Environmental Assessment for

Amazon Prime Air
Drone Package Delivery Test Operations in Pendleton, Oregon

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

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

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 exemption renewals and other approvals requested by Amazon Prime Air (Prime Air) to continue to conduct drone package delivery test operations and Durability & Reliability (D&R) flights at the Pendleton Unmanned Aircraft Systems (UAS) Test Range in Pendleton, Oregon. These approvals would enable Prime Air to continue to conduct unmanned aircraft (UA)[1] delivery test operations at the Pendleton UAS Range (PUR), an FAA-approved UAS Test Site at the Eastern Oregon Regional Airport (FAA Designator PDT) in Pendleton, Oregon. Operating boundaries are depicted in Figure 1 of the EA and Figure 4 of Appendix C. The approval to renew Prime Air's exemptions 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 the FAA Order 1050.1F Desk Reference.

After completing the EA and reviewing and analyzing available data and information on existing conditions and potential impacts, 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 environmental laws and regulations. The EA is incorporated by reference and supports this FONSI/ROD.

[1] Drone and UA may be used interchangeably.

Purpose and Need

The FAA has multiple approvals associated with Prime Air's delivery test operations for the operating area. However, the FAA's renewal of Prime Air's exemptions 18601 and 18602 are the approvals that will ultimately enable the continuation of UA package delivery test flights and D&R operations in this area (as depicted in Figure 1 of the EA and Figure 4 of Appendix C). Prime Air's exemption renewal to cover operations in Pendleton requires FAA review and approval.

The purpose of Prime Air's request is to continue its UA test flight operations at PUR, and the requested exemption renewals are needed so that Prime Air can utilize the new version of its aircraft, the MK27-2. The approval will offer Prime Air an opportunity to assess the D&R of its aircraft, and to further assess the viability of the UA commercial delivery option and demonstrate that it can conduct operations safely and in compliance with its regulatory obligations.

See Section 1.3 of the EA for further information.

Proposed Action

In order for Prime Air to conduct UA operations in a new location, it must receive a number of approvals from the FAA, such as a Certificate of Waiver or Authorization (COA) and an operating exemption. Prime Air is proposing to continue its delivery test flight and D&R operations with the MK27-2 UA. Prime Air has two exemptions that are up for renewal – one exemption is for their aircraft and the other exemption is for their flight operations. Prime Air's COA will continue to restrict their test flight operations in this location; any future expansion beyond the authorization and limitations for the area of operations described in this EA will require additional safety review by the FAA and will receive appropriate NEPA review at that time.

Under the scope of the proposed action (discussed in Section 2.1 of the attached EA), Prime Air projects operating a maximum of approximately 48 test flights per operating day, or approximately 12,000 test flights per year, at this location. However, the average number of daily flights are expected to be considerably less. Prime Air is projecting to fly up to approximately 15 delivery test flights per operating day at PUR. Prime Air may also conduct a maximum of roughly 33 D&R flights per operating day, although Prime Air is not projecting to have a need to continue its D&R flights into 2023. 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.

See Section 2.1 of the EA for further information.

Alternatives

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 continue UA test operations in the Pendleton operating area. 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; Department of Transportation Act, Section 4(f) Resources; Farmlands; Hazardous Materials, Solid Waste, and Pollution Prevention; Land Use; Natural Resources and Energy Supply; Socioeconomic Impacts, Environmental Justice and Children's Environmental Health and Safety Risks; Visual Effects (Light Emissions Only); Water Resources (Wetlands, Floodplains, Groundwater, Surface Waters, 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 Oregon Department of Fish and Wildlife (ODFW) identifies threatened and endangered species that could occur in the state. The five state-listed species that are not also federally-listed are the California Brown Pelican (*Pelecanus occidentalis californicus*), Gray Whale (*Eschrichtius robustus*), Kit Fox (*Vulpes macrotis*), Washington Ground Squirrel (*Urocitellus washingtoni*), and Wolverine (*Gulo gulo*). The likelihood of occurrence in the study area depends on the presence of species’ preferred habitats. The study area is predominantly a landscaped environment with runways, taxiways, landscaped grasses, and some agricultural land. Based on the information available, the FAA does not expect these state-listed species to occcur in the operating area.

The EA identifies special status bird species that could be present in the study area, including 13 Birds of Conservation Concern (BCC). See the U.S. Fish and Wildlife Service official species list in Appendix A of the EA. It is not expected that suitable habitat used by the identified BCC species would occur on PDT or nearby property due to the existing aviation and agricultural activity that predominates in study area. As noted in Appendix A of the EA, the Bald Eagle warrants additional attention because of the Bald and Golden Eagle Protection Act. However, as there are

few to no trees in the study area, and no bodies of water, it is not likely that the Bald Eagle would occur in the study area.

There are two ESA-listed species identified in the official species list as having the potential to occur in the study area: the Gray Wolf (*Canis lupus)*, an endangered mammal species, and the Bull Trout (*Salvelinus confluentus*), a threatened fish species. The Monarch Butterfly *(Danaus plexippus*), a candidate insect species, also has the potential to occur in the study area. There is no critical habitat within the operating area for any species identified in the official species list.

Since the operations will be occuring within airspace only, and there will be no construction or ground disturbance under the proposed action, the FAA has determined that there will be *no effect* on the Bull Trout identified in the official species list.

The federally endangered Gray Wolf was identified in the official species list as possibly occuring in this part of Oregon. However, due to fencing and other wildlife mitigation measures designed to minimize wildlife intrusions around the PDT property, as well as the surrounding agricultural land uses, the Gray Wolf should not occur in the study area. Therefore, the FAA determined that the proposed action will have *no effect* on the Gray Wolf.

The Monarch Butterfly, a candidate for federal listing has 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. Based on the information available and the limited scale of operations, the action is not expected to result in significant impacts to the Monarch Butterfly.

The FAA has determined that Oregon state-listed species would not be expected to occur in the study area, and therefore no effects to state-listed species are anticipated.

- **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 and cultural importance to an Indian 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 American Indian and Alaska Native tribes. The FAA identified no NRHP-listed properties within the APE. There is, however, one historic

property of significance in the APE: the airport itself, which opened in 1934 and is valued for its aviation history values. The Pendleton Airbase was recorded in 1985 and is listed in the Oregon Historic Sites as eligible/contributing to the NRHP. Several buildings from Pendleton Airbase's World War II years are still maintained on the property.

While conducting an environmental review associated with Prime Air's earlier operations in the larger COA-defined area in 2020, the FAA consulted with the Oregon SHPO and three Tribal Historic Preservation Officers (THPOs) for tribes that may potentially attach religious or cultural significance to resources in the APE. The FAA sent a consultation letter to the Oregon SHPO on July 24, 2020. On August 21, 2020, the Oregon SHPO responded to the FAA and confirmed that no historic properties would be affected by the proposed action.

The FAA sent letters on July 24, 2020 to the THPOs from the Confederated Tribes of the Umatilla Indian Reservation, Confederated Tribes of the Warm Springs Reservation of Oregon, and Nez Perce Tribe, and did not receive any responses or objections. Although the FAA did not receive formal responses from the three tribes, it was documented that the Confederated Tribes of the Umatilla Indian Reservation has been in communication with the City of Pendleton regarding PUR in the past and has been supportive of its development.[2]

The FAA's tribal and historic outreach letters from 2020 are included as Appendix B of the EA. The proposed action includes the same types of drone operations and locations that were considered in the 2020 consultation with the Oregon SHPO and THPOs. 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). Therefore, the proposed action will not have a significant impact on historical, architectural, archaeological, or cultural resources.

- **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 Paragraph B-1.3 which requires the FAA to identify the location and number of noise sensitive areas that could be significantly impacted by noise. Additionally, several federal laws, including the Aviation

[2] See Letter from J. David Tovey, Jr., Executive Director, Confederated Tribes of the Umatilla Indian Reservation to Steve Chrisman, Economic Development Director, City of Pendleton (Oct. 1, 2012).

Safety and Noise Abatement Act of 1979, as amended (49 U.S.C. §§ 47501-47507) regulate aircraft noise and the FAA regulates noise from aircraft through 14 CFR Part 36.

The 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.

As noted in the EA, the flight operations will occur at PDT, a regional airport where aviation activities take place, as well as adjacent area north of PDT that is part of the PUR range. Existing aviation noise is not expected to be significant. To ensure that noise would not cause a significant noise impact in 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. Based on FAA's noise analysis (Appendix C), the proposed action will not have a significant noise impact.

- **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 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 rural-agricultural and aviation landscapes.

  The proposed action would take place over airport property and adjacent area north of the airport. The surrounding areas are rural-agricultural. Although the openness of the landscape would make these test flight operations visible for a greater distance than in a more heavily settled or forested area, the short duration and limited number of proposed flights, including over the airport property where noise sensitive areas do not occur, would minimize any potential for significant impacts. Accordingly, any potential visual effects are expected to be similar to PDT and PUR existing air traffic in the vicinity of the operating area. Impacts to visual resources are not expected to be significant.

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

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 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.

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 9, 2022

MARK GIRON Digitally signed by MARK GIRON
Date: 2022.11.09 13:24:06 -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 renew its exemptions and other Federal Aviation Administration (FAA) approvals necessary to continue unmanned aircraft (UA) package delivery test operations and Durability & Reliability (D&R) flights at the Pendleton Unmanned Aircraft Systems (UAS) Test Range in Pendleton, Oregon.[1] The Pendleton UAS Range (PUR) is an FAA-approved UAS Test Site at the Eastern Oregon Regional Airport (FAA Designator PDT) in Pendleton, Oregon. 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 48 test flights per operating day over roughly 250 operating days per year, for a maximum total of roughly 12,000 annual delivery operations at PUR based on the scope of the proposed action, discussed in Section 2.1. The proposed test flight operations at PUR would occur during daylight hours up to five days per week.[2]

Prime Air has been engaged with PUR, and the City of Pendleton, which owns the airport, on UAS development activities since 2018. Prime Air has conducted test flight operations at PUR since April 2019 under Part 91 rules and a Special Airworthiness Certificate-Experimental Category (SAC-EC) Certificate of Authorization (COA). From August 2020 to April 2022, under exemptions 18601 and 18602, Prime Air conducted limited delivery operations under a Part 135 certificate and COA 2021-WSA-113-SAC. These earlier operations utilized the MK27B drone. Amazon is in the process of certifying and transitioning operations to the upgraded MK27-2. The FAA's renewal of Prime Air's exemptions is considered a major federal action subject to environmental review requirements.

This Draft 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 test flight operations to continue at PUR. PUR was designated as a UAS test range by the FAA in 2013, and hosts military and commercial UAS operators. The PUR test range extends over 14,000 square miles beyond PDT. Prime Air's delivery test flight operations will occur on PDT property, which is located at 2016 Airport Rd, Pendleton, OR 97801. The D&R flight operations will occur in the area adjacent to, and north of, the airport. The operating area, which is also the study area for this EA, includes the PDT airport property and the area of the D&R flight operations (the study area). The airport property is outlined in red and depicted in Figure 1. The area for D&R flight operations is shown in Figure 4 of Appendix C. While Prime Air has a COA to operate within the larger dashed-line area in Figure 1, all test flight operations will occur within the smaller 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).

[1] The terms drone and UA may be used interchangeably.

[2] Daylight hours of operation include approximately ~30 min before sunrise to ~30 min after sunset.

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 UAS into the National Airspace System (NAS).[3] The FAA has engaged in a phased, incremental approach 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 drone delivery in the NAS.[4]

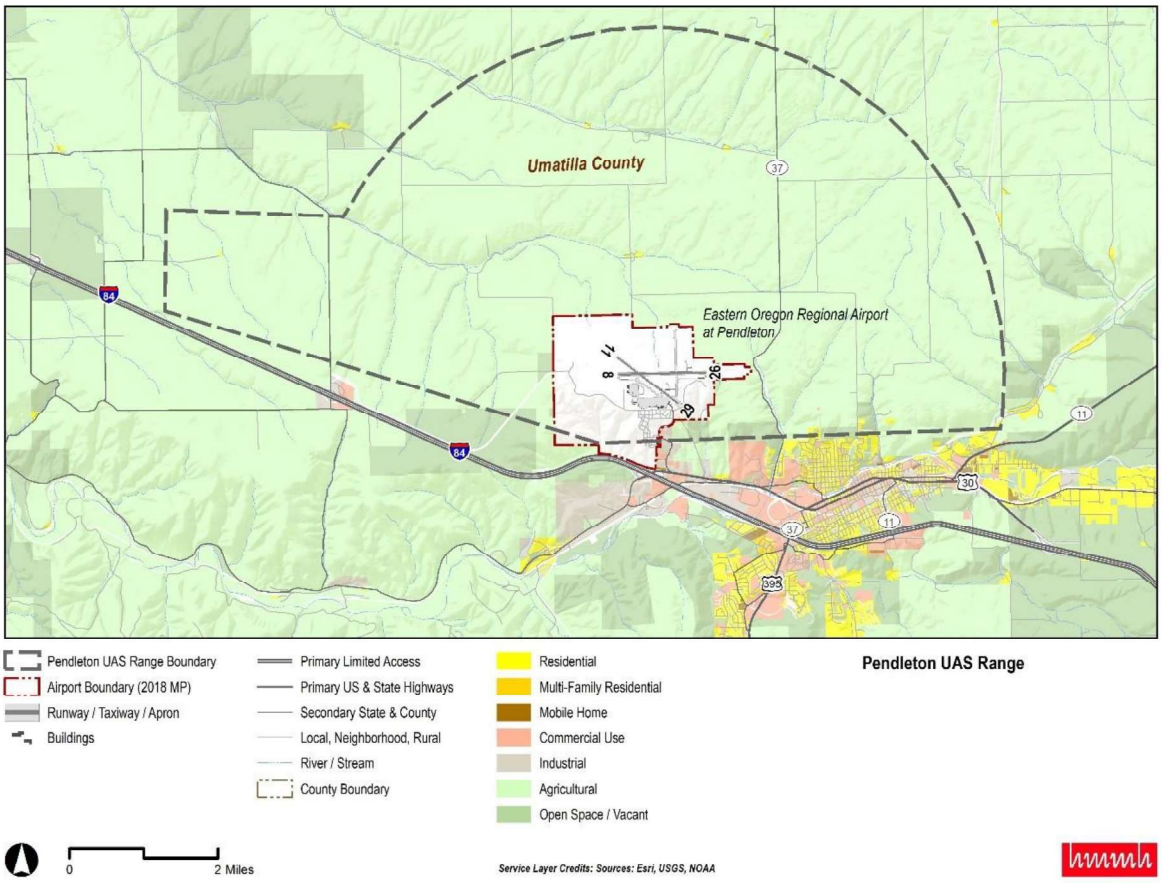
Over the past several years Prime Air has been working under various FAA programs, including the Partnership for Safety Plan (PSP) Program[5] as well as the FAA's established processes to bring certificated commercial UA delivery into practice. Participants in these programs are among the first to prove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

In 2019, Prime Air began conducting UA test flight operations at PUR under FAA exemptions 18601 and 18602. In August 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 FAA conducted a NEPA review for Prime Air's operations at PUR in August 2020, and no significant impacts or extraordinary circumstances were identified. In order for Prime Air to continue its test flight operations at PUR, it must receive exemption renewals from the FAA. Prime Air has requested that the FAA review its exemptions and determine if they meet safety requirements. Prime Air is not expected to be conducting commercial delivery flights from PUR under the scope of the proposed action.

