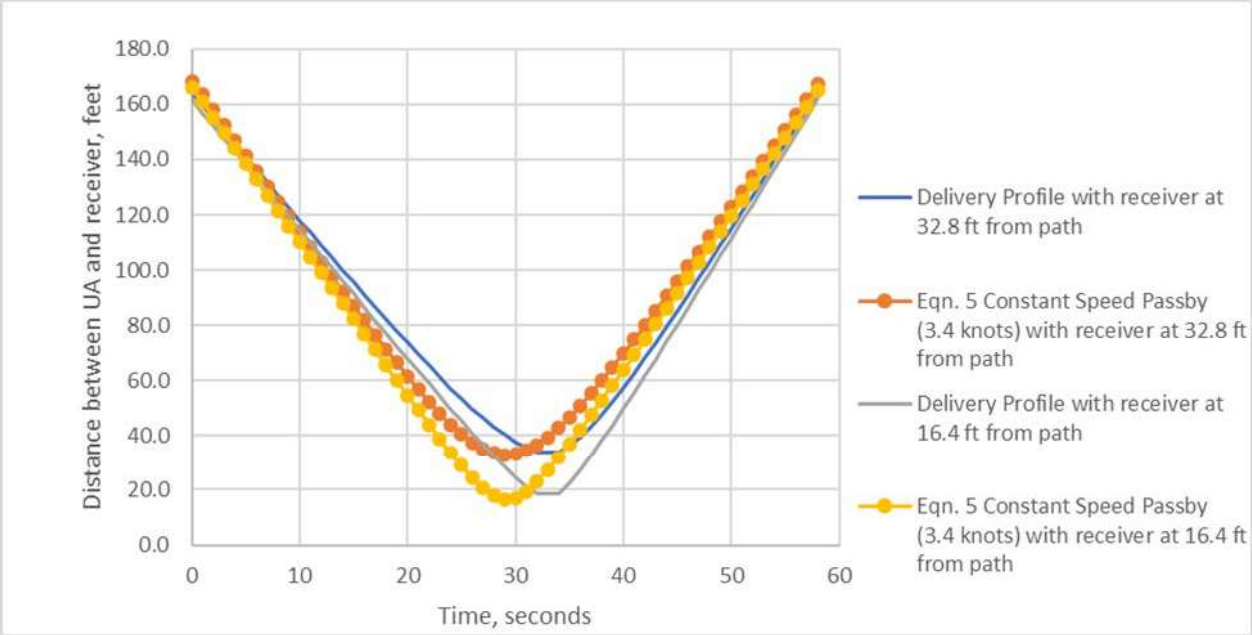

Figure 4: Comparison of Distance versus Time from a Receiver

SEL values for distances of between 16 and 32.8 feet will be adjusted by distance to the delivery point and sound level adjustment of a stationary source as provided by Equation (8).

$$SEL_{Delivery\ Close} = 96.5 + 12.5 \times \log_{10}\left(\frac{32.8}{Distance\ from\ Delivery\ Point\ (ft)}\right),\ dB \quad (8)$$

It should be noted that the SEL values provided only include descent from en route altitude to delivery altitude, various maneuvers associated with the delivery, and climb back to en route altitude. The SEL values do not provide the noise contribution from the horizontal flight associated with either the UA transitioning from en route speed to vertical flight before delivery, or the transition between vertical flight to en route speed after delivery.

3.3.6 Landing

The available sound exposure levels for landing are presented in Section 2.2, specifically in Equation (1), with the parameters presented in Table 3 for the landing profile described in Section 2.1.2.9.

Application of the SEL should be based on the position of the landing pad at a PADDC. If the exact location of the landing pad is not known, then using an outer boundary of the PADDC, at a point closest to the receiver, would be slightly conservative. It should be noted that the SEL values provided only include descent from en route altitude and do not include the deceleration from en route speed or transition to vertical flight that would occur after descent.

3.4 Proposed DNL/CNEL Estimation Methodology

The number of operations overflying a particular receiver's location on the ground will vary based on the proposed operating area and demand. For a given receiver location *i*, and a single instance of sound source *A*, the SEL for that sound source SEL_{iA} is (energy) summed for the average annual daily number of DNL daytime equivalent operations ($N_{DNL,iA}$) to compute the DNL, or equivalently, by Equation (9).

$$DNL_{iA} = SEL_{iA} + 10 \times \log_{10}\left(N_{DNL,\,iA}\right) - 49.4,\ (dB) \tag{9}$$

The above equation applies to an SEL value representing one noise source such as a UA takeoff or a UA landing. For cases where a particular receiver would be exposed to multiple noise sources (A through Z), the complete DNL at that point would be calculated with Equation (10).

$$DNL_i = 10 \times \log_{10}\left(10^{\left(\frac{DNL_{iA}}{10}\right)} + 10^{\left(\frac{DNL_{iB}}{10}\right)} + \cdots + 10^{\left(\frac{DNL_{iZ}}{10}\right)}\right),\ (dB) \tag{10}$$

The calculation for the CNEL metric is nearly identical to Equations (9) and (10), with the exception that the DNL daytime equivalent operations ($N_{DNL,iA}$) used compute DNL is replaced with the CNEL daytime equivalent operations ($N_{CNEL,iA}$). The equations for CNEL are presented below as Equations (11) and (12).

$$CNEL_{iA} = SEL_{iA} + 10 \times \log_{10}\left(N_{CNEL,\,iA}\right) - 49.4,\ (dB) \tag{11}$$

The above equation applies to an SEL value representing one noise source such as a UA takeoff or a UA landing. For cases where a particular receiver would be exposed to multiple noise sources (A through Z), the complete DNL at that point would be calculated with Equation (10).

$$CNEL_i = 10 \times \log_{10}\left(10^{\left(\frac{CNEL_{iA}}{10}\right)} + 10^{\left(\frac{CNEL_{iB}}{10}\right)} + \cdots + 10^{\left(\frac{CNEL_{iZ}}{10}\right)}\right),\ (dB) \tag{12}$$

For each of the conditions presented below, results will be presented in tabular format based on the equivalent daytime operations, either DNL daytime equivalent or CNEL daytime equivalent, for the estimated DNL or CNEL. The proper output of either DNL or CNEL is dependent on the calculation of respective daytime equivalent operations.

3.4.1 DNL/CNEL for PADDC

The takeoff and landing operations are anticipated to occur at the same location. Therefore, the results for both will be calculated for a single set of receptors. Operations will be assumed to be "head-to-head" in which case the takeoff and the landing flight paths will be the same.

Takeoff operations will be represented by two sound levels. First, the UA will take off and climb to en route altitude with the relationship discussed in Section 3.3.2. Second, the UA will begin en route flight by transitioning from vertical flight to horizontal flight and accelerating to en route speed of 52.4 knots assuming that the UA will pass directly over the representative receiver using the relationship in Section 3.3.3.

Landing operations will be represented by two sound levels. First, the UA will fly to the PADDC at en route altitude while slowing down and transition from horizontal to vertical flight (Section 3.3.3).

Second, the UA will descend from en route altitude to the ground and come to rest, which will be represented by the relationships defined in 3.3.6.

The four noise sources representing the complete takeoff and landing cycle associated with a single delivery departing and returning at the PADDC will be added together with Equation (10).

3.4.2 DNL/CNEL for En Route

En route includes the UA flying to and from the PADDC to destinations as discussed in Sections 2.1.2.3 and 2.1.2.7. A representative receiver will be positioned directly under the flight path, and the DNL will be calculated based on the altitude and speed-adjusted delivery SEL calculated in Section 3.3.4. Operations will be based on representative numbers defined in relevant materials and assume that a UA directly overflies the receiver while it is at maximum weight for both outbound and inbound for a single delivery. The en route outbound noise level and the en route inbound noise level will be added together with Equation (10).

3.4.3 DNL/CNEL for Delivery Points

Delivery operations will be represented by three sound levels consisting of the UA:

1. Decelerating from en route speed and transitioning from horizontal flight to vertical flight over the delivery point at the en route altitude of 165 ft;
2. Conducting the delivery phase as described in Section 2.1.2.5 and Table 1; and
3. Transitioning from vertical flight to horizontal flight after reaching the en route altitude of 165 feet AGL and accelerating to en route speed.

The three sound levels will be added together with Equation (10).

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4 Noise Exposure Estimate Results

This section presents the estimated noise exposure for Amazon's proposed operations for a given set of average annual day (AAD) deliveries. The values presented are in tabular format and use of the table requires estimating the number of DNL Equivalent deliveries associated with the PADDC. One delivery includes the outbound takeoff and inbound landing and is representative of two operations.

The DNL Equivalent deliveries, $N_{DNL,i}$ as described in Section 3.1, is presented below as Equation (13).

$$Deliveries_{DNL,\,i} = Deliveries_{Day} + 10 \times Deliveries_{Night} \quad (13)$$

$Deliveries_{Day}$ are between 7 AM and 10 PM and $Deliveries_{Night}$ are between 10 PM and 7 AM. If a portion of a delivery (either takeoff or landing) occurs in the nighttime hours, then it should be counted within $Deliveries_{Night}$.

The CNEL Equivalent deliveries, $N_{CNEL,i}$ as described in 3.1, is presented below as Equation (14).

$$Deliveries_{CNEL,\,i} = Deliveries_{Day} + 3 \times Deliveries_{Eve} + 10 \times Deliveries_{Night} \quad (14)$$

$Deliveries_{Day}$ are between 7 AM and 7 PM, $Deliveries_{Eve}$ are between 7 PM and 10 PM, and $Deliveries_{Night}$ are between 10 PM and 7 AM.[11] If a portion of a delivery (either takeoff or landing) occurs in two time periods, then it should be counted within with the time night or evening, rather than the time evening or day, respectively.

For estimating noise exposure, the noise levels for each flight phase should be considered separate based on the level of proposed operations for a given location. If a particular location is at the transition of different flight phases, the cumulative noise exposure should then be determined by adding the noise from each phase. For example, a typical mission profile will include noise from multiple flight phases:

1. UA departure from and return to a PADDC, including transition to and from vertical to horizontal fixed-wing en route flight;
2. Horizontal fixed-wing en route flight at a defined altitude and speed from a PADDC to a delivery point and back to a PADDC; and
3. Transition to and from horizontal fixed-wing en route flight to vertical flight at the delivery point, vertical descent to complete a delivery at the delivery point, and vertical ascent back to en route altitude for return to a PADCC.

The cumulative noise from the UA is then determined by adding the noise from each of these phases.

4.1 Noise Exposure for Operations at the PADDC

For operations at the PADDC, the UA-related noises include that from takeoff, landing, and transitions from vertical to fixed-wing horizontal flight between the respective en route flight phases. To provide a

[11] Discussion of modification of this process for use in California with the CNEL metric is discussed in Section 3.1.

conservative view, all operations are assumed to be on the same en route flight path with outbound and inbound flights traversing it in opposite directions.

Table 7 presents data for a given number of daily average DNL or CNEL Equivalent deliveries (including the takeoff and climb, transition to en route outbound, transition from en route inbound, and descent and landing as detailed in Section 2.1.2, the estimated extent of DNL/CNEL 45 dB, 50 dB, 55 dB, 60 dB, and 65 dB contours under the flight path for a PADDC extents as described in Section 3.2. The analyses presented in Table 7 were rounded up conservatively to the nearest interval available from the data from Section 2.2, out to 3,500 feet. The actual noise levels, should they be calculated with greater precision or measured, are anticipated to be within the estimated extents depicted.[12]

[12] The calculation of the equations presented in Section 3 require that distance is provided. The DNL levels were calculated at 32.8 feet and then 50-foot intervals from 50 to 3,500 feet as provided in Section 2.2.

Table 7. Estimated Extent of Noise Exposure from PADDC per Number of Deliveries

Number of DNL/CNEL Equivalent Deliveries Served by PADDC		Estimated Extents, feet, for				
Average Daily	Annual	DNL/CNEL 45 dB	DNL/CNEL 50 dB	DNL /CNEL 55 dB	DNL/CNEL 60 dB	DNL/CNEL 65 dB
<= 1	<= 365	75	32.8	32.8	32.8	32.8
<= 5	<= 1,825	150	100	50	32.8	32.8
<= 10	<= 3,650	250	150	75	32.8	32.8
<= 15	<= 5,475	250	150	100	50	32.8
<= 20	<= 7,300	300	200	100	75	32.8
<= 40	<= 14,600	450	250	150	100	32.8
<= 60	<= 21,900	550	300	200	100	75
<= 80	<= 29,200	650	350	200	150	75
<= 100	<= 36,500	750	400	250	150	75
<= 120	<= 43,800	850	400	250	150	100
<= 140	<= 51,100	1000	450	250	150	100
<= 160	<= 58,400	1150	500	300	150	100
<= 180	<= 65,700	1400	500	300	200	100
<= 200	<= 73,000	1650	550	300	200	100
<= 220	<= 80,300	2650	600	300	200	100
<= 240	<= 87,600	Note c	600	350	200	150
<= 260	<= 94,900	Note c	650	350	200	150
<= 280	<= 102,200	Note c	700	350	200	150
<= 300	<= 109,500	Note c	700	350	200	150
<= 340	<= 124,100	Note c	800	400	250	150
<= 360	<= 131,400	Note c	800	400	250	150
<= 380	<= 138,700	Note c	850	400	250	150
<= 400	<= 146,000	Note c	900	450	250	150
<= 420	<= 153,300	Note c	950	450	250	150
<= 440	<= 160,600	Note c	1000	450	250	150
<= 460	<= 167,900	Note c	1050	450	250	150
<= 480	<= 175,200	Note c	1100	450	250	150
<= 500	<= 182,500	Note c	1150	500	300	150

Notes:
a) One delivery includes the outbound takeoff and inbound landing and is representative of two operations.
b) If a value for deliveries is not specifically defined in this table, use the next highest value. For example, if there are 50 average daily DNL Equivalent deliveries, use the entry for 60 average daily DNL Equivalent deliveries.
c) The DNL/CNEL noise level noted extends more than 3,500 feet from the PADDC based on the level of operations specified as the aircraft continues along its en route flight path. En route results in Section 4.2 may be more applicable in these instances for determining noise levels.

4.2 Noise Exposure under En Route Paths

For en route conditions, the UA is expected to fly the same outbound flight path between the PADDC and the delivery point and inbound flight path back to the PADDC (Section 3.4.2). Therefore, each location under the en route path would be overflown twice for each delivery served by the respective overhead en route path.

Table 8 provides the estimated DNL or CNEL for a location on the ground directly under an en route path for various counts of daily average DNL or CNEL Equivalent deliveries. The en route noise calculated for

each delivery includes both the inbound and outbound traversal of the en route path at 165 feet AGL and a ground speed of 52.4 knots.

Table 8. Estimated Noise Exposure Directly Under En Route Flight Paths

Number of DNL/CNEL Equivalent Deliveries Served by Route		DNL/CNEL
Average Daily	Annual	
<= 1	<= 365	21.3
<= 5	<= 1,825	28.3
<= 10	<= 3,650	31.3
<= 15	<= 5,475	33.1
<= 20	<= 7,300	34.4
<= 40	<= 14,600	37.4
<= 60	<= 21,900	39.1
<= 80	<= 29,200	40.4
<= 100	<= 36,500	41.3
<= 120	<= 43,800	42.1
<= 140	<= 51,100	42.8
<= 160	<= 58,400	43.4
<= 180	<= 65,700	43.9
<= 200	<= 73,000	44.4
<= 220	<= 80,300	44.8
<= 240	<= 87,600	45.1
<= 260	<= 94,900	45.5
<= 280	<= 102,200	45.8
<= 300	<= 109,500	46.1
<= 340	<= 124,100	46.7
<= 360	<= 131,400	46.9
<= 380	<= 138,700	47.1
<= 400	<= 146,000	47.4
<= 420	<= 153,300	47.6
<= 440	<= 160,600	47.8
<= 460	<= 167,900	48.0
<= 480	<= 175,200	48.2
<= 500	<= 182,500	48.3

In some instances, the UA may overfly locations at operational levels that differ from both an inbound and outbound traversal of the en route path by the UA as described above and presented in Table 8. For these circumstances, Table 9 presents the equations for calculating the estimated DNL or CNEL for a receiver directly under a specified given number of DNL or CNEL Equivalent average daily individual overflights, defined as N_o.

Table 9. Estimated Noise Exposure Directly Under Overflights

Altitude for Overflight	Weight for Overflight	SEL for 1 Overflight (dB)	DNL for 1 Overflight between 7 AM and 10 PM (dB)[c]	DNL/CNEL equation for the number of DNL/CNEL Equivalent Overflights
115 feet AGL	Maximum	69.7	20.3	$10 \times \log_{10}(N_o) + 20.3$
160 feet AGL	Maximum	67.9	18.5	$10 \times \log_{10}(N_o) + 18.5$
165 feet AGL	Maximum	67.7	18.3	$10 \times \log_{10}(N_o) + 18.3$
180 feet AGL	Maximum	67.2	17.9	$10 \times \log_{10}(N_o) + 17.9$
300 feet AGL	Maximum	64.5	15.1	$10 \times \log_{10}(N_o) + 15.1$
N feet AGL	Maximum	$12.5 \times \log_{10}\left(\frac{165}{N_{ft}}\right) + 67.7$	$SEL_1\ dB - 49.4$	$10 \times \log_{10}(N_o) + DNL_1\ dB$

Notes:
a) The DNL value for a given number of average DNL Equivalent Operations, N_o, can be found by using the equations associated with operation of the UA at a specified altitude and speed interval. In this case, one operation represents a single overflight. The DNL values are applicable using CNEL equivalent ops as discussed in Section 3.1.
b) All values in this table are for level flight at 52.4 knots.
c) The DNL values presented here are also valid for CNEL for 1 Overflight between 7 AM and 7 PM.

4.3 Noise Exposure for Operations at Delivery Point

Table 10 presents the estimated DNL or CNEL values for a range of potential daily average DNL Equivalent delivery counts at a delivery point. Also included in Table 10 is the equation for calculating the estimated DNL or CNEL for a specific number of daily average DNL or CNEL Equivalent delivery counts at a delivery point, defined as N_d, for instances where the number of deliveries may fall between the range of presented delivery count intervals. The DNL or CNEL values include the transition from en route speed to vertical flight at en route altitude, the delivery maneuver, and the transition from vertical flight at en route altitude to en route speed as discussed in Section 3.4.3. The minimum listener distance is 16.4 feet from the delivery point and corresponds to minimum distance between a person and delivery point as discussed in Section 2.1.2.5. Values are also presented at 32.8 feet from the delivery point which corresponds to minimum distance from the available measurement data and analysis presented by FAA. Values were also calculated at distances of 50 feet, 75 feet, 100 feet, and 125 feet from the delivery point and are representative of distances from which nearby properties may experience noise from a delivery.[13]

[13] The 2021 US Census national average lot size for single-family sold homes was 15,218 square feet. This is representative of a property with dimensions of a 123.36 x 123.36 foot square. 125 feet represents a 125 foot lateral width of the parcel rounded up to the nearest 25 feet. https://www.census.gov/construction/chars/ See file "Soldlotsize_cust.xls" sheet MALotSizeSold. Accessed August 17, 2022.

