Draft Environmental Assessment

Amazon Prime Air
Drone Package Delivery Operations in College Station, Texas

September 2022

United States Department of Transportation
Federal Aviation Administration

Washington, D.C.

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Cover Image: Amazon Prime Air

DEPARTMENT of TRANSPORTATION
Federal Aviation Administration
Washington, D.C.

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

The Federal Aviation Administration (FAA) hereby gives Notice of Availability (NOA) for the Draft Environmental Assessment (EA) evaluating the potential effects of the FAA decision to authorize Amazon Prime Air (Prime Air) to conduct unmanned aircraft (UA) commercial package delivery operations from one Prime Air Drone Delivery Center, or "PADDC," in College Station, Texas.

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

The Draft EA has been prepared in accordance with the requirements set forth in the Council on Environmental Quality (CEQ) regulations at Title 40, Code of Federal Regulations (CFR), parts 1500-1508, *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act* and FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*.

The public comment period for the Draft EA begins with the issuance of this Notice of Availability and lasts 14 days. The FAA encourages all interested parties to provide comments concerning the scope and content of the Draft EA by October 14, 2022, or 14 days from the date of publication of this Notice of Availability, whichever is later. The Draft EA is available to view/download electronically at https://www.faa.gov/uas/advanced_operations/nepa_and_drones/

Comments may be directed in writing to 9-FAA-Drone-Environmental@faa.gov. Please reference the Amazon Prime Air College Station Draft EA in the email subject line when sending comments.

Before including your address, phone number, e-mail 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.

Posted September 30, 2022

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1.0 PURPOSE AND NEED

1.1 Introduction

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

This Draft Environmental Assessment (EA) is being prepared by the FAA to evaluate the potential environmental impacts that may result from FAA's approval of the proposed action, which would enable UA commercial delivery operations from the PADDC located at 400 Technology Parkway, College Station, TX. The circle-shaped operating area has a radius of approximately 3.73 miles from the PADDC. It is roughly 43.7 square miles in area. The operating area, which is also the study area for this EA, is depicted in Figure 1 (the study area).

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

1.2 Background and Location

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

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

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

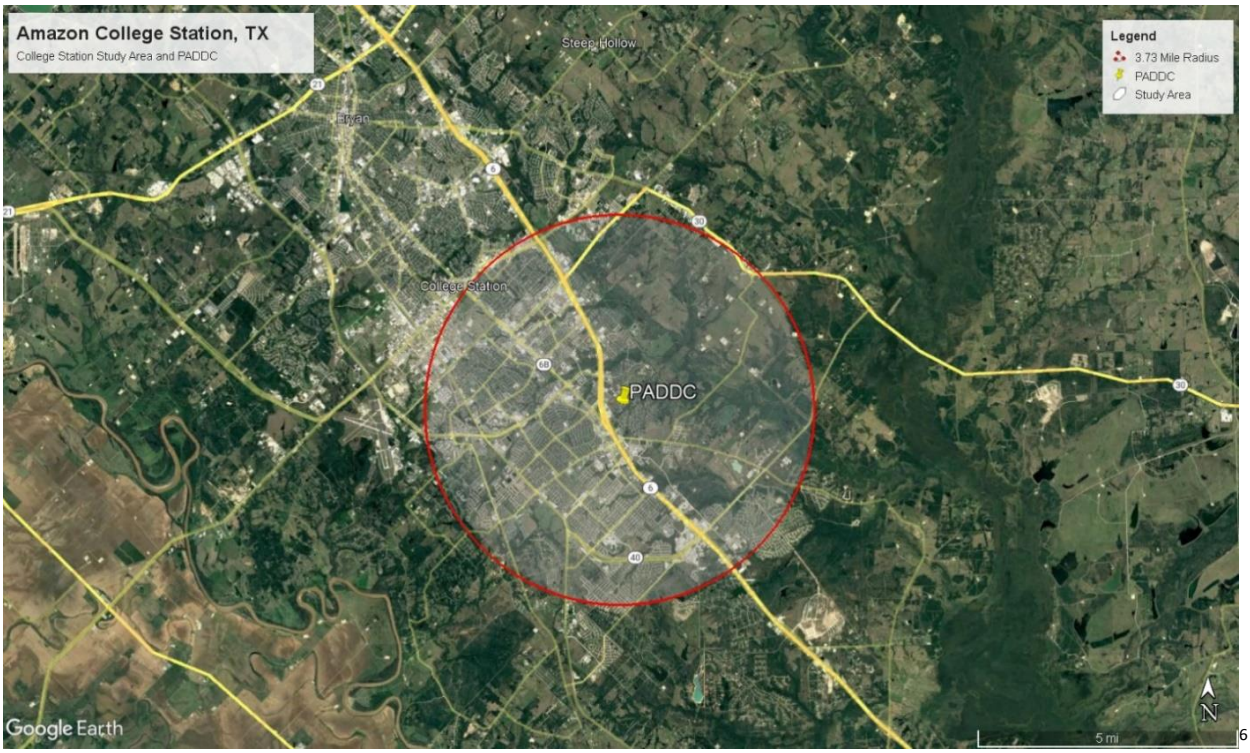
In 2020, Prime Air received its Part 135 air carrier operating certificate, which allows it to carry the property of another for compensation or hire beyond visual line of sight (BVLOS). The certificate contains a stipulation that operations must be conducted in accordance with the provisions and limitations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

The College Station operating area is shown in Figure 1 below. The operating area is outlined in red and the PADDC location is identified using the yellow pin. A closer view of the operating area is shown in Figure 2. The PADDC is located at 400 Technology Parkway, College Station, TX.

The western side of the operating area extends just to the edge of the Reed Arena located at 730 Olsen Blvd, and the eastern side of the operating area is approximately 540 feet from the intersection of William D. Fitch Pkwy and Tonkaway Lake Road. State Highway 6 runs through the operating area from the northwest corner to the southeast corner. The northern edge of the circle is approximately 0.73 miles from the intersection of University Drive East and State Highway 158 and the southern edge of the circle is approximately 815 feet from the intersection of Etonbury Avenue and Greens Praire Road.

There are no airports in the operating area. There is one heliport located at Baylor Scott & White Medical Center, at 800 Scott & White Drive in the operating area. The operating area is the study area for the purposes of this Draft EA.

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



[6]

Figure 1 *Study Area with PADDC in the Center*

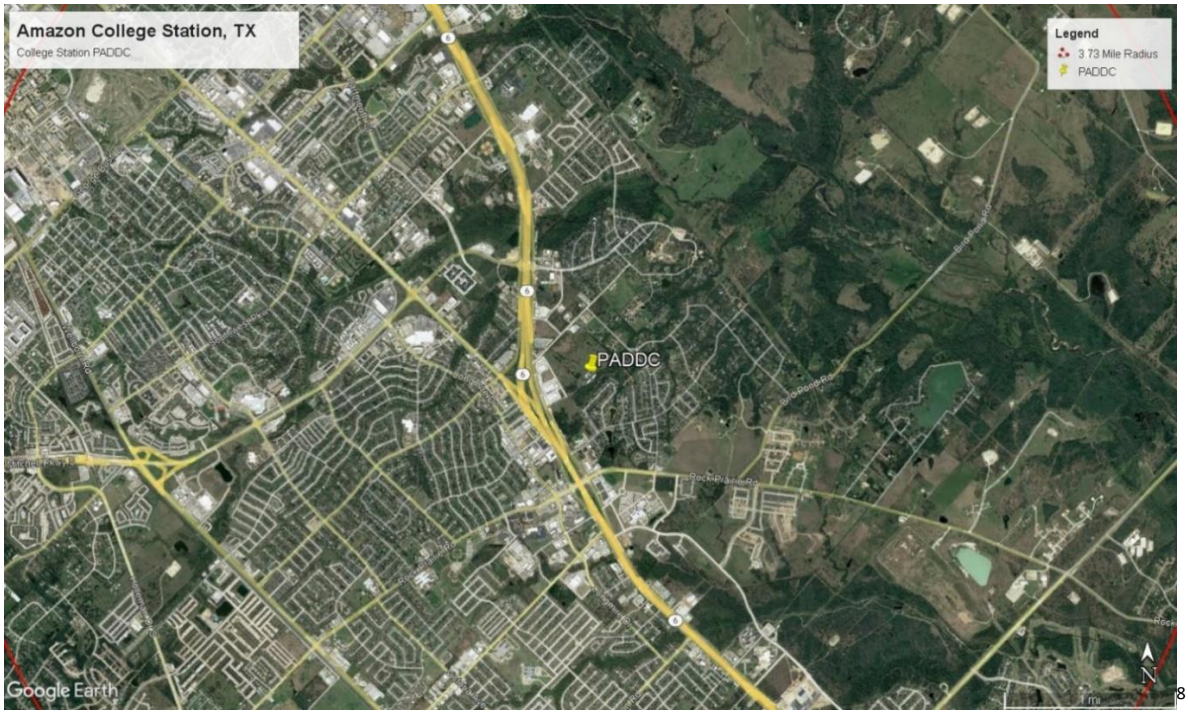
1.2.1 PADDC Location

The PADDC is located at 400 Technology Parkway in College Station, Texas, in Brazos County. College Station is approximately 85 miles east of Austin and 75 miles northwest of Houston.

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 Research and Development. The PADDC is located near the intersection of Texas 6 Frontage Road and Sebesta Road with State Highway 6 approximately 0.33 miles to the west of the site. The properties adjacent to the PADDC are a mix of privately-owned rural, commercial, and residential. The closest residential neighborhood is approximately 500 feet from the site. Prime Air proposes to conduct deliveries from the PADDC to eligible delivery sites such as private residences and commercial facilities.[7] See the PADDC location Figures 2 and 3 below.