The operating area is shown in Figure 1 below. The operating area includes the airport property outlined in red in Figure 1and the adjacent area north of the PDT airport property used for the D&R flights that is shown in Figure 4 of Appendix C (extends approximately 1.5 miles north of PDT). The larger COA operating area is identified with a dotted line in Figure 1. For the purposes of this Draft EA, the study area consists of the PDT airport property shown in Figure 1 and the area for D&R flights shown in Figure 4 of Appendix C.

PDT is located in northeastern Oregon. It is an active airport which handles daily cargo and general aviation operations. The land use in this area is rural-agricultural, with only a sparse number of residences near the area of operations. There is one residence within the operating area, north of the airport. There are no public parks or designated natural areas of significance within the area. The area does not include any residential neighborhoods, schools, or houses of worship.

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



[6]

Figure 1 *Study Area in Pendleton, Oregon*

1.2.1 Operating Area Location

The operating area is located within PDT airport (and PUR) and the adjacent property north of PDT in Pendleton, which is in Umatilla County, Oregon. Pendleton is approximately 200 miles east of Portland, Oregon, and 175 miles southwest of Spokane, Washington. The test range within which these operations will occur was created for the purpose of facilitating the development of UAS by the City of Pendleton and designated as such by the FAA; similar UAS operations have been operating there for several years; and extensive information has been provided to the public about planned and proposed UAS operations at the test range.[7] PDT airport is located at 2016 Airport Rd, Pendleton, OR 97801. The properties adjacent to the operating area are agricultural with a few residences. There is one residence in the area where D&R flights will occur. A closer view of the delivery test flights operating area is shown in Figure 2 below. The test flight pads and test delivery areas are noted with white pins.

[6] Image: HMMH, Inc.
[7] See PUR information: https://pendleton.or.us/airport/page/pendleton-uas-test-range-0

[8]

Figure 2 *Prime Air Delivery Test Flight Launch Pads and Test Delivery Sites at PDT*

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 renew its exemption under 49 USC § 44807 for UA operations pursuant to 14 CFR Part 135, in conjunction with its existing COA. The Section 44807 exemption would address requirements in 14 CFR sections 91.7 and 135.25 for a SAC-EC for the MK27 aircraft. In connection with the 44807 exemption, Amazon has also applied to renew its exemption from some of the operational requirements of 14 CFR Parts 91 and 135. Prime Air would be operating in accordance with its COA for operations in Class D airspace at or below 400 feet Above Ground Level (AGL) in the vicinity of Pendleton, OR under jurisdiction of Pendleton Federal Contract Air Traffic Control Tower (PDT FCT) for

[8] Image: Google Earth, as modified by Prime Air

the purpose of test flight operations. Prime Air's exemption renewal request is an action that requires FAA review and approval.

1.3.2 Prime Air's Purpose and Need

The purpose of Prime Air's request is to continue UA test flight operations at PUR. The requested exemption renewals are needed so that Prime Air can utilize the new version of its aircraft, the MK27-2, in future operations. The approval will offer Prime Air an opportunity to assess the D&R of its aircraft, and to further assess the viability of the UA commercial delivery option and demonstrate that it can conduct operations safely and in compliance with its regulatory obligations.

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 continue its UA test flight operations in Pendleton, it must receive a number of approvals from the FAA, such as a COA, a 49 USC § 44807 exemption for its UA, and an operating exemption. Prime Air is proposing to conduct delivery test flight and D&R operations with the MK27-2 UA. Prime Air has two exemptions that are up for renewal – one exemption is for their aircraft and the other exemption is for their flight operations. Prime Air's COA will continue to restrict their test flight operations in this location; any future expansion beyond the authorization and limitations for the area of operations described in this EA will require additional safety review by 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 48 test flights per operating day, or up to approximately 12,000 test flights per year at this location. In general, however, the average number of daily flights are expected to be considerably less. Prime Air is projecting to fly up to approximately 15 delivery test flights per operating day at PUR. Prime Air may also conduct a maximum of roughly 33 D&R flights per operating day, although Prime Air is not projecting to have a need to continue its D&R flights into 2023. 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.

2.1.2 Description of UA

The UA has a maximum takeoff weight of 92 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. Additional information on the MK27-2 can be found in the Noise Analysis (Appendix C).

2.1.3 Description of Delivery Operations

While Prime Air will not be conducting deliveries in locations beyond PDT property under the proposed action, this EA describes the flight characteristics of a delivery operation. After launch, Prime Air's UA will rise to an altitude below 400 feet AGL and follow a predefined route to its delivery site. Aircraft will typically fly en route at approximately 160-180 feet AGL for delivery test flights, and 200 feet AGL for D&R flights, 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 launch pad (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 launch pad.

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 continue UA test operations in the Pendleton 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 continue UA test flights at PUR. 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 for delivery test flights and the area shown in Figure 4 of Appendix C for D&R flights. 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
- Socioeconomic, 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 would not generate criteria air pollutants or greenhouse gas emissions that could result in air quality or climate impacts. Electricity used to support drone battery charging and launch pad operations would be supplied

by the local power grid and is expected to be minimal, given the limited number of anticipated drone operations. The Prime Air operations may be equipped with an emergency generator, but its use is expected to be very infrequent, and only in times of emergency.

- **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 near the area of operations.

- **Department of Transportation Act, Section 4(f) Resources** – The proposed action will occur on and above airport property and agricultural property adjacent to the airport. There are no public parks, recreation areas, or wildlife refuges in the study area. As noted in Section 3.3, there is one historic property in the operating area, the PDT airport itself, but the proposed action will not affect the recognized features and attributes of the airport. The FAA has determined that there will be no effects to Section 4(f) resources as a result of the proposed action.

- **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 construction or development or any physical disturbances of the ground, beyond what was already constructed at PUR without the need for FAA approval. Based on the Environmental Justice Screening and Mapping Tool (EJSCREEN) Report (Appendix E), there are no Superfund sites inthe operating area. Furthermore, the UA will be disassembled and properly disposed of in accordance with 14 CFR Part 43, and there will be minimal waste. Therefore, the potential for impacts due to hazardous materials, pollution prevention, and solid waste is not anticipated.

- **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. The drones are battery-powered and would likely not require excessive fuel resources for charging, given the planned low number of operations.

- **Socioeconomic Impacts, Environmental Justice, 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. The proposed action would not result in effects that would be predominately or uniquely born by an environmental justice population. 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. Consistent with EO 13045, it is unlikely the proposed action would affect products or substances that a child could come into contact with, ingest, use, or be exposed to, or would result in

environmental health and safety risks that could disproportionately affect children. Additionally, there are no schools within or near the operating area.

- **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, Surface Waters, 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 operation 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. The proposed action would not affect any river segments in the Nationwide Rivers Inventory (NRI).

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.[11]

3.2.2 Affected Environment

This section describes the existing biological environment of the operating area. The operating area is in the Columbia Plateau ecoregion,[12] which is characterized by sagebrush steppe and grasslands with extensive areas of dryland farming and irrigated agriculture. [13] The climate in this region is considered Mediterranean, with cool wet winters and hot dry summers. The proposed action would take place over rural agricultural land and the PDT property. The airport property is managed to help prevent wildlife intrusions, since wildlife entering the airport property could create hazards to flight safety.

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 resource. Through IPaC, the FAA was able to obtain an official species list for the study area, outlined in red in Figure 1 of this EA. The official species list is included with this EA (see Appendix A).

Based on the official species list, there are two federally listed endangered and threatened species, and one candidate species with potential to occur in this part of Oregon. These species are the Gray Wolf

[11] 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.
[12] U.S. EPA. Ecoregions of Oregon. Available: https://gaftp.epa.gov/EPADataCommons/ORD/Ecoregions/or/or_eco_lg.pdf. Accessed: September 26, 2022.
[13] USGS. Professional Paper 1794-A, Chapter 22. 2012. Available: https://pubs.usgs.gov/pp/1794/a/chapters/pp1794a_chapter22.pdf. Accessed September 26, 2022.

(*Canis lupus*), an endangered species, the Bull Trout (*Salvelinus confluentus*), a threatened species, and the Monarch Butterfly *(Danaus plexippus*), a candidate species.

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

State Species of Concern

The Oregon Department of Fish and Wildlife (ODFW) identifies threatened and endangered species that could occur in the state. ODFW identifies whether the state-listed species are also federally-listed threatened or endangered species. The FAA analyzed species that were state-listed but not federally-listed, since the federally-listed species would be included in the USFWS official species list for this proposed action if there was potential for them to occur in the study area. The five state-listed species that are not federally-listed are the California Brown Pelican (*Pelecanus occidentalis californicus*), Gray Whale (*Eschrichtius robustus*), Kit Fox (*Vulpes macrotis*), Washington Ground Squirrel (*Urocitellus washingtoni*), and Wolverine (*Gulo gulo*). The likelihood of occurrence in the study area depends on the presence of species' preferred habitats. The study area is predominantly a landscaped environment with runways, taxiways, landscaped grasses, and some agricultural land. Based on the information available, the FAA does not expect these state-listed species to occcur in the operating area.

Migratory Birds

The official species list identifies 13 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). It is not expected that suitable habitat used by the identified BCC species would occur on PDT or nearby property due to the existing aviation and agricultural activity that predominates in study area. As noted in Appendix A, the Bald Eagle is not a BCC in the study area, but warrants attention because of the Bald and Golden Eagle Protection Act. However, as there are few to no trees in the study area, and no bodies of water, it is not likely that the Bald Eagle would occur in the study area.

3.2.3 Environmental Consequences

There will be no ground construction or habitat modification associated with the proposed action. Prime Air's aircraft will not touch the ground in any other place than the launch pads (except during emergency landings) since it remains airborne while conducting deliveries. The operations will be taking place within airspace 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 predefined routes to its test delivery sites. During D&R flights at Pendleton, the UA is likely to fly closer to 200 feet AGL. During delivery test flights, UA 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 launch pad. Due to the existing aviation and agricultural activity that predominates in the study area, where wildlife is generally discouraged, as well as the low number of daily operations, the proposed action is not expected to affect wildlife that may occur in the study area.

Special Status Species

Since the operations will be occuring within airspace only, and there will be no construction or ground disturbance under the proposed action, the FAA has determined that there will be *no effect* on the Bull Trout identified in the official species list.

The Monarch Butterfly, a candidate for federal listing, has 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. Based on the information available and the limited scale of operations, the FAA determined that the proposed action is not expected to result in significant impacts to the Monarch Butterfly.

The federally endangered Gray Wolf was identified in the official species list as possibly occuring in the area. However, due to fencing and other wildlife mitigation measures designed to minimize wildlife intrusions around the PDT property, as well as the surrounding agricultural land uses, the Gray Wolf is not expected to occur in the study area. Therefore, the FAA determined that the proposed action will have *no effect* on the Gray Wolf.

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 flight operations, 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.

Based on the habitat present within the study area, and the lack of suitable habitat for Oregon state-listed species, the FAA has determined that Oregon state-listed species would not be expected to occur in the study area, and therefore no effects to state-listed species are anticipated.

Migratory Birds

The BCC species identified in the official species list would not be expected to breed in the study area, and they are actively discouraged from feeding in the area so as to minimize threats to aviation safety. Many of the BCC species breed elsewhere, and those that may breed in this part of northeastern Oregon are not likely to find suitable breeding habitat in the study area at PDT. Prime Air's test flight operations are not expected to result in effects to migratory bird species.

Due to the limited operating area and proposed number of daily operations, occasional drone overflights at approximately 160-180 feet AGL or 200 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 Historical, Architectural, Archaeological, and Cultural Resources

3.3.1 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 American Indian and Alaska Native 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 Tribal Historic Preservation Office (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.

3.3.2 Affected Environment

The APE for the proposed action is the entire operating area where Prime Air is planning to conduct UA delivery test flight operations and D&R flight operations. The FAA identified no NRHP-listed properties within the APE. There is, however, one historic property of significance in the APE: the airport itself, which opened in 1934 and is valued for its aviation history values. The Pendleton Airbase was recorded in 1985 and is listed in the Oregon Historic Sites as eligible/contributing to the NRHP. Several buildings from Pendleton Airbase's World War II years are still maintained on the property.

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 land uses in the APE are predominantly aviation activities and agricultural activities, and the nature and location of the historic airport property would not have the potential to be affected by the proposed UA operations.

While conducting an environmental review associated with Prime Air's earlier operations in the larger COA-defined area in 2020, the FAA consulted with the Oregon 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 Oregon SHPO on July 24, 2020. On August 21, 2020, the Oregon SHPO responded to the FAA and confirmed that no historic properties would be affected by the proposed action. The FAA's tribal and historic outreach letters from 2020 are included as Appendix B.

The FAA sent letters on July 24, 2020 to the THPOs from the Confederated Tribes of the Umatilla Indian Reservation, Confederated Tribes of the Warm Springs Reservation of Oregon, and Nez Perce Tribe, and did not receive any responses or objections. Although the FAA did not receive formal responses from the three tribes, it was documented that the Confederated Tribes of the Umatilla Indian Reservation has

been in communication with the City of Pendleton regarding PUR in the past and has been supportive of its development.[14]

The proposed action includes the same types of drone operations and locations that were considered in the 2020 consultation with the THPOs and Oregon SHPO. 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.

3.4 Noise and Noise-Compatible Land Use

3.4.1 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.

3.4.2 Affected Environment

The study area is only a few square miles and includes one residence. The larger COA-defined area, as identified with the dotted line in Figure 1, has an area of roughly 46 square miles and an approximate population of 191.[15] The COA-defined area was reviewed by the FAA for an earlier Prime Air action in August 2020. However, no flights are expected beyond the study area boundaries under the scope of

[14] See Letter from J. David Tovey, Jr., Executive Director, Confederated Tribes of the Umatilla Indian Reservation to Steve Chrisman, Economic Development Director, City of Pendleton (Oct. 1, 2012).