Table 10. Estimated Noise Exposure at Various Distances from a Delivery Point per Number of Deliveries

Average Daily DNL/CNEL Equivalent Deliveries	Annual DNL/CNEL Equivalent Deliveries	Estimated Delivery DNL/CNEL at 16.4 feet (Minimum Possible Listener Distance)	Estimated Delivery DNL/CNEL at 32.8 feet (Minimum Measured Listener Distance)	Estimated Delivery DNL/CNEL at 50 feet	Estimated Delivery DNL/CNEL at 75 feet	Estimated Delivery DNL/CNEL at 100 feet	Estimated Delivery DNL/CNEL at 125 feet
<= 1	<= 365	51.0	47.2	46.1	44.3	41.6	39.1
<= 5	<= 1,825	57.9	54.2	53.1	51.3	48.6	46.1
<= 10	<= 3,650	61.0	57.2	56.1	54.3	51.6	49.1
<= 15	<= 5,475	62.7	58.9	57.9	56.1	53.3	50.8
<= 20	<= 7,300	64.0	60.2	59.1	57.3	54.6	52.1
<= 40	<= 14,600	67.0	63.2	62.1	60.3	57.6	55.1
<= 60	<= 21,900	68.7	65.0	63.9	62.1	59.3	56.9
<= 80	<= 29,200	70.0	66.2	65.1	63.3	60.6	58.1
<= 100	<= 36,500	71.0	67.2	66.1	64.3	61.6	59.1
<= 120	<= 43,800	71.7	68.0	66.9	65.1	62.4	59.9
<= 140	<= 51,100	72.4	68.6	67.6	65.8	63.0	60.5
<= 160	<= 58,400	73.0	69.2	68.2	66.3	63.6	61.1
<= 180	<= 65,700	73.5	69.7	68.7	66.9	64.1	61.6
<= 200	<= 73,000	74.0	70.2	69.1	67.3	64.6	62.1
<= 220	<= 80,300	74.4	70.6	69.5	67.7	65.0	62.5
<= 240	<= 87,600	74.8	71.0	69.9	68.1	65.4	62.9
<= 260	<= 94,900	75.1	71.3	70.3	68.5	65.7	63.2
<= 280	<= 102,200	75.4	71.7	70.6	68.8	66.0	63.6
<= 300	<= 109,500	75.7	72.0	70.9	69.1	66.3	63.9
<= 340	<= 124,100	76.3	72.5	71.4	69.6	66.9	64.4
<= 360	<= 131,400	76.5	72.8	71.7	69.9	67.1	64.6
<= 380	<= 138,700	76.8	73.0	71.9	70.1	67.4	64.9
<= 400	<= 146,000	77.0	73.2	72.1	70.3	67.6	65.1
<= 420	<= 153,300	77.2	73.4	72.4	70.5	67.8	65.3
<= 440	<= 160,600	77.4	73.6	72.6	70.7	68.0	65.5
<= 460	<= 167,900	77.6	73.8	72.7	70.9	68.2	65.7
<= 480	<= 175,200	77.8	74.0	72.9	71.1	68.4	65.9
<= 500	<= 182,500	77.9	74.2	73.1	71.3	68.6	66.1
N_d	$N_d \; x \; 365$	$10 \times \log_{10}(N_d) + 51.0$	$10 \times \log_{10}(N_d) + 47.2$	$10 \times \log_{10}(N_d) + 46.1$	$10 \times \log_{10}(N_d) + 44.3$	$10 \times \log_{10}(N_d) + 41.6$	$10 \times \log_{10}(N_d) + 39.1$

Notes:
a) The DNL/CNEL values presented in this table only reflect the UA conducting descent and climb flight maneuvers associated with a delivery. DNL/CNEL values associated with en route flight to and from a PADDC to a delivery point associated with a delivery, or nearby en route overflights, should be added to these values utilizing the DN/CNEL levels presented in Table 8.
b) If a value for deliveries is not specifically defined in this table, use the next highest value. For example, if there are 50 average daily DNL Equivalent deliveries, use the entry for 60 average daily DNL Equivalent deliveries.

Attachment A

Federal Aviation Administration

Date: August 4, 2022

To: Donald Scata, Manager, Noise Division,
Office of Environment and Energy (AEE-100)

From: Christopher Hobbs, General Engineer, Noise Division,
Office of Environment and Energy (AEE-100)

Subject: Estimated Noise Levels for Amazon Prime Air MK27-2 UA

This memo presents an analysis of noise measurements of the Amazon Prime Air MK27-2 Unmanned Aircraft (UA) by Amazon Prime Air (Amazon), measured between April 1 and April 16, 2022 at the Pendleton UAS Range located at the Eastern Oregon Regional Airport (KPDT) in Pendleton, Oregon. The purpose of the analysis is to provide estimates of expected sound exposure levels resulting from typical operations of the Amazon MK27-2 UA by Amazon and provides the methods used to create the noise estimates. Any deviation of the expected flight profile from those measured at Pendleton will need to be accounted for in the noise estimates using appropriate methodology.

1. Flight Profile and Segment Noise

The phases of a typical flight profile from takeoff to landing from a Prime Air Drone Delivery Center (PADDC) with an included delivery are listed in Table 1 for the MK27-2 UA. For the purposes of this analysis, the point on the ground that the UA takes off of (launch pad), delivers to (delivery point), and lands on (landing pad) will be referred to as the PADDC. For normal operations Amazon will be basing the UA at a PADDC containing the landing and takeoff pad infrastructure, and delivery will be completed at a remote location using a target on the ground at the delivery location to mark the specific delivery point. All noise measurements at Pendleton were made with the UA carrying a 5 lbs package representative of the UA operating at the max takeoff weight of 91.5 lbs. The package was not released during the delivery phase of the flight profile. It is assumed that the noise generated during the climb out after delivery with the package will be greater than if the package had been released; therefore, the noise measurements presented here are a conservative estimate of those during actual operations.

The method used to estimate the noise on the ground during each phase of flight is listed below. The methodology presented for estimating the noise for each flight phase uses the best available information from available measurement data for the MK27-2 UA and represents a conservative estimate of the noise levels resulting from operations of this UA.

Table 1. Phases of Flight for Typical Flight Profile of MK27-2 UA

Phase of Flight	Description
Takeoff	Vertical launch from PADDC on ground to en route altitude (165 ft Above Ground Level (AGL)) in vertical flight mode (pointed upward)
Transition to Outbound En Route Flight	Transition from zero speed above PADDC at en route altitude to cruise speed (52.4 kts) while changing from vertical flight mode to fixed-wing flight mode (pointed horizontally)
Outbound En Route Flight	Fixed-wing flight mode at operational en route altitude and cruise speed
Transition to Delivery	Transition from cruise speed at en route altitude and fixed-wing flight mode to zero speed above PADDC/delivery point at en route altitude and in vertical flight mode
Delivery	Vertically descend from en route altitude to 13 ft AGL delivery altitude, drop a package at the PADCC/delivery point, and vertical ascent back to en route altitude in vertical flight mode
Transition to Inbound En Route Flight	Transition from zero speed above PADDC/delivery point at en route altitude to cruise speed while changing from vertical flight mode to fixed-wing flight mode
Inbound En Route Flight	Fixed-wing flight mode at operational en route altitude and cruise speed
Transition to Landing	Transition from cruise speed at en route altitude and fixed-wing flight mode to zero speed above PADDC at en route altitude and in vertical flight mode
Landing	Descend from en route altitude to PADDC on ground in vertical flight mode

1.1 Transition Noise

Because the transition phase from vertical to fixed-wing flight mode or vice versa is involved in the takeoff, delivery, and landing phases of flight it will be discussed first. The measurements made by Amazon were done with the microphones oriented normal to the flight track as shown in Figure 1. As the figure shows, the UA did not fly over the microphones after takeoff. The same is true for the transitions before and after delivery and the transition before landing. To estimate the maximum noise at a distance from the takeoff/landing pad or delivery point on the ground one must combine the noise emitted from the UA during the vertical portion of the trajectory (descent or ascent) and the noise the UA make as it transitions from the vertical flight mode (pointed up) to fixed-wing flight mode (pointed horizontally). The microphones were not positioned to capture the majority of the transition noise; thus, an estimate of the noise made by the UA while transitioning had to be made based on the overflight measurements as discussed below.

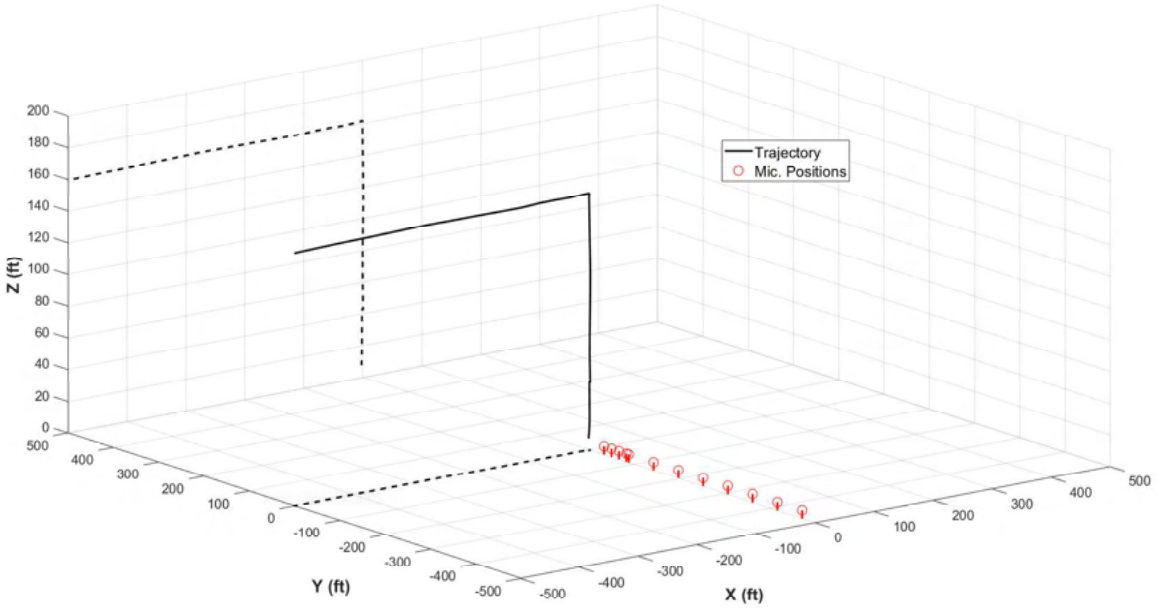


Figure 1. Microphone locations for takeoff, delivery, and landing measurements for MK27-2 UA with example takeoff trajectory.

The duration of the transition of the UA from vertical to fixed-wing flight mode was measured using the time it took the UA to reach cruise speed after it reached the top of the vertical climb during takeoff and post-delivery. The start of the duration for both phases was set as the time the UA began having non-zero ground speed. For the duration of the transition of the UA from fixed-wing flight mode to vertical flight during landing and pre-delivery, the transition duration was measured from the time the UA began to decelerate from cruise speed to zero ground speed. In all cases the acceleration was noted as being nearly constant. The pitch of the UA from vertical to horizontal fixed-wing flight mode was shown to coincide with this time as well. Table 2 shows the average durations for the UA to transition to and from fixed-wing flight mode. As presented in Table 2, the average duration for transition during takeoff and landing was the same 20 seconds. Assuming a constant acceleration to and from a 52.4 knot cruise speed, the distance to transition from vertical to fixed-wing flight mode is approximately 884 ft. It is the same approximate distance to transition from fixed-wing to vertical flight mode.

Table 2. Description of Transition to and from Fixed-Wing Flight Mode

Phase	Description	Altitude (ft AGL)	Ground Speed (kts)	Duration (s)
Transition to Fixed-Wing Mode	Transition from vertical to horizontal fixed-wing flight	165	0 accelerating to 52.4	20
Transition from Fixed-Wing Mode	Transition from horizontal fixed-wing flight to vertical flight	165	52.4 decelerating to 0	20

In order to estimate the noise made by the UA at positions undertrack as it transitions to or from fixed-wing flight mode, the following assumption has been made:

The noise of the UA in fixed-wing flight mode is approximately the same it transitions; furthermore, the noise radiated from the UAS is assumed to be omnidirectional. That is to say that the noise level measured a fixed distance from the UA will be the same in all directions.

To calculate the noise from the transition phase of the flight profile at distances from the PADDC undertrack, the following steps were performed:

1. The maximum noise level from measured overflights was corrected to the en route altitude distance (165 ft) using spherical spreading.
2. At each distance from the PADDC undertrack the estimated sound pressure level was calculated from 25 ft segments along the transition flight trajectory based on the maximum sound level measured during the overflight corrected to the distance between using spherical spreading. The duration applied to each respective segment's sound pressure level was found from the calculated motion of the UA as a function of time to / from a cruise speed of 52.4 kts to / from zero kts using constant acceleration.
3. The sound pressure level duration products were summed to find the estimated sound exposure level at each position.
4. The estimate of the sound exposure levels were corrected to match the overflight sound exposure level once past the effects of the transition at approximately 1600 ft from the PADDC.

The levels in Table 3 are the results of the calculations. It is recommended to use linear interpolation to find values between the distances in the table for the transition flight phases. This estimate of the transition phase of flight can be used for the transition from zero speed to the cruise speed as well as the transition from cruise speed to zero speed. The calculation was done for an estimated altitude of 165 ft AGL.

Table 3. Estimated Sound Exposure Levels from Transition Phase of Flight Profile

Distance from PADDC (ft)	Sound Exposure Level $(dBA)_1$
0	69.9
100	70.6
200	70.3
400	69.4
800	68.2
1600	67.7
3200	67.7

Notes: 1) Applicable to either profile described in Table 2.

The sound exposure levels presented in Table 3 show that beyond 1600 ft from the PADDC the transition profile (Table 2) does not differ from the en route levels (Section 1.3); therefore, the transition phase noise levels present in Table 2 should be added to the noise created by the UA during takeoff, delivery, and landing out to a distance of 1,600 feet. The sound exposure levels from the overflight measurements should be combined with the other phases of flight for distances greater than 1,600 feet from the PADDC.

1.2 Takeoff and Landing Noise

There are two flight activities that generate noise in the vicinity of the takeoff and landing pads at the PADCC. The vertical portion of the trajectory (i.e., the climb or descent to/from the en route altitude), and the transition from vertical flight mode to horizontal fixed-wing flight mode as described above. During takeoff, the MK27-2 will climb from the ground vertically to an operational altitude of 165 feet AGL, then transition from vertical to fixed-wing flight for transit to the delivery location. After completing delivery, the UA returns from the delivery location at 165 feet AGL in fixed-wing flight, transitions to vertical flight, and then descends vertically to the ground at the landing pad. Table 4 details the takeoff and landing phases of the flight profile. The durations in the table are the average time it took the UA to ascend or descend from the cruise altitude.

Table 4. MK27-2 UA Takeoff and Landing Profile Details

Phase of Flight	Flight Description	Altitude (ft AGL)	Ground Speed (kts)	Duration (s)
Takeoff	Vertical ascent to cruise altitude	0 ascend to 165	0	21
Landing	Descent from cruise altitude to land	165 descend to 0	0	38

To estimate the sound exposure level from the takeoff and landing phases of the flight profile, measurements of the noise emissions of the MK27-2 UA were made when the UA was at maximum weight and was following a simulated takeoff and landing profile representative of typical operations. The profile included the vehicle climbing vertically from the PADDC to en route altitude where it transitioned to fixed-wing mode for en route flight, flying an oval "racetrack" pattern at en route altitude to simulate outbound en-route flight, and transitioning from en-route altitude in fixed-wing flight mode to the vertical flight mode for a descent to landing. The microphone positions relative to the takeoff and landing pad are shown in Figure 1. The PADDC

is located at the origin in the plot. It is important to note that only 4 microphones were used for each flight. They were moved to different positions between flights.

The sound exposure level was calculated from the data collected by each microphone for each flight. The sound exposure level was calculated from the entire A-weighted time history of the event. Because the microphone array is normal to the flight track, the noise during transition between en route fixed-wing flight to vertical flight mode is not completely captured as it would be under the vehicle for the inbound and outbound phases of the flight profile and is assumed to not be accounted for in the following tables. Because of this, the sound exposure values versus distance measured from the PADDC must be supplemented to estimate the most conservative sound exposure as detailed below.

There were a total of nine flights where the UA performed a takeoff, delivery, and landing. The microphones were moved for some of the flights. The number of flights for each positioning of the four microphone was not equal; however, the available data represents a good range of distance from the PADDC and has a behavior that can be used to adequately represent the noise emissions from the vertical portion of the flight profile. There were two other flights performed for overflight measurements. Because the aircraft's flight track on takeoff and landing was not the same orientation to the microphone array as the first nine flights, metrics for those four events were not included in the averages. Table 5 presents the averaged results at each microphone for all takeoff events, and Table 6 presents the averaged results for averaged landing events.

Table 5. Average Sound Exposure Levels of MK27-2 UA during Takeoff versus Distance

Position	Distance (ft)	Sound Exposure Level (dBA)1
1	32.8	95.7
2	49.2	94.1
3	65.6	92.1
4	82.0	90.1
5	87.5	88.3
6	142.2	83.0
7	196.9	78.7
8	251.5	77.7
9	306.2	75.8
10	360.9	73.8
11	415.6	72.4
16	689.0	69.1
17	743.7	65.6
18	798.4	64.7
19	853.0	64.0

Notes: 1) Applicable for the takeoff profile presented in Table 4.

Table 6. Average Sound Exposure Levels of MK27-2 during Landing versus Distance

Position	Distance (ft)	Sound Exposure Level $(dBA)_1$
1	32.8	94.8
2	49.2	93.2
3	65.6	92.1
4	82.0	90.2
5	87.5	90.1
6	142.2	85.0
7	196.9	80.7
8	251.5	79.0
9	306.2	77.3
10	360.9	74.9
11	415.6	73.7
16	689.0	69.7
17	743.7	67.6
18	798.4	67.0
19	853.0	66.2

Notes: 1) Applicable for the landing profile presented in Table 4.

The measured data are presented in the following figures. The curve fits in the Tables below represent the best estimates of the sound levels for the distance ranges listed. It is recommended to use the curve fit equations to calculate the sound exposure levels representing only the vertical portion of the flight profile noise emissions for the takeoff and landing phases. Positions four and five were averaged together and the effective distance weight-averaged because of their proximity. The distance of 149 feet from the PADDC is the minimum distance for which the behavior of the noise levels versus distance is consistently decreasing by approximately 6 dB per doubling of distance for the takeoff, delivery, and landing phases of flight. The same distance was chosen to begin the curve fit for consistency. The coefficients in the table for distance less than 149 feet are effectively linear interpolations between the average, measured values.

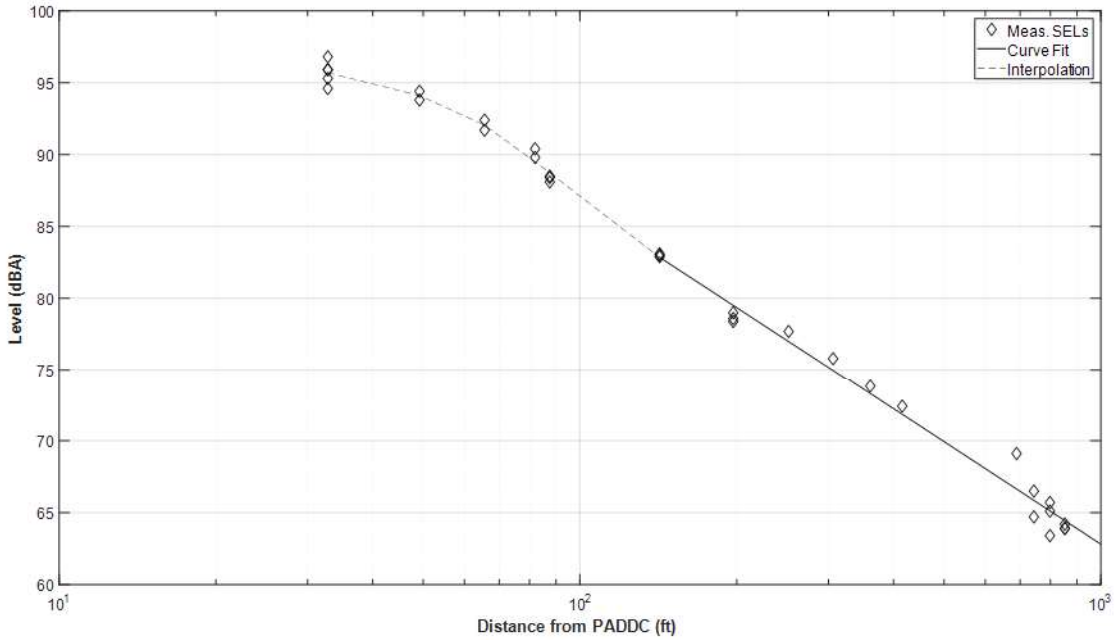


Figure 2. Measured sound exposure levels during takeoffs as described in Table 4.