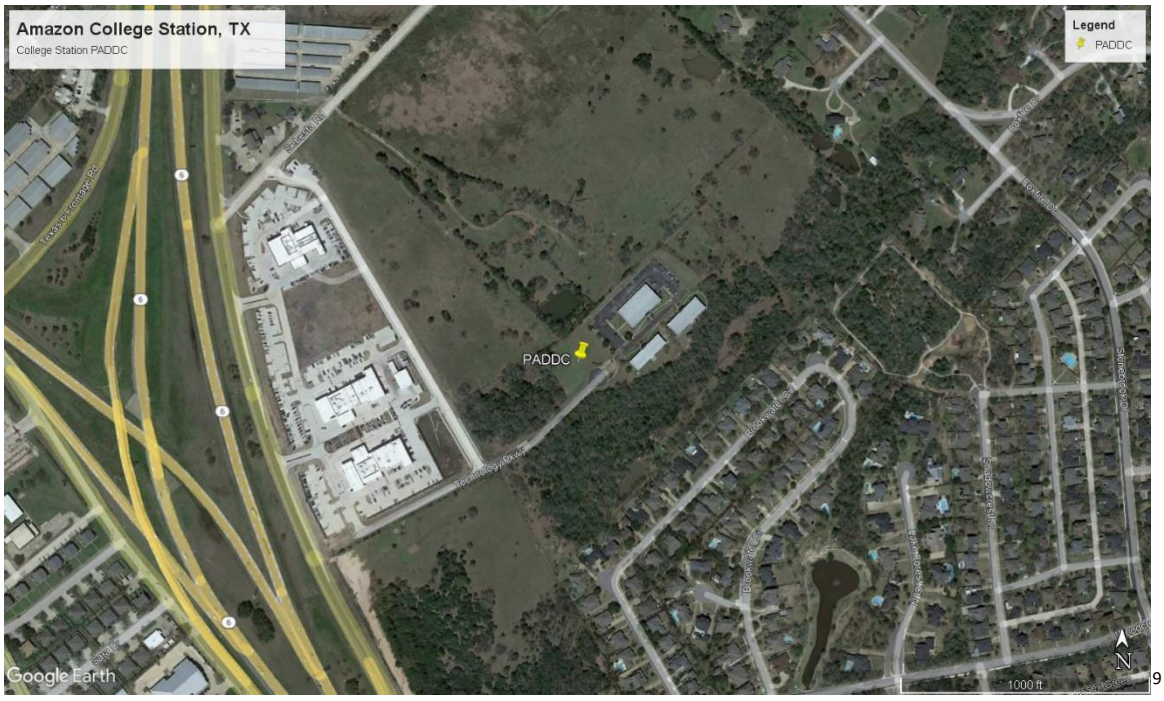
[6] Image: Google Earth, as modified by the FAA

[7] Each delivery site is pre-approved by Amazon to ensure that the area is capable of receiving deliveries.



[8]

Figure 2 *Prime Air's PADDC Location in College Station, TX*



[9]

Figure 3 *Closer View of Prime Air's PADDC Location in College Station, TX*

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

1.3 Purpose and Need

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

1.3.1 FAA Purpose and Need

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

The FAA has a statutory obligation to review Prime Air's request to amend the OpSpecs and determine whether the amendment would affect safety in air transportation or air commerce, and 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. 49 U.S.C. § 40104.

In addition, the FAA has specific statutory and regulatory obligations related to its issuance of a Part 135 certificate and the related OpSpecs. The FAA is required to issue an operating certificate to an air carrier when it "finds, after investigation, that the person properly and adequately is equipped and able to operate safely under this part and regulations and standards prescribed under this part." 49 U.S.C. § 44705. An operating certificate also specifies "terms necessary to ensure safety in air transportation; 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." 49 U.S.C. § 44705. Also included in air carrier certificates is a stipulation that the air carrier's operations must be conducted in accordance with the provisions and limitations specified in OpSpecs. 14 CFR § 119.5 (g), (l). The regulations also specify that a Part 135 certificate holder may not operate in a geographical area unless its OpSpecs specifically authorize the certificate holder to operate in that area. 14 CFR § 119.5(j). The regulations implementing Section 44705 specify that an air carrier's approved OpSpecs must include, among other things, "authorization and limitations for routes and areas of operations." 14 CFR § 119.49(a)(6). An air carrier's OpSpecs may be amended at the request of an operator if the FAA "determines that safety in air commerce and the public interest allows the amendment." 14 CFR § 119.51(a); see also 49 U.S.C. § 44709. After making this determination, the FAA must take an action on the OpSpec amendment.

1.3.2 Prime Air's Purpose and Need

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

1.4 Public Involvement

The FAA will provide a Notice of Availability (NOA) of the Draft EA to local interest groups, local government officials, public park authorities, and the State Historic Preservation Office (SHPO), tribes and Tribal Historic Preservation Offices (THPOs). The FAA will make the EA available to the general public on the FAA website. The NOA provides information about the proposed action and requests review and comments on this Draft EA, which is being published on the FAA website for a 14-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.

2.0 PROPOSED ACTION AND ALTERNATIVES

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

2.1 Proposed Action

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

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

2.1.1 Description of Proposed Operations

Prime Air projects operating a maximum of approximately 200 delivery flights per operating day, up to five days per week, from the College Station PADDC. These operational levels would result in a projected total of approximately 260 operating days and 52,000 delivery operations per year based on the scope of the proposed action. The College Station PADDC will support four sectors, with each sector having one takeoff and landing pad with its own dedicated operating area that can support up to five flights per hour. Only one aircraft in each sector can be airborne at any time. The operations would occur during daylight hours up to five days per week, with daylight hours defined as approximately 30 minutes before sunrise to 30 minutes after sunset. Delivery flights may occur during evening hours, but no later than approximately 30 minutes after sunset and never after 10 p.m. No nighttime deliveries are anticipated or requested under the proposed action. Delivery operations are anticipated to be distributed rather evenly across the four PADDC sectors.

2.1.2 Description of UA

The UA has a maximum takeoff weight of 92 pounds, including a maximum payload of five pounds. It is a hybrid multicopter-fixed wing drone that uses electric power from rechargeable lithium ion batteries. It is launched vertically using powered lift, and converts to using wing lift during en route flight.

2.1.3 Description of Delivery Operations

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

2.2 No Action Alternative

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

3.0 AFFECTED ENVIRONMENT and ENVIRONMENTAL CONSEQUENCES

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

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

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

- Regulatory Setting
- Affected Environment
- Environmental Consequences

3.1 Resources Not Analyzed in Detail

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

- **Air Quality and Climate** – The drone is battery-powered and would not generate criteria air pollutants or greenhouse gas emissions that could result in air quality or climate impacts. Electricity used to support drone battery charging and PADDC operations would be supplied by the local power grid and is expected to be minimal, given the limited number of anticipated

drone operations. The PADDC would be equipped with an emergency generator, but its use is expected to be very infrequent, and only in times of emergency.

- **Coastal Resources** – The proposed action would not directly affect any shorelines, change the use of shoreline zones, or be inconsistent with any National Oceanic and Atmospheric Administration (NOAA)-approved state Coastal Zone Management Plan (CZMP) since there are no coastal zones or shorelines in the area of operations. The proposed action is expected to occur more than 125 miles from the nearest shoreline resource.

- **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.

- **Hazardous Materials, Solid Waste, and Pollution Prevention** – The proposed action would not result in any further construction or development or any physical disturbances of the ground, beyond what was already constructed without the need for FAA approval. Data from the US Environmental Protection Agency (EPA) and Texas Commission on Environmental Quality (TCEQ) indicate no presence of Superfund Sites within the operating area. TCEQ data indicates the presence of 44 sites where clean-up operations for leaking petroleum storage tanks have occurred; however, the proposed action does not include any new construction or ground disturbance which could impact hazardous materials. Furthermore, the delivery drones are assembled from recoverable materials that would be properly managed and disposed of in accordance with 14 CFR Part 43. Therefore, the potential for impact in relation to hazardous materials, pollution prevention, and solid waste is not anticipated.

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

- **Natural Resources and Energy Supply –** The proposed action would not require the need for unusual natural resources and materials, or those in short supply. The drones are battery-powered, but would likely not require excessive fuel resources, given the planned low number of operations.

- **Socioeconomic Impacts 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 affect products or substances that a child would be likely to come into contact with, ingest, use, or be exposed to, and would not result in environmental health and safety risks that could disproportionately affect children. Additionally, Prime Air's proposal includes avoiding operations near schools during operational hours, which will help reduce the potential for environmental health or safety impacts to children. There are 16 public K-12 schools and four private pre-K and elementary schools in the study area. Additionally, Texas A&M University, a public four-year institution, is located partially within the study area. The closest school to the PADDC is Southwood Valley Elementary School, which is approximately one mile from the PADDC. This distance is outside of the potential DNL 45 dB noise exposure around the PADDC. Consistent with EO 13045, it is unlikely the proposed action would affect products or substances

that a child could come into contact with, ingest, use, or be exposed to, or would result in environmental health and safety risks that could disproportionately affect children.

- **Visual Effects (Light Emissions Only)** – The proposed action would not result in significant light emission impacts because flights will not be conducted during the nighttime.
- **Water Resources (Wetlands, Floodplains, Groundwater, Wild and Scenic Rivers)** – The proposed action would not result in any further construction of facilities and would not encroach upon areas designated as navigable waters or directly impact wetlands. The proposed operation would not encroach upon areas designated as a 100-year flood event area as described by the Federal Emergency Management Agency (FEMA). 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.