[15] Environmental Protection Agency's (EPA) Environmental Justice Screening Tool (EJSCREEN). Available: https://www.epa.gov/ejscreen. Accessed: August 30, 2022

the proposed action. As noted in this EA, the flight operations will occur at PDT, a regional airport where aviation activities take place, as well as adjacent area north of the airport that is a part of the PUR range. Existing aviation noise is not expected to be significant.[16] The study area is depicted in Figure 1 and Appendix C Figure 4.

3.4.3 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 noise impact in 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. Based on the FAA's noise analysis (Appendix C), the proposed action will not have a significant impact.

3.5 Visual Effects (Visual Resources and Visual Character)

3.5.1 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 rural-agricultural and aviation 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.

3.5.2 Affected Environment

The proposed action would take place over airport property and the adjacent area north of the airport. The surrounding areas are rural-agricultural. Although the openness of the landscape would make these test flight operations visible for a greater distance than in a more heavily settled or forested area, the short duration and limited number of the proposed flights would minimize any potential for significant visual impacts. As noted in Section 3.1, there are no public parks or natural protected areas within the study area.

[16] The PDT master plan indicates that PDT aviation activity does not meet the FAA noise activity threshold for further noise analysis. Available: https://www.pendletonairport.com/_files/ugd/ce6703_2e4820cd435d407d8b30053ff9a80a6a.pdf. Accessed: November 7, 2022.

3.5.3 Environmental Consequences

The proposed action makes no changes to any landforms, or land uses, and thus there would be no effect to the visual character of the area. The operations will be happening in airspace only. The proposed action involves airspace operations that are unlikely to result in visual impacts on anywhere in the study area, due in part to the aviation land use where the proposed action is occurring. The low number of proposed flights per day, including over the airport property where noise sensitive areas do not occur, will minimize any potential for significant visual impacts at locations in the study area. Any visual effects are expected to be similar to existing PDT and PUR air traffic in the vicinity of the operating area.

3.6 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 this EA, the proposed action will occur at PUR, as well as on and above airport property where other aviation activities are an existing part of the affected environment. Operations at regional airports such as PDT are not known to generate significant DNL noise levels, and the noise generated by Prime Air's test flight operations in combination with other aviation noise at PDT would not be expected to generate a cumulatively significant noise effect. 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

State Agencies

Oregon Parks and Recreation Department, State Historic Preservation Office

Tribes

Confederated Tribes of the Umatilla Indian Reservation

Confederated Tribes of the Warm Springs Reservation of Oregon

Nez Perce Tribe

Appendix A

Official Species List

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Oregon Fish And Wildlife Office
2600 Southeast 98th Avenue, Suite 100
Portland, OR 97266-1398
Phone: (503) 231-6179 Fax: (503) 231-6195

In Reply Refer To:
Project Code: 2022-0088936
Project Name: Pendleton Airport

September 26, 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.*). This is not a consultation.

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
- USFWS National Wildlife Refuges and Fish Hatcheries
- Migratory Birds
- Wetlands

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:

Oregon Fish And Wildlife Office
2600 Southeast 98th Avenue, Suite 100
Portland, OR 97266-1398
(503) 231-6179

Project Summary

Project Code: 2022-0088936
Project Name: Pendleton Airport
Project Type: Drones - Use/Operation of Unmanned Aerial Systems
Project Description: UAS Delivery
Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@45.6909143,-118.84952338915666,14z

Counties: Umatilla County, Oregon

Endangered Species Act Species

There is a total of 3 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
Gray Wolf *Canis lupus* Population: U.S.A.: All of AL, AR, CA, CO, CT, DE, FL, GA, IA, IN, IL, KS, KY, LA, MA, MD, ME, MI, MO, MS, NC, ND, NE, NH, NJ, NV, NY, OH, OK, PA, RI, SC, SD, TN, TX, VA, VT, WI, and WV; and portions of AZ, NM, OR, UT, and WA. Mexico. There is **final** critical habitat for this species. Species profile: https://ecos.fws.gov/ecp/species/4488	Endangered

Fishes

NAME	STATUS
Bull Trout *Salvelinus confluentus* Population: U.S.A., conterminous, lower 48 states There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8212	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

Critical habitats

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

USFWS National Wildlife Refuge Lands And Fish Hatcheries

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 OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

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.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

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
American White Pelican *pelecanus erythrorhynchos* 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/6886	Breeds Apr 1 to Aug 31
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 Dec 1 to Aug 31

NAME	BREEDING SEASON
Black Tern *Chlidonias niger* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3093	Breeds May 15 to Aug 20
Cassin's Finch *Carpodacus cassinii* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9462	Breeds May 15 to Jul 15
Clark's Grebe *Aechmophorus clarkii* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jun 1 to Aug 31
Evening Grosbeak *Coccothraustes vespertinus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 15 to Aug 10
Franklin's Gull *Leucophaeus pipixcan* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Jul 31
Lewis's Woodpecker *Melanerpes lewis* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9408	Breeds Apr 20 to Sep 30
Long-eared Owl *asio otus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3631	Breeds Mar 1 to Jul 15
Marbled Godwit *Limosa fedoa* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9481	Breeds elsewhere
Olive-sided Flycatcher *Contopus cooperi* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3914	Breeds May 20 to Aug 31
Rufous Hummingbird *selasphorus rufus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8002	Breeds Apr 15 to Jul 15
Sage Thrasher *Oreoscoptes montanus* 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/9433	Breeds Apr 15 to Aug 10

NAME	BREEDING SEASON
Western Grebe *aechmophorus occidentalis* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/6743	Breeds Jun 1 to Aug 31
Willet *Tringa semipalmata* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 20 to Aug 5

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.

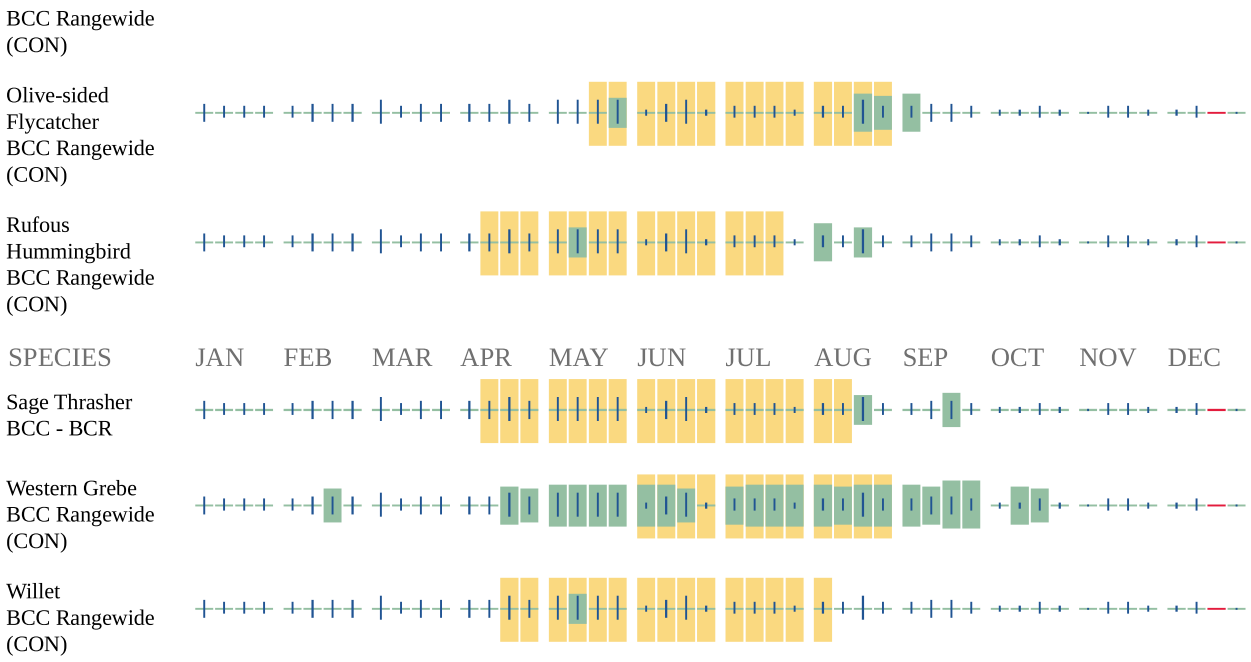
Breeding Season (■)

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.

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.



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

Migratory Birds FAQ

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.

Wetlands

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.

FRESHWATER EMERGENT WETLAND

- Palustrine

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

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

July 24, 2020

Chairman Shannon Wheeler
Nez Perce Tribe
PO Box 305
Lapwai, ID 83540

Dear Chairman Wheeler:

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

Proposed Activity Description
The Federal Aviation Administration (FAA) has been asked to approve waivers and/or exemptions to aeronautical regulations, thereby approving the UAS routes. FAA approval of the UAS routes is an undertaking subject to regulations pursuant to the National Historic Preservation Act.

The UAS operation will be flown by an unmanned aircraft weighing 88 lbs., including a 5 lb. payload, at approximately 200 feet, but no more than 400 feet Above Ground Level (AGL) in the vicinity of Pendleton, OR (see attached operations area map). The purpose is for package delivery, consisting of approximately eight flights per day for an estimated one hour of total flying time per day. Flights will occur primarily Mon-Fri with occasional (approximately once per month) flights on Sat-Sun, with no night operations. 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, there are no registered historical places within the proposed APE. The UAS operation will have no affects to the ground. All flights will takeoff from, and return to the Pendleton UAS Test Range (PUR) located at the Eastern Oregon Regional Airport (KPDT).

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 routes. 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 project, 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,

Mark E. Giron
Aviation Safety
Manager, General Aviation Operations Branch,
Flight Standards Service

Enclosure

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

Aviation Safety

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

July 24, 2020

Ms. Kathryn Brigham
Confederated Tribes of the Umatilla Indian Reservation
46411 Trimine Way
Pendleton, OR 97801

Dear Ms. Brigham:

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

Proposed Activity Description
The Federal Aviation Administration (FAA) has been asked to approve waivers and/or exemptions to aeronautical regulations, thereby approving the UAS routes. FAA approval of the UAS routes is an undertaking subject to regulations pursuant to the National Historic Preservation Act.

The UAS operation will be flown by an unmanned aircraft weighing 88 lbs., including a 5 lb. payload, at approximately 200 feet, but no more than 400 feet Above Ground Level (AGL) in the vicinity of Pendleton, OR (see attached operations area map). The purpose is for package delivery, consisting of approximately eight flights per day for an estimated one hour of total flying time per day. Flights will occur primarily Mon-Fri with occasional (approximately once per month) flights on Sat-Sun, with no night operations. 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, there are no registered historical places within the proposed APE. The UAS operation will have no affects to the ground. All flights will takeoff from, and return to the Pendleton UAS Test Range (PUR) located at the Eastern Oregon Regional Airport (KPDT).

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. 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,

Mark E. Giron
Aviation Safety
Manager, General Aviation Operations Branch,
Flight Standards Service

Enclosure

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

Aviation Safety

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

July 24, 2020

Chairman Raymond Tsumpti
Confederated Tribes of the Warm Springs Reservation of Oregon
1233 Veterans Street
PO Box C
Warm Springs, OR 97761

Dear Chairman Tsumpti:

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

Proposed Activity Description
The Federal Aviation Administration (FAA) has been asked to approve waivers and/or exemptions to aeronautical regulations, thereby approving the UAS routes. FAA approval of the UAS routes is an undertaking subject to regulations pursuant to the National Historic Preservation Act.

The UAS operation will be flown by an unmanned aircraft weighing 88 lbs., including a 5 lb. payload, at approximately 200 feet, but no more than 400 feet Above Ground Level (AGL) in the vicinity of Pendleton, OR (see attached operations area map). The purpose is for package delivery, consisting of approximately eight flights per day for an estimated one hour of total flying time per day. Flights will occur primarily Mon-Fri with occasional (approximately once per month) flights on Sat-Sun, with no night operations. 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, there are no registered historical places within the proposed APE. The UAS operation will have no affects to the ground. All flights will takeoff from, and return to the Pendleton UAS Test Range (PUR) located at the Eastern Oregon Regional Airport (KPDT).

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. 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,

Mark E. Giron
Aviation Safety
Manager, General Aviation Operations Branch,
Flight Standards Service

Enclosure

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

Aviation Safety

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

July 24, 2020

Ms. Christine Curran
State Historic Preservation Office
725 Summer Street NE, Suite C
Salem, OR 97301

Dear Ms. Curran:

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) operation at Pendleton OR. 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 Federal Aviation Administration (FAA) has been asked to approve waivers and/or exemptions to aeronautical regulations, thereby approving the UAS operation in the area. 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 unmanned aircraft weighing 88 lbs., including a 5 lb. payload, at approximately 200 feet, and but no more than 400 feet Above Ground Level (AGL) in the vicinity of Pendleton, OR (see attached operations area map). The purpose is for package delivery, consisting of approximately eight flights per day for an estimated one hour of total flying time per day. Flights will occur primarily Mon-Fri with occasional (approximately once per month) flights on Sat-Sun, with no night operations. 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, there are no registered historical places within the proposed APE. The UAS operation will have no affects to the ground. All flights will takeoff from, and return to the Pendleton UAS Test Range (PUR) located at the Eastern Oregon Regional Airport (KPDT).

Consultation
The FAA seeks concurrence from the SHPO of its no historic properties affected [§ 800.11 (d)] determination for the proposed UAS route. 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,

Mark E. Giron
Aviation Safety
Manager, General Aviation Operations Branch,
Flight Standards Service

Enclosure

Oregon
Kate Brown, Governor

Parks and Recreation Department
State Historic Preservation Office
725 Summer St NE Ste C
Salem, OR 97301-1266
Phone (503) 986-0690
Fax (503) 986-0793
www.oregonheritage.org

We have reviewed the materials submitted on the project referenced above, and we concur there will be no historic properties affected for this undertaking.

This concludes the requirement for consultation with our office under Section 106 of the National Historic Preservation Act (per 36 CFR Part 800) for above-ground historic properties. Local regulations, if any, still apply and review under local ordinances may be required.

Please feel free to contact me if you have any questions, comments or need additional assistance. If you have not already done so, be sure to consult with all appropriate Indian tribes regarding your proposed project. If you have any questions regarding any future discovery or this letter, feel free to contact me at your convenience.