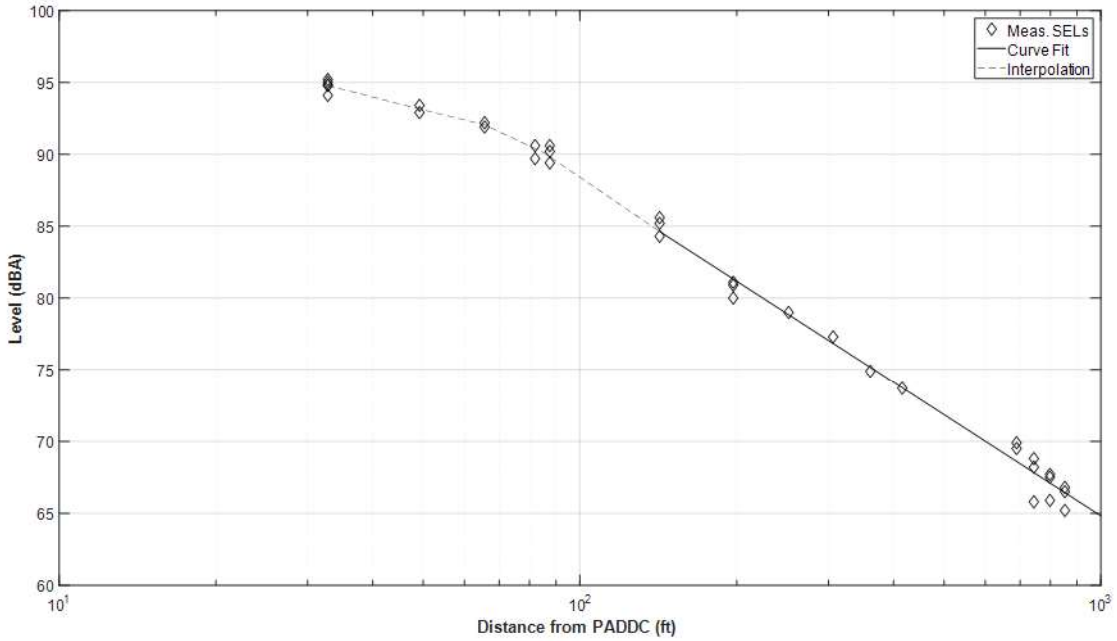


Figure 3. Measured sound exposure levels during landings as described in Table 4.

The following equation governs how to estimate the sound exposure level for a given distance, *d*, in feet from the PADDC resulting from the vertical portion of the takeoff, delivery, or landing portion of the flight

profile of the UA. The constants m and b are to be used in Eq. 1 for the appropriate row in the tables based on the Range. These estimates assume the UA reaches an en route altitude of 165 feet AGL.

$$SEL = m * \log_{10}(d + b) \qquad (dB) \qquad (1)$$

Table 7. Parameters for Estimating Sound Exposure Level for Takeoff versus Distance[2]

Range for *d* (ft from PADDC)	m	b
32.8 to 49.2	-9.09	109.47
49.2 to 65.6	-16.41	121.86
65.6 to 85.3[1]	-26.39	140.00
85.3[1] to 142.2	-27.79	142.71
Greater than 142.2	-23.39	134.99

Notes: 1) Average, weighted distance for the 82 and 87.5 ft position measurements
2) Applicable for the takeoff profile in Table 4

Table 8. Parameters for Estimating Sound Exposure Level for Landing versus Distance[2]

Range for *d* (ft from PADDC)	m	b
32.8 to 49.2	-9.26	108.81
49.2 to 65.6	-8.80	108.05
65.6 to 85.3[1]	-17.10	123.12
85.3[1] to 142.2	-24.56	137.53
Greater than 142.2	-23.39	134.99

Notes: 1) Average, weighted distance for the 82 and 87.5 ft position measurements
2) Applicable for the landing profile in Table 4

1.3 En Route Noise

Two flights were flown to measure noise from the en route phase of flight. The UA flew in a "dog bone" pattern in order to overfly the lead microphone in the array three times traveling in each direction. The microphone array was not moved between the flights and the four positions were the only distances measured from undertrack. A cross wind may be responsible for the microphone undertrack not measuring the highest noise level. The 12 sound exposure levels measured from the two flights were averaged at each of the positions and results presented in Table 9. The slant range column presented in Table 9 is the distance between the UA and position at the closest point of approach during the overflight.

It is recommended that 67.7 dBA sound exposure level be used to represent the noise generated by the UA at cruise speed of 52.4 kts and en route altitude of 165 ft AGL because it is the highest level measured; therefore, it is the most conservative estimate.

Table 9. Average Sound Exposure Levels Measured During Level Overflights

Position	Sound Exposure Level[1] (dBA)	Maximum Level (dBA)	Distance from Undertrack (ft)	Slant Range (ft)	Sound Exposure Level Normalized to 165 ft[2] (dBA)	Maximum Level Normalized to 165 ft[3] (dBA)
1	66.0	59.2	0	165	66.0	59.2
5	67.0	60.3	88	187	67.7	61.4
6	65.1	57.8	142	218	66.6	60.2
7	63.0	55.2	197	257	65.4	59.1

Notes: 1) Measured levels normalized to 52.4 kts before averaging.
*2) Using 12.5*log10(Slant/Distance)*
*3) Using 20*log10(Slant/Distance)*

To estimate the sound exposure level of the UA traveling at speed v_1 when the measured sound exposure level for a level overflight was done when the UA was traveling at speed v_{ref} add the value *del1* calculated with Eq. 2 to the sound exposure level measured with the speed $v_{ref.}$

$$del1 = 10 * \log_{10}\left(v_1 / v_{ref} \right) \qquad (dB) \tag{2}$$

To estimate the sound exposure level of the UA traveling at a height, h_1 ft, above the ground different than 165 ft AGL, add the value *del2* calculated with Eq. 3 to the 67.7 dBA sound exposure level.

$$del2 = 12.5 * \log_{10}\left(h_{ref} / h_1 \right) \qquad (dB) \tag{3}$$

1.4 Delivery Noise

There are five flight activities that generate noise in the vicinity of a delivery location. The MK27-2 will approach the delivery location from fixed-wing en route flight at 165 feet AGL, transition to vertical flight, and then descend vertically to a delivery altitude of 13 ft AGL. At delivery altitude, the UA will drop the package while in hover which takes approximately 2 seconds. At completion of the delivery, the UA will climb from the delivery altitude vertically back to an en route altitude of 165 feet AGL, and then transition from vertical to fixed-wing flight mode for en route flight back to the PADDC. This section considers only the noise generated from the vertical phases of the flight profile during delivery. Table 10 details the vertical portion of the delivery procedure starting at en route altitude and positioned over the delivery point to return to en route altitude. Within this portion of the procedure, Table 10 details the average durations for the descent, delivery, and ascent portions of the profile.

Table 10. MK27-2 UA Delivery Profile Details

Phase	Flight Description	Altitude (ft AGL)	Ground Speed (kts)	Duration (s)
Descent	After transition to above PADDC, descend to delivery height	165 to 13	0	32
Delivery	Drop package on PADDC	13	0	2
Ascent	Ascend to en route altitude before transitioning to en route flight	13 to 165	0	24

To estimate the sound exposure level at a delivery location, measurements of the noise emissions of the MK27-2 UA were made when the UA was at maximum weight utilizing a simulated delivery profile representative of typical operations. The profile included the vehicle flying an oval "racetrack" pattern in fixed-wing mode flight at en route altitude to simulate outbound en route flight, transition from fixed-wing flight mode to vertical flight for descent and delivery at the PADDC, vertical descent to delivery altitude, delivery, vertical climb back to en-route altitude, and transition back to fixed-wing flight mode to simulate inbound en route flight. The microphone locations utilized for the delivery measurements are the same as shown Figure 1. As with the takeoff and landing measurements, the 4 microphones were moved between flights in order to measure the noise at different distances from the PADDC. As with the takeoff and landing measurements, the transition noise was not fully captured by the microphones because the UA did not perform the transition above them.

The average sound exposure level for the entire vertical portions of the delivery phase (descent, delivery, and ascent) were then calculated at each of the microphones. As with the takeoff and landing measurements each position did not have the same number of measurements. The results were then averaged together for each microphone position. Table 11 presents the averaged results at each microphone for all delivery events. Figure 4 shows a plot of the measurements versus distance along with lines showing the methods of estimating the levels between and beyond positions. Table 12 contains the parameters suggested for use in Eq. 1 for estimating the sound exposure level at distances from the delivery location for the noise emitted from the UA during the vertical portion of the delivery. As was the case for the takeoff and landing flight phases, it is recommended for the delivery phase to use the appropriate parameters in Table 12 for the required distance. In order to estimate the noise levels near the delivery location the transition noise would need to be logarithmically added to this noise in order to properly estimate the maximum levels expected for undertrack locations.

Table 11. Average Sound Exposure Level of MK27-2 UA during Delivery versus Distance

Position	Distance (ft)	Sound Exposure Level $(dBA)_1$
1	32.8	96.5
2	49.2	95.5
3	65.6	94.6
4	82.0	93.1
5	87.5	92.3
6	142.2	87.4
7	196.9	82.8
8	251.5	81.6
9	306.2	79.8
10	360.9	77.9
11	415.6	76.3
16	689.0	72.3
17	743.7	70.9
18	798.4	70.4
19	853.0	69.6

Notes: 1) Applicable for the delivery profile presented in Table 10

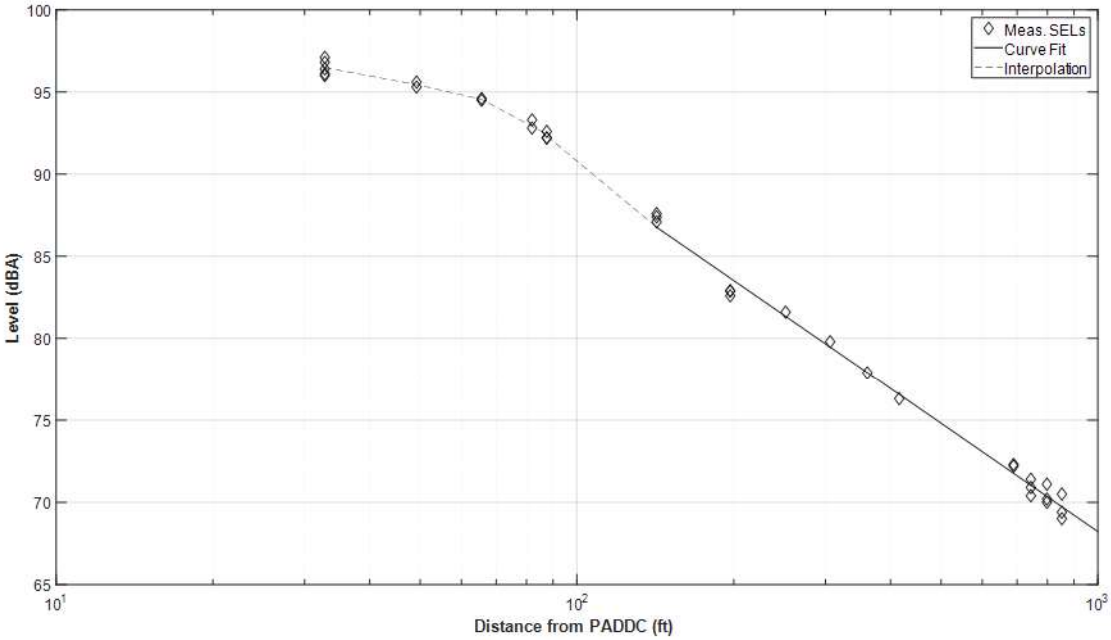


Figure 4. Measured Sound Exposure Levels during deliveries as described in Table 10.

Table 12. Parameters for Estimating Sound Exposure Level for Delivery versus Distance[2]

Range for *d* (ft from PADDC)	m	b
32.8 to 49.2	-5.85	105.35
49.2 to 65.6	-7.20	107.64
65.6 to 85.3[1]	-16.92	125.30
85.3[1] to 142.2	-26.31	143.42
Greater than 142.2	-21.90	133.91

Notes: 1) Average, weighted distance for the 82 and 87.5 ft position measurements
2) Applicable for the delivery profile presented in Table 10

2. Analysis

The analysis of the measurements performed while the MK27-2 flew a typical profile can be used for estimating the noise created for each phase of flight. It is important to combine the transition noise with the takeoff, delivery, and landing phases in order to estimate the maximum noise expected undertrack for those portions of the flight profile. In order to estimate the noise from a flight profile with different speed or altitude, utilization of the correction for different cruise speed using equation 2 and a different en route altitude using equation 3 should be used. It is not expected that the contribution to the noise levels around the takeoff, delivery, or landing sites from the vertical part of the flight profile will change if the cruise speed or altitude are different.

3. Conclusion

This memo provides the means to estimate the sound exposure level from the typical flight profile for the MK27-2 delivering a package. By combining the transition noise with the noise from the vertical phases of the flight profile a conservative estimate of the noise created by the UA is achieved in that the estimate should be greater than the actual noise levels. The means for adjusting the provided noise levels for different flight profile parameters are provided with the assumption that minor changes to the en route altitudes will not change the noise levels for the takeoff, delivery, and landing phases of flight.

Appendix D

Non-Standard Noise Methodology Memos

Federal Aviation Administration

Memorandum

Date: August 25, 2022

To: Don Scata, Noise Division Manager, Office of Environment and Energy (AEE-100)

MICHAEL JAY MILLARD Digitally signed by MICHAEL JAY MILLARD Date: 2022.08.25 09:42:54 -04'00'

From: Mike Millard, Flight Standards (AFS), General Aviation Operations Branch, AFS-830

Subject: Environmental Assessment (EA) Noise Methodology Approval Request for Amazon Prime Air MK27-2 UA Part 135 Operations at Lockeford, CA

FAA Office of Flight Standards (AFS) requests FAA Office of Environmental and Energy, Noise Division (AEE-100) approval of the noise methodology to be used for the Environmental Assessment (EA) for Amazon operations using the Amazon Prime Air MK27-2 unmanned aircraft (UA) in Lockeford, CA to provide package delivery services as a 14 CFR Part 135 operator as described below.

As required under the National Environmental Policy Act (NEPA), the FAA must consider the potential for environmental impacts in informing the agency's decision to approve Federal actions, including the potential for noise impacts as detailed in FAA Order 1050.1F.

As the FAA does not currently have a standard approved noise model for UA, this memo serves as a request for written approval from AEE-100 to use the methodology proposed in the following sections to support the noise analysis for this EA.

Description of Aircraft and Proposed Operations

AFS is evaluating Amazon's proposed commercial package delivery operations using the Model MK27-2 UA from one Prime Air Drone Delivery Center (PADDC) located in the Lockeford, CA operating area. Approval of a Federal Action providing Amazon's air carrier Operations Specifications (OpSpecs) is required before these operations can occur.

Amazon is proposing to perform package delivery operations from the site within the proposed operating area to transport packages to delivery sites including residential homes in the area.

The MK27-2 UA is a multi-rotor design with six propellers mounted on equally spaced arms extending horizontally from a center frame. The UA can transition between vertical and horizontal flight. According to data provided by Amazon, the maximum allowable takeoff weight of the UA is 91.5 pounds, its empty

weight (including battery) is 86.6 pounds, and its maximum allowable package weight is 4.9 pounds. The package is carried in an internal cargo bay.

The MK27-2 can climb and descend vertically, hover, and fly upright with its propellers facing forward like a fixed-wing aircraft for en route flight. Airspeeds during normal en route flight are expected to be approximately 52 knots. Typical flights begin with the UA ascending vertically from a PADDC launch pad at ground level to an en route altitude between 160 and 180 feet Above Ground Level (AGL). The UA then flies a pre-assigned route between 160 and 180 feet AGL and 52 knots to a selected delivery point. Once near the delivery point, the UA decelerates and descends vertically over the delivery point. The UA descends to 13 feet AGL, drops the package, and ascends back to en route altitude. Once back at en route altitude, the UA accelerates to 52 knots and follows a predefined track to return to its originating PADDC. When the UA arrives at the PADDC, it decelerates and vertically descends to its sector's assigned landing pad. Once it lands, the UA is serviced and prepared for the next delivery.

A single PADDC is expected to have four sectors and each sector will have no more than one UA operating at a time. Amazon projects operating 52,000 annual deliveries, of which 1,361 are during the evening between 7 and 10 PM, no night time flights, with 142.47 total deliveries on an average annual daily basis. Based on those overall levels Amazon expects deliveries to be distributed among delivery locations with a minimum number of 0.43 deliveries or less at any one location and maximum of 4.27 per day at any one location on an average annual daily basis. With the evening weighting applied for CNEL, this is 149.92 total CNEL equivalent average annual daily deliveries, with a minimum number of deliveries of 0.45 or less and maximum of 4.48 CNEL equivalent average annual daily deliveries at any one location, respectively.

Noise Analysis Methodology

AFS requests use of the noise analysis methodology described in HMMH Report No. 309990.003-7 for the "Noise Assessment for Amazon Prime Air Proposed Package Delivery Operations with Amazon Prime Air MK27-2 Unmanned Aircraft" dated August 19, 2022.

Federal Aviation Administration

Memorandum

Date: August 30, 2022

To: Mike Millard, Flight Standards (AFS), General Aviation Operations Branch, AFS-830

From: Don Scata, Manager, Noise Division, Office of Environment and Energy (AEE-100)

Digitally signed by DONALD S SCATA
Date: 2022.08.30 14:27:54 -04'00'

Subject: Environmental Assessment (EA) Noise Methodology Approval Request for Amazon Prime Air Commercial Package Delivery Operations with the MK27-2 UA from Lockeford, California

The Office of Environment and Energy (AEE) has reviewed the proposed non-standard noise modeling methodology to be used for Amazon Prime Air (Amazon) operations using the MK27-2 unmanned aircraft (UA) from Lockeford, California. This request is in support of an Environmental Assessment (EA) for Amazon to provide package delivery services as a 14 CFR Part 135 operator in Lockeford and a surrounding operating area.

The Proposed Action is to use the MK27-2 UA to deliver packages from a central distribution center, referred to as a Prime Air Drone Delivery Center (PADCC), to potential delivery locations such as residential homes within a proposed operating area in Lockeford. Typical operations of the UA will consist of departure from a launch/takeoff pad at the PADCC followed by a vertical climb to a typical en route altitude of 160 to180 feet above ground level (AGL). The UA then transitions from vertical to horizontal flight and accelerates to a typical en route speed of 52 knots for transit to a delivery location. Approaching the delivery location, the UA will deaccelerate and transition from horizontal to vertical flight, and then descend vertically over the delivery point. At 13 feet AGL, the UA drops the package at the delivery point, and ascends vertically back to en route altitude. Once back at en route altitude, the UA transitions from vertical to horizontal flight and accelerates to 52 knots for transit back to its originating PADDC. When the UA arrives at the PADDC, the UA will deaccelerate and transition from horizontal to vertical flight and vertically descends to its assigned landing pad. Once it lands, the UA is serviced and prepared for the next delivery.