3.2 Biological Resources (Including Fish, Wildlife and Plants)

3.2.1 Regulatory Setting

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

Threatened and Endangered Species

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

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

Migratory Birds

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

Bald and Golden Eagles

The Bald and Golden Eagle Protection Act prohibits anyone from "taking" a bald or golden eagle, including their parts, nests, or eggs, without a permit issued by the USFWS. Implementing regulations (50 CFR § 22), and USFWS guidelines as published in the National Bald Eagle Management Guidelines, provide for additional protections against "disturbances." Similar to take, "disturb" means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, injury to an eagle or causes either a decrease in its productivity or nest abandonment due to a substantial interference with breeding, feeding, or sheltering. A permitting process provides limited exceptions to the Bald and Golden Eagle Protection Act's prohibitions. The USFWS has issued regulations for the permitting process in 50 CFR Part 22, which include permits for the incidental take of Bald Eagles. Such permits are only needed when avoidance of incidental take is not possible. According to federal guidelines, if conservation measures can be implemented such that no aircraft are flown within 1,000 feet of a nest, incidental take of Bald Eagles is unlikely to occur and no permit is needed.[10]

3.2.2 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. 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 pasture land and vast acreage of grassland.[11]

The proposed action would take place over urban and commercial areas, and some rural areas. 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.[12]

Special Status Species

Federally Listed Species

The potential for impacts to federally-listed species was assessed using the USFWS Information for Planning and Consultation (IPaC) map tool and resource. The study area covered the entire operating

[10] U.S. Fish and Wildlife Service. 2007. National Bald Eagle Management guidelines. Available: https://fws.gov/migratorybirds/pdf/management/nationalbaldeaglenanagementguidelines.pdf. Accessed: February 4, 2022.
[11] Texas Parks and Wildlife. Ecoregion 3 – Post Oak Savannah. Available. https://tpwd.texas.gov/huntwild/wild/wildlife_diversity/wildscapes/ecoregions/ecoregion_3.phtml. Accessed August 19, 2022.
[12] iNaturalist. Brazos County, US, TX Species. Available: Brazos County, TX, US · https://www.inaturalist.org/places/brazos-county.Accessed August 19, 2022.

area, outlined in red in Figure 1 of this EA. The USFWS official species list, obtained through IPaC, is included with this EA (see Appendix A).

Based on the official species list, there are five federally listed endangered and threatened species and one candidate species with potential to occur in study area. This includes three bird species: the Piping Plover (*Charadrius melodus*), a threatened species; the 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 Red Knot only need to be considered for wind energy projects, so no further analysis was conducted for those two species. In addition, the Monarch Butterfly *(Danaus plexippus*) is a candidate for listing that has the potential to occur in the study area. Additionally, there is one clam species and one flowering plant species identified in the official species list (see Appendix A).

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

State Species of Concern

The Texas Parks and Wildlife Department's database of Rare, Threatened, and Endangered Species of Texas lists 67 species amphibians, birds, fish, insects, mammals, mollusks, plants, and reptiles in Brazos County, including some that are considered Species of Greatest Conservation Need as defined in the 2012 Texas Conservation Action Plan.[13] 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, § 65.176).[14] 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 capture, trap, take, or kill, or attempt to capture, trap, take, or kill, endangered fish or wildlife."[15] 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."[16]

Because any federally-listed species with potential to occur in the study area would be identified in the USFWS official species list, the FAA did not analyze state endangered species that are not included the official species list for this study area. The Interior Least Tern (*Sternula antillarum athalassos*) is the only species on the state endangered list with potential to occur in Brazos County. However, the FAA determined that the Interior Least Tern is known to occur at specific locations in Texas, and these locations are outside of the study area.

[13] Texas Parks and Wildlife Department, Wildlife Division, Diversity and Habitat Assessment Programs. TPWD County Lists of Protected Species and Species of Greatest Conservation Need. Available: https://tpwd.texas.gov/gis/rtest/. Accessed: August 18, 2022.
[14] Texas Endangered Species List. Available: https://texreg.sos.state.tx.us/fids/202001043-2.pdf. Accessed: September 29, 2022.
[15] 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.
[16] Texas Administrative Code Title 31 Part 2 Chapter 65 Subchapter G RULE § 65.171. 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. Accessed: September 28, 2022

The likelihood of state-listed species' occurrence in the study area depends on the presence of species' preferred habitats. Much of the study area is densely developed, and potential wildlife habitat is limited to riparian and prairie areas east of the PADDC.

The state-listed endangered, threatened, and rare species in Brazos County, Texas, are presented in Table 3-1. While these species are listed for Brazos County, it does not automatically convey that they have the potential to occur in the study area. Additionally, state-listed fishes are included in the list; however, the FAA does not anticipate that fish species could be affected as there is no ground disturbance or construction under the proposed action.

Table 3-1 State-Listed Species with Potential to Occur in Brazos County

Species Type	Species Scientific Name / Common Name	State Designated Category	Potential to Occur within the Study Area
Invertebrates	*Potamilus streckersoni* / Brazos heelsplitter	ST	This species of muscle is found to exist just outside the study area. Typically, this species is found within the substrate of freshwater waterbodies.
	Bombus pensylvanicus / American bumblebee	SR	The American bumble bee can be found throughout the State of Texas. They nest on the ground and forage within a variety of large open fields where they collect nectar from a variety of blooming plant species.
	Pogonomyrmex Comanche / Comanche harvester ant	SR	Native to Texas, the Comanche harvester ant can be found in open, sandy, upland woodland areas.
	Neotrichia mobilensis / N. mobilensis – Caddisflies	SR	*N. mobilensis* is a species of caddisflies that are freshwater aquatic insects found in flowing streams.
	Bombus variabilis / Variable cuckoo bumblebee	SR	The cuckoo bumblebee is one of the rarest bee species in N. America. Typically found in open fields and meadows in southern Texas. This species relies exclusively on the American bumble bee as its host species
Fish	*Atractosteus spatula* / Alligator gar	SR	The alligator gar can be found in large rivers and reservoirs, as well as in coastal bays of Texas. This species of gar is associated with near surface habitats in slack water and backwater habitats of rivers.
	Anguilla rostrata / American eel	SR	The American eel is found within a variety of habitats throughout the northern hemisphere where the adult eel spends most of their time in freshwater systems.
	Notropis atrocaudalis / Blackspot shiner	SR	This species is considered endemic to the United States and found in the lower Brazos River drainage of eastern Texas. Typically found in small to moderate size tributary streams.

	Notropis potteri / Chub shiner	ST	This species can be found in the Brazos, San Jacinto, Trinity, and Colorado Rivers, in Texas. Typically found within large, turbid rivers and in smaller tributaries
	Hybognathus nuchalis / Mississippi silvery minnow	SR	The Mississippi silvery minnow is found from the Mississippi basin south to the Brazos River, in Texas. It is usually found in calm pools and backwater stream systems.
	Silver chub	SR	The silver chub has a widespread distribution within the United States and is found within the Red River and the lower Brazos River within Texas. This species is typically restricted to large, often silty rivers.
	Notropis shumardi / Silverband shiner	SR	This species is distributed throughout most of eastern Texas's rivers, including Brazos River, Galveston Bay and the Red River. It is common to find the silverband shiner in large rivers but can also be found in smaller tributaries and oxbows associated with turbid water over silt, sand, and gravel.
	Erimyzon claviformis / Western creek chubsucker	ST	The western creek chubsucker is found from the Gulf Slope drainages from Apalachicola River drainage in Georgia to San Jacinto River in Texas. This fish species prefer backwater and undercut banks in creeks and small rivers.
Amphibians	*Ambystoma tigrinum* / Eastern tiger salamander	SR	This species range includes the east coast from southern New York to northern Florida, west from Ohio to Minnesota and southward through eastern Texas to the Gulf. As juveniles, Eastern tiger salamanders are aquatic and as adults they are terrestrial inhabit moist areas near woodlands, wetlands, and prairies. Breeding habitat primarily consists of wetlands or waterbodies.
	Lithobates areolatus areolatus subspecies *Rana Carolina Carolina* / Southern crawfish frog	SR	This subspecies of *Lithobates areolatus areolatus* that can be found in the states of Texas, Oklahoma, Arkansas, Louisiana, Missouri, Ohio, Indiana, Tennessee, and Kansas. Preferred habitat includes grasslands, prairies, and woodlands, where the frog lives underground most of the year in burrows of other animals.
	Pseudacris streckeri / Strecker's chorus frog	SR	Mostly found throughout the eastern counties of Texas, this frog species can live in a variety of habit types, including moist woods, sand prairies, streams, swamps, ponds, temperate grasslands, wetlands, canals, and drainage channels. They spend most of their lives burrowed underground.
	Bufo woodhousii / Woodhouse's toad	SR	This species can be found throughout most of Texas, especially within the eastern counties.

			Habitat for this species includes open woodland areas, prairies, and grasslands, as well as open range lands and pastures.
Reptiles	*Terrapene Carolina* subspecies in Texas (*triunguis*) / Eastern box turtle	SR	Primarily found throughout the Eastern Counties of Texas, Eastern box turtles are primarily a woodland species, although they may also be found along forest edges and brushy fields.
	Plestiodon septentrionalis obtusirostris / Prairie skink	SR	The prairie skink is a subspecies of *P. septentrionalis* and occurs in Central and Northern Texas. Prairie skinks can be found in habitat that contains sandy soils in grasslands and along rivers.
	Sistrurus miliarius / Pygmy rattlesnake	SR	Pygmy rattlesnakes are located throughout the Southeastern United States and mainly within the Eastern Counties of Texas. Pygmy's typically can be found in flatwoods, sandhills, mixed forests, floodplains lakes and marshes.
	Ophisaurus attenuates / Slender glass lizard	SR	The slender glass lizard distribution in Texas ranges from the Central to the Eastern Counties and can be found in prairies, old fields, or open woodlands, often near water.
	Apalone mutica / Smooth softshell turtle	SR	The smooth softshell turtle is known to occur in Brazos County. These turtles can be found in large streams, big lakes, and rivers that contain sandy or muddy bottoms, free of a rocky bottom.
	Phrynosoma cornutum / Texas horned lizard	ST	The Texas horned lizards ranges from the South-Central United States to Northern Mexico. This species is found in arid and semiarid habitats in open areas with sparse plant cover that contains loose sand or loamy soils.
	Crotalus Horridus / Timber (canebrake) rattlesnake	SR	Timber rattlesnakes can be found throughout the Eastern Counties of Texas, in upland woods and rocky ridges.
	Terrapene ornate / Western box turtle	SR	The Western box turtle can be found throughout Texas. These species are typically found in shallow burrows located within grassland habitats.
	Deirochelys reticularia miaria / Western chicken turtle	SR	The Western chicken turtle is an elusive freshwater turtle found in ephemeral wetlands located west of the Mississippi River, including Louisiana, Oklahoma and extending to the Guadalupe River in Texas.

