Federal Aviation Administration

Draft Supplemental Environmental Assessment for Drone Package Delivery in College Station, Texas

May 2024

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

Washington, D.C.

Notice of Availability, Notice of Public Comment Period, and Request for Comment on the Draft Supplemental Environmental Assessment for Amazon Prime Air Package Delivery Operations in College Station, Texas

The Federal Aviation Administration (FAA) provides notice that a Draft Supplemental Environmental Assessment (EA), prepared pursuant to the National Environmental Policy Act (NEPA) (42 United States Code §§ 4321 – 4355), to assess Amazon Prime Air's proposed commercial drone delivery service in the College Station, TX area is available for review and comment.

Amazon Prime Air is seeking to amend its air carrier Operation Specifications (OpSpec) and other FAA approvals necessary to expand commercial drone delivery operations in Texas. The FAA's approval of the amended OpSpec is considered a major federal action under NEPA and Council on Environmental Quality (CEQ) NEPA–implementing regulations (40 Code of Federal Regulations Parts 1500–1508) and requires a NEPA review. The Draft EA is submitted for review pursuant to NEPA, CEQ NEPA Implementing Regulations, FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*, Section 4(f) of the Department of Transportation Act (49 U.S.C. § 303), and Section 106 of the National Historic Preservation Act (16 U.S.C. § 470). The Draft EA will be available for a 30-day public review beginning on Thursday, May 30th, 2024, and ending on Friday, June 28th, 2024.

The Draft EA is available for online review at:
https://www.faa.gov/uas/advanced_operations/nepa_and_drones

Comments on the Draft EA may be submitted electronically to 9-faa-drone-environmental@faa.gov. Written comments may be submitted via U.S. Mail to the address below. Please ensure adequate time for receipt. All comments must be received by 5:00 p.m. Central Time on *Friday, June 28*, *2024*.

Federal Aviation Administration, Suite 802W
C/O AVS Environmental
800 Independence Ave SW
Washington, DC 20591

All substantive comments received will be responded to in the Final EA.

PRIVACY NOTICE: Before including your address, phone number, email address, or other personal identifying information in your comment, be advised that your entire comment – including your personal identifying information – may be made publicly available at any time. While you can ask us in your comment to withhold from public review your personal identifying information, we cannot guarantee that we will be able to do so.

This Draft EA becomes a federal document when evaluated, signed, and dated by the Responsible FAA Official.

Responsible FAA Official:

DEREK W HUFTY Digitally signed by DEREK W HUFTY
Date: 2024.05.15 06:56:11 -04'00'

___________________________________ Date: _____________________________

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CHAPTER 1
Purpose and Need

1.1 Introduction

Amazon.com Services LLC, doing business as Amazon Prime Air (Amazon or Prime Air), intends to expand its delivery capabilities in 2024 under its existing Part 135 air carrier certificate and related operating authorizations by adding the next generation MK30 drone variant to its fleet. Prime Air is seeking to amend its current Operation Specifications (OpSpec) and other Federal Aviation Administration (FAA) authorizations needed to integrate the MK30 and expand commercial drone package delivery operations from the Prime Air Drone Delivery Center (PADDC)[1] located in College Station, Texas.

The FAA prepared an Environmental Assessment (EA) for Prime Air's drone operations at the College Station PADDC and issued a Finding of No Significant Impact (FONSI) and a Record of Decision (ROD) on December 9, 2022 (the 2022 Final EA). This Draft Supplemental EA is being prepared by the FAA to evaluate the potential incremental environmental impacts that may result from the FAA's approval of the Proposed Action, which would expand commercial drone delivery operations from the PADDC. For purposes of this Draft Supplemental EA, the operating area is the Study Area and is further defined in **Chapter 2**.

The FAA would have to amend Prime Air's existing OpSpec to grant airspace access to the MK30 in the proposed operating area. The issuance of an OpSpec is considered a major federal action subject to environmental review requirements. The FAA has prepared this Draft Supplemental EA pursuant to the National Environmental Policy Act of 1969 (NEPA)[2] and its implementing regulations.[3] Under NEPA, federal agencies are required to consider the environmental effects of proposed federal actions and to disclose to decision-makers and the interested public a clear and accurate description of the potential environmental impacts of proposed major federal actions. Additionally, under NEPA, federal agencies are required to consider the environmental effects of a proposed action, the reasonable alternatives to the proposed action, and a no action alternative (assessing the potential environmental effects of not implementing the proposed action). The FAA has established a process to ensure compliance with the provisions of NEPA through FAA Order 1050.1F, Environmental Impacts: Policies and Procedures, and the FAA Order 1050.1F Desk Reference.

1 An Amazon PADDC is a ground-based service area where drones are assigned and where flights originate and return.

2 42 United States Code (U.S.C.) § 4321 et seq.

3 40 Code of Federal Regulations (CFR) §§1500-1508

1.2 Current Operations

The 87-pound (lb) MK27-2 Prime Air drone currently in use carries packages weighing up to 5 lbs. (3 kilograms [kg]) and has a maximum takeoff weight of approximately 92 lbs. (42 kg). Prime Air operates up to 200 MK27-2 delivery flights per operating day and flies up to 260 operating days per year, for a total of roughly 52,000 annual delivery operations. All drone operations originate from and terminate at the Prime Air Drone Delivery Center (PADDC)[4] located at 400 Technology Parkway, College Station, TX, which is approximately 85 mi (136 kilometers [km]) east of Austin and 75 mi (120 km) northwest of Houston. Current commercial drone package delivery operations from the College Station PADDC occur during daylight hours, defined in the 2022 Final EA as between 30 minutes before sunrise and 30 minutes after sunset, but never after 10 P.M., up to five days per week.[5] The existing circle-shaped operating area, which is 43.7 square (sq) miles (mi) (113.2 sq km), has a radius of approximately 3.7 mi (6 km) from the PADDC, which is depicted in **Figures 1-1** and **1-2**.

The PADDC facility includes a warehouse building with office space, ground control station, aircraft maintenance area, battery storage area, parking, truck loading areas, landscaped grounds, paved departure and arrival pads, and perimeter fencing. The PADDC site is zoned for Planned Development District (PDD) with Suburban Commercial Base.[6] The allowable uses for the PDD specifically include “consumer, small scale aerial distribution,” which is defined as “the use of drones or similar devices weighing less than 100 pounds on takeoff, including everything that is on board or otherwise attached to the drone, to enable the receipt, storage, and distribution of packages by air.”[7] Additional discussion of land use can be found in **Chapter 3.2**. The PADDC is located near the intersection of Texas 6 Frontage Road and Sebesta Road with State Highway 6 approximately 0.3 mi (0.5 km) to the west of the site. The properties adjacent to the PADDC are a mix of privately-owned rural, commercial, and residential properties. The closest residential neighborhood is approximately 425 ft (0.13 km) from the site, as shown in **Figure 1-2**. Information about community noise exposure related to drone operations in the vicinity of the PADDC can be found in **Section 3.6**. Prime Air conducts deliveries from the PADDC to eligible delivery sites, such as private residences and commercial facilities.[8] It is important to note that drone delivery flights may occur in any direction to and from the PADDC, but Prime Air may modify operations, if warranted, to avoid or minimize any negative impacts.

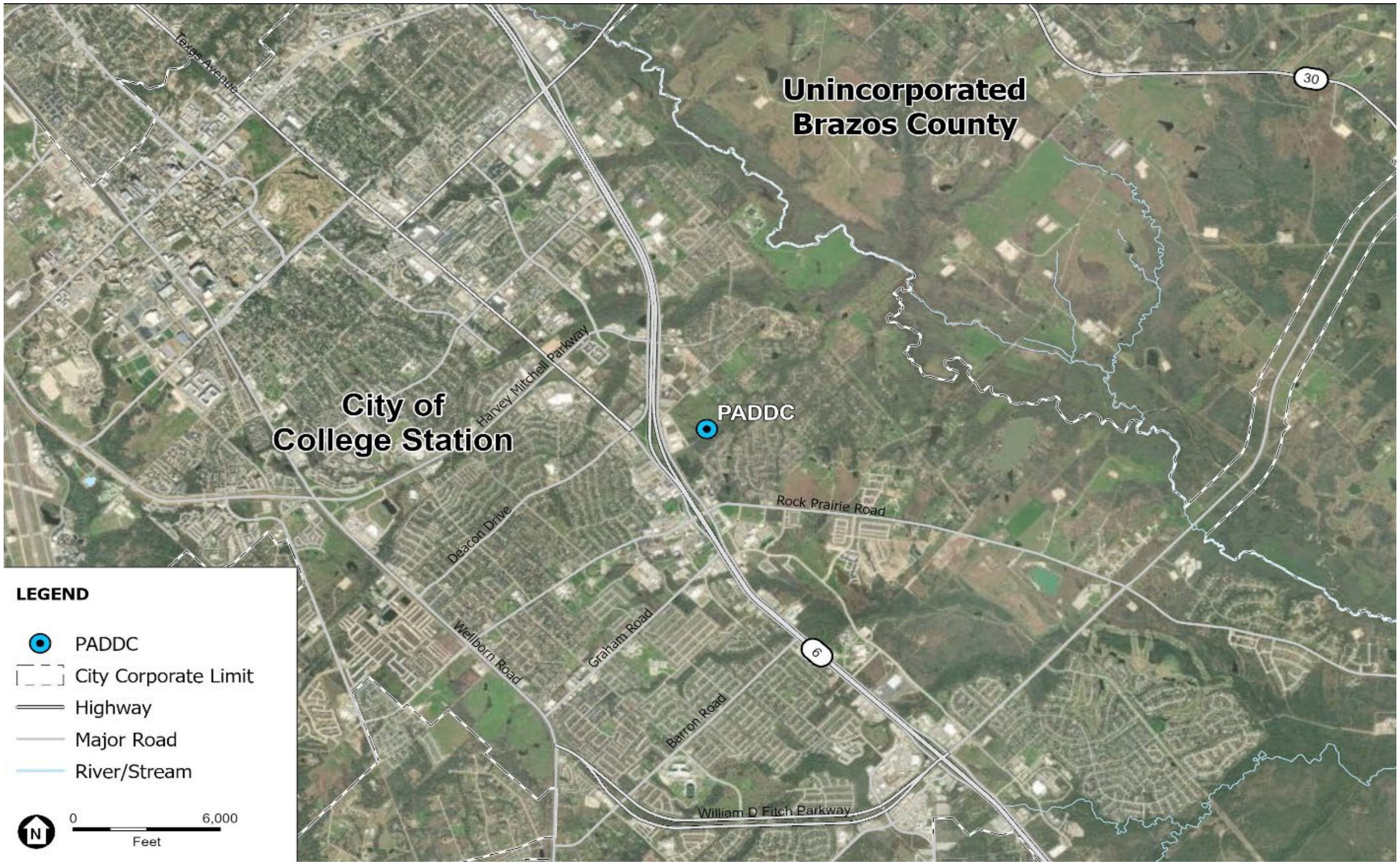
4 An Amazon PADDC is a ground-based service area where drones are assigned and where flights originate and return.

5 The proposed hours of operation include the time period between 7 A.M. and 10 P.M. It should be noted that the FAA and Amazon Prime Air are currently consulting with the United States Fish and Wildlife Service to determine the optimal operating window to minimize potential impacts to biological resources, as discussed in Section 3.3.

6 College Station Zoning Map: https://cstx.maps.arcgis.com/apps/webappviewer/index.html?id=1b2d3c188cd5479e9dbc61b6448f714b

7 College Station Ordinance No. 2022-4372, Jul4 14 2022: https://opendoc.cstx.gov/DocArc/DocView.aspx?id=1692051&dbid=0&repo=DOCUMENT-SERVER

8 Each delivery site is vetted by Amazon to ensure that the area can receive deliveries.



SOURCE: ESA, 2023; Maxar, 2022; US Census Bureau, 2021; US Geological Survey, 2022.

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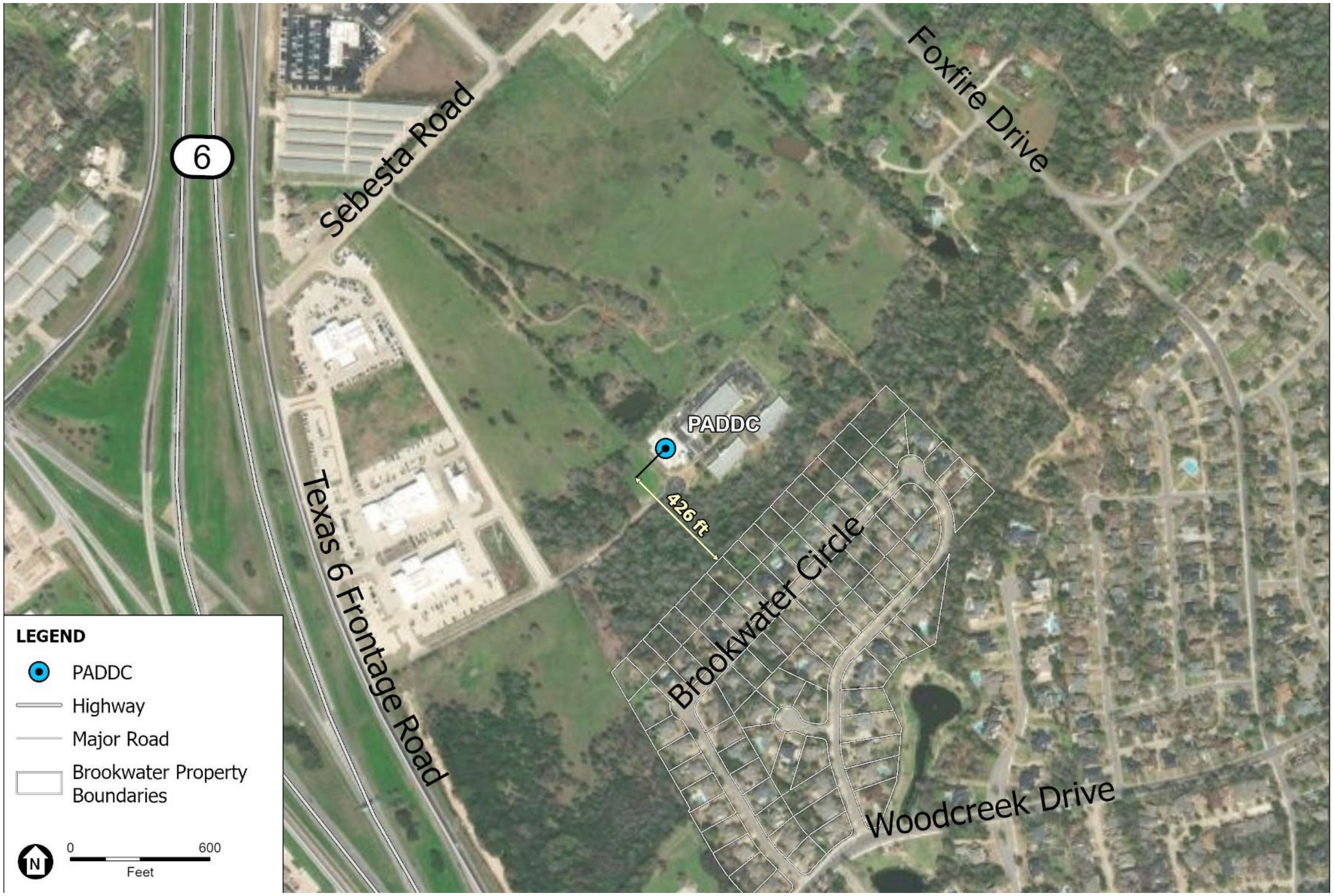
Figure 1-1
Prime Air's PADDC Location in College Station, TX



SOURCE: ESA, 2023; Maxar, 2022; US Census Bureau, 2021; US Geological Survey, 2022.

Draft Supplemental Environmental Assessment for Amazon Prime Air — College Station, TX

Figure 1-2
Close-up View of the College Station PADDC

1.3 Proposed Operations

Based on community demand for service, Prime Air is proposing to amend its OpSpec by incorporating the next generation, MK30 drone variant into service, which offers longer range and a reduced noise profile.

The MK30's operating range is 7.5 mi (12 km) (an increase of 3.7 mi (6.0 km) from the MK27-2 range), which increases the operating area from 43.7 sq mi (113.2 sq km) to 174 sq mi (450.6 sq km). As proposed, average daily operations would increase from the current estimated 200 operations per day using the MK27-2 up to 469 daily operations using the MK30. The transition to the MK30 would result in an increase from 52,000 operations with the MK27-2 to 171,329 operations with the MK30 on an annual basis. The number of operating hours would increase from the current eight (8) hours per day (between 30 minutes before sunrise and 30 minutes after sunset and never after 10 P.M.) to ten (10) hours per day (between 7 A.M. and 10 P.M.), and the number of operating days would increase from the current 260 days per year to 365 days per year. These operational levels would result in a projected total of approximately 365 operating days and 171,329 delivery operations per year based on the scope of the Proposed Action.

1.4 FAA Role and Federal Action

The FAA has a statutory obligation to review Prime Air's request to amend the OpSpec and determine whether the amendment would affect safety in air transportation or air commerce, and to determine whether the public interest requires the amendment. In general, Congress has charged the FAA with the safety of air commerce in the United States and to encourage the development of civil aeronautics.[9]

In addition, the FAA has specific statutory and regulatory obligations related to its issuance of a Part 135 certificate and the related OpSpec. The FAA is required to issue an operating certificate to an air carrier when it "finds, after investigation, that the person properly and adequately is equipped and able to operate safely under this part and regulations and standards prescribed under this part."[10] An operating certificate also specifies "terms necessary to ensure safety in air transportation; and (2)…the places to and from which, and the airways of the United States over which, a person may operate as an air carrier."[11] Also included in air carrier certificates is a stipulation that the air carrier's operations must be conducted in accordance with the provisions and limitations specified in the OpSpec.[12]

The regulations also specify that a Part 135 certificate holder may not operate in a geographical area unless its OpSpec specifically authorizes the certificate holder to operate in that area.[13] The regulations implementing Section 44705 specify that an air carrier's approved OpSpec must include, among other things, "authorization and limitations for routes and areas of operations."[14] An air carrier's OpSpec may be

[9] 49 U.S.C. § 40104.

[10] 49 U.S.C. § 44705.

[11] Id.

[12] 14 CFR § 119.5 (g), (l).

[13] 14 CFR § 119.5(j).

[14] 14 CFR § 119.49(a)(6).

amended at the request of an operator if the FAA "determines that safety in air commerce and the public interest allows the amendment."[15] After making this determination, the FAA must take an action on the OpSpec amendment.

1.5 Purpose and Need

The **purpose** of Prime Air's request is to expand commercial drone package delivery operations in College Station, TX. Based on an assessment of the initial phase of delivery operations in College Station, TX, Prime Air has determined there is increased consumer **need** for drone delivery services, necessitating expanded operations. The MK30's extended range and reduced noise profile support Prime Air's purpose and need.

1.6 Public Involvement

The FAA provided a Notice of Availability (NOA) of the Draft Supplemental EA on May 30, 2024 to local interest groups, local government officials, public park authorities, and the State Historic Preservation Office (SHPO), tribes and Tribal Historic Preservation Offices (THPOs). On the same date, the FAA made the Draft Supplemental EA available to the general public on the FAA website. The NOA, which was published in the local College Station newspaper, The Eagle, and can be found in **Appendix A**, provides information about the Proposed Action and requests review and comments on this Draft Supplemental EA, which is available on the FAA website for a 30-day comment period. Interested parties are invited to submit comments on any environmental concerns relating to the Proposed Action to a specifically assigned email address.

[15] 14 CFR § 119.51(a); see also 49 U.S.C. § 44709.

CHAPTER 2
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 No Action and the Proposed Action alternatives.

2.1 No Action Alternative

Council on Environmental Quality (CEQ) regulations at 40 CFR § 1502.14(c) require agencies to consider a no action alternative in their NEPA analyses. Thus, the no action alternative serves as a baseline to compare the impacts of the proposed action. As described briefly in **Section 1.2** and in detail in the 2022 Final EA, the No Action alternative would entail the continued use of the MK27-2 drone at the current level of approximately 52,000 operations per year. Under the No Action alternative, the FAA would not issue the approvals necessary (e.g., the OpSpec amendment) to enable Prime Air to conduct expanded commercial drone package delivery operations in the College Station operating area, including the use of the MK30 drone and the associated increased number and range of delivery operations. Consumers in the College Station area would continue to be limited by the number of available daily package deliveries, as documented in the 2022 Final EA. This alternative does not support the stated purpose and need.

2.2 Proposed Action

In order for Prime Air to expand commercial drone package deliveries in an existing location, it must receive a number of approvals from the FAA, such as a Certificate of Waiver or Authorization (COA) and an amended OpSpec. Accordingly, Prime Air has requested the FAA to approve its OpSpec amendment so that it can expand and increase commercial drone package delivery operations by using the MK30 drone and expanding airspace access across the intended College Station operating area. The B050 OpSpec, *Authorized Areas of En Route Operations, Limitations, and Provisions*, includes a reference section titled Limitations, Provisions, and Special Requirements. The FAA's approval of this OpSpec amendment – including the paragraph in the B050 OpSpec's reference section with descriptive language about the operating area boundaries, including the specific location and operational profile proposed in Prime Air's request – is the proposed federal action for this EA. The B050 OpSpec will restrict Prime Air to this particular location; any future expansion beyond the authorization and limitations for the area of operations described in the B050 OpSpec may require additional OpSpec amendments from the FAA, and may be subject to appropriate NEPA review, as necessary.

2.2.1 Description of Proposed Operations

As described in **Section 1.3**, Prime Air anticipates operating up to 469 delivery flights per operating day, up to 10 hours per day and 7 days per week, from the College Station PADDC. These operational levels would result in a projected total of approximately 365 operating days and 171,329 delivery operations per year based on the scope of the Proposed Action. Delivery operations would occur between 7 A.M. and 10 P.M. and are anticipated to be distributed evenly across the operating area. The MK30's proposed operating range is 7.5 mi (12 km) from the PADDC, with a potential operating area of 174 sq mi (450.6 sq km). The drone departure and arrival paths from and to the PADDC would generally correspond to the geographical location of the package delivery address.

The proposed operating area, which also serves as the Study Area for the Draft Supplemental EA, is depicted in **Figure 2-1**.

2.2.2 Drone Specifications

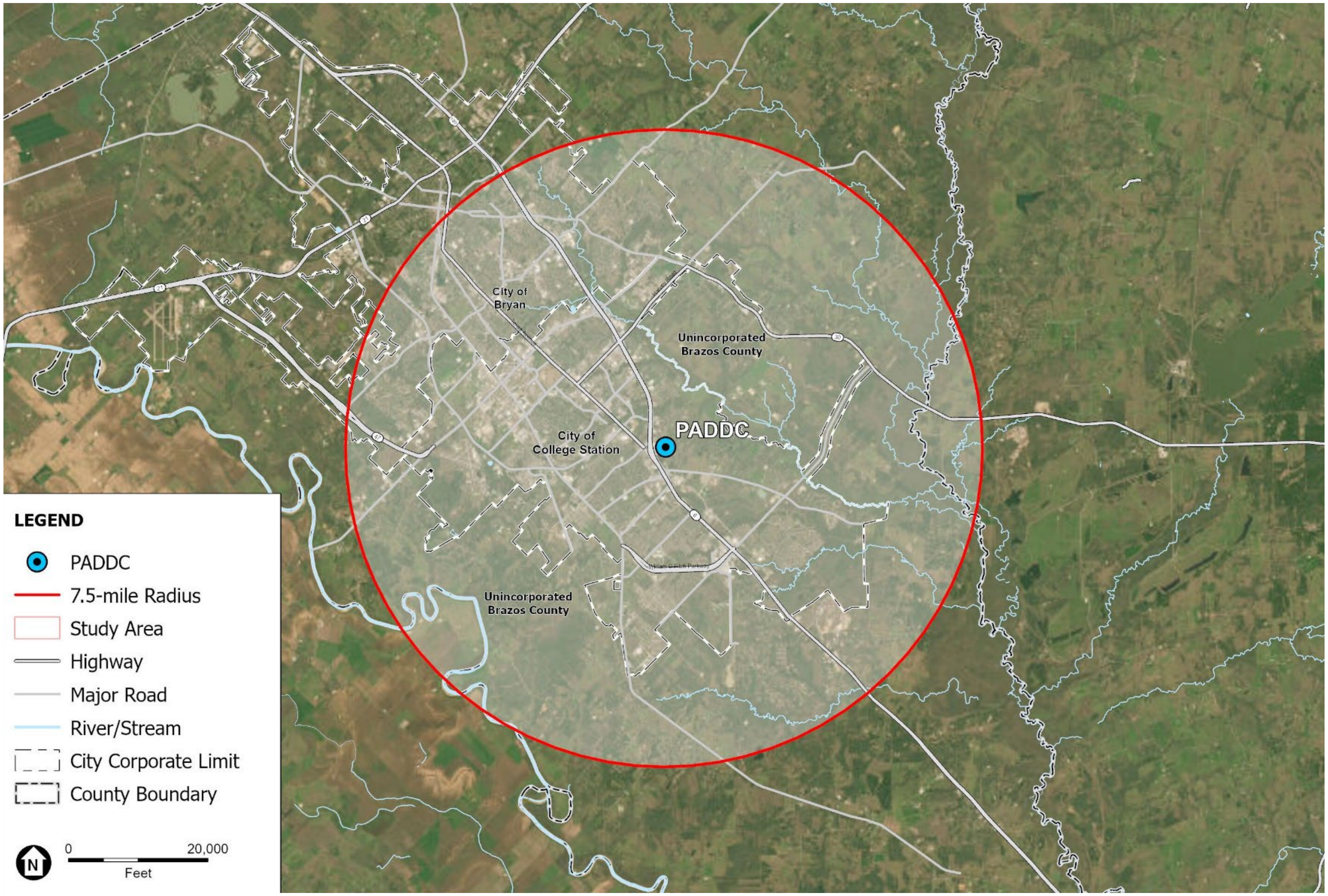
As shown in **Figure 2-2**, the MK30 is an electric powered drone that has a vertical take-off and landing, and transitions to wing borne flight using wing lift during *en route* flight. The drone systems include hardware and software designed for safety and efficiency. The airframe is composed of staggered wings, the propulsion system includes a rechargeable lithium-ion battery, and six (6) motors that include propellers designed for noise reduction, the package delivery system contains the package in a two-door interior receptacle, and a camera and avionics system that has redundancy for critical systems. The drone weighs 77.9 lbs. (35.5 kg) and has a maximum takeoff weight of 83.2 lbs. (37.8 kg), which includes a maximum payload of 5 lbs. (3 kg). It has a maximum operating range of 7.5 mi (12 km) and can fly up to 400 ft (122 m) above ground level (AGL) at a maximum cruise speed of 73 mph (64 knots) during horizontal flight.

2.2.3 Flight Operations

As shown in **Figure 2-3**, a typical flight profile can be broken into the following general flight phases: launch, *en route* outbound, delivery, *en route* inbound, and landing. After launch, Prime Air's MK30 drone would rise to an altitude of less than 400 ft (122 m) AGL and follow a predefined route to its delivery site.[16] Aircraft would typically fly *en route* at between approximately 180 to 377 ft (55 to 115 m) AGL, except when descending to drop a package. Packages would be carried internally in the drone's fuselage. When making a delivery, the drone descends, opens a set of payload doors, and drops the package to the ground from approximately 13 ft (4 m) AGL. Prime Air's drone would not touch the ground in any place other than the PADDC (except during safe contingent landings) and will remain airborne throughout the operation including the delivery stage.[17] After the package is dropped, the MK30 drone climbs vertically and follows its predefined route back to the PADDC at its assigned altitude. A close-up aerial view of the PADDC is shown in **Figure 2-4**.

[16] Prime Air may modify operations, if warranted, to avoid or minimize any negative impacts.

[17] The MK30 vehicle is built with multiple redundant safety features and "detect and avoid" technology. The drone is designed to handle unexpected situations; it is independently safe.



SOURCE: ESA, 2023; Maxar, 2022; US Census Bureau, 2021; US Geological Survey, 2022.

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Figure 2-1
Drone Operation Study Area

SOURCE: Amazon Prime Air, 2023.

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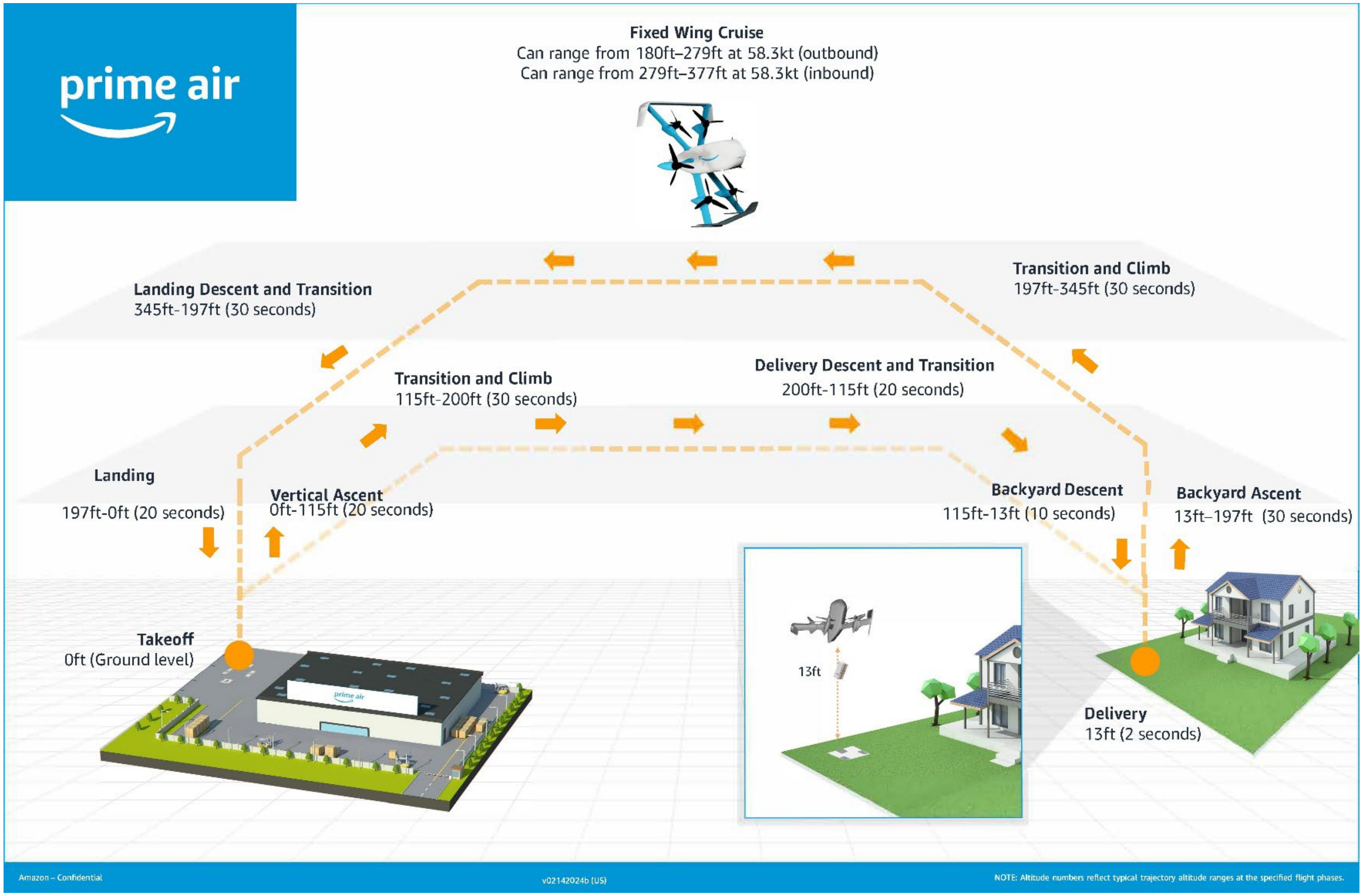
Figure 2-2
MK30 Drone



SOURCE: Amazon Prime Air, 2024.

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Figure 2-3
MK30 Drone Flight Profile

SOURCE: Amazon Prime Air, 2024.

Draft Supplemental Environmental Assessment for Amazon Prime Air — College Station, TX

Figure 2-4
Aerial View of the PADDC

CHAPTER 3

Affected Environment and Environmental Consequences

3.1 Introduction

This chapter provides a description of the affected environment and potential environmental consequences for the environmental impact categories that have the potential to be affected by the No Action Alternative and Proposed Action, as required by CEQ's NEPA–implementing regulations and FAA Order 1050.1F. 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)
- Farmlands
- Hazardous materials, solid waste, and pollution prevention
- Historical, architectural, archaeological, and cultural resources
- Land use
- Natural resources and energy supply
- Noise and noise-compatible land use
- Socioeconomics, environmental justice, and children's environmental health and safety risks
- Visual effects (including light emissions)
- Water resources (including wetlands, floodplains, surface waters, groundwater, and wild and scenic rivers)

The study area evaluated for potential impacts is defined as Prime Air's proposed operating area shown in **Figure 2-1**. The level of detail provided in this chapter is commensurate with the importance of the potential impacts (40 CFR § 1502.15). EAs are intended to be concise documents that focus on aspects of the human environment that may be affected by the Proposed Action.

3.2 Environmental Impact Categories Not Analyzed in Detail

This EA did not analyze potential impacts on the following environmental impact categories in detail because the Proposed Action would not affect the resources included in the category (see FAA Order 1050.1F, Paragraph 4-2.c).

- **Air Quality** and **Climate**: The MK30 is battery-powered and does not generate emissions that could result in air quality impacts or climate impacts. Electricity consumed for battery charging at the PADDC would be minimal. The electricity consumed for the Proposed Action would come from the power grid. College Station, TX is located in an area designated as attainment by the US Environmental Protection Agency; thus, these minimal emissions would not contribute to any exceedance of National Ambient Air Quality Standards. Research suggests that drone-based package delivery could reduce greenhouse gas (GHG) emissions and energy use in the freight sector (Lyon-Hill et al. 2020, Rodrigues et al. 2022, Stolaroff et al. 2018), which would have beneficial effects on climate change.

  The MK30 would be used to replace personal vehicle trips to stores for needed items. The Proposed Action is expected to decrease emissions from automobile delivery services that contribute to GHG emissions; as such, the decreased emissions would have positive effects on climate change as the Proposed Action would replace vehicle miles traveled by GHG-emitting consumer vehicles. MK30 operations are not expected to be impacted by climate change impacts (e.g., rising sea levels, increasing temperatures). Therefore, the Proposed Action would not affect nor be affected by the impacts of climate change, and it is consistent with the January 9, 2023, CEQ *NEPA Guidance on Consideration of Greenhouse Gas Emissions and Climate Change*.

- **Coastal Resources**: The Proposed Action would not directly affect any shorelines or change the use of shoreline zones or be inconsistent with any National Oceanic and Atmospheric Administration–approved state Coastal Zone Management Plan as there are no shorelines in the proposed area of operations. The study area is approximately 100 miles from the nearest shoreline. The Texas Coastal Zone was reviewed from the Texas Coastal Management Program on January 23, 2024 (TGLO 2024).

- **Farmlands**: The Proposed Action would 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. The Proposed Action would not affect designated prime or unique farmlands.

- **Hazardous Materials, Solid Waste, and Pollution Prevention**: The Proposed Action would not result in any construction, development, or any physical disturbances of the ground. Therefore, the potential for impacts related to hazardous materials, pollution prevention, and solid waste is not anticipated. The drones are made of common aircraft-related materials, such as steel, aluminum, and composite materials, such as plastic. Drone/battery disposal would be properly managed at the end of its operating life in accordance with applicable 14 CFR Part 10, *Disposition of life-limited aircraft parts*, and any hazardous materials would be disposed of in accordance with all applicable federal, tribal, state, and local laws, including 40 CFR Part 273, *Standards for Universal Waste Management*.

- **Land Use**: The Proposed Action would not involve any changes to existing, planned, or future land uses within the area of operations. Prime Air would use its current PADDC to conduct its MK30 operations. The PADDC must conform with all applicable local or state land use ordinances and zoning requirements.

- **Natural Resources and Energy Supply**: The Proposed Action would not require the need for unusual amounts of natural resources and materials, or those in scarce supply. The MK30 is powered by a rechargeable battery which does not consume fossil fuel (e.g., gasoline or aviation fuel) resources. The battery is charged by an electric charger which can leverage the local grid to charge the batteries. The MK30 would be used to replace personal vehicle trips to stores for urgently needed items; thus, the MK30 is expected to reduce consumption of fossil fuel resources. The Proposed Action is expected to decrease emissions from automobile delivery services that contribute to GHG emissions. The decreased emissions would have positive effects on climate change as the Proposed Action would replace vehicle miles traveled by GHG-emitting consumer vehicles.

- **Socioeconomics and Children's Environmental Health and Safety Risks**: The Proposed Action would not involve acquisition of real estate, relocation of residents or community businesses, disruption of local traffic patterns, loss in community tax base, or changes to the fabric of the community. Executive Order (EO) 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, requires federal agencies to ensure that children do not suffer disproportionately from environmental or safety risks. The proposed action would not introduce products or substances 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. It is not anticipated that the Proposed Action would pose a greater health and safety risk to children than package delivery by other means (truck, mail, personal automobile, etc.).
- **Visual Effects (Light Emissions Only)**: The Proposed Action would not result in significant light emission impacts because flights would not be conducted during the nighttime.[18]
- **Water Resources (Wetlands, Floodplains, Surface Water, Groundwater, Wild and Scenic Rivers)**: The Proposed Action would not result in any further construction of facilities and does not include any new facilities in areas identified as flood hazard areas according to the approaches established in the Federal Flood Risk Management Standard (FFRMS)[19]. The Proposed Action would 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) as the nearest NRI river segment is Village Creek and Big Sandy Creek, approximately 90 miles from the operating area boundary.
- **Biological Resources (Fish and Plants)**: The Proposed Action would not result in impacts to fish and plant species as the action is launched from developed/industrial areas, transported by drone, and delivered to residential houses and communities.

3.3 Biological Resources (Wildlife)

3.3.1 Definition of Resource and 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

[18] The FAA defines nighttime between the hours 10 P.M. and 7 A.M.

[19] Executive Order 14030, *Climate-Related Financial Risk*, May 2021.

critical habitat. In addition to their intrinsic values, biological resources provide aesthetic, recreational, and economic benefits to society.

3.3.1.1 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 may affect listed species, consultation with the USFWS must be initiated. Conversely, if the FAA determines the action would have *no effect* on listed species or critical habitat, consultation is not required.

Impacts considered significant 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.

3.3.1.2 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").

3.3.1.3 Bald and Golden Eagles

The Bald and Gold 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*." Like 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 the USFWS National Bald Eagle Management Guideline, to avoid Bald Eagle disturbance resulting from new or intermittent activities, the implementation of conservation measures to avoid operating aircraft within 1,000 feet of a nest during the breeding season should be implemented.[20] However, a Bald Eagle Disturbance Take General Permit may be offered if disturbance (range of 330 to 1,000 feet) to an in-use eagle nest is unavoidable.[21]

3.3.2 Affected Environment

This section describes the existing biological environment of the operating area. The operating area is in the Post Oak Savanna ecoregion, a transitional area between woodlands and prairies, within Brazos and portions of Burleson and Grimes Counties, Texas. The Post Oak Savanna ecoregion is characterized by gently rolling to hilly land scattered with a variety of trees, including oaks, black hickory, cedar elm, and persimmon. Today the region is mostly improved pastureland and vast acreage of grassland.[22]

The Proposed Action would take place over high to medium density developed urban and commercial areas, and some rural areas scattered throughout the study area. Therefore, wildlife habitats within the study area predominantly include parks, a few open spaces, waterways, and vacant lands. These areas provide habitat for many of the more common and ubiquitous bird and mammal species in the region, including deer, squirrels, raccoons, armadillos, wild boar, jackrabbits, mice, badgers, songbirds, raptors, waterfowl, and insects.[23]

3.3.3 Special Status Species

3.3.3.1 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. The action area covered the entire operating area, outlined in red in **Figure 2-1**. The USFWS official species list, obtained through IPaC, is included with this EA (accessed January 2024, see **Appendix B**).

Based on the official species list, there are seven (7) federally listed endangered and threatened species and one (1) candidate species with potential to occur in the action area. **Table 3-1** lists the federally threatened and endangered species that could be present in the action area. In addition, there is one critical habitat identified that overlaps the action area.

Based on the IPaC report, there are three bird species: the piping plover (*Charadrius melodus*), a threatened species; the Rufa Red Knot (*Calidris canutus rufa*), a threatened species; and the Whooping Crane (*Grus americana*), an endangered species. As noted in the official species list, both the Piping Plover and the Rufa Red Knot only need to be considered for wind energy or wind related projects, so no further analysis was conducted for those two species (please refer to **Appendix B**, page 3). Additionally, there is one mammal (Tricolored bat (*Perimyotis subflavus*)) – proposed endangered, one amphibian (Houston toad (*Bufo houstonensis*)) – endangered, one clam species Texas fawnsfoot (*Truncilla*

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20 National Bald Eagle Management Guidelines, US Fish and Wildlife Service, May 2007.

21 Department of the Interior, USFWS, Federal Register, Vol. 89, No 29 Rules and Regulations, 50 CFR Parts 13 and 22. Available at: https://www.endangeredspecieslawandpolicy.com/assets/htmldocuments/NewBlogs/EndangeredSpecies/2024-02182.pdf, accessed April 2024.

22 Texas Parks and Wildlife. Ecoregion 3 – Post Oak Savannah. Available: https://tpwd.texas.gov/huntwild/wild/wildlife_diversity/wildscapes/ecoregions/ecoregion_3.phtml, Accessed January 2024.

23 iNaturalist. Brazos County, US, TX Species. Available: Brazos County, TX, US·https://www.inaturalist.org/places/brazos-county. Accessed August 19, 2022.

macrodon)) – proposed threatened, and one flowering plant species (Navasota ladies-tresses (*Spiranthes parksii*)) - endangered, identified in the official species list (see Appendix A). The IPaC list also included one candidate species, the monarch butterfly *(Danaus plexippus*), that has the potential to occur in the action area.

TABLE 3-1
IPAC RESULTS

Species	Common Name	Species Name	Federal Status	Critical Habitat
Mammals	Tricolored bat	*Perimyotis subflavus*	Proposed Endangered	N
Birds	Rhus Red Knot	*Calidris canutus rufa*	Threatened	N
	Piping Plover	*Charadrius melodus*	Threatened	N
	Whooping Crane	*Grus americana*	Endangered	N
Clams	Texas fawnsfoot	*Truncilla macrondon*	Proposed Threatened	Y
Insects	Monarch butterfly	*Danaus plexippus*	Candidate Species	N
Plants	Navasota lades-tresses	*Spiranthes parksii*	Endangered	N

SOURCE: USFWS IPaC, accessed January 2024

Bald Eagles are not included within Table 3-1; however, they are addressed under **Migratory Birds**, below. The Whooping Crane nests much farther north in Canada; there is no threat of disturbing that critical part of their lifecycle. According to IPaC, Whooping Cranes currently exist in the wild at three locations. There is only one self-sustaining wild population, which winters in the coastal marshes in Texas at Aransas. However, Whooping Cranes migrate through the central portion of Texas, from the eastern panhandle to the Dallas-Fort Worth area to Texas' coastal plains near Rockport, in and around Aransas National Wildlife Refuge.[24] It is possible that Whooping Cranes could use wetlands and/or waterbodies within and/or adjacent to the action area as stopover habitat on their way to wintering grounds along the Gulf Coast. However, most of the identified wetlands / water bodies that exist within the action area are identified as riverine systems and and/or small water retention ponds.[25] According to the Cornell University eBird database (2019-2024), one observation of a whooping crane transitioning through the action area was documented in March 2023.[26] No sightings have been recorded on iNaturalist's Texas Whooper Watch Program.

According to IPaC and the Texas Parks & Wildlife Department (TPWD), the tricolored bat has the potential to occur within the action area. This small, yellowish-brown bat typically hibernates from September/October to April/May in caves or mines, migrating to nursery sites for the remainder of the spring and summer months.[27] During these spring and summer months, tricolored bats can be found in live and/or dead deciduous hardwood forests. Tricolored bats are known to have one emergence in the

24 Texas Parks & Wildlife Department, https://tpwd.texas.gov/huntwild/wild/species/whooper/#:~:text=Whooping%20cranes%20migrate%20throughout%20the%20central%20portion%20of,central%20coast%20during%20October-November%20and%20again%20in%20April, accessed January 2024.

25 EPA, NEPAssist, https://nepassisttool.epa.gov/nepassist/nepamap.aspx?wherestr=college+station+, accessed January 2024.

26 https://www.allaboutbirds.org/guide/Whooping_Crane/maps-sightings, accessed January 2024.

27 Texas Parks & Wildlife Department, https://tpwd.texas.gov/huntwild/wild/species/easpip/, accessed January 2024.

early evening (dusk) and one emergence later in the evening where foraging occurs along the forested edges and over pond or other waterbodies.[28]

Data received using the USFWS IPaC system also identified the monarch butterfly as potentially occurring in the action area. Monarchs occur throughout the United States during summer months and is a candidate species for federal listing. The preferred habitat for monarchs is open meadows, fields, and wetland edges with the presence of milkweed and flowering plants. Monarchs migrate through Texas in the fall and the spring through two major flyways. Monarchs enter the first flyway during the last days of September and travel from Wichita Falls to Eagle Pass. The second flyway is along the Texas coast and lasts roughly from the third week of October to the middle of November.[29]

The Texas Fawnsfoot clam and its associated critical habitat (identified Brazos and Navasota Rivers) are identified within the action area. While there is the potential for the Texas Fawnsfoot clam to exist within the action area, potential impacts to the species or its habitat are not anticipated due to the nature of the Proposed Action.

One additional plant species, Navasota ladies-tresses, is listed on IPaC as endangered. This species is known to exist within the action area, specifically within Brazos, Burleson, and Grimes Counties. Navasota Ladies-tresses are perennial herbaceous plants that occur primarily in openings of post oak woodlands, in association with sandstone glades.[30] Given the nature of the Proposed Action, it is not anticipated that activities associated with the Action would impact Navasota Ladies-tresses, nor is it anticipated that the Proposed Action would impact naturally existing plant community.

3.3.3.2 State Species of Concern

The Texas Parks and Wildlife Department's database of Rare, Threatened, and Endangered Species of Texas lists 85 species of amphibians, birds, fish, insects, mammals, mollusks, plants, and reptiles in Brazos, Burleson, and Grimes Counties, including some that are considered Species of Greatest Conservation Need (SGCN) as defined within the Texas Conservation Action Plan, updated January 31, 2024.[31] **Appendix B** provides information on the SGCN in these counties. The State of Texas maintains a list of fish and wildlife that are protected under the Texas Parks and Wildlife Code. This list includes all species that the director of the Texas Parks and Wildlife Department deems threatened with statewide extinction (Title 31, Part 2, Chapter 65, Subchapter G RULE, § 65.175 and § 65.176).[32] In addition, a species that is indigenous to the State of Texas and listed by the federal government as endangered automatically receives state protection as an endangered species. Species on this list are protected under state law: the Texas Parks and Wildlife Code (§ 68.015, *Prohibited Acts*) states that "no person may

[28] U.S. Fish & Wildlife Service, Tricolored Bat (Perimyotis subflavus) | U.S. Fish & Wildlife Service (fws.gov), accessed January 2024.

[29] Texas Parks & Wildlife Department, https://tpwd.texas.gov/huntwild/wild/wildlife_diversity/texas_nature_trackers/monarch/#:~:text=Monarchs%20funnel%20through%20Texas%20both%20in%20the%20fall,early%20November%2C%20most%20have%20passed%20through%20into%20Mexico, accessed January 2024.

[30] Texas Parks & Wildlife Department, https://tpwd.texas.gov/huntwild/wild/wildlife_diversity/nongame/listed-species/plants/navasota_ladies_tresses.phtml, accessed January 2024.

[31] Texas Parks & Wildlife Department, Species of Greatest Conservation Need – TPWD (texas.gov), accessed January 2024.

[32] Texas Endangered Species List. Available: https://texreg.sos.state.tx.us/fids/202001043-2.pdf, accessed January 2024.

capture, trap, take, or kill, or attempt to capture, trap, take, or kill, endangered fish or wildlife."[33] Additionally, the Texas Administrative Code (Title 31, Part 2, Chapter 65, Subchapter G RULE, § 65.171) states that "no person may: (1) take, possess, propagate, transport, export, sell or offer for sale, or ship any species of fish or wildlife listed by the department as endangered; or (2) take, possess, propagate, transport, import, export, sell, or offer for sale any species of fish or wildlife listed in this subchapter as threatened."[34]

3.3.3.3 Migratory Birds

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

The Bald Eagle is a migratory species that is protected under the Bald and Golden Eagle Act. Eagles may appear year-round throughout Texas as spring and fall migrants, breeders, or winter residents.[35] Bald Eagles could nest in areas near bodies of water such as Carter Lake, Lake Placid, Bee Creek, Carters Creek, or Hudson Creek in the operating area. One active Bald Eagle nest has been identified that exists within the action area, as shown in **Appendix B**. Based on the National Bald Eagle Management Guidelines, to reduce an incursion incident, aircraft should stay at least 1,000 feet from Bald Eagle nests during the breeding season unless the aircraft is operated by a trained wildlife biologist.

In addition to Bald Eagles, both Chimney Swifts and Red-Headed Woodpeckers are also migratory birds that are identified as Birds of Conservation Concern (BCC). These species are further discussed under **Section 3.3.4**, below.

3.3.4 Environmental Consequences

Drones used for commercial package delivery fly at lower speeds and elevations and are smaller than conventional aircraft. Furthermore, the drones would be hovering in fixed positions at both the nest and delivery locations leaving them temporarily exposed to a potential mobbing and/or attacking bird defending its breeding territory.

Bird behavior, in particular mobbing and territorial defense behaviors, on flying and hovering drones is the most important risk consideration analysis, as these behaviors are the most pertinent to the Proposed Action. Mobbing behavior includes birds emitting alarm calls, flying at a potential predator, diverting its attention, and harassing it. Mobbing and aerial attack behaviors typically occur when a raptor, crow, or

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13 Texas Parks and Wildlife Code, § 68.015 Prohibited Acts. Under the Federal ESA, the term "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect. Available: https://texas.public.law/statutes/tex._parks_and_wild._code_section_68.015. Accessed: September 28, 2022.

34 Texas Parks & Wildlife Department, Available: https://texreg.sos.state.tx.us/public/readtac$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=31&pt=2&ch=65&rl=171.

35 Cornell Lab of Ornithology (Cornell Lab). No Date. All About Birds: Bald Eagle. Available: https://www.allaboutbirds.org/guide/Bald_Eagle/overview.

other aerial predator enters the airspace of a breeding habitat bird or territorial male.[36] Certain species of birds are known to harass, mob, and attack aerial predators that fly into or near their territory, especially during the breeding season when birds are actively nesting. The defending birds will chase, dive bomb, attack the backside, and vocalize to harass the aerial predator until the offender is far enough from the territory that the defending birds cease attacking and return to their nests and foraging activities.[37] Not all bird species exhibit mobbing and territorial defensive behaviors. Some bird species are more aggressive, defensive, and cued on aerial predators, while other species may show aggression or interest towards an overflying hawk in its territory. Species of birds that exhibit mobbing and territorial defense behaviors include Northern Mockingbirds, kingbirds, blackbirds, grackles, jays, crows, ravens, and some raptors.

The facility where Amazon's PADDC is located was built in 1998. The MK30 drone would utilize existing PADDC infrastructure developed for the MK27-2 drone in 2022. There would be no further expansion of the PADDC or habitat modification associated with the Proposed Action, beyond what Prime Air has already completed at their PADDC site for the MK27-2. Earlier construction was not part of the Proposed Action reviewed by the FAA, and any future ground construction at the PADDC site would not require approval or authorization by the FAA.

Prime Air's aircraft would not touch the ground in any other place than the PADDC (except during emergency landings) since it remains airborne while conducting deliveries. The operations would be taking place within airspace, and typically well above the tree line and away from sensitive habitats. After launch, Prime Air's drone would rise to a cruising altitude between 180 feet and 377 feet AGL and follow a preplanned route to its delivery site. The pre-planned route is optimized to avoid terrain and object obstructions, areas of high aircraft traffic, and areas where people may gather in large numbers such as highways, parks, and schools.

Aircraft would typically stay at 180 to 377 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 drone then climbs vertically to approximately 180 to 377 feet and reverses the path taken, returning to the takeoff/landing pad at the PADDC. The drone would take approximately 53 seconds to complete a delivery, which includes the descent from en route altitude, dropping the package, and returning back to en route altitude. As a result, the duration of exposure by most wildlife on the ground to the visual or noise impacts from the drone would be of very short duration (less than a minute).

It is not likely that listed species would be in the vicinity of the delivery location because such locations would be developed areas. However, even if species were expected to be exposed to this noise level, the noise would be unlikely to cause significant disturbance (for context, a drone overflight at 50 feet is

36 Royal Society for the Protection of Birds (RPSB). 2023. What is Mobbing? Available: https://www.rspb.org.uk/birds-and-wildlife/wildlife-guides/birdwatching/bird-behaviour/what-is-mobbing/. Accessed: July 2023 and February 2024.

37 Kalb, N., and C. Randler. 2019. Behavioral Responses to Conspecific Mobbing Calls Are Predator-Specific in Great Tits (Parus major). Ecology and Evolution 9(16):9207–9213. Available: https://doi.org/10.1002/ece3.5467.

approximately 74.2 decibels, whereas a leaf blower at 50 feet is approximately 73 to 77 decibels).[38] At a potential maximum of 469 flights per day across the entire action area, the distribution and altitude of the flights are not expected to significantly affect wildlife in the action area.

A significant impact on federally listed threatened and endangered species would occur when the USFWS or NMFS determines 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.

Additionally, the FAA has looked at the potential effects of wildfires that may be caused by the Proposed Action. While the Prime Air drone has been evaluated for airworthiness and is considered to be safe for the proposed operations over the operating area, the FAA acknowledges that a crash may occur and could result in a wildfire. Amazon Prime Air will use system reported data to locate and report an off-nominal drone and will follow their Safety Management System's prescribed Incident Response Process to coordinate with local first responders as required.

The FAA understands that Prime Air would immediately notify local emergency fire response services if one of its drones were to crash, and that fire responders would be able to manage any wildfire that could occur before the wildfire could cause significant impacts to biological resources in the operating area.