Amazon expects to operate four sectors at the Lockeford PADCC and each sector will have no more than one UA operating at a time. Amazon projects operating a maximum of 52,000 annual deliveries, of which 1,361 are during the evening between 7 and 10 PM, no night time flights, with 142.47 total deliveries on an average annual daily (AAD) basis. Amazon anticipates deliveries will be distributed throughout the operating area with a minimum number of 0.43 deliveries or less at any one delivery location and maximum of 4.27 per day at any one delivery location on an AAD basis as detailed in the proposed non-standard noise modeling methodology request, "Environmental Assessment (EA) Noise Methodology Approval Request for Amazon Prime Air MK27-2 UA Part 135 Operations at Lockeford, CA" dated August 25, 2022.

As the FAA does not currently have a standard approved noise model for assessing UA, and in accordance with FAA Order 1050.1F, all non-standard noise analysis in support of the noise impact analysis for the National Environmental Policy Act (NEPA) must be approved by AEE. This letter serves as AEE's response to the method developed in in HMMH Report No. 309990.003-7 for the "Noise Assessment for Amazon Prime Air Proposed Package Delivery Operations with Amazon Prime Air MK27-2 Unmanned Aircraft" dated August 19, 2022.

The proposed methodology appears to be adequate for this analysis; therefore, AEE concurs with the methodology proposed for this project. Please understand that this approval is limited to this particular Environmental Review, location, vehicle, and circumstances. Any additional projects using this or other methodologies or variations in the vehicle will require separate approval.

Appendix E

EJSCREEN Report

EJScreen Report (Version 2.0)

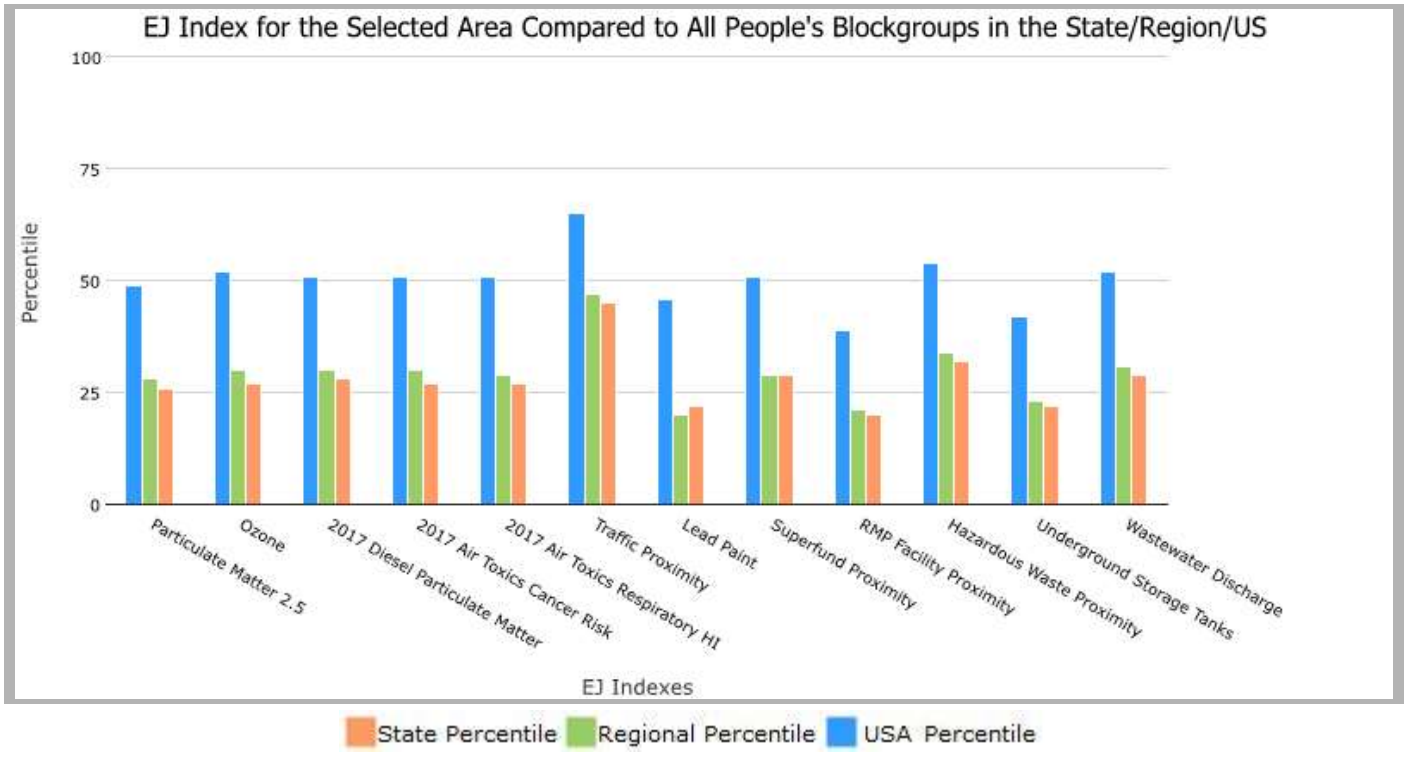
the User Specified Area, CALIFORNIA, EPA Region 9

Approximate Population: 7,482

Input Area (sq. miles): 50.36

Lockeford 4 Mile Radius

Selected Variables	State Percentile	EPA Region Percentile	USA Percentile
Environmental Justice Indexes			
EJ Index for Particulate Matter 2.5	26	28	49
EJ Index for Ozone	27	30	52
EJ Index for 2017 Diesel Particulate Matter*	28	30	51
EJ Index for 2017 Air Toxics Cancer Risk*	27	30	51
EJ Index for 2017 Air Toxics Respiratory HI*	27	29	51
EJ Index for Traffic Proximity	45	47	65
EJ Index for Lead Paint	22	20	46
EJ Index for Superfund Proximity	29	29	51
EJ Index for RMP Facility Proximity	20	21	39
EJ Index for Hazardous Waste Proximity	32	34	54
EJ Index for Underground Storage Tanks	22	23	42
EJ Index for Wastewater Discharge	29	31	52



This report shows the values for environmental and demographic indicators and EJSCREEN indexes. It shows environmental and demographic raw data (e.g., the estimated concentration of ozone in the air), and also shows what percentile each raw data value represents. These percentiles provide perspective on how the selected block group or buffer area compares to the entire state, EPA region, or nation. For example, if a given location is at the 95th percentile nationwide, this means that only 5 percent of the US population has a higher block group value than the average person in the location being analyzed. The years for which the data are available, and the methods used, vary across these indicators. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJSCREEN documentation for discussion of these issues before using reports.

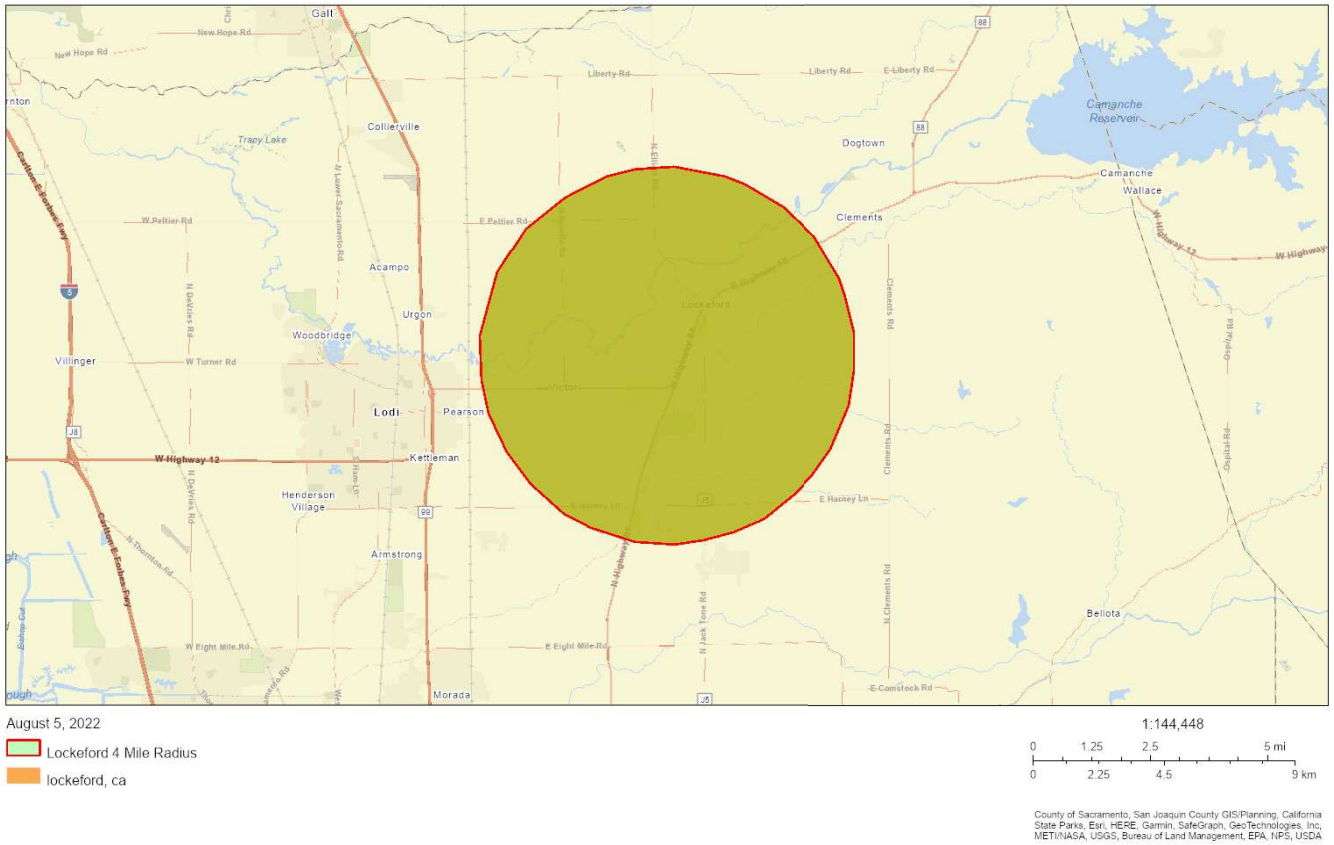
EJScreen Report (Version 2.0)

the User Specified Area, CALIFORNIA, EPA Region 9

Approximate Population: 7,482

Input Area (sq. miles): 50.36

Lockeford 4 Mile Radius



Sites reporting to EPA	
Superfund NPL	0
Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)	0

EJScreen Report (Version 2.0)

the User Specified Area, CALIFORNIA, EPA Region 9

Approximate Population: 7,482

Input Area (sq. miles): 50.36

Lockeford 4 Mile Radius

Selected Variables	Value	State Avg.	%ile in State	EPA Region Avg.	%ile in EPA Region	USA Avg.	%ile in USA
Pollution and Sources							
Particulate Matter 2.5 (µg/m^3)	14.4	11.7	91	10.8	93	8.74	98
Ozone (ppb)	51.9	48.1	64	49.6	53	42.6	89
2017 Diesel Particulate Matter* (µg/m^3)	0.199	0.33	25	0.33	<50th	0.295	<50th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	30	31	76	30	70-80th	29	80-90th
2017 Air Toxics Respiratory HI*	0.44	0.43	77	0.41	70-80th	0.36	80-90th
Traffic Proximity (daily traffic count/distance to road)	240	1300	44	1300	45	710	52
Lead Paint (% Pre-1960 Housing)	0.15	0.29	44	0.23	52	0.28	47
Superfund Proximity (site count/km distance)	0.039	0.18	22	0.15	27	0.13	34
RMP Facility Proximity (facility count/km distance)	0.69	1.1	54	1	59	0.75	67
Hazardous Waste Proximity (facility count/km distance)	0.15	5.2	4	4.4	6	2.2	23
Underground Storage Tanks (count/km^2)	0.36	3.7	27	3.3	29	3.9	32
Wastewater Discharge (toxicity-weighted concentration/m distance)	1.2E-05	74	9	59	10	12	19
Socioeconomic Indicators							
Demographic Index	33%	47%	29	46%	31	36%	54
People of Color	37%	63%	20	60%	24	40%	54
Low Income	29%	31%	53	31%	53	31%	52
Unemployment Rate	5%	6%	50	6%	51	5%	59
Linguistically Isolated	6%	9%	49	8%	54	5%	75
Less Than High School Education	19%	17%	62	16%	65	12%	77
Under Age 5	7%	6%	59	6%	59	6%	62
Over Age 64	21%	14%	83	15%	81	16%	77

*Diesel particular matter, air toxics cancer risk, and air toxics respiratory hazard index are from the EPA's 2017 Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one significant figure and any additional significant figures here are due to rounding. More information on the Air Toxics Data Update can be found at: https://www.epa.gov/haps/air-toxics-data-update.

For additional information, see: www.epa.gov/environmentaljustice

EJSCREEN ACS Summary Report

Location: User-specified polygonal location
Ring (buffer): 0-miles radius
Description: Lockeford 4 Mile Radius

Summary of ACS Estimates	2015 - 2019
Population	7,482
Population Density (per sq. mile)	148
People of Color Population	2,739
% People of Color Population	37%
Households	2,677
Housing Units	2,823
Housing Units Built Before 1950	305
Per Capita Income	38,511
Land Area (sq. miles) (Source: SF1)	50.57
% Land Area	99%
Water Area (sq. miles) (Source: SF1)	0.46
% Water Area	1%

	2015 - 2019 ACS Estimates	Percent	MOE (±)
Population by Race			
Total	7,482	100%	562
Population Reporting One Race	6,725	90%	1,036
White	5,914	79%	510
Black	17	0%	54
American Indian	28	0%	30
Asian	108	1%	97
Pacific Islander	1	0%	16
Some Other Race	657	9%	329
Population Reporting Two or More Races	756	10%	346
Total Hispanic Population	2,478	33%	544
Total Non-Hispanic Population	5,004		
White Alone	4,743	63%	374
Black Alone	17	0%	54
American Indian Alone	11	0%	30
Non-Hispanic Asian Alone	106	1%	97
Pacific Islander Alone	1	0%	16
Other Race Alone	0	0%	12
Two or More Races Alone	125	2%	62
Population by Sex			
Male	3,824	51%	260
Female	3,658	49%	370
Population by Age			
Age 0-4	509	7%	124
Age 0-17	1,798	24%	178
Age 18+	5,684	76%	356
Age 65+	1,561	21%	201

Data Note: Detail may not sum to totals due to rounding. Hispanic population can be of any race.
N/A means not available. **Source:** U.S. Census Bureau, American Community Survey (ACS) 2015 - 2019 .

EJSCREEN ACS Summary Report

Location: User-specified polygonal location
Ring (buffer): 0-miles radius
Description: Lockeford 4 Mile Radius

	2015 - 2019 ACS Estimates	Percent	MOE (±)
Population 25+ by Educational Attainment			
Total	5,206	100%	392
Less than 9th Grade	508	10%	164
9th - 12th Grade, No Diploma	458	9%	104
High School Graduate	1,337	26%	198
Some College, No Degree	1,307	25%	146
Associate Degree	637	12%	91
Bachelor's Degree or more	960	18%	94
Population Age 5+ Years by Ability to Speak English			
Total	6,973	100%	565
Speak only English	5,155	74%	362
Non-English at Home[1+2+3+4]	1,818	26%	370
[1]Speak English "very well"	992	14%	206
[2]Speak English "well"	310	4%	125
[3]Speak English "not well"	381	5%	105
[4]Speak English "not at all"	136	2%	147
[3+4]Speak English "less than well"	516	7%	172
[2+3+4]Speak English "less than very well"	826	12%	213
Linguistically Isolated Households*			
Total	161	100%	65
Speak Spanish	139	86%	55
Speak Other Indo-European Languages	12	7%	17
Speak Asian-Pacific Island Languages	11	7%	32
Speak Other Languages	0	0%	12
Households by Household Income			
Household Income Base	2,677	100%	150
< $15,000	293	11%	67
$15,000 - $25,000	169	6%	71
$25,000 - $50,000	550	21%	103
$50,000 - $75,000	393	15%	97
$75,000 +	1,271	47%	149
Occupied Housing Units by Tenure			
Total	2,677	100%	150
Owner Occupied	1,928	72%	123
Renter Occupied	749	28%	130
Employed Population Age 16+ Years			
Total	5,949	100%	538
In Labor Force	3,282	55%	310
Civilian Unemployed in Labor Force	171	3%	73
Not In Labor Force	2,667	45%	351

Data Note: Datail may not sum to totals due to rounding. Hispanic population can be of anyrace.
N/A means not available. **Source:** U.S. Census Bureau, American Community Survey (ACS)
*Households in which no one 14 and over speaks English "very well" or speaks English only.

EJSCREEN ACS Summary Report

Location: User-specified polygonal location
Ring (buffer): 0-miles radius
Description: Lockeford 4 Mile Radius

	2015 - 2019 ACS Estimates	Percent	MOE (±)
Population by Language Spoken at Home*			
Total (persons age 5 and above)	5,954	100%	870
English	4,127	69%	626
Spanish	1,668	28%	1,000
French	0	0%	27
French Creole	N/A	N/A	N/A
Italian	N/A	N/A	N/A
Portuguese	N/A	N/A	N/A
German	37	1%	90
Yiddish	N/A	N/A	N/A
Other West Germanic	N/A	N/A	N/A
Scandinavian	N/A	N/A	N/A
Greek	N/A	N/A	N/A
Russian	N/A	N/A	N/A
Polish	N/A	N/A	N/A
Serbo-Croatian	N/A	N/A	N/A
Other Slavic	N/A	N/A	N/A
Armenian	N/A	N/A	N/A
Persian	N/A	N/A	N/A
Gujarathi	N/A	N/A	N/A
Hindi	N/A	N/A	N/A
Urdu	N/A	N/A	N/A
Other Indic	N/A	N/A	N/A
Other Indo-European	49	1%	42
Chinese	6	0%	29
Japanese	N/A	N/A	N/A
Korean	9	0%	49
Mon-Khmer, Cambodian	N/A	N/A	N/A
Hmong	N/A	N/A	N/A
Thai	N/A	N/A	N/A
Laotian	N/A	N/A	N/A
Vietnamese	0	0%	17
Other Asian	17	0%	41
Tagalog	39	1%	102
Other Pacific Island	N/A	N/A	N/A
Navajo	N/A	N/A	N/A
Other Native American	N/A	N/A	N/A
Hungarian	N/A	N/A	N/A
Arabic	3	0%	12
Hebrew	N/A	N/A	N/A
African	N/A	N/A	N/A
Other and non-specified	0	0%	17
Total Non-English	1,827	31%	1,072

Data Note: Detail may not sum to totals due to rounding. Hispanic popultion can be of any race.
N/A meansnot available. **Source:** U.S. Census Bureau, American Community Survey (ACS) 2015 - 2019.
*Population by Language Spoken at Home is available at the census tract summary level and up.