Sincerely,

Jamie French, M.A.
SHPO Archaeologist
(503) 979-7580
Jamie.French@oregon.gov

Appendix C

Noise Analysis Report

Noise Assessment for Amazon Prime Air MK27-2 Flight Test and Durability & Reliability Operations at the Pendleton Unmanned Aircraft Systems Range, Oregon

In support of Environmental Assessment for Amazon Prime Air Drone Package Delivery Test Operations in Pendleton, Oregon

Final

HMMH Report No. 313090.002 002-1
September 23, 2022

Prepared for:

Federal Aviation Administration
Unmanned Aircraft Systems Integration Office (AUS)
Unmanned Aircraft System (UAS) Environment Review
697DCK-22-D-00004

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Noise Assessment for Amazon Prime Air MK27-2 Flight Test and Durability & Reliability Operations at the Pendleton Unmanned Aircraft Systems Range, Oregon

In support of Environmental Assessment for Amazon Prime Air Drone Package Delivery Test Operations in Pendleton, Oregon

Final

HMMH Report No. 313090.002 002-1
September 23, 2022

Prepared for:

Federal Aviation Administration
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Unmanned Aircraft System (UAS) Environment Review
697DCK-22-D-00004

Prepared by:

David Crandall
Michael Hamilton
Mihir Rimjha
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 results for the estimation of noise exposure related to Unmanned Aircraft (UA) package delivery test flight operations and Durability & Reliability (D&R) operations conducted by Amazon Prime Air (Amazon) at the Pendleton Unmanned Aircraft Systems (UAS) Range in Pendleton, Oregon. The Pendleton UAS Range is a Federal Aviation Administration (FAA)-approved UAS Test Site at the Eastern Oregon Regional Airport (FAA Designator PDT) in Pendleton, Oregon. Figure 1 presents the Pendleton UAS range, the airport, and local land use.

Amazon Prime Air has conducted flight test operations on this range since April 2019 under Part 91 rules and Special Airworthiness Certificate-Experimental Category (SAC-EC) Certificate of Authorization (COA). From August 2020 to April 2022, under COA Exemptions No. 18601 and 18602, Amazon Prime Air conducted limited delivery operations under a Part 135 certificate and COA 2021-WSA-113-SAC. This delivery operation utilized the deprecated MK27B drone. Amazon is in the process of certifying and transitioning operations to the upgraded MK27-2.

Amazon is proposing to conduct delivery test flight and D&R operations with the Amazon Prime Air MK27-2 UA. In order for Prime Air to continue its flight test operations at Pendleton, it must receive exemption renewals from the FAA. Prime Air has two exemptions that will expire on September 30, 2022; one exemption is for their aircraft, the MK-27, and the other exemption is for their flight operations under Part 91. Prime Air has requested that the FAA review its exemptions and determine if they meet safety requirements.

The MK27-2 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 2 depicts the UA considered in this report.

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

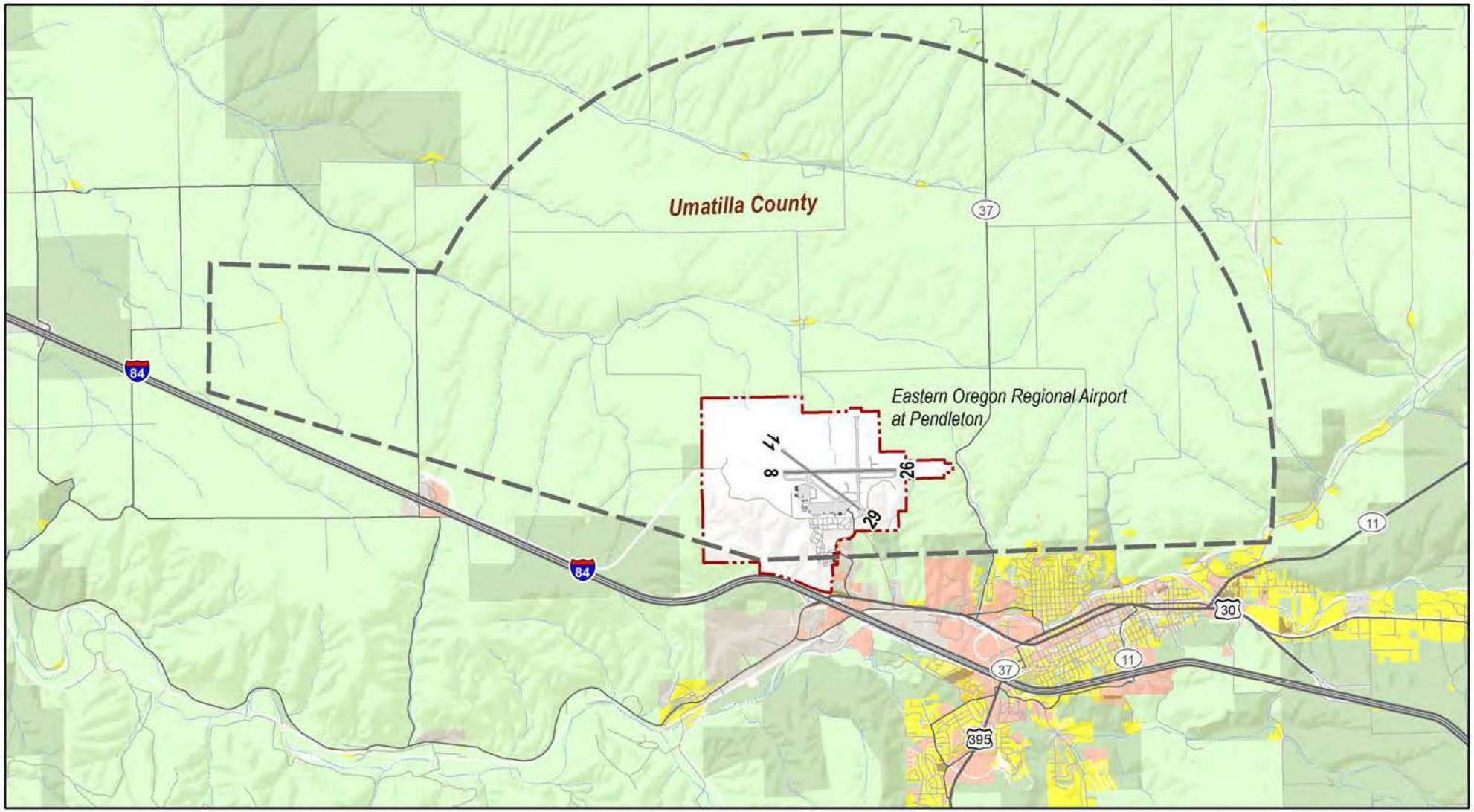

Figure 1: Pendleton UAS Range Boundary

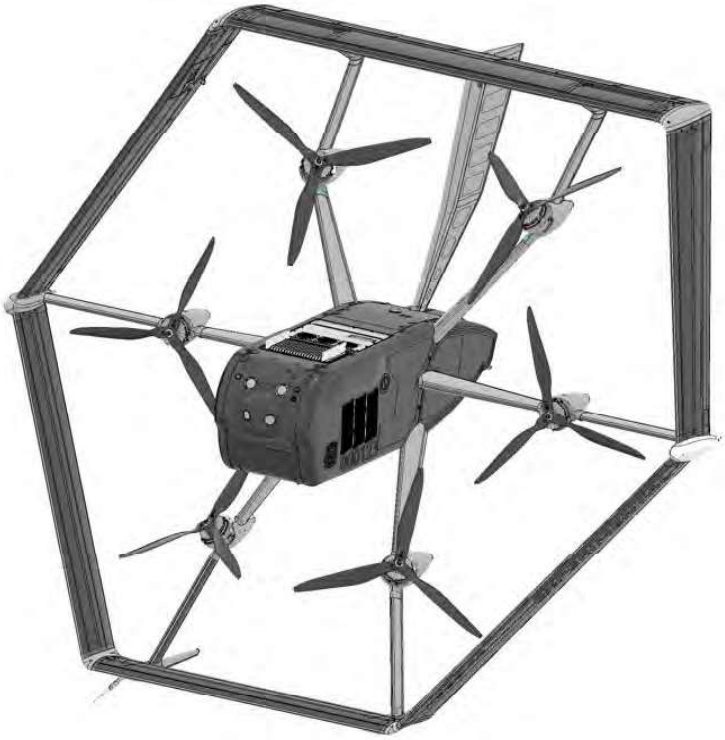

Figure 2: Amazon Prime Air MK27-2 Unmanned Aircraft

Source: Amazon

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 delivery flight tests begin with the UA ascending vertically from a launch location 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 location. Once near the delivery location, the UA decelerates and descends vertically over the delivery location. 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 an assigned landing location. When the UA arrives at the landing location, it decelerates and vertically descends to the ground. D&R flights follow similar procedures to the delivery flight tests but are more numerous, conducted in a different area of the UAS range, and are typically flown at a higher typical en route altitude of 200 feet AGL.

The noise analysis results presented in this document 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).[2]

Noise analysis of the proposed activity was 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 at the Pendleton UAS range. 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 forecast maximum levels of operations for areas at ground level below each phase of the flight for operations at the Pendleton UAS range.

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 at the Pendleton UAS range using available data. Section 4 presents the resulting estimated DNL levels for various flight phases at the Pendleton UAS range based on anticipated levels of typical test flight 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 Operations and Noise Measurement Data Set Descriptions

Multiple data sets form the basis of the noise assessment for the proposed Amazon flight operations. The data sets include 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 "NEPA RFI_071222_Final.docx," all marked "Amazon Confidential and Propriety Trade Secret Information." Amazon also provided the boundary for the Pendleton UAS Range included in "Response to May 20 email from AA_CONFIDENTIAL AND PROPRIETARY TRADE SECRET INFORMATION.pdf." Additionally, GIS files named "8f550de6-6b70-4782-a8b8-e58cba844279-2022-07-16T04 40 21.175Z-4a128.kmz" and "D&R.kmz" were received on August 2, 2022 and July 29, 2022, respectively. Information for test flight delivery locations were also received on September 2, 2022 in "PDT Test Launch – Delivery Locations.png."

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]

FAA provided "Eastern Oregon Regional Airport, Airport Master Plan, September 2018 (FAA ALP Grant No. 3-41-0046-024-2014) with AS-BUILT Pen & Inks dated February 3, 2022" (2018 MP), which was used for determining the PDT airport property line.

2.1 Operations 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 the Pendleton UAS range. 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 results and the methodology for the noise analysis.

2.1.1 Operations

The methodology presented in this report has been performed at a specified level of D&R and delivery test flight activity based on anticipated maximum levels of operations provided by Amazon. Annual D&R and delivery test flights are estimated at a maximum of 9,390 and 2,610, respectively.

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.

[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.

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

2.1.2 Flight Paths and Profiles

The UA will fly a predefined flight path between predefined launch and delivery locations and then complete the flight at landing locations. 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 test flights and D&R operations. The subsections that follow provide a narrative description of each of the nine flight phases.

2.1.2.1 Takeoff and vertical ascent

For takeoff, the UA starts at the launch location. Once it is cleared for takeoff, the UA takes off from the ground vertically to the en route altitude (165 feet AGL for delivery test flights, 200 feet AGL for D&R flights) in vertical flight mode (pointed upward).[5]

2.1.2.2 Transition and climb outbound

Once at the en route altitude (165 feet AGL for delivery test flights, 200 feet AGL for D&R flights) and still above the launch location, the UA transitions from zero speed to cruise speed (52.4 knots) while changing from vertical flight mode to horizontal flight mode.

[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).

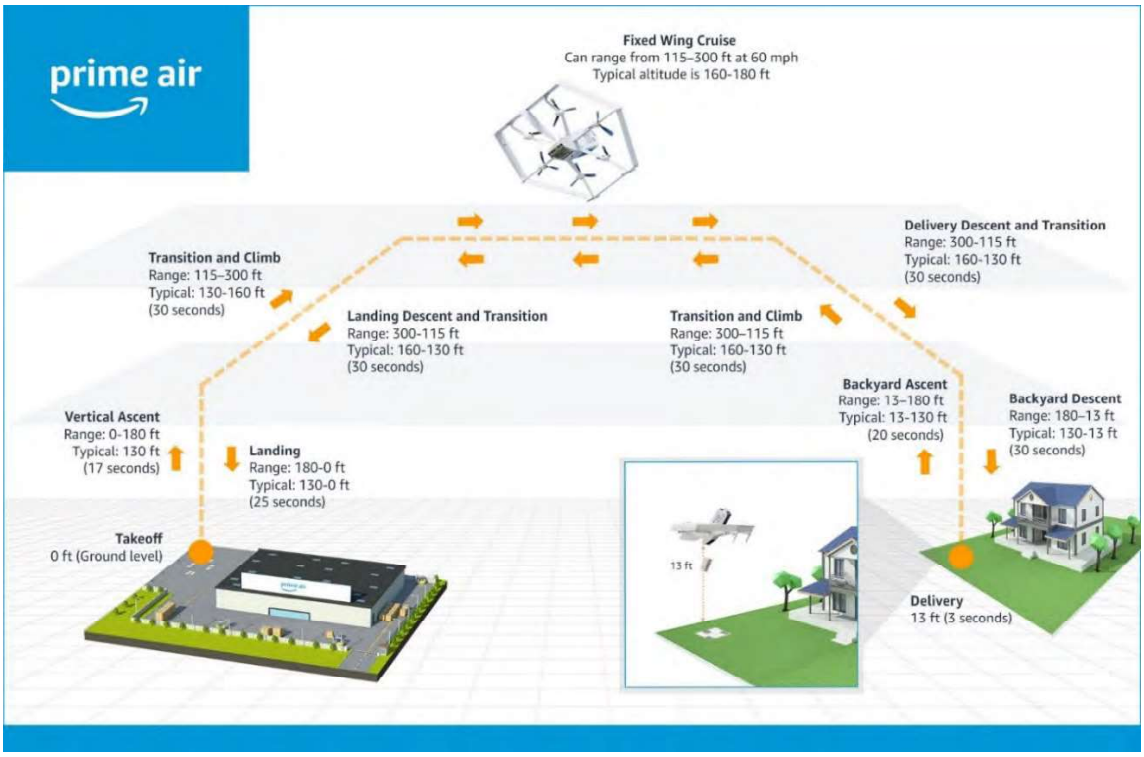

Figure 3: Graphical Depiction of the Proposed Amazon Prime Air MK27-2 Flight Profile to a Destination

Source: Amazon, August 2022

2.1.2.3 Fixed-wing cruise outbound

The UA continues to fly at en route altitude (165 feet AGL for delivery test flights, 200 feet AGL for D&R flights) and en route speed of 52.4 knots to the delivery location.

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 location 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 location. 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 location during this maneuver is 16.4 ft.[6]

[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."

2.1.2.6 Transition and climb inbound

Once at the en route altitude (165 feet AGL for delivery test flights, 200 feet AGL for D&R flights) and still above the delivery location, the UA transitions from zero speed to cruise speed (52.4 knots) while changing from vertical flight mode to horizontal flight mode.