3.3.4.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue the approvals necessary to enable Prime Air to conduct expanded commercial drone package delivery operations in the College Station operating area, including the use of the MK30 drone and the associated increased annual number (from 52,000 to 171,329) and range (from 3.7 mi to 7.5 mi) of delivery operations. As described briefly in **Section 1.2** and in detail in the 2022 Final EA, the No Action Alternative would entail the continued use of the MK27-2 drone at the current level of approximately 52,000 operations per year. Accordingly, the No Action Alternative would not result in impacts on biological resources.

3.3.4.2 Proposed Action

The Proposed Action includes up to 469 MK30 drone flights per day, up to 365 days per year, operating between 7 A.M. and 10 P.M. There would be no ground construction or habitat modification associated with the Proposed Action. The drone would not touch the ground in any other place than the PADDC (except during emergency landings) because it remains aerial while conducting deliveries. Scheduled deliveries would initiate from the nest, approach an en route altitude less than 400 feet AGL, and would generally occur between 180 and 377 feet AGL. The drone would lower to around 13 feet AGL and hover for two seconds to make a delivery. Then, the drone would transition back to an en route flight mode to return to the PADDC.

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38 Appendix E: Noise Assessment Amazon Prime Air MK27-2 Unmanned Aircraft Operations at College Station Texas, Table 10 and Characteristics of Lawn and Garden Equipment Sound: A Community Pilot Study (National Institutes of Health) (National), December 2017, Available https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6707732/, Table 2.

Operations would occur mostly in an urban environment, typically well above the tree line and away from sensitive habitats and given the short duration of increased ambient sound levels, flights are not expected to significantly influence wildlife in the area. A direct line of communication would be established with Texas Parks & Wildlife to discuss any potential concerns regarding impacts on wildlife or habitat in the action area. In addition, Prime Air would also specifically coordinate with the managing entities of state parks and natural areas within the action area on the thoughtful placement and use of delivery sites within these areas as necessary.

Special Status Species

Since the operations would continue to occur within airspace only, and there would be no construction or ground disturbance under the Proposed Action, it is anticipated that there would be *no effect* on the Texas fawnsfoot clam or plant species identified within the USFWS IPaC official species list. Additionally, since Texas fawnsfoot critical habitat is identified within the action area, *no effect* would occur to the habitat because of the Proposed Action.

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. Some research shows that monarch butterflies are not commonly observed at higher AGL altitudes (generally between 1 and 300 feet) and would not be expected to frequently occur at the altitudes where Prime Air is proposing to operate.[39]

The federally-endangered Whooping Crane was identified in the official species list as possibly occurring in the area, although it nests much further north in Canada so there is no threat of disturbing that critical part of their lifecycle. The Whooping Crane's traditional wintering grounds and closest critical habitat is approximately 171 miles south of the action area, in Aransas National Wildlife Refuge.[40]

While it is possible that Whooping Cranes could use the small agricultural fields in the eastern part of the operating area as stopover habitat on their way to wintering grounds along the Gulf Coast, only one recorded sighting of a whooping crane transitioning through the action area has been recorded. The FAA has found that there is no known stopover habitat in the action area based on the Texas Parks and Wildlife Nature Trackers project, Texas Whooper Watch.[41] Based on 1) operations occurring mostly in an urban environment, 2) the altitude at which the drone flies in the en route phase (150 to 300 feet AGL); 3) the expected low sound levels experienced by a whooping crane, 4) any increase in ambient sound levels would be short in duration, 5) the low probability of a whooping crane occurring in the action area, and 6) the low likelihood of the drone striking a Whooping Crane, the FAA has determined that the action *may affect, but is not likely to adversely affect*, the Whooping Crane. Any effects would be discountable (extremely unlikely to occur) or insignificant (not able to be meaningfully measured, detected, or evaluated).

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39 Altitudes attained by migrating monarch butterflies, Danaus p. plexippus (Lepidoptera: Danaidae), as reported by glider pilots. Available: https://cdnsciencepub.com/doi/abs/10.1139/z81-084. Accessed April 2022 and February 2024.

40 USFWS Whooping Crane, Critical Habitat Spatial Extents. Available: https://ecos.fws.gov/ecp/species/758#crithab. Accessed: August 2022 and February 2024.

21 Texas Parks and Wildlife, Nature Trackers, Texas Whooper Watch. iNaturalist. Available: https://www.inaturalist.org/projects/texas-whooper-watch. Accessed: August2022 and January 2024.

The tricolored bat is a proposed federally-endangered species that could be located within the action area. The Proposed Action will extend current drone service flights from 5pm to 10pm, depending on the need. This increase is anticipated to occur during the dusk emergence of bat activity during the evening civil twilight hours, however, drone service will not affect the dawn civil twilight hours. Although operations may occur during dusk emergence, tricolor bats typically forage in areas near water or along forested edges.[42] Research suggests that drones have "*minimal impact on bat behavior*"[43] and that bats do not appear to be disturbed by drones.[44] Also, the risk of bat conflicts is only present for 3 to 6 months each year (i.e., when bats are not hibernating). Tricolored bats at roost or in flight could experience drone noise during the en route and delivery flight phases. Bats foraging at or near the tree line at the time a drone flies by would experience the greatest sound levels. Roosting bats or bats foraging near the ground at the time a drone flies by would experience lower sound levels. Given the estimated sound levels of the drone, the drone's linear flight profile to and from nests and delivery locations, the short period of time the drone would be in any particular location, and the low probability of encountering an individual tricolored bat in the action area, drone noise is not expected to adversely affect tricolored bats. Any increase in ambient sound levels caused by the drone's flight would only last a few seconds during the en route phase and approximately 49 seconds during a delivery.

Bats could also be struck by a drone, particularly around dawn and dusk when foraging. Given the bat's ability to avoid flying into objects, the short period of time the drone would be in any one place, and the low probability of encountering a tricolored bat during operations, the likelihood of the drone striking a bat is not likely.

Based on 1) operations occurring mostly in an urban environment, 2) the altitude at which the drone flies in the en route phase (150 to 300 feet AGL), 3) the expected low sound levels experienced by a bat, 4) the short duration of any increases in ambient sound levels, 5) the low probability of a tricolored bat occurring in the action area, and 6) the low likelihood of the drone striking a bat, the FAA has determined the action *may affect, but is not likely to adversely affect*, the tricolored bat. Any effects would be discountable (extremely unlikely to occur) or insignificant (not able to be meaningfully measured, detected, or evaluated).

Appendix B identifies the federal and state-listed threatened and endangered species that could occur in Brazos, Burleson and Grimes Counties. The Red-Cockaded Woodpecker (*Dryobates borealis*) was identified on the Texas state endangered list and was identified on the Texas Species of Greatest Conservation Need list as potentially being found within Brazos, Burleson and/or Grimes Counties. This species is also federally - listed endangered; however, the Red-Cockaded Woodpecker was not identified within the USFWS IPaC review area. Since Red-Cockaded Woodpeckers are known to nest in old (60+ years) pines trees and given the urbanized action area, minimal habitat to support this species exists. Therefore, it is anticipated that the Proposed Action would have *no effect* to this species.

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42 US Fish & Wildlife Service, Tricolored Bat. Available: https://www.fws.gov/species/tricolored-bat-perimyotis-subflavus. Accessed: February 2024.

43 Fu, Y., M. Kinniry, and L.N. Kloepper. 2018. The Chirocopter: A UAV for Recording Sound and Video of Bats at Altitude. Methods in Ecology and Evolution 9(6):1531-1535. Available: https://doi.org/10.1111/2041-210x.12992

44 August, T. and T. Moore. 2008. Autonomous Drones Are a Viable Tool for Acoustic Bat Surveys. Available: https://www.biorxiv.org/content/10.1101/673772v1.full.pdf. Accessed July 2023 and February 2024.

Given the habitat type and distribution required by state-listed species that may occur in Brazos, Burleson and /or Grimes Counties, and due to the lack of suitable habitat in the action area, no effects to state-listed species or species habitat are anticipated.

The FAA's effect determinations for the federally-listed species discussed are presented in **Table 3-2** below.

TABLE 3-2
EFFECTS DETERMINATION TABLE

Common Name	Species Name	Federal Status	Effects Determination
Tricolored bat	*Perimyotis subflavus*	Proposed Endangered	*Not Likely to Adversely Affect (NLAA)*
Whooping Crane	*Grus americana*	Endangered	*Not Likely to Adversely Affect (NLAA)*
Texas fawnsfoot	*Truncilla macrondon*	Proposed Threatened	*No Effect*
Monarch butterfly	*Danaus plexippus*	Candidate Species	*No Effect*
Navasota lades-tresses	*Spiranthes parksii*	Endangered	*No Effect*

SOURCE: FAA, 2024.

The FAA electronically submitted a Section 7 consultation letter to the USFWS on March 19, 2024, which is included in **Appendix B**. The FAA and Amazon Prime Air are currently coordinating with USFWS staff to determine the following: time of day drone operating window, en route drone speed, and the need for and extent of possible wildlife habitat assessments/surveys. As these program elements are more fully defined during the consultation process, Section 3.3, and potentially other sections of this EA, will be updated accordingly. The Final EA will document the results of the consultation process.

3.3.4.3 Migratory Birds

Prime Air has stated to the FAA that it would monitor the operating area for any active Bald Eagle nests that may occur. Bald Eagle nests are typically very conspicuous, usually five to nine feet in diameter, with a vertical depth up to eight feet, and Prime Air should be able to visually identify any nests that may be present in the area.[45] Online resources such as iNaturalist were utilized to identify a Bald Eagle nest found during the 2023 nesting season that is located within the action area. This nest has been identified as an active nest and Prime Air has established an avoidance area such that there is a 1,000 feet vertical and horizontal separation distance between the vehicle's flight path and the nest. This avoidance area would be maintained until the end of the breeding season (September 1 through July 31 in the action area), or when/if a qualified biologist indicates the nest has been vacated. At this time, Amazon is in consultation with USFWS regarding this nest as it has been possibly identified to be located within the current operating area.

The Red-Headed Woodpecker (*Melanerpes erythrocephalus*) is a BCC within the operating area. Red-Headed Woodpeckers typically nest in tall, dead trees near marshes and open bodies of water. Throughout the Red-Headed species range, their population numbers are in decline. It is possible that Red-Headed

45 USFWS Midwest Region: Identification of Large Nests. Available: https://www.fws.gov/program/eagle-management/eagle-permits. Accessed: January 2024.

Woodpeckers may be nesting within the operating area and, while it is not anticipated, there is the possibility that drone operations in close proximity could disturb birds at nesting sites during its breeding season (May 10 to September 10). While it is not expected that infrequent drone overflights would cause adverse effects to Red-Headed Woodpeckers, Prime Air would continually monitor the operating area for their nesting sites and take avoidance measures if determined to be necessary by Prime Air.

The Chimney Swift (*Chaetura pelagica*) is another BCC within the operating area. Chimney Swifts often make their nests in manmade vertical surfaces such as within a chimney, air shaft, or abandoned buildings.[46] It is possible that Chimney Swifts may be nesting within the operating area and that drone operations in close proximity could affect its nesting sites during its breeding nesting season (March 15 to August 25). While it is not expected that infrequent drone overflights would cause adverse effects to nesting or feeding Chimney Swifts, Prime Air would continually monitor the operating area for active Chimney Swift nesting sites and take avoidance measures if determined to be necessary by Prime Air.

The other BCC species identified in the IPaC official species list breed elsewhere or they are not likely to be nesting out in the open and within close proximity to human presence. These other BCC species typically nest in forests and riparian corridor environments that are not within close proximity to locations where the Prime Air drone would be completing its ascent and descent. Additionally, the drone's en route overflights are not expected to result in effects to any lifecycles of these species.

Due to the limited operating area and proposed number of daily operations, occasional drone overflights at approximately 180 to 377 feet AGL are not expected to impact critical lifecycles of wildlife species or their ability to survive.

In summary, 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.

46 Texas Parks and Wildlife. Chimney Swift. Available: https://tpwd.texas.gov/huntwild/wild/species/cswift/. Accessed: August 2022 and February 2024.

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

3.4.1 Definition of Resource and Regulatory Setting

Section 4(f) of the U.S. Department of Transportation (DOT) Act (codified at 49 U.S.C. § 30I)) protects significant publicly owned parks, recreational areas, wildlife and waterfowl refuges, and public and private historic sites. Section 4(f) states that "… [the] Secretary of Transportation may approve a transportation program or project requiring the use of any publicly owned land from a public park, recreation area, or wildlife or waterfowl refuge of national, state, or local significance or land from a historic site of national, State, or local significance, only if there is no feasible and prudent alternative to the use of such land and the program or project includes all possible planning to minimize harm resulting from the use."

The word "use" can mean either a physical or constructive use. A physical use is the actual physical taking of a Section 4(f) property through purchase of land or a permanent easement, physical occupation of a portion or all of the property, or alteration of structures of facilities on the property. A "constructive" use does not require a physical taking of a Section 4(f) property. A constructive use would occur when a project would produce an effect, such as excessive noise, that would result in substantial impairment to a property to the degree that the activities, features, or attributes of the property that contribute to its significance or enjoyment are substantially diminished. The determination of use must consider the entire property and not simply the portion of the property being used for a Proposed Action.

The procedural obligations for Section 4(f) compliance are outlined in DOT Order 5610.1C, *Procedures for Considering Environmental Impacts*. Additionally, the FAA adheres to the regulations and guidance provided by the Federal Highway Administration (FHWA) when evaluating potential impacts on Section 4(f) properties.[47, 48] While these requirements are not obligatory for the FAA, they may be utilized as guidance to the extent that they are applicable.[49]

3.4.2 Affected Environment

The FAA used data from federal, state, and other publicly accessible sources to identify potential Section 4(f) resources within the study area. As listed in Table C-1 of **Appendix C**, the FAA identified a total of 152 properties that could meet the definition of a Section 4(f) resource, including public parks administered by city authorities. There are no state parks, national parks, or wildlife or waterfowl refuges within the operating area. Historic and cultural resources are addressed by both Section 4(f) and the National Historic Preservation Act (NHPA) of 1966 (16 U.S.C. § 470, as amended), and are discussed further in **Section 3.5**. Additionally, the FAA requested assistance from national, state, city, and county governments in identifying the appropriate stakeholders that likely have an interest in the project and its effects on Section 4(f) resources. The entities with Section 4(f) regulatory interest, such as the City of

47 FHWA, July 20, 2012. Section 4(f) Policy Paper. Office of Planning, Environment and Realty Project Development and Environmental Review, Washington, DC. Available at: https://www.environment.fhwa.dot.gov/legislation/section4f/4fpolicy.aspx.

48 23 CFR Part 774, Parks, Recreation Areas, Wildlife and Waterfowl Refuges, and historic Sites (Section 4(f)).

49 Further details about the DOT Act and Section 4(f) can be accessed in 23 CFR Part 774 et seq.

College Station, City of Bryan, and Texas A&M University, were informed of the Proposed Action and the opportunity to provide comments via the Notice of Availability, which was electronically distributed to them on May 30, 2024.

3.4.3 Environmental Consequences

3.4.3.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue the approvals necessary to enable Prime Air to conduct expanded drone commercial drone package delivery operations in the College Station operating area, including the use of the MK30 drone and the associated increased number and range of delivery operations. As described briefly in **Section 1.2** and in detail in the 2022 Final EA, the No Action Alternative would entail the continued use of the MK27-2 drone at the current level of approximately 52,000 operations per year. There would be no change in noise exposure to Section 4(f) resources under the No Action Alternative. Further, there would be no visual effects under the No Action Alternative. Accordingly, the No Action Alternative would not result in impacts on Section 4(f) properties.

3.4.3.2 Proposed Action

Under the Proposed Action, the FAA would approve Prime Air's OpSpec amendment so that it can expand and increase commercial drone package delivery operations by using the MK30 drone and expanding airspace access across the intended College Station operating areas. There would be no physical use of Section 4(f) resources because the Proposed Action has no direct interaction with any resources on the ground. Constructive use could occur when a project would produce an effect, such as excessive noise, that would result in substantial impairment to a property where the features of that property are substantially diminished. However, as discussed in **Section 3.6**, the Proposed Action would not result in a significant increase in noise levels at any location within the study area. As further described in **Section 3.8**, the short duration of en route flights would minimize any potential for significant visual impacts. Therefore, the FAA has determined that *the Proposed Action would not cause substantial impairment, or direct* or *constructive use*, as defined in **Section 3.4.1**, to any of the Section 4(f) resources in the study area.

3.5 Historical, Architectural, Archaeological, and Cultural Resources

3.5.1 Regulatory Setting

This section discusses historic, architectural, archaeological, and cultural resources within the study area. These resources reflect human culture and history in the physical environment, and may include structures, objects, and other features important in past human events. Cultural resources can also include characteristics of the physical environment such as natural features and biota that are important to traditional cultural practices and institutions.

The primary laws pertaining to the treatment of historic, architectural, archaeological, and cultural resources during environmental analyses are the *National Historic Preservation Act of 1966* (NHPA) (54 U.S.C. §§ 300101 *et seq*.), the *Archaeological Resources Protection Act* (16 U.S.C. §§ 470aa-470mm), and the *Native Graves Protection and Repatriation Act* (25 U.S.C. §§ 3001-3013).

Section 106 of the NHPA requires federal agencies with jurisdiction over a proposed federal action (referred to as an "undertaking" under the NHPA) to take into account the effects of the undertaking on historic properties and to afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on any undertaking that would adversely affect properties eligible for listing in the National Register of Historic Places (National Register). The term "historic properties" describes "any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register" (36 CFR § 800.16(l)(1)).

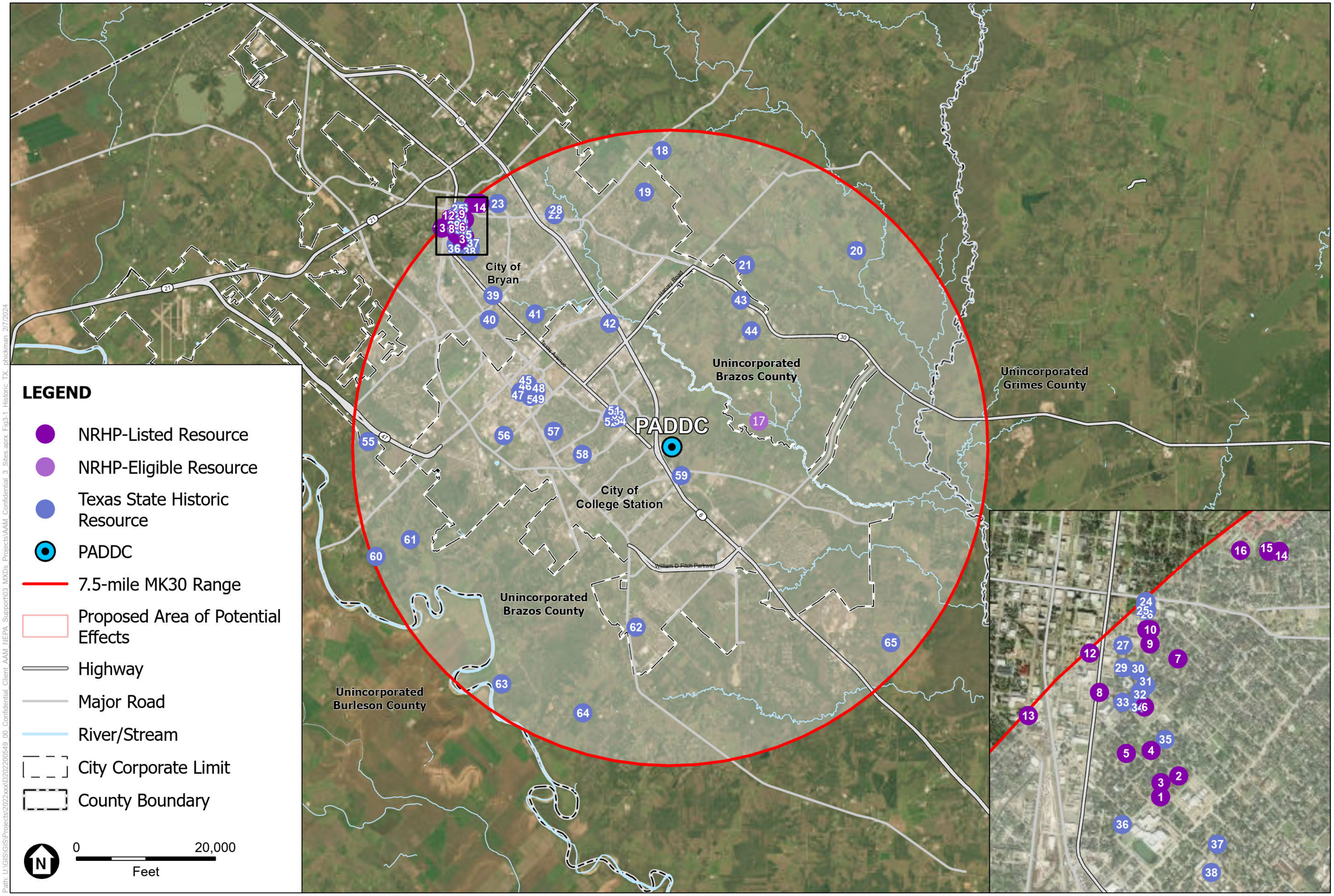
As documented in the 1050.1F Desk Reference, the regulations implementing Section 106 require the FAA to consult with certain parties, such as the SHPO and the THPO of a Federally Recognized Indian Tribe pursuant to Section 1010(d)(2) of the NHPA. Consultation with THPO(s) occurs if an undertaking is occurring on tribal lands or if an undertaking's Area of Potential Effects (APE) is located outside tribal lands but include historic resources of religious and cultural significance to a tribe. The purpose of consultation is to identify potentially affected historic properties, assess effects to such properties, and seek ways to avoid, minimize, or mitigate any adverse effects on such properties. The agency also must provide an opportunity for public involvement (36 CFR § 800.1(a)). Consultation with Federally Recognized Indian Tribes regarding issues related to Section 106 must recognize the government-to-government relationship between the Federal Government and Native American tribes as set forth in Executive Order (EO) 13175, "*Consultation and Coordination with Indian Tribal Governments*" and the Presidential Memorandum on Tribal Consultation, dated November 5, 2009.

Consultation under Section 106 is not required if the undertaking has no potential to affect historic properties. The regulations implementing Section 106 state: "If the undertaking is a type of activity that does not have the potential to cause effects on historic properties, assuming such historic properties were present, the agency official has no further obligations under section 106 of this part." (36 CFR § 800.3(a)(1)).

As discussed in FAA Order 1050.1F, the FAA has not established a significance threshold for Historical, Architectural, Archaeological, and Cultural Resources. Whether an action would result in a finding of adverse effect through the Section 106 process is a consideration when assessing the significance of an impact. However, a finding that an adverse effect has occurred does not necessarily mean an impact is significant; nor would it necessarily require the preparation of an Environmental Impact Statement. Should an adverse effect be determined to have occurred, the Section 106 process would be resolved through a Memorandum of Agreement or Programmatic Agreement to record resolution measures to mitigate or minimize adverse effects.

3.5.2 Affected Environment

An APE was established pursuant to 36 CFR § 800.4(a) which encompasses approximately 175 square miles occurring within a 7.5-mile radius surrounding the PADCC. The historical, architectural, archaeological, and cultural resources located within the APE are depicted in **Figure 3-1**. According to geospatial data published by the National Park Service, there are 16 historic resources listed in the National Register located in the APE. Additionally, there is one National Register-eligible resource, and 48 state-listed resources located in the APE. The historic and cultural attributes of these sites are unlikely to be affected by drone overflights. Historic resources occurring within the APE are listed in **Table D-1** of **Appendix D**.



SOURCE: ESA, 2023; Maxar, 2022; US Census Bureau, 2021; US Geological Survey, 2022; National Park Service, 2023; Texas Historical Commission, 2022.

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Figure 3-1
Historical, Architectural, Archaeological, and Cultural Resources
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In accordance with 36 CFR § 800.4(a)(1) and (d)(1), the FAA previously consulted with the Texas SHPO and received concurrence on July 12, 2022, that "*no historic properties are present or affected by the project as proposed*" by the initial introduction of commercial drone delivery operations using the MK27-2. For the Proposed Action (MK30 drone operations), the FAA and Amazon Prime Air are currently consulting with the Texas SHPO and the results of that consultation will be documented in the Final EA. The FAA also consulted with Tribal Governments, on April 2, 2024, that may potentially attach religious or cultural significance to resources in the APE, which include the following:

- Alabama-Coushatta Tribe of Texas
- Apache Tribe of Oklahoma
- Comanche Nation, Oklahoma
- Coushatta Tribe of Louisiana
- Kickapoo Traditional Tribe of Texas
- Tonkawa Tribe of Indians of Oklahoma
- Wichita and Affiliated Tribes (Wichita, Keechi, Waco & Tawakonie), Oklahoma
- Ysleta del Sur Pueblo

Copies of representative correspondence with potentially interested Tribal Governments are included in **Appendix D**. No replies have been received as of the publication date of the Draft EA.

3.5.3 Environmental Consequences

3.5.3.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue the approvals necessary to enable Prime Air to conduct expanded drone commercial drone package delivery operations in the College Station operating area, including the use of the MK30 drone and the associated increased number and range of delivery operations. As described briefly in **Section 1.2** and in detail in the 2022 Final EA, the No Action Alternative would entail the continued use of the MK27-2 drone at the current level of approximately 52,000 operations per year. As such, no additional drone commercial delivery operations would be implemented within the APE, and there would be no impact on any historical, architectural, archaeological, or cultural resources.

3.5.3.2 Proposed Project

The effect of drone operations on historic properties would be limited to non-physical, reversible impacts such as the introduction of audible and/or visual elements. The number of daily drone operations would be limited such that any historic or cultural resource would only be subject to a small number of overflights per day. Furthermore, as described in **Section 3.6**, a noise analysis concluded that noise levels would be below the FAA's threshold for significance, even in areas with the highest noise exposure.

The FAA is currently in the process of conducting Section 106 consultation with the Texas SHPO and the Final EA will document the results of that agency consultation.

3.6 Noise and Noise-Compatible Land Use

3.6.1 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. To ensure that noise would not cause a significant impact to any residential land use or noise sensitive resource within the study area, the FAA initiated an analysis of the potential noise exposure in the area that could result from implementation of the Proposed Action.

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. Unless otherwise noted, all sound levels discussed in this document should be understood to be A-weighted.

To comply with NEPA requirements, the FAA has issued requirements for assessing aircraft noise in Appendix B of FAA Order 1050.1F. 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 occurring 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 at a noise sensitive receiver (e.g. residential).

3.6.2 Affected Environment

As shown in **Figure 2-1**, the study area is approximately 175 square miles, and the estimated population within the area is roughly 186,000. The population density is approximately 1,100 persons per square mile.[50] There is one airport and four heliports located in the MK30 drone's proposed area of operations, to include[51]:

- Easterwood Field Airport, 1 McKenzie Terminal Blvd., College Station, TX
- Texas World Speedway Helistop, 17529 Texas 6 Frontage Rd., College Station, TX

[50] Environmental Protection Agency's (EPA) Environmental Justice Screening Tool (EJSCREEN). Available: https://www.epa.gov/ejscreen. Accessed: February 7, 2024.

[51] It is necessary to evaluate the cumulative noise exposure in areas subject to other aviation noise sources.

- Scott & White Medical Center - College Station Heliport, 700 Scott & White Dr., College Station, TX
- St Joseph Health/College Station Heliport, 1604 Rock Prairie Rd., College Station, TX
- St Joseph Hospital Heliport, 2801 Franciscan Dr., Bryan, TX

3.6.3 Environmental Consequences

3.6.3.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue the approvals necessary to enable Prime Air to conduct expanded commercial drone package delivery operations in the College Station operating area, including the use of the MK30 drone and the associated increased number and range of delivery operations. As described briefly in **Section 1.2** and in detail in the 2022 Final EA, the No Action Alternative would entail the continued use of the MK27-2 drone at the current level of approximately 52,000 operations per year. As such, no impacts to compatible land use would occur.

3.6.3.2 Proposed Action

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).[52] Drone noise generally has high-frequency acoustic content, which can often be more discernable from other typical noise sources.

To ensure that noise would not cause a significant impact to any noise sensitive area within the action area, the FAA initiated an analysis of the potential noise exposure in the area that could result from implementation of the Proposed Action. Except for on the actual PADDC property, the rural, commercial, and residential properties that are adjacent to the PADDC location are likely to experience the highest noise levels as a result of the Proposed Action. This is due to noise from drone departures from and arrivals to the PADDC, as well as more concentrated en route noise from the aircraft transiting to and from the PADDC.

Noise Exposure

Since-the MK30 drone is still under development and final noise data is not yet available, a more conservative approach was taken that uses the MK27-2 noise data to assess potential environmental impacts associated with the Proposed Action. This ensures that the noise impact of the MK30 (which was demonstrated during acoustical testing to be quieter than the MK27-2) falls within the analyzed parameters and supports the Proposed Action. The measured difference in Maximum A-Weighted Level (Lmax)[53] for the MK30 drone during the takeoff and landing phase of flight was between 5 and 7 dB lower than the MK27-2 drone, and the measured Sound Exposure Level (SEL)[54] was lower in all cases for the MK30 when compared to the MK27-2. The measured Lmax for the MK30 drone during the forward flight flyover phase were equivalent or lower when compared to the MK27-2.

[52] Federal Aviation Administration, Fundamentals of Noise and Sound. Available: https://www.faa.gov/noise/aviation_noise/fundamentals_of_noise. Accessed: April 30, 2024.

[53] Lmax is defined as the maximum, or peak, sound level during a noise event, expressed in decibels. The metric only accounts for the highest A-weighted sound level measured during a noise event, not for the duration of the event.

[54] SEL is defined as the sound energy of a single noise event at a reference duration of one second, expressed in decibels. The sound level is integrated over the period that the level exceeds a threshold. Therefore, SEL accounts for both the maximum sound level and the duration of the sound.

The flight profiles between the MK27-2 and MK30 are also similar in nature, in that they both perform a VTOL climb, a transition to fixed-wing flight en route to backyard, transition back to VTOL for descent into the backyard for delivery at 13 feet AGL, followed by the same maneuvers to return to the PADDC. Differences between the drones are shown in the manner at which they operate in each phase of flight. For example, the MK30 en route altitude is between 200 feet and 345 feet AGL as compared to the 160-foot AGL en route altitude of the MK27-2. In addition to the increased altitudes of the MK30, the ground speed also increased from 52.4 to 58.3 knots. Additional information on the drone comparison, noise measurement methodology, and results can be found in **Appendix E.**

To this end, it was determined that the MK27-2 noise exposure data would be used for this EA noise analysis. It is expected that the noise generated by the MK27-2 is equivalent to or louder than the MK30; therefore, this substitution represents a more conservative approach to estimating community noise exposure. Importantly, this substitution ensures that the noise exposure values presented in this EA are higher than what is expected to occur when the MK30 drone is deployed into delivery service. Utilizing the operational projections defined in **Chapters 1** and **2**, the noise analysis methodology detailed in **Appendix E** was used to estimate DNL levels for the proposed College Station operations. Noise levels were calculated for each flight phase and are presented in the following three sub-sections:

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

Noise Exposure for PADDC Operations

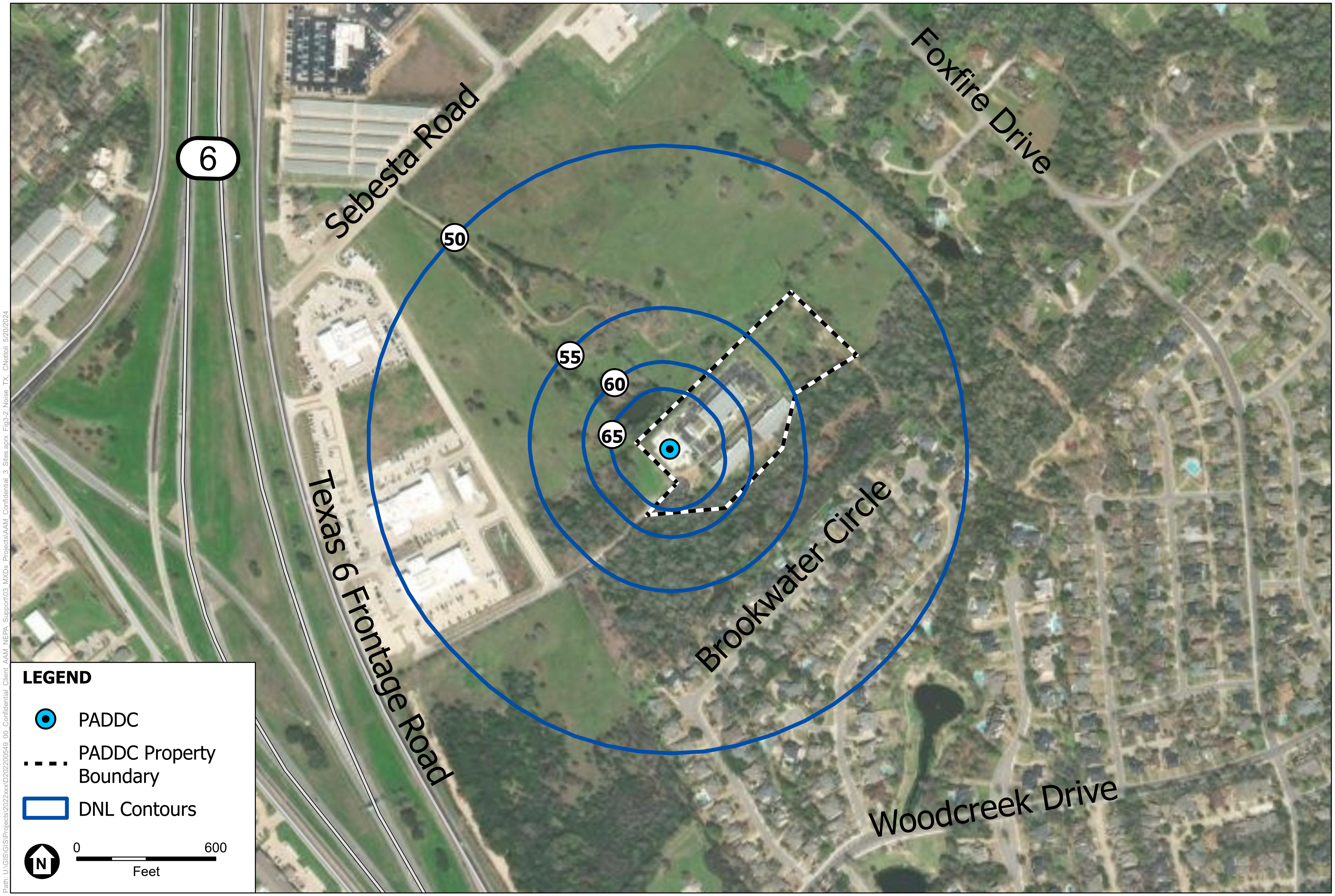
Based on the anticipated average daily maximum of 470 deliveries provided by Prime Air, the extent of noise exposure associated with PADDC operations is shown in **Figure 3-2**. This region was determined based on a review of the layout of the College Station PADDC location and using the noise level information presented in **Table 8** of the Noise Technical Report in **Appendix E**. **Table 3-3** provides the extent of noise exposure for nest operations for the DNL 65 dB and lower noise levels.

Noise Exposure for En route Operations

As described in the Noise Technical Report in **Appendix E**, the drone is expected to typically fly the same outbound flight path between the PADDC and the delivery point and inbound flight path back to the PADDC. While the average daily deliveries from the PADCC is 469, the number of overflights in a day will be dispersed because the PADCC is centrally located in the proposed operating area and delivery locations would be distributed throughout the proposed operating area. A conservative estimate for the maximum number of overflights over any one location would be half, or 235 daily overflights. The en route noise exposure can be determined by referencing **Tables 9** and **10** of the Noise Technical Report in **Appendix E**. This analysis shows that en route noise levels could reach DNL 45 dB in any location within the action area.

Noise Exposure for Delivery Operations

Due to the inherent uncertainty of the exact delivery site locations, the noise analysis developed a minimum and maximum representative distribution of deliveries in the action area. The noise analysis conservatively assumes the minimum and maximum distribution of average daily deliveries that could occur at a single delivery location. The distribution of average annual daily deliveries ranges from 0.1 to 4.0 deliveries per operating day.



SOURCE: ESA, 2023; Maxar, 2022; US Census Bureau, 2021; US Geological Survey, 2022.

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Figure 3-2
PADDC Noise Exposure Contours
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TABLE 3-3
ESTIMATED EXTENT OF NOISE EXPOSURE FROM PADDC

Annual Average Daily DNL Equivalent Deliveries	Annual DNL Equivalent Deliveries	DNL 50 dB	DNL 55 dB	DNL 60 dB	DNL 65 dB
≤480	≤175,200	1,100 feet	450 feet	250 feet	150 feet

SOURCE: ESA, 2024.

The noise exposure for delivery operations also includes en route overflights at the lower end of the typical operating altitude of 165 feet AGL, as modeled, for operations associated with deliveries to other locations. En route flight altitudes for the MK30 are expected to be flown at higher altitudes than what was modeled.

A conservative estimate of delivery noise exposure can then be determined by referencing **Table 11** of the Noise Technical Report in **Appendix E**. The estimated delivery DNL includes values at the minimum and maximum distribution of DNL equivalent deliveries at various distances from the delivery point. They include the minimum listener distance from the delivery point at 16.4 feet, which is representative of the closest distance a person may approach before the aircraft takes automated actions to safely cancel the delivery. This is in addition to the minimum measured distance from the drone for which noise measurement data was available for a delivery, which is 32.8 feet. Values were also calculated at distances of 50 feet, 75 feet, 100 feet, and 125 feet from the delivery point, and are representative of distances from which nearby properties may experience noise from a delivery based on the average lot size for sold homes as reported in the 2022 US Census.[55] The noise exposure for any one delivery point (with en route noise as mentioned above) is provided in **Table 3-4**. Noise exposure from deliveries is shown graphically in **Figure 3-3**. The noise exposure is depicted over the PADDC but is only representative of a maximum of five deliveries at any one delivery point.

TABLE 3-4
DNL FOR DELIVERY LOCATIONS BASED ON MAXIMUM DELIVERIES PER LOCATION

Average Daily DNL Equivalent Deliveries	Annual DNL Equivalent Deliveries	Estimated Delivery DNL at 16 Feet[1]	Estimated Delivery DNL at 32.8 Feet[2]	Estimated Delivery DNL at 50 Feet	Estimated Delivery DNL at 75 Feet	Estimated Delivery DNL at 100 Feet	Estimated Delivery DNL at 125 Feet
≤5	≤1,825	58.1	54.7	53.7	52.2	50.2	48.6

NOTES:
1. Minimum possible listener distance from drone.
2. Minimum measured listener distance.
3. Assumes conservative estimate of 235 overflights over any one delivery location as mentioned above.

SOURCE: ESA, 2024.

55 The 2022 US Census national average lot size for single-family sold homes was 15,265 square feet. This is representative of a property with dimensions of a 123.55 x 123.55-foot square. 125 feet represents a 125-foot lateral width of the parcel rounded up to the nearest 25 feet. Available: https://www.census.gov/construction/chars/xls/soldlotsize_cust.xls. Accessed: January 18, 2024.

SOURCE: ESA, 2023; Maxar, 2022; US Census Bureau, 2021; US Geological Survey, 2022.

Figure 3-3
Noise Exposure Contours Based on Maximum Deliveries Per Location
College Station, TX

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Table 3-4 shows that, with the maximum number of average annual daily deliveries at a single location, including overflights, noise levels at or above DNL 49 dB could extend beyond 125 feet from the delivery location and may reach adjacent properties. However, these noise levels would not exceed the FAA's significance threshold for noise of DNL 65 dB in any of the areas where Prime Air anticipates conducting deliveries.

Total Noise Exposure Results

The maximum noise exposure levels within the action area would occur at the PADDC site where noise levels at or above DNL 50 dB would extend approximately 1,100 feet from the College Station PADDC. Noise levels at or above DNL 65 dB would extend approximately 150 feet from the PADDC, although this is within the PADDC property. Additionally, the estimated noise exposure for en route operations could reach DNL 45 dB at any location within the action area, and the estimated noise exposure for delivery operations, including en route overflights, would not have the potential to exceed DNL 55 dB at any location in the action area and is below the FAA's threshold of significance for noise.

College Station has a noise ordinance under Section 26.8 of the College Station Code of Ordinances which declares a nuisance and prescribes an offense for unreasonable noise between 7 A.M. and 10 P.M. measured from the property line of a residence located in a residential-zoned property that exceeds 63 dB and would disturb or annoy a person of ordinary sensibilities.[56] Likewise, Section 26.8 declares a nuisance and prescribes an offense for unreasonable noise between 10:01 P.M. and 6:59 A.M. that exceeds 56 dB and would disturb or annoy a person of ordinary sensibilities.

As explained in **Section 3.6.1** above, the FAA has an established noise significance threshold, defined in FAA Order 1050.1F, which is used when assessing noise impacts in a particular project area. A significant noise impact is defined 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. Based on the results of the noise analysis performed for this EA, the DNL 65 dB contour is expected to extend approximately 150 feet from the launch pads and be contained within PADDC property. Thus, noise impacts from the College Station operations are not expected to result in a significant impact. Nor is the noise generated by the College Station operations expected to be incompatible with noise sensitive resources within the action area. The resulting noise exposure for delivery site locations at a distance of 32 feet between drone and receiver is DNL 54.7 dB. Noise exposure from deliveries includes the en route overflight at the typical operating altitude of 165 feet AGL, as modeled in **Appendix E**. The maximum noise exposure at any property line in residential zoned property would not exceed DNL 55 dB, which is well below the FAA's DNL 65 dB significance threshold.

[56] City of College Station, Texas. Code of Ordinances Sec. 26-8 – Noise. Available: https://library.municode.com/tx/college_station/codes/code_of_ordinances?nodeId=SPAGEOR_CH26MIPROF_S26-8NO. Accessed: February 2024.

3.7 Environmental Justice

3.7.1 Regulatory Setting

Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation and enforcement of environmental laws, regulations and policies. Fair treatment means no group of people should bear a disproportionate share of the negative environmental consequences resulting from industrial, governmental and commercial operations or policies. Meaningful involvement means people have an opportunity to participate in decisions about activities that may affect their environment and/or health; the public's contribution can influence the regulatory agency's decision; community concerns will be considered in the decision-making process; and decision makers will seek out and facilitate the involvement of those potentially affected.[57]

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, was enacted in 1994. The purpose of the EO is to focus federal attention on the environmental and human health effects of federal actions on minority and low-income populations with the goal of achieving environmental protection for all communities. The EO directs federal agencies to identify and address the disproportionately high and adverse human health or environmental effects of their actions on minority and low-income populations, to the greatest extent practicable and permitted by law. The order is also intended to promote nondiscrimination in federal programs that affect human health and the environment, as well as provide minority and low-income communities' access to public information and public participation.

EO 14096, *Revitalizing Our Nation's Commitment to Environmental Justice for All* (April 21, 2023), made changes to federal policy regarding environmental justice including an update of the definition of environmental justice, an expansion of what constitutes an environmental justice impact, and a broadening of what constitutes a community with environmental justice concerns.

DOT Order 5610.2C, *Procedures for Considering Environmental Impact*, incorporates consideration of environmental justice principles into the Department of Transportation's planning and decision-making processes. The order provides helpful guidance for defining minority and low-income populations. The term minority population is established to refer to "any readily identifiable groups of minority persons who live in geographic proximity, and if circumstances warrant, geographically dispersed/transient persons (such as migrant workers or Native Americans) who will be similarly affected by a proposed DOT program, policy, or activity." A minority person is defined as a person who is:

- Black: a person having origins in any of the black racial groups of Africa;
- Hispanic or Latino: a person of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race;
- Asian American: a person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent;

57 US Environmental Protection Agency, https://www.epa.gov/environmentaljustice/learn-about-environmental-justice (accessed February 5, 2024).

- American Indian and Alaskan Native: a person having origins in any of the original people of North America, South America (including Central America), and who maintains cultural identification through tribal affiliation or community recognition; or
- Native Hawaiian and Other Pacific Islander: people having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands.

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

The FAA has not established a significance threshold for Environmental Justice. FAA Order 1050.1F indicates the factors to be considered in determining whether an action would have the potential to lead to a disproportionate and adverse impact to communities with environmental justice concerns include:

- Significant impacts in other environmental impact categories; or
- Impacts on the physical or natural environment that affect a community in a way that the FAA determines are unique to communities with environmental justice concerns and significant to that population.

Whether an adverse effect is "disproportionately high" on minority and low-income populations depends on whether that effect is:

- Predominantly borne by an environmental justice community of concern population, or
- Will be suffered by the environmental justice community of concern population and is appreciably more severe or greater in magnitude than the adverse effect that will be suffered by the population outside of the environmental justice community of concern.[58]

3.7.2 Affected Environment

The environmental justice communities of concern were identified using demographic and socioeconomic data derived from 2022 American Community Survey data published by the US Census Bureau. The census block group level of census geography was used to map populations, and to compare minority populations and occurrences of household income below the Department of Health and Human Services Poverty Guidelines.

The study area intersects 134 census block groups occurring within Brazos, Burleson, and Grimes Counties. The total land area of the census block groups intersected by the GSA comprised the reference area used to determine communities of environmental justice concern. An aggregation of the 134 census block groups comprising the reference area was determined to serve as the baseline to which individual census block groups were compared. Data for the State of Texas and the United States were also provided for additional context.

[58] Federal Aviation Administration, Office of Environment and Energy, 1050.1F Desk Reference, p. 12-12, October 2023.

Census block groups were identified as communities of environmental justice concern when the proportion of minority or low-income populations exceeded that of the reference area.

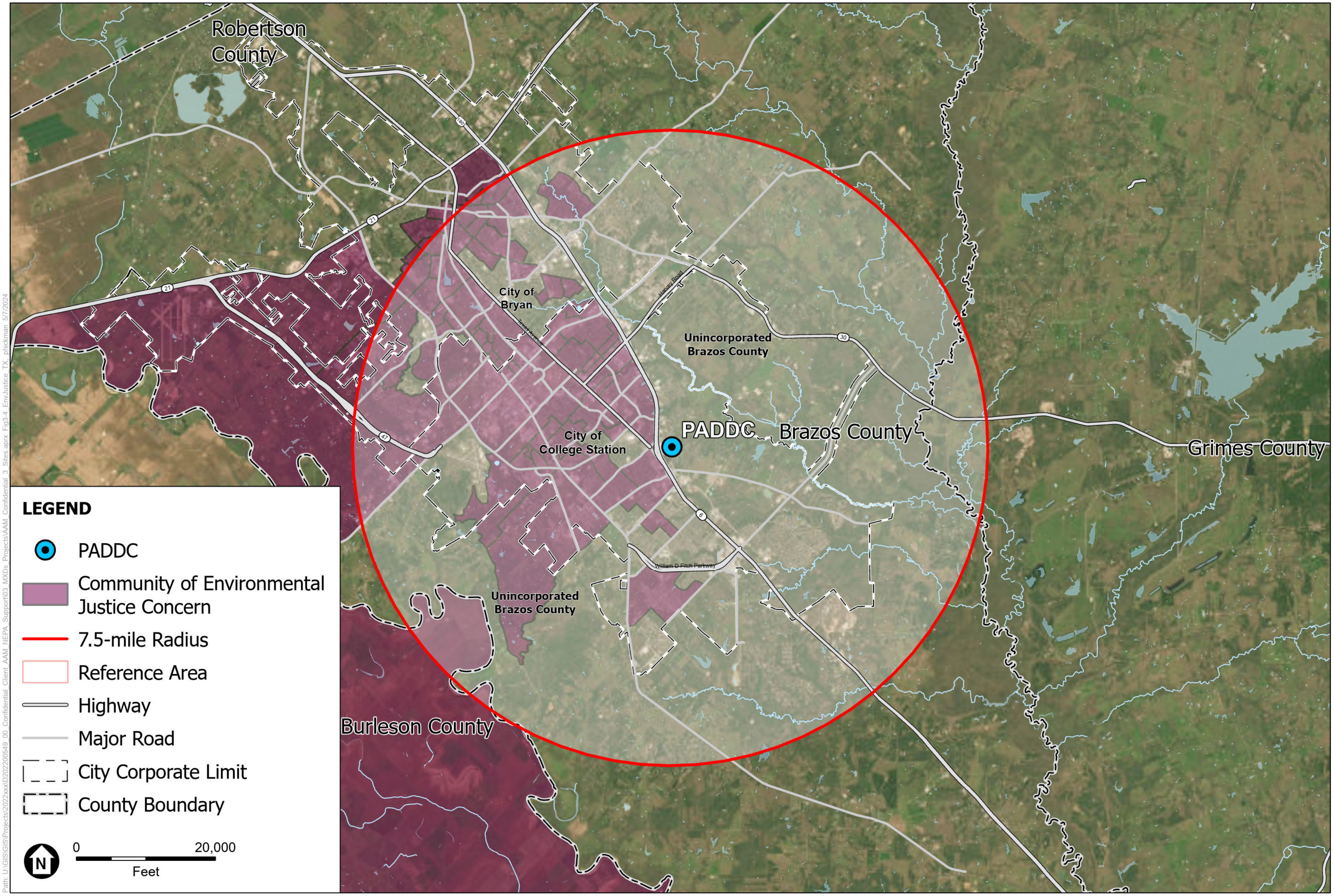
The demographic data for the census block groups within the reference area are presented in **Tables F-1** and **F-2** of **Appendix F**. The data were gathered from 2018-2022 American Community Survey 5-Year Estimates from the U.S. Census Bureau. The HHS Poverty Guidelines were gathered from the US Department of Health and Human Services Federal Poverty Income Guidelines, effective January 17, 2024.[59]

Table F-1 indicates the racial demographic information for the reference area and all 134 census block groups. The percentage of the population identified as minority includes the total population, less the white, non-Hispanic population. The minority population of the reference area is 41 percent of the total population. The aggregate threshold for the reference area discussed above was used to determine communities of environmental justice concern.

Table F-2 indicates the income and poverty data for each area. The Health and Human Services Poverty Guidelines in **Table F-2** were determined by comparing the Federal Poverty Income Guidelines annual income per persons to the average household size provided by the American Community Survey 5-year estimates. The poverty threshold is proportional to the household size, and both measures are presented in the table. The percentage of households below poverty were determined by gathering the annual household income below the Health and Human Services Poverty Guideline. As with the data on ethnicity, the low-income population aggregate threshold for the reference area was used to determine communities of environmental justice concern. Approximately 24 percent of the households residing in the reference area are living below poverty. Any census block group whose percentage of households below poverty equals or exceeds the reference area constitutes a community of environmental justice concern. Reference Area communities of environmental justice concern are listed in **Table F-3** of **Appendix F**.

Of the 134 census block groups evaluated in the reference area, 90 have been identified as communities of environmental justice concern. This total includes 63 census block groups with minority populations exceeding the average for the reference area and 63 census block groups with occurrences of low-income households exceeding that of the reference area aggregate percentage. There are 36 census block groups identified as having both a minority population and a percentage of low-income households exceeding the reference area aggregate percentage. Communities of environmental justice concern in the reference area are depicted on **Figure 3-4**.

59 US Department of Health and Human Services, Poverty Guidelines, January 17, 2024. https://aspe.hhs.gov/topics/poverty-economic-mobility/poverty-guidelines.



SOURCE: ESA, 2023; Maxar, 2022; US Census Bureau, 2022; US Geological Survey, 2022.

Figure 3-4
Reference Area Communities of Environmental Justice Concern
College Station, TX

ESA

3.7.3 Environmental Consequences

3.7.3.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue the approvals necessary to enable Prime Air to conduct expanded commercial drone package delivery operations in the College Station operating area, including the use of the MK30 drone and the associated increased number and range of delivery operations. As described briefly in **Section 1.2** and in detail in the 2022 Final EA, the No Action Alternative would entail the continued use of the MK27-2 drone at the current level of approximately 52,000 operations per year. Accordingly, there would be no adverse effects on low-income or minority populations as no new types of operations would be introduced into the reference area.

3.7.3.2 Proposed Project

As indicated throughout this EA, the Proposed Action *would not result in significant impacts in any environmental impact categories evaluated,* and there is no indication any disproportionately high and adverse effects would be borne by any communities with environmental justice concerns. As noted in **Section 3.6**, the drone's noise emissions could be perceptible in areas within the study area, but noise exposure equal to or greater than DNL 65 dB, the level determined to constitute a significant impact, would not occur in any residential areas or other sensitive locations. Furthermore, the drone delivery operations could provide increased access to in-demand goods without increasing congestion on local roads. As traffic congestion can have a disproportionate effect on low-income populations, the implementation of commercial drone delivery services could positively affect low-income populations.

Thus, the Proposed Action would not create impacts exceeding thresholds of significance in any environmental impact categories; neither would the Proposed Action generate impacts that affect an environmental justice population in a way that the FAA determines are unique and significant to that population. Therefore, *the Proposed Action would not result in significant environmental justice impacts or disproportionately high and adverse effects on minority and low-income populations*.

3.8 Visual Effects (Visual Resources and Visual Character)

3.8.1 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 drone in flight – which could be out of character with the suburban or natural landscapes.

The FAA has not developed a visual effects significance threshold. Factors the 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.

3.8.2 Affected Environment

The Proposed Action would take place over a combination of suburban and rural properties. As noted in **Section 3.4**, there are public parks that could be valued for aesthetic attributes within the study area. Prime Air's proposal is to avoid overflights of large open-air gatherings of people during the scope of the Proposed Action, which includes public parks and other public properties that may be covered under Section 4(f) (which are identified in **Appendix C**).

3.8.3 Environmental Consequences

3.8.3.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue the approvals necessary to enable Prime Air to conduct expanded drone commercial drone package delivery operations in the College Station operating area, including the use of the MK30 drone and the associated increased number and range of delivery operations. As described briefly in **Section 1.2** and in detail in the 2022 Final EA, the No Action Alternative would entail the continued use of the MK27-2 drone at the current level of approximately 52,000 operations per year. As such, there would be no visual impacts associated with the No Action Alternative.

3.8.3.2 Proposed Action

The Proposed Action makes no changes to any landforms or land uses, and visual effects would be short-term in nature; thus, there would be no effect to the visual character of the area. Excluding ground-based activities supporting the drones, operations would be occurring in airspace only. The FAA estimates that at typical operating altitude and speeds the drone en route would be observable for approximately 3.6 seconds by an observer on the ground. The Proposed Action involves airspace operations that are unlikely to result in visual impacts anywhere in the study area, including Section 4(f) properties. The short duration that each drone flight could be seen from any resource in the operating area – approximately 3.6 seconds while the drone is traveling en route at 52.4 knots (approximately 60 mph) – and the distribution of flights throughout the 175-square mile operating area, would minimize any potential for significant visual impacts at any location in the study area. Any visual effects are expected to be similar to existing air traffic in the vicinity of the operating area. Therefore, *the Proposed Action would not result in significant visual impacts*.