Appendix F

AEDT Census Block Group Data

Appendix F: AEDT Census Block Group Data

Lockeford Operating Area Block Group ACS 2020 5-Year Estimate Data

STATE	COUNTY	NAME	Population Total	Population Minority	Percent Minority	Population Low Income	Percent Low income
CA	San Joaquin County	Block Group 1, Census Tract 47.04, San Joaquin County, California	942	465	49.4	112	12.1
CA	San Joaquin County	Block Group 2, Census Tract 47.01, San Joaquin County, California	1726	465	26.9	166	9.6
CA	San Joaquin County	Block Group 4, Census Tract 47.04, San Joaquin County, California	1204	479	39.8	57	4.7
CA	San Joaquin County	Block Group 3, Census Tract 47.04, San Joaquin County, California	1502	481	32	128	8.6
CA	San Joaquin County	Block Group 3, Census Tract 47.03, San Joaquin County, California	1492	798	53.5	183	12.3
CA	San Joaquin County	Block Group 1, Census Tract 41.07, San Joaquin County, California	1174	675	57.5	53	4.5
CA	San Joaquin County	Block Group 5, Census Tract 46, San Joaquin County, California	713	353	49.5	45	6.6
CA	San Joaquin County	Block Group 2, Census Tract 47.03, San Joaquin County, California	1128	582	51.6	20	1.8
CA	San Joaquin County	Block Group 1, Census Tract 47.01, San Joaquin County, California	1308	515	39.4	270	20.6
CA	San Joaquin County	Block Group 1, Census Tract 47.03, San Joaquin County, California	1354	508	37.5	185	13.7
CA	San Joaquin County	Block Group 4, Census Tract 46, San Joaquin County, California	2000	707	35.4	164	8.2
CA	San Joaquin County	Block Group 2, Census Tract 47.04, San Joaquin County, California	1049	305	29.1	54	5.1
CA	San Joaquin County	Block Group 1, Census Tract 46, San Joaquin County, California	1897	1149	60.6	23	1.2
			17489	7482	43.2461538	1460	8.38461538

San Joaquin County Block Group ACS 2020 5-Year Estimate Data

STATE	COUNTY	NAME	Population Total	Population Minority	Percent Minority	Population Low Income	Percent Low income
CA	San Joaquin County	Block Group 2, Census Tract 51.22, San Joaquin County, California	588	452	76.9	177	30.1
CA	San Joaquin County	Block Group 3, Census Tract 35.03, San Joaquin County, California	1452	1365	94	0	0
CA	San Joaquin County	Block Group 1, Census Tract 31.09, San Joaquin County, California	1004	993	98.9	369	36.8
CA	San Joaquin County	Block Group 3, Census Tract 10, San Joaquin County, California	1669	1192	71.4	300	18
CA	San Joaquin County	Block Group 1, Census Tract 51.41, San Joaquin County, California	800	329	41.1	0	0
CA	San Joaquin County	Block Group 1, Census Tract 31.18, San Joaquin County, California	807	332	41.1	21	2.6
CA	San Joaquin County	Block Group 1, Census Tract 4.01, San Joaquin County, California	781	604	77.3	66	9.1
CA	San Joaquin County	Block Group 3, Census Tract 32.13, San Joaquin County, California	1159	1116	96.3	201	17.3
CA	San Joaquin County	Block Group 1, Census Tract 1.02, San Joaquin County, California	493	432	87.6	193	39.1
CA	San Joaquin County	Block Group 2, Census Tract 33.11, San Joaquin County, California	1904	1649	86.6	677	35.7
CA	San Joaquin County	Block Group 1, Census Tract 52.19, San Joaquin County, California	3048	2383	78.2	50	1.6
CA	San Joaquin County	Block Group 3, Census Tract 53.03, San Joaquin County, California	441	257	58.3	146	37.6
CA	San Joaquin County	Block Group 3, Census Tract 54.03, San Joaquin County, California	1771	1106	62.5	359	21.2
CA	San Joaquin County	Block Group 3, Census Tract 55.03, San Joaquin County, California	134	102	76.1	36	26.9
CA	San Joaquin County	Block Group 1, Census Tract 34.10, San Joaquin County, California	2837	2705	95.3	260	9.3
CA	San Joaquin County	Block Group 3, Census Tract 41.05, San Joaquin County, California	868	138	15.9	83	9.7
CA	San Joaquin County	Block Group 2, Census Tract 44.03, San Joaquin County, California	1053	944	89.6	425	40.4
CA	San Joaquin County	Block Group 2, Census Tract 52.22, San Joaquin County, California	2385	1597	67	0	0
CA	San Joaquin County	Block Group 2, Census Tract 51.35, San Joaquin County, California	1952	1402	71.8	59	3
CA	San Joaquin County	Block Group 1, Census Tract 55.02, San Joaquin County, California	1073	751	70	16	1.5
CA	San Joaquin County	Block Group 2, Census Tract 9, San Joaquin County, California	1396	1145	82	395	28.3
CA	San Joaquin County	Block Group 3, Census Tract 32.15, San Joaquin County, California	506	177	35	29	5.7
CA	San Joaquin County	Block Group 2, Census Tract 31.15, San Joaquin County, California	1709	1348	78.9	0	0
CA	San Joaquin County	Block Group 1, Census Tract 52.12, San Joaquin County, California	1717	1287	75	0	0
CA	San Joaquin County	Block Group 2, Census Tract 22.01, San Joaquin County, California	2466	2421	98.2	996	40.4
CA	San Joaquin County	Block Group 1, Census Tract 25.04, San Joaquin County, California	2526	2364	93.6	352	14.1
CA	San Joaquin County	Block Group 1, Census Tract 40.03, San Joaquin County, California	1327	904	68.1	151	11.4
CA	San Joaquin County	Block Group 2, Census Tract 49.04, San Joaquin County, California	1407	130	9.2	204	14.5
CA	San Joaquin County	Block Group 1, Census Tract 51.32, San Joaquin County, California	668	481	72	0	0
CA	San Joaquin County	Block Group 2, Census Tract 51.29, San Joaquin County, California	2418	1972	81.6	327	13.8
CA	San Joaquin County	Block Group 1, Census Tract 38.05, San Joaquin County, California	1135	985	86.8	161	14.2
CA	San Joaquin County	Block Group 4, Census Tract 50.01, San Joaquin County, California	1673	553	33.1	0	0
CA	San Joaquin County	Block Group 2, Census Tract 52.16, San Joaquin County, California	1165	873	74.9	11	0.9
CA	San Joaquin County	Block Group 1, Census Tract 46, San Joaquin County, California	1897	1149	60.6	23	1.2
CA	San Joaquin County	Block Group 2, Census Tract 24.01, San Joaquin County, California	1442	1402	97.2	321	22.4
CA	San Joaquin County	Block Group 4, Census Tract 36.01, San Joaquin County, California	872	548	62.8	126	14.9
CA	San Joaquin County	Block Group 1, Census Tract 51.37, San Joaquin County, California	2777	2346	84.5	313	11.3
CA	San Joaquin County	Block Group 2, Census Tract 38.03, San Joaquin County, California	4486	3854	85.9	349	12.8
CA	San Joaquin County	Block Group 2, Census Tract 6, San Joaquin County, California	789	782	99.1	208	26.4

CA	San Joaquin County	Block Group 2, Census Tract 34.05, San Joaquin County, California	801	707	88.3	87	10.9
CA	San Joaquin County	Block Group 2, Census Tract 47.04, San Joaquin County, California	1049	305	29.1	54	5.1
CA	San Joaquin County	Block Group 1, Census Tract 31.12, San Joaquin County, California	2077	1242	59.8	275	13.2
CA	San Joaquin County	Block Group 1, Census Tract 51.23, San Joaquin County, California	1262	804	63.7	125	10.1
CA	San Joaquin County	Block Group 3, Census Tract 43.07, San Joaquin County, California	762	198	26	103	13.6
CA	San Joaquin County	Block Group 2, Census Tract 21, San Joaquin County, California	1135	1135	100	93	8.2
CA	San Joaquin County	Block Group 2, Census Tract 33.07, San Joaquin County, California	1660	1179	71	161	10.4
CA	San Joaquin County	Block Group 2, Census Tract 12, San Joaquin County, California	707	273	38.6	59	8.3
CA	San Joaquin County	Block Group 1, Census Tract 27.02, San Joaquin County, California	1220	1132	92.8	143	11.7
CA	San Joaquin County	Block Group 3, Census Tract 51.27, San Joaquin County, California	1761	1213	68.9	282	16
CA	San Joaquin County	Block Group 1, Census Tract 41.04, San Joaquin County, California	1979	741	37.4	131	6.6
CA	San Joaquin County	Block Group 1, Census Tract 53.07, San Joaquin County, California	1431	996	69.6	111	7.9
CA	San Joaquin County	Block Group 3, Census Tract 54.05, San Joaquin County, California	1195	837	70	17	1.5
CA	San Joaquin County	Block Group 3, Census Tract 52.23, San Joaquin County, California	984	426	43.3	0	0
CA	San Joaquin County	Block Group 3, Census Tract 19, San Joaquin County, California	1262	1218	96.5	216	17.3
CA	San Joaquin County	Block Group 2, Census Tract 41.07, San Joaquin County, California	1373	905	65.9	127	9.2
CA	San Joaquin County	Block Group 4, Census Tract 43.05, San Joaquin County, California	847	434	51.2	0	0
CA	San Joaquin County	Block Group 1, Census Tract 51.40, San Joaquin County, California	1735	768	44.3	71	4.1
CA	San Joaquin County	Block Group 4, Census Tract 13, San Joaquin County, California	1130	739	65.4	63	5.6
CA	San Joaquin County	Block Group 3, Census Tract 33.10, San Joaquin County, California	1657	1287	77.7	355	22.2
CA	San Joaquin County	Block Group 4, Census Tract 31.09, San Joaquin County, California	1349	672	49.8	149	11
CA	San Joaquin County	Block Group 1, Census Tract 51.09, San Joaquin County, California	1560	1105	70.8	278	18.8
CA	San Joaquin County	Block Group 3, Census Tract 50.04, San Joaquin County, California	1426	687	48.2	20	1.4
CA	San Joaquin County	Block Group 3, Census Tract 43.02, San Joaquin County, California	1733	1066	61.5	235	14.5
CA	San Joaquin County	Block Group 1, Census Tract 34.03, San Joaquin County, California	1248	1068	85.6	156	12.7
CA	San Joaquin County	Block Group 1, Census Tract 42.05, San Joaquin County, California	676	282	41.7	27	4
CA	San Joaquin County	Block Group 1, Census Tract 53.10, San Joaquin County, California	1651	1342	81.3	440	26.7
CA	San Joaquin County	Block Group 1, Census Tract 51.27, San Joaquin County, California	2030	1775	87.4	284	14.1
CA	San Joaquin County	Block Group 1, Census Tract 42.02, San Joaquin County, California	1809	529	29.2	208	12.1
CA	San Joaquin County	Block Group 1, Census Tract 36.01, San Joaquin County, California	656	200	30.5	59	9.1
CA	San Joaquin County	Block Group 3, Census Tract 52.08, San Joaquin County, California	2169	1565	72.2	8	0.4
CA	San Joaquin County	Block Group 2, Census Tract 54.05, San Joaquin County, California	1157	770	66.6	57	4.9
CA	San Joaquin County	Block Group 2, Census Tract 50.03, San Joaquin County, California	1578	594	37.6	248	15.7
CA	San Joaquin County	Block Group 3, Census Tract 51.23, San Joaquin County, California	2357	1633	69.3	93	3.9
CA	San Joaquin County	Block Group 3, Census Tract 35.02, San Joaquin County, California	1596	1048	65.7	335	21
CA	San Joaquin County	Block Group 1, Census Tract 40.04, San Joaquin County, California	1742	1332	76.5	0	0
CA	San Joaquin County	Block Group 1, Census Tract 49.03, San Joaquin County, California	791	154	19.5	0	0
CA	San Joaquin County	Block Group 1, Census Tract 52.21, San Joaquin County, California	7962	5554	69.8	404	5.1
CA	San Joaquin County	Block Group 1, Census Tract 52.11, San Joaquin County, California	531	301	56.7	24	4.6
CA	San Joaquin County	Block Group 2, Census Tract 31.16, San Joaquin County, California	794	517	65.1	228	56.7
CA	San Joaquin County	Block Group 1, Census Tract 51.31, San Joaquin County, California	4254	2850	67	129	13.1
CA	San Joaquin County	Block Group 1, Census Tract 34.09, San Joaquin County, California	864	839	97.1	180	20.8
CA	San Joaquin County	Block Group 1, Census Tract 8.02, San Joaquin County, California	1980	1919	96.9	134	6.8
CA	San Joaquin County	Block Group 2, Census Tract 52.17, San Joaquin County, California	1847	1110	60.1	143	7.7
CA	San Joaquin County	Block Group 3, Census Tract 28, San Joaquin County, California	1754	1514	86.3	207	11.9
CA	San Joaquin County	Block Group 1, Census Tract 32.17, San Joaquin County, California	2034	1848	90.9	791	39.4
CA	San Joaquin County	Block Group 2, Census Tract 32.10, San Joaquin County, California	1032	716	69.4	45	4.4
CA	San Joaquin County	Block Group 1, Census Tract 52.13, San Joaquin County, California	1305	750	57.5	42	3.2
CA	San Joaquin County	Block Group 5, Census Tract 9, San Joaquin County, California	1597	1531	95.9	242	15.2
CA	San Joaquin County	Block Group 1, Census Tract 38.08, San Joaquin County, California	2169	2023	93.3	57	2.6
CA	San Joaquin County	Block Group 2, Census Tract 24.02, San Joaquin County, California	884	852	96.4	228	25.8
CA	San Joaquin County	Block Group 1, Census Tract 49.05, San Joaquin County, California	840	271	32.3	153	18.2
CA	San Joaquin County	Block Group 4, Census Tract 46, San Joaquin County, California	2000	707	35.4	164	8.2
CA	San Joaquin County	Block Group 2, Census Tract 38.06, San Joaquin County, California	2063	2034	98.6	912	44.5
CA	San Joaquin County	Block Group 2, Census Tract 32.14, San Joaquin County, California	1818	988	54.3	100	5.5
CA	San Joaquin County	Block Group 1, Census Tract 49.06, San Joaquin County, California	1135	82	7.2	52	4.6
CA	San Joaquin County	Block Group 1, Census Tract 51.33, San Joaquin County, California	934	500	53.5	0	0
CA	San Joaquin County	Block Group 2, Census Tract 32.03, San Joaquin County, California	1612	558	34.6	122	7.6
CA	San Joaquin County	Block Group 4, Census Tract 32.19, San Joaquin County, California	1657	1261	76.1	47	2.8
CA	San Joaquin County	Block Group 1, Census Tract 47.03, San Joaquin County, California	1354	508	37.5	185	13.7

CA	San Joaquin County	Block Group 1, Census Tract 51.19, San Joaquin County, California	2442	1929	79	420	17.2
CA	San Joaquin County	Block Group 2, Census Tract 43.05, San Joaquin County, California	1676	629	37.5	45	2.7
CA	San Joaquin County	Block Group 2, Census Tract 39, San Joaquin County, California	730	554	75.9	30	4.1
CA	San Joaquin County	Block Group 3, Census Tract 7, San Joaquin County, California	873	856	98.1	267	30.6
CA	San Joaquin County	Block Group 1, Census Tract 5, San Joaquin County, California	929	794	85.5	333	35.8
CA	San Joaquin County	Block Group 4, Census Tract 11.02, San Joaquin County, California	798	446	55.9	207	25.9
CA	San Joaquin County	Block Group 2, Census Tract 27.01, San Joaquin County, California	866	763	88.1	62	7.2
CA	San Joaquin County	Block Group 1, Census Tract 13, San Joaquin County, California	1651	1236	74.9	125	8.6
CA	San Joaquin County	Block Group 2, Census Tract 20, San Joaquin County, California	1365	1134	83.1	597	43.7
CA	San Joaquin County	Block Group 1, Census Tract 48, San Joaquin County, California	1166	335	28.7	196	16.8
CA	San Joaquin County	Block Group 1, Census Tract 53.12, San Joaquin County, California	1283	1143	89.1	32	2.5
CA	San Joaquin County	Block Group 2, Census Tract 34.06, San Joaquin County, California	1836	1647	89.7	588	32.5
CA	San Joaquin County	Block Group 1, Census Tract 44.02, San Joaquin County, California	1233	778	63.1	135	11
CA	San Joaquin County	Block Group 3, Census Tract 31.10, San Joaquin County, California	1759	1347	76.6	510	29.4
CA	San Joaquin County	Block Group 2, Census Tract 35.01, San Joaquin County, California	881	320	36.3	12	1.4
CA	San Joaquin County	Block Group 1, Census Tract 53.11, San Joaquin County, California	1207	947	78.5	517	46
CA	San Joaquin County	Block Group 1, Census Tract 33.10, San Joaquin County, California	2345	2162	92.2	582	25.1
CA	San Joaquin County	Block Group 2, Census Tract 18, San Joaquin County, California	2601	2242	86.2	684	26.3
CA	San Joaquin County	Block Group 3, Census Tract 41.08, San Joaquin County, California	1778	1281	72	13	0.7
CA	San Joaquin County	Block Group 2, Census Tract 43.09, San Joaquin County, California	1286	632	49.1	0	0
CA	San Joaquin County	Block Group 2, Census Tract 31.19, San Joaquin County, California	1192	730	61.2	67	5.6
CA	San Joaquin County	Block Group 4, Census Tract 51.35, San Joaquin County, California	1979	390	19.7	79	4
CA	San Joaquin County	Block Group 3, Census Tract 14, San Joaquin County, California	635	374	58.9	144	22.7
CA	San Joaquin County	Block Group 3, Census Tract 33.12, San Joaquin County, California	990	891	90	537	55.3
CA	San Joaquin County	Block Group 1, Census Tract 42.06, San Joaquin County, California	2504	875	34.9	425	17
CA	San Joaquin County	Block Group 2, Census Tract 53.08, San Joaquin County, California	412	104	25.2	78	18.9
CA	San Joaquin County	Block Group 1, Census Tract 51.08, San Joaquin County, California	1864	1276	68.5	332	18
CA	San Joaquin County	Block Group 1, Census Tract 53.03, San Joaquin County, California	1385	1036	74.8	109	7.9
CA	San Joaquin County	Block Group 1, Census Tract 1.01, San Joaquin County, California	888	888	100	178	20
CA	San Joaquin County	Block Group 1, Census Tract 50.04, San Joaquin County, California	1068	247	23.1	0	0
CA	San Joaquin County	Block Group 2, Census Tract 51.27, San Joaquin County, California	3228	2142	66.4	331	12.4
CA	San Joaquin County	Block Group 2, Census Tract 52.11, San Joaquin County, California	2511	1878	74.8	277	11
CA	San Joaquin County	Block Group 2, Census Tract 51.40, San Joaquin County, California	1429	1140	79.8	417	29.2
CA	San Joaquin County	Block Group 3, Census Tract 51.19, San Joaquin County, California	3661	3256	88.9	282	7.8
CA	San Joaquin County	Block Group 3, Census Tract 51.24, San Joaquin County, California	998	650	65.1	15	1.5
CA	San Joaquin County	Block Group 4, Census Tract 48, San Joaquin County, California	1735	992	57.2	213	12.3
CA	San Joaquin County	Block Group 1, Census Tract 31.17, San Joaquin County, California	1294	666	51.5	23	1.8
CA	San Joaquin County	Block Group 3, Census Tract 44.02, San Joaquin County, California	2260	1192	52.7	10	0.4
CA	San Joaquin County	Block Group 2, Census Tract 51.24, San Joaquin County, California	1092	491	45	169	15.8
CA	San Joaquin County	Block Group 4, Census Tract 40.04, San Joaquin County, California	1977	1374	69.5	65	3.3
CA	San Joaquin County	Block Group 2, Census Tract 52.21, San Joaquin County, California	2358	1940	82.3	0	0
CA	San Joaquin County	Block Group 3, Census Tract 51.34, San Joaquin County, California	1281	935	73	69	5.5
CA	San Joaquin County	Block Group 2, Census Tract 38.04, San Joaquin County, California	2348	2067	88	347	14.8
CA	San Joaquin County	Block Group 2, Census Tract 11.02, San Joaquin County, California	874	684	78.3	268	30.7
CA	San Joaquin County	Block Group 4, Census Tract 28, San Joaquin County, California	1221	1134	92.9	320	26.2
CA	San Joaquin County	Block Group 1, Census Tract 25.03, San Joaquin County, California	1091	995	91.2	479	43.9
CA	San Joaquin County	Block Group 2, Census Tract 34.09, San Joaquin County, California	1488	1341	90.1	422	28.4
CA	San Joaquin County	Block Group 2, Census Tract 49.03, San Joaquin County, California	2292	943	41.1	404	17.6
CA	San Joaquin County	Block Group 4, Census Tract 7, San Joaquin County, California	1536	1302	84.8	581	40
CA	San Joaquin County	Block Group 1, Census Tract 52.18, San Joaquin County, California	1508	1377	91.3	155	10.3
CA	San Joaquin County	Block Group 2, Census Tract 38.08, San Joaquin County, California	2396	1939	80.9	118	4.9
CA	San Joaquin County	Block Group 1, Census Tract 32.15, San Joaquin County, California	1006	735	73.1	42	4.2
CA	San Joaquin County	Block Group 1, Census Tract 32.13, San Joaquin County, California	1203	987	82	98	8.2
CA	San Joaquin County	Block Group 1, Census Tract 45.02, San Joaquin County, California	2004	1709	85.3	621	31
CA	San Joaquin County	Block Group 1, Census Tract 47.01, San Joaquin County, California	1308	515	39.4	270	20.6
CA	San Joaquin County	Block Group 3, Census Tract 8.03, San Joaquin County, California	1481	1352	91.3	125	8.5
CA	San Joaquin County	Block Group 3, Census Tract 23, San Joaquin County, California	1288	1186	92.1	197	15.3
CA	San Joaquin County	Block Group 2, Census Tract 49.05, San Joaquin County, California	958	232	24.2	44	4.6
CA	San Joaquin County	Block Group 2, Census Tract 51.31, San Joaquin County, California	1954	1234	63.2	183	9.4
CA	San Joaquin County	Block Group 3, Census Tract 52.15, San Joaquin County, California	1372	739	53.9	137	10