	Heterodon nasicus / Western hognose snake	SR	The Western hognose snake can be found throughout Texas, within sandhills, prairies, and river floodplains and typically like environments that are dry and sandy.
	Sistrurus tergeminus / Western massasauga rattlesnake	SR	The Western massasauga has two subspecies that exist in Texas. The desert massasauga that is commonly associated with xeric prairie habitat from western Texas and the prairie massasauga, which prefer mesic grasslands and wetland communities. Both subspecies have a patchy distribution throughout Texas,
Birds	*Haliaeetus leucocephalus* Bald eagle	SR	Although no nests have been identified through database searches within the study area, nonbreeding populations typically occur throughout the state.
	Calcarius ornatus / Chestnut-collared longspur	SR	Species distribution of the chestnut-collared longspur within Texas primarily lies just west of the study area and throughout the Western Counties of Texas. Longspur are ground-feeding birds that breeds in prairie habitats in Canada and the northern United States and winters to the south in the United States and Mexico.
	Leucophaeus pipixcan / Franklin's gull	SR	Franklin's Gull is not a common occurrence within the study area, although occasionally large flocks are observed in migration. This species breeds in northern prairies and winters on the west coast of South America.
	Sterna antillarum athalassos / Interior least tern	SR	This is a state endangered species. In Texas, interior least terns are found at three reservoirs along the Rio Grande River, on the Canadian River in the northern Panhandle, on the Prairie Dog Town Fork of the Red River in the eastern Panhandle, and along the Red River. These habitats are located outside of the study area. They can be found on bare or sparsely vegetated sand, shell, and gravel beaches, sandbars, islands, and salt flats associated with rivers and reservoirs. The interior least tern is not expected to occur in the study area.
	Elanoides forficatus / Swallow-tailed kite	ST	This species occurs within the Southeast portion of Texas near the coast and the lower Sabine River in the Coastal Prairies regions. Swallow-tailed kites breed in Texas from sea level to 230 meters in bottomland forests with nearby open areas, freshwater marshes skirting large lakes and pine glades adjoining cypress swamps.
	Athena funicular hypugaea Western burrowing owl	SR	Found throughout Texas, in grassland habitat that supports open areas with short vegetation and bare ground. These owls can excavate their own burrows but usually select

			existing burrows or burrows that were excavated by mammals. A majority of suitable habitat within the study areas has been heavily developed.
	Plegadis chihi / White-faced ibis	ST	This species frequents marshes, swamps, ponds and rivers. In Texas, they breed and winter along the Gulf Coast and may occur as migrants in the Panhandle and within west Texas
	Mycteria americana / Wood stork	ST	Wood storks typically observed east of Dallas to San Antonio to Zapata. Wood stork nesting habitat consists of shrubby wetland systems and swamps. Their nests are typically constructed in short shrubs, especially red mangroves or in medium or tall trees such as cypress.
Mammals	*Eptesicus fuscus* / Big brown bat	SR	This species of bat is widely distributed within the Eastern and Western Counties of Texas. Big brown bats emerge just before or just after sundown, though they will emerge even in mid-day to drink or feed when they are especially stressed. Feeding activity is most intense within the first two hours after sunset but may occur anytime during the day.
	Nyctinomops macrotis / Big free-tailed bat	SR	The big free-tailed bat typically ranges from South America northward to Mexico, Arizona, New Mexico, and southern and western Texas. This species likes to occupy rocky habitats in arid landscapes, but has also been found in desert shrub, woodlands, and evergreen forests. This species forages late in the evening but is sometimes seen flying early in the afternoon
	Lasiurus borealis / Eastern red bat	SR	Mostly found within Western Texas, the Eastern red bat likes a variety of habitats, including along the edges of pastures, crop lands, or other openings dotted with large deciduous trees, in cypress stands, and near pecan trees along rivers. This species is often the first bats to emerge after sunset and feed most actively during the first several hours after sundown but may feed all night.
	Spilogale putorius / Eastern spotted skunk	SR	The range of the Eastern spotted skunk in Texas extends across the Central Counties, including Brazos County, where they occupy tall-grass prairies, wooded areas and rocky habitats.
	Aeorestes cinereus / Hoary bat	SR	None. Known to occur in Brazos County, the hoary bat typically roosts singly in deciduous or coniferous tree foliage 3–19 m tall and often near the edge of clearings. The bat will usually emerge late in the evening and is

		seen during the daylight hours during migration.
Mustela frenata / Long-tailed weasel	SR	Long-tailed weasels can be found throughout Texas except for the Panhandle region. They occupy a variety of habitats, including brush lands, fencerows, upland woods, bottomland hardwoods, forest edges, and rocky deserts. The presence of water is a habitat requirement for this species.
Puma concolor / Mountain lion	SR	Native to Texas, however populations have become extinct in the eastern Counties. Mountain lions are typically found in remote mountains, canyon lands, or hilly areas.
Ondatra zibethicus / Muskrat	SR	Muskrats are known to occur throughout much of North America. They are found around water habitats that contain thick vegetation suck as ponds, wetlands, marshes, streams, lakes, swamps, and bogs.
Lasiurus intermedius / Northern yellow bat	SR	Northern Yellow Bat is a non-migratory species that lives along the Gulf Coast, in areas where Spanish moss is prevalent. In Texas, they are best known from coastal palm groves. Foraging typically begins at dusk in areas such as pastures, golf courses, and the edges of lakes and forests.
Perimyotis subflavus / Tricolored bat	SR	This species can be found in Eastern and Western Texas, where they typically hibernate singly and up to six to nine months, on cave walls or ceilings. Tricolored bat forages along forest edges and over ponds and waterways.

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 official species list identifies 10 Birds of Conservation Concern (BCC) that could occur in the operating area, along with information on the likelihood that they may be nesting in the area (see Appendix A). Habitat used by BCC species listed in the study area would occur mostly in grasslands and riparian environments.

The Bald Eagle (*Haliaeetus leucocephalus)* is listed by USFWS as a BCC in the operating area, and it is protected under the Bald and Golden Eagle Protection Act. 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. The National Bald Eagle Management Guidelines state that aircraft should stay at least 1,000 feet from

Bald Eagle nests during the breeding season unless the aircraft is operated by a trained wildlife biologist.[17]

3.2.3 Environmental Consequences

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

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

Aircraft will typically stay at 160-180 feet AGL or higher except when descending to drop a package. When making a delivery, the aircraft descends and packages are dropped to the ground from approximately 13 feet AGL. Packages are carried internally in the aircraft's fuselage, and are dropped by opening a set of payload doors on the aircraft. After the package is dropped the UA then climbs vertically to approximately 160-180 feet and reverses the path taken, returning to the takeoff/landing pad at the PADDC. The UA will 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 UA would be of very short duration (less than a minute).

Based on the noise analysis, as discussed in Section 3.5 and Appendix C, the typical noise levels for a single daily delivery was determined to be at the Annual Day-Night Average Sound Level (DNL) of 51 dB at 16.4 feet. Based on the numbers Prime Air provided, the highest noise level that could be experienced associated with a delivery, including overflights, would be DNL 58 dB. The PADCC noise levels would be higher. 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 unlikley to cause significant disturbance (for context, an air conditioning unit at 100 feet is approximately 60dB.)[18]. The low number of daily operations and nature of the flights are not expected to affect wildlife behavior in the study area.

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

[17] U.S. Fish and Wildlife Service. 2007. National Bald Eagle Management Guidelines. Available: https://www.fws.gov/sites/default/files/documents/national-bald-eagle-management-guidelines.pdf. Accessed: October 19, 2021.

[18] Federal Agency Review of Selected Airport Noise Analysis Issues (Federal Interagency Committee on Noise), August 1992, Table B.1.

emergency fire response services if one of its UA were to crash, and that fire responders would be be able to manage any wildfire that could occur before the wildfire could cause significant impacts to biological resources in the operating area.

Special Status Species

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

The Monarch Butterfly, a candidate for federal listing, has the potential to occur in the operating area. Information regarding drone impacts on insects is limited and there have been no widespread negative impacts identified in the scientific literature. Some research shows that Monarch Butterflies are not commonly observed at higher AGL altitudes, and would not be expected to frequently occur at the altitudes where Prime Air is proposing to operate.[19]

The federally endangered Whooping Crane was identified in the official species list as possibly occuring 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 study area, in Aransas National Wildlife Refuge.[20]

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, the FAA found that there were no recorded sightings of Whooping Crane within the study area boundaries. The FAA also 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.[21] Additionally, Whooping Crane migration flights are usually between 1,000 and 6,000 feet; therefore, it is not expected that occasional drone flights at 160-180 feet AGL would affect transitory Whooping Cranes if they were to migrate through the study area. Because the FAA has determined that Whooping Cranes would not be present where effects are likely to occur, the FAA has determined that there would be *no effect* to the Whooping Crane as a result of the proposed action.

In the Affected Environment section, Table 3-1 identifies the federal and state-listed threatened and endangered species that could occur in Brazos County. The Interior Least Tern (*Sternula antillarum athalassos*) was identifed on the Texas state endangered list, and was identified on the Texas Species of Greatest Conservation Need list as potentially being found within Brazos County. However, because the known habitat locations for the Interior Least Tern are not within the study area, the FAA determined that there would be no effects to this species.

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

[19] Altitudes attained by migrating monarch butterflies, *Danaus p. plexippus* (Lepidoptera: Danaidae), as reported by glider pilots. Available: https://cdnsciencepub.com/doi/abs/10.1139/z81-084. Accessed April 25, 2022.
[20] USFWS Whooping Crane, Critical Habitat Spatial Extents. Available: https://ecos.fws.gov/ecp/species/758#crithab. Accessed: August 24, 2022.
[21] Texas Parks and Wildlife, Nature Trackers, Texas Whooper Watch. iNaturalist. Available: https://www.inaturalist.org/projects/texas-whooper-watch. Accessed: August 24, 2022.