CHAPTER 4
Cumulative Effects

Consideration of cumulative impacts applies to the impacts resulting from implementing the Proposed Action along with other actions. The CEQ regulations define cumulative impacts 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 most of the potential impacts discussed in Chapter 3, *Affected Environment and Environmental Consequences*, were found to be minimal and given that drone operations are unlikely to interact with other outside actions due to the short duration of flights, the Proposed Action's contribution to cumulative impacts in the Study Area would primarily be from noise. Thus, this section will focus on the Proposed Action's potential cumulative impact on the noise environment.

Because drone operations would occur in areas subject to other aviation noise sources, it is necessary to evaluate the cumulative noise exposure that would result from the other aviation noise sources present. Examples of such scenarios are drone operations occurring in the vicinity of Prime Air's operating areas with increased aviation activity (e.g., where other commercial drone operators operate or operations close to airports). Aviation noise sources are most likely to be the dominant contribution to noise exposure near airports. By comparison, other sources of noise would not appreciably contribute to overall noise levels at these locations.

Easterwood Field Airport, which is located in a portion of the drone's proposed area of operations, operates with controlled surface area Class D airspace. For areas where the drone operating area does not overlap with Easterwood Field Airport's Class D airspace, there would be little potential for the cumulative effect of traditional aircraft noise combined with drone noise. Based on calculations presented in the Noise Technical Report in **Appendix E**, the potential for noise and compatible land use cumulative effects could result from drones and traditional aircraft operating within an airport's DNL 55 dB contour (overlapping inside Class D airspace). However, the potential for cumulative effects would be minimized because Prime Air's PADDC is not located near the vicinity of the Easterwood Field Airport's DNL 55 dB contour.[60] Prime Air's delivery route planning would take into account air traffic to avoid dense airspace restrictions such as airport runways. This would help avoid potential noise cumulative effects of the air traffic near Easterwood Field Airport. There are no other known Part 135 commercial drone

[60] DNL contours for Easterwood Field Airport were reported in 2005 Master Plan. While the DNL 60 dB extends several thousand feet from the main runway ends, it can be expected that the current fleet operating at the airport would result in a smaller noise exposure due to changes in fleet mix. As such, it was assumed that drone activity could be possible within the DNL 55 dB, although unlikely. For additional information, see Appendix E. https://fcor.tamu.edu/downloads/Easterwood%20Airport%20Combined.pdf.

package delivery operators conducting operations in proximity to Prime Air's proposed MK30 operations area or the PADDC, which is located in an area zoned for commercial activities. As such, the addition of Prime Air's commercial delivery service is not expected to result in cumulative effects with other potential Part 135 commercial drone operations. Any future Part 135 operators would be required to work with the FAA to complete an environmental review before beginning operations, ensuring that any potential cumulative effects are properly analyzed and disclosed, and the appropriate siting of potential drone operating facilities would be considered to avoid a significant impact on the environment.

In the future, other drone operators may propose locating operations within this Proposed Action's Study Area. Should that occur, Prime Air understands the potential for impacts may increase due to another operator's activities and would work with that operator and the FAA to mitigate potential impacts. Additionally, the FAA would conduct a new environmental analysis – including noise and cumulative impacts – prior to another operator beginning drone package delivery operations in this area.

As discussed in Chapter 3, the Proposed Action is not expected to significantly impact any of the environmental impact categories. Areas of existing aviation noise sources within the Study Area would be avoided; thus, the Proposed Action would not contribute to significant cumulative noise impacts. No other actions are anticipated to interact with the Proposed Action in a way that could result in cumulative effects; therefore, *the Proposed Action is not expected to result in significant cumulative effects*.

Appendix A
Notice of Availability

(English and Spanish Versions)

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

Washington, D.C.

Notice of Availability, Notice of Public Comment Period, and Request for Comment on the Draft Supplemental Environmental Assessment for Amazon Prime Air Package Delivery Operations in College Station, Texas

The Federal Aviation Administration (FAA) provides notice that a Draft Supplemental Environmental Assessment (EA), prepared pursuant to the National Environmental Policy Act (NEPA) (42 United States Code §§ 4321 – 4355), to assess Amazon Prime Air's proposed commercial drone delivery service in the College Station, TX area is available for review and comment.

Amazon Prime Air is seeking to amend its air carrier Operation Specifications (OpSpec) and other FAA approvals necessary to expand commercial drone delivery operations in Texas. The FAA's approval of the amended OpSpec is considered a major federal action under NEPA and Council on Environmental Quality (CEQ) NEPA–implementing regulations (40 Code of Federal Regulations Parts 1500–1508) and requires a NEPA review. The Draft EA is submitted for review pursuant to NEPA, CEQ NEPA Implementing Regulations, FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*, Section 4(f) of the Department of Transportation Act (49 U.S.C. § 303), and Section 106 of the National Historic Preservation Act (16 U.S.C. § 470). The Draft EA will be available for a 30-day public review beginning on Thursday, May 30th, 2024, and ending on Friday, June 28th, 2024.

The Draft EA is available for online review at:
https://www.faa.gov/uas/advanced_operations/nepa_and_drones

Comments on the Draft EA may be submitted electronically to 9-faa-drone-environmental@faa.gov. Written comments may be submitted via U.S. Mail to the address below. Please ensure adequate time for receipt. All comments must be received by 5:00 p.m. Central Time on *Friday, June 28, 2024*.

Federal Aviation Administration, Suite 802W
C/O AVS Environmental
800 Independence Ave SW
Washington, DC 20591

All substantive comments received will be responded to in the Final EA.

PRIVACY NOTICE: Before including your address, phone number, email address, or other personal identifying information in your comment, be advised that your entire comment – including your personal identifying information – may be made publicly available at any time. While you can ask us in your comment to withhold from public review your personal identifying information, we cannot guarantee that we will be able to do so.

DEPARTMENTO DE TRANSPORTACIÓN

Administración Federal de Aviación

Washington, D.C.

AVISO DE DISPONIBILIDAD, NOTIFICACIÓN DE PERÍODO DE COMENTARIOS PÚBLICOS Y SOLICITUD DE COMENTARIOS SOBRE EL BORRADOR DEL SUPLEMENTO DE EVALUACIÓN AMBIENTAL PARA OPERACIONES COMERCIALES DE ENTREGA DE PAQUETES MEDIANTE DRONES DE AMAZON PRIME AIR EN COLLEGE STATION, TX

La Administración Federal de Aviación (FAA, sigla en inglés) notifica que un Borrador del Suplemento de Evaluación Ambiental (EA), preparado conforme a la Ley de Política Ambiental Nacional (NEPA) (42 Código de los Estados Unidos §§ 4321 - 4355), para evaluar el servicio propuesto por Amazon Prime Air para llevar acabo operaciones comerciales de entrega de paquetes mediante drones en el área de College Station, TX, está disponible para revisión y comentarios.

Amazon Prime Air busca enmendar sus especificaciones operacionales (OpSpec) y otras autorizaciones emitidas por la FAA que son necesarias para expandir las operaciones comerciales de entrega de paquete mediante drones en Texas. La aprobación de la FAA de los OpSpecs enmendados se considera una acción federal mayor en virtud de NEPA y de los reglamentos de implementación del Consejo de Calidad Ambiental (CEQ) de NEPA (40 Código Federal de Reglamentos Partes 1500-1508) y requiere una evaluación bajo NEPA. El Borrador de EA ha sido sometido para revisión conforme a NEPA, los reglamentos de implementación de CEQ NEPA, la Orden 1050.1F de la FAA, *Impactos Ambientales: Políticas y Procedimientos*, Sección 4(f) de la Ley del Departamento de Trasportación (49 U.S.C. § 303), la y Sección 106 de la Ley de Preservación Nacional Histórica (16 U.S.C. § 470).

El Borrador de EA estará disponible para revisión pública durante 30 días a partir del jueves, 30 de mayo de 2024 hasta el viernes 28 de junio de 2024.

El Borrador de EA está disponible para revisión en línea en:
https://www.faa.gov/uas/advanced_operations/nepa_and_drones

Se pueden someter comentarios electrónicos sobre el Borrador de EA enviándolos 9-faa-drone-environmental@faa.gov. También se pueden someter enviando un escrito por correo postal a la dirección a continuación. Asegúrese de dejar tiempo suficiente para la recepción de sus comentarios. Todos los comentarios deben recibirse antes de las 5:00 p.m., hora Central, el viernes 28 de junio de 2024.

Federal Aviation Administration, Suite 802W
C/O AVS Environmental
800 Independence Ave SW
Washington, DC 20591

Se responderá a todos los comentarios recibidos en el EA final.

AVISO DE PRIVACIDAD: Antes de incluir su dirección, número de teléfono, dirección de correo electrónico u otra información de identificación personal en su comentario, tenga en cuenta que la totalidad de su comentario, incluida su información de identificación personal, podría hacerse pública en cualquier momento. Si bien puede pedirnos en su comentario que no divulguemos al público su información de identificación personal, no podemos garantizar que podamos hacerlo.

Appendix A-1
NOA Distribution List

Prime Air NEPA Notice of Availability Distribution - College Station

Name	Organization	Email Contact	Type of Contact
Bill Norman	Foxfire HOA	6normans@bellsouth.net	Homeowner's Assn President
Kathy Brick	Foxfire HOA	katbrick17@gmail.com	Homeowner's Assn Secretary
General HOA	Foxfire HOA	foxfirehoa@gmail.com	Homeowner's Assn General Inbox
Cindy Giedraitis	Sandstone HOA	safetycmg@gmail.com	Homeowner's Assn President
David Higdon	Emerald Forest HOA	agdad74@gmail.com	Homeowner's Assn President
Jason Jaggars	Emerald Forest HOA	thejaggars@hotmail.com	Homeowner's Assn Secretary
BHHS Caliber	Emerald Forest HOA	HOAMGMT18@bhhscaliber.com	Homeowner's Assn Manager
Jimmy Brown	Amberlake HOA	jimmy.brown457@gmail.com	Homeowner's Assn Board Member
Tom Moore	Amberlake HOA	ralphtmoore@yahoo.com	Homeowner's Assn Board Member
Suzan Reed	Amberlake HOA	suzanr@bhhscaliber.com	Homeowner's Assn Manager
Kyanne Hoak	Shadowcrest HOA	kyannev@gmail.com	Homeowner's Assn President
Gabe Neal	Shadowcrest HOA	stacyandgabe@gmail.com	
Suzan Reed	Shadowcrest HOA	suzanr@bhhscaliber.com	Homeowner's Assn Manager
Robert Chronister	Chadwick--HOA	chroni66@hotmail.com	
Dwight Allen	Stonebridge--HOA	drallen34@outlook.com	Homeowner's Assn President
Tiffany York	Stonebridge--HOA	help@associationservicesbcs.com	Homeowner's Assn Manager
Michael McCaul	Member of Congress - Michael McCaul	andrew.ross@mail.house.gov, destinee.vargas@mail.house.gov	Elected official
John Raney	State Rep	john.raney@house.texas.gov;	Elected official
Kyle Kacal	State Rep	kyle.kacal@house.texas.gov	Elected official
Charles Schwertner	State Senator	charles.schwertner@senate.texas.gov	Elected official
Susan Davenport	Brazos Valley EDC	sdavenport@brazosvalleyedc.org	Community Partner
Glen Brewer	Bryan-College Station Chamber	Glen@bcschamber.org	Community Partner
Todd McDaniel	City of Bryan, TX Economic Development	tmcdaniel@bryantx.gov	Community Partner
Kelli Weatherman	Texas A&M University	kelliweatherman@tamu.edu	University partner
William Rice	St. Joseph Health (heliport)	william.rice@commonspirit.org	Aviation stakeholder
Kevin Davis	Easterwood Airport	kmdavis49@gmail.com	Aviation stakeholder - Airport Manager
Jeff Borowiec	Texas Transportation Institute	Borowiec, Jeff' <j-borowiec@tti.tamu.edu>	University partner

Prime Air NEPA Notice of Availability Distribution -
City of College Station

Department	Contact Name	Email	About
Parks and Recreation Department	Kelsey Heiden - Director	parks@cstx.gov/swright@cstx.gov	
Neighborhood Services	Barbara Moore	NeighborhoodServices@cstx.gov/bmoore@cstx.gov	Neighborhood Services maintains collaborative partnerships between neighborhoods, community organizations and the City of College Station.
Historic Preservation Committee	Crystal Garcia	cgarcia@cstx.gov	The duties of the Historic Preservation Committee shall be to aid in the collection and preservation of the history of the City of College Station and its environs, and to provide for education of citizens on the history of this City.
Parks and Recreation Advisory Board	Andrea Lauer	alauer@cstx.gov	
Economic Development	BRIAN PISCACEK	bpiscacek@cstx.gov	City official- taken from Amazon List
Chief Development Officer	Michael Ostrowski	mostrowski@cstx.gov	City official- taken from Amazon List
Planning and Zoning Committee	Anthony Armstrong	cspds@cstx.gov/aarmstrong@cstx.gov	The Planning and Zoning Commission serves as a review body to recommend changes in development codes and the zoning ordinance to the City Council. The Commission shall prepare, adopt, and modify a comprehensive plan for the city for subsequent approval and adoption by the City Council.
Mayor	John Nicols	jnichols@cstx.gov	
Place 1 Councilman	Mark Smith	msmith@cstx.gov	
Place 2 Councilman	William Wright	wwright@cstx.gov	
Place 3 Councilwoman	Linda Harvell	lharvell@cstx.gov	
Place 4 Councilwoman	Elizabeth Cunha	ecunha@cstx.gov	
Place 5 Councilman	Bob Yancy	byancy@cstx.gov	
Place 6 Councilman	Dennis Maloney	dmaloney@cstx.gov	
City Manger's Office	Bryan Woods (City Manager)	cmo@cstx.gov	
City Secretary Office	Tanya D. Smith (City Secretary)	cso@cstx.gov	The City Secretary's Office provides citizens with public information and implements requests for city records, attends and prepares official minutes of the city council meetings, conducts city elections, coordinates boards and commissions appointments, provides staff support to the mayor and council, and manages the council and city secretary budgets
Heritage Programs Office	Meaghan O'Rourke	heritageprogram@cstx.gov/morourke@cstx.gov	
Department of Emergency Management	Tradd Mills	dem@cstx.gov/tmills@cstx.gov	
Fire Department	Richard Mann	csfire@cstx.gov/rmann@cstx.gov	
Planning and Development	Anthony Armstrong	cspds@cstx.gov/aarmstrong@cstx.gov	Planning & Development Services is responsible for services including land use, development, engineering, building regulations, comprehensive planning, floodplain management, and community development.
Chief of Police	Billy Couch	bcouch@cstx.gov	
Police Public Information Officer	David Simmons	dsimmons@cstx.gov	
Public Comminication Manager	Colin Killian	ckillian@cstx.gov	

Prime Air NEPA Notice of Availability Distribution - City of Brian

Historic Landmark Commission (HLC)	Allison Kay	akay@bryantx.gov	Planning Administrator
Parks and Recreation Advisory Board	Brad Stafford	bstafford@bryantx.gov	Parks and Rec Director
Business Development Manager	Todd McDaniel, CEcD	tmcdaniel@bryantx.gov	
Chief Development Officer	Kevin Russell	krussell@bryantx.gov	Development Services Director
Planning and Zoning Committee	Allison Kay	akay@bryantx.gov	Planning Administrator
Mayor	Bobby Gutierrez	CouncilWeb@bryantx.gov	Mayor
Councilmember	Paul Torres	CouncilWeb@bryantx.gov	Single Member District 1
Councilmember	Ray Arrington	CouncilWeb@bryantx.gov	Single Member District 2
Councilmember	Jared Salvato	CouncilWeb@bryantx.gov	Single Member District 3
Councilmember – Mayor Pro Tem	James Edge	CouncilWeb@bryantx.gov	Single Member District 4
Councilmember	Marca Ewers-Shurtleff	CouncilWeb@bryantx.gov	Single Member District 5
Councilmember	Kevin Boriskie	CouncilWeb@bryantx.gov	At Large, Place 6
City Manger's Office	Kean Register	kregister@bryantx.gov	City Manager
City Secretary Office	Mary Lynne Stratta, TRMC, MMC	citysecretaryweb@bryantx.gov	City Secretary/Legislative Director
Heritage Programs Office (if applicable)			
Department of Emergency Management (if applicable)			
Fire Department	Richard Giusti	rgiusti@bryantx.gov	
Planning and Development	Martin Zimmermann, AICP	mzimmermann@bryantx.gov	
Chief of Police	Eric Buske	ebuske@bryantx.gov	
Public Information Officer (if applicable)			
Public Comminication Manager	Lacey Lively, CPC	llively@bryantx.gov	Communications & Marketing Director
	tonya barrios	tbarrios@bryantx.gov	Providing final email list- did not respond post phone call

Prime Air NEPA Notice of Availability Distribution - Brazos County

County Level Commission	Name	Email
Commisioner Precinct 1	Steve Aldrich	saldrich@brazoscountytx.gov
Commisioner Precinct 2	Chuck Konderla	ckonderla@brazoscountytx.gov
Commisioner Precinct 3	Nancy Berry	nberry@brazoscountytx.gov
Commisioner Precinct 4	Wanda J. Watson	wjwatson@brazoscountytx.gov
Brazos County Historical Commission		info@brazoscountyhistory.org

Prime Air NEPA Notice of Availability Distribution - Texas Parks & Wildlife

Wildlife Contact Title	Name	Email
Wildlife Biologist Brazos County	Bobby Allcorn	Robert.Allcorn@tpwd.texas.gov
District Leader Post Oak Savannah District	Roger Wolfe	Roger.Wolfe@tpwd.texas.gov

Prime Air NEPA Notice of Availability Distribution - Other Organizations

Organization	Contact Name	Contact Email	About
Rio Brazos Audubon Society	Nancy Thaden	riobrazosaudubon@gmail.com/nan513@yahoo.com	Local Chapter for College Station
Keep Brazos Beautiful	Allison Batte/Executive Direc	director@keepbrazosbeautiful.org/allison@keepbrazosbeautiful.org	
Audubon Texas		audubontexas@audubon.org	
Scenic Texas	NA	info@scenictexas.org	
Texas Foundation for Conservation	John Shepperd	info@TexasFoundationForConservation.org/js@TexasFoundationForConservation.org	

Prime Air NEPA Notice of Availability Distribution - 4F

Department	Contact Name	Email	About
Director of Parks & Recreation	Ms. Kelsey Heiden	kheiden@cstx.gov	City of College Station Ms. Kelsey Heiden Director of Parks & Recreation City of College Station P.O. Box 9960 College Station, TX, 77842 979.764.3415 kheiden@cstx.gov
Director, Department of Parks and Recreation	Mr. Brad Stafford	bstafford@bryantx.gov	City of Bryan Mr. Brad Stafford Director Department of Parks and Recreation City of Bryan 1309 East Martin Luther King Street Bryan, Texas 77803
Director of Golf Operations	Mr. John Saffle	John@thegolfclubtamu.com	Texas A&M Mr. John Saffle Director of Golf Operations 1 Bizzell St College Station, TX 77841 John@thegolfclubtamu.com

Appendix B
Biological Resources and Agency Consultation

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Texas Coastal & Central Plains Eso
17629 El Camino Real, Suite 211
Houston, TX 77058-3051
Phone: (281) 286-8282 Fax: (281) 488-5882

In Reply Refer To: January 30, 2024
Project Code: 2024-0042426
Project Name: Drone Project

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 U.S. Fish and Wildlife Service (Service) field offices in Clear Lake, Corpus Christi, Arlington, and Alamo, Texas, have combined administratively to form the Texas Coastal Ecological Services Field Office. All project related correspondence should be sent to the field office address listed below responsible for the county in which your project occurs:

Project Leader; U.S. Fish and Wildlife Service; 17629 El Camino Real Ste. 211; Houston, Texas 77058
Angelina, *Austin*, *Brazoria*, *Brazos*, *Chambers, Colorado, Fayette, Fort Bend, Freestone, Galveston, Grimes, Hardin, Harris, Houston, Jasper, Jefferson, Leon, Liberty, Limestone, Madison, Matagorda, Montgomery, Newton, Orange, Polk, Robertson, Sabine, San Augustine, San Jacinto, Trinity, Tyler, Walker, Waller, and Wharton.*

Assistant Field Supervisor, U.S. Fish and Wildlife Service; 4444 Corona Drive, Ste 215; Corpus Christi, Texas 78411
Aransas, Atascosa, Bee, Brooks, Calhoun, De Witt, Dimmit, Duval, Frio, Goliad, Gonzales, Hidalgo, Jackson, Jim Hogg, Jim Wells, Karnes, Kenedy, Kleberg, La Salle, Lavaca, Live Oak, Maverick, McMullen, Nueces, Refugio, San Patricio, Victoria, and Wilson.

U.S. Fish and Wildlife Service; Santa Ana National Wildlife Refuge; Attn: Texas Ecological Services Sub-Office; 3325 Green Jay Road, Alamo, Texas 78516
Cameron, Hidalgo, Starr, Webb, Willacy, and Zapata.

For questions or coordination for projects occurring in counties not listed above, please contact arles@fws.gov.

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 Service under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the 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 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/media/endangered-species-consultation-handbook.

Non-Federal entities may consult under Sections 9 and 10 of the Act. Section 9 and Federal regulations prohibit the take of endangered and threatened species, respectively, without special exemption. “Take” is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. “Harm” is further defined (50 CFR § 17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. “Harass” is defined (50 CFR § 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Should the proposed project have the potential to take listed species, the Service recommends that the applicant develop a Habitat Conservation Plan and obtain a section 10(a)(1)(B) permit. The Habitat Conservation Planning Handbook is available at: https://www.fws.gov/library/collections/habitat-conservation-planning-handbook.

Migratory Birds:
In addition to responsibilities to protect threatened and endangered species under the Act, 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 Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts visit: https://www.fws.gov/program/migratory-birds.

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 National Environmental Policy Act (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/library/collections/threats-birds.

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.

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.

Note: IPaC has provided all available attachments because this project is in multiple field office jurisdictions.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Bald & Golden Eagles
- 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:

Texas Coastal & Central Plains Eso
17629 El Camino Real, Suite 211
Houston, TX 77058-3051
(281) 286-8282

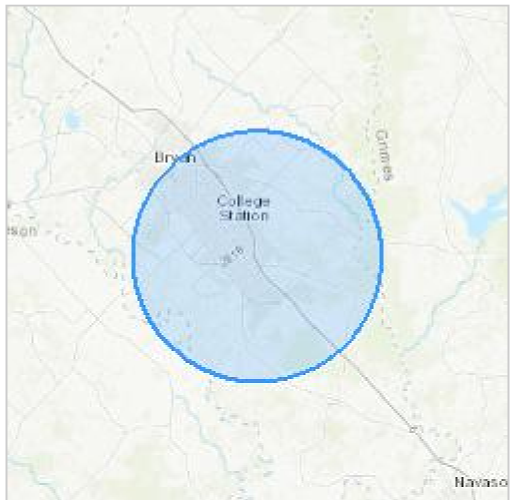
This project's location is within the jurisdiction of multiple offices. However, only one species list document will be provided for all offices. The species and critical habitats in this document reflect the aggregation of those that fall in each of the affiliated office's jurisdiction. Other offices affiliated with the project:

Austin Ecological Services Field Office
1505 Ferguson Lane
Austin, TX 78754-4501
(512) 937-7371

PROJECT SUMMARY

Project Code: 2024-0042426
Project Name: Drone Project
Project Type: Drones - Use/Operation of Unmanned Aerial Systems
Project Description: Drone facility
Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@30.59221505,-96.28657050984259,14z



Counties: Brazos , Burleson , and Grimes counties, Texas

ENDANGERED SPECIES ACT SPECIES

There is a total of 8 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. Note that 2 of these species should be considered only under certain conditions.

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
Tricolored Bat *Perimyotis subflavus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/10515	Proposed Endangered

BIRDS

NAME	STATUS
Piping Plover *Charadrius melodus* Population: [Atlantic Coast and Northern Great Plains populations] - Wherever found, except those areas where listed as endangered. There is **final** critical habitat for this species. Your location does not overlap the critical habitat. This species only needs to be considered under the following conditions: ▪ Wind related projects within migratory route. ▪ Wind Energy Projects Species profile: https://ecos.fws.gov/ecp/species/6039	Threatened
Rufa Red Knot *Calidris canutus rufa* There is **proposed** critical habitat for this species. This species only needs to be considered under the following conditions: ▪ Wind related projects within migratory route. ▪ Wind Energy Projects Species profile: https://ecos.fws.gov/ecp/species/1864	Threatened
Whooping Crane *Grus americana* Population: Wherever found, except where listed as an experimental population There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/758	Endangered

AMPHIBIANS

NAME	STATUS
Houston Toad *Bufo houstonensis* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2206	Endangered

CLAMS

NAME	STATUS
Texas Fawnsfoot *Truncilla macrodon* There is **proposed** critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8965	Proposed 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

FLOWERING PLANTS

NAME	STATUS
Navasota Ladies-tresses *Spiranthes parksii* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1570	Endangered

CRITICAL HABITATS

There is 1 critical habitat wholly or partially within your project area under this office's jurisdiction.

NAME	STATUS
Texas Fawnsfoot *Truncilla macrodon* https://ecos.fws.gov/ecp/species/8965#crithab	Proposed

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.

BALD & GOLDEN EAGLES

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

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats[3], should follow appropriate regulations and consider implementing appropriate conservation measures, as described in the links below. Specifically, please review the "Supplemental Information on Migratory Birds and Eagles".

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1. The Bald and Golden Eagle Protection Act of 1940.
2. The Migratory Birds Treaty Act of 1918.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

There are bald and/or golden eagles in your project area.

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

NAME	BREEDING SEASON
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 Sep 1 to Jul 31

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 "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

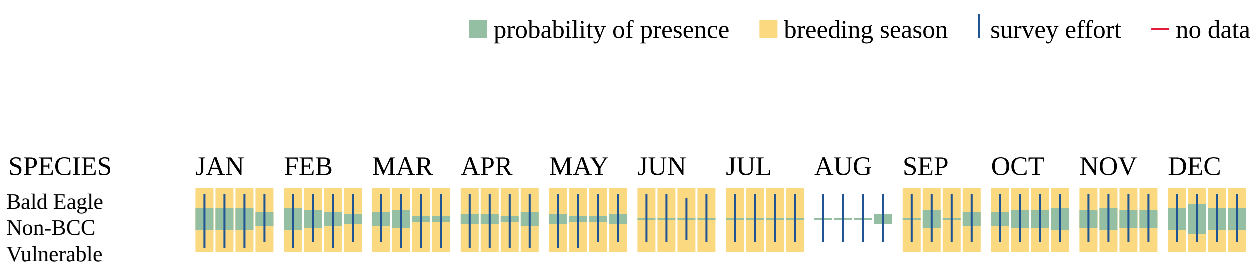
Probability of Presence (■)

Green bars; the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during that week of the year.

Breeding Season (■)
Yellow bars; liberal estimate of the timeframe inside which the bird breeds across its entire range.

Survey Effort (|)
Vertical black lines; the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

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



Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- 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
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

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[3] should follow appropriate regulations and consider implementing appropriate conservation measures, as described in the links below. Specifically, please review the "Supplemental Information on Migratory Birds and Eagles".

---

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)

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

NAME	BREEDING SEASON
American Golden-plover *Pluvialis dominica* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/10561	Breeds elsewhere
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 Sep 1 to Jul 31
Chimney Swift *Chaetura pelagica* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9406	Breeds Mar 15 to Aug 25
Kentucky Warbler *Oporornis formosus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9443	Breeds Apr 20 to Aug 20

NAME	BREEDING SEASON
Lesser Yellowlegs *Tringa flavipes* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9679	Breeds elsewhere
Little Blue Heron *Egretta caerulea* 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/9477	Breeds Mar 10 to Oct 15
Long-billed Curlew *Numenius americanus* 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/5511	Breeds elsewhere
Mountain Plover *Charadrius montanus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3638	Breeds elsewhere
Pectoral Sandpiper *Calidris melanotos* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9561	Breeds elsewhere
Prothonotary Warbler *Protonotaria citrea* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9439	Breeds Apr 1 to Jul 31
Red-headed Woodpecker *Melanerpes erythrocephalus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9398	Breeds May 10 to Sep 10
Sprague's Pipit *Anthus spragueii* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8964	Breeds elsewhere

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 "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

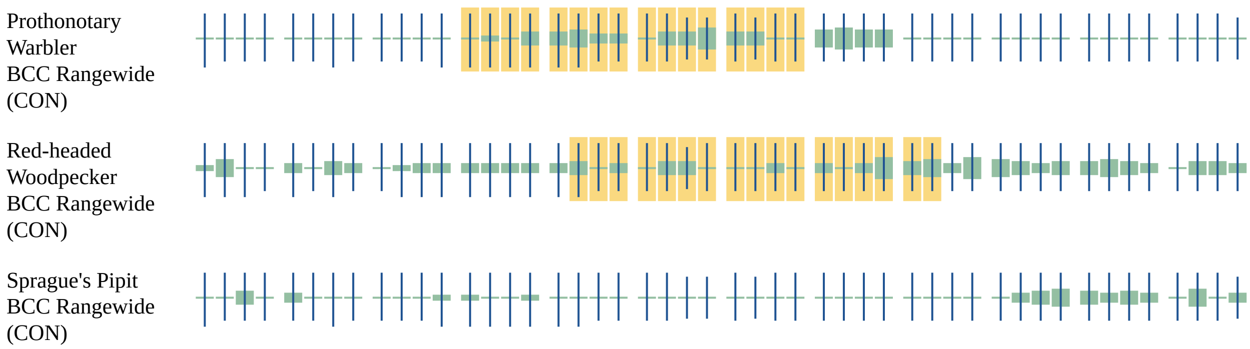
Probability of Presence (■)

Green bars; the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during that week of the year.

Breeding Season (■)
Yellow bars; liberal estimate of the timeframe inside which the bird breeds across its entire range.

Survey Effort (|)
Vertical black lines; the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

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



Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- 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
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

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.

Due to your project's size, the list below may be incomplete, or the acreages reported may be inaccurate. For a full list, please contact the local U.S. Fish and Wildlife office or visit https://www.fws.gov/wetlands/data/mapper.HTML

LAKE

- L1UBHx
- L1UBHh

FRESHWATER EMERGENT WETLAND

- PEM1F
- PEM1C
- PEM1/SS1A

- PEM1A
- PEM1Fh

FRESHWATER FORESTED/SHRUB WETLAND

- PFO1C
- PFO1A
- PSS1A
- PSS1C
- PFO5/UBHh
- PSS1F
- PFO1Fh
- PSS1/UBF
- PFO1F
- PFO1Ch

FRESHWATER POND

- PAB4Hh
- PUBH
- PAB3/UBH
- PUBF
- PUB/AB4Hh
- PUBHh

IPAC USER CONTACT INFORMATION

Agency: Private Entity
Name: Sarah McAbee
Address: 1001 Virginia Avenue
City: Hapeville
State: GA
Zip: 30354
Email smcabee@esassoc.com
Phone: 4076006723

Appendix X
SGCN lised for Brazos, Burleson and Grimes Counties, Texas

Taxon	SName	CName	USESA	SPROT	GRank	SRank	SGCN	Description
Amphibians	Ambystoma tigrinum	eastern tiger salamander			G5	S3	Y	Terrestrial adults generally occur under cover objects or in burrows surrounding a variety of lentic freshwater habitats, such as ponds, lakes, bottomland wetlands, or upland ephemeral pools. The specific terrestrial habitats are also varied and the occurrence of this species seems to be more closely associated with sandy, loamy or other soils which have easy burrowing properties, rather than any particular ecological system type. Requires fishless breeding pools for successful reproduction.
Amphibians	Anaxyrus houstonensis	Houston toad	LE	E	G1	S1	Y	Terrestrial and aquatic: Primary terrestrial habitat is forests with deep sandy soils. Juveniles and adults are presumed to move through areas of less suitable soils using riparian corridors. Aquatic habitats can include any water body from a tire rut to a large lake.
Amphibians	Anaxyrus woodhousii	Woodhouse's toad			G5	SU	Y	Terrestrial and aquatic: A wide variety of terrestrial habitats are used by this species, including forests, grasslands, and barrier island sand dunes. Aquatic habitats are equally varied.
Amphibians	Pseudacris streckeri	Strecker's chorus frog			G5	S3	Y	Terrestrial and aquatic: Wooded floodplains and flats, prairies, cultivated fields and marshes. Likes sandy substrates.
Amphibians	Lithobates areolatus areolatus	southern crawfish frog			G4T4	S3	Y	Terrestrial and aquatic: The terrestial habitat is primarily grassland and can vary from pasture to intact prairie; it can also include small prairies in the middle of large forested areas. Aquatic habitat is any body of water but preferred habitat is ephemeral wetlands.
Birds	Plegadis chihi	white-faced ibis		T	G5	S4B	Y	The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; currently confined to near-coastal rookeries in so-called hog-wallow prairies. Nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats.
Birds	Mycteria americana	wood stork		T	G4	SHB,S2N	Y	The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Prefers to nest in large tracts of baldcypress (Taxodium distichum) or red mangrove (Rhizophora mangle); forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960.
Birds	Elanoides forficatus	swallow-tailed kite		T	G5	S2B	Y	The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Lowland forested regions, especially swampy areas, ranging into open woodland; marshes, along rivers, lakes, and ponds; nests high in tall tree in clearing or on forest woodland edge, usually in pine, cypress, or various deciduous trees.
Birds	Haliaeetus leucocephalus	bald eagle			G5	S3B,S3N	Y	Found primarily near rivers and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds
Birds	Laterallus jamaicensis	black rail	T	T	G3	S2	Y	The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Salt, brackish, and freshwater marshes, pond borders, wet meadows, and grassy swamps; nests in or along edge of marsh, sometimes on damp ground, but usually on mat of previous years dead grasses; nest usually hidden in marsh grass or at base of Salicornia
Birds	Grus americana	whooping crane	LE	E	G1	S1S2N	Y	The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Small ponds, marshes, and flooded grain fields for both roosting and foraging. Potential migrant via plains throughout most of state to coast; winters in coastal marshes of Aransas, Calhoun, and Refugio counties.
Birds	Charadrius melodus	piping plover	LT	T	G3	S2N	Y	The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Beaches, sandflats, and dunes along Gulf Coast beaches and adjacent offshore islands. Also spoil islands in the Intracoastal Waterway. Based on the November 30, 1992 Section 6 Job No. 9.1, Piping Plover and Snowy Plover Winter Habitat Status Survey, algal flats appear to be the highest quality habitat. Some of the most important aspects of algal flats are their relative inaccessibility and their continuous availability throughout all tidal conditions. Sand flats often appear to be preferred over algal flats when both are available, but large portions of sand flats along the Texas coast are available only during low-very low tides and are often completely unavailable during extreme high tides or strong north winds. Beaches appear to serve as a secondary habitat to the flats associated with the primary bays, lagoons, and inter-island passes. Beaches are rarely used on the southern Texas coast, where bayside habitat is always available, and are abandoned as bayside habitats become available on the central and northern coast. However, beaches are probably a vital habitat along the central and northern coast (i.e. north of Padre Island) during periods of extreme high tides that cover the flats. Optimal site characteristics appear to be large in area, sparsely vegetated, continuously available or in close proximity to secondary habitat, and with limited human disturbance.

Taxon	SName	CName	USESA	SPROT	GRank	SRank	SGCN	Description
Birds	Calidris canutus rufa	rufa red knot	LT	T	G4T2	S2N	Y	The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Habitat: Primarily seacoasts on tidal flats and beaches, herbaceous wetland, and Tidal flat/shore. Bolivar Flats in Galveston County, sandy beaches Mustang Island, few on outer coastal and barrier beaches, tidal mudflats and salt marshes.
Birds	Leucophaeus pipixcan	Franklin's gull			G5	S2N	Y	The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. This species is only a spring and fall migrant throughout Texas. It does not breed in or near Texas. Winter records are unusual consisting of one or a few individuals at a given site (especially along the Gulf coastline). During migration, these gulls fly during daylight hours but often come down to wetlands, lake shore, or islands to roost for the night.
Birds	Athene cunicularia hypugaea	western burrowing owl			G4T4	S2	Y	Open grasslands, especially prairie, plains, and savanna, sometimes in open areas such as vacant lots near human habitation or airports; nests and roosts in abandoned burrows
Birds	Dryobates borealis	red-cockaded woodpecker	LE	E	G3	S2	Y	Cavity nests in older pine (60+ years); forages in younger pine (30+ years); prefers longleaf, shortleaf, and loblolly
Birds	Anthus spragueii	Sprague's pipit			G3G4	S3N	Y	The county distribution for this species includes geographic areas that the species may use during migration. Time of year should be factored into evaluations to determine potential presence of this species in a specific county. Habitat during migration and in winter consists of pastures and weedy fields (AOU 1983), including grasslands with dense herbaceous vegetation or grassy agricultural fields.
Birds	Calcarius ornatus	chestnut-collared longspur			G5	S3	Y	Occurs in open shortgrass settings especially in patches with some bare ground. Also occurs in grain sorghum fields and Conservation Reserve Program lands
Fish	Polyodon spathula	paddlefish		T	G4	S3	Y	Species occurred in every major river drainage from the Trinity Basin eastward, but its numbers and range had been substantially reduced by the 1950â€™s; recently reintroduced into Big Cypress drainage upstream of Caddo Lake. Prefers large, free-flowing rivers but will frequent impoundments with access to spawning sites.
Fish	Atractosteus spatula	alligator gar			G3G4	S4	Y	From the Red River to the Rio Grande (Hubbs et al. 2008); occurs in the Trinity River upstream of Lake Livingston. Found in rivers, streams, lakes, swamps, bayous, bays and estuaries typically in pools and backwater habitats. Floodplains inundated with flood waters provide spawning and nursery habitats.
Fish	Anguilla rostrata	american eel			G4	S4	Y	Originally found in all river systems from the Red River to the Rio Grande. Aquatic habtiats include large rivers, streams, tributaries, coastal watersheds, estuaries, bays, and oceans. Spawns in Sargasso Sea, larva move to coastal waters, metamorphose, and begin upstream movements. Females tend to move further upstream than males (who are often found in brackish estuaries). American Eel are habitat generalists and may be found in a broad range of habitat conditions including slow- and fast-flowing waters over many substrate types. Extirpation in upstream drainages attributed to reservoirs that impede upstream migration.
Fish	Hybognathus nuchalis	Mississippi silvery minnow			G5	S4	Y	Found in eastern Texas streams, from the Brazos River eastward and northward to the Red River; found in moderate current; silty, muddy, or rocky substrate. In Texas, adults likely to inhabit smaller tributary streams.
Fish	Notropis atrocaudalis	blackspot shiner			G4	S3	Y	Occurs from the lower Brazos River to the Sabine River drainage; Red River drainage. Small to moderate size tributary streams in runs and pools over all types of substrates.
Fish	Notropis buccula	smalleye shiner	LE	E	G2	S1S2	Y	Endemic to the Brazos River drainage; presumed to have been introduced into the Colorado River. Historically found in lower Brazos River as far south as Hempstead, Texas but appears to now be restricted to upper Brazos River system upstream of Possum Kingdom Lake. Typically found in turbid waters of broad, sandy channels of main stream, over substrate consisting mostly of shifting sand.
Fish	Notropis potteri	chub shiner		T	G4	S2	Y	Brazos, Colorado, San Jacinto, and Trinity river basins. Flowing water with silt or sand substrate
Fish	Notropis shumardi	silverband shiner			G5	S4	Y	In Texas, found from Red River to Lavaca River; Main channel with moderate to swift current velocities and moderate to deep depths; associated with turbid water over silt, sand, and gravel.
Fish	Macrhybopsis storeriana	silver chub			G5	S3	Y	Red River and Brazos River basins. Mainly restricted to large, often silty rivers. Ranges over gravel to silt substrates but found more commonly over silt or mud bottom.
Fish	Erimyzon claviformis	western creek chubsucker		T	G5	S2S3	Y	Eastern Texas streams from the Red River to the San Jacinto drainage. Habitat includes silt-, sand-, and gravel-bottomed pools of clear headwaters, creeks, and small rivers; often near vegetation; occasionally in lakes. Spawning occurs in river mouths or pools, riffles, lake outlets, or upstream creeks. Prefers headwaters, but seldom occurs in springs.
Mammals	Myotis austroriparius	southeastern myotis bat			G4	S3?	Y	Caves are rare in Texas portion of range; buildings, hollow trees are probably important. Historically, lowland pine and hardwood forests with large hollow trees; associated with ecological communities near water. Roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures.
Mammals	Myotis velifer	cave myotis bat			G4G5	S2S3	Y	Colonial and cave-dwelling; also roosts in rock crevices, old buildings, carports, under bridges, and even in abandoned Cliff Swallow (Hirundo pyrrhonota) nests; roosts in clusters of up to thousands of individuals; hibernates in limestone caves of Edwards Plateau and gypsum cave of Panhandle during winter; opportunistic insectivore.
Mammals	Perimyotis subflavus	tricolored bat			G3G4	S2	Y	Forest, woodland and riparian areas are important. Caves are very important to this species.

Taxon	SName	CName	USESA	SPROT	GRank	SRank	SGCN	Description
Mammals	Eptesicus fuscus	big brown bat			G5	S5	Y	Any wooded areas or woodlands except south Texas. Riparian areas in west Texas.
Mammals	Lasiurus borealis	eastern red bat			G3G4	S4	Y	Red bats are migratory bats that are common across Texas. They are most common in the eastern and central parts of the state, due to their requirement of forests for foliage roosting. West Texas specimens are associated with forested areas (cottonwoods). Also common along the coastline. These bats are highly mobile, seasonally migratory, and practice a type of wandering migration". Associations with specific habitat is difficult unless specific migratory stopover sites or wintering grounds are found. Likely associated with any forested area in East
Mammals	Lasiurus cinereus	hoary bat			G3G4	S3	Y	Hoary bats are highly migratory, high-flying bats that have been noted throughout the state. Females are known to migrate to Mexico in the winter, males tend to remain further north and may stay in Texas year-round. Commonly associated with forests (foliage roosting species) but are found in unforested parts of the state and lowland deserts. Tend to be captured over water and large, open flyways.
Mammals	Lasiurus intermedius	northern yellow bat			G5	S4	Y	Occurs mainly along the Gulf Coast but inland specimens are not uncommon. Prefers roosting in spanish moss and in the hanging fronds of palm trees. Common where this vegtation occurs. Found near water and forages over grassy, open areas. Males usually roost solitarily, whereas females roost in groups of several individuals.
Mammals	Corynorhinus rafinesquii	Rafinesque's big-eared bat		T	G3G4	S2	Y	Historically, lowland pine and hardwood forests with large hollow trees. roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures
Mammals	Nyctinomops macrotis	big free-tailed bat			G5	S3	Y	Habitat data sparse but records indicate that species prefers to roost in crevices and cracks in high canyon walls, but will use buildings, as well; reproduction data sparse, gives birth to single offspring late June-early July; females gather in nursery colonies; winter habits undetermined, but may hibernate in the Trans-Pecos; opportunistic insectivore
Mammals	Sylvilagus aquaticus	swamp rabbit			G5	S5	Y	Primarily found in lowland areas near water including: cypress bogs and marshes, floodplains, creeks and rivers.
Mammals	Cynomys ludovicianus	black-tailed prairie dog			G4	S3	Y	Dry, flat, short grasslands with low, relatively sparse vegetation, including areas overgrazed by cattle; live in large family groups
Mammals	Ondatra zibethicus	muskrat			G5	S5	Y	Found in fresh or brackish marshes, lakes, ponds, swamps, and other bodies of slow-moving water. Most abundant in areas with cattail. Dens in bank burrow or conical house of vegetation in shallow vegetated water. It is primarily found in the Rio Grande near El Paso and in SE Texas in the Houston area.
Mammals	Ursus americanus luteolus	Louisiana black bear		T	G5T2	SNA	Y	Bottomland hardwoods, floodplain forests, upland hardwoods with mixed pine; marsh. Possible as transient; bottomland hardwoods and large tracts of inaccessible forested areas.
Mammals	Mustela frenata	long-tailed weasel			G5	S5	Y	Includes brushlands, fence rows, upland woods and bottomland hardwoods, forest edges & rocky desert scrub. Usually live close to water.
Mammals	Spilogale putorius	eastern spotted skunk			G4	S1S3	Y	Generalist; open fields prairies, croplands, fence rows, farmyards, forest edges & woodlands. Prefer wooded, brushy areas & tallgrass prairies. S.p. ssp. interrupta found in wooded areas and tallgrass prairies, preferring rocky canyons and outcrops when such sites are available.
Mammals	Conepatus leuconotus	western hog-nosed skunk			G4	S4	Y	Habitats include woodlands, grasslands & deserts, to 7200 feet, most common in rugged, rocky canyon country; little is known about the habitat of the ssp. telmalestes
Mammals	Puma concolor	mountain lion			G5	S2S3	Y	Generalist; found in a wide range of habitats statewide. Found most frequently in rugged mountains & riparian zones.
Reptiles	Macrochelys temminckii	alligator snapping turtle		T	G3	S2	Y	Aquatic: Perennial water bodies; rivers, canals, lakes, and oxbows; also swamps, bayous, and ponds near running water; sometimes enters brackish coastal waters. Females emerge to lay eggs close to the waters edge.
Reptiles	Deirochelys reticularia miaria	western chicken turtle			G5T5	S2S3	Y	Aquatic and terrestrial: This species uses aquatic habitats in the late winter, spring and early summer and then terrestrial habitats the remainder of the year. Preferred aquatic habitats seem to be highly vegetated shallow wetlands with gentle slopes. Specific terrestrial habitats are not well known.
Reptiles	Terrapene carolina	eastern box turtle			G5	S3	Y	Terrestrial: Eastern box turtles inhabit forests, fields, forest-brush, and forest-field ecotones. In some areas they move seasonally from fields in spring to forest in summer. They commonly enters pools of shallow water in summer. For shelter, they burrow into loose soil, debris, mud, old stump holes, or under leaf litter. They can successfully hibernate in sites that may experience subfreezing temperatures.
Reptiles	Terrapene ornata	western box turtle			G5	S3	Y	Terrestrial: Ornate or western box trutles inhabit prairie grassland, pasture, fields, sandhills, and open woodland. They are essentially terrestrial but sometimes enter slow, shallow streams and creek pools. For shelter, they burrow into soil (e.g., under plants such as yucca) (Converse et al. 2002) or enter burrows made by other species.
Reptiles	Apalone mutica	smooth softshell			G5	S3	Y	Aquatic: Large rivers and streams; in some areas also found in lakes and impoundments (Ernst and Barbour 1972). Usually in water with sandy or mud bottom and few aquatic plants. Often basks on sand bars and mudflats at edge of water. Eggs are laid in nests dug in high open sandbars and banks close to water, usually within 90 m of water (Fitch and Plummer 1975).
Reptiles	Ophisaurus attenuatus	slender glass lizard			G5	S3	Y	Terrestrial: Habitats include open grassland, prairie, woodland edge, open woodland, oak savannas, longleaf pine flatwoods, scrubby areas, fallow fields, and areas near streams and ponds, often in habitats with sandy soil.

Taxon	SName	CName	USESA	SPROT	GRank	SRank	SGCN	Description
Reptiles	Phrynosoma cornutum	Texas horned lizard		T	G4G5	S3	Y	Terrestrial: Open habitats with sparse vegetation, including grass, prairie, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive. Occurs to 6000 feet, but largely limited below the pinyon-juniper zone on mountains in the Big Bend area.
Reptiles	Plestiodon septentrionalis	prairie skink			G5	S2	Y	The prairie skink can occur in any native grassland habitat across the Rolling Plains, Blackland Prairie, Post Oak Savanna and Pineywoods ecoregions.
Reptiles	Heterodon nasicus	western hognose snake			G5	S4	Y	Terrestrial: Shortgrass or mixed grass prairie, with gravel or sandy soils. Often found associated with draws, floodplains, and more mesic habitats within the arid landscape. Frequently occurs in shrub encroached grasslands.
Reptiles	Crotalus horridus	timber (canebrake) rattlesnake			G4	S4	Y	Terrestrial: Swamps, floodplains, upland pine and deciduous woodland, riparian zones, abandoned farmland. Limestone bluffs, sandy soil or black clay. Prefers dense ground cover, i.e. grapevines, palmetto.
Reptiles	Sistrurus tergeminus	western massasauga			G3G4	S3	Y	Terrestrial: Shortgrass or mixed grass prairie, with gravel or sandy soils. Often found associated with draws, floodplains, and more mesic habitats within the arid landscape. Frequently occurs in shrub encroached grasslands.
Reptiles	Sistrurus miliarius	pygmy rattlesnake			G5	S2S3	Y	The pygmy rattlesnake occurs in a variety of wooded habitats from bottomland coastal hardwood forests to upland savannas. The species is frequently found in association with standing water.
Crustaceans	Fallicambarus houstonensis	Houston burrowing crayfish			G2	S3	Y	All species in the genus <i>Fallicambarus </i>are primary burrowers (Guiasu, 2007). It is clearly a primary burrower with 100% of adult and subadult specimens known from excavated burrows. Large numbers of juveniles were collected from Temporary pools (October through February) (Johnson, 2008).
Insects	Bombus pensylvanicus	American bumblebee			G3G4	SNR	Y	Habitat description is not available at this time.
Insects	Bombus variabilis	No accepted common name			G1G2	SNR	Y	Habitat description is not available at this time.
Insects	Pogonomyrmex comanche	Comanche harvester ant			G2G3	S2	Y	Habitat description is not available at this time.
Insects	Melanoplus alexanderi	No accepted common name			G1G2	S2?	Y	Primarily in open oak or pine/oak savannah type habitats with fine grain loamy sand to sandy loam soils.
Insects	Neotrichia mobilensis	No accepted common name			G1G2	S1?	Y	Habitat description is not available at this time.
Mollusks	Potamilus streckersoni	Brazos heelsplitter		T	GNR	SNR	Y	Reported from streams, but not far into the headwaters, to large rivers, and some reservoirs. In riverine systems occurs most often in nearshore habitats such as banks and backwater pools but occasionally in mainchannel habitats such as riffles. Typically found in standing to slow-flowing water in soft substrates consisting of silt, mud or sand but occasionally in moderate flows with gravel and cobble substrates (Randklev et al. 2014b,c; Tsakiris and Randklev 2016b; Smith et al. 2019) [Mussels of Texas 2020]
Mollusks	Fusconaia mitchelli	false spike	PE	T	GNR	S1	Y	Occurs in large rivers but may also be found in medium-sized streams. Is found in protected near shore areas such as banks and backwaters but also riffles and point bar habitats with low to moderate water velocities. Typically occurs in substrates of mud, sandy mud, gravel and cobble. Considered intolerant of reservoirs (Randklev et al. 2010; Howells 2010o; Randklev et al. 2014b,c; Randklev et al. 2017a,b). [Mussels of Texas 2019]
Mollusks	Truncilla macrodon	Texas fawnsfoot	PT	T	G1	S2	Y	
Plants	Tauschia texana	Texas tauschia			G3	S3	Y	Occurs in loamy soils in deciduous forests or woodlands on river and stream terraces; Perennial; Flowering/Fruiting Feb-April
Plants	Liatris cymosa	branched gay-feather			G2	S2	Y	Somewhat barren grassland openings in post oak woodlands on tight clayey, chalky, or gravelly soils, often over Catahoula Formation; flowering July-October
Plants	Paronychia setacea	bristle nailwort			G3	S2	Y	Flowering vascular plant endemic to eastern southcentral Texas, occurring in sandy soils
Plants	Cuscuta exaltata	tree dodder			G3	S3	Y	Parasitic on various Quercus, Juglans, Rhus, Vitis, Ulmus, and Diospyros species as well as Acacia berlandieri and other woody plants; Annual; Flowering May-Oct; Fruiting July-Oct
Plants	Amorpha paniculata	panicled indigobush			G3	S3	Y	A stout shrub, 3 m (9 ft) tall that grows in acid seep forests, peat bogs, wet floodplain forests, and seasonal wetlands on the edge of Saline Prairies in East Texas. It is distinguished from other Amorpha species by its fuzzy leaflets with prominent raised veins underneath, and the flower panicles, which are 8 to 16 inches long and slender, held above the foliage. Perennial; Flowering May-August.
Plants	Nemophila sayersensis	Sayersville blue eyes			G2	S2	Y	Open fields and woodland margins on deep loose nutrient-poor sand (Simpson, Helfgott and Neff 2001). Mar-May.
Plants	Rhododon ciliatus	Texas sandmint			G3	S3	Y	Open sandy areas in the Post Oak Belt of east-central Texas; Annual; Flowering April-Aug; Fruiting May-Aug
Plants	Spigelia texana	Texas pinkroot			G3	S3	Y	Woodlands on loamy soils; Perennial; Flowering March-Nov; Fruiting April-Nov
Plants	Polygonella parksii	Parks' jointweed			G2	S2	Y	Mostly found on deep, loose, whitish sand blowouts (unstable, deep, xeric, sandhill barrens) in Post Oak Savanna landscapes over the Carrizo and Sparta formations; also occurs in early successional grasslands, along right-of-ways, and on mechanically disturbed areas; flowering June-late October or September-November
Plants	Thalictrum texanum	Texas meadow-rue			G2Q	S2	Y	Mostly found in woodlands and woodland margins on soils with a surface layer of sandy loam, but it also occurs on prairie pimple mounds; both on uplands and creek terraces, but perhaps most common on claypan savannas; soils are very moist during its active growing season; flowering/fruiting (January-)February-May, withering by midsummer, foliage reappears in late fall(November) and may persist through the winter
Plants	Crataegus viridis var. glabriuscula	Sutherland hawthorn			G5T3T4	S3	Y	In mesic soils of woods or on edge of woods, treeline/fenceline, or thicket. Above\near creeks and draws, in river bottoms. Flowering Mar-Apr; fruiting May-Oct.