CA	San Joaquin County	Block Group 1, Census Tract 38.07, San Joaquin County, California	1657	1587	95.8	82	4.9
CA	San Joaquin County	Block Group 1, Census Tract 43.07, San Joaquin County, California	1308	313	23.9	101	7.8
CA	San Joaquin County	Block Group 5, Census Tract 32.19, San Joaquin County, California	3713	3011	81.1	209	5.7
CA	San Joaquin County	Block Group 4, Census Tract 34.04, San Joaquin County, California	1733	857	49.5	61	3.5
CA	San Joaquin County	Block Group 3, Census Tract 37, San Joaquin County, California	943	649	68.8	451	47.8
CA	San Joaquin County	Block Group 2, Census Tract 47.03, San Joaquin County, California	1128	582	51.6	20	1.8
CA	San Joaquin County	Block Group 4, Census Tract 51.33, San Joaquin County, California	786	363	46.2	86	11.1
CA	San Joaquin County	Block Group 3, Census Tract 32.05, San Joaquin County, California	1231	797	64.7	418	34.5
CA	San Joaquin County	Block Group 5, Census Tract 11.02, San Joaquin County, California	648	548	84.6	98	16.1
CA	San Joaquin County	Block Group 2, Census Tract 13, San Joaquin County, California	1846	1420	76.9	235	12.7
CA	San Joaquin County	Block Group 2, Census Tract 53.12, San Joaquin County, California	1124	496	44.1	201	17.9
CA	San Joaquin County	Block Group 1, Census Tract 34.07, San Joaquin County, California	1148	909	79.2	299	26
CA	San Joaquin County	Block Group 3, Census Tract 20, San Joaquin County, California	1169	1048	89.6	397	34.3
CA	San Joaquin County	Block Group 2, Census Tract 33.06, San Joaquin County, California	1377	1274	92.5	65	4.7
CA	San Joaquin County	Block Group 2, Census Tract 5, San Joaquin County, California	1428	1193	83.5	618	44.5
CA	San Joaquin County	Block Group 1, Census Tract 40.01, San Joaquin County, California	992	554	55.8	185	18.9
CA	San Joaquin County	Block Group 1, Census Tract 51.39, San Joaquin County, California	1124	570	50.7	390	35.5
CA	San Joaquin County	Block Group 1, Census Tract 43.02, San Joaquin County, California	2062	1207	58.5	606	29.4
CA	San Joaquin County	Block Group 1, Census Tract 35.02, San Joaquin County, California	710	28	3.9	0	0
CA	San Joaquin County	Block Group 1, Census Tract 32.18, San Joaquin County, California	1861	1645	88.4	446	24
CA	San Joaquin County	Block Group 1, Census Tract 54.03, San Joaquin County, California	1184	1042	88	234	19.8
CA	San Joaquin County	Block Group 1, Census Tract 19, San Joaquin County, California	1085	1073	98.9	45	4.1
CA	San Joaquin County	Block Group 1, Census Tract 31.11, San Joaquin County, California	1966	1463	74.4	150	7.6
CA	San Joaquin County	Block Group 2, Census Tract 33.10, San Joaquin County, California	1145	745	65.1	282	24.6
CA	San Joaquin County	Block Group 2, Census Tract 31.06, San Joaquin County, California	572	366	64	40	7
CA	San Joaquin County	Block Group 4, Census Tract 4.01, San Joaquin County, California	588	330	56.1	109	18.5
CA	San Joaquin County	Block Group 4, Census Tract 53.03, San Joaquin County, California	1876	1461	77.9	658	35.6
CA	San Joaquin County	Block Group 4, Census Tract 41.08, San Joaquin County, California	2210	1908	86.3	221	10.6
CA	San Joaquin County	Block Group 1, Census Tract 53.09, San Joaquin County, California	1741	1205	69.2	205	11.8
CA	San Joaquin County	Block Group 2, Census Tract 51.08, San Joaquin County, California	958	621	64.8	270	28.2
CA	San Joaquin County	Block Group 2, Census Tract 31.09, San Joaquin County, California	1537	728	47.4	32	2.1
CA	San Joaquin County	Block Group 2, Census Tract 16, San Joaquin County, California	1166	984	84.4	277	23.9
CA	San Joaquin County	Block Group 2, Census Tract 51.41, San Joaquin County, California	2066	1214	58.8	261	12.6
CA	San Joaquin County	Block Group 4, Census Tract 32.13, San Joaquin County, California	1174	665	56.6	162	16.3
CA	San Joaquin County	Block Group 1, Census Tract 33.12, San Joaquin County, California	616	594	96.4	190	31.1
CA	San Joaquin County	Block Group 2, Census Tract 52.19, San Joaquin County, California	2221	1261	56.8	138	6.2
CA	San Joaquin County	Block Group 1, Census Tract 9800, San Joaquin County, California	2355	1694	71.9	0	0
CA	San Joaquin County	Block Group 4, Census Tract 54.03, San Joaquin County, California	2351	1685	71.7	42	1.8
CA	San Joaquin County	Block Group 3, Census Tract 50.01, San Joaquin County, California	835	97	11.6	23	2.8
CA	San Joaquin County	Block Group 3, Census Tract 44.04, San Joaquin County, California	1379	1125	81.6	413	30.5
CA	San Joaquin County	Block Group 2, Census Tract 35.04, San Joaquin County, California	1695	1622	95.7	222	13.2
CA	San Joaquin County	Block Group 1, Census Tract 52.08, San Joaquin County, California	1610	641	39.8	113	7
CA	San Joaquin County	Block Group 1, Census Tract 51.26, San Joaquin County, California	1684	1370	81.4	0	0
CA	San Joaquin County	Block Group 4, Census Tract 41.05, San Joaquin County, California	1668	703	42.1	51	3.1
CA	San Joaquin County	Block Group 3, Census Tract 31.15, San Joaquin County, California	1214	627	51.6	372	30.6
CA	San Joaquin County	Block Group 5, Census Tract 46, San Joaquin County, California	713	353	49.5	45	6.6
CA	San Joaquin County	Block Group 3, Census Tract 51.22, San Joaquin County, California	860	592	68.8	197	23.3
CA	San Joaquin County	Block Group 3, Census Tract 32.09, San Joaquin County, California	2677	1939	72.4	0	0
CA	San Joaquin County	Block Group 3, Census Tract 9, San Joaquin County, California	824	506	61.4	258	31.3
CA	San Joaquin County	Block Group 3, Census Tract 36.02, San Joaquin County, California	1144	700	61.2	356	31.3
CA	San Joaquin County	Block Group 3, Census Tract 52.16, San Joaquin County, California	1748	1236	70.7	130	7.4
CA	San Joaquin County	Block Group 2, Census Tract 25.04, San Joaquin County, California	1444	1294	89.6	304	21.1
CA	San Joaquin County	Block Group 3, Census Tract 22.02, San Joaquin County, California	1536	1479	96.3	823	53.6
CA	San Joaquin County	Block Group 3, Census Tract 49.04, San Joaquin County, California	1341	288	21.5	90	6.7
CA	San Joaquin County	Block Group 4, Census Tract 50.04, San Joaquin County, California	1793	1063	59.3	700	39
CA	San Joaquin County	Block Group 2, Census Tract 38.05, San Joaquin County, California	2208	2102	95.2	241	11
CA	San Joaquin County	Block Group 2, Census Tract 11.01, San Joaquin County, California	1778	1353	76.1	162	9.1
CA	San Joaquin County	Block Group 1, Census Tract 51.30, San Joaquin County, California	711	533	75	31	4.4
CA	San Joaquin County	Block Group 3, Census Tract 24.01, San Joaquin County, California	2165	1857	85.8	700	32.4
CA	San Joaquin County	Block Group 3, Census Tract 15.01, San Joaquin County, California	2952	2499	84.7	197	6.7

CA	San Joaquin County	Block Group 2, Census Tract 46, San Joaquin County, California	618	24	3.9	114	18.4
CA	San Joaquin County	Block Group 3, Census Tract 12, San Joaquin County, California	915	520	56.8	45	5.5
CA	San Joaquin County	Block Group 2, Census Tract 52.14, San Joaquin County, California	1512	1209	80	0	0
CA	San Joaquin County	Block Group 3, Census Tract 38.03, San Joaquin County, California	1299	898	69.1	112	8.6
CA	San Joaquin County	Block Group 1, Census Tract 7, San Joaquin County, California	1284	1233	96	175	13.6
CA	San Joaquin County	Block Group 2, Census Tract 33.05, San Joaquin County, California	1841	1307	71	194	10.6
CA	San Joaquin County	Block Group 1, Census Tract 52.25, San Joaquin County, California	1491	515	34.5	123	8.2
CA	San Joaquin County	Block Group 2, Census Tract 51.09, San Joaquin County, California	1762	833	47.3	179	10.2
CA	San Joaquin County	Block Group 3, Census Tract 15.02, San Joaquin County, California	1162	1057	91	468	44
CA	San Joaquin County	Block Group 1, Census Tract 43.08, San Joaquin County, California	1566	845	54	161	10.4
CA	San Joaquin County	Block Group 1, Census Tract 28, San Joaquin County, California	1739	1619	93.1	162	9.3
CA	San Joaquin County	Block Group 4, Census Tract 19, San Joaquin County, California	932	890	95.5	517	56.8
CA	San Joaquin County	Block Group 3, Census Tract 34.05, San Joaquin County, California	1435	1229	85.6	358	24.9
CA	San Joaquin County	Block Group 3, Census Tract 33.07, San Joaquin County, California	1774	1500	84.6	500	28.6
CA	San Joaquin County	Block Group 3, Census Tract 4.02, San Joaquin County, California	482	409	84.9	103	21.4
CA	San Joaquin County	Block Group 1, Census Tract 41.05, San Joaquin County, California	1312	162	12.3	56	4.3
CA	San Joaquin County	Block Group 1, Census Tract 34.04, San Joaquin County, California	1315	1218	92.6	790	60.1
CA	San Joaquin County	Block Group 4, Census Tract 51.34, San Joaquin County, California	1397	722	51.7	153	11
CA	San Joaquin County	Block Group 4, Census Tract 34.10, San Joaquin County, California	940	789	83.9	34	3.6
CA	San Joaquin County	Block Group 1, Census Tract 41.08, San Joaquin County, California	704	616	87.5	288	40.9
CA	San Joaquin County	Block Group 4, Census Tract 51.37, San Joaquin County, California	573	251	43.8	0	0
CA	San Joaquin County	Block Group 4, Census Tract 43.02, San Joaquin County, California	626	134	21.4	87	17.4
CA	San Joaquin County	Block Group 1, Census Tract 42.04, San Joaquin County, California	761	314	41.3	341	44.9
CA	San Joaquin County	Block Group 1, Census Tract 31.10, San Joaquin County, California	1054	575	54.6	70	6.6
CA	San Joaquin County	Block Group 3, Census Tract 17, San Joaquin County, California	1094	753	68.8	508	46.4
CA	San Joaquin County	Block Group 2, Census Tract 53.10, San Joaquin County, California	1285	753	58.6	31	2.4
CA	San Joaquin County	Block Group 1, Census Tract 51.06, San Joaquin County, California	2147	1323	61.6	87	4.1
CA	San Joaquin County	Block Group 2, Census Tract 32.19, San Joaquin County, California	1865	1750	93.8	376	20.5
CA	San Joaquin County	Block Group 2, Census Tract 42.05, San Joaquin County, California	1915	853	44.5	182	9.5
CA	San Joaquin County	Block Group 1, Census Tract 45.01, San Joaquin County, California	779	146	18.7	53	6.8
CA	San Joaquin County	Block Group 1, Census Tract 42.03, San Joaquin County, California	1852	969	52.3	212	11.5
CA	San Joaquin County	Block Group 2, Census Tract 51.26, San Joaquin County, California	1624	938	57.8	99	6.2
CA	San Joaquin County	Block Group 1, Census Tract 50.03, San Joaquin County, California	1190	382	32.1	341	29.2
CA	San Joaquin County	Block Group 1, Census Tract 41.07, San Joaquin County, California	1174	675	57.5	53	4.5
CA	San Joaquin County	Block Group 2, Census Tract 40.04, San Joaquin County, California	1054	951	90.2	0	0
CA	San Joaquin County	Block Group 2, Census Tract 52.08, San Joaquin County, California	1403	1031	73.5	14	1
CA	San Joaquin County	Block Group 1, Census Tract 43.10, San Joaquin County, California	1864	442	23.7	51	2.8
CA	San Joaquin County	Block Group 3, Census Tract 47.03, San Joaquin County, California	1492	798	53.5	183	12.3
CA	San Joaquin County	Block Group 1, Census Tract 54.06, San Joaquin County, California	2376	1952	82.2	289	12.2
CA	San Joaquin County	Block Group 4, Census Tract 51.22, San Joaquin County, California	1234	566	45.9	47	3.8
CA	San Joaquin County	Block Group 1, Census Tract 35.03, San Joaquin County, California	1188	1127	94.9	24	2
CA	San Joaquin County	Block Group 1, Census Tract 52.17, San Joaquin County, California	1754	602	34.3	79	4.5
CA	San Joaquin County	Block Group 2, Census Tract 44.02, San Joaquin County, California	2513	1989	79.1	443	17.7
CA	San Joaquin County	Block Group 3, Census Tract 46, San Joaquin County, California	1137	114	10	36	3.2
CA	San Joaquin County	Block Group 1, Census Tract 8.03, San Joaquin County, California	2156	2097	97.3	41	1.9
CA	San Joaquin County	Block Group 3, Census Tract 51.06, San Joaquin County, California	827	629	76.1	122	15.1
CA	San Joaquin County	Block Group 1, Census Tract 37, San Joaquin County, California	1115	828	74.3	202	18.3
CA	San Joaquin County	Block Group 3, Census Tract 35.04, San Joaquin County, California	2260	1777	78.6	205	9.1
CA	San Joaquin County	Block Group 3, Census Tract 11.01, San Joaquin County, California	1227	800	65.2	94	7.7
CA	San Joaquin County	Block Group 1, Census Tract 32.10, San Joaquin County, California	1586	942	59.4	164	10.9
CA	San Joaquin County	Block Group 2, Census Tract 52.13, San Joaquin County, California	1699	1100	64.7	0	0
CA	San Joaquin County	Block Group 1, Census Tract 24.02, San Joaquin County, California	821	783	95.4	157	19.2
CA	San Joaquin County	Block Group 1, Census Tract 23, San Joaquin County, California	2252	2221	98.6	421	18.7
CA	San Joaquin County	Block Group 2, Census Tract 31.08, San Joaquin County, California	2130	1147	53.8	40	1.9
CA	San Joaquin County	Block Group 1, Census Tract 55.03, San Joaquin County, California	935	372	39.8	130	14
CA	San Joaquin County	Block Group 2, Census Tract 49.06, San Joaquin County, California	1464	389	26.6	164	11.3
CA	San Joaquin County	Block Group 2, Census Tract 36.01, San Joaquin County, California	1016	682	67.1	115	11.7
CA	San Joaquin County	Block Group 1, Census Tract 38.06, San Joaquin County, California	1854	1627	87.8	25	1.3
CA	San Joaquin County	Block Group 1, Census Tract 10, San Joaquin County, California	1305	824	63.1	104	8
CA	San Joaquin County	Block Group 3, Census Tract 33.05, San Joaquin County, California	2230	1644	73.7	273	12.2