2.1.2.7 Fixed-wing cruise inbound

The UA continues to fly at en route altitude (165 feet AGL for delivery test flights, 200 feet AGL for D&R flights) and en route speed of 52.4 knots towards the landing location.

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 location with zero speed.

2.1.2.9 Landing

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

2.2 Flight Paths

This projects as two different groups of flight paths, located at different areas within the Pendleton UAS Range. The delivery test flights are discussed in Section 2.2.1 and the D&R flights are discussed in Section 2.2.2.

Figure 4 presents the location of these two different activities.

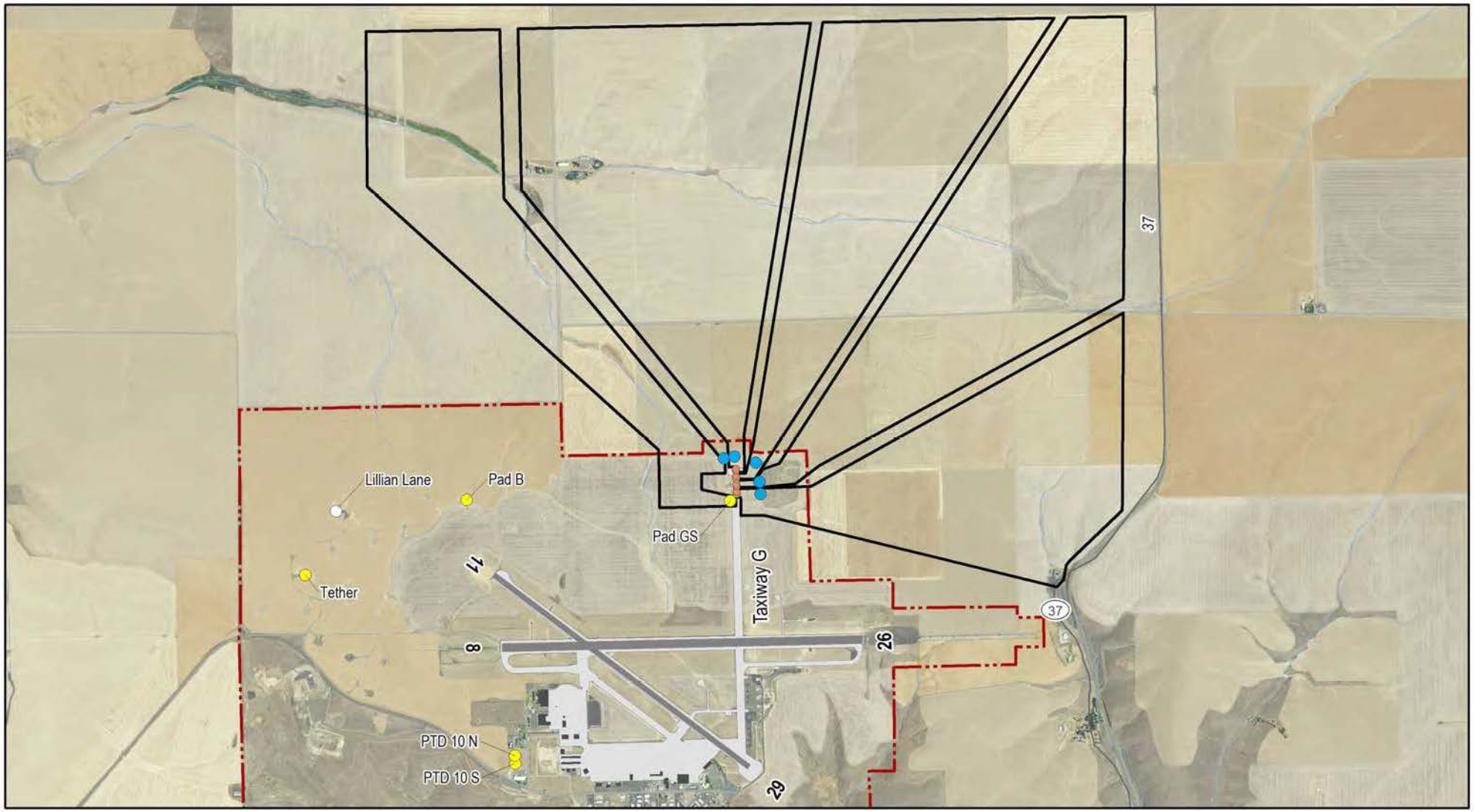

Figure 4: Amazon MK27-2 Test and D&R Flight Operating Areas

2.2.1 Delivery Test Flights

Amazon Prime Air conducts delivery test flight operations from launch and landing locations adjacent to its test facility, PDT10, located at 1901 NW 56th Drive Pendleton, OR 97801. The test flights are usually shorter in duration than D&R flights and are either conducted from the launch location from PDT 10, a tether rig located northwest of PDT 10, Pad B located to the north of PDT 10, or Pad GS on the North Gulf Taxiway. A test flight may or may not follow a nominal D&R CONOPS flight profile. The delivery test flights following a normal flight profile would fly to an on-airport area known as Lillian Lane. Lillian Lane is a small mockup of several life-size structures and delivery areas that mimic a customer delivery location. In this report, test operations are modeled with a similar CONOPS flight profile as D&R flights with their launch and landing locations at PDT 10 N and PDT 10 S, tether rig, Pad B, and the Pad GS launch and landing locations (shown in Figure 4) and a delivery location at Lillian Lane.

According to Amazon Prime Air, the launch location is determined by test requirements, but it can be assumed that approximately 75 percent of flights will take off and land from PDT 10 (approximately 1,957.5 annual flights) and remaining approximately 25 percent will be distributed equally other launch and landing (approximately 217.5 annual flights each at Tether, Pad GS and Pad B).

Table 1 summarizes different phases of a test flight and includes the assumptions regarding altitude, ground speed, and durations.

Table 1. Amazon Prime Air MK27-2 Typical Delivery Test 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 launch location 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 launch location 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 location at en route altitude and in vertical flight mode	165’	52.4 to 0	20
Delivery Location 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

Phase	Description	Altitude (ft AGL)	Ground Speed (knots)	Duration (s)
Transition and Climb Inbound	Transition from zero speed above delivery location 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 landing location at en route altitude and in vertical flight mode	165’	52.4 to 0	20
Landing	Descend from en route altitude to landing location on ground in vertical flight mode	Descend from 165 to 0’	0	38

2.2.2 D&R Flight Paths and Profiles

At Pendleton airport, Amazon Prime Air is utilizing its operations crews to conduct D&R flights from four designated launch and landing locations on the North Golf Taxiway located at 5292 NW Doolittle Canyon Ln, Pendleton, OR 97801. D&R flights are conducted in the five flight sectors as shown in Figure 4. D&R flights are not anticipated to occur on a regular basis at the Pendleton UAS range, but only as needed to meet FAA operational requirements for safety and other operational approvals.

Starting at takeoff, the drone vertically climbs over the launch location to a height of about 200 feet AGL, transitions to forward flight, and follows a pre-loaded path to a test delivery location adjacent to the launch and landing locations, where it descends to a safe altitude of about 4 meters (approximately 13 feet) and drops the package. The MK27-2 then climbs vertically to approximately 200 feet AGL and reverses the path taken and returns to a designated landing pad. The D&R profiles are the same as discussed in 2.2.1 and Table 1, except the typical en route altitude would change from 165 ft AGL to 200 ft AGL.

2.3 Acoustical Data

Noise measurements of the Amazon Prime Air MK27-2 UA were collected at the Pendleton UAS Range 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 2.1.1. 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 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 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 Section 2.1.2.5, 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 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 test flights and D&R operations. These would be operations originating from the Pendleton UAS range (which has multiple launch, delivery, and landing locations) occurring daily between the hours of 7:00 AM and 10:00 PM. 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 at the Pendleton UAS range. 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 (3) 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.

3.2 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 a launch location
- The UA transitioning from either vertical to horizontal flight or horizontal to vertical flight
- En route travel of the UA in horizontal flight between a launch location and a delivery location
- Delivery
- The UA landing at a landing location

3.2.1 General Assumptions

This analysis is based on the tables presented in Section 2.3. 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.

3.2.2 Takeoff

The process for calculating SELs for the takeoff profile described in Section 2.1.2.1 are presented in Section 2.3, specifically Equation (1) combined with the parameters presented Table 2.

Application of the SEL is based on the position of the launch locations at the Pendleton UAS range. 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.

3.2.3 Transitions between Vertical and Horizontal Flight Modes

The available SELs for transitioning between vertical and horizontal flight modes are presented in Section 2.3, 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.

3.2.4 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 aircraft 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 is 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 (4).

$$\Delta J_1 = 12.5 \times \log_{10}\left(\frac{H_A}{H_T}\right), dB \quad (4)$$

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 (5).

$$\Delta J_3 = 10 \times \log_{10}\left(\frac{V_R}{V_{RA}}\right), dB \quad (5)$$

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 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 (6) to arrive at an estimate $SEL_{maximum\ weight}$ dB for that respective phase of flight.

$$SEL_{maximum\ weight} = 67.7 + 12.5 \times \log_{10}\left(\frac{165}{Alt_i}\right) + 10 \times \log_{10}\left(\frac{52.4}{V_i}\right), dB \quad (6)$$

[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

For the purpose of this noise analysis, Equation (6) 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]

3.2.5 Delivery

The available SELs for delivery are presented in Section 2.3, 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 is based on the distance of the receiver relative to the position of the delivery locations at the Pendleton UAS range. The values in Table 4 are valid for distances from the delivery point of 32.8 feet or greater.[10]

3.2.6 Landing

The available sound exposure levels for landing are presented in Section 2.3, 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 is based on the position of the landing locations at the Pendleton UAS range. 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.

3.3 Proposed DNL 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 (7).

$$DNL_{iA} = SEL_{iA} + 10 \times \log_{10}\left(N_{DNL,\,iA}\right) - 49.4,\ (dB) \tag{7}$$

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 (8).

$$DNL_i = 10 \times \log_{10}\left(10^{\left(\frac{DNL_{iA}}{10}\right)} + 10^{\left(\frac{DNL_{iB}}{10}\right)} + \cdots + 10^{\left(\frac{DNL_{iZ}}{10}\right)}\right),\ (dB) \tag{8}$$

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

[10] According to Amazon, there should not be a person, animal, or object within 5 meters of the delivery point. If the UA detects a person, animal, or object within 5 meters of the delivery point, it will abort the delivery. However, since the delivery points are on airport property, there does not seem to be a case where a non-participant noise sensitive receiver would be less than 32.8 feet provided for in Table 4.

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

3.3.1 DNL for Takeoff and Landing Locations

The takeoff and landing operations are anticipated to occur at the same locations. 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 3.2.2. 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 3.2.3.

Landing operations will be represented by two sound levels. First, the UA will fly to the landing locations at en route altitude while slowing down and transition from horizontal to vertical flight (Section 3.2.3). 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 3.2.6.

The four noise sources representing the complete takeoff and landing cycle associated with a single delivery departing and returning at the launch and landing locations will be added together with Equation (8).

3.3.2 DNL for En Route Overflight

En route includes the UA flying to and from the launch and landing locations 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 3.2.4. Operations will be based on the forecast maximum 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 (8).

3.3.3 DNL for Delivery Locations

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 location at the en route altitude;
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 and accelerating to en route speed.

The three sound levels will be added together with Equation (8).

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4 Noise Exposure Estimate Results

This section presents the estimated average annual day (AAD) noise exposure for the forecast maximum number of test and D&R flights proposed by Amazon at the Pendleton UAS Range. One flight includes the outbound takeoff and inbound landing and is representative of two operations.

The DNL Equivalent flights, $N_{DNL,i}$ as described in Section 3.1, is presented below as Equation (9).

$$Flights_{Day,i} = Flights_{Day} + 10 \times Flights_{Night} \quad (9)$$

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

For estimating noise exposure, the noise levels for each flight phase are considered separate based on the level of proposed operations for a given location. When particular location is at the transition of different flight phases, the cumulative noise exposure was 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 launch and landing location, 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 launch location to a delivery location and return; and
3. Transition to and from horizontal fixed-wing en route flight to vertical flight at the delivery location, vertical descent to complete a delivery at the delivery location, and vertical ascent back to en route altitude for return to a landing location.

The cumulative noise from the UA at that given location was then determined by adding the noise from each of these phases.

4.1 D&R Flight Noise Exposure Results

For D&R flights, noise exposure from operations at takeoff, landing, and delivery locations at the Pendleton UAS range is estimated from methodology described in Section 3.4.1 and Section 3.4.3, respectively, and the results are presented in Section 4.1.1. Noise exposure directly under D&R en route overflights at the Pendleton UAS range is estimated from the methodology described in Section 3.4.2, and the results are presented in Section 4.2.2.

4.1.1 D&R Noise Exposure for Activity at the North End of Taxiway G

For operations at the D&R takeoff and landing locations at the Pendleton UAS range, 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 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. Also, all takeoff, delivery, and landing operations are assumed to occur at the same point and were then applied to each takeoff, landing, and delivery location associated with D&R flights as shown in Figure 4 (Section 2.2). The outer extent of the noise contours for each D&R takeoff, landing, and delivery location were then combined to determine the combined maximum extent of noise contours for all D&R flights using a convex hull algorithm.[11]

Table 7 presents the forecast maximum annual daytime D&R flights and the associated extents of the DNL 45 to DNL 65 dB contours under the flight path from takeoff, landing, and delivery locations as described in Section 2.2.2. Estimated noise exposure includes the takeoff and climb, transition to en route outbound, decelerating and transitioning from horizontal to vertical flight, conducting delivery phase, and transitioning from vertical to horizontal and accelerating, transition from en route inbound, and descent and landing as detailed in Section 2.1.2.

The analyses presented in Table 7 were rounded up conservatively to the nearest interval available from the data from Section 2.3. The actual noise levels, should they be calculated with greater precision or measured, are anticipated to be within the estimated extents depicted.[12]

Table 7. Maximum Extent of Noise Exposure from D&R Takeoff, Landing, and Delivery Locations

Annual Daytime D&R Flights	9,390
AAD Daytime D&R Flights	25.72
DNL 45 dB	475 feet
DNL 50 dB	275 feet
DNL 55 dB	175 feet
DNL 60 dB	100 feet
DNL 65 dB	50 feet

Figure 5 depicts the maximum extent of noise exposure from D&R takeoff, landing, and delivery locations.

[11] A convex hull is the smallest polygon that encloses a set of points

[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 2.3.