Taxon	SName	CName	USESA	SPROT	GRank	SRank	SGCN	Description
Plants	Agalinis navasotensis	Navasota false foxglove			G1	S1	Y	Relatively sparsely vegetated, shallow, sandy soils on calcareous sandstone outcrops of the Oakville Formation, with associated surrounding species more typical of Edwards Plateau, than Post Oak Savanna or Blackland Prairie; also, Catahoula Formation barrens in pine savanna; Annual; Flowering September-October
Plants	Valerianella florifera	Texas cornsalad			G3	S3	Y	Grasslands and early-successional openings in the post oak belt of east-central and northeast Texas; Sandy soils; Annual; Flowering March-April
Plants	Cyperus grayioides	Mohlenbrock's sedge			G3G4	S3S4	Y	Deep sand and sandy loam in dry, almost barren openings in upland longleaf pine savannas, mixed pine-oak forests, and post oak woodlands; Occurs primarily in deep, periodically disturbed sandy soils in open areas maintained by factors such as wind, erosion, or fire. This species does not occur in shaded areas or in areas of high competition with other herbaceous species. Habitats include remnant sand prairies, sandy fields, sand blow outs, sandhill woodlands, pine barrens, and open barrens in which the slope is sufficient to produce sand erosion. May also occur in areas where the soils have been disturbed by logging or road construction; Perennial
Plants	Eriocaulon koernickianum	small-headed pipewort		T	G2	S1S2	Y	In East Texas, post-oak woodlands and xeric sandhill openings on permanently wet acid sands of upland seeps and hillside seepage bogs, usually in patches of bare sand rather than among dense vegetation or on muck; in Gillespie County, on permanently wet or moist hillside seep on decomposing granite gravel and sand among granite outcrops; flowering/fruiting late May-late June
Plants	Schoenolirion wrightii	Texas sunnybell			G3	S3	Y	Rocky barrens in the Post Oak region near College Station, with a few disjunct populations on the Catahoula Formation of southeast Texas; Perennial; Flowering March-April; Fruiting March
Plants	Calopogon oklahomensis	Oklahoma grass pink			G2	S1S2	Y	Mesic, acidic, sandy to loamy prairies, pine savannas, oak woodlands, edges of bogs, and frequently mowed meadows (Goldman, Magrath & Catling 2002). Flowering March-July.
Plants	Spiranthes parksii	Navasota ladies'-tresses	LE	E	G3	S3	Y	Openings in post oak woodlands in sandy loams along upland drainages or intermittent streams, often in areas with suitable hydrologic factors, such as a perched water table associated with the underlying claypan; flowering populations fluctuate widely from year to year, an individual plant does not flower every year; flowering late October-early November (-early December)
Plants	Chloris texensis	Texas windmill grass			G2	S2	Y	Sandy to sandy loam soils in relatively bare areas in coastal prairie grassland remnants, often on roadsides where regular mowing may mimic natural prairie fire regimes; flowering in fall

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Bald Eagle Haliaeetus leucocephalus
VU
Research Grade
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brandonwoo
Observed:April 2023
Submitted:April 2023

Texas, US(Obscured)

Map data ©2024 10 km

Details

- Lat: 30.619613
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  Accuracy: 29.33km
  Geoprivacy: Open

  Encompassing Places

  Standard:North AmericaContinentUnited StatesCountryTexas, USStateBrazos County, TX, USCounty
  Community Curated:
  Texas and Florida, USColloquialEast Central Texas Plains EPA Level III EcoregionRegionEast Texas, TX, USColloquialSouthern Post Oak Savanna, TX, USRegionTPWD Wildlife District 5, TX, USLocal administrative areaTexas and neighboring statesUnknownTexas and neighboring states (US and Mexico)UnknownTexas & states with shared river basins (US and Mexico)UnknownSouth-Central U.S.UnknownWestern Chicken Turtle rangeUnknownForests of North and South AmericaUnknownAmerican SoutheastRegionSouthwestern United States, USRegionNorth America (inc. ocean)ContinentThe AmericasUnknownNearctic EcozoneZone LessMore

  Why the Coordinates Are Obscured

  - **Taxon is threatened, coordinates obscured by default:** One of the taxa suggested in the identifications, or one of the taxa that contain any of these taxa, is known to be rare and/or threatened, so the location of this observation has been obscured.

  Who Can See the Coordinates

  - The person who made the observation
  - Individuals who the observer has trusted with their hidden coordinates
  - Curators of the following projects:

- Texas Eagle Nests

View on Google OpenStreetMap Macrostrat

Activity

brandonwoo suggested an ID Improving Apr '23

- View observations of this taxon by:
  brandonwoo
  Everyone


Bald Eagle Haliaeetus leucocephalus

a-tristis suggested an ID Apr '23

- View observations of this taxon by:
  a-tristis
  Everyone


Bald Eagle Haliaeetus leucocephalus

oviscanadensis_connerties suggested an ID Apr '23

- View observations of this taxon by:
  oviscanadensis_connerties
  Everyone


Bald Eagle Haliaeetus leucocephalus

rhett_raibley suggested an ID Apr '23

- View observations of this taxon by:
  rhett_raibley
  Everyone


Bald Eagle Haliaeetus leucocephalus

connlindajo suggested an ID Apr '23

- View observations of this taxon by:
  connlindajo
  Everyone


Bald Eagle Haliaeetus leucocephalus

phil333 suggested an ID Jun '23

- View observations of this taxon by:
  phil333
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Bald Eagle Haliaeetus leucocephalus

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Community Taxon What's this?

VU
Bald Eagle Haliaeetus leucocephalusCumulative IDs: 6 of 6

0
2/3rds
6
Agree
About

Projects (1)

Texas Eagle Nests
Observation Fields
Count of Individuals Observed:

3

Is this an active nest?:

Yes

Nesting Activity:

Nest with young

For Bald Eagles, what kind of tree is the nest in?:

sycamore

TPWD Staff/Contractors: A Private Land Owner Permission Form is Required.:

No

Observation Fields (5)

Count of Individuals Observed:

3

For Bald Eagles, what kind of tree is the nest in?:

sycamore

Is this an active nest?:

Yes

Nesting Activity:

Nest with young

TPWD Staff/Contractors: A Private Land Owner Permission Form is Required.:

No

Top Identifiers of Bald Eagle

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SUBJECT: Endangered Species Act Section 7 Consultation for Drone Commercial Package Delivery Operations in College Station, Texas

In accordance with Section 7 of the Endangered Species Act (ESA), the Federal Aviation Administration (FAA) is requesting U.S. Fish and Wildlife Service (USFWS) concurrence that the FAA's action of authorizing Amazon Prime Air to expand its drone package delivery operations in the College Station metropolitan area ***may affect, but is not likely to adversely affect***, the tricolored bat (*Perimyotis subflavus*) and whooping crane (*Grus americana*). Our biological evaluation is provided below, including a brief background, project description, identification of the action area, and a discussion of potential effects to ESA-listed species.

Project Description

Amazon Prime Air (Amazon) currently operates the MK27-2 drone under 14 Code of Federal Regulations Part 135 (Part 135) in College Station, TX. Amazon has a Part 135 Air Carrier Certificate from the FAA, which allows it to conduct commercial package deliveries using drones. Amazon intends to expand its delivery capabilities in 2024 and has requested the FAA to authorize the operation of its next generation MK30 drone variant so it can add it to its Part 135 fleet to provide broader access to its drone package delivery services across its operating areas.

Amazon projects flying up to approximately 469 MK30 drone flights per operating day from the Prime Air Drone Delivery Center (PADDC) located in College Station, with each flight taking a package to a customer delivery address before returning to the PADDC. The PADDC is associated with Amazon's existing fulfillment center in College Station. The number of flights per day would vary based on customer demand and weather conditions. Amazon is taking an incremental approach to operations and expects to gradually ramp up to approximately 469 flights per day as consumer demand increases over time. Drone flights could be conducted up to 365 days a year and, as Amazon ramps up operations, it could operate up to 10 hours per day, primarily during daylight hours (operations will not occur before 7 A.M. or after 10 P.M). The current MK27-2 operating area and PADDC are depicted in **Attachment A**. The proposed MK30 operating area and PADDC are depicted in **Attachment B**.

Unmanned Aircraft

As pictured in **Attachment C**, the MK30 drone is a hybrid multicopter fixed-wing tail-sitter drone with six propulsors allowing it to take off and land vertically and transition to wing borne flight. Its airframe is composed of staggered tandem wings for stable wing borne flight. The drone weighs approximately 78 pounds and has a maximum takeoff weight of approximately 83 pounds, which includes a maximum payload of 5 pounds. It has a maximum operating range of 7.5 miles and can fly up to 58 knots (67 miles per hour) during wing-borne flight. It uses electric power from rechargeable lithium-ion batteries and is launched vertically using powered lift and converts to using wing lift during en route flight.

Flight Operations

The MK30 drone would generally be operated at an altitude of 300 feet above ground level (AGL) and up to a maximum operating altitude of 400 feet AGL while en route to and from delivery locations. At a delivery location, the drone would descend vertically to a stationary hover and drop a package to the ground. Once a package has been delivered, the drone would ascend vertically to the en route altitude and depart the delivery area to return to the PADDC. The drone would fly a predefined flight path that is set prior to takeoff. Flight missions would be automatically planned by Amazon's flight planning software, which assigns, deconflicts, and routes each flight. The PADDC is a controlled area wherein drone flights are launched and recovered.

Takeoff

Once a package is loaded onto the MK30 drone and the drone is cleared for takeoff at the PADDC, the drone takes off from the ground vertically to an altitude of about 180 feet AGL and then transitions and climbs to its en route altitude of about 300 feet AGL.

En Route Outbound

The en route outbound phase is the part of flight in which the MK30 drone transits from the PADDC to a delivery point on a predefined flight path. During this flight phase, the drone will typically operate at an altitude of 300 feet AGL with a typical airspeed of 58 knots (67 miles per hour).

Delivery

The delivery phase consists of descent from the en route altitude to a delivery point to deliver a package. The MK30 drone transitions and descends to about 180 feet AGL and then vertically descends to about 13 feet AGL while maintaining position over the delivery point. The drone hovers while dropping the package and then proceeds to climb vertically back to en route inbound altitude.

En Route Inbound

The MK30 drone continues to fly at an altitude of about 300 feet AGL with a speed of 58 knots towards the PADDC.

Landing

Upon reaching the PADDC, the MK30 drone slowly descends over its assigned landing pad and lands on the pad.

Predicted Sound Levels

The FAA conducted a noise analysis using sound level measurement data for the MK27-2 drone. Amazon reports that improvements made to the MK30 model have reduced the overall operating sound level of the drone, and as such, use of the MK27-2 as a surrogate in the noise analysis is conservative for noise estimation. The estimated maximum sound exposure level (SEL) for the takeoff, delivery, and landing phases of flight is approximately 95.7, 96.3, and 94.8 decibels (dB), respectively, at 32.8 feet from the drone. Predicted sound levels decrease as distances from the drone increase. The maximum SEL for the en route phase is approximately 67.7 dB when the drone is flying about 52 knots (60 miles per hour). The detailed noise analysis is provided as **Attachment D**.

Action Area

The action area is defined as all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action (50 CFR § 402.02). The action area is defined as Amazon's proposed MK30 operating area (see **Attachment B**). This area captures all possible flight routes to the delivery areas and where potential effects (e.g., visual, auditory, physical) to listed species could occur.

According to the Texas Parks and Wildlife Department (TPWD), the action area is in the Post Oak Savanna ecoregion, a transitional area between woodlands and prairies, within Brazo County and portions of Burleson and Grimes counties. The Post Oak Savanna ecoregion is generally characterized by gently rolling to hilly land scattered with a variety of trees, including oaks, black hickory, cedar elm, and persimmon. Today the region is mostly improved pastureland and vast acreage of grassland.[1] However, within the action area, high to medium density developed urban and commercial areas exist, including some rural areas scattered throughout. Wildlife habitats within the action area predominantly include parks, a few open spaces, waterways, and vacant lands. Additionally, urban flora and fauna thrive in such environments and typically are well established and populated. These areas provide habitat for many of the more common and ubiquitous bird and mammal species in the region, including deer, squirrels, raccoons, armadillos, wild boar, jackrabbits, mice, badgers, songbirds, raptors, waterfowl, and insects.

ESA-Listed Species and Critical Habitat in the Action Area

The FAA acquired the Official Species List (see **Attachment E**) from the USFWS Information for Planning and Conservation online system to identify ESA-listed species, species proposed for listing, and designated critical habitat in the action area (**Table 1**). The action area contains designated critical habitat for the Texas fawnsfoot (*Truncilla macrodon*).

Table 1. ESA-Listed Species, Species Proposed for Listing, and Candidate Species Potentially Present in the Action Area

Species	Common Name	Species Name	Federal Status	Critical Habitat
Mammals	Tricolored bat	*Perimyotis subflavus*	Proposed Endangered	N
Birds	Rufa red knot	*Calidris canutus rufa*	Threatened	N
	Piping plover	*Charadrius melodus*	Threatened	N
	Whooping crane	*Grus americana*	Endangered	N
Amphibian	Houston toad	*Bufo houstonensis*	Endangered	N
Clams	Texas fawnsfoot	*Truncilla macrondon*	Proposed Threatened	Y

[1] Texas Parks and Wildlife. Ecoregion 3 – Post Oak Savannah. Available: https://tpwd.texas.gov/huntwild/wild/wildlife_diversity/wildscapes/ecoregions/ecoregion_3.phtml, Accessed January 2024.

Insects	Monarch butterfly	*Danaus plexippus*	Candidate Species	N
Plants	Navasota lades-tresses	*Spiranthes parksii*	Endangered	N
SOURCE: USFWS IPaC, accessed January 2024				

The Official Species List states the piping plover and red knot only need to be considered for wind energy projects. Since the action is not a wind energy project, these two species are not considered further.

Potential Effects of the Action on ESA-Listed Species and Critical Habitat

The action does not include any ground construction or habitat modification. During nominal operations, the drone would not touch the ground except at the PADDC, which is a developed area. The action would not result in any physical disturbance to habitat. Therefore, the proposed action does not have the potential to affect the Texas fawnsfoot critical habitat and Navasota lades-tresses (*Spiranthes parksii*). The FAA has determined the action would have ***no effect*** on Texas fawnsfoot critical habitat and Navasota lades-tresses.

Drone noise and the potential for airborne strikes with flying species are the action's potential stressors or threats to ESA-listed species. Flight operations would take place mostly in an urban environment, within airspace, and typically remain well above the tree line while en route to and from the PADDC. The duration of exposure by wildlife on the ground to visual or noise impacts from the drone would be of very short duration (approximately 30 seconds during takeoff/landing and delivery and a few seconds during the en route phase).

As noted above, the highest estimated SEL associated with Amazon's proposed operations is 96.3 dB, which would occur when the drone is taking off from or landing at the PADDC in a commercial area and during a delivery. For reference, the sound level of a diesel truck at 50 feet or a noisy urban environment during the day is approximately 80 to 90 dB. The SEL on the ground when the drone is flying in the en route phase at an altitude of 165 feet AGL is estimated to be around 67.7 dB, which is comparable to the sound of an air conditioning unit at 100 feet (60 dB).

A noise descriptor for noise effects on wildlife has not been universally adopted, but some research indicates SEL is the most useful predictor of responses. Characteristic of the bulk of research to date has been lack of systematic documentation of the source noise event. Many studies report "sound levels" without specifying the frequency spectrum or duration. A notable exception is a study sponsored by U.S. Air Force that identifies SEL as the best descriptor for response of domestic turkey poults to low-altitude aircraft overflights (Bradley et al. 1990). This study identified a threshold of response for disturbance of domestic turkeys ("100 percent rate of crowding") as SEL 100 dB. None of the predicted sound levels for the different flight phases exceed SEL 96.3 dB.

The following paragraphs describe the anticipated effects of the action on the remaining ESA-listed species and species proposed for listing (**Table 1**).

<u>Tricolored Bat</u>

The tricolored bat typically uses trees, caves, or manmade structures for roosting and forages for insects during dusk, nighttime, and dawn time periods. Tricolored bats emerge early in the evening and forage at treetop level or above but may forage closer to ground later in the evening. This species exhibits slow, erratic, fluttery flight while foraging and are known to forage most commonly over waterways and forest edges (USFWS 2023a). This species spends six to nine months per year hibernating in caves or mines (TPWD 2023c). The USFWS has proposed to list the tricolored bat as an endangered species, primarily due to white-nose syndrome.[2] Other factors that influence the tricolored bat's viability include wind-energy-related mortality, habitat loss, and effects from climate change.

Suitable habitat for tricolored bat roosting and feeding in the action area includes wooded areas, open water habitat, and manmade structures. Based on current data from the North American Bat Monitoring Program (USGS 2024), there is a low average occupancy of tricolored bats occurring in the action area, particularly in the urban environment where the PADDC is located and deliveries would occur (see **Attachment F**). The PADDC is located in a commercial area and therefore not within suitable habitat for tricolored bats.

As stated above, Amazon is proposing to conduct drone delivery operations during daylight hours (never before 7 A.M. or after 10 P.M). Therefore, the time period that represents the greatest potential for the action to affect a tricolored bat is at dawn and dusk. Also, the risk is only present for three to six months each year (i.e., when bats are not hibernating). Tricolored bats at roost or in flight could experience drone noise during the en route and delivery flight phases. Bats foraging at or near the tree line at the time a drone flies by would experience the greatest sound levels. Roosting bats or bats foraging near the ground at the time a drone flies by would experience lower sound levels. Given the estimated sound levels of the drone, the drone's linear flight profile to and from the PADDC and delivery locations, the short period of time the drone would be in any particular location, and the low probability of encountering an individual tricolored bat in the action area, drone noise is not expected to adversely affect tricolored bats. Any increase in ambient sound levels caused by the drone's flight would only last a few seconds during the en route phase and approximately 30 seconds during a delivery.

Bats could also be struck by a drone, particularly around dawn and dusk when foraging. Given the bat's ability to avoid flying into objects, the short period of time the drone would be in any one place, and the low probability of encountering a tricolored bat during operations, the likelihood of the drone striking a bat is discountable.

Based on 1) operations occurring mostly in an urban environment, 2) the altitude at which the drone flies in the en route phase (300 feet AGL), 3) the expected low sound levels experienced by a bat, 4) any increase in ambient sound levels would be short in duration, 5) the low probability of a tricolored bat occurring in the action area, and 6) the low likelihood of the drone striking a bat, the FAA has determined the action ***may affect, but is not likely to adversely affect*** the tricolored bat. Any effects would be discountable (extremely unlikely to occur) or insignificant (not able to be meaningfully measured, detected, or evaluated).

Whooping Crane

Whooping cranes use a variety of habitats, including wetlands, estuaries, pastures, agricultural fields, and shallow areas of open water habitats. They are omnivores that eat a variety of food including insects, reptiles, rodents, fish, small birds, mollusks, crustaceans, and berries. Whooping cranes breed in northwest Canada and migrate south and winter in Texas, primarily in the Aransas National Wildlife Refuge located on the Gulf coast (TPWD 2023e). The whooping crane is listed under the ESA primarily due to hunting pressures and habitat loss (USFWS 2023b; Cornell 2023). Suitable foraging habitat in the action area includes shallow areas of open water habitats, marshes, pastures, and agricultural fields.

The whooping crane may occur in the action area in the spring or fall months as it migrates to and from its breeding grounds in Canada and wintering grounds at the Aransas National Wildlife Refuge. The majority of migrant crane observations in Texas occur in the spring from March 19 to April 30 and fall

[2] 87 Federal Register 56381 (September 14, 2022).

from October 20 to November 24 (Pearse et al. 2020). The crane may use habitat (e.g., agricultural fields) in the action area as a stopover site to feed or rest during migration.

The action does not include ground disturbance and therefore would not physically impact potential foraging or resting habitat. If present in the action area during operations, whooping cranes could experience en route noise. Given the estimated sound levels of the drone, the drone's linear flight profile to and from the PADDC and delivery locations, the low probability of encountering an individual whooping crane during operations, and the short period of time the drone would be in any particular location, drone noise is not expected to adversely affect whooping cranes. Further, the chances of any one individual experiencing multiple overflights of a drone are low given the mobility of the birds. One study found that, in most instances, drones within 4 meters of birds did not cause a behavioral response (Vas et al. 2015).

Whooping cranes could be struck by a drone when in flight. The risk of a strike is low given the crane's limited occurrence in the action area and the crane's ability to fly and avoid the drone. The FAA has found that there is no known stopover habitat in the study area based on the Texas Parks and Wildlife Nature Trackers project, Texas Whooper Watch TPWD. 2023. Additionally, whooping crane migration flights are usually between 1,000 and 6,000 feet; therefore, it is not expected that occasional drone flights around 300 feet AGL would affect transitory swooping cranes if they were to migrate through the study area.

Based on 1) operations occurring mostly in an urban environment, 2) the altitude at which the drone flies in the en route phase (300 feet AGL), 3) the expected low sound levels experienced by a whooping crane, 4) any increase in ambient sound levels would be short in duration, 5) the low probability of a whooping crane occurring in the action area, 6) the low likelihood of the drone striking a whooping crane, and 7) no known stopover habitat in the study area based on the Texas Parks and Wildlife Nature Trackers project, the FAA has determined the action ***may affect, but is not likely to adversely affect*** the whooping crane. Any effects would be discountable (extremely unlikely to occur) or insignificant (not able to be meaningfully measured, detected, or evaluated).

Houston Toad

The Houston toad requires loose, deep sands supporting Loblolly pine forest, or mixed post oak-woodland savannah with 60-80% canopy cover and an open understory that supports native bunch grasses and still or flowing waters for breeding. The Houston toad lives primarily on land. These toads are considered habitat specialists, requiring very specific environmental conditions to survive. They aestivate (a dormant period during hot, dry conditions similar to hibernation during cold conditions) during most of the year, burrowing into the sand for protection. Habitat preferences include forested areas with loblolly pine, post oak, bluejack or sandjack oak, yaupon, and little bluestem. . The action does not involve any ground-disturbing activities or activities within Houston Toad habitat. As there is no plausible route of effect to this species, the FAA determined the action would have ***no effect*** on the Houston Toad.

Texas Fawnsfoot

The Texas fawnsfoot is a freshwater mussel that is endemic to Texas and found in the three river basins: Colorado, Brazos, and Trinity. The action does not involve any ground-disturbing activities or activities within Texas fawnsfoot habitat. As there is no plausible route of effect to this species, the FAA determined the action would have ***no effect*** on the Texas fawnsfoot.

Monarch Butterfly

The monarch butterfly is a candidate for federal listing. The primary threat to monarch butterflies is habitat loss, including the loss of breeding, migratory, and overwintering habitat. Pesticide use and climate change are also threats. While portions of the action area may contain potential summer breeding habitat, the entirety of Texas is within the migration path of monarch butterflies flying back and forth to wintering grounds in Mexico (TPWD 2023g).

The action would not physically affect monarch butterfly habitat or host plants. Monarch butterflies could be struck by drones en route to and from delivery; however, strikes are not likely given the species' mobility. 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 adversely affect*** the monarch butterfly.

Conclusion

Based on the analysis above, the FAA has determined the proposed action ***may affect, but is not likely to adversely affect*** the tricolored bat and whooping crane. The FAA appreciates your review of the proposed project and requests your concurrence with our effects determinations for these two species within 30 days of receiving this letter. If you have any questions, please contact Christopher Hurst via email at 9-faa-drone-environmental@faa.gov.

Sincerely,

DEREK W HUFTY

Digitally signed by DEREK W HUFTY
Date: 2024.03.19 14:57:48 -04'00'

Derek Hufty
Manager, General Aviation and Commercial Branch (AFS-750)
Emerging Technologies Division
Office of Safety Standards, Flight Standards Service

Attachments:
Attachment A – MK27-2 Operating Area
Attachment B – Proposed MK30 Operating Area
Attachment C – MK 30 Drone
Attachment D – Technical Noise Report
Attachment E – Official Species List
Attachment F – Tricolored Bat Mean Occupancy Probabilities

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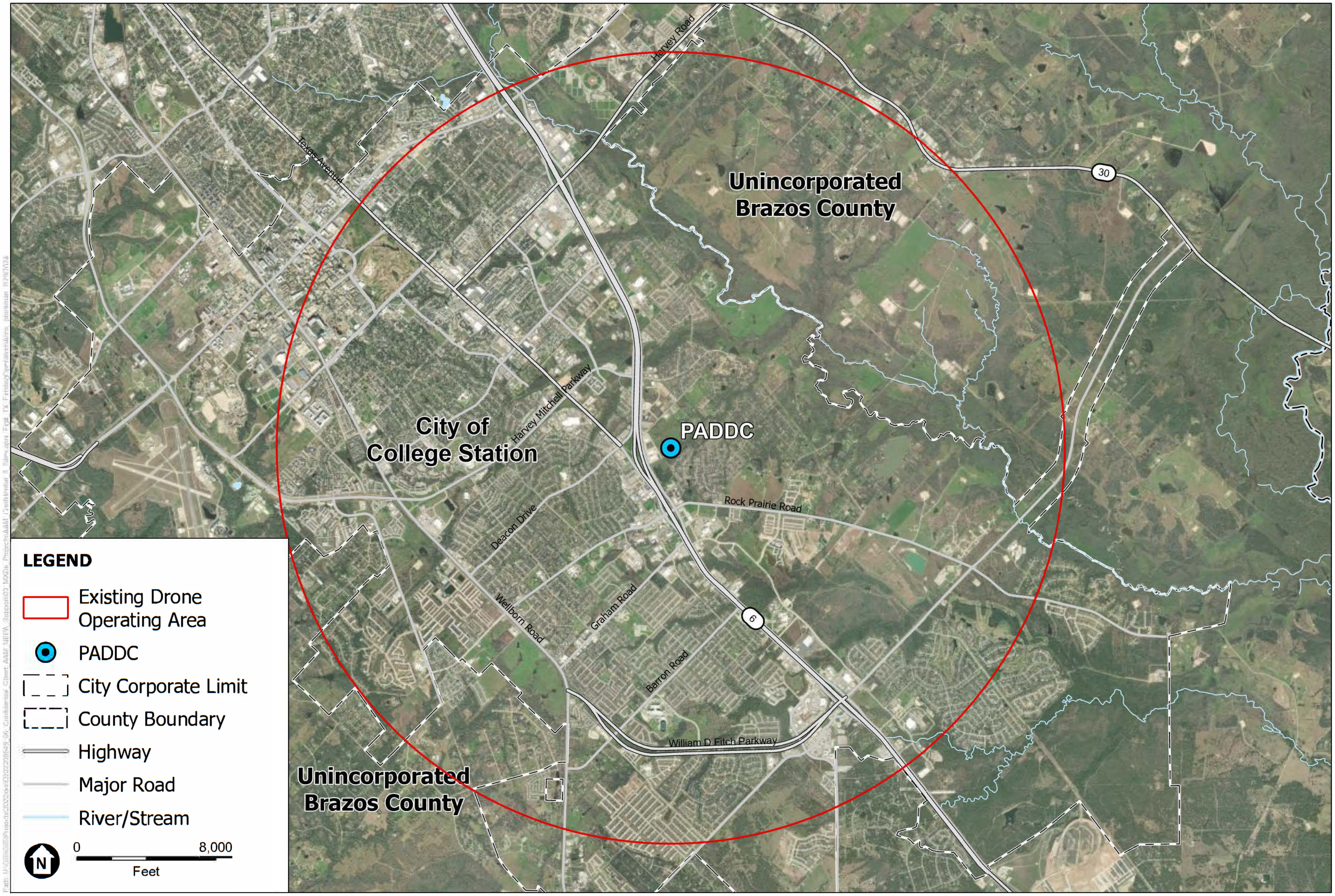
Attachment A

MK27-2 Operating Area



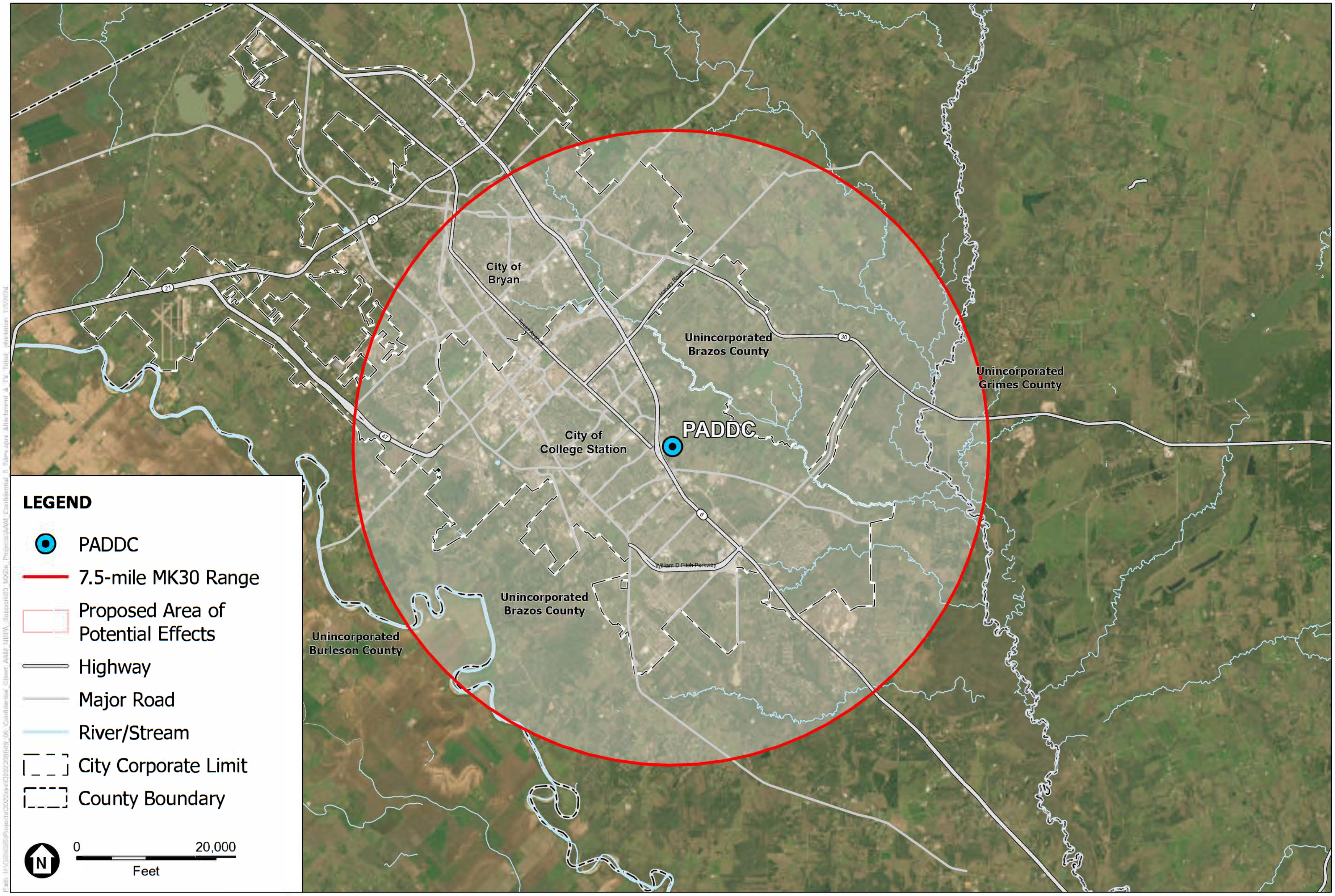
SOURCE: ESA, 2023; Maxar, 2022; US Census Bureau, 2021; US Geological Survey, 2022.

Existing Drone MK27-2
Operating Area
College Station, TX

ESA

Attachment B

Proposed MK30 Operating Area



SOURCE: ESA, 2023; Maxar, 2022; US Census Bureau, 2021; US Geological Survey, 2022; National Park Service, 2023.

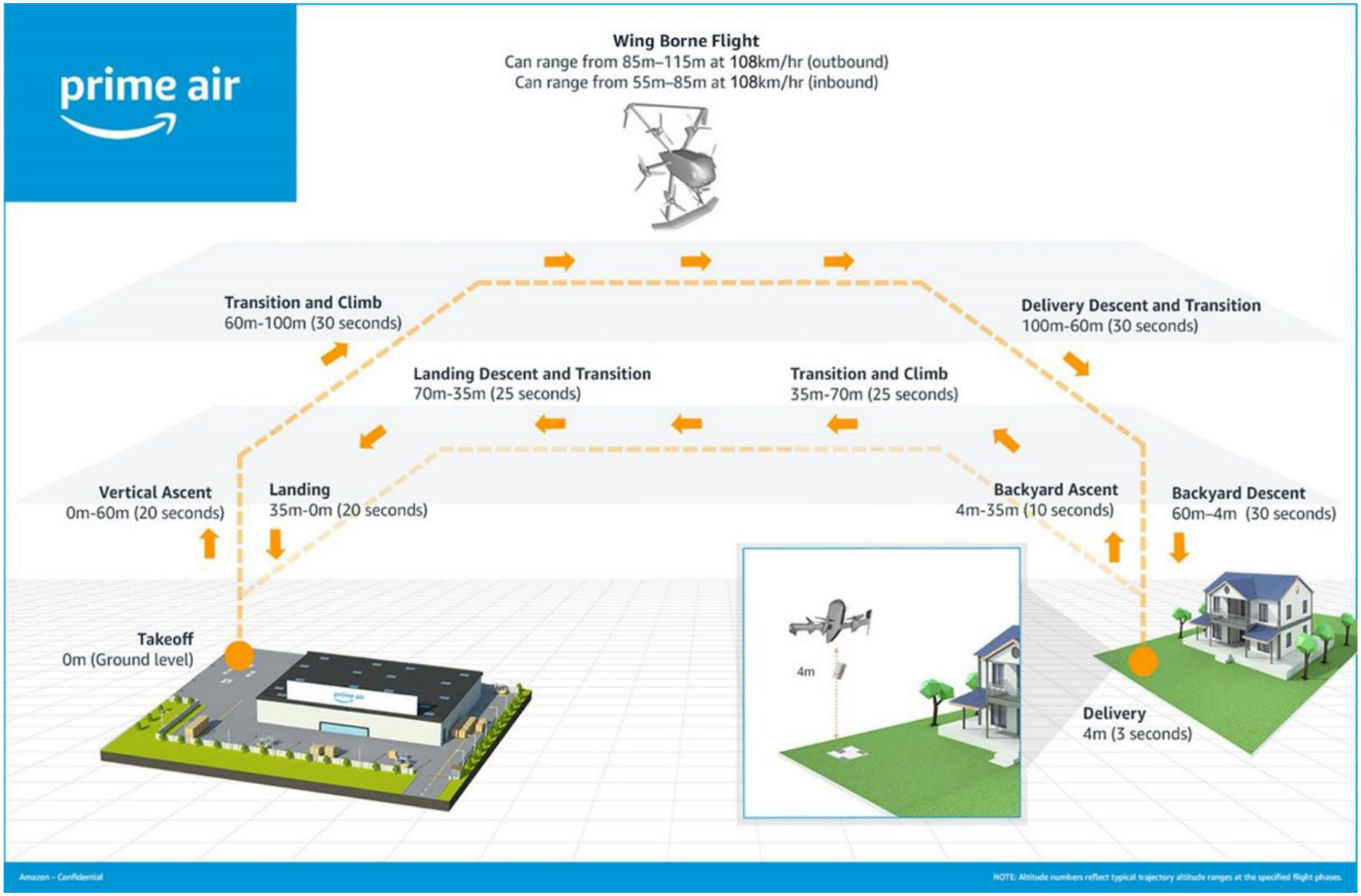
Proposed Drone MK30
Operating Area
College Station, TX

ESA

Attachment C
MK30 Drone

SOURCE: Amazon Prime Air, 2023.

MK30 Drone



SOURCE: Amazon Prime Air, 2023.

MK30 Drone Flight Profile

Attachment D

Technical Noise Report

NOISE ASSESSMENT
AMAZON PRIME AIR
MK27-2 UNMANNED AIRCRAFT OPERATIONS AT COLEGE STATION TEXAS

Noise Technical Report

February 2024

ESA

NOISE ASSESSMENT
AMAZON PRIME AIR
MK27-2 UNMANNED AIRCRAFT OPERATIONS AT COLEGE STATION TEXAS

Noise Technical Report

February 2024

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1 Introduction

Amazon Prime Air (Prime Air) is proposing to conduct drone delivery operations with the MK27-2 drone at their distribution hub (the Prime Air Drone Delivery Center, or PADDC) in College Station, Texas. The PADDC is located approximately 4 miles southeast of downtown College Station on Technology Parkway, as shown in **Figure 1**.

This document outlines the methodology and estimation of noise exposure expected with the proposed use of Prime Air's drone package delivery operations. The nonstandard methodology, equivalent to Federal Aviation Administration (FAA) Order 1050.1F, was approved by the FAA to inform the environmental decision-making regarding drone noise exposure from the proposed Prime Air package delivery operations[1]. Noise measurements of the MK27-2 drone were conducted by Amazon and processed by the FAA for the five phases of flight expected from drone operations. The methodology below adheres to the requirements of the National Environmental Policy Act (NEPA) and other relevant environmental local and federal review requirements. The results of the noise analysis are presented in terms of the annual Day-Night Average Sound Level (DNL), considering varying levels of operations for areas at ground level below each flight phase.

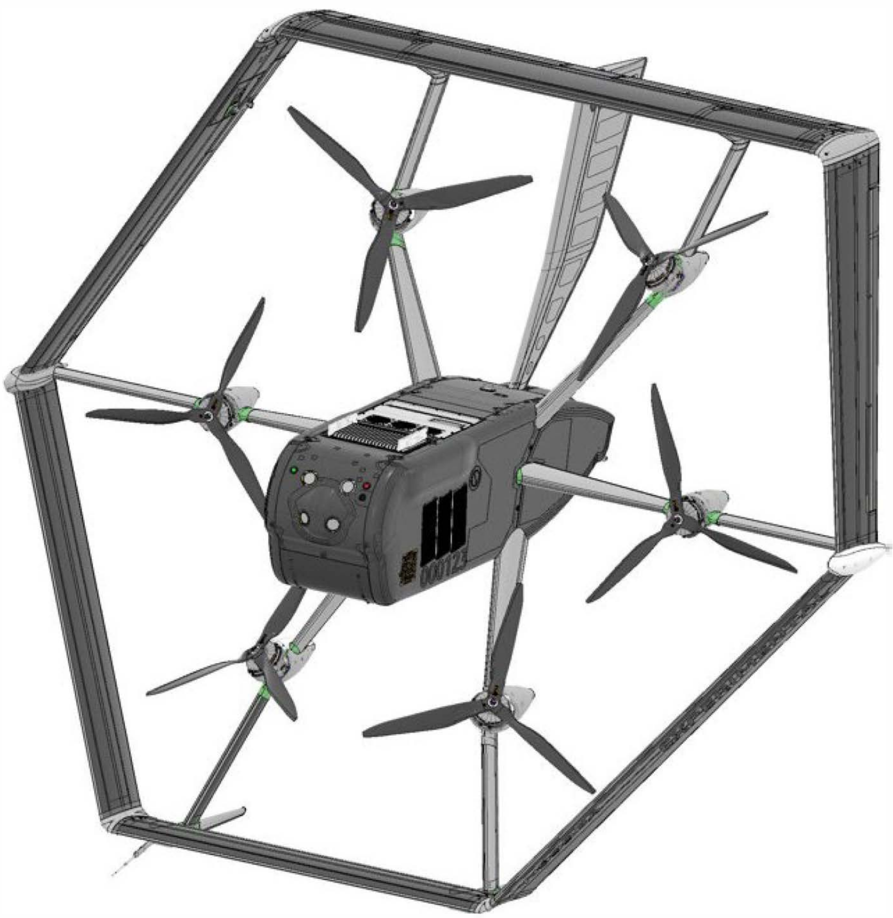
The MK27-2 is equipped with a multi-rotor design consisting of six propellers extending horizontally from the central frame with the ability to switch between vertical and horizontal flight. Per the specification from Prime Air, the drones' empty weight, including the battery, is 86.6 pounds with a maximum allowable takeoff weight is 91.5 pounds. The maximum allowable package weight the UA is certified to carry is 4.9 pounds. Packages delivered by the UA are transported within an internal cargo bay. An image of the MK27-2 drone is shown in **Figure 2**.

[1] *Environmental Assessment (EA) Noise Methodology Approval Request for Amazon Prime Air Commercial Package Delivery Operations with the MK27-2 UA from College Station, Texas,* FAA Office of Environment and Energy, September 2022. (See Attachment A).

Figure 1. PADDC Regional Location

Source: ESA, 2024; Maxar; 2022; US Census Bureau, 2021; US Geological Survey, 2022.

Figure 2. Amazon Prime Air MK27-2 Drone



Source: Amazon Prime Air, 2022.

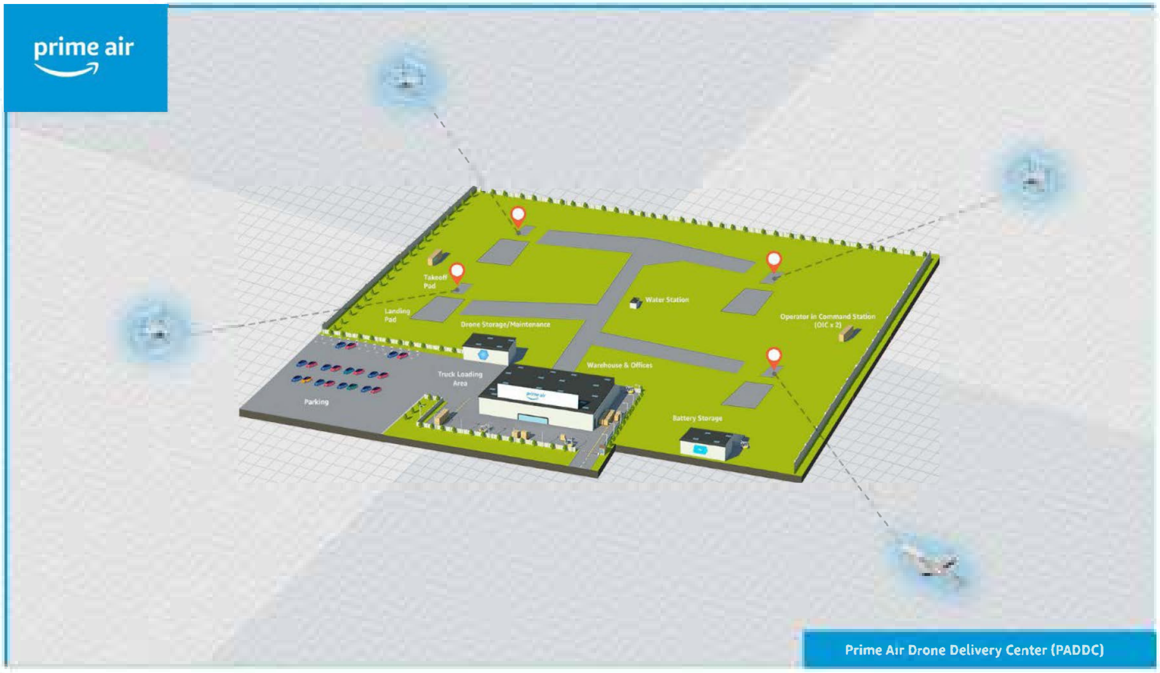
2 Drone Delivery Operations

The PADDC and its associated flight routes are determined by 'Prime Air's business and operational needs.

Takeoff pads at the PADDC's are four meters by four meters. Landing pads are eight meters by eight meters. Both pads are contained within a launch area approximately 35 meters by 45 meters. A diagram of a representative PADDC layout is presented in **Figure 3**.

The MK27-2 drone is capable of vertical ascent and descent, hovering, and flying upright with forward-facing propellers for en route travel. Airspeeds during normal en route flight are expected to be approximately 52.4 knots. A typical flight will commence with a vertical ascent from the launch pad to the en route altitude ranging between 160 and 180 feet Above Ground Level (AGL). The drone then maintains altitude and follows a predetermined route, traveling at 52.4 knots toward the designated delivery point. Upon arrival of the delivery point, the drone decelerates o zero speed and begins a vertical descent to 13 feet AGL at which time the package is released. The drone will ascend back to en route altitude and accelerate to 52.4 knots along the predetermined route back to the PADDC. Once the drone arrives at the PADDC it will decelerate to zero speed and begin a vertical descent to the landing pad.

Figure 3. Representative PADDC Layout



Source: Amazon Prime Air, 2022.

2.1 Flight Paths and Flight Profiles

Flight profiles of drone operations are broken into five general phases: takeoff, transitions to and from vertical and horizontal flight, en route, delivery, and landing. These phases can be combined to represent the typical operational profile of the drone as outlined below. A graphical representation of the operational profile is presented in **Figure 4** and each phase is summarized in **Table 1**.

Takeoff and Vertical Ascent

The drone departs from the launch pad once cleared for takeoff. It will ascend vertically to the en route altitude of between 160 and 180 feet AGL in vertical flight mode.[2]

Transition and Outbound Climb

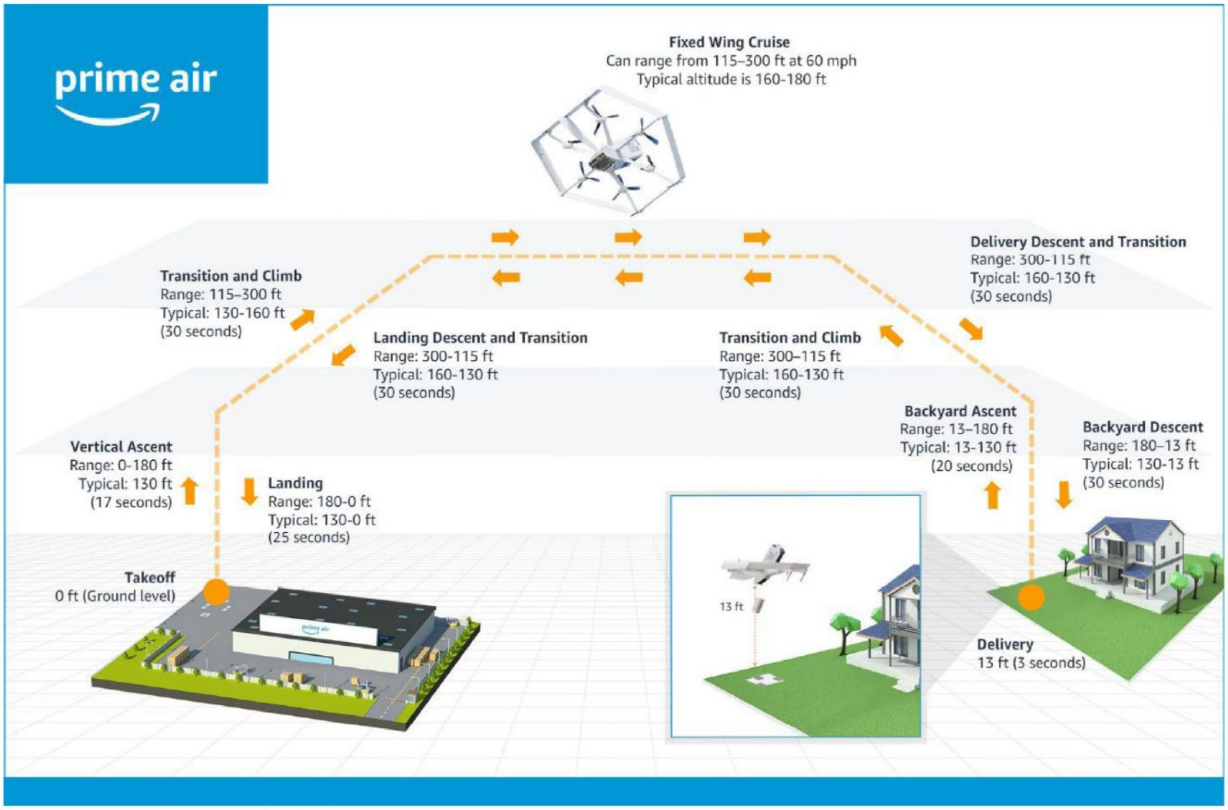
Upon reaching the en route altitude and while still positioned above the launch pad, the drone transitions from zero speed to its cruise speed of 52.4 knots. This transition is accompanied by a shift from vertical flight mode to horizontal flight mode.

Fixed-wing Outbound Cruise

The drone proceeds to fly at between 160 and 180 feet AGL and 52.4 knots to the delivery point.

[2] En route altitude is assumed to be 165 feet AGL, corresponding to the measurement data reviewed in FAA's memorandum, *Estimated Noise Levels for Amazon Prime Air MK27-2 UA*, FAA Office of Environment and Energy, August 2022 (See Attachment B).

Figure 4. Representative Operational Profile



Source: Amazon Prime Air, 2022.

Table 1. Representative Operational Profile by Phase of Flight

Phase of Flight	Altitude (feet AGL)	Ground Speed (knots)	Duration (seconds)
Takeoff and Vertical Ascent	Ascent from 0 to 165	0	21
Transition and Outbound Climb	165	0 to 52.4	20
Fixed-wing Outbound Cruise	165	52.4	Variable
Delivery Decent and Transition	165	52.4 to 0	20
Backyard Descent	Descend from 165 to 13	0	32
Delivery	13	0	2
Backyard Ascent	Ascent from 13 to 165	0	24
Transition and Inbound Climb	165	0 to 52.4	20
Fixed-wing Inbound Cruise	165	52.4	Variable
Landing Descent and Transition	165	52.4 to 0	20
Vertical Descent and Landing	Descend from 165 to 0	0	38

SOURCE: FAA, August 2022.

Delivery Descent and Transition

The drone decelerates from the en route speed of 52.4 knots and transitions to vertical flight mode, where it will be positioned over the delivery point at zero speed.

Backyard Descent, Delivery, and Ascent

The drone beings a vertical descent from en route altitude to 13 feet AGL while maintaining position above the delivery point. Once at 13 feet AGL, the drone drops the package and ascends vertically back to the en route altitude. It's important to note that the nearest allowable proximity of any individual, animal, or other obstacles to the delivery point during this maneuver is 16.4 feet.

Transition and Inbound Climb

Once at the en route altitude and positioned above the delivery point, the drone transitions from zero speed to en route speed while changing from vertical flight to horizontal flight.

Fixed-wing Inbound Cruise

The drone continues to fly at the en route altitude and speed towards the PADDC.

Landing Descent and Transition

The drone decelerates as it approaches the PADDC and transitions from horizontal flight to vertical flight, coming to a zero-speed position over its assigned landing pad.

Vertical Descent and Landing

The drone descends over its assigned landing pad in vertical flight until it touches down and shuts down the motors.

3 Acoustical Data of Flight Profiles

Prime Air conducted noise measurements of the MK27-2 drone in April 2021 at the Pendleton UAS Range located at the Eastern Oregon Regional Airport (KPDT). The FAA processed and analyzed the measurement data and calculated the estimate noise levels for each of the five phases of flight.[3] The following tables show either the A-weighted Sound Exposure Levels (SEL) or formulas to calculate the estimated SELs used for this analysis, which can be matched to each flight phase detailed in **Table 1**. The formula is based on Equation 1 below.

$$eq.1.\ SEL = m\ x\ Log_{10}(d) + b(dB)$$

Where:

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

Table 2 provides parameters to use within Equation 1 to estimate SELs associated with takeoff as a function of distance from the PADDC launch pad to the receiver. **Table 3** provides parameters to use within Equation 1 to estimate SELs associated with takeoff as a function of distance from the PADDC launch pad to the receiver. **Table 4** provides parameters to use within Equation 1 to estimate the SEL associated with delivery, as a function of distance from the delivery point to the receiver. **Table 5** presents the estimated SELs that correspond to the transition between vertical flight to horizontal flight. The values in this table are for distances relative to the point under the vertical flight path. **Table 5** is applicable to all transition phases discussed in **Section 2.1**. These levels should be integrated with data 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**.). Lastly, **Table 6** presents the estimates of en route SEL.

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

Range for d (feet 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	140.00
85.3 to 142.2	-27.79	142.71
142.2 and greater	-23.39	134.99

SOURCE: FAA, August 2022.

Note: Distance is along ground from launch pad to receiver.

[3] *Estimated Noise Levels for Amazon Prime Air MK27-2 UA,* FAA Office of Environment and Energy, August 2022 (See Attachment B).

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

Range for d (feet from delivery point)	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	-17.1	123.12
85.3 to 142.2	-24.56	137.53
142.2 and greater	-23.39	134.99

SOURCE: FAA, August 2022.

Note: Distance is along ground from launch pad to receiver.

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

Range for d (feet from delivery point)	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	-16.92	125.3
85.3 to 142.2	-26.31	143.42
142.2 and greater	-21.9	133.91

SOURCE: FAA, August 2022.

Note: Distance is along ground from launch pad to receiver.

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

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

SOURCE: FAA, August 2022.

Table 6. Estimates of En Route SEL

Aircraft Configuration	Reference Air Speed (knots)	Reference Altitude (feet AGL)	SEL (dB)
Max Weight	52.4	165	67.7

SOURCE: FAA, August 2022.

4 Methodology

Operations originating from the College Station PADDC is expected to occur daily between the hours of 7:00 AM and 10:00 PM. The number of daily and equivalent annual delivery operations is 469 and 171,329, respectively. As previously mentioned, there is not a standardized process for drone noise assessments. Therefore, ESA is applying technical guidance that was previously approved by the FAA Office of Environment and Energy for past analyses. The following subsection outlines this methodology.

4.1 Daytime Equivalent Operations and DNL

As mentioned, results are presented as DNL which applies a 10 dB weighting, or equivalent to 10 time the number of nighttime operations, for operations between 10:00 PM and 7:00 AM. Therefore, the operations near point *i* can be weighted to develop a daytime equivalent number of operations ($N_{equiv,i}$).

$$eq.2.\ N_{Equiv,i} = W_{Day}\ x\ N_{Day,i} + W_{Eve}\ x\ N_{Eve,i} + W_{Night}\ x\ N_{Night,i}$$

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

The number of daytime equivalent operations, $N_{DNL,i}$ can be simplified to

$$eq.3.\ N_{DNL,i} = N_{Day,i} + N_{Eve,i} + 10\ x\ N_{Night,i}$$

4.2 PADDC Infrastructure

The PADDC at College Station accommodates four sets of launch and landing pads. In the context of this noise analysis, it is assumed that only one launch/landing pad is under consideration at a given time. To conservatively represent all operations within the PADDC, including all launch and landing pads, the analysis is focused on the southernmost launch and landing pad that is closest to the noise-sensitive location. Application of Acoustical Data

The summation of the SELs in the previous section are used to estimate the DNL for Prime Air's drone operations covered in this report. SEL results are detailed in FAA's Memorandum found in **Attachment B**.

For calculating SEL, five specific activities are considered:

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

- The drone landing at the PADDC

This analysis is based on the SEL data provided in **Section 3**. **Table 5** displays noise exposure values at distinct increments corresponding to the drone vertical profile, ranging from 0 to 3,200 feet. In instances where additional values within this range are required, linear interpolation can be employed to approximate SEL values at intermediary distances. However, extrapolating SEL values for distances less than 32.8 feet during takeoff, landing, or delivery is discouraged due to increased deviations in the estimation method's accuracy as the distance approaches the noise source.