CA	San Joaquin County	Block Group 1, Census Tract 52.15, San Joaquin County, California	1755	1135	64.7	31	1.8
CA	San Joaquin County	Block Group 2, Census Tract 52.25, San Joaquin County, California	1141	768	67.3	39	3.4
CA	San Joaquin County	Block Group 2, Census Tract 51.19, San Joaquin County, California	411	324	78.8	43	10.5
CA	San Joaquin County	Block Group 2, Census Tract 7, San Joaquin County, California	987	921	93.3	493	50.4
CA	San Joaquin County	Block Group 2, Census Tract 51.33, San Joaquin County, California	1448	912	63	77	5.5
CA	San Joaquin County	Block Group 4, Census Tract 21, San Joaquin County, California	2278	2034	89.3	821	36.1
CA	San Joaquin County	Block Group 1, Census Tract 43.05, San Joaquin County, California	1931	975	50.5	71	3.8
CA	San Joaquin County	Block Group 1, Census Tract 39, San Joaquin County, California	967	558	57.7	156	16.9
CA	San Joaquin County	Block Group 4, Census Tract 4.02, San Joaquin County, California	1757	1574	89.6	304	18.2
CA	San Joaquin County	Block Group 3, Census Tract 27.01, San Joaquin County, California	2228	1847	82.9	296	13.3
CA	San Joaquin County	Block Group 2, Census Tract 53.11, San Joaquin County, California	1911	1562	81.7	324	17.6
CA	San Joaquin County	Block Group 1, Census Tract 34.06, San Joaquin County, California	1973	1741	88.2	553	28
CA	San Joaquin County	Block Group 1, Census Tract 32.05, San Joaquin County, California	859	439	51.1	11	1.3
CA	San Joaquin County	Block Group 2, Census Tract 48, San Joaquin County, California	1989	560	28.2	87	4.4
CA	San Joaquin County	Block Group 1, Census Tract 33.08, San Joaquin County, California	1819	1530	84.1	346	19
CA	San Joaquin County	Block Group 2, Census Tract 41.08, San Joaquin County, California	2138	1988	93	258	12.1
CA	San Joaquin County	Block Group 3, Census Tract 53.10, San Joaquin County, California	1735	1369	78.9	7	0.4
CA	San Joaquin County	Block Group 1, Census Tract 52.23, San Joaquin County, California	2418	2099	86.8	91	4.1
CA	San Joaquin County	Block Group 2, Census Tract 28, San Joaquin County, California	1321	1314	99.5	490	37.1
CA	San Joaquin County	Block Group 3, Census Tract 31.19, San Joaquin County, California	1214	692	57	14	1.2
CA	San Joaquin County	Block Group 2, Census Tract 34.04, San Joaquin County, California	2074	1820	87.8	275	13.3
CA	San Joaquin County	Block Group 3, Census Tract 53.08, San Joaquin County, California	1096	971	88.6	118	10.8
CA	San Joaquin County	Block Group 4, Census Tract 14, San Joaquin County, California	1603	806	50.3	437	28.1
CA	San Joaquin County	Block Group 1, Census Tract 18, San Joaquin County, California	1721	1566	91	235	13.7
CA	San Joaquin County	Block Group 1, Census Tract 51.36, San Joaquin County, California	2323	1310	56.4	522	22.5
CA	San Joaquin County	Block Group 1, Census Tract 51.38, San Joaquin County, California	2207	988	44.8	75	3.4
CA	San Joaquin County	Block Group 2, Census Tract 42.06, San Joaquin County, California	886	82	9.3	0	0
CA	San Joaquin County	Block Group 3, Census Tract 31.08, San Joaquin County, California	1717	1329	77.4	195	11.4
CA	San Joaquin County	Block Group 3, Census Tract 32.19, San Joaquin County, California	660	308	46.7	13	2
CA	San Joaquin County	Block Group 1, Census Tract 33.13, San Joaquin County, California	1239	1142	92.2	208	16.8
CA	San Joaquin County	Block Group 2, Census Tract 42.04, San Joaquin County, California	941	213	22.6	120	12.8
CA	San Joaquin County	Block Group 1, Census Tract 17, San Joaquin County, California	1129	986	87.3	412	36.5
CA	San Joaquin County	Block Group 2, Census Tract 41.04, San Joaquin County, California	860	236	27.4	99	11.5
CA	San Joaquin County	Block Group 4, Census Tract 35.03, San Joaquin County, California	4572	3503	76.6	25	0.6
CA	San Joaquin County	Block Group 4, Census Tract 10, San Joaquin County, California	886	522	58.9	9	1
CA	San Joaquin County	Block Group 1, Census Tract 51.29, San Joaquin County, California	1504	1208	80.3	7	0.5
CA	San Joaquin County	Block Group 2, Census Tract 34.10, San Joaquin County, California	1145	1090	95.2	183	16
CA	San Joaquin County	Block Group 2, Census Tract 31.18, San Joaquin County, California	2108	1266	60.1	122	5.8
CA	San Joaquin County	Block Group 2, Census Tract 4.01, San Joaquin County, California	406	342	84.2	58	14.3
CA	San Joaquin County	Block Group 2, Census Tract 1.02, San Joaquin County, California	1157	967	83.6	566	50.4
CA	San Joaquin County	Block Group 1, Census Tract 41.06, San Joaquin County, California	654	322	49.2	25	3.8
CA	San Joaquin County	Block Group 1, Census Tract 44.04, San Joaquin County, California	1365	1026	75.2	324	23.8
CA	San Joaquin County	Block Group 3, Census Tract 51.40, San Joaquin County, California	879	482	54.8	77	8.8
CA	San Joaquin County	Block Group 1, Census Tract 50.01, San Joaquin County, California	1347	1029	76.4	44	3.3
CA	San Joaquin County	Block Group 4, Census Tract 51.19, San Joaquin County, California	2365	1957	82.7	342	14.5
CA	San Joaquin County	Block Group 1, Census Tract 51.25, San Joaquin County, California	1029	605	58.8	133	13
CA	San Joaquin County	Block Group 2, Census Tract 55.02, San Joaquin County, California	961	532	55.4	175	18.2
CA	San Joaquin County	Block Group 1, Census Tract 51.35, San Joaquin County, California	1449	698	48.2	26	1.8
CA	San Joaquin County	Block Group 3, Census Tract 44.03, San Joaquin County, California	960	894	93.1	442	46
CA	San Joaquin County	Block Group 2, Census Tract 52.12, San Joaquin County, California	2661	2454	92.2	0	0
CA	San Joaquin County	Block Group 1, Census Tract 32.16, San Joaquin County, California	1795	1430	79.7	171	9.5
CA	San Joaquin County	Block Group 2, Census Tract 40.03, San Joaquin County, California	1615	771	47.7	133	8.2
CA	San Joaquin County	Block Group 3, Census Tract 38.04, San Joaquin County, California	1408	1063	75.5	356	25.3
CA	San Joaquin County	Block Group 3, Census Tract 11.02, San Joaquin County, California	1034	696	67.3	98	9.5
CA	San Joaquin County	Block Group 1, Census Tract 31.15, San Joaquin County, California	726	670	92.3	206	28.4

CA	San Joaquin County	Block Group 3, Census Tract 50.03, San Joaquin County, California	1989	364	18.3	88	4.5
CA	San Joaquin County	Block Group 1, Census Tract 22.02, San Joaquin County, California	1530	1492	97.5	511	33.5
CA	San Joaquin County	Block Group 1, Census Tract 49.04, San Joaquin County, California	935	86	9.2	10	1.1
CA	San Joaquin County	Block Group 1, Census Tract 52.16, San Joaquin County, California	1713	1293	75.5	13	0.8
CA	San Joaquin County	Block Group 2, Census Tract 45.02, San Joaquin County, California	1248	1176	94.2	353	28.6
CA	San Joaquin County	Block Group 2, Census Tract 51.32, San Joaquin County, California	834	498	59.7	102	12.2
CA	San Joaquin County	Block Group 2, Census Tract 32.13, San Joaquin County, California	1301	969	74.5	170	13.2
CA	San Joaquin County	Block Group 1, Census Tract 24.01, San Joaquin County, California	1869	1722	92.1	636	34
CA	San Joaquin County	Block Group 1, Census Tract 15.01, San Joaquin County, California	805	601	74.7	310	38.5
CA	San Joaquin County	Block Group 1, Census Tract 34.05, San Joaquin County, California	2069	1867	90.2	559	28.4
CA	San Joaquin County	Block Group 1, Census Tract 15.02, San Joaquin County, California	2345	2147	91.6	174	7.4
CA	San Joaquin County	Block Group 1, Census Tract 38.03, San Joaquin County, California	877	752	85.7	86	9.8
CA	San Joaquin County	Block Group 3, Census Tract 33.06, San Joaquin County, California	1210	1038	85.8	101	8.3
CA	San Joaquin County	Block Group 1, Census Tract 33.07, San Joaquin County, California	1408	1179	83.7	281	20.1
CA	San Joaquin County	Block Group 2, Census Tract 32.17, San Joaquin County, California	1575	1393	88.4	263	16.7
CA	San Joaquin County	Block Group 1, Census Tract 51.34, San Joaquin County, California	1230	497	40.4	7	0.6
CA	San Joaquin County	Block Group 3, Census Tract 21, San Joaquin County, California	710	646	91	170	24.1
CA	San Joaquin County	Block Group 2, Census Tract 31.12, San Joaquin County, California	1357	859	63.3	90	6.6
CA	San Joaquin County	Block Group 1, Census Tract 32.09, San Joaquin County, California	1582	1032	65.2	100	6.3
CA	San Joaquin County	Block Group 3, Census Tract 47.04, San Joaquin County, California	1502	481	32	128	8.6
CA	San Joaquin County	Block Group 2, Census Tract 51.23, San Joaquin County, California	608	296	48.7	5	0.8
CA	San Joaquin County	Block Group 1, Census Tract 6, San Joaquin County, California	1004	942	93.8	265	27.2
CA	San Joaquin County	Block Group 2, Census Tract 27.02, San Joaquin County, California	1361	1119	82.2	401	29.5
CA	San Joaquin County	Block Group 1, Census Tract 12, San Joaquin County, California	3454	1624	47	109	9.8
CA	San Joaquin County	Block Group 2, Census Tract 53.07, San Joaquin County, California	1854	1375	74.2	135	7.4
CA	San Joaquin County	Block Group 1, Census Tract 14, San Joaquin County, California	1121	766	68.3	16	1.4
CA	San Joaquin County	Block Group 2, Census Tract 19, San Joaquin County, California	1386	1284	92.6	577	41.6
CA	San Joaquin County	Block Group 3, Census Tract 53.12, San Joaquin County, California	1036	690	66.6	16	1.6
CA	San Joaquin County	Block Group 2, Census Tract 34.03, San Joaquin County, California	2282	2185	95.7	389	17.1
CA	San Joaquin County	Block Group 2, Census Tract 43.02, San Joaquin County, California	2005	606	30.2	37	2
CA	San Joaquin County	Block Group 3, Census Tract 31.06, San Joaquin County, California	1793	633	35.3	173	9.6
CA	San Joaquin County	Block Group 1, Census Tract 4.02, San Joaquin County, California	973	537	55.2	382	41.3
CA	San Joaquin County	Block Group 1, Census Tract 52.24, San Joaquin County, California	1385	671	48.4	45	3.2
CA	San Joaquin County	Block Group 2, Census Tract 51.39, San Joaquin County, California	2175	1124	51.7	58	2.7
CA	San Joaquin County	Block Group 3, Census Tract 43.08, San Joaquin County, California	1548	1341	86.6	523	33.8
CA	San Joaquin County	Block Group 2, Census Tract 50.04, San Joaquin County, California	1692	657	38.8	285	16.8
CA	San Joaquin County	Block Group 1, Census Tract 36.02, San Joaquin County, California	1210	597	49.3	111	9.2
CA	San Joaquin County	Block Group 1, Census Tract 3, San Joaquin County, California	1356	1082	79.8	586	43.2
CA	San Joaquin County	Block Group 3, Census Tract 31.09, San Joaquin County, California	1231	1060	86.1	149	12.1
CA	San Joaquin County	Block Group 2, Census Tract 32.18, San Joaquin County, California	1723	1320	76.6	23	1.4
CA	San Joaquin County	Block Group 2, Census Tract 53.09, San Joaquin County, California	910	409	44.9	102	11.2
CA	San Joaquin County	Block Group 2, Census Tract 51.37, San Joaquin County, California	2517	1286	51.1	217	8.6
CA	San Joaquin County	Block Group 2, Census Tract 33.12, San Joaquin County, California	1061	916	86.3	378	39.7
CA	San Joaquin County	Block Group 1, Census Tract 52.20, San Joaquin County, California	2321	1534	66.1	140	6
CA	San Joaquin County	Block Group 3, Census Tract 45.02, San Joaquin County, California	845	760	89.9	328	38.8
CA	San Joaquin County	Block Group 1, Census Tract 54.05, San Joaquin County, California	1168	1096	93.8	130	11.1
CA	San Joaquin County	Block Group 3, Census Tract 34.10, San Joaquin County, California	1459	1201	82.3	77	5.5
CA	San Joaquin County	Block Group 2, Census Tract 17, San Joaquin County, California	1395	1208	86.6	358	25.7
CA	San Joaquin County	Block Group 3, Census Tract 41.04, San Joaquin County, California	1072	181	16.9	52	4.9
CA	San Joaquin County	Block Group 1, Census Tract 35.04, San Joaquin County, California	4807	4369	90.9	491	10.2
CA	San Joaquin County	Block Group 1, Census Tract 11.01, San Joaquin County, California	2191	1275	58.2	173	7.9
CA	San Joaquin County	Block Group 1, Census Tract 31.19, San Joaquin County, California	621	257	41.4	0	0
CA	San Joaquin County	Block Group 3, Census Tract 4.01, San Joaquin County, California	928	353	38	121	13
CA	San Joaquin County	Block Group 2, Census Tract 44.04, San Joaquin County, California	1659	1467	88.4	743	44.8
CA	San Joaquin County	Block Group 2, Census Tract 50.01, San Joaquin County, California	2578	157	6.1	57	2.3
CA	San Joaquin County	Block Group 2, Census Tract 51.25, San Joaquin County, California	969	531	54.8	101	10.4
CA	San Joaquin County	Block Group 2, Census Tract 35.02, San Joaquin County, California	727	300	41.3	13	1.8
CA	San Joaquin County	Block Group 1, Census Tract 31.16, San Joaquin County, California	2408	2177	90.4	965	40.2
CA	San Joaquin County	Block Group 4, Census Tract 52.08, San Joaquin County, California	1518	1038	68.4	0	0
CA	San Joaquin County	Block Group 2, Census Tract 22.02, San Joaquin County, California	1795	1758	97.9	539	30
CA	San Joaquin County	Block Group 2, Census Tract 36.02, San Joaquin County, California	1714	1441	84.1	605	35.3
CA	San Joaquin County	Block Group 2, Census Tract 34.07, San Joaquin County, California	1529	1316	86.1	314	21
CA	San Joaquin County	Block Group 3, Census Tract 40.03, San Joaquin County, California	1516	981	64.7	129	8.6
CA	San Joaquin County	Block Group 2, Census Tract 32.09, San Joaquin County, California	851	522	61.3	126	15.5
CA	San Joaquin County	Block Group 3, Census Tract 52.12, San Joaquin County, California	2773	2326	83.9	7	0.3

CA	San Joaquin County	Block Group 4, Census Tract 50.03, San Joaquin County, California	1396	698	50	93	6.7
CA	San Joaquin County	Block Group 2, Census Tract 32.16, San Joaquin County, California	1870	1555	83.2	227	12.2
CA	San Joaquin County	Block Group 3, Census Tract 1.02, San Joaquin County, California	530	436	82.3	364	68.7
CA	San Joaquin County	Block Group 2, Census Tract 15.01, San Joaquin County, California	1926	1926	100	11	0.6
CA	San Joaquin County	Block Group 4, Census Tract 49.04, San Joaquin County, California	903	312	34.6	45	5
CA	San Joaquin County	Block Group 2, Census Tract 51.30, San Joaquin County, California	2038	1468	72	165	8.1
CA	San Joaquin County	Block Group 4, Census Tract 9, San Joaquin County, California	1244	1075	86.4	230	18.5
CA	San Joaquin County	Block Group 1, Census Tract 32.14, San Joaquin County, California	934	583	62.4	83	9
CA	San Joaquin County	Block Group 2, Census Tract 15.02, San Joaquin County, California	680	539	79.3	61	9
CA	San Joaquin County	Block Group 3, Census Tract 42.05, San Joaquin County, California	818	220	26.9	114	13.9
CA	San Joaquin County	Block Group 4, Census Tract 12, San Joaquin County, California	1152	462	40.1	4	0.3
CA	San Joaquin County	Block Group 3, Census Tract 51.32, San Joaquin County, California	1542	993	64.4	368	23.9
CA	San Joaquin County	Block Group 3, Census Tract 51.09, San Joaquin County, California	399	166	41.6	64	16
CA	San Joaquin County	Block Group 2, Census Tract 41.06, San Joaquin County, California	1243	375	30.2	217	17.5
CA	San Joaquin County	Block Group 1, Census Tract 22.01, San Joaquin County, California	913	886	97	270	29.6
CA	San Joaquin County	Block Group 1, Census Tract 20, San Joaquin County, California	771	771	100	137	17.8
CA	San Joaquin County	Block Group 4, Census Tract 47.04, San Joaquin County, California	1204	479	39.8	57	4.7
CA	San Joaquin County	Block Group 3, Census Tract 27.02, San Joaquin County, California	1133	990	87.4	163	14.4
CA	San Joaquin County	Block Group 1, Census Tract 33.05, San Joaquin County, California	1162	727	62.6	186	16
CA	San Joaquin County	Block Group 1, Census Tract 27.01, San Joaquin County, California	1484	1284	86.5	462	31.1
CA	San Joaquin County	Block Group 2, Census Tract 51.34, San Joaquin County, California	718	301	41.9	58	8.1
CA	San Joaquin County	Block Group 1, Census Tract 32.03, San Joaquin County, California	1826	1047	57.3	110	6
CA	San Joaquin County	Block Group 1, Census Tract 51.24, San Joaquin County, California	1104	624	56.5	203	18.4
CA	San Joaquin County	Block Group 2, Census Tract 43.08, San Joaquin County, California	1220	1002	82.1	308	25.2
CA	San Joaquin County	Block Group 3, Census Tract 34.03, San Joaquin County, California	1691	1506	89.1	255	16.7
CA	San Joaquin County	Block Group 1, Census Tract 43.09, San Joaquin County, California	1089	363	33.3	62	5.7
CA	San Joaquin County	Block Group 2, Census Tract 14, San Joaquin County, California	1271	1066	83.9	382	32.8
CA	San Joaquin County	Block Group 2, Census Tract 4.02, San Joaquin County, California	1417	1256	88.6	512	36.1
CA	San Joaquin County	Block Group 3, Census Tract 51.35, San Joaquin County, California	2644	1640	62	133	5.1
CA	San Joaquin County	Block Group 2, Census Tract 31.10, San Joaquin County, California	1265	1072	84.7	89	7
CA	San Joaquin County	Block Group 1, Census Tract 35.01, San Joaquin County, California	1328	1110	83.6	97	7.3
CA	San Joaquin County	Block Group 2, Census Tract 41.05, San Joaquin County, California	1339	494	36.9	62	4.6
CA	San Joaquin County	Block Group 2, Census Tract 55.03, San Joaquin County, California	460	160	34.8	59	13.4
CA	San Joaquin County	Block Group 2, Census Tract 52.24, San Joaquin County, California	3857	2502	64.9	386	10
CA	San Joaquin County	Block Group 1, Census Tract 31.08, San Joaquin County, California	1545	829	53.7	158	10.2
CA	San Joaquin County	Block Group 3, Census Tract 51.37, San Joaquin County, California	1762	1264	71.7	9	0.5
CA	San Joaquin County	Block Group 2, Census Tract 42.03, San Joaquin County, California	848	547	64.5	94	11.3
CA	San Joaquin County	Block Group 1, Census Tract 53.08, San Joaquin County, California	1020	691	67.7	199	19.5
CA	San Joaquin County	Block Group 2, Census Tract 51.06, San Joaquin County, California	2706	2129	78.7	252	9.3
CA	San Joaquin County	Block Group 1, Census Tract 32.19, San Joaquin County, California	1856	1527	82.3	37	2
CA	San Joaquin County	Block Group 2, Census Tract 1.01, San Joaquin County, California	653	594	91	245	37.5
CA	San Joaquin County	Block Group 2, Census Tract 3, San Joaquin County, California	747	713	95.4	286	38.3
CA	San Joaquin County	Block Group 2, Census Tract 31.17, San Joaquin County, California	1389	682	49.1	0	0
CA	San Joaquin County	Block Group 2, Census Tract 45.01, San Joaquin County, California	1572	1103	70.2	280	17.8
CA	San Joaquin County	Block Group 2, Census Tract 53.03, San Joaquin County, California	1120	926	82.7	168	15
CA	San Joaquin County	Block Group 2, Census Tract 52.18, San Joaquin County, California	1900	1402	73.8	364	19.2
CA	San Joaquin County	Block Group 2, Census Tract 43.10, San Joaquin County, California	996	209	21	90	9.1
CA	San Joaquin County	Block Group 1, Census Tract 52.22, San Joaquin County, California	2473	1252	50.6	0	0
CA	San Joaquin County	Block Group 3, Census Tract 52.11, San Joaquin County, California	1408	1284	91.2	18	1.3
CA	San Joaquin County	Block Group 4, Census Tract 51.06, San Joaquin County, California	3943	2466	62.5	256	6.5
CA	San Joaquin County	Block Group 2, Census Tract 35.03, San Joaquin County, California	1859	1705	91.7	141	7.6
CA	San Joaquin County	Block Group 2, Census Tract 54.06, San Joaquin County, California	994	654	65.8	215	22.1
CA	San Joaquin County	Block Group 3, Census Tract 40.04, San Joaquin County, California	2357	1755	74.5	27	1.1
CA	San Joaquin County	Block Group 2, Census Tract 8.03, San Joaquin County, California	1893	1818	96	457	24.1
CA	San Joaquin County	Block Group 1, Census Tract 44.03, San Joaquin County, California	1717	1525	88.8	360	21.1
CA	San Joaquin County	Block Group 1, Census Tract 38.04, San Joaquin County, California	2009	1816	90.4	0	0
CA	San Joaquin County	Block Group 1, Census Tract 9, San Joaquin County, California	708	261	36.9	74	10.5
CA	San Joaquin County	Block Group 1, Census Tract 11.02, San Joaquin County, California	1529	831	54.3	303	19.8
CA	San Joaquin County	Block Group 2, Census Tract 37, San Joaquin County, California	1119	913	81.6	417	37.6
CA	San Joaquin County	Block Group 3, Census Tract 38.08, San Joaquin County, California	693	646	93.2	30	4.4
CA	San Joaquin County	Block Group 2, Census Tract 25.03, San Joaquin County, California	879	771	87.7	250	28.4
CA	San Joaquin County	Block Group 3, Census Tract 34.09, San Joaquin County, California	1229	1029	83.7	221	18
CA	San Joaquin County	Block Group 2, Census Tract 23, San Joaquin County, California	862	821	95.2	286	33.2
CA	San Joaquin County	Block Group 2, Census Tract 47.01, San Joaquin County, California	1726	465	26.9	166	9.6
CA	San Joaquin County	Block Group 1, Census Tract 52.14, San Joaquin County, California	3422	1877	54.9	152	4.4
CA	San Joaquin County	Block Group 2, Census Tract 32.15, San Joaquin County, California	861	556	64.6	68	7.9
CA	San Joaquin County	Block Group 3, Census Tract 49.06, San Joaquin County, California	688	476	69.2	314	45.6
CA	San Joaquin County	Block Group 3, Census Tract 51.31, San Joaquin County, California	1395	683	49	149	
CA	San Joaquin County	Block Group 2, Census Tract 10, San Joaquin County, California	1580	1226	77.6	538	