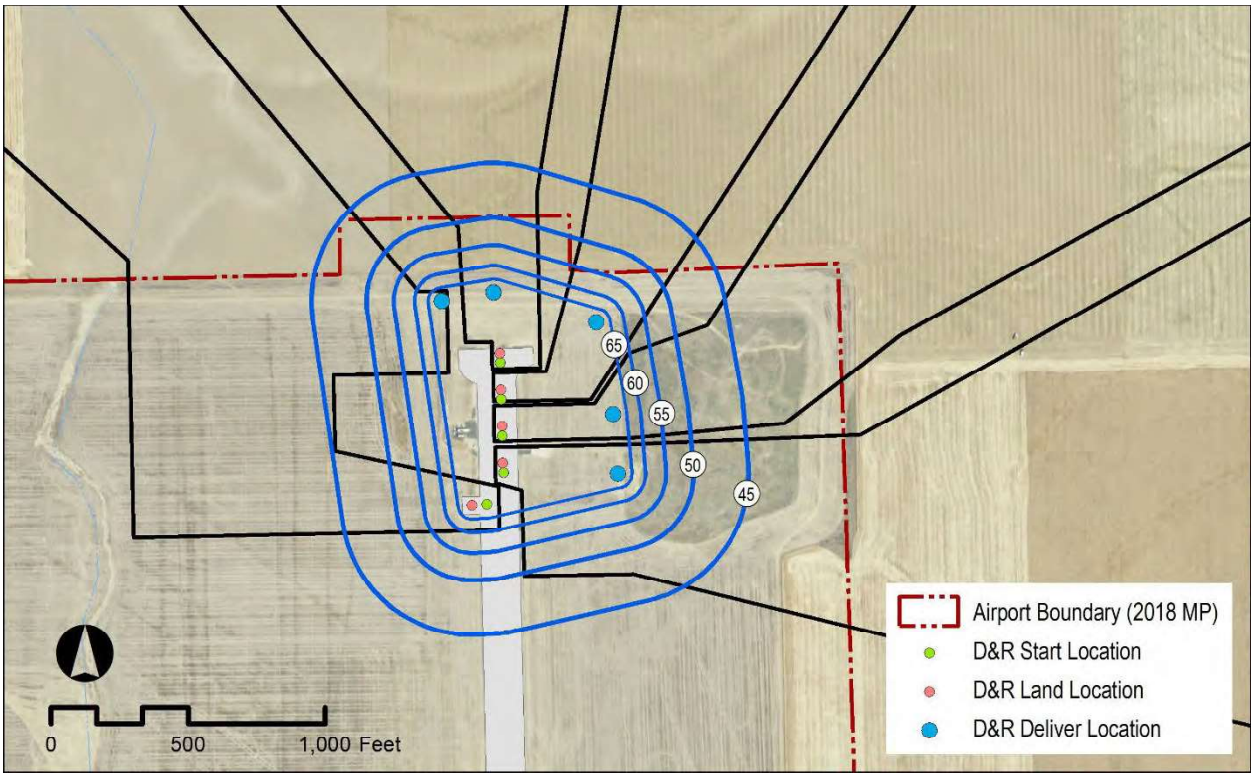

Figure 5: Noise Exposure Extent for D&R Flights

Source: HMMH

4.2 D&R En Route Overflight Noise Exposure

Potential en route noise exsposure from D&R overflights is estmated for a worst-case scenraio based on all 9,390 annual D&R flights overflying the same receiver. While this is not expected to occur over any single location, the resultant AAD DNL noise exposure value provides an upper threshold limit for en route overflight noise exposure that would not be exceeded under any possible D&R flight sector usage scenario.

A single residental land use area has been identified in the D&R test sectors and is depicted in Figure 6. Noise exposure at this residential location would not exceed the AAD DNL value presented in Table 8.

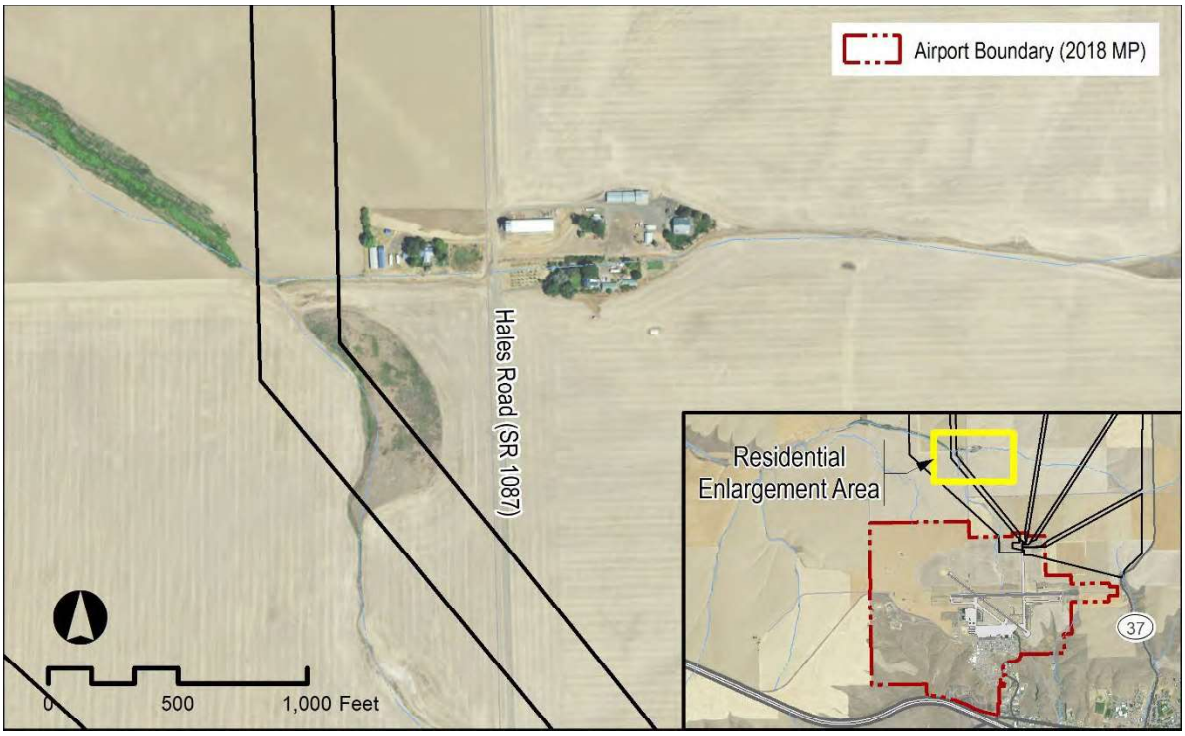

Figure 6: Residential Land Use In the D&R Sectors

Source: HMMH

Table 8 presents the noise exposure resulting from en route overflights within the D&R flight sectors. The en route noise calculated for each flight includes both the inbound and outbound traversal of the en route path at 200 feet AGL and a ground speed of 52.4. Results include the en route SEL and DNL for one D&R flight (i.e., two overflights) and the maximum potential annual average daily DNL level.

Table 8. Estimated Noise Exposure Directly Under D&R En Route Overflights

Annual D&R Flights	9,390
AAD D&R Flights	25.72
Altitude for Overflight (AGL)	200 feet
Weight for Overflight	Maximum
En Route SEL for 1 flight (dB)	69.7
En Route DNL for 1 Flight between 7 AM and 10 PM (dB)	20.3
DNL for Average Annual Day (dB)	34.4

4.3 Delivery Test Flight Noise Exposure Results

For delivery test flights at the Pendleton UAS range, noise exposure is estimated for three separate phases: takeoff and landing, en route, and delivery. The launch and landing locations at the Pendleton UAS range are located at PDT 10, Pad GS, Tether, and Pad B and the delivery location at LL. See Figure 4

for the locations of all launch and landing locations and LL. According to Amazon Prime Air, the launch location is determined by test requirements, but it can be assumed that approximately 75 percent of flights will take off and land from PDT 10 and remaining approximately 25 percent will use other launch and landing locations.

The noise exposure from operations associated with the launch and landing locations, en-route overflight, and delivery are estimated from the methodology mentioned in Section 3.3.1, Section 3.3.2, and Section 3.3.3, respectively.

4.3.1 Test Flight Noise Exposure for Operations at Launch and Landing Locations

For operations at the launch and landing locations at the Pendleton UAS range, 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 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 9 presents the forecast maximum annual daytime delivery test fights and the associated extents of the DNL 45 to DNL 65 dB contours from takeoff and landing locations as described in Section 2.2.1. Estimated noise exposure for delivery test flights includes the takeoff and climb, transition to en route outbound, transition from en route inbound, and descent and landing as described in Section 2.1.2. The analyses presented in Table 9 were rounded up conservatively to the nearest interval available from the data from Section 2.3. The actual noise levels, should they be calculated with greater precision or measured, are anticipated to be within the estimated extents depicted.[13]

Table 9. Estimated Extent of Noise Exposure at Launch and Landing Locations for Test Flights

Takeoff/Landing Location	PDT 10	Tether / Pad GS / Pad B
Annual Daytime Test Flights	1957.5	217.5
AAD Daytime Test Flights	5.36	0.59
DNL 45 dB	175 feet	50 feet
DNL 50 dB	100 feet	32.8 feet
DNL 55 dB	50 feet	32.8 feet
DNL 60 dB	32.8 feet	32.8 feet
DNL 65 dB	32.8 feet	32.8 feet

4.3.2 Test Flight En Route Overflight Noise Exposure

For en route conditions, the UA is expected to fly the same outbound flight path between the launch and delivery location and inbound flight path back to the landing location (Section 3.3.2). Therefore, each location under the en route path would be overflown twice for each delivery test flight served by the respective overhead en route path.

[13] 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 2.3.

Table 10 provides the estimated DNL for a location on the ground directly under an en route path for various counts of daily average DNL Equivalent flights. The en route noise calculated for each flight 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 10. Estimated Extent of Noise Exposure Directly Under En Route Flight Paths from Delivery Test Flights

Takeoff/Landing Location	PDT 10	Tether/ Pad GS / Pad B
Annual Daytime Test Flights	1957.5	217.5
AAD Daytime Test Flights	5.36	0.59
Altitude for Overflight (AGL)	165 ft	165 ft
Weight for Overflight	Maximum	Maximum
En Route SEL for 1 flight (dB)	70.7	70.7
En Route DNL for 1 flight between 7 AM and 10 PM (dB)	21.3	21.3
DNL for AAD	28.6	19.1

4.3.3 Test Flight Noise Exposure for Operations at Delivery Locations

The delivery location for all delivery test flights at the Pendleton UAS range is Lillian Lane. Table 11 presents the forecast maximum annual daytime delivery test fights and the associated extents of the DNL 45 to DNL 65 dB contours from the delivery location as described in Section 2.2.1. Estimated noise exposure for delivery test flights includes decelerating and transitioning from horizontal to vertical flight, conducting delivery phase, and transitioning from vertical to horizontal and accelerating as detailed in Section 2.1.2. The analyses presented in Table 11 were rounded up conservatively to the nearest interval available from the data from Section 2.3. The actual noise levels, should they be calculated with greater precision or measured, are anticipated to be within the estimated extents depicted.[14]

Table 11. Maximum Extent of Noise Exposure from the Test Flight Delivery Location

Delivery Location	Lillian Lane
Annual Daytime Test Flights	2,610
AAD Daytime Test Flights	7.12
DNL 45 dB	175 feet
DNL 50 dB	125 feet
DNL 55 dB	50 feet
DNL 60 dB	32.8 feet
DNL 65 dB	32.8 feet

[14] 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 2.3.

Figure 7 depicts the estimated extents of the DNL 45 dB to DNL 65 dB noise exposure for the locations discussion in Sections 4.3.1, 4.3.2, and 4.3.3.

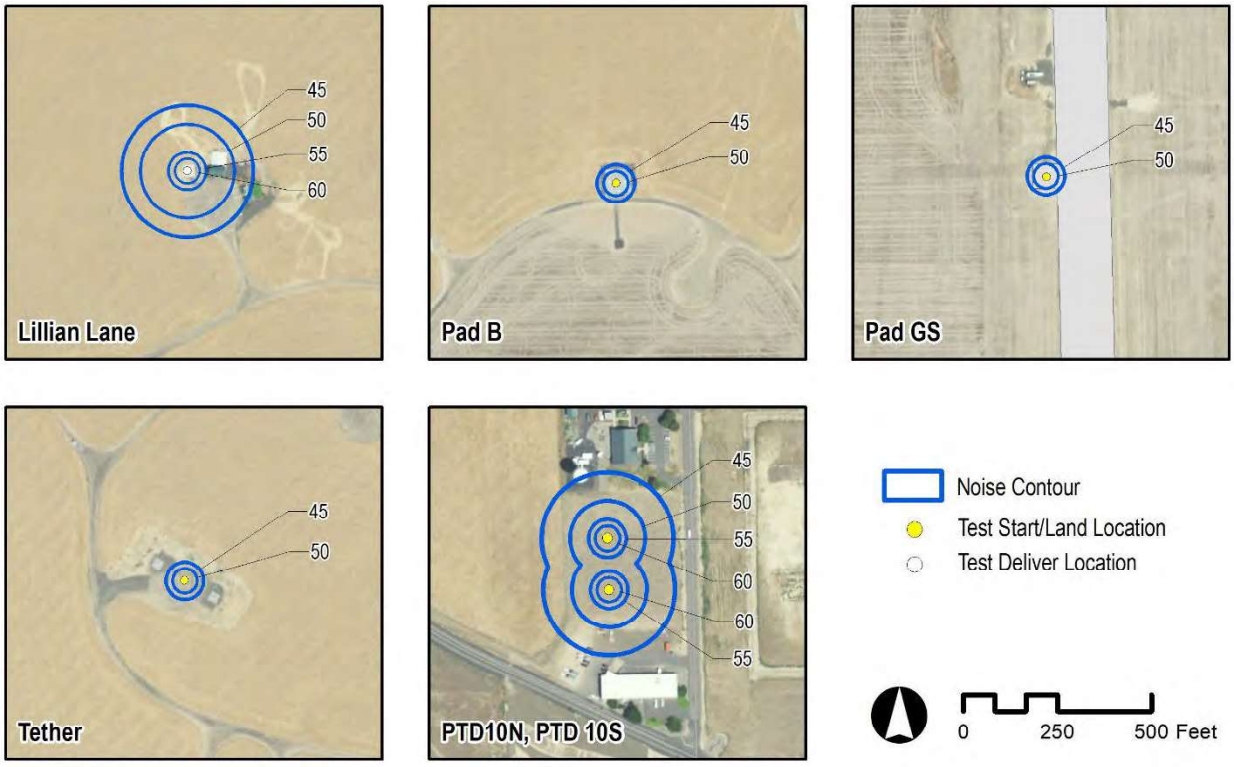

Figure 7: Estimated Extents of Noise Exposure Extents from Test Flight Takeoff, Landing, and Delivery Locations
Source: HMMH

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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.