Migratory Birds

Prime Air has stated to the FAA that it will monitor the operating area for any active Bald Eagle nests that may occur. Bald Eagle nests are typically very conspicuous, usually five to nine feet in diameter, with a vertical depth up to eight feet, and Prime Air should be able to visually identify any nests that may be present in the area.[22] Online resources such as iNaturalist may also be used to identify Bald Eagle nests that may be active in the operating area. If Prime Air identifies a Bald Eagle nest or is notified of the presence of a nest by a state regulator or naturalist group, Prime Air will establish an avoidance area such that there is a 1,000 feet vertical and horizontal separation distance between the vehicle's flight path and the nest. This avoidance area will be maintained until the end of the breeding season (September 1 through July 31 in the study area),[23] or a qualified biologist indicates the nest has been vacated.

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 Woodpeckers may be nesting within the operating area and, while it is not anticipated, there is possibility that drone operations in close proximity could disturb birds at nesting sites during its breeding season (May 10 – September 10). While it is not expected that infrequent drone overflights will cause adverse effects to Red-headed Woodpeckers, Prime Air will 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. Chimmney Swifts often make their nests in manmade vertical surfaces such as within a chimney, air shaft, or abandoned buildings.[24] 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 – August 25). While it is not expected that infrequent drone overflights will cause adverse effects to nesting or feeding Chimney Swifts, Prime Air will 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 such as the Bald Eagle, Red-headed Woodpecker, or Chimney Swift. These other BCC species typically nest in forests and riparian corridor environments that are not within close proximity to locations where the Prime Air UA will be completing is ascent and descent. Additionally, the UA's en route overflights are not expected to result in effects to any lifecycles of these species.

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

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

- A long-term or permanent loss of unlisted plant or wildlife species, i.e., extirpation of the species from a large project area;

[22] USFWS Midwest Region: Identification of Large Nests. Available: https://www.fws.gov/midwest/eagle/Nhistory/nest_id.html. Accessed: December 13, 2021
[23] See IPaC report in Appendix A for Bald Eagle breeding dates in the study area.
[24] Texas Parks and Wildlife. Chimney Swift. Available: https://tpwd.texas.gov/huntwild/wild/species/cswift/. Accessed: August 24, 2022.

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

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

3.3.1 Regulatory Setting

Section 4(f) of the Department of Transportation Act [DOT Act, codified at 49 U.S.C. § 303(c)] protects significant publicly owned parks, recreational areas, wildlife and waterfowl refuges, and public and private historic sites. Section 4(f) states that, subject to exceptions for de minimis impacts[25]: "The Secretary may approve a transportation program or project requiring the use of [4(f) resources]…only if—(1) there is no prudent and feasible alternative to using that land; and (2) the program or project includes all possible planning to minimize harm to the park, recreation area, wildlife and waterfowl refuge, or historic site resulting from the use."

The term "use" includes both direct or physical and indirect or "constructive" impacts to Section 4(f) resources. Direct use is the physical occupation or alteration of a Section 4(f) property or any portion of a Section 4(f) property. A constructive use does not require direct physical impacts or occupation of a Section 4(f) resource. A constructive use would occur when a proposed action would result in substantial impairment of a resource to the degree that the protected activities, features, or attributes of the resource that contribute to its significance or enjoyment are substantially diminished. The determination of use must consider the entire property and not simply the portion of the property used for a proposed project.[26]

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

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

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

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

3.3.2 Affected Environment

The FAA identified properties that could meet the definition of a Section 4(f) resource within the operating area. There are no state parks, national parks, or wildlife or waterfowl refuges within the operating area. However, there are several local parks that have the potential to be recognized as Section 4(f) resources. These properties include Bee Creek Park, Central Park, Woodcreek Park, Rock Prairie School and Church, and Richard Carter Homesite. The potential Section 4(f) resources in the study area are listed in Table 3-2 below.

Table 3-2 Section 4(f) Resources in the College Station Study Area

Name	Address
Anderson Park	900 Anderson St, College Station, TX 77840
Andy Anderson Arboretum	900 Anderson St, College Station, TX 77840
Art & Myra Bright Park	2505 Raintree Dr, College Station, TX 77845
Bachmann Park	1600 Rock Prairie Rd, College Station, TX 77845
Barracks Park	30.570781432787836, -96.31753371534207
Bee Creek Park	1900 Anderson St, College Station, TX 77840
Bonfire Memorial	Texas A&M University, History Walk / Spirit Ring, College Station, TX 77843
Bridgewood Park	30.55180810371838, -96.28806381534207
Brison Park	400 Dexter Dr, College Station, TX 77840
Brothers Pond Park	3100 Rio Grande Blvd, College Station, TX 77845
Carter's Crossing Park	2115 N Forest Pkwy, College Station, TX 77845
Castlegate Park	4455 Castlegate Dr, College Station, TX 77845
Castlerock Park	4550 Castle Rock Pkwy, College Station, TX 77845
College Station Cemetery	2530 Texas Ave S, College Station, TX 77840
Creek View Park	1001 Eagle Ave, College Station, TX 77845
Cy Miller Park	2615 Texas Ave, College Station, TX 77840
Edelweiss Gartens Park	500 Hartford Dr, College Station, TX 77845
Edelweiss Park	3900 Victoria Ave, College Station, TX 77845
Emerald Forest Park	8400 Appomattox Dr, College Station, TX 77840
G.Hysmith Skatepark	1520 Rock Prairie Rd, College Station, TX 77845
Gabbard Park	1201 Dexter Dr S, College Station, TX 77840
Georgie K. Fitch Park	1100 Balcones Dr, College Station, TX 77845
Holleman Crossing Dog Park	1300 Harvey Mitchell Pkwy S, College Station, TX 77840

Jack & Dorothy Miller Park	501 Rock Prairie Rd, College Station, TX 77845
John Crompton Park	201 Holleman Dr W, College Station, TX 77840
Kiwanis Trail	30.62797349018994, -96.32021325767103
Kyle Field	756 Houston St, College Station, TX 77843
Lemontree Park	1300 Lemon Tree Ln, College Station, TX 77840
Lick Creek Greenbelt	30.574254218950944, -96.2496116797288
Longmire Park	2600 Longmire Dr, College Station, TX 77845
Luther Jones Park	501 Park Pl, College Station, TX 77840
Merry Oaks Park	1401 Merry Oaks Dr, College Station, TX 77840
Midtown Reserve	1136 Amistad Loop, College Station, TX 77845
Oaks Park	1601 Stallings Dr, College Station, TX 77840
Parkway Park	1106 Munson Ave, College Station, TX 77840
Pebble Creek Park	401 Parkview Dr, College Station, TX 77845
Phillips Park	30.545718198645407, -96.285021
Raintree Park	2505 Raintree Dr, College Station, TX 77845
Reatta Meadows Park	30.559038735322304, -96.2804719
Richard Carter Park	1800 Brazoswood Dr, College Station, TX 77840
Sandstone	1730 Sebesta Road, College Station, TX 77845
Schob Nature Preserve	906 Ashburn Ave, College Station, TX 77840
Smith Track	30.62944944558417, -96.29437517560841
Sonoma Park	City of College Station, 1101 Texas Ave S, College Station, TX 77840
Southern Oaks Park	1398 Southern Plantation Dr, College Station, TX 77845
Southwest Park	300 Southwest Pkwy, College Station, TX 77840
Spring Creek Greenbelt	30.573703777720876, -96.26876971534206
Steeplechase Park	301 W Ridge Dr, College Station, TX 77845
Stephen C. Beachy Central Park	1000 Krenek Tap Rd, College Station, TX 77840
Texas A&M University Numerous Athletic Fields in Area	400 Bizzell St, College Station, TX 77843
The London Beach Volleyball Court	601 Luther W St, College Station, TX 77840

Thomas Park	1300 James Pkwy, College Station, TX 77840
Tiger Stadium	1801 Harvey Mitchell Pkwy S, College Station, TX 77840
TruFit Athletic Clubs	3526 Longmire Dr, College Station, TX 77845
Veterans Park and Athletic Complex	3101 Harvey Rd, College Station, TX 77845
W.A. Tarrow Park	107 Holleman Dr, College Station, TX 77840
Wallace Lake Park	4200 WS Phillips Pkwy, College Station, TX 77845
Windwood Park	2650 Brookway Ct, College Station, TX 77845
Wolf Pen Creek Park	1015 Colgate Dr, College Station, TX 77840
Wolf Pen Creek Trail	1015 Colgate Dr, College Station, TX 77840
Woodcreek Park	9100 Shadowcrest Dr, College Station, TX 77845
Woodland Hills Park	4418 Woodland Ridge Dr, College Station, TX 77845

There are no historic sites within the operating area, as listed on the Texas SHPO and Brazos County Historical Commission websites. There are several historical markers in the operating area; however, these historical markers would not typically be affected by UA operations.[27] Additionally, as discussed in Section 3.4, *Historical, Architectural, Archaeological, and Cultural Resources*, the FAA conducted outreach with the Texas SHPO and six tribes (including three THPOs) regarding Prime Air's proposed operations to determine whether historic or traditional cultural properties would be affected by the proposed action.

3.3.3 Environmental Consequences

There will be no physical use of Section 4(f) resources because there will be no construction on any Section 4(f) resource. The FAA has determined that infrequent UAS overflights as described in the proposed action are not considered a constructive use of any Section 4(f) resource, and will not cause substantial impairment to any of the Section 4(f) resources in the operating area. As described in the Section 3.5, Noise and Noise-Compatible Land Use, and the Noise Analysis Report (Appendix C), the proposed operations will not result in significant noise levels at any location in the operating area other than the PADDC property. Noise and visual effects from Prime Air's occasional overflights are not expected to diminish the activities, features, or attributes of the resources that contribute to their significance or enjoyment.