CA	San Joaquin County	Block Group 3, Census Tract 36.01, San Joaquin County, California	524	115	21.9	43	8.2
CA	San Joaquin County	Block Group 2, Census Tract 52.15, San Joaquin County, California	1282	867	67.6	62	4.8
CA	San Joaquin County	Block Group 3, Census Tract 49.05, San Joaquin County, California	716	15	2.1	18	2.5
CA	San Joaquin County	Block Group 4, Census Tract 53.08, San Joaquin County, California	2324	1448	62.3	197	8.6
CA	San Joaquin County	Block Group 1, Census Tract 21, San Joaquin County, California	1406	1406	100	435	30.9
CA	San Joaquin County	Block Group 1, Census Tract 47.04, San Joaquin County, California	942	465	49.4	112	12.1
CA	San Joaquin County	Block Group 2, Census Tract 38.07, San Joaquin County, California	673	623	92.6	165	25.5
CA	San Joaquin County	Block Group 2, Census Tract 43.07, San Joaquin County, California	1792	1201	67	162	9
CA	San Joaquin County	Block Group 3, Census Tract 51.33, San Joaquin County, California	1243	1194	96.1	607	48.8
CA	San Joaquin County	Block Group 3, Census Tract 34.04, San Joaquin County, California	1461	1324	90.6	308	21.6
CA	San Joaquin County	Block Group 1, Census Tract 51.22, San Joaquin County, California	4771	3926	82.3	139	2.9
CA	San Joaquin County	Block Group 2, Census Tract 32.05, San Joaquin County, California	2392	1461	61.1	206	8.9
CA	San Joaquin County	Block Group 2, Census Tract 40.01, San Joaquin County, California	1136	666	58.6	273	24.4
CA	San Joaquin County	Block Group 4, Census Tract 27.01, San Joaquin County, California	1804	1334	73.9	330	18.3
CA	San Joaquin County	Block Group 1, Census Tract 33.06, San Joaquin County, California	2369	1795	75.8	476	22.4
CA	San Joaquin County	Block Group 3, Census Tract 48, San Joaquin County, California	1062	630	59.3	38	3.6
CA	San Joaquin County	Block Group 2, Census Tract 52.23, San Joaquin County, California	2807	2543	90.6	221	7.9
CA	San Joaquin County	Block Group 4, Census Tract 32.15, San Joaquin County, California	1608	1179	73.3	301	18.7
CA	San Joaquin County	Block Group 2, Census Tract 51.38, San Joaquin County, California	778	460	59.1	45	5.8
CA	San Joaquin County	Block Group 3, Census Tract 51.26, San Joaquin County, California	1467	519	35.4	206	15.4
CA	San Joaquin County	Block Group 2, Census Tract 31.11, San Joaquin County, California	2279	1728	75.8	263	11.5
CA	San Joaquin County	Block Group 1, Census Tract 31.06, San Joaquin County, California	1583	1095	69.2	146	9.3
CA	San Joaquin County	Block Group 3, Census Tract 13, San Joaquin County, California	549	356	64.8	102	18.6
CA	San Joaquin County	Block Group 2, Census Tract 54.03, San Joaquin County, California	1287	908	70.6	0	0
CA	San Joaquin County	Block Group 2, Census Tract 33.13, San Joaquin County, California	1719	1628	94.7	730	42.5
CA	San Joaquin County	Block Group 1, Census Tract 33.11, San Joaquin County, California	2033	1614	79.4	244	12.1
CA	San Joaquin County	Block Group 3, Census Tract 43.05, San Joaquin County, California	1569	1212	77.2	152	9.7
CA	San Joaquin County	Block Group 3, Census Tract 42.03, San Joaquin County, California	1368	792	57.9	131	9.8
CA	San Joaquin County	Block Group 5, Census Tract 53.03, San Joaquin County, California	1324	1062	80.2	326	24.6
CA	San Joaquin County	Block Group 3, Census Tract 51.08, San Joaquin County, California	2153	1424	66.1	731	34
CA	San Joaquin County	Block Group 2, Census Tract 51.36, San Joaquin County, California	1122	467	41.6	36	3.2
CA	San Joaquin County	Block Group 3, Census Tract 42.04, San Joaquin County, California	1026	280	27.3	0	0
CA	San Joaquin County	Block Group 1, Census Tract 16, San Joaquin County, California	1204	810	67.3	321	26.7
			751615	520758	67.38263473	100689	14.745709

Appendix G

Public Comments and FAA Responses

Appendix G. Public Comments and FAA Responses

Michael Robbins, AUVSI Executive Vice President, 3100 Clarendon Boulevard, Arlington VA 22201

September 20, 2022

The Association for Uncrewed Vehicle Systems International (AUVSI) supports the amendment by Amazon Prime Air (Prime Air) to its Part 135 air carrier Operations Specification (OpSpecs) to expand its package delivery operations in an industrial area within San Joaquin County, including parts of Lockeford, Lodi, Victor, and Acampo. Prime Air seeks to bring commercial package delivery to this area via drone operations conducted at a 1:1 pilot to aircraft ratio during daylight hours.

AUVSI is the world's largest non-profit devoted exclusively to advancing the uncrewed systems and robotics community. Thousands of businesses – large and small, across the country – are embracing advanced aerospace technologies, including drones, to simultaneously provide workforce, economic, and environmental benefits. AUVSI and its members, including Prime Air, work closely with the U.S. government to ensure that operations remain safe and compliant with federal regulations, and we have built an enviable track record.

It is noteworthy that Prime Air has been working under various FAA programs for several years, including the Partnership for Safety Plan Program, and has proved concepts within existing regulatory frameworks. Prime Air's amendment to its Part 135 is a reasonable extension of this extensive regulatory compliance and market research effort. The approval will enable an industry leader to further assess the economic viability and demonstrate the safety of commercial drone operations.

I also write to encourage FAA to ensure NEPA reviews for UAS operations are documented and streamlined in order to fulfill FAA's Congressional mandate to integrate drones into the national airspace. For scaled commercial operations over a broad geographic area, FAA should consider a programmatic approach to NEPA reviews that is similar to the approach used for traditional air carrier operations. A system-neutral approach will improve regulatory clarity and consistency and avoid disproportionate burdens on the still growing UAS industry.

AUVSI encourages the approval of Prime Air's Part 135 air carrier OpSpecs amendment to launch package delivery operations in the Lockeford, CA area. Thank you for the opportunity to comment.

FAA Response

Comment noted.

David Dunning, Director, Global Innovation & Policy General Aviation Manufacturers Association, 1400 K Street NW, Suite 801, Washington, DC 20005

September 22, 2022

The General Aviation Manufacturers Association (GAMA) values the opportunity to provide comment in support of the FAA's draft Environmental Assessment (EA) of Amazon Prime Air's (Prime Air) proposed commercial package delivery operations. GAMA exists to foster and advance the general welfare, safety, interests, and activities of the global business and general aviation industry. This includes strategic

activities to foster the development and entry-into-service of innovations in aviation technologies, products, and services.

GAMA recognizes the critical importance of environmental review as an enabler for UAS commercial package delivery operations to scale. Prime Air's amendment to its Part 135 air carrier Operations Specifications (OpSpecs) is a natural evolution in concert with the FAA's action to support commercial UAS operations that are safe, efficient, and environmentally friendly. We appreciate the FAA's effort to work with Amazon in a thorough evaluation and analysis of any reasonably foreseeable impacts of the proposed operations to the environment.

GAMA encourages the FAA to work with industry in the development of documented and streamlined FAA NEPA procedures that will support future scaled commercial drone operations. The FAA's commitment to developing programmatic approaches to NEPA are a critical enabler for advanced aviation technologies across the United States.

GAMA supports the FAA's activities and efforts to approve the amendments to Prime Air's OpSpecs to establish its package delivery operations. These operations will serve to prove the viability of drone delivery under real world conditions and showcase how commercial UAS operations may be maximized nationwide.

FAA Response

Comment noted.

Gregory S. Walden, Partner, Dentons Global Advisors Government Relations LLC, 1900 K Street, Washington, DC 20006

September 22, 2022

The Small UAV Coalition ("Coalition") is pleased to submit these comments in support of the FAA's draft Environmental Assessment ("EA") and recommends the FAA issue a Finding of No Significant Impact ("FONSI") promptly after consideration of the public comments.

The Coalition recommends that the FAA develop clear and transparent drone-specific guidance on compliance with the National Environmental Policy Act ("NEPA") to inform its environmental reviews such as this one, to consider the development of a broad and high level programmatic environmental assessment, and to gather data to determine certain operations and operational environment that would qualify for a categorical exclusion.

Commercial delivery by drone will result in quick and safe delivery of a variety of products that will benefit both businesses and the public. Amazon Prime Air's delivery of packages up to 5 pounds using its MK27-2 battery-powered drone will reduce use of carbon-emitting ground vehicles, whether by a customer driving to a business or a business that delivers goods to a residence. Apart from its environmental benefits, drone operations have the potential to reduce the number of vehicles on the road thereby improved road safety.

Amazon seeks an amendment to its Part 135 Operations Specifications ("Op Specs") to conduct flight operations from its Prime Air Drone Delivery Center ("PADDC") to destinations within a four-mile radius.

This Op Specs amendment is the Federal action triggering review under the National Environmental Policy Act ("NEPA"). These flights will be distributed among four sectors, limiting daily flights within each sector. The draft EA also states that only one drone will be flown in a sector at any one time. Flights will not be conducted at night, thereby eliminating the risk of any sleep disturbance, and flown only five days per week. Amazon pledges to avoid operations near schools during operational hours and will avoid operating over any large open-air assembly of persons, such as in a public park.

The Coalition agrees with the FAA's conclusion that nine of the 14 areas of evaluation of environmental impacts do not warrant detailed consideration and expects the FAA will be able to make this same determination with respect to other drone operations unless the particular location or nature of operation has the potential to adversely impact one of those nine areas.

The Coalition notes that the PADDC is in an industrial area zoned General Industrial. While the draft EA does not reference the potential of ambient noise to drown out the noise from drones, industrial areas are typically expected to generate noise from trucks, facilities, and machinery. Appendix A of Part 150 (land use compatibility) shows that commercial use and manufacturing are compatible at DNL amounts over 65 DNL, suggesting that the location of the PADDC is not in an environmentally sensitive area.

For the noise impacts, the FAA examined noise at three stages: the PADDC; en route while the drone will operate between 160 and 180 feet Above Ground Level ("AGL"); and at the point of delivery, when the drone descends to about 13 feet AGL. Using its DNL metric, adjusted to include the stricter California noise metric CNEL, the draft EA concludes that at no point will the noise exceed 58 dBa, except within a 100 feet radius from the PADDC, which is entirely on Amazon Prime Air's property. Otherwise, the highest noise levels will be at delivery, but the maximum number of deliveries per day at one point is only 4.5. During the en route phase of the operation, the noise will at no point exceed 45 dBa. It is worth noting that delivery locations will be chosen by the person or business requesting the delivery, although other individuals may be nearby. Eligible customers must opt in to drone delivery and may choose alternative delivery methods or modes.

With respect to Section 4(f) resources, the Coalition agrees with the FAA's conclusion that "infrequent flights are not a constructive use of any section 4(f) resource and will not cause any substantial impact."

With respect to visual impacts, the Coalition agrees that a drone that is seen only up to 3.6 seconds at any point is not likely to have any significant visual impact.

In sum, the Coalition agrees with the findings in the draft EA and urges the FAA to promptly issue a FONSI after it considers comments from the public.

FAA Response

Comment noted.

Lisa Ellman, Executive Director, Commercial Drone Alliance, 555 Thirteenth Street, NW, Washington, DC 20004-1109

September 22, 2022

The Commercial Drone Alliance ("CDA")1 appreciates the opportunity to submit comments on the Federal Aviation Administration's ("FAA") "Notice of Availability, Notice of Public Comment Period, and Request for Comment on the Draft Environmental Assessment for Amazon Prime Air's Drone Package Delivery Operations in Lockeford, California" (hereafter the "Draft EA"). For the reasons set forth below, the CDA strongly supports the FAA's efforts to authorize uncrewed aircraft systems ("UAS") commercial package delivery operations by Amazon Prime Air ("Prime Air") from the Prime Air Drone Delivery Center ("PADDC") in Lockeford, California. FAA's approval of Prime Air's UAS operations supports the federal government's ongoing efforts to implement its congressional mandate to fully integrate UAS into the National Airspace System ("NAS"). FAA approval of Prime Air's proposed operations will help normalize safe, scalable, economically viable, and environmentally advantageous commercial UAS package delivery operations in the United States.

The CDA recognizes that environmental review is a critical piece of the regulatory framework enabling UAS package delivery operations to scale commercially in the U.S. CDA supports the FAA's efforts to approve the amendment of Prime Air's air carrier Operations Specifications ("OpSpecs") to allow expanded operations from the PADDC in Lockeford, CA. Existing commercial drone deployments have already demonstrated a net positive impact on the environment—including reductions in overall noise levels and CO2 greenhouse gas emissions. For example, a September 2020 economic report published by the Virginia Tech Office of Economic Development found that enabling drone delivery in a single metropolitan area could avoid up to 294 million miles per year in road use and up to 580 car crashes per year, equivalent to taking 25,000 cars off the road or planting 46,000 acres per year of new forest, reducing carbon emissions by up to 113,900 tons per year.2 And UAS play an increasingly important role in reducing global greenhouse gas emissions associated with infrastructure construction and sustainment.3

In its Draft EA, the FAA has evaluated potential impacts that may result from the proposed action including: Department of Transportation Act, Section 4(f) resources, environmental impacts, the range of alternatives, noise and noise compatible land use, socioeconomics, environmental justice, health and safety risks, cultural resources, among others. Documented NEPA review procedures for drone operational approvals would facilitate efficient NEPA review, which is integral to scaling commercial drone delivery and other beneficial drone use cases.. Consideration of programmatic approaches to NEPA, under certain conditions, would facilitate operations for a broader geographic region – which is similar to traditional air carrier OpSpec approvals. Another streamlining approach/goal is to identify actions where a NEPA Categorical Exclusion is more appropriate.

Prime Air continuously demonstrates its commitment to safety and community engagement, which are critical to the success of commercial drone delivery operations. We agree with the FAA's conclusions that Prime Air's proposed operations will not have a significant environmental consequence, particularly for noise analysis and exposure. According to the Draft EA, none of the environmental effects meet the FAA's significance thresholds (where established) or raise significant adverse impacts. CDA encourages the FAA to determine that Prime Air's operations will not significantly affect the quality of the human environment (individually or cumulatively) and issue a Finding of No Significant Impact. In addition, we urge the FAA to consider a programmatic NEPA review to serve as the basis for a streamlined site-specific review (such as a categorical exclusion or streamlined EA).

By enabling operations such as those proposed by Prime Air, the FAA is taking important steps to support the UAS industry's viability and enable safe, efficient and environmentally friendly commercial UAS operations that will benefit the American public.

FAA Response

Comment noted.

Appendix H

Acronyms and Abbreviations

Appendix H: Acronyms and Abbreviations

AAD - Average Annual Day

ACS - American Community Survey

AEDT - Aviation Environmental Design Tool

AGL - Above Ground Level

APE - Area of Potential Effects

BCC - Birds of Conservation Concern

BVLOS - Beyond Visual Line of Sight

CEQ - Council on Environmental Quality

CESA - California Endangered Species Act

CFR - Code of Federal Regulations

CNEL - California Noise Equivalent Level

COA - Certificate of Waiver or Authorization

CZMP - Coastal Zone Management Plan

dB - Decibel

DNL - Day-Night Average Sound Level

DOT - Department of Transportation

EA - Environmental Assessment

EJSCREEN - Environmental Justice Screening and Mapping Tool

EO - Executive Order

EPA - Environmental Protection Agency

ESA - Endangered Species Act

FAA - Federal Aviation Administration

FEMA - Federal Emergency Management Agency

FHWA - Federal Highway Administration

IPaC - Information for Planning and Consultation

NAS - National Airspace System

NEPA - National Environmental Policy Act

NHPA - National Historic Preservation Act

NMFS - National Marine Fisheries Service

NOA - Notice of Availability

NOAA - National Oceanic and Atmospheric Administration

NPDES - National Pollutant Discharge Elimination System

NRHP - National Register of Historic Places

NRI - Nationwide Rivers Inventory

NTSB - National Transportation Safety Board

OiC - Operator in Command

OpSpecs - Operations Specifications

PADDC - Prime Air Drone Delivery Center

Prime Air - Amazon Prime Air

PSP - Partnership for Safety Program

SHPO - State Historic Preservation Office(r)

THPO - Tribal Historic Preservation Office(r)

U.S.C - United States Code

UA - Unmanned Aircraft

UAS - Unmanned Aircraft Systems

USDA - U.S. Department of Agriculture

USFWS - United States Fish and Wildlife Service

VOs - Visual Observers

WSRS - National Wild and Scenic Rivers System