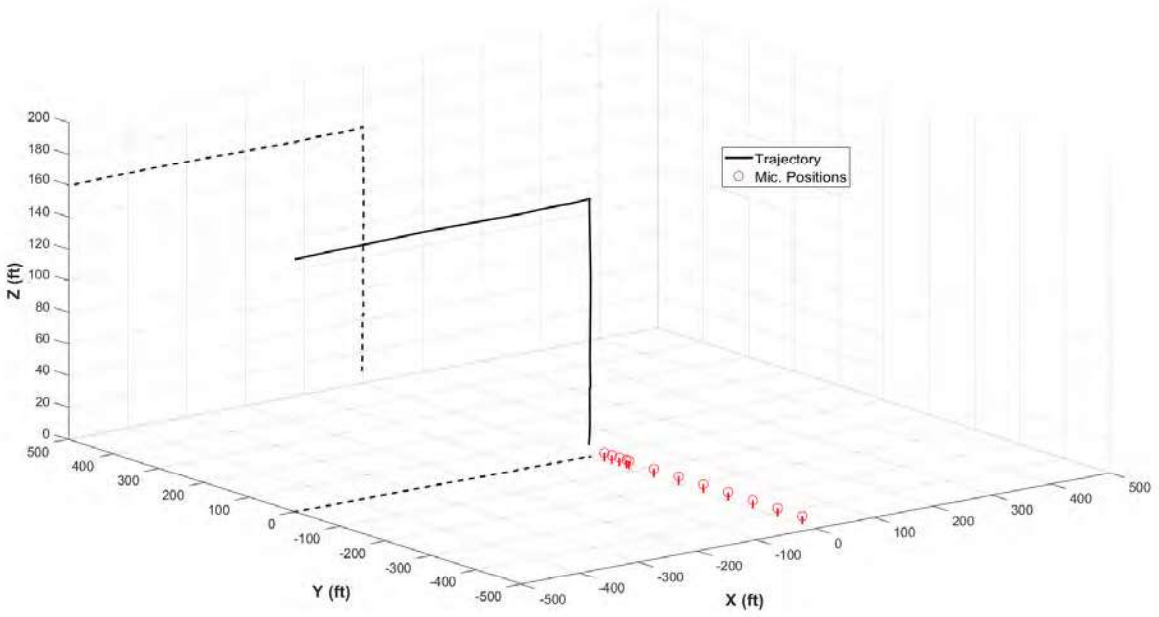


Figure 1. Microphone locations for takeoff, delivery, and landing measurements for MK27-2 UA with example takeoff trajectory.

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.

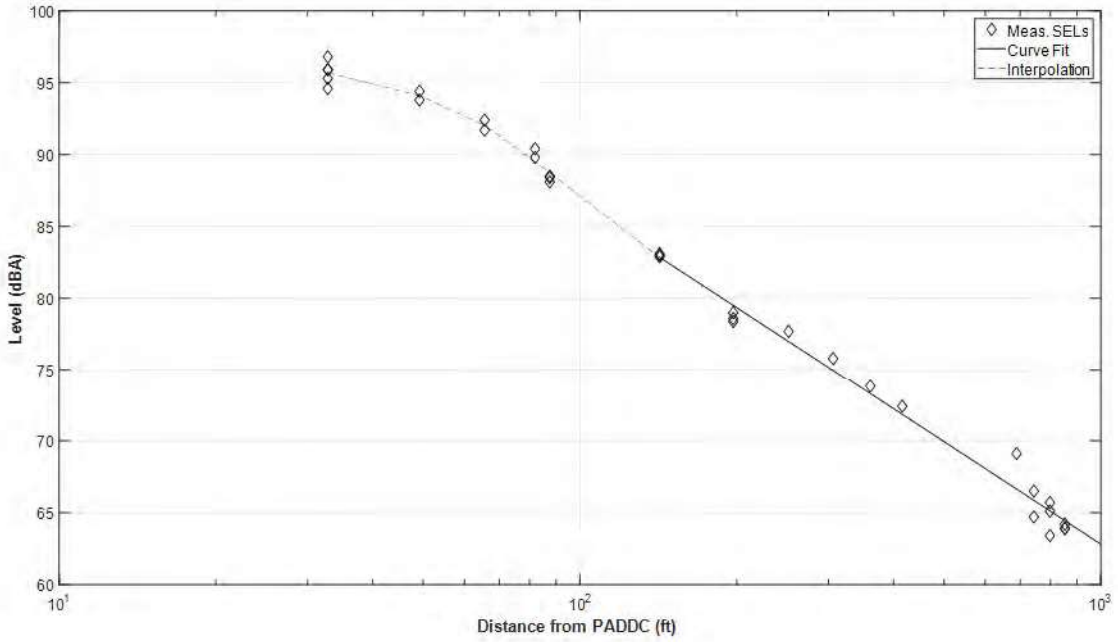


Figure 2. Measured sound exposure levels during takeoffs as described in Table 4.

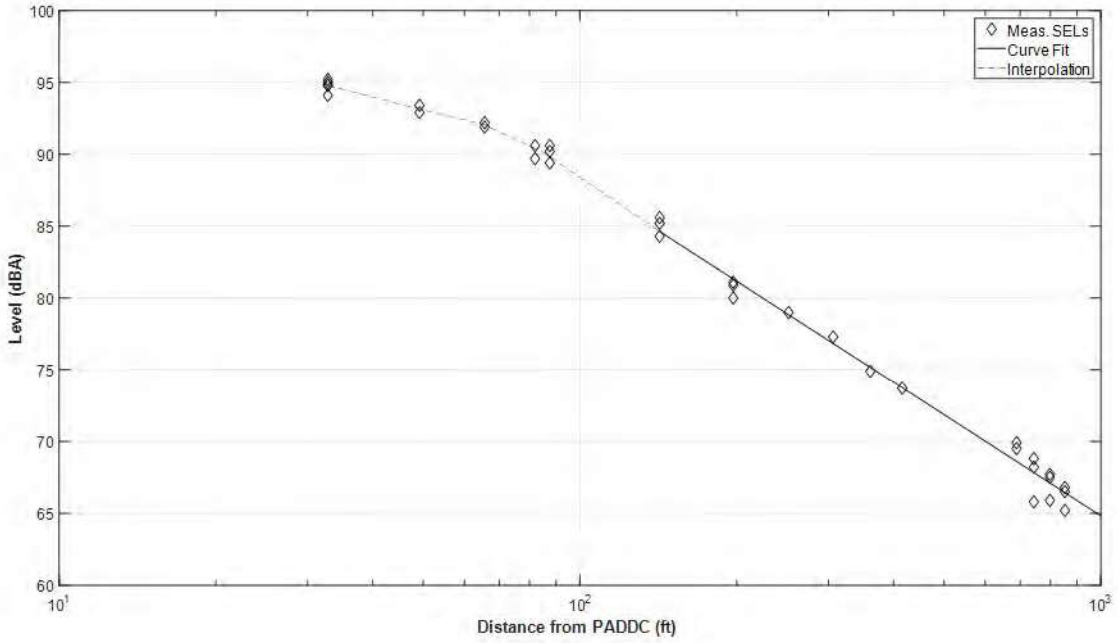


Figure 3. Measured sound exposure levels during landings as described in Table 4.

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 $v_{ref.}$

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

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.

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

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

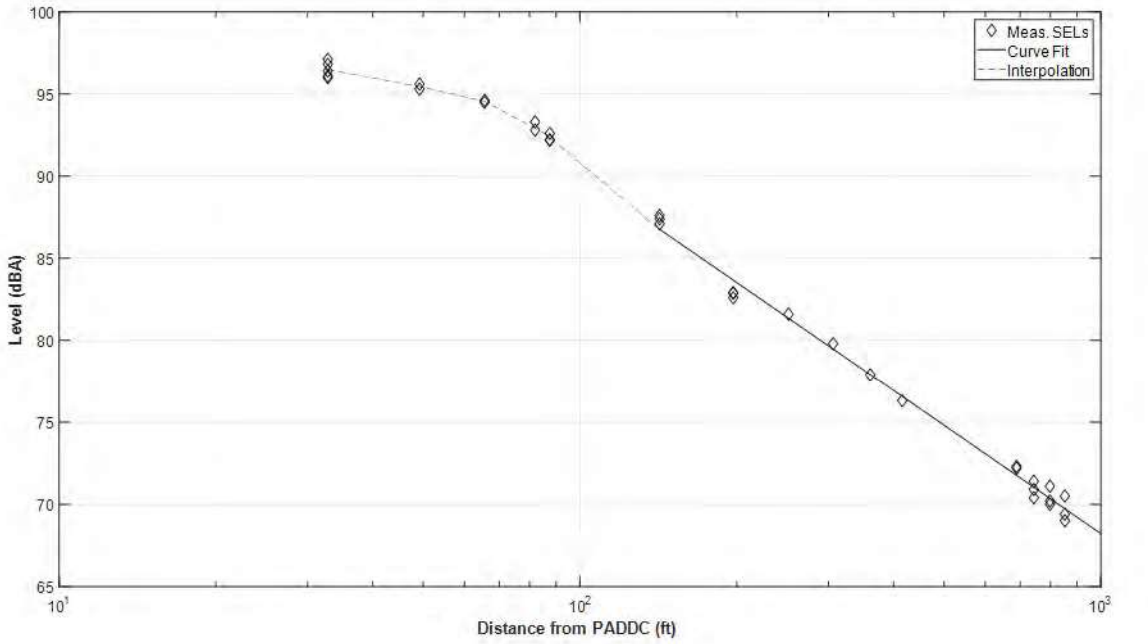


Figure 4. Measured Sound Exposure Levels during deliveries as described in Table 10.

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: November 9, 2022

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

MICHAEL JAY MILLARD Digitally signed by MICHAEL JAY MILLARD Date: 2022.11.09 06:20:14 -05'00'

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 Flight Test and Durability & Reliability Operations at the Pendleton Unmanned Aircraft Systems Range, Oregon

FAA Office of Flight Standards (AFS) requests FAA Office of Environment and Energy, Noise Division (AEE-100) approval of the noise methodology to be used for the Environmental Assessment (EA) for the renewal of exemptions for Amazon Prime Air (Amazon) to use the MK27-2 unmanned aircraft (UA) for flight test and Durability & Reliability (D&R) operations at the Pendleton Unmanned Aircraft Systems Range (PUR) in Pendleton, Oregon, 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 flight test and D&R operations using the MK27-2 UA at PUR, which is an FAA-approved UAS Test Site at the Eastern Oregon Regional Airport (FAA Designator PDT) in Pendleton, Oregon[1].

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

[1] This is being evaluated with regards to Amazon's expiring exemptions for package delivery test operations as a 14 CFR Part 135 operator at PUR.

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 UA can climb and descend vertically, hover, and fly upright with its propellers facing forward like a fixed-wing aircraft for en route flight. During test flights, airspeeds during normal en route flight are expected to be up to approximately 52 knots. Typical test flights begin with the UA ascending vertically from test launch/landing pads on the PDT airport 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 test delivery point. Once near the test delivery point, the UA decelerates and descends vertically over the test 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 approximately 52 knots and follows a predefined track to return to its originating test launch/landing pad. When the UA arrives at the originating test launch/landing pad, it decelerates and vertically descends for a landing on the ground at the assigned pad.

D&R flights follow similar procedures to the delivery test flights but are more numerous, conducted in a different area of the UAS range, and are typically flown at a higher typical en route altitude of 200 feet AGL.

Amazon projects operating a maximum of approximately 10 delivery test flights and 38 D&R test flights per operating day over roughly 250 operating days per year, for a maximum total of 12,000 test flight operations at PUR based on the scope of the proposed action. The proposed test flight operations at PUR would occur during daylight hours (7 AM to 10 PM) up to five days per week.

Noise Analysis Methodology

AFS requests use of the noise analysis methodology described in HMMH Report No. 313090.002 002-1 for the “Noise Assessment for Amazon Prime Air MK27-2 Flight Test and Durability & Reliability Operations at the Pendleton Unmanned Aircraft Systems Range, Oregon” dated September 23, 2022.

Federal Aviation Administration

Memorandum

Date: November 9, 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)

11/9/2022

Subject: Environmental Assessment (EA) Noise Methodology Approval Request for Amazon Prime Air MK27-2 Flight Test and Durability & Reliability Operations at the Pendleton Unmanned Aircraft Systems Range, Oregon

The Office of Environment and Energy (AEE) has reviewed the proposed non-standard noise modeling methodology to be used for Amazon Prime Air (Amazon) test operations using the MK27-2 unmanned aircraft (UA) from Pendleton, Oregon. This request is in support of an Environmental Assessment (EA) for the renewal of expiring exemptions to allow Amazon to continue to conduct package delivery test operations as a 14 CFR Part 135 operator within the Pendleton UAS Range (PUR) located at the Eastern Oregon Regional Airport (PDT).

The Proposed Action is to use the MK27-2 UA to conduct Durability and Reliability (D&R) and delivery flight test operations from test launch/landing pads at PDT to test delivery locations located on the PDT airport within the existing PUR operating area. Typical operations of the UA will consist of departure from one of the test launch/landing pads at PDT followed by a vertical climb to a typical en route altitude of 160 to180 feet above ground level (AGL) for delivery test flights, and 200 feet AGL for D&R flights. The UA then transitions from vertical to horizontal flight and accelerates to a typical en route speed of 52 knots for transit to a test delivery location. Approaching the test delivery location, the UA will deaccelerate and transition from horizontal to vertical flight, and then descend vertically over the test delivery point. At 13 feet AGL, the UA drops the package at the test 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 test launch/landing pad. When the UA arrives at the test launch/landing pad, the UA will deaccelerate and transition from horizontal to vertical flight and vertically descends to its assigned test launch/landing pad. Once it lands, the UA is serviced and prepared for the next test flight.

Amazon expects to operate a maximum of approximately 10 delivery test flights and 38 D&R test flights per operating day over roughly 250 operating days per year, for a maximum total of 12,000 annual test flight operations at PUR based on the scope of the proposed action. The proposed test flight operations at PUR would occur during daylight hours (7 AM to 10 PM) up to five days per week.