4.2.1 Takeoff

The process for calculating SELs for the takeoff profile is presented in **Section 3**, Equation 1 combined with the parameters presented **Table 2**.

Application of the SEL is based on the position of the southernmost launch pad at a PADDC. It should be noted that the SEL values provided do not include the transition to horizontal flight or the acceleration to en route speed that would occur after the climb.

4.2.2 Transitions between Vertical and Horizontal Flight

Table 5 presents noise exposure values SELs for the transition between vertical and horizontal flight. Noise exposure is expressed at discrete increments relative to the drone's ground location for distances from 0 to 3,200 feet. These values are applicable to the drone when it is in level flight at 165 feet AGL and is either accelerating or decelerating within the speed range of 0 to 52.4 knots over a duration of 20 seconds.

4.2.3 En Route

The anticipated flight speed of the drone en route is 52.4 knots at a cruise altitude of 165 feet AGL. Sound exposure level for a given point *i* (*SELi*) with the drone flying directly overhead at altitude (*Alti*) in feet and a ground speed (*Vi*) in knots, is calculated based on the guidance in *14 CFR Part 36 Appendix J, Section J36.205 Detailed Data Correction Procedures.*[4] The equations presented in this section are only applicable for a drone that is moving relative to a stationary receptor. The sound exposure level adjustment for the altitude of a moving drone is presented in Equation 4.

$$Eq.4.\ \Delta J_1 = 10\ x\ Log_{10}\frac{H_A}{H_T}, dB$$

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.

Note 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.

[4] https://www.ecfr.gov/current/title-14/chapter-I/subchapter-C/part-36.

The sound exposure level adjustment for speed is presented in Equation 5.

$$Eq. 5.\ \Delta J_3 = 10\ x\ Log_{10}\frac{V_R}{V_{RA}}, dB$$

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 drone at speed V_{RA} when the measured SEL corresponds to the drone traveling at a reference speed V_R.

This adjustment accounts for how the varying speed impacts the duration of the overflight at the stationary receptor.

As shown in **Table 6**, the SEL is 67.7 dB when the drone is at maximum weight, at 165 feet from the stationary receiver and traveling at approximately 52.4 knots. Using the maximum weight (outbound) en route condition when the drone is operating 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_{max} weight dB for that respective phase of flight.

$$Eq. 6.\ SEL_{Max} = 67.7 + 12.5\ x\ Log_{10}\frac{165}{Alt_i} + Log_{10}\frac{52.4}{V_i}, dB$$

For this analysis, it was assumed that Equation 6 is applicable for all en route activity to ensure a conservative assumption for drone flyovers at 165 feet AGL.[5]

4.2.4 Delivery

The available SELs to be applied for the delivery phase in Equation 1 are presented in **Table 4**. The SELs are based on the distance of the receiver relative to the position of the delivery point. The minimum distance used for calculation between the delivery point and a person is 16.4 feet.[6] The values in **Table 4** are valid for distances from the delivery point of 32.8 feet or greater. SEL values for distances of between 16 and 32.8 feet are adjusted by distance to the delivery point and sound level adjustment of a stationary source as provided by Equation 7.

$$Eq. 7.\ SEL_{Delivery} = 96.5 + 12.5\ x\ Log_{10}\frac{32.8}{Distance\ from\ Delivery\ Point\ (ft)}$$

The SEL values in **Table 4** do not provide the noise contribution from the horizontal flight associated with either the drone transitioning from en route speed to vertical flight before delivery, or the transition between vertical flight to en route speed after delivery. The SEL values only include descent from en route altitude to delivery altitude, various maneuvers associated with the delivery, and climb back to en route altitude.

[5] *Estimated Noise Levels for Amazon Prime Air MK27-2 UA*, FAA Office of Environment and Energy, August 2022 (See Attachment B).

[6] Prime Air's safety guidance stipulates that there should not be a person, animal or object within 5 meters of the delivery point, and if the drone detects a person, animal or object within 5 meters of the delivery point, it will abort the delivery.

4.2.5 Landing

The available SELs to be applied for the landing profile in Equation 1 are presented in **Table 3**. Application of the SEL is based on the location of the southernmost landing pad at a PADDC. 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.

4.3 DNL Estimation Methodology

The number of operations flying over a specific receiver's ground location will fluctuate depending 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 equivalent DNL in Equation 8.

$$Eq.8.\ DNL_{iA} = SEL_{iA} + 10\ x\ Log_{10}\left(N_{DNL,iA}\right) - 49.4, dB$$

The above equation applies to an SEL value representing one noise source such as a drone takeoff or landing. For cases where a receiver would be exposed to multiple noise sources (e.g. takeoff, transiting, en route, and departure), the complete DNL at that point was calculated with Equation 9.

$$Eq.9.\ DNL_i = 10\ x\ Log_{10}\left(10^{\left(\frac{DNL_{ia}}{10}\right)} + 10^{\left(\frac{DNL_{ib}}{10}\right)} + \cdots + 10^{\left(\frac{DNL_{iz}}{10}\right)}\right), dB$$

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

4.3.1 DNL at PADDC

The takeoffs and landings are anticipated to occur at the same location. Therefore, the results for both will be calculated for a single set of receptors. Operations were assumed to takeoff and the landing flight paths along the path.

Takeoff operations are represented by two sound levels. The drone will take off and climb to en route altitude as discussed in Section 2. The drone will then begin en route flight by transitioning from vertical flight to horizontal flight and accelerating to en route speed of 52.4 knots.

Landing operations are also represented by two sound levels. The drone flies to the PADDC at en route altitude while slowing down and transitions from horizontal to vertical flight as described in Section 2. Then the drone descends from en route altitude to the ground and shuts down.

The four noise sources representing the complete takeoff and landing cycle associated with a single delivery departing and returning at the PADDC were added together in Equation 9.

4.3.2 DNL for En Route

A 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. The number of operations would be based on relevant materials and assume that a drone directly overflies the receiver while at maximum weight for both outbound and inbound for a single delivery. The en route outbound and inbound noise level are added together with Equation 9.

4.3.3 DNL for Delivery Points

Delivery operations will be represented by three sound levels. First, the drone decelerates from en route speed and transitioning from horizontal flight to vertical flight over the delivery point at the en route altitude of 165 ft. Second, delivery phase where the package is dropped at the delivery point. Lastly, the drone transitions from vertical flight to horizontal flight after reaching the en route altitude of 165 feet AGL and accelerating to en route speed. The three sound levels are added together with Equation 9.

5 Estimated Noise Exposure

This section outlines the estimated noise exposure for Prime Air's proposed operations for any given number of average annual day (AAD) deliveries. Results are based off the estimated number of DNL equivalent deliveries associated with the PADDC and presented in tabular format. Prime Air expects to conduct 469 daily deliveries, which per note B in **Table 7**, the average daily deliveries rounds to 480. Note that one delivery includes the outbound takeoff and inbound landing and is representative of two operations.

The DNL equivalent deliveries, $N_{DNL,i}$ as described in Section 4.1, is presented below as Equation 10.

$$Eq. 10.\ Deliveries_{DNL,i} = Deliveries_{Day} + 10\ x\ Deliveries_{Night}$$

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

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 a particular receptor is at the transition of different flight phases, the cumulative noise exposure is then determined by adding the noise from each phase.

5.1 Noise Exposure for Operations at the PADDC

For operations at the PADDC, noise generated by the drone includes takeoff, landing, and transitions from vertical to fixed-wing horizontal flight within the corresponding en route flight phases. It was assumed that all operations follow the same en route flight path, with outbound and inbound flights traversing it in opposing directions for a conservative approach.

Table 7 presents data for the number of average daily DNL equivalent deliveries (including the takeoff and climb, transition to en route outbound, transition from en route inbound, and descent and landing as detailed in Section 2. The table provides the estimated extent of DNL 45 dB, 50 dB, 55 dB, 60 dB, and 65 dB contours under the flight path for the PADDC. The analyses presented were rounded up conservatively to the nearest interval available from the data from Section 3, out to 3,500 feet.

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

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

SOURCE: ESA, 2024.

Notes:

1. One delivery accounts for the outbound takeoff and inbound landing and is representative of two operations.
2. If a value for deliveries is not specifically defined in this table, use the next highest value. For example, if there are 50 average daily DNL equivalent deliveries, use the entry for 60 average daily DNL equivalent deliveries.

3 The DNL noise level noted extends more than 3,500 feet from the PADDC based on the level of operations specified as the aircraft continues along its en route flight path. En route results in Section 5.2 may be more applicable in these instances for determining noise levels.

5.2 Noise Exposure under En Route Paths

When the drone is en route it is expected to fly the same outbound flight path between the PADDC and the delivery point and inbound flight path back to the PADDC. Therefore, each receiver under the en route path would experience two overflights for each delivery served by the corresponding en route flight path.

Table 8 provides the estimated DNL for a receiver on the ground directly under an en route path for various counts of daily average DNL equivalent deliveries. The en route noise calculated for each delivery includes both the inbound and outbound traversal of the en route path at 165 feet AGL and a ground speed of 52.4 knots.

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

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

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

SOURCE: ESA, 2024.

Table 9. Estimated Noise Exposure Directly Under Overflights

Altitude of Overflight	SEL for One Overflight (dB)	DNL for One Overflight Between 7 AM and 10 PM (dB)	DNL Equation for the Number of DNL Equivalent Overflights
115 feet AGL	69.7	20.3	$10 \times \log_{10} (No) + 20.3$
160 feet AGL	67.9	18.5	$10 \times \log_{10} (No) + 18.5$
165 feet AGL	67.7	18.3	$10 \times \log_{10} (No) + 18.3$
180 feet AGL	67.2	17.9	$10 \times \log_{10} (No) + 17.9$
300 feet AGL	64.5	15.1	$10 \times \log_{10}(No) + 15.1$
N Feet AGL	$12.5 \times \log_{10}(165/N_{ft}) + 67.7$	$SEL_1 - 49.4$	$10 \times \log_{10}(No) + DNL_1$

SOURCE: ESA, 2024.

Notes:

1. The DNL value for a given number of average DNL Equivalent Operations, N_o, can be found by using the equations associated with operation of the drone at a specified altitude and speed interval. In this case, one operation represents a single overflight.
2. All values in this table are for level flight at maximum weight and 52.4 knots.

5.3 Noise Exposure for Operations at Delivery Point

Table 10 presents the estimated DNL values for a range of potential daily average DNL equivalent delivery counts at a delivery point. Also included in **Table 10** is the equation for calculating the estimated DNL for a specific number of daily average DNL equivalent delivery counts at a delivery point, defined as N_d, for instances where the number of deliveries may fall between the range of presented delivery count intervals.

The DNL values include the transition from en route speed to vertical flight at en route altitude, the delivery maneuver, and the transition from vertical flight at en route altitude to en route speed as discussed in Section 4.4.3. The minimum listener distance is 16.4 feet from the delivery point and corresponds to minimum distance between a person and delivery point. Values are also presented at 32.8 feet from the delivery point which corresponds to minimum distance from the available measurement data and analysis presented by FAA. Values were also calculated at distances of 50 feet, 75 feet, 100 feet, and 125 feet from the delivery point and are representative of distances from which nearby properties may experience noise from a delivery.[7]

[7] The 2022 US Census national average lot size for single-family sold homes was 15,265 square feet. This is representative of a property with dimensions of a 123.55 x 123.55-foot square. 125 feet represents a 125-foot lateral width of the parcel rounded up to the nearest 25 feet. https://www.census.gov/construction/chars/ See file “Soldlotsize_cust.xls” sheet MALotSizeSold. Accessed January 18, 2024.

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

Average Daily Deliveries	Annual Deliveries	DNL at 16.4 feet[1]	DNL at 32.8 feet[2]	DNL at 50 feet	DNL at 75 feet	DNL at 100 feet	DNL at 125 feet
<= 1	<= 365	51.0	47.2	46.1	44.3	41.6	39.1
<= 5	<= 1,825	57.9	54.2	53.1	51.3	48.6	46.1
<= 10	<= 3,650	61.0	57.2	56.1	54.3	51.6	49.1
<= 15	<= 5,475	62.7	58.9	57.9	56.1	53.3	50.8
<= 20	<= 7,300	64.0	60.2	59.1	57.3	54.6	52.1
<= 40	<= 14,600	67.0	63.2	62.1	60.3	57.6	55.1
<= 60	<= 21,900	68.7	65.0	63.9	62.1	59.3	56.9
<= 80	<= 29,200	70.0	66.2	65.1	63.3	60.6	58.1
<= 100	<= 36,500	71.0	67.2	66.1	64.3	61.6	59.1
<= 120	<= 43,800	71.7	68.0	66.9	65.1	62.4	59.9
<= 140	<= 51,100	72.4	68.6	67.6	65.8	63.0	60.5
<= 160	<= 58,400	73.0	69.2	68.2	66.3	63.6	61.1
<= 180	<= 65,700	73.5	69.7	68.7	66.9	64.1	61.6
<= 200	<= 73,000	74.0	70.2	69.1	67.3	64.6	62.1
<= 220	<= 80,300	74.4	70.6	69.5	67.7	65.0	62.5
<= 240	<= 87,600	74.8	71.0	69.9	68.1	65.4	62.9
<= 260	<= 94,900	75.1	71.3	70.3	68.5	65.7	63.2
<= 280	<= 102,200	75.4	71.7	70.6	68.8	66.0	63.6
<= 300	<= 109,500	75.7	72.0	70.9	69.1	66.3	63.9
<= 340	<= 124,100	76.3	72.5	71.4	69.6	66.9	64.4
<= 360	<= 131,400	76.5	72.8	71.7	69.9	67.1	64.6
<= 380	<= 138,700	76.8	73.0	71.9	70.1	67.4	64.9
<= 400	<= 146,000	77.0	73.2	72.1	70.3	67.6	65.1
<= 420	<= 153,300	77.2	73.4	72.4	70.5	67.8	65.3
<= 440	<= 160,600	77.4	73.6	72.6	70.7	68.0	65.5
<= 460	<= 167,900	77.6	73.8	72.7	70.9	68.2	65.7
<= 480	<= 175,200	77.8	74.0	72.9	71.1	68.4	65.9
<= 500	<= 182,500	77.9	74.2	73.1	71.3	68.6	66.1

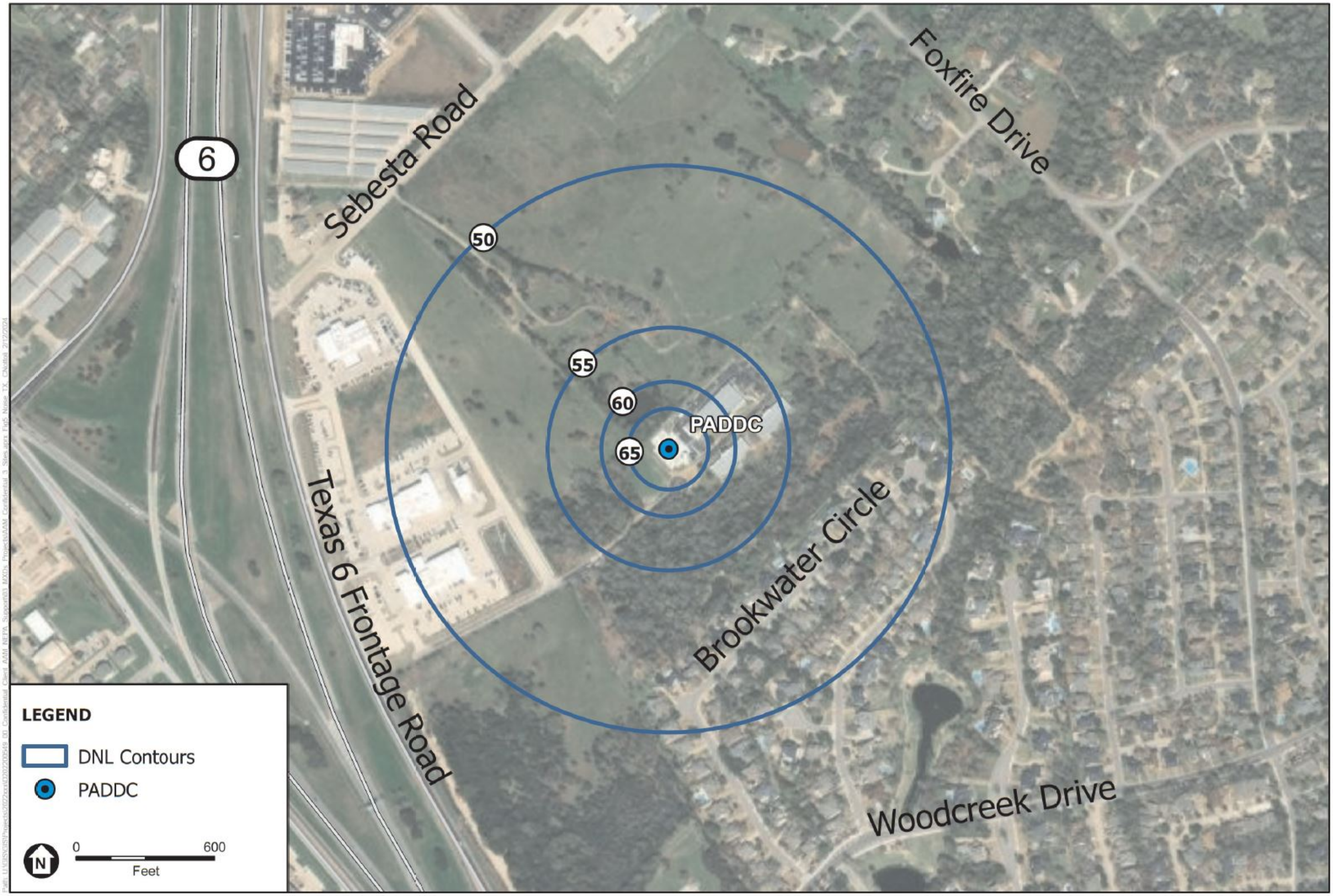
SOURCE: ESA, 2024.

Notes:

1. Minimum possible listener distance from drone.
2. Minimum measured distance to listener from drone.
3. The DNL values presented in this table only reflect the UA conducting descent and climb flight maneuvers associated with a delivery. DNL values associated with en route flight to and from a PADDC to a delivery point associated with a delivery, or nearby en route overflights, should be added to these values utilizing the DNL presented in Table 8.
4. If a value for deliveries is not specifically defined in this table, use the next highest value. For example, if there are 50 average daily DNL equivalent deliveries, use the entry for 60 average daily DNL equivalent deliveries.

6 Results

The DNL 50-, 55-, 60-, and 65-dB contours for Proposed Action are presented in **Figure 5**. These contours represent the 24-hour drone noise exposure to areas surrounding the College Station PADDC on an average annual day. Note that the DNL 65 dB contour does not extend beyond the Prime Air property line and is expected that no noise impacts to non-compatible land uses would occur.



SOURCE: ESA, 2023; Maxar, 2022; US Census Bureau, 2021; US Geological Survey, 2022.

Figure 5
PADDC Noise Exposure Contours
College Station, TX

ESA

Attachment A

Federal Aviation Administration

Memorandum

Date: September 22, 2022

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

MICHAEL JAY MILLARD Digitally signed by MICHAEL JAY MILLARD Date: 2022.09.22 13:41:19 -04'00'

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

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

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

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

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

Description of Aircraft and Proposed Operations

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

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

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

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

A single PADDC is expected to have four sectors and each sector will have no more than one UA operating at a time. Amazon projects operating 52,000 annual deliveries, no night time flights, with 142.47 total deliveries on an average annual daily basis. Based on those overall levels Amazon expects deliveries to be distributed among delivery locations with a minimum number of 0.1 deliveries per day or less at any one location and maximum of 4.0 per day at any one location on an average annual daily basis.

Noise Analysis Methodology

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

Federal Aviation Administration

Memorandum

Date: September 26, 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)

Donald S Scata

Digitally signed by DONALD S SCATA
Date: 2022.09.26 09:42:28 -04'00'

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

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

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

Amazon expects to operate four sectors at the College Station PADCC and each sector will have no more than one UA operating at a time. Amazon projects operating a maximum of 52,000 annual deliveries, no night time flights, with 142.47 total deliveries on an average annual daily (AAD) basis. Amazon anticipates deliveries will be distributed throughout the operating area with a maximum of 4 per day at any one delivery location on an AAD basis as detailed in the proposed non-standard noise modeling methodology request, "Environmental Assessment (EA) Noise Methodology Approval Request for Amazon Prime Air MK27-2 UA Part 135 Operations at College Station, TX" dated September 22, 2022.

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

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

Attachment B

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.

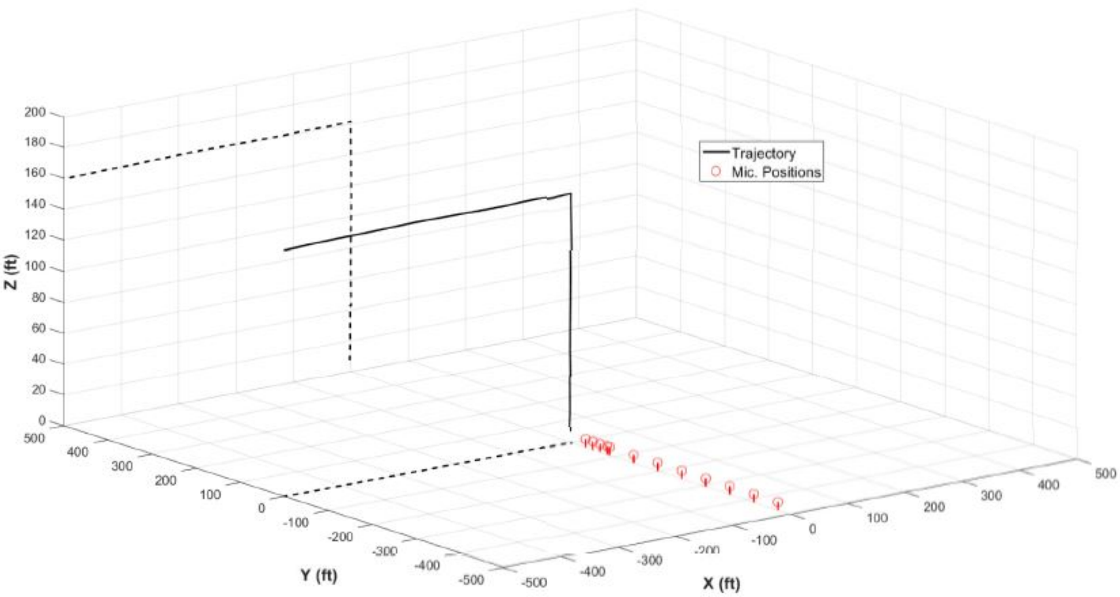


Figure 1. Microphone locations for takeoff, delivery, and landing measurements for MK27-2 UA with example takeoff trajectory.

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.

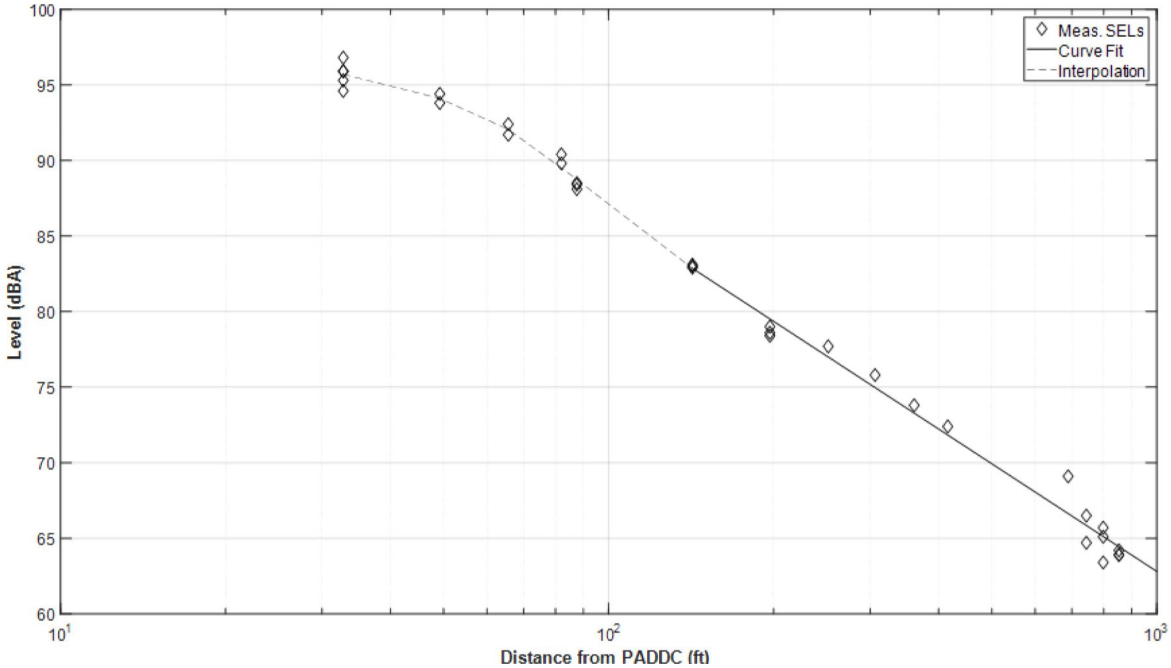


Figure 2. Measured sound exposure levels during takeoffs as described in Table 4.

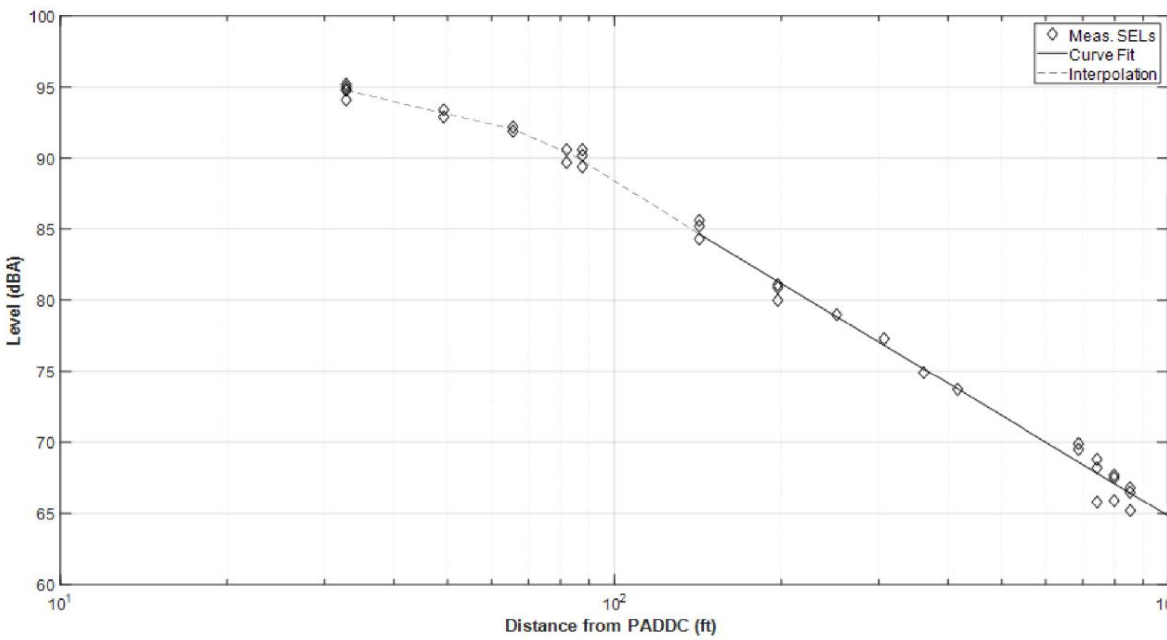


Figure 3. Measured sound exposure levels during landings as described in Table 4.

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.

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

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}.

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

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.

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

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

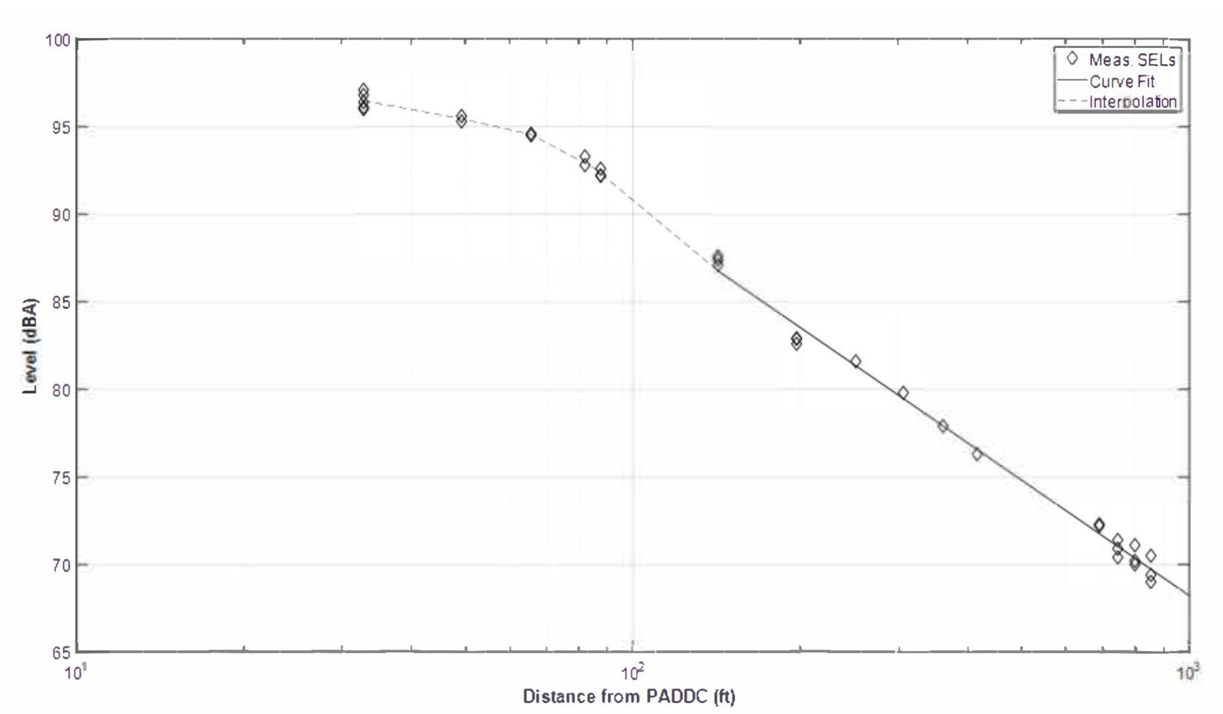


Figure 4. Measured Sound Exposure Levels during deliveries as described in Table 10.

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.

Attachment E

Official Species List

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Texas Coastal & Central Plains Esfo
17629 El Camino Real, Suite 211
Houston, TX 77058-3051
Phone: (281) 286-8282 Fax: (281) 488-5882

In Reply Refer To: 03/13/2024 12:29:15 UTC
Project Code: 2024-0061947
Project Name: Amazon College Station, TX Drone Package Delivery 2024 Official

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 U.S. Fish and Wildlife Service (Service) field offices in Clear Lake, Corpus Christi, Fort Worth, and Alamo, Texas, have combined administratively to form the Texas Coastal Ecological Services Field Office. All project related correspondence should be sent to the field office address listed below responsible for the county in which your project occurs:

Project Leader; U.S. Fish and Wildlife Service; 17629 El Camino Real Ste. 211; Houston, Texas 77058
Angelina, Austin, Brazoria, Brazos, Chambers, Colorado, Fayette, Fort Bend, Freestone, Galveston, Grimes, Hardin, Harris, Houston, Jasper, Jefferson, Leon, Liberty, Limestone, Madison, Matagorda, Montgomery, Newton, Orange, Polk, Robertson, Sabine, San Augustine, San Jacinto, Trinity, Tyler, Walker, Waller, and Wharton.

Assistant Field Supervisor, U.S. Fish and Wildlife Service; 4444 Corona Drive, Ste 215; Corpus Christi, Texas 78411
Aransas, Atascosa, Bee, Brooks, Calhoun, De Witt, Dimmit, Duval, Frio, Goliad, Gonzales, Hidalgo, Jackson, Jim Hogg, Jim Wells, Karnes, Kenedy, Kleberg, La Salle, Lavaca, Live Oak, Maverick, McMullen, Nueces, Refugio, San Patricio, Victoria, and Wilson.

U.S. Fish and Wildlife Service; Santa Ana National Wildlife Refuge; Attn: Texas Ecological Services Sub-Office; 3325 Green Jay Road, Alamo, Texas 78516
Cameron, Hidalgo, Starr, Webb, Willacy, and Zapata.

For questions or coordination for projects occurring in counties not listed above, please contact arles@fws.gov.

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 Service under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the 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 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/media/endangered-species-consultation-handbook.

Non-Federal entities may consult under Sections 9 and 10 of the Act. Section 9 and Federal regulations prohibit the take of endangered and threatened species, respectively, without special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined (50 CFR § 17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is defined (50 CFR § 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Should the proposed project have the potential to take listed species, the Service recommends that the applicant develop a Habitat Conservation Plan and obtain a section 10(a)(1)(B) permit. The Habitat Conservation Planning Handbook is available at: https://www.fws.gov/library/collections/habitat-conservation-planning-handbook.

Migratory Birds:
In addition to responsibilities to protect threatened and endangered species under the Act, 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 Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts visit: https://www.fws.gov/program/migratory-birds.

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 National Environmental Policy Act (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/library/collections/threats-birds.

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.

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.

Note: IPaC has provided all available attachments because this project is in multiple field office jurisdictions.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Bald & Golden Eagles
- 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:

Texas Coastal & Central Plains Esfo
17629 El Camino Real, Suite 211
Houston, TX 77058-3051
(281) 286-8282

This project's location is within the jurisdiction of multiple offices. However, only one species list document will be provided for all offices. The species and critical habitats in this document reflect the aggregation of those that fall in each of the affiliated office's jurisdiction. Other offices affiliated with the project:

Austin Ecological Services Field Office
1505 Ferguson Lane
Austin, TX 78754-4501
(512) 937-7371

PROJECT SUMMARY

Project Code: 2024-0061947

Project Name: Amazon College Station, TX Drone Package Delivery 2024 Official

Project Type: Drones - Use/Operation of Unmanned Aerial Systems

Project Description: Prime Air Drone Delivery Center (PADDC) located at 400 Technology Parkway, College Station, TX. MK30's operating range is 7.5 mi (12 km); operating area is 174 sq mi (450.6 sq km).

Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@30.59585075,-96.28365164506553,14z

Counties: Brazos , Burleson , and Grimes counties, Texas

ENDANGERED SPECIES ACT SPECIES

There is a total of 8 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. Note that 2 of these species should be considered only under certain conditions.

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
Tricolored Bat *Perimyotis subflavus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/10515	Proposed Endangered

BIRDS

NAME	STATUS
Piping Plover *Charadrius melodus* Population: [Atlantic Coast and Northern Great Plains populations] - Wherever found, except those areas where listed as endangered. There is **final** critical habitat for this species. Your location does not overlap the critical habitat. This species only needs to be considered under the following conditions: ▪ Wind related projects within migratory route. ▪ Wind Energy Projects Species profile: https://ecos.fws.gov/ecp/species/6039	Threatened
Rufa Red Knot *Calidris canutus rufa* There is **proposed** critical habitat for this species. This species only needs to be considered under the following conditions: ▪ Wind related projects within migratory route. ▪ Wind Energy Projects Species profile: https://ecos.fws.gov/ecp/species/1864	Threatened
Whooping Crane *Grus americana* Population: Wherever found, except where listed as an experimental population There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/758	Endangered

AMPHIBIANS

NAME	STATUS
Houston Toad *Bufo houstonensis* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2206	Endangered

CLAMS

NAME	STATUS
Texas Fawnsfoot *Truncilla macrodon* There is **proposed** critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8965	Proposed Threatened

INSECTS

NAME	STATUS
Monarch Butterfly *Danaus plexippus*	Candidate

NAME	STATUS
No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	

FLOWERING PLANTS

NAME	STATUS
Navasota Ladies-tresses *Spiranthes parksii* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1570	Endangered

CRITICAL HABITATS

There is 1 critical habitat wholly or partially within your project area under this office's jurisdiction.

NAME	STATUS
Texas Fawnsfoot *Truncilla macrodon* https://ecos.fws.gov/ecp/species/8965#crithab	Proposed

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.

BALD & GOLDEN EAGLES

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

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats[3], should follow appropriate regulations and consider implementing appropriate conservation measures, as described in the links below. Specifically, please review the "Supplemental Information on Migratory Birds and Eagles".

---

1. The Bald and Golden Eagle Protection Act of 1940.
2. The Migratory Birds Treaty Act of 1918.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

There are likely bald eagles present in your project area. For additional information on bald eagles, refer to Bald Eagle Nesting and Sensitivity to Human Activity

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

NAME	BREEDING SEASON
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 Sep 1 to Jul 31

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 "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence ()

Green bars; the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during that week of the year.

Breeding Season ()

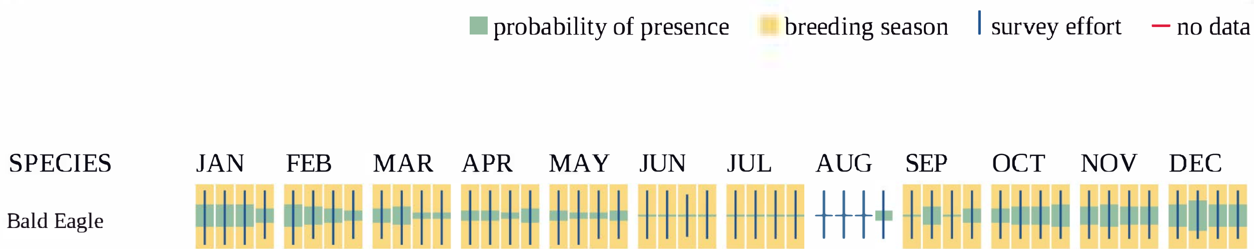
Yellow bars; liberal estimate of the timeframe inside which the bird breeds across its entire range.

Survey Effort (|)

Vertical black lines; the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data (–)

A week is marked as having no data if there were no survey events for that week.



Non-BCC
Vulnerable

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- 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
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

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[3] should follow appropriate regulations and consider implementing appropriate conservation measures, as described in the links below. Specifically, please review the "Supplemental Information on Migratory Birds and Eagles".

---

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)

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

NAME	BREEDING SEASON
American Golden-plover *Pluvialis dominica* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/10561	Breeds elsewhere

NAME	BREEDING SEASON
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 Sep 1 to Jul 31
Chimney Swift *Chaetura pelagica* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9406	Breeds Mar 15 to Aug 25
Lesser Yellowlegs *Tringa flavipes* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9679	Breeds elsewhere
Little Blue Heron *Egretta caerulea* 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/9477	Breeds Mar 10 to Oct 15
Long-billed Curlew *Numenius americanus* 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/5511	Breeds elsewhere
Mountain Plover *Charadrius montanus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3638	Breeds elsewhere
Pectoral Sandpiper *Calidris melanotos* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9561	Breeds elsewhere
Prothonotary Warbler *Protonotaria citrea* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9439	Breeds Apr 1 to Jul 31
Red-headed Woodpecker *Melanerpes erythrocephalus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9398	Breeds May 10 to Sep 10
Sprague's Pipit *Anthus spragueii* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8964	Breeds elsewhere

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 "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

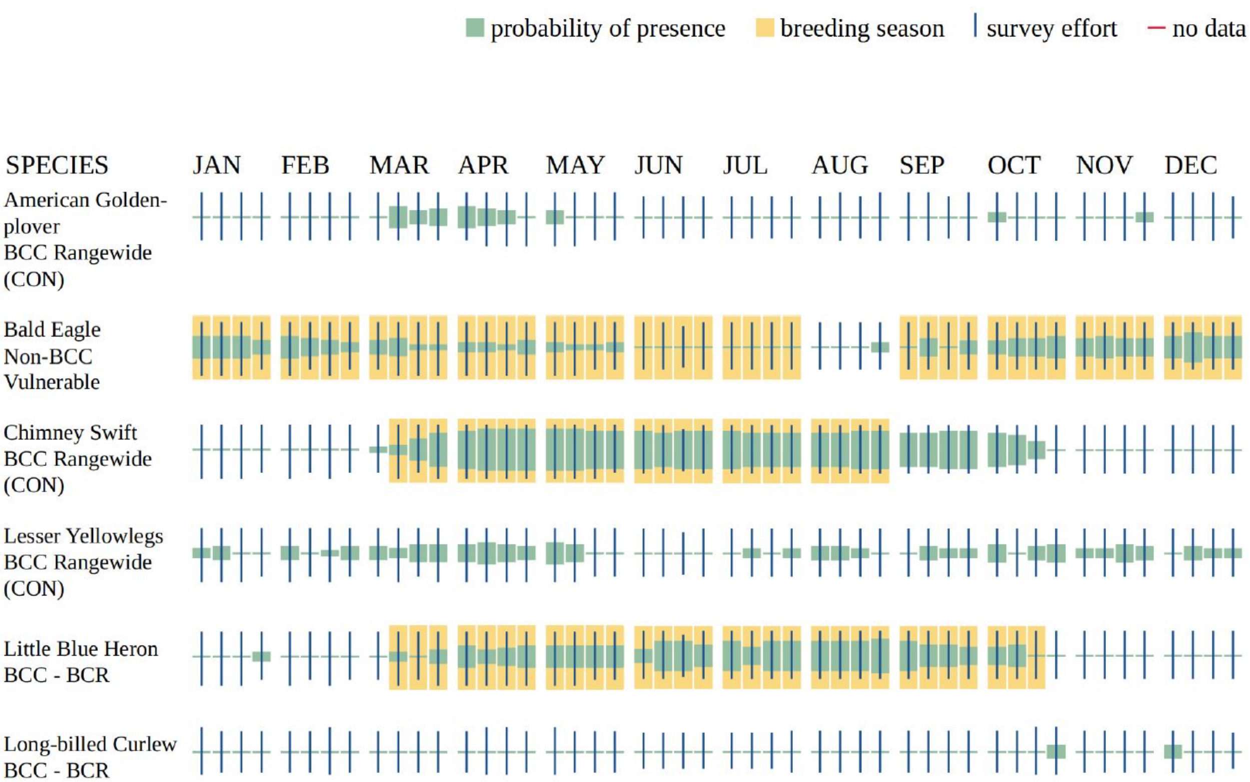
Probability of Presence ( )

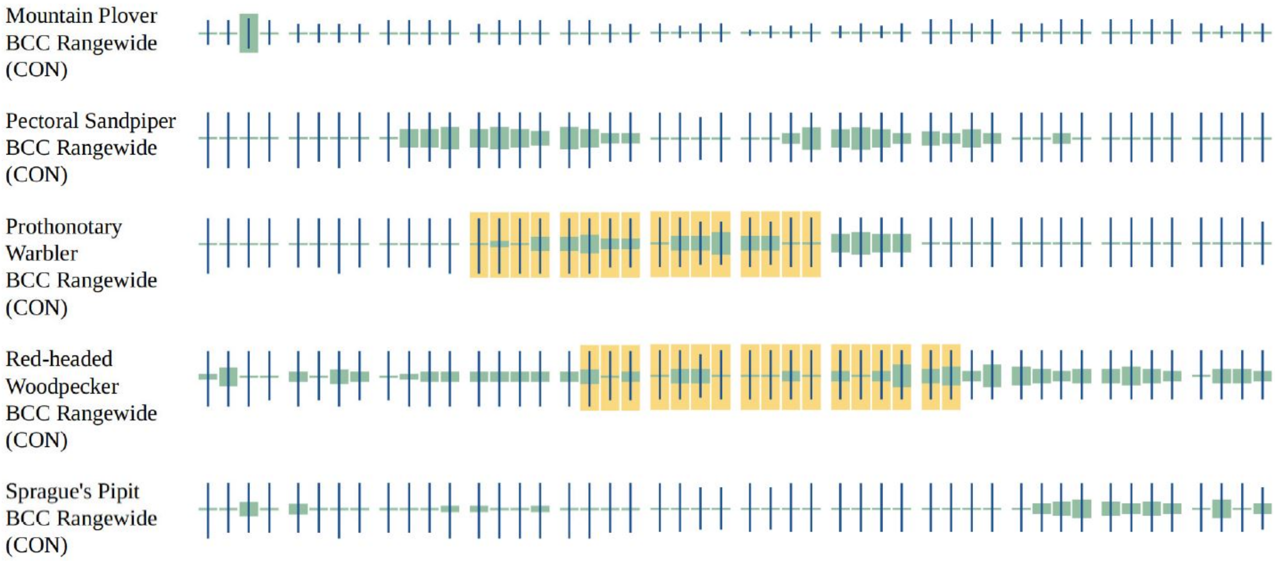
Green bars; the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during that week of the year.

Breeding Season ( )
Yellow bars; liberal estimate of the timeframe inside which the bird breeds across its entire range.

Survey Effort (|)
Vertical black lines; the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

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





Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- 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
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

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.

Due to your project's size, the list below may be incomplete, or the acreages reported may be inaccurate. For a full list, please contact the local U.S. Fish and Wildlife office or visit https://www.fws.gov/wetlands/data/mapper.HTML

FRESHWATER POND

- PUBH

- PUBF
- PAB4Hh
- PAB3/UBH
- PUB/AB4Hh
- PUBHh

FRESHWATER FORESTED/SHRUB WETLAND

- PSS1F
- PFO5/UBHh
- PSS1A
- PFO1Ch
- PFO1C
- PSS1C
- PSS1/UBF
- PFO1F
- PFO1Fh
- PFO1A

LAKE

- L1UBHh
- L1UBHx

FRESHWATER EMERGENT WETLAND

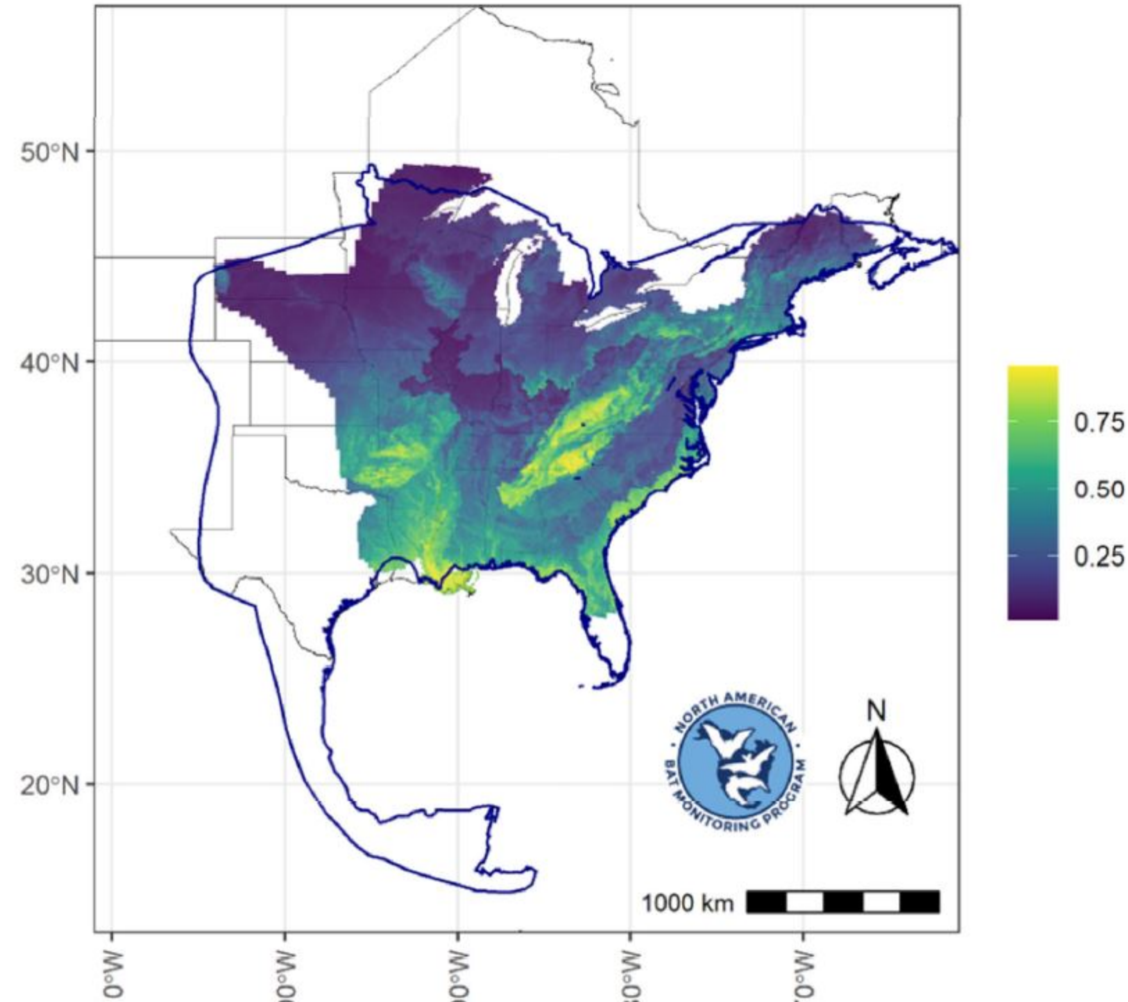
- PEM1C
- PEM1A
- PEM1F
- PEM1Fh
- PEM1/SS1A

IPAC USER CONTACT INFORMATION

Agency: Federal Aviation Administration
Name: Chris Hurst
Address:
Address Line 2:
City:
State:
Zip:
Email Christopher.a.hurst@faa.gov
Phone:

Attachment F

Tricolored Bat Mean Occupancy Probabilities



Perimyotis subflavus (PESU) mean occupancy probabilities (color bar) predicted in each NABat grid cell in the modeled species range for 2019. Probabilities are depicted against the reference range map (blue polygon; M. Turner written communication, August 20, 2021) and borders of U.S. states and Canadian provinces/territories.