Additionally, Prime Air identifies areas where open air gatherings of people typically occur, such as open air concert venues and school yards, and avoids these properties through the creation of keep-out areas via Prime Air's route planning software, which prepares an optimized flight path from the PADDC to each designated delivery site. The software ensures that each route integrates and respects all of the restrictions entered into the database, including Section 4(f) properties, which can be automatically

[27] Brazos County Historical Commission. Map of Historical Markers. Available: https://brazoscountyhistory.org/map-of-historical-markers. Accessed: August 26, 2022.

avoided based on the time of day and other factors. The FAA has determined that there will be no significant impacts to Section 4(f) resources as a result of the proposed action.

3.4 Historical, Architectural, Archaeological, and Cultural Resources

3.4.1 Regulatory Setting

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

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

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

3.4.2 Affected Environment

The APE for the proposed action is the entire operating area where Prime Air is planning to conduct UA package deliveries, as shown in Figure 1 in this EA. The FAA identified several historic markers that were listed on the Texas SHPO website; however, no NRHP-listed sites were within the APE.[28] Data from the Texas Historical Commission (THC) indicates that 12 historical markers have been established within the APE on sites with state or local historical significance. These historical markers are show in Table 3-3 below.

Table 3-3 Historical Markers of State or Local Significance in the APE

THC Marker Number	Name
8628	African American Education in College Station
8662	A&M College Consolidated Rural School
8672	Carter, Richard, Homesite
8674	College Station Railroad Depots
8675	Early Texas A&M Campus Housing
8692	Rock Prairie School and Church

[28]Texas Historical Commission. Texas Historical Sites Atlas: Brazos County. Available: https://atlas.thc.texas.gov/. Accessed: August 26, 2022.

8696	Shiloh Community
8698	Texas A&M Corps of Cadets
8699	Texas A&M University
13065	Early Play-By-Play Radio Broadcast of a College Football Game
13369	Main Drill Field, Texas A&M University
18810	Texas AMC and WWI

SOURCE: Texas Historical Commission, 2022.

THC historical markers are placed to commemorate various topics including, "history and architecture of houses, commercial and public buildings, religious congregations, and military sites; events that changed the course of local and state history; and individuals who have made lasting contributions to our state, community organizations, and businesses." There are three types of markers established by the THC: subject markers, Historic Texas Cemetery markers, and Recorded Texas Historic Landmark markers. None of the historical markers in the APE are recorded as Texas Historic Landmarks. Not all locations with historical markers are necessarily historic places with characteristics with potential to be impacted by drone delivery operations.

3.4.2 Environmental Consequences

The nature of UA effects on historic properties is limited to non-physical, reversible impacts (i.e., the introduction of audible and/or visual elements). In addition, the distribution of daily flights that Prime Air is proposing –divided into four separate sectors – means that any historic or cultural resource would be subject to only a small number of overflights per day, if any.-

In an accordance with 36 CFR § 800.4(a)(1), the FAA consulted with the Texas SHPO and six tribes that may potentially attach religious or cultural significance to resources in the APE. Three of the tribes have THPOs: Comanche Nation of Oklahoma, Coushatta Tribe of Louisiana, Wichita and Affiliated Tribes of Oklahoma (Wichita, Keechi, Waco & Tawakonie). The FAA sent a consultation letter to the Texas SHPO on July 12, 2022. On August 4, 2022, the Texas SHPO responded to the FAA and confirmed that no historic properties are present or affected by the proposed action. The FAA's tribal and historic outreach letters are included as Appendix B.

The FAA sent letters on July 12, 2022 to the Alabama-Coushatta Tribe, Apache Tribe of Oklahoma, Comanche Nation of Oklahoma THPO, Coushatta Tribe of Louisiana THPO, Tonkawa Tribe of Indians of Oklahoma, and Wichita and Affiliated Tribes of Oklahoma (Wichita, Keechi, Waco & Tawakonie) THPO. On July 28, 2022, the Coushatta Tribe of Louisiana THPO responded to the FAA and stated that the proposed action will not have a negative impact on any archaeological, historic, or cultural resources of the Coushatta people. This response is available in Appendix B. The other five tribes did not provide a response.

Additionally, the FAA's noise exposure analysis for the proposed action concluded that noise levels are not likely to exceed DNL 45 dB in any location other than the PADDC property and at a few properties immmediately surrounding the PADDC, and in the immediate vicinity of locations that may receive a delivery. Based on a review of the proposed action and the nature of the historic properties identified in

the APE, the FAA has determined that no historic properties or cultural resources will be affected by the proposed action, in accordance with 36 CFR § 800.4(d)(1). The proposed action will not have a significant impact on historical, architectural, archaeological, or cultural resources.

3.5 Noise and Noise-Compatible Land Use

3.5.1 Regulatory Setting

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

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

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

To comply with NEPA requirements, the FAA has issued requirements for assessing aircraft noise in FAA Order 1050.1F, Appendix B. FAA's primary noise metric for aviation noise analysis is the yearly DNL metric. The DNL metric is a single value representing the logarithmically average aircraft sound level at a location over a 24-hour period, with a 10 dB adjustment added to those noise events occuring from 10:00 p.m. and up to 7:00 a.m. the following morning. A significant noise impact is defined in Order 1050.1F as an increase in noise of DNL 1.5 dB or more at or above DNL 65 dB noise exposure or a noise exposure at or above the 65 dB level due to a DNL 1.5 dB or greater increase.

3.5.2 Affected Environment

The study area is approximately 43.7 square miles, and the estimated population within the area is roughly 101,719. The population density is approximately 2,445 persons per square mile.[29] There are no airports in the study area. The closest airport is Easterwood Airport, a regional airport approximately 0.70 miles west of the operating area boundary. There is one heliport in the operating area located at Baylor Scott & White Medical Center, at 800 Scott & White Drive. Existing aviation noise is not expected to be significant. The study area is depicted in Figure 1.

3.5.3 Environmental Consequences

Human perception of noise depends on a number of factors, including overall noise level, number of noise events, the extent of audibility above the background ambient noise level, and acoustic frequency

[29] Environmental Protection Agency's (EPA) Environmental Justice Screening Tool (EJSCREEN). Available: https://www.epa.gov/ejscreen. Accessed: August 26, 2022

content (pitch). UA noise generally has high acoustic frequency content, which can often be more discernable from other typical noise sources.

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

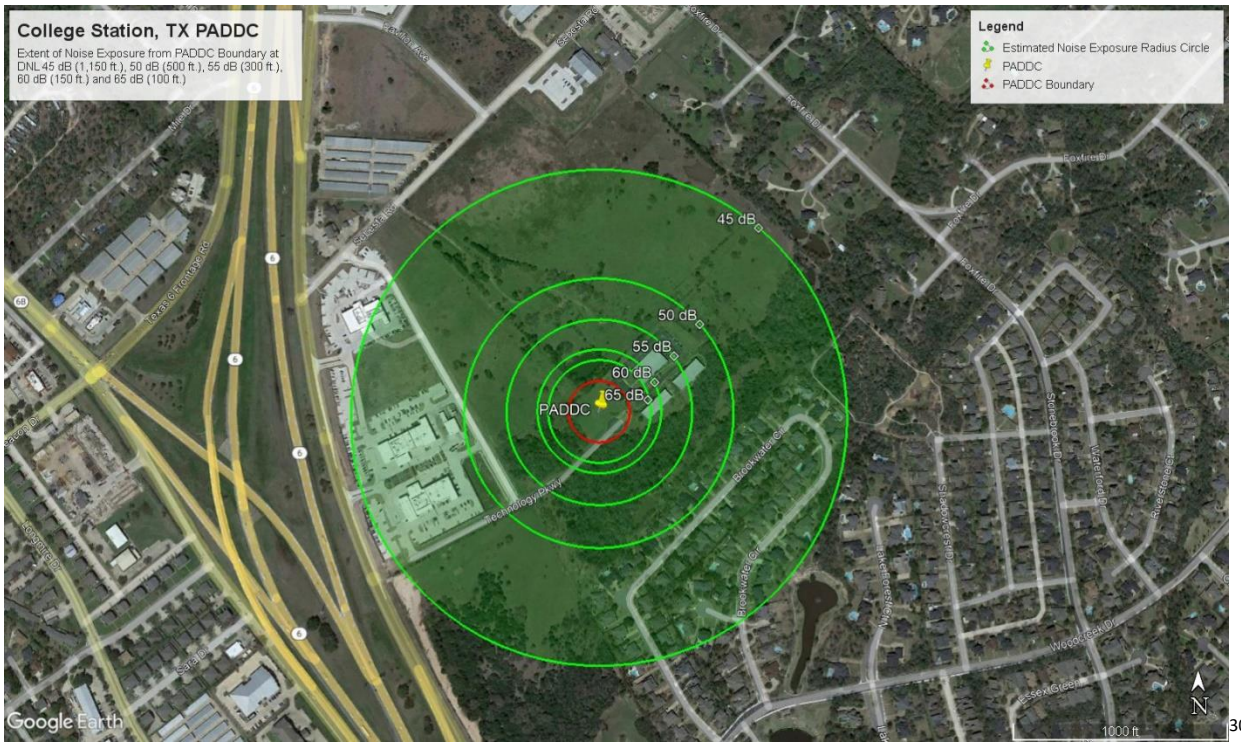
Noise Exposure

Utilizing the operational projections defined in Sections 1 and 2, the noise analysis methodology detailed in Appendix C was then used to the estimate 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 number of deliveries provided by Prime Air, the extent of DNL 45 dB associated with PADDC operations is shown in Figure 5. 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 referencing Table 7 of Appendix C.