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. 313090.002 002-1 for the "Noise Assessment for Amazon Prime Air MK27-2 Flight Test and Durability & Reliability Operations at the Pendleton Unmanned Aircraft Systems Range, Oregon" dated September 23, 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)

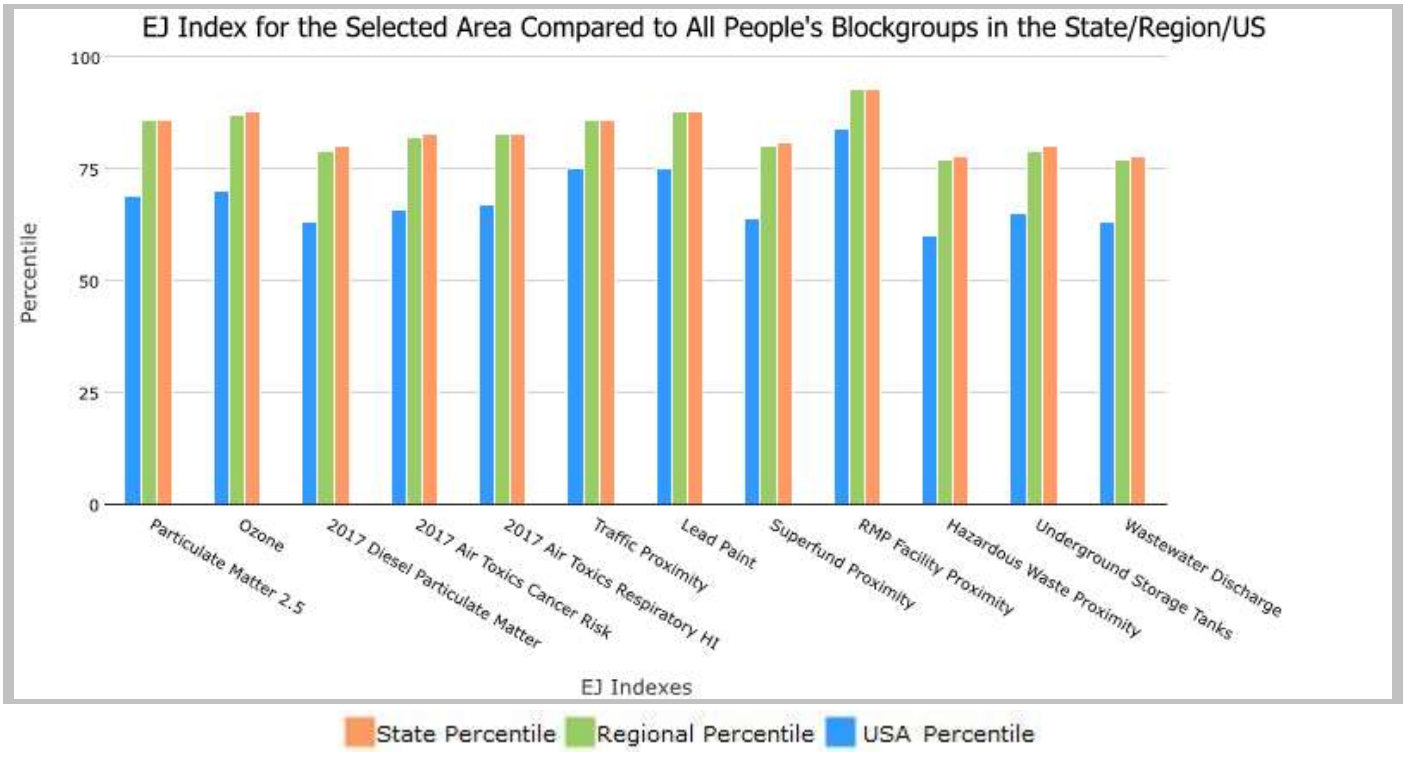
the User Specified Area, OREGON, EPA Region 10

Approximate Population: 191

Input Area (sq. miles): 46.62

Pendleton

Selected Variables	State Percentile	EPA Region Percentile	USA Percentile
Environmental Justice Indexes			
EJ Index for Particulate Matter 2.5	86	86	69
EJ Index for Ozone	88	87	70
EJ Index for 2017 Diesel Particulate Matter*	80	79	63
EJ Index for 2017 Air Toxics Cancer Risk*	83	82	66
EJ Index for 2017 Air Toxics Respiratory HI*	83	83	67
EJ Index for Traffic Proximity	86	86	75
EJ Index for Lead Paint	88	88	75
EJ Index for Superfund Proximity	81	80	64
EJ Index for RMP Facility Proximity	93	93	84
EJ Index for Hazardous Waste Proximity	78	77	60
EJ Index for Underground Storage Tanks	80	79	65
EJ Index for Wastewater Discharge	78	77	63



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.

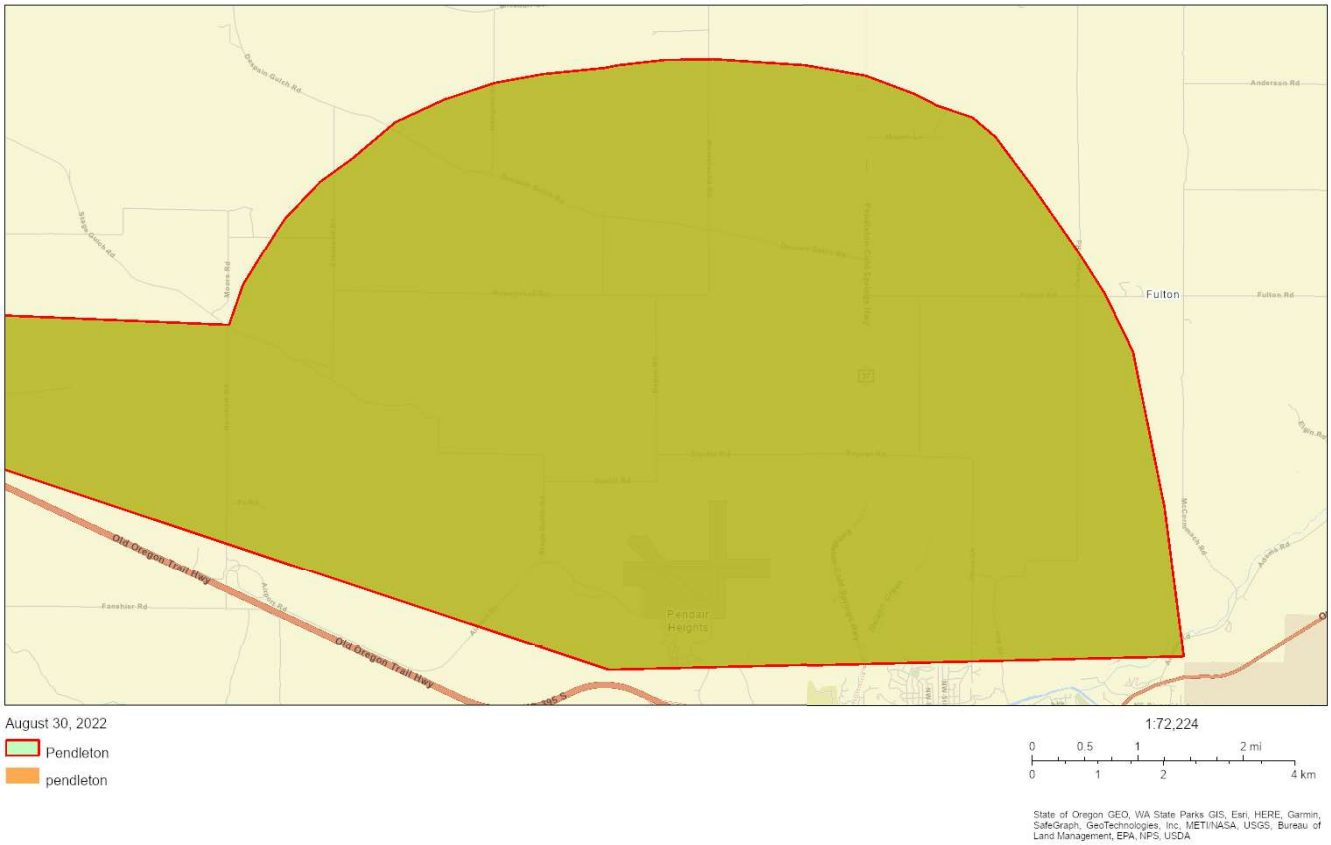
EJScreen Report (Version 2.0)

the User Specified Area, OREGON, EPA Region 10

Approximate Population: 191

Input Area (sq. miles): 46.62

Pendleton



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, OREGON, EPA Region 10

Approximate Population: 191

Input Area (sq. miles): 46.62

Pendleton

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)	8.69	8.75	44	8.17	67	8.74	52
Ozone (ppb)	44.7	37	94	37.2	91	42.6	73
2017 Diesel Particulate Matter* (µg/m^3)	0.078	0.345	14	0.312	<50th	0.295	<50th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	20	33	15	33	<50th	29	<50th
2017 Air Toxics Respiratory HI*	0.3	0.47	15	0.47	<50th	0.36	<50th
Traffic Proximity (daily traffic count/distance to road)	360	590	59	600	61	710	60
Lead Paint (% Pre-1960 Housing)	0.61	0.25	90	0.22	91	0.28	84
Superfund Proximity (site count/km distance)	0.019	0.083	17	0.13	20	0.13	17
RMP Facility Proximity (facility count/km distance)	1.7	0.79	86	0.66	89	0.75	88
Hazardous Waste Proximity (facility count/km distance)	0.027	1.6	7	1.7	7	2.2	2
Underground Storage Tanks (count/km^2)	0.2	3.4	34	4.5	33	3.9	27
Wastewater Discharge (toxicity-weighted concentration/m distance)	1.1E-06	0.004	15	0.53	17	12	9
Socioeconomic Indicators							
Demographic Index	40%	28%	81	28%	80	36%	63
People of Color	30%	24%	69	28%	62	40%	48
Low Income	37%	31%	67	28%	72	31%	65
Unemployment Rate	2%	5%	26	5%	29	5%	30
Linguistically Isolated	0%	2%	52	3%	47	5%	45
Less Than High School Education	17%	9%	83	9%	85	12%	74
Under Age 5	1%	6%	6	6%	5	6%	7
Over Age 64	8%	17%	15	16%	18	16%	20

*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: Pendleton

Summary of ACS Estimates	2015 - 2019
Population	191
Population Density (per sq. mile)	3
People of Color Population	57
% People of Color Population	30%
Households	77
Housing Units	102
Housing Units Built Before 1950	57
Per Capita Income	30,650
Land Area (sq. miles) (Source: SF1)	58.02
% Land Area	100%
Water Area (sq. miles) (Source: SF1)	0.28
% Water Area	0%

	2015 - 2019 ACS Estimates	Percent	MOE (±)
Population by Race			
Total	191	100%	280
Population Reporting One Race	179	93%	539
White	147	77%	282
Black	11	6%	78
American Indian	4	2%	51
Asian	1	1%	38
Pacific Islander	1	0%	15
Some Other Race	15	8%	75
Population Reporting Two or More Races	13	7%	78
Total Hispanic Population	32	17%	119
Total Non-Hispanic Population	159		
White Alone	135	70%	294
Black Alone	10	5%	73
American Indian Alone	3	2%	42
Non-Hispanic Asian Alone	1	0%	38
Pacific Islander Alone	1	0%	15
Other Race Alone	0	0%	12
Two or More Races Alone	10	5%	53
Population by Sex			
Male	160	83%	205
Female	32	17%	148
Population by Age			
Age 0-4	2	1%	35
Age 0-17	12	6%	82
Age 18+	179	94%	250
Age 65+	16	8%	80

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: Pendleton

	2015 - 2019 ACS Estimates	Percent	MOE (±)
Population 25+ by Educational Attainment			
Total	160	100%	238
Less than 9th Grade	6	4%	62
9th - 12th Grade, No Diploma	21	13%	114
High School Graduate	50	31%	141
Some College, No Degree	45	28%	133
Associate Degree	11	7%	53
Bachelor's Degree or more	27	17%	105
Population Age 5+ Years by Ability to Speak English			
Total	190	100%	272
Speak only English	163	86%	229
Non-English at Home[1+2+3+4]	26	14%	116
[1]Speak English "very well"	17	9%	96
[2]Speak English "well"	5	3%	51
[3]Speak English "not well"	2	1%	39
[4]Speak English "not at all"	2	1%	19
[3+4]Speak English "less than well"	4	2%	42
[2+3+4]Speak English "less than very well"	9	5%	65
Linguistically Isolated Households*			
Total	0	0%	12
Speak Spanish	0	0%	12
Speak Other Indo-European Languages	0	0%	12
Speak Asian-Pacific Island Languages	0	0%	12
Speak Other Languages	0	0%	12
Households by Household Income			
Household Income Base	77	100%	75
< $15,000	28	36%	59
$15,000 - $25,000	1	1%	19
$25,000 - $50,000	18	23%	48
$50,000 - $75,000	10	12%	64
$75,000 +	21	27%	69
Occupied Housing Units by Tenure			
Total	77	100%	75
Owner Occupied	22	28%	68
Renter Occupied	56	72%	77
Employed Population Age 16+ Years			
Total	180	100%	246
In Labor Force	33	18%	177
Civilian Unemployed in Labor Force	1	0%	49
Not In Labor Force	148	82%	195

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: Pendleton

	2015 - 2019 ACS Estimates	Percent	MOE (±)
Population by Language Spoken at Home*			
Total (persons age 5 and above)	789	100%	393
English	714	91%	359
Spanish	63	8%	145
French	1	0%	16
French Creole	N/A	N/A	N/A
Italian	N/A	N/A	N/A
Portuguese	N/A	N/A	N/A
German	0	0%	17
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	1	0%	16
Chinese	0	0%	17
Japanese	N/A	N/A	N/A
Korean	0	0%	17
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	2	0%	16
Tagalog	1	0%	15
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	0	0%	17
Hebrew	N/A	N/A	N/A
African	N/A	N/A	N/A
Other and non-specified	5	1%	36
Total Non-English	75	9%	532

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

Acronyms and Abbreviations

Appendix F: Acronyms and Abbreviations

AGL - Above Ground Level

APE - Area of Potential Effects

BCC - Birds of Conservation Concern

CEQ - Council on Environmental Quality

CFR - Code of Federal Regulations

COA - Certificate of Waiver or Authorization

CZMP - Coastal Zone Management Plan

D&R - Durability & Reliability

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

FONSI - Finding of No Significant Impact

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

NOAA - National Oceanic and Atmospheric Administration

NRHP - National Register of Historic Places

NRI - Nationwide Rivers Inventory

NTSB - National Transportation Safety Board

ODFW - Oregon Department of Fish and Wildlife

PDT - Eastern Oregon Regional Airport

PDT FCT - Pendleton Federal Contract Air Traffic Control Tower

Prime Air - Amazon Prime Air

PSP - Partnership for Safety Program

PUR - Pendleton UAS Range

ROD - Record of Decision

SAC-EC - Special Airworthiness Certificate-Experimental Category

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

USFWS - United States Fish and Wildlife Service

WSRS - National Wild and Scenic Rivers System