USGS
science for a changing world

Appendix C
Section 4(f) Resources

APPENDIX C
TABLE C-1
SECTION 4(F) RESOURCES IN THE STUDY AREA

Name	Owner	Address
Texas Independence Ballpark	College Station, City of	
Edelweiss Gartens	College Station, City of	500 Hartford Dr, 77845
Anderson	College Station, City of	900 Anderson St, 77840
Billie Madeley	College Station, City of	760 Sunny Ln, 77840
Brothers Pond	College Station, City of	3100 Rio Grande Blvd, 77845
Cy Miller	College Station, City of	2609 Texas Ave S, 77840
Edelweiss	College Station, City of	3900 Victoria Ave, 77845
Emerald Forest	College Station, City of	8400 Appomattox Dr, 77845
Gabbard	College Station, City of	1201 Dexter Dr S, 77840
Georgie K Fitch	College Station, City of	925 Balcones Drive, 77840
Jack & Dorothy Miller	College Station, City of	501 Rock Prairie Rd, 77845
Lemontree	College Station, City of	1300 Lemontree Ln, 77840
Lions	College Station, City of	501 Chappel St, 77840
Longmire	College Station, City of	2601 Longmire Dr, 77845
Luther Jones	College Station, City of	400 Park Place, 77840
Merry Oaks	College Station, City of	1401 Merry Oaks Dr, 77840
Oaks	College Station, City of	1601 Stallings Dr, 77840
Parkway	College Station, City of	901 Woodland Pkwy, 77840
Pebble Creek	College Station, City of	400 Parkview Dr, 77845
Woodland Hills	College Station, City of	4418 Woodland Ridge Dr, 77845
Sandstone	College Station, City of	1700 Sebesta Rd, 77845
Southwest	College Station, City of	300 Southwest Pkwy, 77840
Brian Bachmann	College Station, City of	1600 Rock Prairie Rd, 77845
Steeplechase	College Station, City of	301 West Ridge Dr, 77845
University	College Station, City of	300 Park Rd, 77840
W A Tarrow	College Station, City of	107 Holleman Dr, 77840
Windwood	College Station, City of	2600 Brookway Ct, 77845
Wolf Pen Creek	College Station, City of	2275 Dartmouth St, 77840
Woodcreek	College Station, City of	9100 Shadowcrest Dr, 77845
John Crompton	College Station, City of	201 Holleman Dr W, 77840
Castle Rock	College Station, City of	4550 Castle Rock Pkwy, 77845
Crescent Pointe	College Station, City of	2191 Crescent Pointe Pkwy, 77845
Cove of Nantucket	College Station, City of	1725 Parkland Dr, 77845
Northgate	College Station, City of	306 Spruce St, 77840
Southern Oaks	College Station, City of	4101 Alexandria Dr, 77845
Art & Myra Bright	College Station, City of	2505 Raintree Dr, 77845
Carter's Crossing	College Station, City of	2101 North Forest Pkwy, 77845

Name	Owner	Address
Sonoma	College Station, City of	318 Hanna Ct, 77845
Smith Tract	College Station, City of	2708 Harvey Rd, 77845
Wallace Lake	College Station, City of	4202 W S Phillips Pwky, 77845
Phillips	College Station, City of	4197 W S Phillips Pkwy, 77845
College Station Cemetery	College Station, City of	2530 Texas Ave S, 77840
Bridgewood	College Station, City of	4023 Dunlap Lp, 77845
Etonbury	College Station, City of	3330 Greens Prairie Rd W, 77845
Summit Crossing	College Station, City of	4001 Harvey Rd, 77845
Reatta Meadows	College Station, City of	1108 Southern Plantation Dr, 77840
Castlegate	College Station, City of	4455 Castlegate Dr, 77845
Creek View	College Station, City of	951 Eagle Ave, 77845
Eastgate	College Station, City of	910 Foster Ave, 77840
Thomas	College Station, City of	1300 James Pkwy, 77840
Wildwood	College Station, City of	4609 Lakeway Dr, 77845
Lick Creek	College Station, City of	14800 Rock Prairie Rd, 77845
Huntington Trail	College Station, City of	1130 Midtown Dr, 77845
Greens Prairie Reserve	College Station, City of	4801 Diamondback Dr, 77845
Midtown Reserve	College Station, City of	1027 Toledo Bend Dr, 77845
First Down	College Station, City of	8670 HSC Pkwy, 77845
Southland	College Station, City of	
MD Wheeler Ph2	College Station, City of	1150 Midtown Dr, 77845
Headlake	College Station, City of	
Stephen C Beachy Central	College Station, City of	1000 Krenek Tap Rd, 77840
Memorial Cemetery	College Station, City of	3800 Raymond Stotzer Pkwy, 77845
Barracks II	College Station, City of	3331 Cullen Trl, 77845
Bee Creek	College Station, City of	1900 Anderson St, 77840
Veterans Park & Athletic Comp.	College Station, City of	3101 Harvey Rd, 77845
Anderson Aboretum	College Station, City of	
Fun For All Playground	College Station, City of	
Adamson Lagoon	College Station, City of	
Cindy Hallaran Pool	College Station, City of	
Lick Creek Greenway	College Station, City of	
Lincoln Recreation Center	College Station, City of	1000 Eleanor St, 77840
Brison	College Station, City of	400 Dexter Dr, 77840
Spring Creek	College Station, City of	Subdivision, COCS – Fire Station #5
Bee Creek	College Station, City of	Subdivision, COCS – City Centr
White Creek	College Station, City of	Subdivision, TCC
Carter Creek	College Station, City of	Subdivision, High Ridge
Lick Creek	College Station, City of	Subdivision, Carroll Addition

Name	Owner	Address
Lick Creek	College Station, City of	Subdivision, Lick Creek Ph 1
Lick Creek	College Station, City of	Subdivision, COCS – Spring Creek Electric Substation
Wolf Pen Creek	College Station, City of	Subdivision, Lacour
Wolf Pen Creek	College Station, City of	Subdivision, Boardwalk
Wolf Pen Creek	College Station, City of	Subdivision, Wolf Pen Plaza
Wolf Pen Creek Trib A	College Station, City of	Subdivision, University Oaks
Wolf Pen Creek Trib A	College Station, City of	Subdivision, University Oaks
Bee Creek	College Station, City of	Subdivision, COCS – Water Services
Carter's Creek	College Station, City of	Subdivision, Entergy
Carter's Creek	College Station, City of	N/A
Carter's Creek	College Station, City of	Subdivision, Martell
Lick Creek Trib 13	College Station, City of	Subdivision, Alexandria
Lick Creek Trib 13	College Station, City of	Subdivision, Dove Crossing Ph 6
Spring Creek	College Station, City of	Subdivision, Spring Creek Gardens
Spring Creek	College Station, City of	Subdivision, Spring Creek Gardens
Spring Creek	College Station, City of	Subdivision, Spring Creek Gardens
Lick Creek	College Station, City of	Subdivision, Graham Corner Plaza
Lick Creek	College Station, City of	Subdivision, Aggieland
Burton Creek Park	College Station, City of	
Copperfield Park	Bryan, City of	5001 Canterbury Dr
Garden Acres Park	Bryan, City of	700 Garden Acres Blvd
Tiffany Park	Bryan, City of	3890 Copperfield Dr
Austins Colony Park	Bryan, City of	2496 Austins Colony
Astin Recreational Area	Bryan, City of	129 Rountree Dr
Williamson Park	Bryan, City of	411 Williamson Dr
Cherry Park	Bryan, City of	3800 Oak Hill Dr
Miracle Place Park	Bryan, City of	1605 E Wjb Pkwy
Garden Acres Boulevard	Bryan, City of	Garden Acres Blvd
Barbara's Byway	Bryan, City of	Villa Maria Rd & 2818
Morris ""Buzz"" Hamilton Memorial Park	Bryan, City of	Boonville Rd
Autumn Lake	Bryan, City of	2011 Turning Leaf Dr
Hudson @ University	Bryan, City of	Park Hudson Development
Crescent Park	Bryan, City of	Hensel Av
Greenbrier (Future)	Bryan, City of	Thornberry Dr
Shirewood Trail	Bryan, City of	W Villa Maria Rd Sw of Westwood Main
Briar Meadows Creek	Bryan, City of	Ella Ln & Peterson Way
Freedom Blvd	Bryan, City of	Freedom Blvd
Sue Haswell Memorial Park	Bryan, City of	1142 E Wjb Pkwy

Name	Owner	Address
Villa West Park	Bryan, City of	2050 W Villa Maria Rd
Travis Bryan Midtown Park	Bryan, City of	206 W Villa Maria Rd
Bryan Aquatic Center	Bryan, City of	3101 Oak Ridge Dr
Camelot Park	Bryan, City of	E Villa Maria Rd
Henderson Park	Bryan, City of	1629 Mockingbird Ln
Heritage Park	Bryan, City of	600 S Hutchins St
Federal Park	Bryan, City of	1111 Waco St
Tanglewood Park	Bryan, City of	3901 Carter Creek Pkwy
Travis Athletic Complex	Bryan, City of	525 Carson St
Crescent Triangle	Bryan, City of	Hensel Av
Austin's Colony Greenway	Bryan, City of	2400 Austin's Colony Pw
Carriage Hills Trail	Bryan, City of	Graystone Dr
Heritage Triangle	Bryan, City of	30th St
Moran Boulevard	Bryan, City of	Moran St
Redbud Park	Bryan, City of	Redbud St
Shady Point	Bryan, City of	S Rosemary Dr
Winchester Park	Bryan, City of	5004 Brompton Ln
Sam Rayburn School Park	Bryan, City of	1048 N Earl Rudder Frw
Allen Ridge Park	Bryan, City of	1517 Prairie Dr
Coulter Park	Bryan, City of	S Coulter Dr
Shirewood Park	Bryan, City of	Beaver Pond Ct
Symphony Park	Bryan, City of	2530 Rhapsody Ct
Rosewood Trail	Bryan, City of	W Villa Maria & Shirewood Dr
Visitors Center	Bryan, City of	512 E 26th St
Bryan High Tennis Courts	Bryan, City of	3401 E 29th St
Twin Blvd	Bryan, City of	Twin Blvd
Park Hudson Trail	Bryan, City of	Boonville Rd
Avondale Park	Bryan, City of	Deadend Of Avondale Dr
Madeley Park	Bryan, City of	End Of Sunny Lane
Edgewater Parkland	Bryan, City of	6720 Chick Ln
Dominion Oaks Park	Bryan, City of	Bienski Pkwy
Rock Hollow Trail	Bryan, City of	Off N Harvey Mitchell Pkwy-Rear Rock Hollow Subd
City Course at the Philips Event Center	Bryan, City of	
City Course at the Philips Event Center	Bryan, City of	
Bob Bond Park	Bryan, City of	
Texas A&M University Golf Course	Texas A&M University	

SOURCE: City of Bryan, 2024; City of College Station, 2024; County of Brazos, 2024.

Appendix D

Section 106 Resources and Agency Consultation

APPENDIX D

TABLE D-1
HISTORIC RESOURCES IN THE APE

Map Key	Resource Name	Significance
1	Jones, J. M., House	NRHP Listed
2	Edge, Eugene, House	NRHP Listed
3	Stone, Roy C., House	NRHP Listed
4	Cavitt House	NRHP Listed
5	House at 603 E. Thirty-first	NRHP Listed
6	East Side Historic District	NRHP Listed
7	House at 1401 Baker	NRHP Listed
8	Sinclair Station, (Old)	NRHP Listed
9	Jenkins, Edward J., House	NRHP Listed
10	House at 604 E. Twenty-seventh	NRHP Listed
11	McDougal--Jones House	NRHP Listed
12	Bryan Municipal Building	NRHP Listed
13	House at 407 N. Parker	NRHP Listed
14	Armstrong House-Allen Academy	NRHP Listed
15	Allen, R. O., House-Allen Academy	NRHP Listed
16	Allen Academy Memorial Hall	NRHP Listed
17	Bridge Replacement on Bird Pond Road at Carter Creek	NRHP Eligible
18	Steep Hollow Cemetery	State Listed
19	Moravian Czech Cemetery	State Listed
20	Stick Cemetery	State Listed
21	Old Bethel Cemetery	State Listed
22	Boonville Cemetery	State Listed
23	Site of Villa Maria Ursuline Academy	State Listed
24	Odd Fellows University and Orphans Home	State Listed
25	St. Joseph School	State Listed
26	St. Joseph Catholic Church	State Listed
27	First Methodist Church of Bryan	State Listed
28	Weddington, Wesa	State Listed
29	Wipprecht Home	State Listed
30	Astin-Porter Home	State Listed
31	Wilkerson, A.W.	State Listed
32	Waldrop House	State Listed
33	Edge, Eugene	State Listed
34	First Public School in Bryan	State Listed
35	McMichael-Wilson House	State Listed
36	First Christian Church	State Listed

Map Key	Resource Name	Significance
37	First Presbyterian Church	State Listed
38	Woman's Club	State Listed
39	First National Bank of Bryan	State Listed
40	Martin's Place	State Listed
41	South Family Cemetery	State Listed
42	Carter, Richard	State Listed
43	Bright Light Cemetery	State Listed
44	Roans Chapel Cemetery	State Listed
45	Texas AMC and WWI	State Listed
46	Main Drill Field, Texas A&M University	State Listed
47	College Station Railroad Depots	State Listed
48	Texas A&M Corps of Cadets	State Listed
49	Texas A&M University	State Listed
50	Early Play-By-Play Radio Broadcast of a College Football Game	State Listed
51	Shiloh Community	State Listed
52	College Station Cemetery	State Listed
53	Shiloh Cemetery	State Listed
54	Salem Cemetery	State Listed
55	Jones-Roberts Cemetery	State Listed
56	Bush Cemetery	State Listed
57	African American Education in College Station	State Listed
58	A&M College Consolidated Rural School	State Listed
59	Rock Prairie School and Church	State Listed
60	Brushy Cemetery	State Listed
61	Newsom Cemetery	State Listed
62	Wellborn Cemetery	State Listed
63	Burkhalter Cemetery	State Listed
64	Minter Springs Cemetery	State Listed
65	Peach Creek Cemetery	State Listed

SOURCE: National Park Service, 2024; Texas Historical Commission, 2022.

U.S. Department of Transportation
Federal Aviation Administration

Aviation Safety

800 Independence Ave., SW.
Washington, DC 20591

Via Email and Regular Mail

President Terri Parton
Wichita and Affiliated Tribes (Wichita, Keechi, Waco & Tawakonie), Oklahoma
PO Box 729
Anadarko, OK 73005
Email: terri.parton@wichitatribe.com

RE: Invitation for Government-to-Government Tribal Consultation for Drone Package Delivery Operations in Texas

The purpose of this letter is to initiate formal government-to-government consultation regarding a proposal under consideration by the Federal Aviation Administration (FAA) to authorize commercial Unmanned Aircraft Systems (UAS) operators to deliver goods to customers (referred to as package delivery) using unmanned aircraft (also referred to as drones) in accordance with 14 Code of Federal Regulations Part 135 (Part 135) in the state of Texas. The FAA is the lead federal agency for government-to-government consultation for the proposed project. Amazon.com Services LLC, doing business as Amazon Prime Air, is the proponent of the project. We wish to solicit your views regarding potential effects on tribal interests in the area.

The primary purpose of government-to-government consultation is to ensure that Federally Recognized Tribes are given the opportunity to provide meaningful and timely input regarding proposed FAA actions that uniquely or significantly affect the Tribes. This policy is provided in Federal Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments*; Presidential Memorandum, *Uniform Standards for Tribal Consultation*; DOT Order 5301.1A, *Department of Transportation Tribal Consultation Policy and Procedures*; and FAA Order 1210.20, *American Indian and Alaska Native Tribal Consultation Policy and Procedures*.

Consultation Initiation

With this letter, the FAA is seeking input concerning any Tribal lands or sites of religious or cultural significance that may be affected by the proposed operation. Early identification of Tribal concerns, or known properties of traditional, religious, and cultural importance, will allow the FAA to consider ways to avoid or minimize potential impacts to Tribal resources. We are available to discuss the details of the proposed project with you.

Proposed Activity Description

The FAA is preparing an Environmental Assessment to assess the potential environmental impacts of commercial package delivery operations using drones in College Station, TX under Part 135. Since 2019, the FAA has been issuing air carrier certificates to UAS operators in accordance with Part 135 so that operators can conduct package delivery flights. Generally, these approvals are associated with issuing a new or amended Part 135 air carrier Operations Specifications as the operative approval. For your reference, the project description used for consultation under Section 106 is enclosed with this letter.

Confidentiality

We understand that you may have concerns about the confidentiality of information on areas or resources of traditional, religious, and cultural importance to your Tribe. We are available to discuss these concerns and develop procedures to ensure the confidentiality of such information is maintained.

FAA Contact Information

Your timely response over the next 30 days will greatly assist us in incorporating your concerns into our environmental review of the operation. In addition, we respectfully request your response in the event that the Wichita and Affiliated Tribes of Oklahoma would like to consult with the FAA in a government-to-government relationship about this proposal. Please contact Christopher Hurst via email at 9-faa-drone-environmental@faa.gov within 30 days of receipt of this letter to confirm your intent to participate in this government-to-government consultation.

Sincerely,

Derek Hufty
Manager, General Aviation and Commercial Branch (AFS-750)
Emerging Technologies Division
Office of Safety Standards, Flight Standards Service

CC: Ms. Robin Williams
Tribal Historic Preservation Officer

Enclosure:
Attachment A – Section 106 Consultation Package

Attachment A
Section 106 Consultation Package

U.S. Department of Transportation
Federal Aviation Administration

Aviation Safety

800 Independence Ave., SW.
Washington, DC 20591

Ms. Robin Williams
Tribal Historic Preservation Officer
Wichita and Affiliated Tribes (Wichita, Keechi, Waco & Tawakonie), Oklahoma
PO Box 729
Anadarko, OK 73005
Email: robin.williams@wichitatribe.com

Dear Ms. Williams:

The Federal Aviation Administration (FAA) is currently evaluating the Amazon.com Services LLC, doing business as Amazon Prime Air, proposal to conduct expanded delivery drone operations in the College Station, TX area. Prime Air must obtain approval from the FAA prior to expanding its existing operations by operating the new, MK30 drone in College Station, TX. The FAA has determined that its proposed action, which would encompass all FAA approvals necessary to enable expanded operations, is an undertaking as defined under the regulations implementing Section 106 of the National Historic Preservation Act (36 CFR § 800.16(y)). The purpose of this letter is to initiate Section 106 consultation with the Wichita and Affiliated Tribes and to solicit your views regarding potential effects on tribal interests in the area. The FAA has begun an Environmental Assessment (EA) under the National Environmental Policy Act (NEPA) to analyze the proposed action. FAA intends to complete consultation for Section 106 of the NHPA concurrently with the NEPA process.

Project Description

Amazon Prime Air is proposing to continue transporting consumer goods via drone delivery in the communities they already serve and expand these services to the larger operational area using the new MK30 drone. The MK30 drone would take off from the Prime Air Drone Delivery Center (PADDC) and quickly rise to a cruising altitude of 115 to 300 feet above ground level (AGL). The MK30 drone weighs approximately 77.9 pounds and can transport a small package up to about 5 pounds. The MK30 drone has an approximate 7.5-mile service radius. Once at the delivery site, the MK30 drone hovers in place at about 13 feet AGL and drops the package to the ground. Once the package has been delivered, the drone flies back to the PADDC at roughly the same altitude.

Amazon Prime Air is proposing up to 469 MK30 drone flights per day from the PADDC, with each flight taking a package to a customer delivery address before returning. There is variability in the number of flights per day based on customer demand and weather conditions. Initially, Amazon Prime Air expects to fly much less than 469 flights per day from the PADDC and gradually ramp up to the proposed level as consumer demand increases. Flights will occur up to 365 days a year, with operations being conducted for 10 hours per day, primarily during daylight hours, but never before 7 A.M. or after 10 P.M.

Area of Potential Effects
In accordance with 36 CFR § 800.4(a)(1), the FAA has defined the Area of Potential Effects (APE) in consideration of the undertaking's potential direct and indirect effects. The current operation that was coordinated with the TX SHPO showed the APE would be limited to areas near College Station, TX. This expansion extends through the similarly, densely populated or congested regions of the College Station area. The enclosed map (see **Attachment A**) shows the newly proposed APE in detail.

Identification of Historic Properties
The proposed undertaking does not have the potential to affect below ground or archeological resources because the undertaking does not include ground disturbance, but could result in auditory or visual effects. Therefore, the FAA focused its identification efforts on above-ground historic properties.

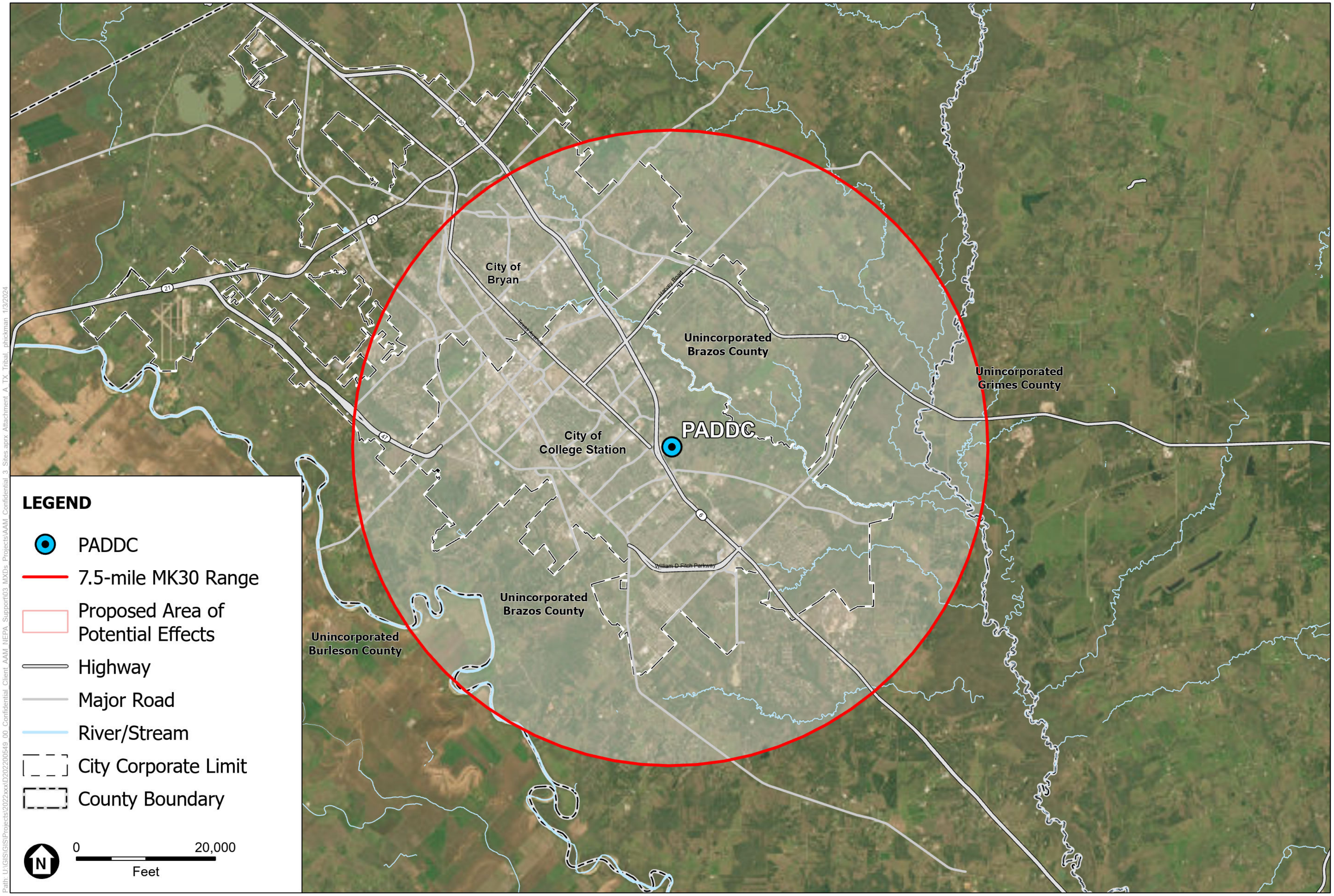
Consultation
The FAA is soliciting the opinion of the tribes concerning any tribal lands, or sites of religious or cultural significance that may be affected by the proposed operations area. Your response over the next 30 days will greatly assist us in incorporating your concerns into our environmental review of the operation. If you have any questions or need additional information, please contact Christopher Hurst via email at 9-faa-drone-environmental@faa.gov within 30 days of receipt of this letter.

Sincerely,

Derek Hufty
Manager, General Aviation and Commercial Branch (AFS-750)
Emerging Technologies Division
Office of Safety Standards, Flight Standards Service

Enclosure:
Attachment A – Proposed Area of Potential Effects

Attachment A
Proposed Area of Potential Effects



SOURCE: ESA, 2023; Maxar, 2022; US Census Bureau, 2021; US Geological Survey, 2022; National Park Service, 2023.

Attachment A
Proposed Area of Potential Effects
College Station, TX

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

Aviation Safety

800 Independence Ave., SW.
Washington, DC 20591

Via Email and Regular Mail

Chairman Ricky Sylestine
Tribal Council Chairman
Alabama-Coushatta Tribe of Texas
571 State Park Road 56
Livingston, TX 77351
Email: tcrsylestine@actribe.org

RE: Invitation for Government-to-Government Tribal Consultation for Drone Package Delivery Operations in Texas

The purpose of this letter is to initiate formal government-to-government consultation regarding a proposal under consideration by the Federal Aviation Administration (FAA) to authorize commercial Unmanned Aircraft Systems (UAS) operators to deliver goods to customers (referred to as package delivery) using unmanned aircraft (also referred to as drones) in accordance with 14 Code of Federal Regulations Part 135 (Part 135) in the state of Texas. The FAA is the lead federal agency for government-to-government consultation for the proposed project. Amazon.com Services LLC, doing business as Amazon Prime Air, is the proponent of the project. We wish to solicit your views regarding potential effects on tribal interests in the area.

The primary purpose of government-to-government consultation is to ensure that Federally Recognized Tribes are given the opportunity to provide meaningful and timely input regarding proposed FAA actions that uniquely or significantly affect the Tribes. This policy is provided in Federal Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments*; Presidential Memorandum, *Uniform Standards for Tribal Consultation*; DOT Order 5301.1A, *Department of Transportation Tribal Consultation Policy and Procedures*; and FAA Order 1210.20, *American Indian and Alaska Native Tribal Consultation Policy and Procedures*.

Consultation Initiation

With this letter, the FAA is seeking input concerning any Tribal lands or sites of religious or cultural significance that may be affected by the proposed operation. Early identification of Tribal concerns, or known properties of traditional, religious, and cultural importance, will allow the FAA to consider ways to avoid or minimize potential impacts to Tribal resources. We are available to discuss the details of the proposed project with you.

Proposed Activity Description

The FAA is preparing an Environmental Assessment to assess the potential environmental impacts of commercial package delivery operations using drones in College Station, TX under Part 135. Since 2019, the FAA has been issuing air carrier certificates to UAS operators in accordance with Part 135 so that operators can conduct package delivery flights. Generally, these approvals are associated with issuing a new or amended Part 135 air carrier Operations Specifications as the operative approval. For your reference, the project description used for consultation under Section 106 is enclosed with this letter.

Confidentiality

We understand that you may have concerns about the confidentiality of information on areas or resources of traditional, religious, and cultural importance to your Tribe. We are available to discuss these concerns and develop procedures to ensure the confidentiality of such information is maintained.

FAA Contact Information

Your timely response over the next 30 days will greatly assist us in incorporating your concerns into our environmental review of the operation. In addition, we respectfully request your response in the event that the Alabama-Coushatta Tribe of Texas would like to consult with the FAA in a government-to-government relationship about this proposal. Please contact Christopher Hurst via email at 9-faa-drone-environmental@faa.gov within 30 days of receipt of this letter to confirm your intent to participate in this government-to-government consultation.

Sincerely,

Derek Hufty
Manager, General Aviation and Commercial Branch (AFS-750)
Emerging Technologies Division
Office of Safety Standards, Flight Standards Service

CC: Mr. Delvin Johnson
Tribal Historic Preservation Officer

Enclosure:
Attachment A – Section 106 Consultation Package

Attachment A

Section 106 Consultation Package

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

Aviation Safety

800 Independence Ave., SW.
Washington, DC 20591

Mr. Delvin Johnson
Tribal Historic Preservation Officer
Alabama-Coushatta Tribe of Texas
571 State Park Road 56
Livingston, TX 77351
Email: tcrsylestine@actribe.org

Dear Mr. Johnson:

The Federal Aviation Administration (FAA) is currently evaluating the Amazon.com Services LLC, doing business as Amazon Prime Air, proposal to conduct expanded delivery drone operations in the College Station, TX area. Prime Air must obtain approval from the FAA prior to expanding its existing operations by operating the new, MK30 drone in College Station, TX. The FAA has determined that its proposed action, which would encompass all FAA approvals necessary to enable expanded operations, is an undertaking as defined under the regulations implementing Section 106 of the National Historic Preservation Act (36 CFR § 800.16(y)). The purpose of this letter is to initiate Section 106 consultation with the Alabama-Coushatta Tribe of Texas and to solicit your views regarding potential effects on tribal interests in the area. The FAA has begun an Environmental Assessment (EA) under the National Environmental Policy Act (NEPA) to analyze the proposed action. FAA intends to complete consultation for Section 106 of the NHPA concurrently with the NEPA process.

Project Description

Amazon Prime Air is proposing to continue transporting consumer goods via drone delivery in the communities they already serve and expand these services to the larger operational area using the new MK30 drone. The MK30 drone would take off from the Prime Air Drone Delivery Center (PADDC) and quickly rise to a cruising altitude of 115 to 300 feet above ground level (AGL). The MK30 drone weighs approximately 77.9 pounds and can transport a small package up to about 5 pounds. The MK30 drone has an approximate 7.5-mile service radius. Once at the delivery site, the MK30 drone hovers in place at about 13 feet AGL and drops the package to the ground. Once the package has been delivered, the drone flies back to the PADDC at roughly the same altitude.

Amazon Prime Air is proposing up to 469 MK30 drone flights per day from the PADDC, with each flight taking a package to a customer delivery address before returning. There is variability in the number of flights per day based on customer demand and weather conditions. Initially, Amazon Prime Air expects to fly much less than 469 flights per day from the PADDC and gradually ramp up to the proposed level as consumer demand increases. Flights will occur up to 365 days a year, with operations being conducted for 10 hours per day, primarily during daylight hours, but never before 7 A.M. or after 10 P.M. There are no ground disturbing activities associated with this proposed action.

Area of Potential Effects
In accordance with 36 CFR § 800.4(a)(1), the FAA has defined the Area of Potential Effects (APE) in consideration of the undertaking's potential direct and indirect effects. The current operation that was coordinated with the TX SHPO showed the APE would be limited to areas near College Station, TX. This expansion extends through the similarly, densely populated or congested regions of the College Station area. The enclosed map (see **Attachment A**) shows the newly proposed APE in detail.

Identification of Historic Properties
The proposed undertaking does not have the potential to affect below ground or archeological resources because the undertaking does not include ground disturbance, but could result in auditory or visual effects. Therefore, the FAA focused its identification efforts on above-ground historic properties.

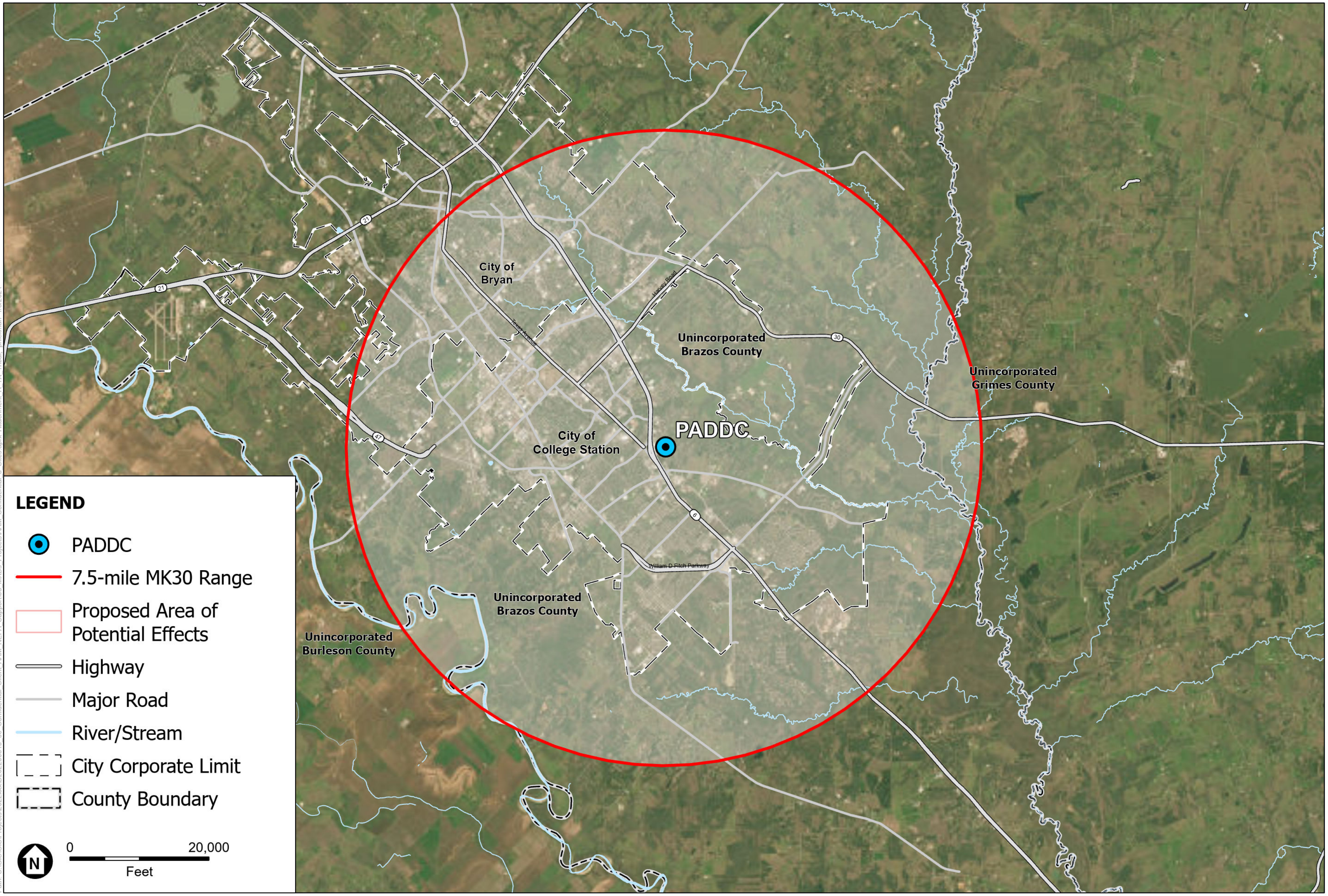
Consultation
The FAA previously consulted the Alabama-Coushatta Tribe of Texas on July 13, 2022, regarding the introduction of the current drone operations (see **Attachment B**). The FAA is now soliciting the opinion of the tribes concerning any tribal lands, or sites of religious or cultural significance that may be affected by the proposed operations 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 questions or need additional information, please contact Christopher Hurst via email at 9-faa-drone-environmental@faa.gov within 30 days of receipt of this letter.

Sincerely,

Derek Hufty
Manager, General Aviation and Commercial Branch (AFS-750)
Emerging Technologies Division
Office of Safety Standards, Flight Standards Service

Enclosures:
Attachment A – Proposed Area of Potential Effects
Attachment B – Previous Tribal Consultation

Attachment A
Proposed Area of Potential Effects



SOURCE: ESA, 2023; Maxar, 2022; US Census Bureau, 2021; US Geological Survey, 2022; National Park Service, 2023.

Attachment A
Proposed Area of Potential Effects
College Station, TX

ESA

Attachment B
Previous Tribal Consultation

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

Aviation Safety

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

THPO Bryant Celestine
Alabama-Coushatta Tribe of Texas
571 State Park Road 56
Livingston, TX, 77351

Dear Mr. Celestine:

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

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

The UAS operation will be flown by an MK27-2 unmanned aircraft at approximately 200 feet, but no more than 400 feet above ground level (AGL) within a 3.73 mile radius in College Station, TX (see attached operations area map). The purpose is for package delivery, consisting of no greater than approximately 200 flights each day, with each flight lasting approximately 15 minutes. Flights will occur primarily Mon-Fri, no holidays, with operations being conducted for 8-10 hours per day, during daylight hours. The dimension of the UAS area defines the Area of Potential Effect (APE). The UAS operation will have no affects to the ground. All flights will takeoff from, and return to a drone delivery center in College Station, TX.

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

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

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

Sincerely,

DAVID M MENZIMER

Digitally signed by DAVID M MENZIMER
Date: 2022.07.13 11:22:55 -07'00'

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

Enclosure

Appendix E

Technical Noise Report

NOISE ASSESSMENT
AMAZON PRIME AIR
MK27-2 UNMANNED AIRCRAFT OPERATIONS AT COLLEGE STATION TEXAS

Noise Technical Report

May 2024

ESA

NOISE ASSESSMENT AMAZON PRIME AIR MK27-2 UNMANNED AIRCRAFT OPERATIONS AT COLLEGE STATION TEXAS

Noise Technical Report

May 2024

5404 Cypress Center Drive
Suite 125
Tampa, FL 33609
813.207.7200
esassoc.com

ESA

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Delray Beach
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Seattle
Tampa

202200549.03

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1 Introduction

Amazon Prime Air (Prime Air) is proposing to conduct drone delivery operations with the MK30 drone at their distribution hub (the Prime Air Drone Delivery Center, or PADDC) in College Station, Texas. The PADDC is located approximately 4 miles southeast of downtown College Station on Technology Parkway, as shown in **Figure 1**. This figure shows the 7.5-mile extent of the drone's operating radius, which corresponds to the project area.

Since the MK30 drone is still under development and final noise data is not yet available, a more conservative approach was taken that uses the MK27-2 noise data to assess potential environmental impacts associated with the Proposed Action. This ensures that the noise impact of the MK30 (which was demonstrated during acoustical testing to be quieter than the MK27-2) falls within the analyzed parameters.

The MK27-2 and MK30 are equipped with a multi-rotor design consisting of six propellers extending horizontally from the central frame with the ability to switch between vertical and horizontal flight. Per the specification from Prime Air, the empty weight of each drone includes the battery, and is 86.6 pounds for the MK27-2 and 77.9 pounds for the MK-30. The maximum allowable takeoff weight is 91.5 pounds for the MK27-2 and 83.2 pounds for the MK-30. The maximum allowable package weight that both drones are certified to carry is 5 pounds. Packages delivered by the UA are transported within an internal cargo bay. An image of the MK27-2 and MK30 drone is shown in **Figure 2** and **Figure 3**, respectively.

As shown in **Table 1**, the flight profiles are similar in nature, in that they both perform a VTOL climb, a transition to fixed-wing flight en route to backyard, transition back to VTOL for descent into the backyard for delivery at 13 feet Above Ground Level (AGL), followed by the same maneuvers to return to the PADDC. Differences between the drones are shown in the manner at which they operate in each phase of flight. A breakdown of each difference is shown in **Table 1** and in **Figure 4** and **Figure 5**.

Prime Air conducted noise measurements from flights in February 2024 to compare noise exposure between each drone. The measured difference in Maximum A-Weighted Level (Lmax)[1] for the MK30 drone during the takeoff and landing phase of flight was between 5 and 7 dB lower than the MK27-2 drone, and the measured Sound Exposure Level (SEL)[2] was lower in all cases for the MK30 when compared to the MK27-2. The measured Lmax for the MK30 drone during the forward flight flyover phase were equivalent or lower when compared to the MK27-2. The difference in Lmax between the MK30 and the MK27-2 is expected to be smaller in the flyover phase versus the takeoff/landing phase. However, given that the MK30 flies faster and higher than the MK27-2 in actual operation, the SEL in operational flyover will still be lower for the MK30 due to the shorter event duration. Overall, the measurement data showed that the MK27-2 has an equivalent or louder noise profile compared to the MK-30 drone. Additional information on the drone comparison, noise measurement methodology, and results can be found in **Attachment A,** ***MK30 to MK27-2 Noise Flight Test Comparison Report***.

[1] Lmax is defined as the maximum, or peak, sound level during a noise event, expressed in decibels. The metric only accounts for the highest A-weighted sound level measured during a noise event, not for the duration of the event.

[2] SEL is defined as the sound energy of a single noise event at a reference duration of one second, expressed in decibels. The sound level is integrated over the period that the level exceeds a threshold. Therefore, SEL accounts for both the maximum sound level and the duration of the sound.

Table 1. Comparison of Typical MK27-2 and MK30 Operational Flight Profiles

Phase of Flight	Altitude (feet AGL)		Ground Speed (knots)		Duration (seconds)	
	MK27-2	**MK30**	**MK27-2**	**MK30**	**MK27-2**	**MK30**
Takeoff and Vertical Ascent	Ascent from 0 to 130	Ascent from 0 to 115	0	0	21	15
Transition and Outbound Climb	130 to 160	115 to 200	0 to 52.4	0 to 58.3	20	30
Fixed-wing Outbound Cruise	160	200	52.4	58.3	Variable*	Variable*
Delivery Decent and Transition	Descent from 160 to 130	Descent from 200 to 115	52.4 to 0	58.3 to 0	20	30
Backyard Descent	Descent from 130 to 13	Descent from 115 to 13	0	0	32	21
Delivery	13	13	0	0	2	2
Backyard Ascent	Ascent from 13 to 130	Ascent from 13 to 197	0	0	24	26
Transition and Inbound Climb	Ascent from 130 to 160	Ascent from 197 to 345	0 to 52.4	0 to 58.3	20	30
Fixed-wing Inbound Cruise	160	345	52.4	58.3	Variable*	Variable*
Landing Descent and Transition	Descent from 160 to 130	Descent from 345 to 197	52.4 to 0	58.3 to 0	20	30
Vertical Descent and Landing	Descent from 130 to 0	Descent from 197 to 0	0	0	38	35

SOURCE: Amazon Prime Air, April 2024

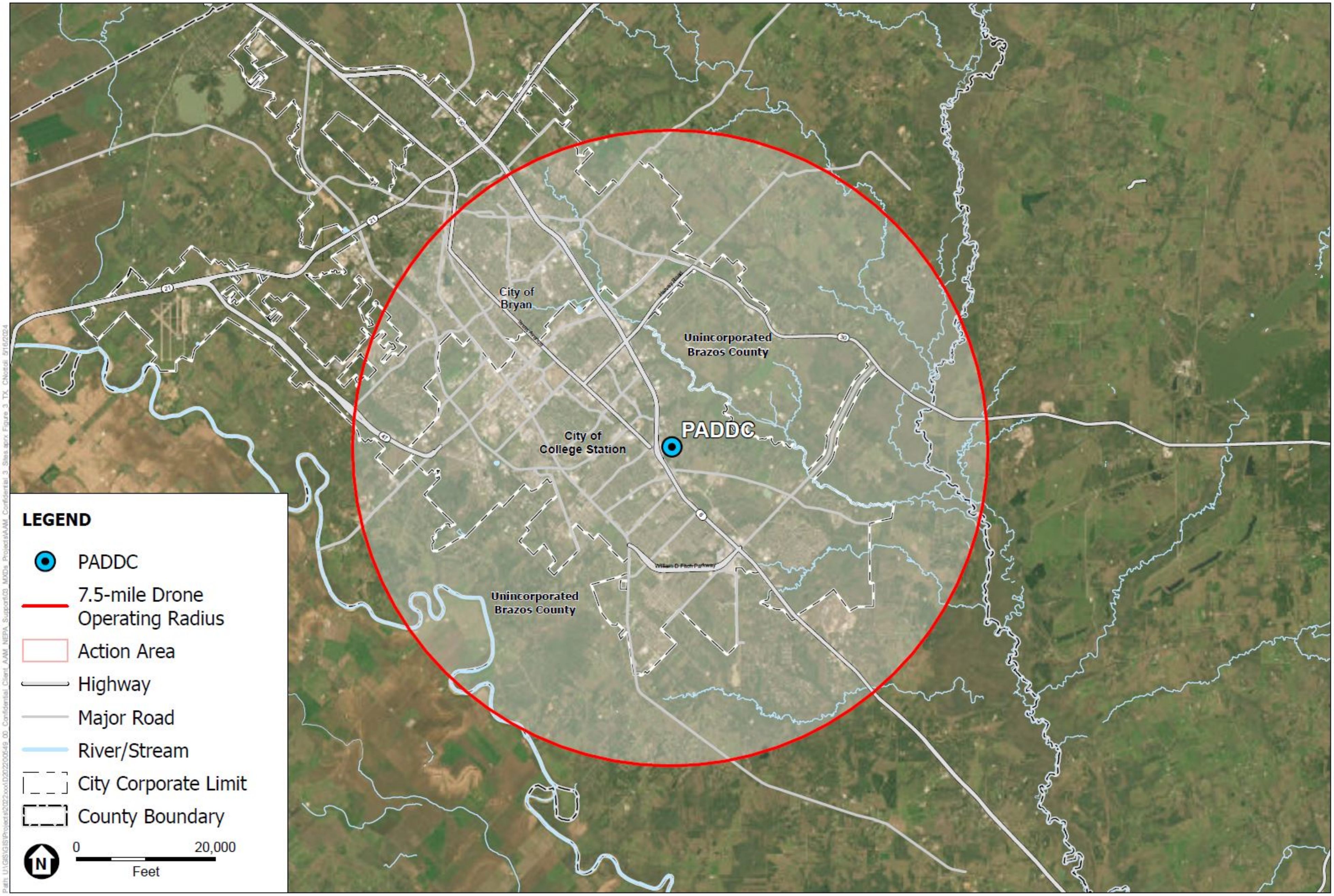
Note: *Duration of fixed-wing flight time varies based on distance to customer.

This document outlines the methodology and estimation of noise exposure expected with the proposed use of Prime Air's drone package delivery operations.[3] The methods presented below are suitable for the evaluation of Federal actions in compliance with the National Environmental Policy Act (NEPA) and other applicable environmental regulations or federal review standards 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 therefore requires prior written consent from the FAA's Office of Environment and Energy (AEE) for each project seeking a NEPA determination.[4] The results of the noise analysis are presented in terms of the annual Day-Night Average Sound Level (DNL), considering varying levels of operations for areas at ground level below each flight phase.

[3] *Supplemental Environmental Assessment (EA) Noise Methodology Approval Request for Amazon Prime Air Commercial Package Delivery Operations with the MK30 UA from College Station, Texas,* FAA Office of Environment and Energy, May 2024. (See Attachment B).

[4] See FAA Order 1050.1F, July 16, 2015,

Appendix B, Section B-1.2, for discussion on the use of "equivalent methodology", available online at https://www.faa.gov/documentLibrary/media/Order/FAA_Order_1050_1F.pdf#page=113

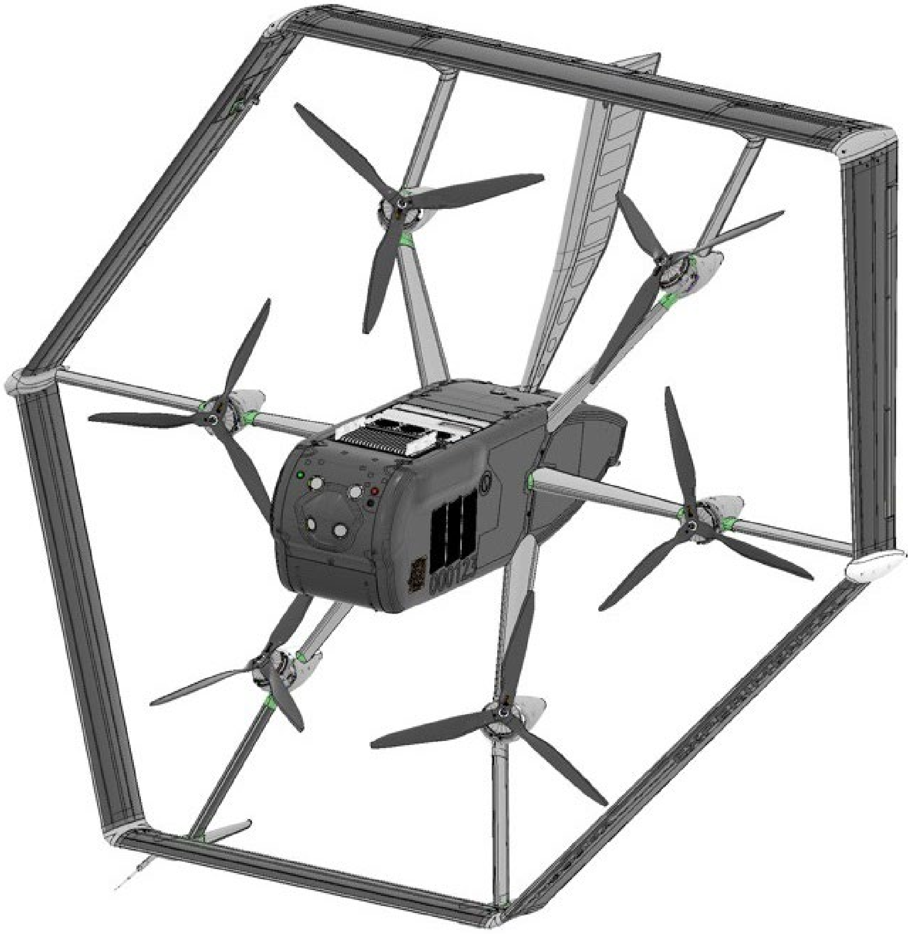


SOURCE: ESA, 2023; Maxar, 2022; US Census Bureau, 2021; US Geological Survey, 2022.

Figure 1
Action Area and PADDC
College Station, TX

ESA

Figure 2. Amazon Prime Air MK27-2 Drone

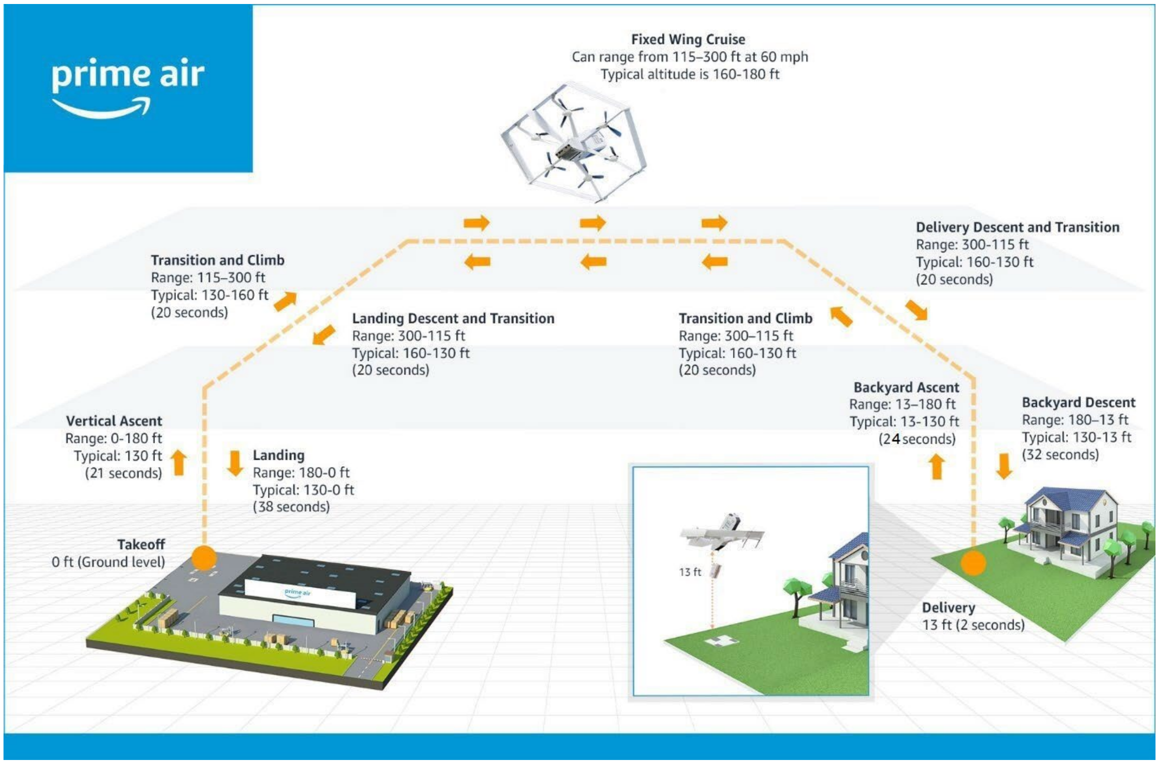


Source: Amazon Prime Air, 2022.

Figure 3. Amazon Prime Air MK30 Drone

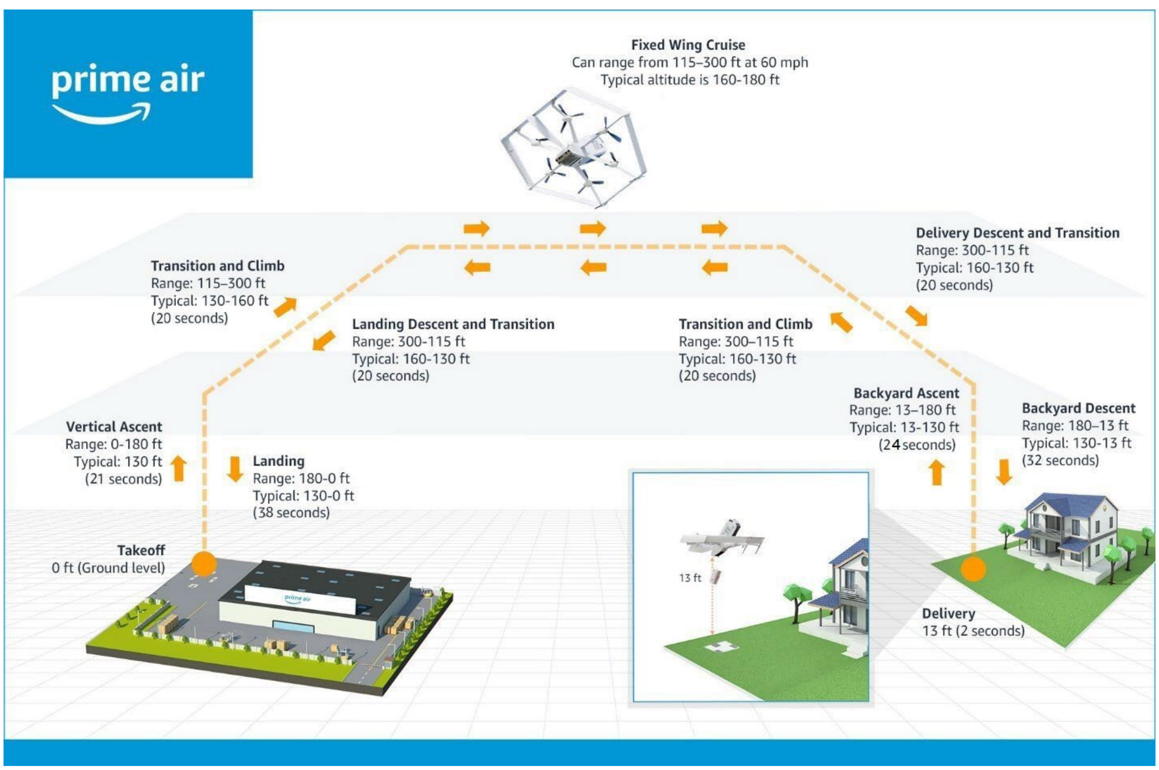
Source: Amazon Prime Air, 2024.

Figure 4. Representative Operational Profile of the MK27-2



Source: Amazon Prime Air, 2022.

Figure 5. Representative Operational Profile of the MK30



Source: Amazon Prime Air, 2024.

2 Drone Delivery Operations

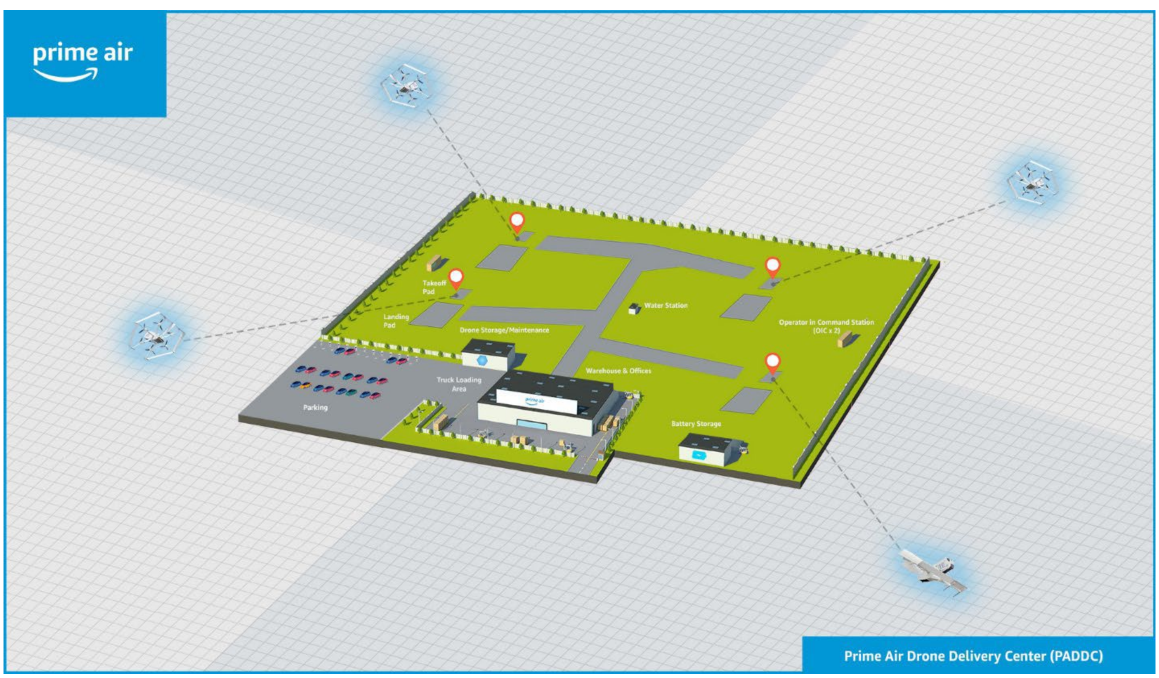
The PADDC and its associated flight routes are determined by Prime Air's business and operational needs.

Takeoff pads at the PADDC's are four meters by four meters. Landing pads are eight meters by eight meters. Both pads are contained within a launch area approximately 35 meters by 45 meters. A diagram of a representative PADDC layout is presented in **Figure 6**.

As demonstrated above, MK27-2 is a conservative surrogate to the MK30 through its similar flight profiles and equivalent or louder noise profile. As such, the flight profiles of the MK27-2 are discussed below.