[30]

Figure 4 *DNL Noise Exposure at College Station PADDC Location*

Noise Exposure for En route Operations

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

Noise Exposure for Delivery Operations

Due to the inherent uncertainty of the exact delivery site locations, the noise analysis developed a minimum and maximum representative distribution of deliveries in the study area based on data provided by Prime Air. The noise analysis conservatively assumes the minimum and maximum distribution of average daily deliveries that could occur at a single delivery location. The distribution of average annual daily deliveries based on the projections provided by Prime Air range from 0.1 to 4.0 deliveries per operating day. The DNL values include the decelerating transition maneuver from en route horizontal flight to vertical flight at en route altitude, the delivery maneuver, and the accelerating transition maneuver from vertical flight at en route altitude to horizontal en route flight as discussed in noise analysis report. The noise exposure for delivery operations also includes en route overflights at the

[30] Google Earth, as modified by the FAA

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

A conservative estimate of delivery noise exposure can then be determined by referencing Tables 9 and 10 of Appendix C. The estimated delivery DNL includes values at the minimum and maximum distribution of DNL equivalent deliveries based on the distributions provided by Prime Air at various distances from the delivery point. They include the minimum listener distance from the delivery point at 16.4 feet, which is representative of the closest distance a person may approach before the aircraft takes automated actions to safely cancel the delivery. This is in addition to the minimum measured distance from the UA for which noise measurement data was available for a delivery, which is 32.8 feet. Values were also calculated at distances of 50 feet, 75 feet, 100 feet, and 125 feet from the delivery point, and are representative of distances from which nearby properties may experience noise from a delivery based on the average lot size for sold homes as reported in the 2021 US Census.[31] The DNL for the minimum and maximum distribution of average annual daily DNL deliveries are presented below in Table 3-4.

Table 3-4 DNL for a Delivery Location Based on the Minimum and Maximum Distribution of Deliveries

Annual Average Daily DNL Equivalent Deliveries	Annual DNL Equivalent Deliveries	Estimated Delivery DNL (dB) at 16.4 feet (Minimum Possible Listener Distance)	Estimated Delivery DNL (dB) at 32.8 feet (Minimum Measured Listener Distance)	Estimated Delivery DNL (dB) at 50 feet	Estimated Delivery DNL (dB) at 75 feet	Estimated Delivery DNL (dB) at 100 feet	Estimated Delivery DNL (dB) at 125 feet
0.1	52.0	45.8	44.4	44.1	43.8	43.5	43.3
4.0	1456.0	57.2	53.6	52.6	51.1	48.9	47.2

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 45 dB could extend beyond 125 feet from the delivery location and may reach adjacent properties. However, these noise levels would not exceed the FAA's significance threshold for noise of DNL 65 dB in any of the areas where Prime Air anticipates providing deliveries.

Total Noise Exposure Results

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

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

delivery operations, including en route overflights, would not have the potential to exceed DNL 58 dB at any location in the study 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 decibels and would disturb or annoy a person of ordinary sensibilities.[32] 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 decibels and would disturb or annoy a person of ordinary sensibilities.

As explained in Section 3.5.1 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, 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 resource within the study area. The maximum noise exposure at any property line in residential zoned property will not exceed DNL 50 dB.[33]

This is well below the FAA DNL 65 dB significance threshold.[34]

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

3.6 Environmental Justice

3.6.1 Regulatory Setting

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

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

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

[32] 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: August 26, 2022.
[33] City of College Station GIS. Planning and Development Map. Available: https://cstx.maps.arcgis.com/apps/webappviewer/index.html?id=1b2d3c188cd5479e9dbc61b6448f714b. Accessed: August 26, 2022.
[34] This discussion of the College Station noise ordinance is provided for informational purposes only.

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

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

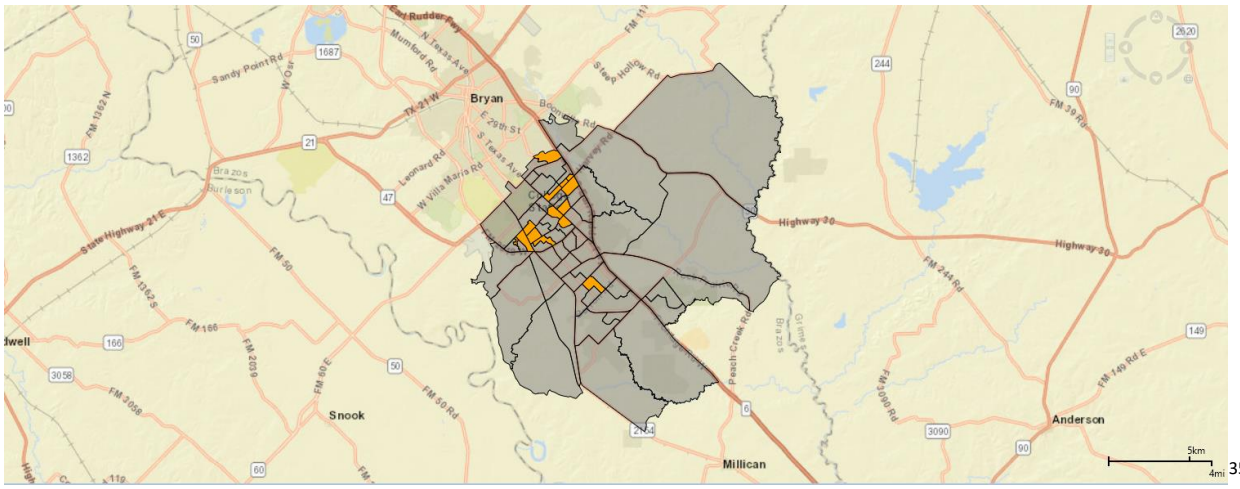
1. Is predominately borne by a minority population and/or a low-income population; or
2. Will be suffered by the minority population and/or low-income population and is appreciable more severe or greater in magnitude than adverse effects that will be suffered by the non-minority population and/or low-income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

3.6.2 Affected Environment

The estimated population within the area is roughly 102,000. Minority and low-income populations were mapped at the Census Block Group level using 2020 American Community Survey (ACS) 5-year estimates from the U.S. Census Bureau. The analysis was performed using the Aviation Environmental Design Tool (AEDT). The FAA utilized a combination of the *fifty-percent analysis* and *meaningfully greater analysis* to complete the analysis for the study area. Low-income populations in the study area were identified by using *the Low-Income Threshold Criteria* analysis. The census block group data used for the analysis is provided in Appendix F.

Minority Population Fifty-Percent Analysis

As depicted in Figure 6, there are 14 census block groups out of 67 that have minority populations at or above 50 percent. The percentage of minority individuals residing within the study area at the census block level is below 50 percent at approximately 36.17 percent.



[35]

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

Minority Population Meaningfully Greater Analysis

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

The percentage of minority persons residing within the study area at the census block group level, approximately 36.17 percent, is lower than that of the reference community, which is approximately 46.42 percent. Based on the analysis, the FAA determined that the percentage of minority persons residing within the study area is both less than 50 percent and is not meaningfully greater than the percentage of minority persons residing within the reference community.

Low-Income Threshold Criteria Analysis

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

The percentage of low-income individuals residing within the study area at the census block group level is approximately 30.05 percent as compared to 25.86 percent in the reference community. Based on the analysis, the FAA identified a low-income population since the percentage of low-income individuals residing within the study area is greater than that of the reference community. The FAA's AEDT analysis data is included in Appendix F.

3.6.3 Environmental Consequences

The proposed action would not result in adverse or significant impacts in any environmental resource category. As noted in Section 3.5, *Noise and Noise-Compatible Land Use*, and the Noise Analysis Report in Appendix C, the drone's noise emissions could be perceptible in areas within the study area, but will stay well below the level determined to constitute a significant impact. Using the fifty-percent analysis and meaningfully greater analysis, the FAA determined that there was not a minority population

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

present. The percentage of low-income individuals was higher in the study area than the reference community; however, the low-income populations would not be subject to significant noise or visual effects that could occur at the PADDC location. Since the proposed action would not result in significant noise or visual effects at any location beyond the PADDC property, and because any effects in the study area would not be predominately or uniquely born by an environmental justice population, the FAA determined that the proposed action would not result in a disproportionately high and adverse effect on a low-income or a minority population.

3.7 Visual Effects (Visual Resources and Visual Character)

3.7.1 Regulatory Setting

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

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

3.7.2 Affected Environment

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

3.7.3 Environmental Consequences

The proposed action makes no changes to any landforms, or land uses, thus there would be no effect to the visual character of the area. The operations will be happening in airspace only. The FAA estimates that at typical operating altitude and speeds the UA en route would be observable for approximately 3.6 seconds by an observer on the ground. The proposed action involves airspace operations that are unlikely to result in visual impacts on 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 – and the distribution of flights throughout the 43.7-square mile operating area, would minimize any potential for significant visual impacts at any location in the study area. Any visual effects are expected to be similar to existing air traffic in the vicinity of the operating area.

3.8 Water Resources (Surface Waters)

3.8.1 Regulatory Setting

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

3.8.2 Affected Environment

Approximately 0.09 square miles of surface waters occur within the operating area, or less than one percent of the area, based on the Environmental Justice Screening and Mapping Tool (EJSCREEN) report for this proposed action (Appendix E). Notable surface waters include Carters Creek, Hudson Creek, Wolf Pen Creek, Bee Creek, Carter Lake, and Lake Placid. Prime Air's operations will not require a NPDES permit or any other authorization under the CWA.

3.8.3 Environmental Consequences

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

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

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

There will be no further construction activities associated with the proposed action. Prime Air's Part 135 operations will not require a NPDES permit or any other authorization under the Clean Water Act. The proposed action would not have the potential to adversely affect natural and beneficial water resource values to a degree that substantially diminishes or destroys such values, or to adversely affect surface waters such that the beneficial uses and values of such waters are appreciably diminished or can no longer be maintained and such impairment cannot be avoided or satisfactorily mitigated. For all of these reasons, the proposed action would not cause an exceedance of water quality standards established by federal, state, local, and tribal regulatory agencies, and the proposed action would not contaminate public drinking water supply such that public health may be adversely affected. Therefore, the potential for impacts to surface waters is not significant.