The MK27-2 drone is capable of vertical ascent and descent, hovering, and flying upright with forward-facing propellers for en route travel. Airspeeds during normal en route flight are expected to be approximately 52.4 knots. A typical flight will commence with a vertical ascent from the launch pad to the en route altitude ranging between 160 and 180 feet AGL. The drone then maintains altitude and follows a predetermined route, traveling at 52.4 knots toward the designated delivery point. Upon arrival at the delivery point, the drone decelerates to zero-speed and begins a vertical descent to 13 feet AGL at which time the package is released. The drone will ascend back to en route altitude and accelerate to 52.4 knots along the predetermined route back to the PADDC. Once the drone arrives at the PADDC it will decelerate to zero speed and begin a vertical descent to the landing pad.

Figure 6. Representative PADDC Layout



Source: Amazon Prime Air, 2022.

2.1 Flight Profiles

Flight profiles of drone operations are broken into five general phases: takeoff, transitions to and from vertical and horizontal flight, en route, delivery, and landing. These phases can be combined to represent the typical operational profile of the drone as outlined below. A graphical representation of the operational profile is presented in **Figure 4** and each phase is summarized in **Table 2**.

Takeoff and Vertical Ascent

The drone departs from the launch pad once cleared for takeoff. It will ascend vertically to the en route altitude of between 160 and 180 feet AGL in vertical flight mode.[5]

Transition and Outbound Climb

Upon reaching the en route altitude and while still positioned above the launch pad, the drone transitions from zero speed to its cruise speed of 52.4 knots. This transition is accompanied by a shift from vertical flight mode to horizontal flight mode.

Fixed-wing Outbound Cruise

The drone proceeds to fly at between 160 and 180 feet AGL and 52.4 knots to the delivery point.

Table 2. Representative Operational Profile by Phase of Flight

Phase of Flight	Altitude (feet AGL)	Ground Speed (knots)	Duration (seconds)
Takeoff and Vertical Ascent	Ascent from 0 to 165	0	21
Transition and Outbound Climb	165	0 to 52.4	20
Fixed-wing Outbound Cruise	165	52.4	Variable
Delivery Decent and Transition	165	52.4 to 0	20
Backyard Descent	Descend from 165 to 13	0	32
Delivery	13	0	2
Backyard Ascent	Ascent from 13 to 165	0	24
Transition and Inbound Climb	165	0 to 52.4	20
Fixed-wing Inbound Cruise	165	52.4	Variable
Landing Descent and Transition	165	52.4 to 0	20
Vertical Descent and Landing	Descend from 165 to 0	0	38

SOURCE: FAA, August 2022.

[5] En route altitude is assumed to be 165 feet AGL, corresponding to the measurement data reviewed in FAA's memorandum, *Estimated Noise Levels for Amazon Prime Air MK27-2 UA*, FAA Office of Environment and Energy, August 2022 (See Attachment C).

Delivery Descent and Transition

The drone decelerates from the en route speed of 52.4 knots and transitions to vertical flight mode, where it will be positioned over the delivery point at zero speed.

Backyard Descent, Delivery, and Ascent

The drone begins a vertical descent from en route altitude to 13 feet AGL while maintaining position above the delivery point. Once at 13 feet AGL, the drone drops the package and ascends vertically back to the en route altitude. It's important to note that the nearest allowable proximity of any individual, animal, or other obstacles to the delivery point during this maneuver is 16.4 feet.

Transition and Inbound Climb

Once at the en route altitude and positioned above the delivery point, the drone transitions from zero speed to en route speed while changing from vertical flight to horizontal flight.

Fixed-wing Inbound Cruise

The drone continues to fly at the en route altitude and speed towards the PADDC.

Landing Descent and Transition

The drone decelerates as it approaches the PADDC and transitions from horizontal flight to vertical flight, coming to a zero-speed position over its assigned landing pad.

Vertical Descent and Landing

The drone descends over its assigned landing pad in vertical flight until it touches down and shuts down the motors.

3 Acoustical Data of Flight Profiles

As demonstrated above, MK27-2 is a conservative surrogate to the MK30 through its similar flight profiles and equivalent or louder noise profile. As such, the noise profiles of the MK27-2 are discussed below.

Prime Air conducted noise measurements of the MK27-2 drone in April 2021 at the Pendleton UAS Range located at the Eastern Oregon Regional Airport (KPDT). The FAA processed and analyzed the measurement data and calculated the estimate noise levels for each of the five phases of flight.[6] The following tables show either the A-weighted Sound Exposure Levels (SEL) or formulas to calculate the estimated SELs used for this analysis, which can be matched to each flight phase detailed in **Table 2**. The formula is based on Equation 1 below.

$$eq. 1.\ SEL = m\ x\ Log_{10}(d) + b(dB)$$

Where:

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

Table 3 provides parameters to use within Equation 1 to estimate SELs associated with takeoff as a function of distance from the PADDC launch pad to the receiver. **Table 4** provides parameters to use within Equation 1 to estimate SELs associated with landing as a function of distance from the PADDC launch pad to the receiver. **Table 5** provides parameters to use within Equation 1 to estimate the SEL associated with delivery, as a function of distance from the delivery point to the receiver. **Table 6** presents the estimated SELs that correspond to the transition between vertical flight to horizontal flight. The values in this table are for distances relative to the point under the vertical flight path. **Table 6** is applicable to all transition phases discussed in **Section 2.1**. These levels should be integrated with data from appropriate phases of flight (e.g., to estimate maximum possible landing noise, combine the transition noise from **Table 6** with the landing noise from **Table 4**.). Lastly, **Table 7** presents the estimates of en route SEL.

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

Range for d (feet 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	140.00
85.3 to 142.2	-27.79	142.71
142.2 and greater	-23.39	134.99

SOURCE: FAA, August 2022.

Note: Distance is along ground from launch pad to receiver.

[6] *Estimated Noise Levels for Amazon Prime Air MK27-2 UA,* FAA Office of Environment and Energy, August 2022 (See Attachment C).

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

Range for d (feet from delivery point)	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	-17.1	123.12
85.3 to 142.2	-24.56	137.53
142.2 and greater	-23.39	134.99

SOURCE: FAA, August 2022.
Note: Distance is along ground from launch pad to receiver.

Table 5. Parameters for Estimating Sound Exposure Level for Delivery versus Distance

Range for d (feet from delivery point)	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	-16.92	125.3
85.3 to 142.2	-26.31	143.42
142.2 and greater	-21.9	133.91

SOURCE: FAA, August 2022.
Note: Distance is along ground from launch pad to receiver.

Table 6. Estimated Sound Exposure Levels from Transition Phase of Flight Profile at 165 Feet Above Ground Level

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

SOURCE: FAA, August 2022.

Table 7. Estimates of En Route SEL

Aircraft Configuration	Reference Air Speed (knots)	Reference Altitude (feet AGL)	SEL (dB)
Max Weight	52.4	165	67.7

SOURCE: FAA, August 2022.

4 Methodology

Operations originating from the College Station PADDC is expected to occur daily between the hours of 7:00 AM and 10:00 PM. The number of daily and equivalent annual delivery operations is 469 and 171,329, respectively. As previously mentioned, there is not a standardized process for drone noise assessments. Therefore, ESA is applying technical guidance that was previously approved by the FAA Office of Environment and Energy for past analyses. The following subsection outlines this methodology.

4.1 Daytime Equivalent Operations and DNL

As mentioned, results are presented as DNL which applies a 10 dB weighting, or equivalent to 10 times the number of nighttime operations, for operations between 10:00 PM and 7:00 AM. Therefore, the operations near point i can be weighted to develop a daytime equivalent number of operations ($N_{equiv,i}$).

$$eq. 2.\ N_{Equiv,i} = W_{Day}\ x\ N_{Day,i} + W_{Eve}\ x\ N_{Eve,i} + W_{Night}\ x\ N_{Night,i}$$

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

The number of daytime equivalent operations, $N_{DNL,i}$ can be simplified to

$$eq. 3.\ N_{DNL,i} = N_{Day,i} + N_{Eve,i} + 10\ x\ N_{Night,i}$$

4.2 PADDC Infrastructure

The PADDC at College Station accommodates four sets of launch and landing pads. In the context of this noise analysis, it is assumed that only one launch/landing pad is under consideration at a given time. To conservatively represent all operations within the PADDC, including all launch and landing pads, the analysis is focused on the southernmost launch and landing pad that is closest to the noise-sensitive location.

4.3 Application of Acoustical Data

The summation of the SELs in the previous section are used to estimate the DNL for Prime Air's drone operations covered in this report. SEL results are detailed in FAA's Memorandum found in **Attachment C**.

For calculating SEL, five specific activities are considered:

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

- The drone landing at the PADDC

This analysis is based on the SEL data provided in **Section 3**. **Table 6** displays noise exposure values at distinct increments corresponding to the drone transition profile, ranging from 0 to 3,200 feet. In instances where additional values within this range are required, linear interpolation can be employed to approximate SEL values at intermediary distances. However, extrapolating SEL values for distances less than 32.8 feet during takeoff, landing, or delivery is discouraged due to increased deviations in the estimation method's accuracy as the distance approaches the noise source.

4.3.1 Takeoff

The process for calculating SELs for the takeoff profile is presented in **Section 3**, Equation 1 combined with the parameters presented **Table 3**.

Application of the SEL is based on the position of the southernmost launch pad at a PADDC. It should be noted that the SEL values provided do not include the transition to horizontal flight or the acceleration to en route speed that would occur after the climb.

4.3.2 Transitions between Vertical and Horizontal Flight

Table 6 presents noise exposure values SELs for the transition between vertical and horizontal flight. Noise exposure is expressed at discrete increments relative to the drone's ground location for distances from 0 to 3,200 feet. These values are applicable to the drone when it is in level flight at 165 feet AGL and is either accelerating or decelerating within the speed range of 0 to 52.4 knots over a duration of 20 seconds.

4.3.3 En Route

The anticipated flight speed of the drone en route is 52.4 knots at a cruise altitude of 165 feet AGL. Sound exposure level for a given point *i* (*SELi*) with the drone flying directly overhead at altitude (*Alti*) in feet and a ground speed (*Vi*) in knots, is calculated based on the guidance in *14 CFR Part 36 Appendix J, Section J36.205 Detailed Data Correction Procedures*.[7] The equations presented in this section are only applicable for a drone that is moving relative to a stationary receptor. The sound exposure level adjustment for the altitude of a moving drone is presented in Equation 4.

$$Eq. 4.\ \Delta J_1 = 10\ x\ Log_{10}\frac{H_A}{H_T}, dB$$

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.

Note 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.

[7] https://www.ecfr.gov/current/title-14/chapter-I/subchapter-C/part-36.

The sound exposure level adjustment for speed is presented in Equation 5.

$$Eq.5.\ \Delta J_3 = 10\ x\ Log_{10}\frac{V_R}{V_{RA}}, dB$$

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 drone at speed V_{RA} when the measured SEL corresponds to the drone traveling at a reference speed V_R.

This adjustment accounts for how the varying speed impacts the duration of the overflight at the stationary receptor.

As shown in **Table 7**, the SEL is 67.7 dB when the drone is at maximum weight, at 165 feet from the stationary receiver and traveling at approximately 52.4 knots. Using the maximum weight (outbound) en route condition when the drone is operating 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_{max} weight dB for that respective phase of flight.

$$Eq.6.\ SEL_{Max} = 67.7 + 12.5\ x\ Log_{10}\frac{165}{Alt_i} + Log_{10}\frac{52.4}{V_i}, dB$$

For this analysis, it was assumed that Equation 6 is applicable for all en route activity to ensure a conservative assumption for drone flyovers at 165 feet AGL.[8]

4.3.4 Delivery

The available SELs to be applied for the delivery phase in Equation 1 are presented in **Table 5**. The SELs are based on the distance of the receiver relative to the position of the delivery point. The minimum distance used for calculation between the delivery point and a person is 16.4 feet.[9] The values in **Table 5** are valid for distances from the delivery point of 32.8 feet or greater. SEL values for distances of between 16 and 32.8 feet are adjusted by distance to the delivery point and sound level adjustment of a stationary source as provided by Equation 7.

$$Eq.7.\ SEL_{Delivery} = 96.5 + 12.5\ x\ Log_{10}\frac{32.8}{Distance\ from\ Delivery\ Point\ (ft)}$$

The SEL values in **Table 5** do not provide the noise contribution from the horizontal flight associated with either the drone transitioning from en route speed to vertical flight before delivery, or the transition between vertical flight to en route speed after delivery. The SEL values only include descent from en route altitude to delivery altitude, various maneuvers associated with the delivery, and climb back to en route altitude.

[8] *Estimated Noise Levels for Amazon Prime Air MK27-2 UA*, FAA Office of Environment and Energy, August 2022 (See Attachment C).

[9] Prime Air's safety guidance stipulates that there should not be a person, animal or object within 5 meters of the delivery point, and if the drone detects a person, animal or object within 5 meters of the delivery point, it will abort the delivery.

4.3.5 Landing

The available SELs to be applied for the landing profile in Equation 1 are presented in **Table 4**. Application of the SEL is based on the location of the southernmost landing pad at a PADDC. 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.

4.4 DNL Estimation Methodology

The number of operations flying over a specific receiver's ground location will fluctuate depending 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 equivalent DNL in Equation 8.

$$Eq. 8.\ DNL_{iA} = SEL_{iA} + 10\ x\ Log_{10}\left(N_{DNL,iA}\right) - 49.4, dB$$

The above equation applies to an SEL value representing one noise source such as a drone takeoff or landing. For cases where a receiver would be exposed to multiple noise sources (e.g. takeoff, transiting, en route, and departure), the complete DNL at that point was calculated with Equation 9.

$$Eq. 9.\ DNL_i = 10\ x\ Log_{10}\left(10^{\left(\frac{DNL_{ia}}{10}\right)} + 10^{\left(\frac{DNL_{ib}}{10}\right)} + \cdots + 10^{\left(\frac{DNL_{iz}}{10}\right)}\right), dB$$

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

4.4.1 DNL at PADDC

The takeoff and landing operations are anticipated to occur at the one Pad for this analysis. Therefore, the results at PADDC will be calculated for a single set of receptors. Operations were assumed to take off and land along the same flight path.

Takeoff operations are represented by two sound levels. The drone will takeoff and climb to en route altitude as discussed in Section 2. The drone will then begin en route flight by transitioning from vertical flight to horizontal flight and accelerating to en route speed of 52.4 knots.

Landing operations are also represented by two sound levels. The drone flies to the PADDC at en route altitude while slowing down and transitions from horizontal to vertical flight as described in Section 2. Then the drone descends from en route altitude to the ground and shuts down.

The four noise sources representing the complete takeoff and landing cycle associated with a single delivery departing and returning at the PADDC were added together using Equation 9.

4.4.2 DNL for En Route

A 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. The number of operations would be based on relevant materials and assume that a drone directly overflies the receiver while at maximum weight for both outbound and inbound for a single delivery. The en route outbound and inbound noise level are added together with Equation 9.

4.4.3 DNL for Delivery Points

Delivery operations will be represented by three sound levels. The first sound level is represented by the deceleration of the drone from en route speed and transitioning from horizontal flight to vertical flight over the delivery point at the en route altitude of 165 ft. The second sound level is represented by the delivery phase where the package is dropped at the delivery point. The first sound level is represented by the drone's transition from vertical flight to horizontal flight after reaching the en route altitude of 165 feet AGL and accelerating to en route speed. The three sound levels are added together with Equation 9.

5 Estimated Noise Exposure

This section outlines the estimated noise exposure for Prime Air's proposed operations for any given number of average annual day (AAD) deliveries. Results are based off the estimated number of DNL equivalent deliveries associated with the PADDC and presented in tabular format. Prime Air expects to conduct 469 daily deliveries, which per note B in **Table 8**, the average daily deliveries rounds to 480. Deliveries will not occur during nighttime hours (10 P.M. – 7 A.M.). Note that one delivery includes the outbound takeoff and inbound landing and is representative of two operations.

The DNL equivalent deliveries, $N_{DNL,i}$ as described in Section 4.1, is presented below as Equation 10.

$$Eq. 10.\ Deliveries_{DNL,i} = Deliveries_{Day} + 10\ x\ Deliveries_{Night}$$

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

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 a particular receptor is at the transition of different flight phases, the cumulative noise exposure is then determined by adding the noise from each phase.

5.1 Noise Exposure for Operations at the PADDC

For operations at the PADDC, noise generated by the drone includes takeoff, landing, and transitions from vertical to fixed-wing horizontal flight within the corresponding en route flight phases. It was assumed that all operations follow the same en route flight path, with outbound and inbound flights traversing it in opposing directions for a conservative approach.

Table 8 presents data for the number of average daily DNL equivalent deliveries (including the takeoff and climb, transition to en route outbound, transition from en route inbound, and descent and landing as detailed in Section 2. The table provides the estimated extent of DNL 45 dB, 50 dB, 55 dB, 60 dB, and 65 dB contours under the flight path for the PADDC. The analyses presented were rounded up conservatively to the nearest interval available from the data from Section 3, out to 3,500 feet.

Table 8. Estimated Extent of Noise Exposure from PADDC per Number of Deliveries

Number of DNL Equivalent Deliveries		Estimated Extent of Exposure (feet)				
Average Daily	Annual	DNL 45	DNL 50	DNL 55	DNL 60	DNL 65
<= 1	<= 365	75	32.8	32.8	32.8	32.8
<= 5	<= 1,825	150	100	50	32.8	32.8
<= 10	<= 3,650	250	150	75	32.8	32.8
<= 15	<= 5,475	250	150	100	50	32.8
<= 20	<= 7,300	300	200	100	75	32.8
<= 40	<= 14,600	450	250	150	100	32.8
<= 60	<= 21,900	550	300	200	100	75
<= 80	<= 29,200	650	350	200	150	75
<= 100	<= 36,500	750	400	250	150	75
<= 120	<= 43,800	850	400	250	150	100
<= 140	<= 51,100	1000	450	250	150	100
<= 160	<= 58,400	1150	500	300	150	100
<= 180	<= 65,700	1400	500	300	200	100
<= 200	<= 73,000	1650	550	300	200	100
<= 220	<= 80,300	2650	600	300	200	100
<= 240	<= 87,600	Note 3	600	350	200	150
<= 260	<= 94,900	Note 3	650	350	200	150
<= 280	<= 102,200	Note 3	700	350	200	150
<= 300	<= 109,500	Note 3	700	350	200	150
<= 340	<= 124,100	Note 3	800	400	250	150
<= 360	<= 131,400	Note 3	800	400	250	150
<= 380	<= 138,700	Note 3	850	400	250	150
<= 400	<= 146,000	Note 3	900	450	250	150
<= 420	<= 153,300	Note 3	950	450	250	150
<= 440	<= 160,600	Note 3	1,000	450	250	150
<= 460	<= 167,900	Note 3	1,050	450	250	150
<= 480	<= 175,200	Note 3	1,100	450	250	150
<= 500	<= 182,500	Note 3	1,150	500	300	150

SOURCE: ESA, 2024.

Notes:

1. One delivery accounts for the outbound takeoff and inbound landing and is representative of two operations.
2. If a value for deliveries is not specifically defined in this table, use the next highest value. For example, if there are 50 average daily DNL equivalent deliveries, use the entry for 60 average daily DNL equivalent deliveries.

3 The DNL noise level noted extends more than 3,500 feet from the PADDC based on the level of operations specified as the aircraft continues along its en route flight path. En route results in Section 5.2 may be more applicable in these instances for determining noise levels.

5.2 Noise Exposure under En Route Paths

When the drone is en route it is expected to fly the same outbound flight path between the PADDC and the delivery point and inbound flight path back to the PADDC. Therefore, each receiver under the en route path would experience two overflights for each delivery served by the corresponding en route flight path.

Table 9 provides the estimated DNL for a receiver on the ground directly under an en route path for various counts of daily average DNL equivalent deliveries. The en route noise calculated for each delivery includes both the inbound and outbound traversal of the en route path at 165 feet AGL and a ground speed of 52.4 knots.

The drone may overfly locations at operational levels that differ from both an inbound and outbound traversal of the en route path by the drone as described above and presented in **Table 9**. For these circumstances, **Table 10** presents the equations for calculating the estimated DNL for a receiver directly under a specified given number of DNL equivalent average daily individual overflights, defined as N_o.

Table 9. Estimated Noise Exposure Directly Under En Route Flight Paths

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

SOURCE: ESA, 2024.

Table 10. Estimated Noise Exposure Directly Under Overflights

Altitude of Overflight	SEL for One Overflight (dB)	DNL for One Overflight Between 7 AM and 10 PM (dB)	DNL Equation for the Number of DNL Equivalent Overflights
115 feet AGL	69.7	20.3	10 x $\log_{10}(No)$ + 20.3
160 feet AGL	67.9	18.5	10 x $\log_{10}(No)$ + 18.5
165 feet AGL	67.7	18.3	10 x $\log_{10}(No)$ + 18.3
180 feet AGL	67.2	17.9	10 x $\log_{10}(No)$ + 17.9
300 feet AGL	64.5	15.1	10 x $\log_{10}(No)$ + 15.1
N Feet AGL	12.5 x $\log_{10}(165/N_{ft})$ + 67.7	SEL_1 – 49.4	10 x $\log_{10}(No)$ + DNL_1

SOURCE: ESA, 2024.

Notes:

1. The DNL value for a given number of average DNL Equivalent Operations, N_o, can be found by using the equations associated with operation of the drone at a specified altitude and speed interval. In this case, one operation represents a single overflight.
2. All values in this table are for level flight at maximum weight and 52.4 knots.

5.3 Noise Exposure for Operations at Delivery Point

Table 11 presents the estimated DNL values for a range of potential daily average DNL equivalent delivery counts at a delivery point. Also included in **Table 11** is the equation for calculating the estimated DNL for a specific number of daily average DNL equivalent delivery counts at a delivery point, defined as N_d, for instances where the number of deliveries may fall between the range of presented delivery count intervals.

The DNL values include the transition from en route speed to vertical flight at en route altitude, the delivery maneuver, and the transition from vertical flight at en route altitude to en route speed as discussed in Section 4.4.3. The minimum listener distance is 16.4 feet from the delivery point and corresponds to minimum distance between a person and delivery point. Values are also presented at 32.8 feet from the delivery point which corresponds to minimum distance from the available measurement data and analysis presented by FAA. Values were also calculated at distances of 50 feet, 75 feet, 100 feet, and 125 feet from the delivery point and are representative of distances from which nearby properties may experience noise from a delivery.[10]

[10] The 2022 US Census national average lot size for single-family sold homes was 15,265 square feet. This is representative of a property with dimensions of a 123.55 x 123.55-foot square. 125 feet represents a 125-foot lateral width of the parcel rounded up to the nearest 25 feet. https://www.census.gov/construction/chars/ See file "Soldlotsize_cust.xls" sheet MALotSizeSold. Accessed January 18, 2024.

Table 11. Estimated Noise Exposure at Various Distances from a Delivery Point per Number of DNL Equivalent Deliveries

Average Daily Deliveries	Annual Deliveries	DNL at 16.4 feet[1]	DNL at 32.8 feet[2]	DNL at 50 feet	DNL at 75 feet	DNL at 100 feet	DNL at 125 feet
<= 1	<= 365	51.0	47.2	46.1	44.3	41.6	39.1
<= 5	<= 1,825	57.9	54.2	53.1	51.3	48.6	46.1
<= 10	<= 3,650	61.0	57.2	56.1	54.3	51.6	49.1
<= 15	<= 5,475	62.7	58.9	57.9	56.1	53.3	50.8
<= 20	<= 7,300	64.0	60.2	59.1	57.3	54.6	52.1
<= 40	<= 14,600	67.0	63.2	62.1	60.3	57.6	55.1
<= 60	<= 21,900	68.7	65.0	63.9	62.1	59.3	56.9
<= 80	<= 29,200	70.0	66.2	65.1	63.3	60.6	58.1
<= 100	<= 36,500	71.0	67.2	66.1	64.3	61.6	59.1
<= 120	<= 43,800	71.7	68.0	66.9	65.1	62.4	59.9
<= 140	<= 51,100	72.4	68.6	67.6	65.8	63.0	60.5
<= 160	<= 58,400	73.0	69.2	68.2	66.3	63.6	61.1
<= 180	<= 65,700	73.5	69.7	68.7	66.9	64.1	61.6
<= 200	<= 73,000	74.0	70.2	69.1	67.3	64.6	62.1
<= 220	<= 80,300	74.4	70.6	69.5	67.7	65.0	62.5
<= 240	<= 87,600	74.8	71.0	69.9	68.1	65.4	62.9
<= 260	<= 94,900	75.1	71.3	70.3	68.5	65.7	63.2
<= 280	<= 102,200	75.4	71.7	70.6	68.8	66.0	63.6
<= 300	<= 109,500	75.7	72.0	70.9	69.1	66.3	63.9
<= 340	<= 124,100	76.3	72.5	71.4	69.6	66.9	64.4
<= 360	<= 131,400	76.5	72.8	71.7	69.9	67.1	64.6
<= 380	<= 138,700	76.8	73.0	71.9	70.1	67.4	64.9
<= 400	<= 146,000	77.0	73.2	72.1	70.3	67.6	65.1
<= 420	<= 153,300	77.2	73.4	72.4	70.5	67.8	65.3
<= 440	<= 160,600	77.4	73.6	72.6	70.7	68.0	65.5
<= 460	<= 167,900	77.6	73.8	72.7	70.9	68.2	65.7
<= 480	<= 175,200	77.8	74.0	72.9	71.1	68.4	65.9
<= 500	<= 182,500	77.9	74.2	73.1	71.3	68.6	66.1

SOURCE: ESA, 2024.

Notes:

1. Minimum possible listener distance from drone.
2. Minimum measured distance to listener from drone.
3. The DNL values presented in this table only reflect the drone conducting descent and climb flight maneuvers associated with a delivery. DNL values associated with en route flight to and from a PADDC to a delivery point associated with a delivery, or nearby en route overflights, should be added to these values utilizing the DNL presented in Table 9.
4. If a value for deliveries is not specifically defined in this table, use the next highest value. For example, if there are 50 average daily DNL equivalent deliveries, use the entry for 60 average daily DNL equivalent deliveries.

6 Results

The DNL 50-, 55-, 60-, and 65-dB contours for Proposed Action are presented in **Figure 7**. These contours represent the 24-hour drone noise exposure to areas surrounding the College Station PADDC on an average annual day. Note that the DNL 65 dB contour does not extend beyond the Prime Air property line and is expected that no noise impacts to non-compatible land uses would occur.

As described Section 4.3.1, the drone is expected to fly the same outbound flight path between the PADDC and the delivery point and inbound flight path back to the PADDC. While the average daily deliveries from the PADCC is 469, the number of overflights in a day will be dispersed because the PADCC is centrally located in the proposed operating area and delivery locations would be distributed throughout the proposed operating area. A conservative estimate for the maximum number of overflights over any one location would not be anticipated to exceed half, or 235 daily overflights, which would result in en route noise levels of DNL 45.1 dB at any location within the action area. The en route overflight noise exposure is determined by referencing **Table 9**.

Due to the inherent uncertainty of the exact delivery site locations, the noise analysis developed a minimum and maximum representative distribution of deliveries in the action area. The noise analysis conservatively assumes the minimum and maximum distribution of average daily deliveries that could occur at a single delivery location. The distribution of average annual daily deliveries ranges from 0.1 to 4.0 deliveries per operating day. The resulting DNL values, provided in **Table 12**, include the descent and climb flight maneuvers associated with a delivery. The noise exposure for delivery operations also includes the en route overflight at the typical operating altitude of 165 feet AGL as presented in **Table 9** and discussed above. The resulting noise exposure for delivery site locations is DNL 58.1 dB. Noise exposure from deliveries is shown graphically in **Figure 8**. The noise exposure is depicted over the PADDC but is only representative of a maximum of five deliveries at any one delivery point.

Table 12. DNL for Delivery Locations Based on Maximum Deliveries Per Location

Average Daily DNL Equivalent Deliveries	Annual DNL Equivalent Deliveries	Estimated Delivery DNL at 16 Feet[1]	Estimated Delivery DNL at 32.8 Feet[2]	Estimated Delivery DNL at 50 Feet	Estimated Delivery DNL at 75 Feet	Estimated Delivery DNL at 100 Feet	Estimated Delivery DNL at 125 Feet
≤5	≤1,825	58.1	54.7	53.7	52.2	50.2	48.6

NOTES:
1. Minimum possible listener distance from drone.
2. Minimum measured listener distance.
3. Assumes conservative estimate of 235 overflights over any one delivery location as mentioned above.

SOURCE: ESA, 2024.

6.1 Cumulative Noise

It is necessary to evaluate the cumulative noise exposure that would result from other aviation noise sources present in College Station. This may occur in the vicinity of Easterwood Airport (KCLL), located southwest of Texas A&M University.

FAA has an established noise significance threshold, defined in FAA Order 1050.1F Environmental Impacts: Policies and Procedures and the associated 1050.1F Desk Reference, which is used when assessing noise impacts in a particular project area that are considered reportable and/or significant.

A significant noise impact is defined 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. For example, an increase from DNL 63.5 dB to 65.0 dB is considered a significant impact.

FAA Order 1050.1F requires additional reporting where the study area is larger than the immediate vicinity of an airport. These noise exposure assessments should identify where noise will change by the following specified amounts:

- For DNL 65 dB and greater: +1.5 dB ("Significant" impact)
- Between DNL 60 dB to <65 dB: +3 dB ("Reportable" impact)
- Between DNL 45 dB to <60 dB: +5 dB ("Reportable" impact)

Easterwood Field Airport, which is located in a portion of the drone's proposed area of operations, operates with controlled surface area Class D airspace. For areas where the drone operating area does not overlap with Easterwood Field Airport's Class D airspace, there would be little potential for the cumulative effect of traditional aircraft noise combined with drone noise. Based on calculations presented in **Table 13**, the potential for noise and compatible land use cumulative effects could result from drones and traditional aircraft operating within an airport's DNL 55 dB contour (overlapping inside Class D airspace). However, the potential for cumulative effects would be minimized because Amazon Prime Air's PADDC is not located near the vicinity of the Easterwood Field Airport's DNL 55 dB contour[11]. Prime Air's delivery route planning would take into account air traffic to avoid dense airspace restrictions such as airport runways. This would help avoid potential noise cumulative effects of the air traffic near Easterwood Field Airport.

Prime Air's delivery route planning would take into account air traffic to avoid dense airspace restrictions such as airport runways. This would help avoid potential noise cumulative effects of the air traffic near Easterwood Field Airport. There are no other known Part 135 commercial drone package delivery operators conducting operations in proximity to Amazon Prime Air's proposed MK30 operations area or PADDC, which is located in an area zoned for commercial activities. As such, the addition of Amazon Prime Air's commercial delivery service is not expected to result in cumulative effects with other potential Part 135 commercial drone operations. Any future Part 135 operators would be required to complete an environmental review before beginning operations, ensuring that any potential cumulative effects are properly analyzed and disclosed, and the appropriate siting of potential drone operating facilities would be considered to avoid a significant impact on the environment. Therefore, no significant cumulative noise impacts are expected.

[11] DNL contours for Easterwood Field Airport were reported in 2005 Master Plan. While the DNL 60 dB extends several thousand feet from the main runway ends, it can be expected that the current fleet operating at the airport would result in a smaller noise exposure due to changes in fleet mix. As such, it was assumed that drone activity could be possible within the DNL 55 dB, although unlikely", available online at https://fcor.tamu.edu/downloads/Easterwood%20Airport%20Combined.pdf.

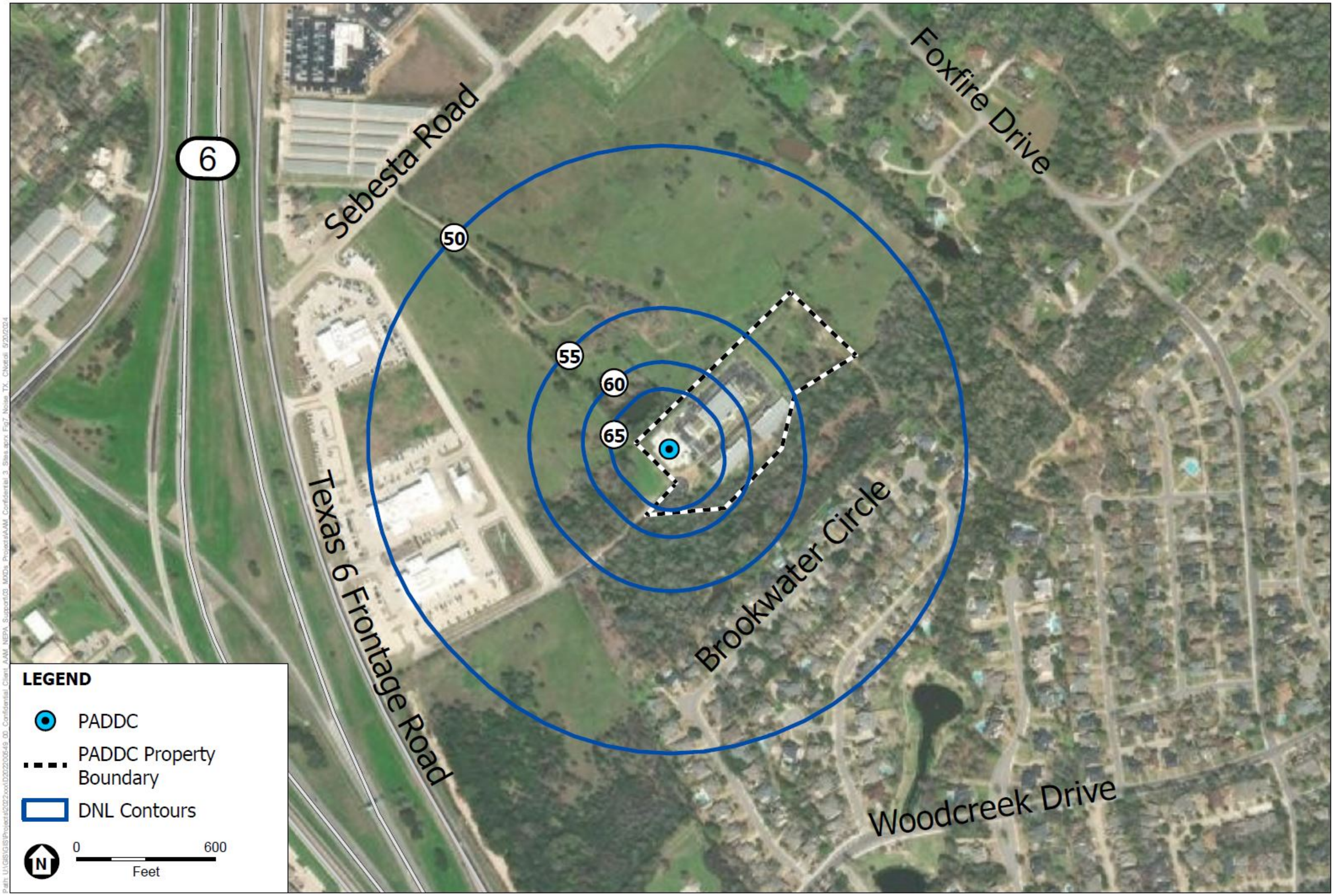
Table 13. Potential Cumulative Noise Exposure

Noise Source	Description	DNL (dB)	Energy $10^{(DNL/10)}$	Combine Noise Sources in DNL (dB)
1	Proposed Action[1]	58.1	645654.2	-
2	Airports within Study Area	55.0	316227.8	-
1+2	Proposed Action + Airports	-	961882.0	59.8
Delta	Change in Cumulative Noise	-	-	4.8

SOURCE: ESA, 2024.

Notes:

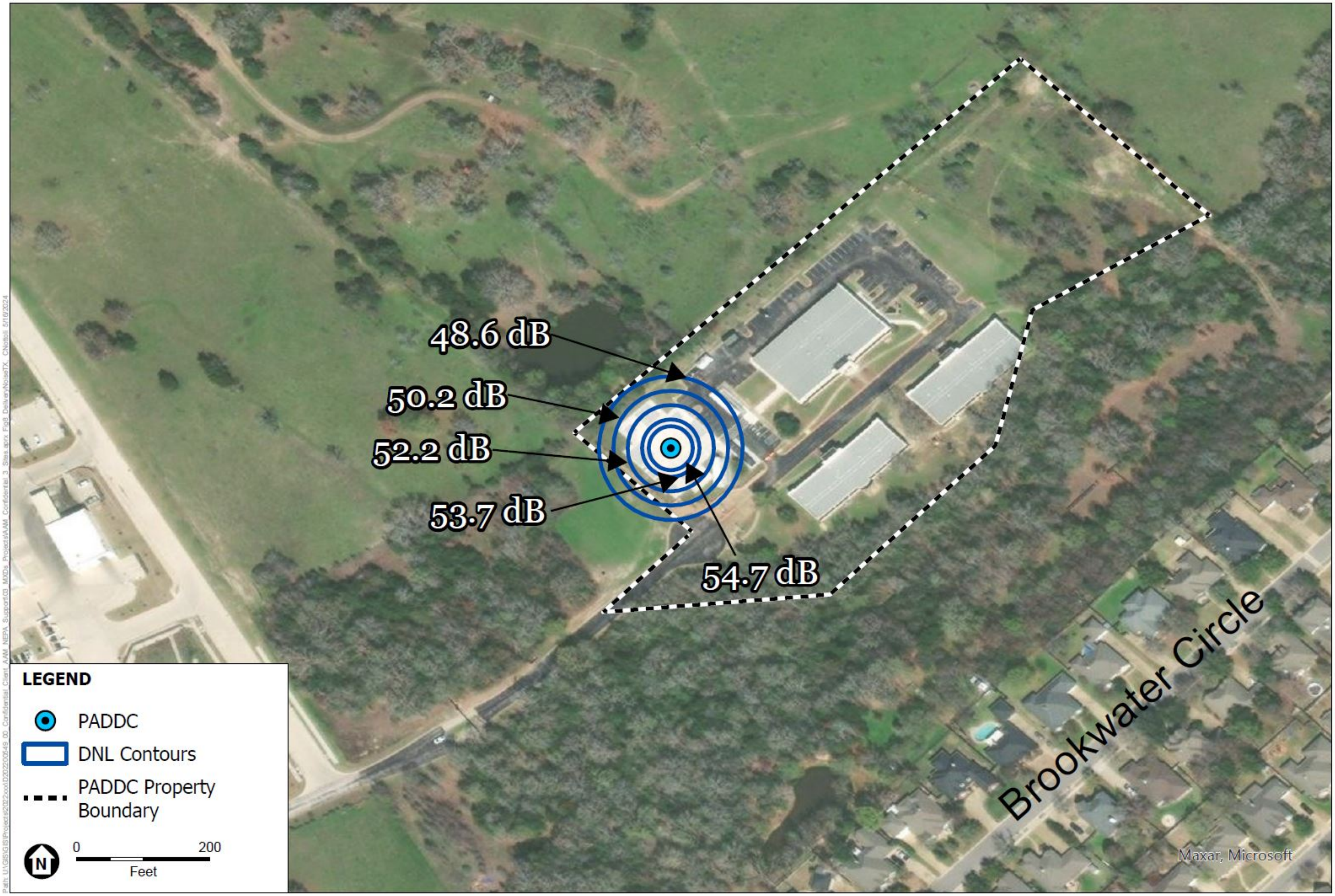
1. Proposed Action DNL based off exposure at delivery site location to assume conservative estimates.



SOURCE: ESA, 2023; Maxar, 2022; US Census Bureau, 2021; US Geological Survey, 2022.

Figure 7
PADDC Noise Exposure Contours
College Station, TX

ESA



SOURCE: ESA, 2023; Maxar, 2022; US Census Bureau, 2021; US Geological Survey, 2022.

Figure 8
Noise Exposure Contours Based on Maximum Deliveries Per Location
College Station, TX

ESA

Attachment A

MK30 to MK27-2 Noise Flight Test Comparison Report

REVISION LOG

Revision Number	Notes	Author [First and last name + Alias]	Date Released [YYYY-MM-DD]
1	Initial revision	Arvin Shajanian	2024-04-16

APPROVING AUTHORITY

Amazon Approvals ID	Name [First and last name]	Role
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1. INTRODUCTION

This document contains the data gathered during the noise flight test campaign performed in February 2024. The purpose of the testing was to provide noise profiles of the MK27-2 drone and the MK30 drone when flown back-to-back under the same environmental conditions to demonstrate that the MK30 is quieter than the MK27-2. This enables the use of previously collected MK27-2 National Environmental Policy Act (NEPA) noise data for the NEPA assessment of the MK30 drone for operations at College Station, TX and Tolleson, AZ. The results from this test campaign demonstrate that the MK30 is equivalent or quieter when compared to the MK27-2, which supports the use of the MK27-2 noise data as a more conservative representation of the MK30 noise profile for NEPA evaluation of MK30 operations. The MK27-2 and MK30 flight profiles are similar in nature, in that they both perform a VTOL climb, a transition to fixed-wing flight en route to the customer backyard, transition back to VTOL for descent into the backyard area for delivery at 4m (12 feet) Above Ground Level (AGL), followed by the same maneuvers to return to the Prime Air Drone Delivery Center (PADDC). The difference between these profiles is that the MK30 flies higher and faster than the MK27-2, which contributes to the reduction of the overall Sound Exposure Level (SEL) for the MK30. A comparison of the typical operational flight parameters can be seen below in Table 1. Additionally, a comparison of the MK27-2 and MK30 flight profiles can be seen below in Figure 1. Note that these are the flight profiles for operational flights and not the flight test profiles for this noise flight test campaign. The data gathered during this testing, detailed in section 3, was collected with both the MK27-2 and the MK30 flying at similar AGLs between 31 and 44 meters (102 to 145 feet), in order to review the data at a consistent distance.

Phase of Flight	Altitude (feet AGL)		Ground Speed (knots)		Duration (seconds)	
	MK27-2	MK30	MK27-2	MK30	MK27-2	MK30
Takeoff and Vertical Ascent	Ascent from 0 to 130	Ascent from 0 to 115	0	0	21	15
Transition and Outbound Climb	130 to 160	115 to 200	0 to 52.4	0 to 58.3	20	30
Fixed Wing Outbound Cruise	160	200	52.4	58.3	Variable*	Variable*
Delivery Descent and Transition	Descent from 160 to 130	Descent from 200 to 115	52.4 to 0	58.3 to 0	20	30
Backyard Descent	Descent from 130 to 13	Descent from 115 to 13	0	0	32	21
Delivery	13	13	0	0	2	2
Backyard Ascent	Ascent from 13 to 130	Ascent from 13 to 197	0	0	24	26
Transition and Inbound Climb	Ascent from 130 to 160	Ascent from 197 to 345	0 to 52.4	0 to 58.3	20	30
Fixed-wing Inbound Cruise	160	345	52.4	58.3	Variable*	Variable*
Landing Descent and Transition	Descent from 160 to 130	Descent from 345 to 197	52.4 to 0	58.3 to 0	20	30
Vertical Descent and landing	Descent from 130 to 0	Descent from 197 to 0	0	0	38	35

*Duration of fixed-wing flight time varies based on distance to customer

Table 1: Comparison of Typical MK27-2 and MK30 Operational Flight Profiles

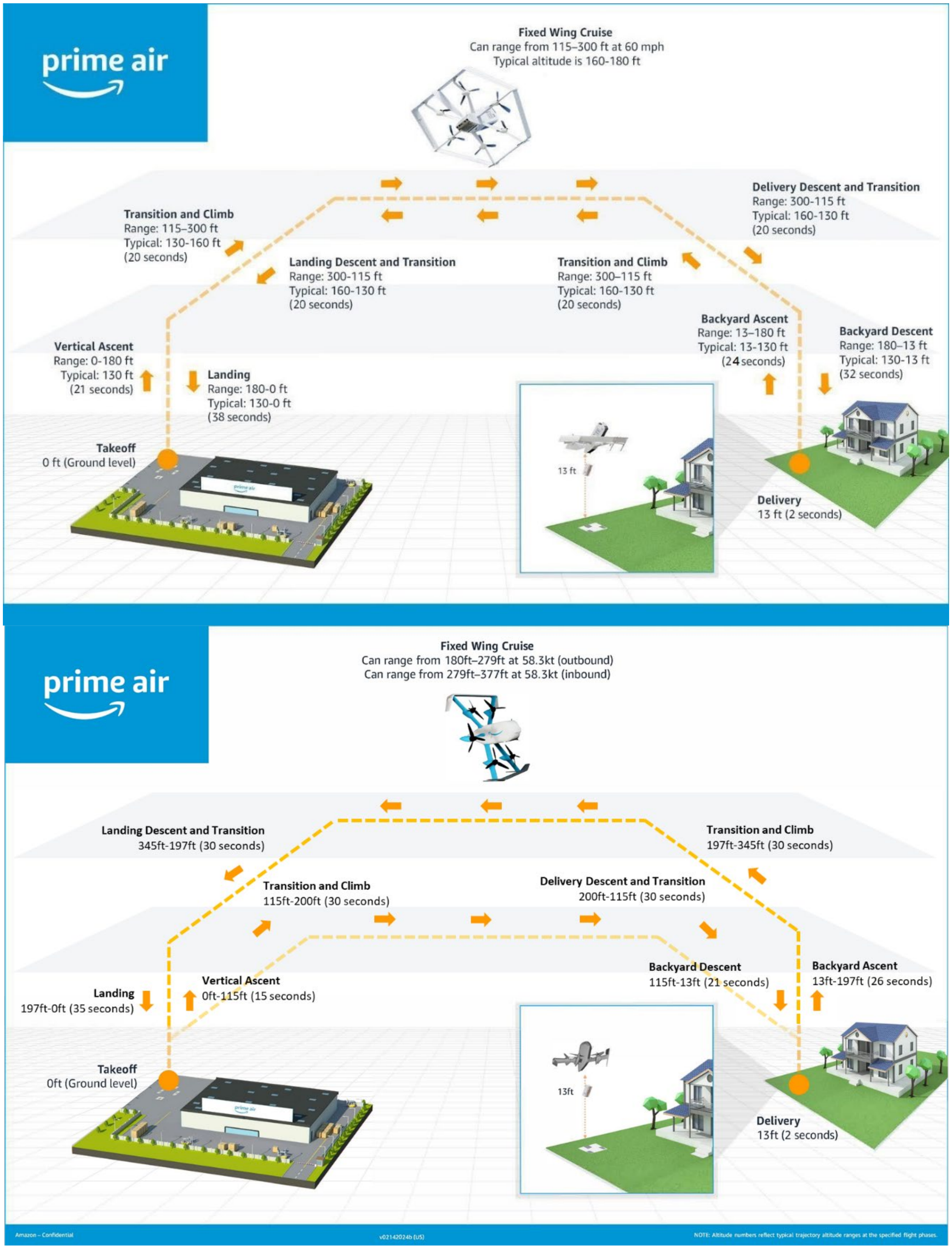


Figure 1: MK27-2 (Top) and MK30 (Bottom) Example Operational Flight Profiles

2. TEST METHODOLOGY

2.1. Overview

The data gathered during this test campaign utilized the same test methodology, instrumentation, and analysis methods as those utilized to support the MK27-2 NEPA evaluation conducted in April 2022 as described in the Prime Air Noise Measurement Report for the MK27-2 and the MK27-2 NEPA reports for College Station, TX and Lockeford, CA.

2.2. Instrumentation

An internally developed system for gathering acoustic data measurements was utilized in this campaign. This system provides time synchronized audio and location data with respect to the drone. The audio, drone-synchronized time and location data allow accurate determination of sound pressure level (SPL), distance, and incidence angle required for post-processing.

The system is composed of commercially available hardware with internal and external calibrations. The data acquisition system (DAQ) is a National Instruments cDAQ-9171 with a NI- 9234 analog unit capable of 51.2 kHz sampling rate at 24-bit resolution. New and calibrated GRAS 46AO ½" CCP Pressure Standard Microphones were used with the factory sensitivity values for the test. Calibration tones of the microphones were collected using a GRAS 42AG sound calibrator at 1000 Hz/114dB and 1000Hz/94dB at the start of each day.

2.3. Test Description

2.3.1. Overview

The flight profiles flown by the MK27-2 and the MK30 consisted of clockwise racetracks, with the microphone array positioned adjacent to the takeoff/landing pad to capture data for the VTOL/transition flight phases, and under a segment of straight and level flight to capture data for the fixed wing flight phase (See Figures 2 & 3). Both vehicles' flight profiles utilized the same takeoff/landing pad as well as the same overflight location in order to keep vehicle flight conditions the same at the acoustic measurement points.

For both vehicles' flight profiles, the drones performed a VTOL climb to an AGL between 27 and 40 meters (89 to 131 feet), began a Westbound transition to fixed-wing flight, continued in fixed wing flight until passing beyond the overflight microphone array, performed a right hand 180 degree turn, flew Eastbound, performed another right 180 degree turn, transitioned back to VTOL flight, and landed back at the pad. Both drones remained at a constant cruising altitude throughout the cruise segments. A package delivery segment was not performed, but is represented by the VTOL landing segment.

The MK27-2 flew a total of 1km westbound prior to its initial 180 degree turn, and 1.3km eastbound prior to its turn back to return to the pad. The MK30 flew 0.8km westbound prior to its initial turn, and 1.6km eastbound prior to its turn back to return to the pad. The difference in the racetrack geometry flown by the MK30 seen in Figure 2 is due to differences in the drone design and flight performance characteristics for turn radius and transition distances. However, as can be seen in Figure 2, the microphone array was set up below a flight segment with at least 150m (500 feet) of straight and level flight on both sides of the microphone array, which is more than was found to be required during prior testing to cover the 10dB down interval (as described in 14 CFR 36).

2.3.2. Microphone Locations

Microphones were placed on a North/South line perpendicular to the flight path. For both the overflight (Microphone Setup #1 in Figure 2) and takeoff/landing (Microphone Setup #2 in Figure 2) measurement locations, microphones were placed at a 5 ft height and oriented for a proper incidence angle with the aircraft during both phases of flight. Figure 3 shows the placement of the four microphones at each of the two setup locations. Tables 2 and 3 show the GPS coordinates of the microphones and the distances between them.

Note that some of the signals were not usable due to interference and were excluded from this analysis.

Figure 2: MK27-2 Racetrack (Blue) and MK30 Racetrack (Red) Overlay

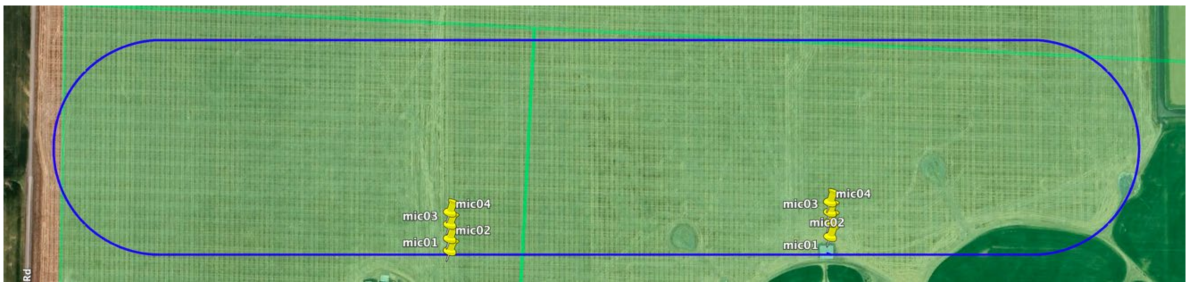


Figure 3: MK27 Flight Path with Microphone Locations

Location	Mic 1	Mic 2	Mic 3	Mic 4
Takeoff/Landing	45°42'09.2"N 118°51'20.1"W	45°42'09.9"N 118°51'20.1"W	45°42'10.4"N 118°51'20.1"W	45°42'10.9"N 118°51'20.1"W
Overflight	45°42'08.5"N 118°51'46.9"W	45°42'09.1"N 118°51'46.9"W	45°42'09.8"N 118°51'46.9"W	45°42'10.4"N 118°51'46.9"W

Table 2: GPS Coordinates for each microphone

Location	Pad Center to Mic 1	Pad Center to Mic 2	Pad Center to Mic 3	Pad Center to Mic 4
Takeoff/Landing	10m	26.67m	43.33m	60m
Location	**Flight Path Center to Mic 1**	**Mic 1 to Mic 2**	**Mic 1 to Mic 3**	**Mic 1 to Mic 4**
Overflight	0m	20m	40m	60m

Table 3: Microphone placement summary

3. RESULTS

The following section contains the test data comparing the noise signatures of the MK27-2 and MK30, as well as the ambient atmospheric conditions of each recording. A total of 12 flights were flown, comprising six total pairs of back-to-back flights (each pair having one MK27-2 flight and one MK30 flight). Of the six pairs, three were flown to collect data for VTOL, and three were flown to collect data for flyover.

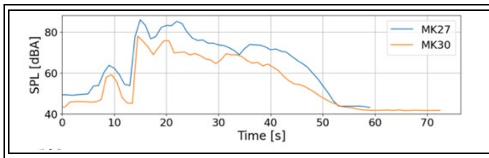
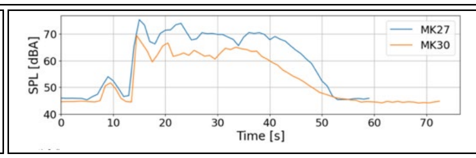
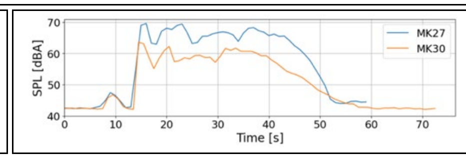
3.1. VTOL

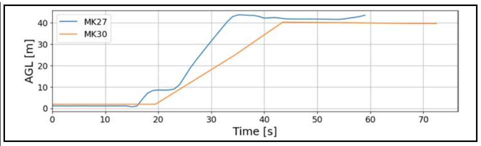
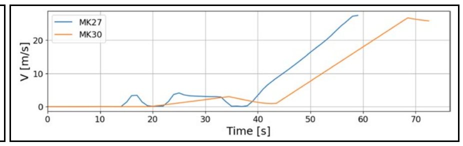
This section contains the test data for each of the three pairs of VTOL flights having both a takeoff and landing segment.

3.1.1. Pair 1

Drone	MK27-2	MK30
Temperature [C]	12.4	11.4
Wind 10 Min Average Speed [kts]	4.3	1.6
Wind 10 Min Average Direction [deg]	296	24.3
Wind 10 Min Gust Average [kts]	6.6	2.1
Density Altitude [ft]	1461	1331

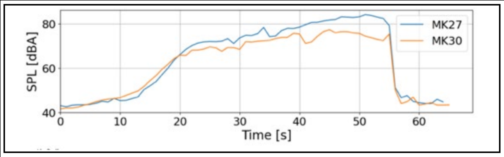
Takeoff

		
Mic 1	Mic 2	Mic 3

	
AGL	Velocity

	Drone	Mic 1	Mic 2	Mic 3
L_{max}	**MK27-2**	86.1	75.4	69.6
	MK30	78.1	69.4	63.5
SEL	**MK27-2**	94.0	85.3	81.7
	MK30	85.4	78.4	74.8

Landing



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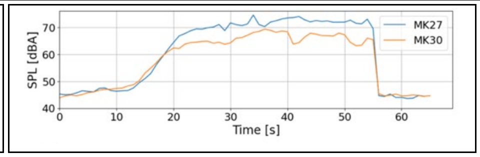

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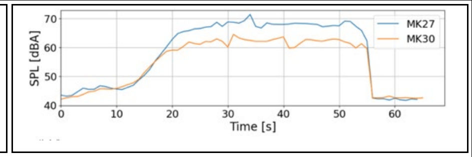

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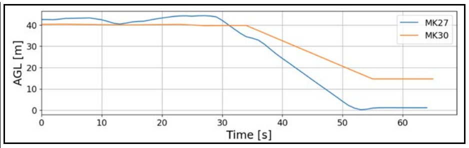

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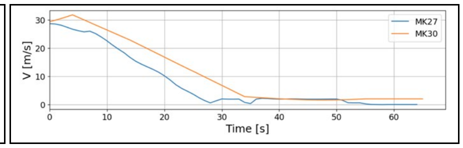


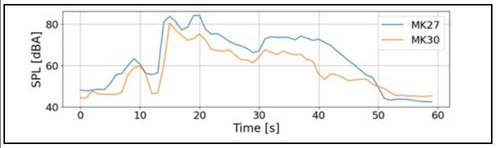
Velocity

	Drone	Mic 1	Mic 2	Mic 3
L_{max}	MK27-2	84.2	74.6	71.4
	MK30	77.4	69.3	64.5
SEL	MK27-2	95.1	87.2	83.3
	MK30	89.0	82.0	77.8

3.1.2. Pair 2

Drone	MK27-2	MK30
Temperature [C]	3.9	2
Wind 10 Min Average Speed [kts]	3.5	3.1
Wind 10 Min Average Direction [deg]	134	144.1
Wind 10 Min Gust Average [kts]	5.2	4.5
Density Altitude [ft]	380	140.2

Takeoff



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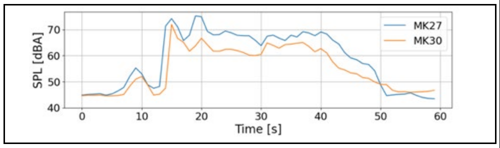

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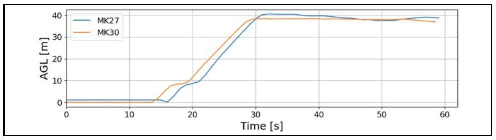

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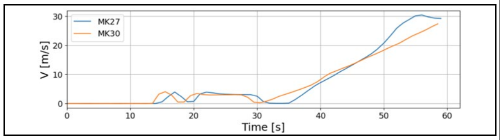
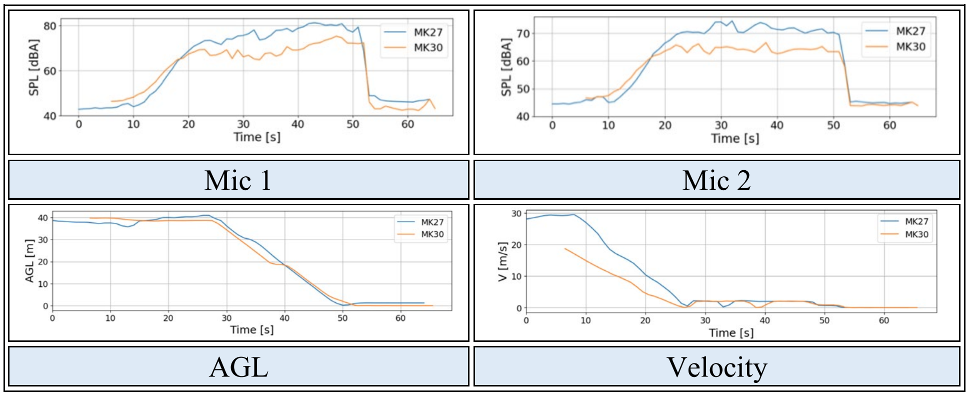


Velocity

	Drone	Mic 1	Mic 2
L_{max}	**MK27-2**	84.2	75.2
	MK30	80.6	72.0
SEL	**MK27-2**	92.0	84.3
	MK30	85.5	78.8

Landing

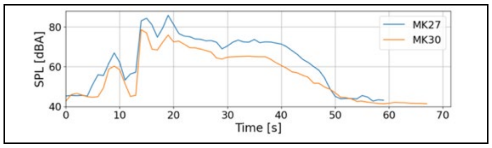


	Drone	Mic 1	Mic 2
L_{max}	**MK27-2**	81.2	74.5
	MK30	75.2	66.6
SEL	**MK27-2**	92.7	86.6
	MK30	85.7	79.8

3.1.3. Pair 3

Drone	MK27-2	MK30
Temperature [C]	8.1	8.3
Wind 10 Min Average Speed [kts]	9.1	9.5
Wind 10 Min Average Direction [deg]	5	354
Wind 10 Min Gust Average [kts]	13.6	12.4
Density Altitude [ft]	964	994

Takeoff



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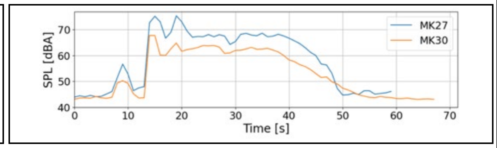

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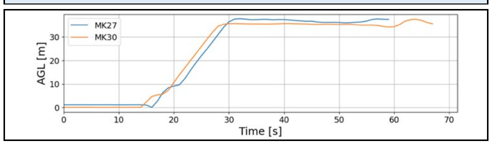

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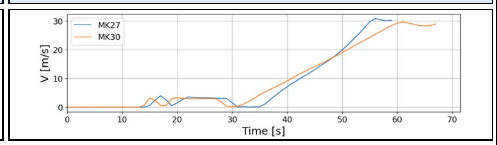
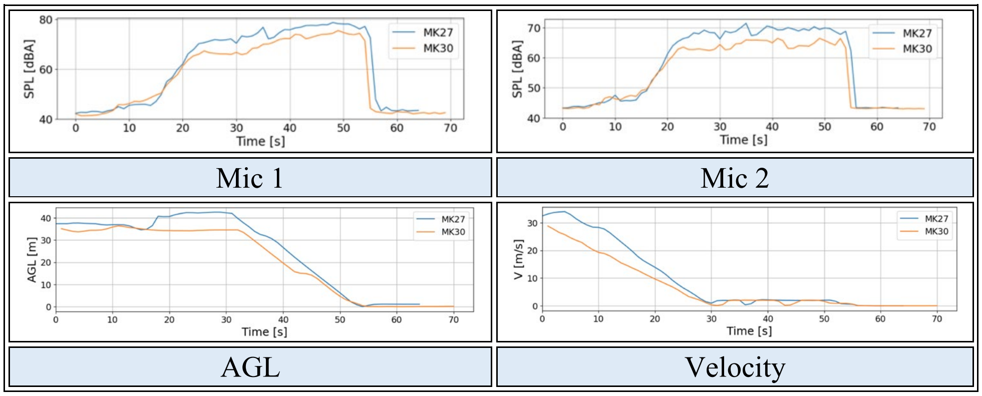


Velocity

	Drone	Mic 1	Mic 2
L_{max}	**MK27-2**	85.8	75.4
	MK30	78.6	67.8
SEL	**MK27-2**	92.3	84.3
	MK30	85.1	77.7

Landing



Mic 1 | Mic 2 | AGL | Velocity

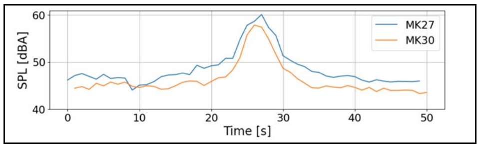
	Drone	Mic 1	Mic 2
L_{max}	**MK27-2**	78.8	71.4
	MK30	75.5	66.4
SEL	**MK27-2**	90.9	84.2
	MK30	86.9	79.8

3.2. Forward Flight (Flyover)

This section contains the test data for each of the three pairs of forward flight (flyover) flights.

3.2.1. Pair 1

Drone	MK27-2	MK30
Temperature [C]	8	8.8
Wind 10 Min Average Speed [kts]	2	5.7
Wind 10 Min Average Direction [deg]	169	259
Wind 10 Min Gust Average [kts]	5.1	8
Density Altitude [ft]	856	987



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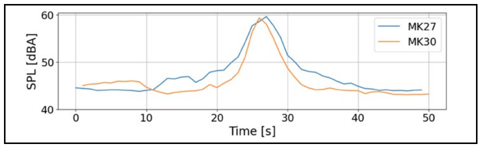

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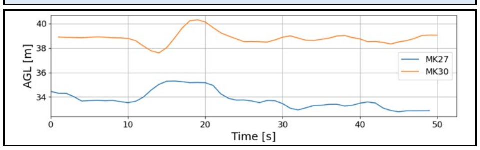

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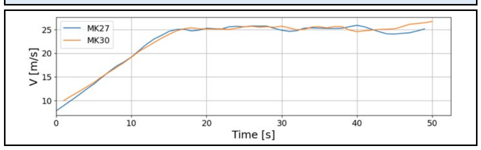

Velocity

	Drone	Mic 1	Mic 2
L_{max}	**MK27-2**	60.1	59.6
	MK30	57.9	59.4
SEL	**MK27-2**	66.1	65.7
	MK30	63.7	64.3

3.2.2. Pair 2

Drone	MK27-2	MK30
Temperature [C]	9	9.6
Wind 10 Min Average Speed [kts]	11.7	14.4
Wind 10 Min Average Direction [deg]	264	264
Wind 10 Min Gust Average [kts]	15.7	18.5
Density Altitude [ft]	1015	1083

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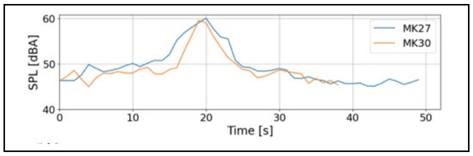
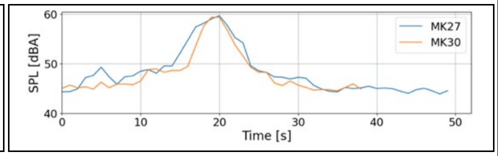
<tr><td>
</td><td>
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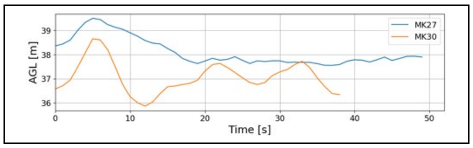
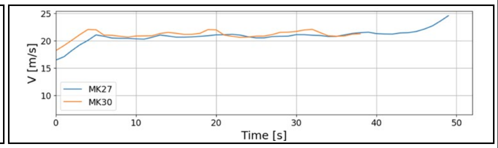
<tr><td>
</td><td>
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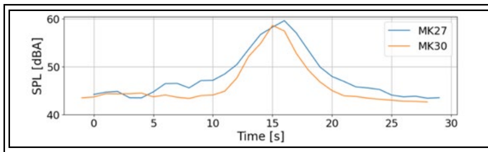
	Drone	Mic 1	Mic 2
L_{max}	MK27-2	60.0	59.7
	MK30	59.5	59.4
SEL	MK27-2	67.0	66.8
	MK30	65.1	65.5

3.2.3. Pair 3

Drone	MK27-2	MK30
Temperature [C]	7	5.4
Wind 10 Min Average Speed [kts]	11.7	6.8
Wind 10 Min Average Direction [deg]	359	15.4
Wind 10 Min Gust Average [kts]	14.6	9.9
Density Altitude [ft]	840	640



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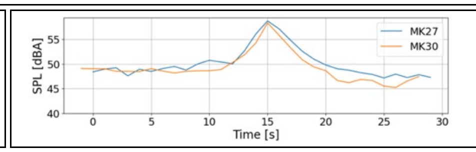

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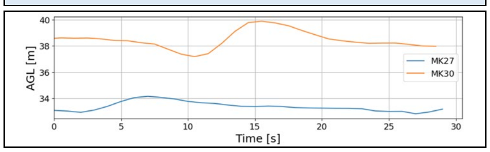

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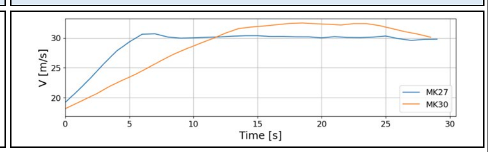

Velocity

	Drone	Mic 2	Mic 4
L_{max}	MK27-2	59.6	58.8
	MK30	58.6	58.4
SEL	MK27-2	65.3	64.4
	MK30	63.4	63.2

4. CONCLUSIONS

The data in Section 3.1 shows that the MK30 noise is 5-7 dB lower in maximum noise levels than the MK27-2 in the takeoff/landing phases of flight. In some localized portions of the flight noise data, the MK30 was recorded at higher SPL, but these occurred outside the peak noise event regions. The SEL in all cases is lower for the MK30.

The data in Section 3.2 showed that the MK30 maximum noise levels in the flyover phase are equivalent or lower when compared to the MK27-2. The difference in L_{max} between the MK30 and the MK27-2 is expected to be smaller in the flyover phase versus the takeoff/landing phase. However, given that the MK30 flies faster and higher than the MK27-2 in actual operation (detailed in Table 1), the SEL in operational flyover will still be lower for the MK30 due to the shorter event duration.

The data in Section 3 shows that in all flights, the MK30 is equivalent to or quieter than the MK27-2 in terms of maximum noise levels. It also shows that the SEL for the MK30 is lower in all cases. This supports the approach of using the previously collected MK27-2 NEPA noise data as a conservative representation of the MK30 noise profile for the purpose of the NEPA evaluation of MK30 operations.

Attachment B

Federal Aviation Administration

Memorandum

Date: May 16, 2024

To: Dave Senzig (Acting), Noise Division Manager, Office of Environment and Energy (AEE-100)

From: Chris Hurst, Flight Standards (AFS), General Aviation and Commercial Branch, AFS-752

Subject: Environmental Assessment (EA) Noise Methodology Approval Request for MK-30 Amazon Prime Air Operations in College Station, TX

AFS requests AEE approval of the noise methodology to be used for the supplemental Environmental Assessment (EA) for Amazon Prime Air (Amazon) operations using the Amazon MK30 unmanned aircraft (UA) in College Station, TX to expand it's package delivery services as a 14 CFR Part 135 operator as described below.

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

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

Description of Aircraft and Proposed Operations

AFS is evaluating Amazon's proposal to expand its delivery capabilities from the College Station, TX Prime Air Drone Delivery Center (PADCC) and associated operating area under its existing Part 135 air carrier certificate and related operating authorizations by adding the next generation MK30 UA to its fleet, increasing the number of operations and operating days, and expanding the approved area of operations.

The MK30 UA has six (6) propulsors allowing it to take-off and land vertically and transition to wing borne flight (WBF). Its airframe is composed of staggered tandem wings for stable WBF. The drone weighs 77.9 lbs. (35.5 kg) and has a maximum takeoff weight of 83.2 lbs. (37.8 kg), which includes a maximum payload of 5 lbs. (3 kg). It has a maximum operating range of 7.5 mi (12 km). It is a hybrid multicopter fixed-wing UA that uses electric power from rechargeable lithium- ion batteries and can fly up to 400 ft (122 m) above ground level (AGL) at a maximum cruise speed of 73 mph (64 knots) during WBF. It is launched vertically using powered lift and converts to using wing lift during en route flight. A typical flight profile can be broken into the following general flight phases: launch, en route outbound, delivery, en route inbound, and landing. After launch, Amazon's MK30 UA would rise to an altitude of less than 400 ft (122 m) AGL and follow a predefined route to its delivery site. Aircraft would typically fly en route at between approximately 180 to 377 ft (55 to 115 m) AGL, except when descending to drop a package. Packages would be carried internally in the UA's fuselage. When making a delivery, the UA descends, opens a set of payload doors, and drops the package to the ground from approximately 13 ft (4 m) AGL. Amazon's UA would not touch the ground in any place other than the PADDC (except during safe contingent landings) and will remain airborne throughout the operation including the delivery stage. After the package is dropped, the MK30 UA climbs vertically and follows its predefined route back to the PADDC at its assigned altitude.

Amazon is seeking to amend its current Operation Specifications (OpSpec) and other Federal Aviation Administration (FAA) authorizations needed to integrate the MK30 and expand drone commercial package delivery operations from a single PADDC located in College Station, Texas.

Amazon is proposing to amend its OpSpec by:

(1) Incorporating the next generation, MK30 drone variant into service, which offers longer range and a reduced noise profile,

(2) Increasing the number of annual operations,

(3) Increasing the number of daily operating hours (between 7 AM and 10 PM) and operating days, and

(4) Increase the College Station, TX approved area of operations. The MK30's operating range is 7.5 mi (12 km) (an increase of 3.7 mi (6.0 km) from the MK27-2 range), which increases the potential operating area from 43.7 sq mi (113.2 sq km) to 174 sq mi (450.6 sq km).

As proposed, average daily operations would increase from the current estimated 200 operations per day using the MK27-2 UA to an estimated 469 average annual daily operations using the MK30 UA. The transition to the MK30 UA would amount to an increase from 52,000 operations with the MK27-2 UA to 171,329 operations with the MK30 UA on an annual basis. The number of daytime (7 AM to 10 PM) operating hours would increase from the current eight (8) hours per day (daytime) to 10 hours per day and the number of operating days would increase from the current 260 days per year to 365 days per year. Based on those overall levels Amazon expects deliveries to be distributed among delivery locations with a minimum number of 0.1 deliveries per day or less at any one location and maximum of 4.0 per day at any one location on an average annual daily basis.

Noise Analysis Methodology

AFS requests to use the noise analysis methodology described in ESA Report No. 202200549.03 for the "Noise Assessment Amazon Prime Air MK27-2 Unmanned Aircraft Operations at College Station Texas Noise Technical Report May 2024" dated May 2024.

Federal Aviation Administration

Memorandum

Date: May 20, 2024

To: Chris Hurst, Flight Standards (AFS), General Aviation and Commercial Branch (AFS-752)

From: David Senzig, Manager (Acting), Noise Division, Office of Environment and Energy (AEE-100)

Subject: Supplemental Environmental Assessment (EA) Noise Methodology Approval Request for Amazon Prime Air Commercial Package Delivery Operations with the MK30 UA from College Station, Texas

The Office of Environment and Energy (AEE) has reviewed the proposed non-standard noise modeling methodology to be used for Amazon Prime Air (Amazon) operations using the MK30 unmanned aircraft (UA) from College Station, Texas. This request is in support of a supplemental Environmental Assessment (EA) for Amazon to provide expanded package delivery services as a 14 CFR Part 135 operator in College Station and a surrounding operating area.

The Proposed Action is for Amazon to expand its package delivery capabilities from the existing Prime Air Drone Delivery Center (PADCC) located in College Station by integrating the MK30 UA into its fleet, increasing the number of operations and operating days, and expanding Amazon's approved operating area. Typical operations of the MK30 UA will consist of departure from a launch/takeoff pad at the PADCC followed by a vertical climb to a typical en route altitude of 180 to 377 feet above ground level (AGL). The UA then transitions from vertical to horizontal wing borne flight (WBF) for transit to a delivery location. Approaching the delivery location, the UA will transition from horizontal WBF to vertical flight, and then descend vertically over the delivery point. At 13 feet AGL, the UA drops the package at the delivery point, and ascends vertically back to en route altitude. Once back at en route altitude, the UA again transitions from vertical to horizontal WBF for transit back to its originating PADDC. When the UA arrives at the PADDC, the UA will transition from horizontal WBF to vertical flight and vertically descends to its assigned landing pad. Once it lands, the UA is serviced and prepared for the next delivery.

Under the scope of the Proposed Action Amazon is proposing to increase from the current estimated 52,000 annual deliveries at the College Station PADCC with the MK27-2 UA to a maximum of 171,329 annual deliveries with the MK30 UA. This is equivalent to 169 average annual daily (AAD) deliveries. Based on those overall levels Amazon expects deliveries to be distributed among delivery locations with a minimum number of 0.1 deliveries per day or less at any one location and maximum of 4.0 per day at any one location on an AAD basis. Additionally, the number of daytime (7 AM to 10 PM) operating hours would increase from the current eight (8) hours per day to 10 hours per day and the number of operating days would increase from the current 260 days per year to 365 days per year. The area of operations associated with the College Station PADCC will also expand from 43.7 square miles to 174 square miles due to the increased range of the MK30 UA when compared to the MK27-2.

The MK30 UA is still under development and final noise data for the vehicle is not yet available. To assess the noise exposure of MK30 UA operations for the Proposed Action being considered in this supplemental EA, Amazon in coordination with AEE conducted noise measurements in February 2024 of the MK30 and MK27-2 UAs. The purpose of these measurements was to evaluate if the MK30 is quieter than the MK27-2 and determine if the noise measurement data and analysis methodology developed for the MK27-2 as detailed in the December 2022 EA for evaluating Amazon's initial package delivery operations in College Station could be used as a surrogate for evaluating the noise exposure of the MK30. Overall, the noise measurement data showed that the MK27-2 UA has an equivalent or louder noise profile compared to the MK-30 and use of the previously developed noise analysis methodology and measurement data from the MK27-2 represents a conservative surrogate for evaluating the noise exposure from proposed MK30 operations.

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 ESA Report No. 202200549.03 for the "Noise Assessment Amazon Prime Air MK27-2 Unmanned Aircraft Operations at College Station Texas Noise Technical Report" dated May 2024.

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.

Attachment C

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.

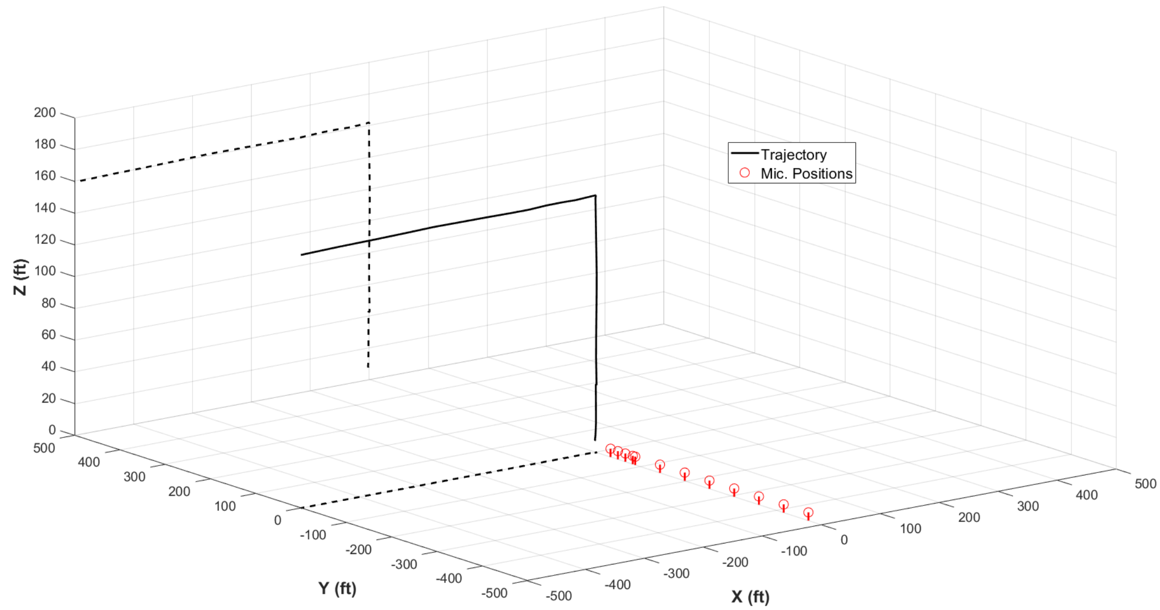

Figure 1. Microphone locations for takeoff, delivery, and landing measurements for MK27-2 UA with example takeoff trajectory.

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.

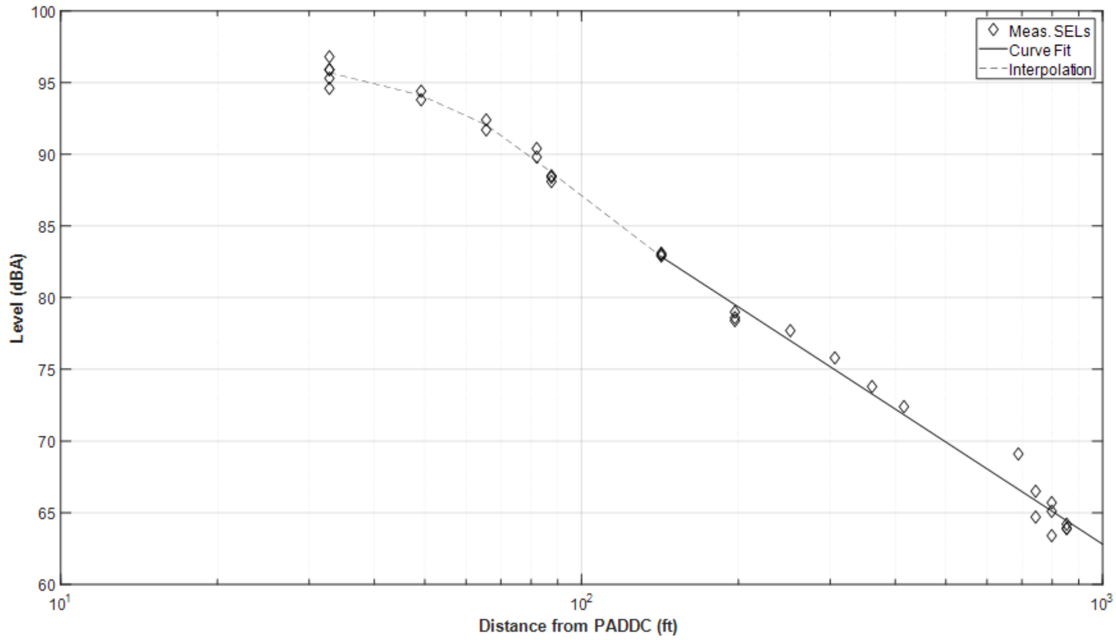

Figure 2. Measured sound exposure levels during takeoffs as described in Table 4.

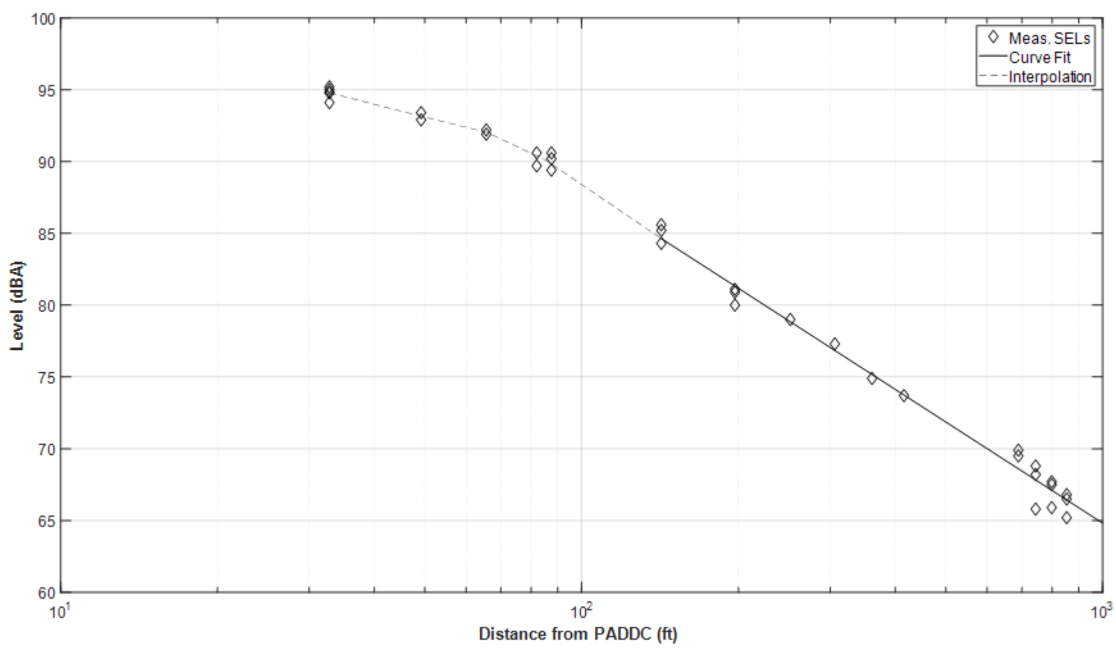

Figure 3. Measured sound exposure levels during landings as described in Table 4.

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.

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

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

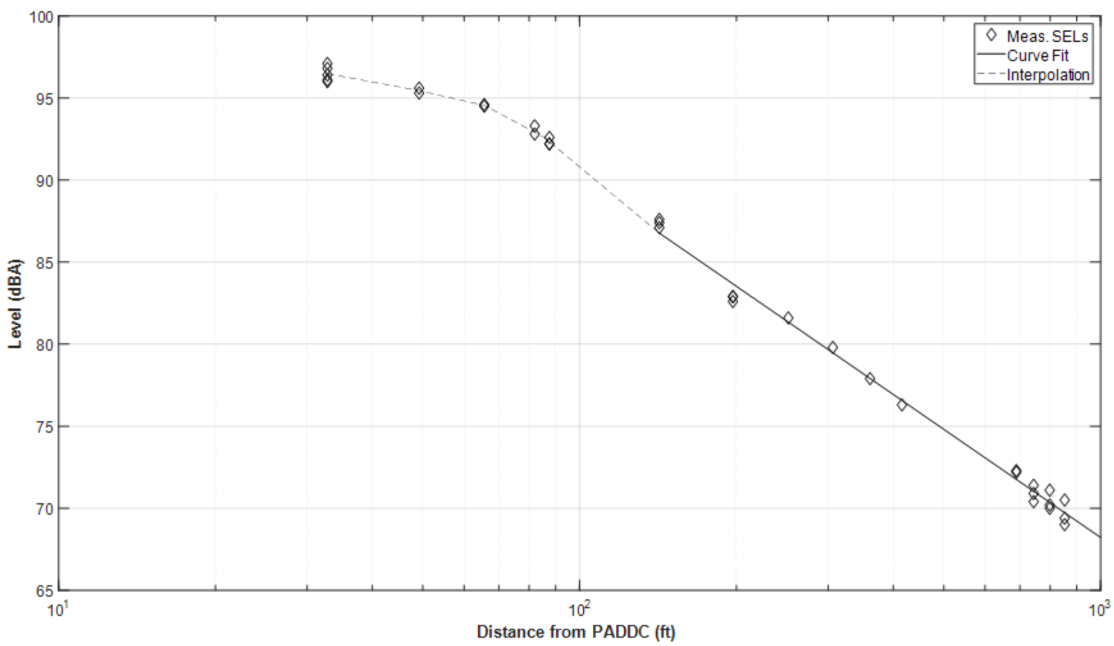

Figure 4. Measured Sound Exposure Levels during deliveries as described in Table 10.

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 F
Environmental Justice

Appendix F

Table F-1
Selected Demographic Characteristics (Race) by Census Block Group

Geographic Area	Total Population	White (Non-Hispanic) Population	% White	Minority Population	% Minority
Census Block Group 480410001051	2,387	1,736	73%	651	27%
Census Block Group 480410001052	956	785	82%	171	18%
Census Block Group 480410001063	1,523	1,370	90%	153	10%
Census Block Group 480410001071	1,982	1,402	71%	580	29%
Census Block Group 480410001072	2,440	1,288	53%	1,152	47%
Census Block Group 480410001081	827	777	94%	50	6%
Census Block Group 480410002031	1,132	535	47%	597	53%
Census Block Group 480410002032	1,284	793	62%	491	38%
Census Block Group 480410002041	353	239	68%	114	32%
Census Block Group 480410002042	661	164	25%	497	75%
Census Block Group 480410002043	896	142	16%	754	84%
Census Block Group 480410002044	521	44	8%	477	92%
Census Block Group 480410002045	1,702	416	24%	1,286	76%
Census Block Group 480410002061	2,529	1,245	49%	1,284	51%
Census Block Group 480410002071	582	110	19%	472	81%
Census Block Group 480410002072	2,202	995	45%	1,207	55%
Census Block Group 480410004011	1,528	37	2%	1,491	98%
Census Block Group 480410004012	1,585	317	20%	1,268	80%
Census Block Group 480410004013	705	242	34%	463	66%
Census Block Group 480410004021	1,159	306	26%	853	74%
Census Block Group 480410006031	531	292	55%	239	45%
Census Block Group 480410006033	2,620	255	10%	2,365	90%
Census Block Group 480410006051	566	0	0%	566	100%
Census Block Group 480410006052	1,257	451	36%	806	64%
Census Block Group 480410006053	1,815	312	17%	1,503	83%
Census Block Group 480410006061	654	75	11%	579	89%
Census Block Group 480410006062	822	57	7%	765	93%
Census Block Group 480410007001	927	93	10%	834	90%
Census Block Group 480410007002	768	192	25%	576	75%
Census Block Group 480410007003	820	279	34%	541	66%
Census Block Group 480410007004	587	337	57%	250	43%
Census Block Group 480410008001	385	89	23%	296	77%
Census Block Group 480410008002	1,081	891	82%	190	18%
Census Block Group 480410008003	422	253	60%	169	40%
Census Block Group 480410008004	2,067	1,055	51%	1,012	49%

Geographic Area	Total Population	White (Non-Hispanic) Population	% White	Minority Population	% Minority
Census Block Group 480410008005	880	419	48%	461	52%
Census Block Group 480410009001	1,158	256	22%	902	78%
Census Block Group 480410009002	1,397	124	9%	1,273	91%
Census Block Group 480410010011	874	298	34%	576	66%
Census Block Group 480410010012	681	514	75%	167	25%
Census Block Group 480410010013	1,446	604	42%	842	58%
Census Block Group 480410010014	337	254	75%	83	25%
Census Block Group 480410010021	1,140	941	83%	199	17%
Census Block Group 480410010022	518	153	30%	365	70%
Census Block Group 480410010023	1,153	892	77%	261	23%
Census Block Group 480410010024	1,195	322	27%	873	73%
Census Block Group 480410011011	617	308	50%	309	50%
Census Block Group 480410011012	1,339	950	71%	389	29%
Census Block Group 480410011013	817	767	94%	50	6%
Census Block Group 480410011021	790	657	83%	133	17%
Census Block Group 480410011022	832	325	39%	507	61%
Census Block Group 480410013011	1,879	1,106	59%	773	41%
Census Block Group 480410013012	856	505	59%	351	41%
Census Block Group 480410013021	2,128	1,762	83%	366	17%
Census Block Group 480410013022	738	588	80%	150	20%
Census Block Group 480410013023	903	160	18%	743	82%
Census Block Group 480410013024	908	277	31%	631	69%
Census Block Group 480410013031	1,571	1,250	80%	321	20%
Census Block Group 480410013032	1,527	342	22%	1,185	78%
Census Block Group 480410013033	1,537	774	50%	763	50%
Census Block Group 480410013034	1,740	1,187	68%	553	32%
Census Block Group 480410014011	1,542	712	46%	830	54%
Census Block Group 480410016041	1,147	860	75%	287	25%
Census Block Group 480410016042	821	670	82%	151	18%
Census Block Group 480410016043	1,470	876	60%	594	40%
Census Block Group 480410016044	723	373	52%	350	48%
Census Block Group 480410016045	812	402	50%	410	50%
Census Block Group 480410016051	1,724	1,079	63%	645	37%
Census Block Group 480410016052	2,451	859	35%	1,592	65%
Census Block Group 480410016061	1,333	870	65%	463	35%
Census Block Group 480410016062	1,559	712	46%	847	54%
Census Block Group 480410016071	1,689	904	54%	785	46%

Geographic Area	Total Population	White (Non-Hispanic) Population	% White	Minority Population	% Minority
Census Block Group 480410016081	613	150	24%	463	76%
Census Block Group 480410016082	1,554	1,369	88%	185	12%
Census Block Group 480410017021	1,452	700	48%	752	52%
Census Block Group 480410017022	1,646	631	38%	1,015	62%
Census Block Group 480410017031	1,053	632	60%	421	40%
Census Block Group 480410017032	1,695	1,035	61%	660	39%
Census Block Group 480410017033	1,436	932	65%	504	35%
Census Block Group 480410017041	1,307	683	52%	624	48%
Census Block Group 480410017042	730	415	57%	315	43%
Census Block Group 480410018011	2,927	1,586	54%	1,341	46%
Census Block Group 480410018012	1,110	925	83%	185	17%
Census Block Group 480410018013	1,442	1,225	85%	217	15%
Census Block Group 480410018031	2,335	1,190	51%	1,145	49%
Census Block Group 480410018032	1,857	1,031	56%	826	44%
Census Block Group 480410018033	1,786	1,109	62%	677	38%
Census Block Group 480410018041	1,786	966	54%	820	46%
Census Block Group 480410019011	1,722	1,085	63%	637	37%
Census Block Group 480410019012	1,314	1,050	80%	264	20%
Census Block Group 480410019021	444	241	54%	203	46%
Census Block Group 480410019022	1,222	731	60%	491	40%
Census Block Group 480410019023	1,161	897	77%	264	23%
Census Block Group 480410020011	2,695	1,842	68%	853	32%
Census Block Group 480410020012	2,153	1,844	86%	309	14%
Census Block Group 480410020061	1,395	885	63%	510	37%
Census Block Group 480410020091	2,343	1,477	63%	866	37%
Census Block Group 480410020092	2,754	2,052	75%	702	25%
Census Block Group 480410020093	547	416	76%	131	24%
Census Block Group 480410020101	1,439	1,113	77%	326	23%
Census Block Group 480410020102	2,759	2,218	80%	541	20%
Census Block Group 480410020111	2,161	1,945	90%	216	10%
Census Block Group 480410020112	4,666	3,550	76%	1,116	24%
Census Block Group 480410020141	844	788	93%	56	7%
Census Block Group 480410020142	2,330	1,524	65%	806	35%
Census Block Group 480410020161	2,473	1,602	65%	871	35%
Census Block Group 480410020162	1,154	1,064	92%	90	8%
Census Block Group 480410020171	2,683	1,515	56%	1,168	44%
Census Block Group 480410020181	1,881	1,279	68%	602	32%

Geographic Area	Total Population	White (Non-Hispanic) Population	% White	Minority Population	% Minority
Census Block Group 480410020182	1,871	1,170	63%	701	37%
Census Block Group 480410020191	1,559	742	48%	817	52%
Census Block Group 480410020192	3,358	2,093	62%	1,265	38%
Census Block Group 480410020201	641	505	79%	136	21%
Census Block Group 480410020202	1,912	1,598	84%	314	16%
Census Block Group 480410020211	3,897	2,900	74%	997	26%
Census Block Group 480410020212	2,731	2,332	85%	399	15%
Census Block Group 480410020221	1,636	1,136	69%	500	31%
Census Block Group 480410020222	1,876	1,245	66%	631	34%
Census Block Group 480410020223	1,839	1,151	63%	688	37%
Census Block Group 480410020231	547	156	29%	391	71%
Census Block Group 480410020232	2,377	1,583	67%	794	33%
Census Block Group 480410020241	1,450	787	54%	663	46%
Census Block Group 480410020242	1,590	1,128	71%	462	29%
Census Block Group 480410020251	2,663	1,913	72%	750	28%
Census Block Group 480410020252	2,787	2,016	72%	771	28%
Census Block Group 480410020261	1,525	898	59%	627	41%
Census Block Group 480410020262	4,926	2,856	58%	2,070	42%
Census Block Group 480410021001	2,527	1,025	41%	1,502	59%
Census Block Group 480410021002	880	254	29%	626	71%
Census Block Group 480410021003	8,930	5,215	58%	3,715	42%
Census Block Group 480419800001	0	0	0%	0	0%
Census Block Group 480519704004	700	443	63%	257	37%
Census Block Group 481851803031	2,124	1,681	79%	443	21%
Census Block Group 481851803032	854	854	100%	0	0%
Aggregate Reference Area	**206,577**	**121,004**	**59%**	**85,573**	**41%**
Texas	**29,243,342**	**11,732,834**	**40%**	**17,510,508**	**60%**
United States	**331,097,593**	**194,886,464**	**59%**	**136,211,129**	**41%**

SOURCE: US Census Bureau, 2018-2022 American Community Survey 5-Year Estimates.

APPENDIX F

TABLE F-2
SELECTED DEMOGRAPHIC CHARACTERISTIC (POVERTY) BY CENSUS BLOCK GROUP

Geographic Area	Number of Households	Average Household Size	2024 HHS Poverty Guideline	% of Households Below Poverty
Census Block Group 480410001051	1,072	2.23	$21,677.40	2%
Census Block Group 480410001052	398	2.40	$22,592.00	3%
Census Block Group 480410001063	660	2.30	$22,054.00	4%
Census Block Group 480410001071	768	2.58	$23,560.40	9%
Census Block Group 480410001072	974	2.51	$23,183.80	5%
Census Block Group 480410001081	330	2.51	$23,183.80	7%
Census Block Group 480410002031	535	2.12	$21,085.60	7%
Census Block Group 480410002032	498	2.58	$23,560.40	17%
Census Block Group 480410002041	201	1.76	$19,148.80	19%
Census Block Group 480410002042	224	2.95	$25,551.00	34%
Census Block Group 480410002043	483	1.86	$19,686.80	15%
Census Block Group 480410002044	198	2.63	$23,829.40	31%
Census Block Group 480410002045	803	2.12	$21,085.60	59%
Census Block Group 480410002061	970	2.61	$23,721.80	5%
Census Block Group 480410002071	264	2.20	$21,516.00	4%
Census Block Group 480410002072	1,106	1.99	$20,386.20	19%
Census Block Group 480410004011	553	2.76	$24,528.80	33%
Census Block Group 480410004012	412	3.85	$30,393.00	12%
Census Block Group 480410004013	0	0.00	N/A	0%
Census Block Group 480410004021	579	2.00	$20,440.00	3%
Census Block Group 480410006031	156	2.40	$22,592.00	4%
Census Block Group 480410006033	867	2.84	$24,959.20	32%
Census Block Group 480410006051	124	4.56	$34,212.80	29%
Census Block Group 480410006052	548	2.29	$22,000.20	19%
Census Block Group 480410006053	417	4.35	$33,083.00	49%
Census Block Group 480410006061	179	3.65	$29,317.00	28%
Census Block Group 480410006062	284	2.89	$25,228.20	23%
Census Block Group 480410007001	228	3.89	$30,608.20	56%
Census Block Group 480410007002	265	2.90	$25,282.00	7%
Census Block Group 480410007003	392	2.09	$20,924.20	4%
Census Block Group 480410007004	232	2.52	$23,237.60	5%
Census Block Group 480410008001	160	2.41	$22,645.80	28%
Census Block Group 480410008002	390	2.77	$24,582.60	3%
Census Block Group 480410008003	235	1.80	$19,364.00	16%
Census Block Group 480410008004	803	2.46	$22,914.80	16%

Geographic Area	Number of Households	Average Household Size	2024 HHS Poverty Guideline	% of Households Below Poverty
Census Block Group 480410008005	436	1.84	$19,579.20	24%
Census Block Group 480410009001	390	2.89	$25,228.20	21%
Census Block Group 480410009002	457	3.06	$26,142.80	32%
Census Block Group 480410010011	318	2.69	$24,152.20	46%
Census Block Group 480410010012	386	1.76	$19,148.80	72%
Census Block Group 480410010013	514	2.81	$24,797.80	45%
Census Block Group 480410010014	157	2.15	$21,247.00	48%
Census Block Group 480410010021	334	3.41	$28,025.80	25%
Census Block Group 480410010022	259	2.00	$20,440.00	35%
Census Block Group 480410010023	526	2.19	$21,462.20	61%
Census Block Group 480410010024	434	2.75	$24,475.00	60%
Census Block Group 480410011011	386	1.39	$17,158.20	10%
Census Block Group 480410011012	537	2.49	$23,076.20	7%
Census Block Group 480410011013	271	3.01	$25,873.80	14%
Census Block Group 480410011021	261	3.03	$25,981.40	5%
Census Block Group 480410011022	381	2.18	$21,408.40	29%
Census Block Group 480410013011	794	2.37	$22,430.60	35%
Census Block Group 480410013012	466	1.84	$19,579.20	53%
Census Block Group 480410013021	769	2.77	$24,582.60	24%
Census Block Group 480410013022	250	2.95	$25,551.00	26%
Census Block Group 480410013023	378	2.39	$22,538.20	24%
Census Block Group 480410013024	297	2.62	$23,775.60	11%
Census Block Group 480410013031	482	3.26	$27,218.80	49%
Census Block Group 480410013032	631	2.42	$22,699.60	54%
Census Block Group 480410013033	510	1.96	$20,224.80	26%
Census Block Group 480410013034	844	2.06	$20,762.80	63%
Census Block Group 480410014011	415	1.65	$18,557.00	53%
Census Block Group 480410016041	395	2.90	$25,282.00	71%
Census Block Group 480410016042	295	2.78	$24,636.40	19%
Census Block Group 480410016043	833	1.76	$19,148.80	34%
Census Block Group 480410016044	448	1.61	$18,341.80	14%
Census Block Group 480410016045	404	2.01	$20,493.80	34%
Census Block Group 480410016051	678	2.54	$23,345.20	27%
Census Block Group 480410016052	1,204	2.04	$20,655.20	32%
Census Block Group 480410016061	618	2.16	$21,300.80	25%
Census Block Group 480410016062	728	2.02	$20,547.60	39%
Census Block Group 480410016071	759	2.23	$21,677.40	25%

Geographic Area	Number of Households	Average Household Size	2024 HHS Poverty Guideline	% of Households Below Poverty
Census Block Group 480410016081	347	1.77	$19,202.60	78%
Census Block Group 480410016082	544	2.86	$25,066.80	30%
Census Block Group 480410017021	614	2.36	$22,376.80	37%
Census Block Group 480410017022	697	2.36	$22,376.80	38%
Census Block Group 480410017031	480	2.19	$21,462.20	36%
Census Block Group 480410017032	779	2.18	$21,408.40	58%
Census Block Group 480410017033	573	2.51	$23,183.80	58%
Census Block Group 480410017041	719	1.82	$19,471.60	39%
Census Block Group 480410017042	361	2.02	$20,547.60	16%
Census Block Group 480410018011	1,270	2.30	$22,054.00	8%
Census Block Group 480410018012	592	1.88	$19,794.40	9%
Census Block Group 480410018013	847	1.70	$18,826.00	20%
Census Block Group 480410018031	908	2.57	$23,506.60	28%
Census Block Group 480410018032	704	2.41	$22,645.80	4%
Census Block Group 480410018033	882	2.00	$20,440.00	31%
Census Block Group 480410018041	588	3.04	$26,035.20	31%
Census Block Group 480410019011	723	2.38	$22,484.40	22%
Census Block Group 480410019012	700	1.80	$19,364.00	25%
Census Block Group 480410019021	186	2.39	$22,538.20	10%
Census Block Group 480410019022	688	1.78	$19,256.40	14%
Census Block Group 480410019023	322	3.61	$29,101.80	25%
Census Block Group 480410020011	926	2.89	$25,228.20	5%
Census Block Group 480410020012	946	2.26	$21,838.80	8%
Census Block Group 480410020061	618	2.26	$21,838.80	15%
Census Block Group 480410020091	794	2.91	$25,335.80	5%
Census Block Group 480410020092	1,014	2.72	$24,313.60	2%
Census Block Group 480410020093	186	2.94	$25,497.20	0%
Census Block Group 480410020101	540	2.66	$23,990.80	0%
Census Block Group 480410020102	965	2.86	$25,066.80	3%
Census Block Group 480410020111	737	2.92	$25,389.60	7%
Census Block Group 480410020112	1,478	3.16	$26,680.80	2%
Census Block Group 480410020141	345	2.45	$22,861.00	0%
Census Block Group 480410020142	768	3.03	$25,981.40	80%
Census Block Group 480410020161	1,544	1.60	$18,288.00	22%
Census Block Group 480410020162	450	2.56	$23,452.80	0%
Census Block Group 480410020171	532	2.03	$20,601.40	77%
Census Block Group 480410020181	630	2.99	$25,766.20	4%

Geographic Area	Number of Households	Average Household Size	2024 HHS Poverty Guideline	% of Households Below Poverty
Census Block Group 480410020182	658	2.84	$24,959.20	7%
Census Block Group 480410020191	545	2.86	$25,066.80	4%
Census Block Group 480410020192	1,075	3.12	$26,465.60	5%
Census Block Group 480410020201	279	2.30	$22,054.00	16%
Census Block Group 480410020202	640	2.99	$25,766.20	3%
Census Block Group 480410020211	1,450	2.69	$24,152.20	68%
Census Block Group 480410020212	1,048	2.61	$23,721.80	37%
Census Block Group 480410020221	1,105	1.35	$16,943.00	16%
Census Block Group 480410020222	597	3.05	$26,089.00	9%
Census Block Group 480410020223	948	1.94	$20,117.20	11%
Census Block Group 480410020231	186	2.94	$25,497.20	55%
Census Block Group 480410020232	877	2.71	$24,259.80	69%
Census Block Group 480410020241	721	2.01	$20,493.80	46%
Census Block Group 480410020242	711	2.24	$21,731.20	45%
Census Block Group 480410020251	769	3.44	$28,187.20	2%
Census Block Group 480410020252	1,228	2.25	$21,785.00	5%
Census Block Group 480410020261	461	3.31	$27,487.80	2%
Census Block Group 480410020262	1,762	2.80	$24,744.00	3%
Census Block Group 480410021001	329	1.49	$17,696.20	11%
Census Block Group 480410021002	414	2.08	$20,870.40	39%
Census Block Group 480410021003	435	2.06	$20,762.80	54%
Census Block Group 480419800001	0	0.00	N/A	0%
Census Block Group 480519704004	315	2.13	$21,139.40	25%
Census Block Group 481851803031	809	2.63	$23,829.40	12%
Census Block Group 481851803032	293	2.88	$25,174.40	4%
Aggregate Reference Area	**78,205**	**2.49**	**$23,075.38**	**24%**
Texas	**10,490,553**	**2.73**	**$24,367.40**	**13%**
United States	**125,736,353**	**2.57**	**$23,506.60**	**12%**

SOURCE: US Census Bureau, 2022; US Department of Health and Human Services, 2024.

APPENDIX F

TABLE F-3
COMMUNITIES OF ENVIRONMENTAL JUSTICE CONCERN

Geographic Area	% Minority	% Households Below Poverty
Census Block Group 480410001072	47%	X
Census Block Group 480410002031	53%	X
Census Block Group 480410002042	75%	34%
Census Block Group 480410002043	84%	X
Census Block Group 480410002044	92%	31%
Census Block Group 480410002045	76%	59%
Census Block Group 480410002061	51%	X
Census Block Group 480410002071	81%	X
Census Block Group 480410002072	55%	X
Census Block Group 480410004011	98%	33%
Census Block Group 480410004012	80%	X
Census Block Group 480410004013	66%	X
Census Block Group 480410004021	74%	X
Census Block Group 480410006031	45%	X
Census Block Group 480410006033	90%	32%
Census Block Group 480410006051	100%	29%
Census Block Group 480410006052	64%	X
Census Block Group 480410006053	83%	49%
Census Block Group 480410006061	89%	28%
Census Block Group 480410006062	93%	X
Census Block Group 480410007001	90%	56%
Census Block Group 480410007002	75%	X
Census Block Group 480410007003	66%	X
Census Block Group 480410007004	43%	X
Census Block Group 480410008001	77%	28%
Census Block Group 480410008004	49%	X
Census Block Group 480410008005	52%	24%
Census Block Group 480410009001	78%	X
Census Block Group 480410009002	91%	32%
Census Block Group 480410010011	66%	46%
Census Block Group 480410010012	X	72%
Census Block Group 480410010013	58%	45%
Census Block Group 480410010014	X	48%
Census Block Group 480410010021	X	25%
Census Block Group 480410010022	70%	35%
Census Block Group 480410010023	X	61%

Geographic Area	% Minority	% Households Below Poverty
Census Block Group 480410010024	73%	60%
Census Block Group 480410011011	50%	X
Census Block Group 480410011022	61%	29%
Census Block Group 480410013011	X	35%
Census Block Group 480410013012	X	53%
Census Block Group 480410013021	X	24%
Census Block Group 480410013022	X	26%
Census Block Group 480410013023	82%	24%
Census Block Group 480410013024	69%	X
Census Block Group 480410013031	X	49%
Census Block Group 480410013032	78%	54%
Census Block Group 480410013033	50%	26%
Census Block Group 480410013034	X	63%
Census Block Group 480410014011	54%	53%
Census Block Group 480410016041	X	71%
Census Block Group 480410016043	X	34%
Census Block Group 480410016044	48%	X
Census Block Group 480410016045	50%	34%
Census Block Group 480410016051	X	27%
Census Block Group 480410016052	65%	32%
Census Block Group 480410016061	X	25%
Census Block Group 480410016062	54%	39%
Census Block Group 480410016071	46%	25%
Census Block Group 480410016081	76%	78%
Census Block Group 480410016082	X	30%
Census Block Group 480410017021	52%	37%
Census Block Group 480410017022	62%	38%
Census Block Group 480410017031	X	36%
Census Block Group 480410017032	X	58%
Census Block Group 480410017033	X	58%
Census Block Group 480410017041	48%	39%
Census Block Group 480410017042	43%	X
Census Block Group 480410018011	46%	X
Census Block Group 480410018031	49%	28%
Census Block Group 480410018032	44%	X
Census Block Group 480410018033	X	31%
Census Block Group 480410018041	46%	31%
Census Block Group 480410019012	X	25%
Census Block Group 480410019021	46%	X

Geographic Area	% Minority	% Households Below Poverty
Census Block Group 480410019023	X	25%
Census Block Group 480410020142	X	80%
Census Block Group 480410020171	44%	77%
Census Block Group 480410020191	52%	X
Census Block Group 480410020211	X	68%
Census Block Group 480410020212	X	37%
Census Block Group 480410020231	71%	55%
Census Block Group 480410020232	X	69%
Census Block Group 480410020241	46%	46%
Census Block Group 480410020242	X	45%
Census Block Group 480410020262	42%	X
Census Block Group 480410021001	59%	X
Census Block Group 480410021002	71%	39%
Census Block Group 480410021003	42%	54%
Census Block Group 480519704004	X	25%
Aggregate Reference Area	**41%**	**24%**

SOURCE: US Census Bureau, 2022; US Department of Health and Human Services, 2024.