3.9 Cumulative Impacts

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

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

4.0 LIST OF PREPARERS and CONTRIBUTORS

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

Table 4-1 List of Preparers and Contributors

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

5.0 LIST of AGENCIES CONSULTED

Federal Agencies

U.S. Fish and Wildlife Service, Texas Coastal Ecological Services Field Office

State Agencies

Texas Historical Commission

Tribes

Alabama-Coushatta Tribe

Apache Tribe of Oklahoma

Comanche Nation of Oklahoma

Coushatta Tribe of Louisiana

Tonkawa Tribe of Indians of Oklahoma

Wichita and Affiliated Tribes of Oklahoma (Wichita, Keechi, Waco & Tawakonie)

Appendix A

Official Species List

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Texas Coastal Ecological Services Field Office
4444 Corona Drive, Suite 215
Corpus Christi, TX 78411
Phone: (281) 286-8282 Fax: (281) 488-5882

In Reply Refer To:
Project Code: 2022-0068643
Project Name: College Station

July 28, 2022

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

To Whom It May Concern:

The U.S. Fish and Wildlife Service (Service) field offices in Clear Lake, Tx, and Corpus Christi, Tx, have combined administratively to form the Texas Coastal Ecological Services Field Office. A map of the Texas Coastal Ecological Services Field Office area of responsibility can be found at: http://www.fws.gov/southwest/es/TexasCoastal/Map.html. All project related correspondence should be sent to the field office responsible for the area in which your project occurs. For projects located in southeast Texas please write to: Field Supervisor; U.S. Fish and Wildlife Service; 17629 El Camino Real Ste. 211; Houston, Texas 77058. For projects located in southern Texas please write to: Field Supervisor; U.S. Fish and Wildlife Service; P.O. Box 81468; Corpus Christi, Texas 78468-1468. For projects located in six counties in southern Texas (Cameron, Hidalgo, Starr, Webb, Willacy, and Zapata) please write: Santa Ana NWR, ATTN: Ecological Services Sub Office, 3325 Green Jay Road, Alamo, Texas 78516.

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

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

implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.
A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:
http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF
Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see https://www.fws.gov/birds/policies-and-regulations.php.

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

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities

that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/birds/policies-and-regulations/executive-orders/e0-13186.php.

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

Attachment(s):

- Official Species List
- 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".

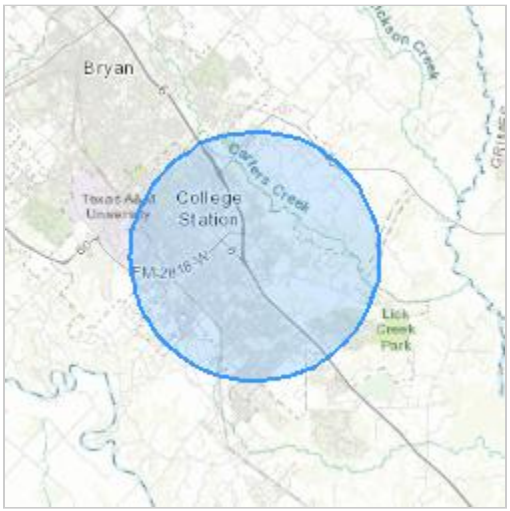
This species list is provided by:

Texas Coastal Ecological Services Field Office
4444 Corona Drive, Suite 215
Corpus Christi, TX 78411
(281) 286-8282

Project Summary

Project Code: 2022-0068643
Project Name: College Station
Project Type: Drones - Use/Operation of Unmanned Aerial Systems
Project Description: 3.73 Mile Radius from 400 Technology Parkway
Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@30.593894849999998,-96.28439702548829,14z



Counties: Brazos County, Texas

Endangered Species Act Species

There is a total of 6 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.

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. The location of the critical habitat is not available. This species only needs to be considered under the following conditions: ▪ Wind related projects within migratory route. Species profile: https://ecos.fws.gov/ecp/species/6039	Threatened
Red Knot *Calidris canutus rufa* There is **proposed** critical habitat for this species. The location of the critical habitat is not available. This species only needs to be considered under the following conditions: ▪ Wind related projects within migratory route. 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. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/758	Endangered

Clams

NAME	STATUS
Texas Fawnsfoot *Truncilla macrodon* There is **proposed** critical habitat for this species. The location of the critical habitat is not available. 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 ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

Migratory Birds

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

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

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

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

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

NAME	BREEDING SEASON
American Golden-plover *Pluvialis dominica* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	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

NAME	BREEDING SEASON
Chimney Swift *Chaetura pelagica* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	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.	Breeds Apr 20 to Aug 20
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	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
Prothonotary Warbler *Protonotaria citrea* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	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.	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 and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see

below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

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

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

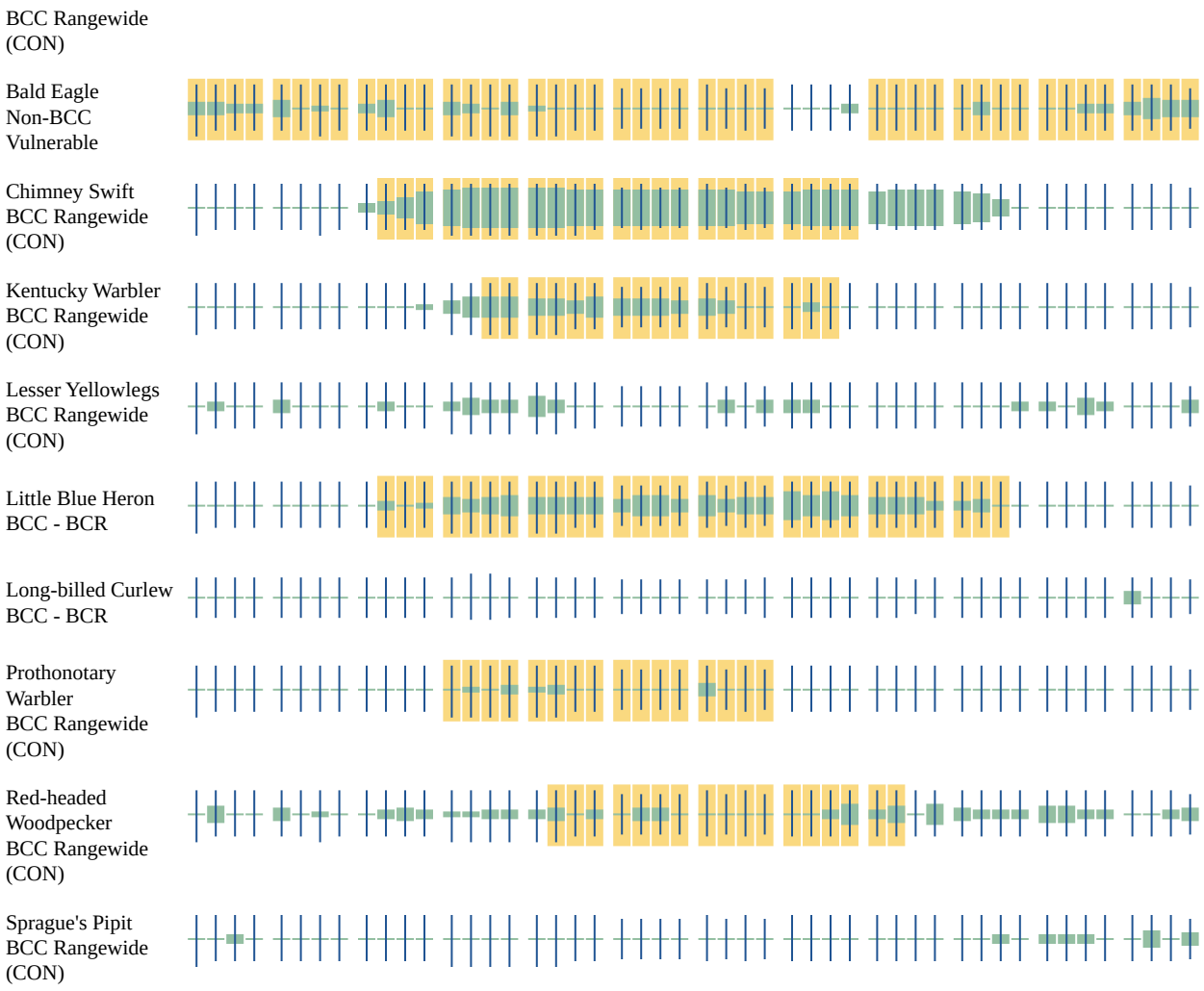
Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

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

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

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

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



Additional information can be found using the following links:

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

Migratory Birds FAQ

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

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding

in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?
The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

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

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

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?
The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

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

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

What are the levels of concern for migratory birds?
Migratory birds delivered through IPaC fall into the following distinct categories of concern:

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

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

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

Details about birds that are potentially affected by offshore projects

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

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

What if I have eagles on my list?

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

Proper Interpretation and Use of Your Migratory Bird Report

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

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

Wetlands

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

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

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

RIVERINE

- Riverine

FRESHWATER POND

- Palustrine

LAKE

- Lacustrine

IPaC User Contact Information

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

Appendix B

Tribal and Historic Outreach Letters

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

Aviation Safety

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

Mr. Mark Wolfe
State Historic Preservation Officer
Texas Historical Commission
P.O. Box 12276
Austin, TX 78711-2276

Via electronic submission to https://xapps.thc.state.tx.us/106Review/

Dear Mr. Wolfe:

The purpose of this letter is to inform you of a proposal under consideration by the Federal Aviation Administration (FAA) for the approval of a Certificate of Waiver and/or Exemption for an Unmanned Aircraft System (UAS) delivery operation in College Station, TX. The FAA has determined that this proposed action is a Federal undertaking as defined in 36 CFR § 800.16 (y). Therefore, the FAA is initializing consultation with the State Historic Preservation Officer (SHPO) pursuant to § 800.4(d), Finding of no historic properties affected.

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

The UAS operation will be flown by an 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). According to the National Park Service online database of the National Register of Historic Places, no historical places were identified within the proposed 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
Based on the results of the FAA's search of the National Park Service online database of the National Register of Historic Places, the FAA has determined that this undertaking will have no historic properties affected. In accordance with to § 800.4(d) please review this finding

and the enclosed documentation, and provide either your concurrence or non-concurrence within the 30 day regulatory time frame.

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.

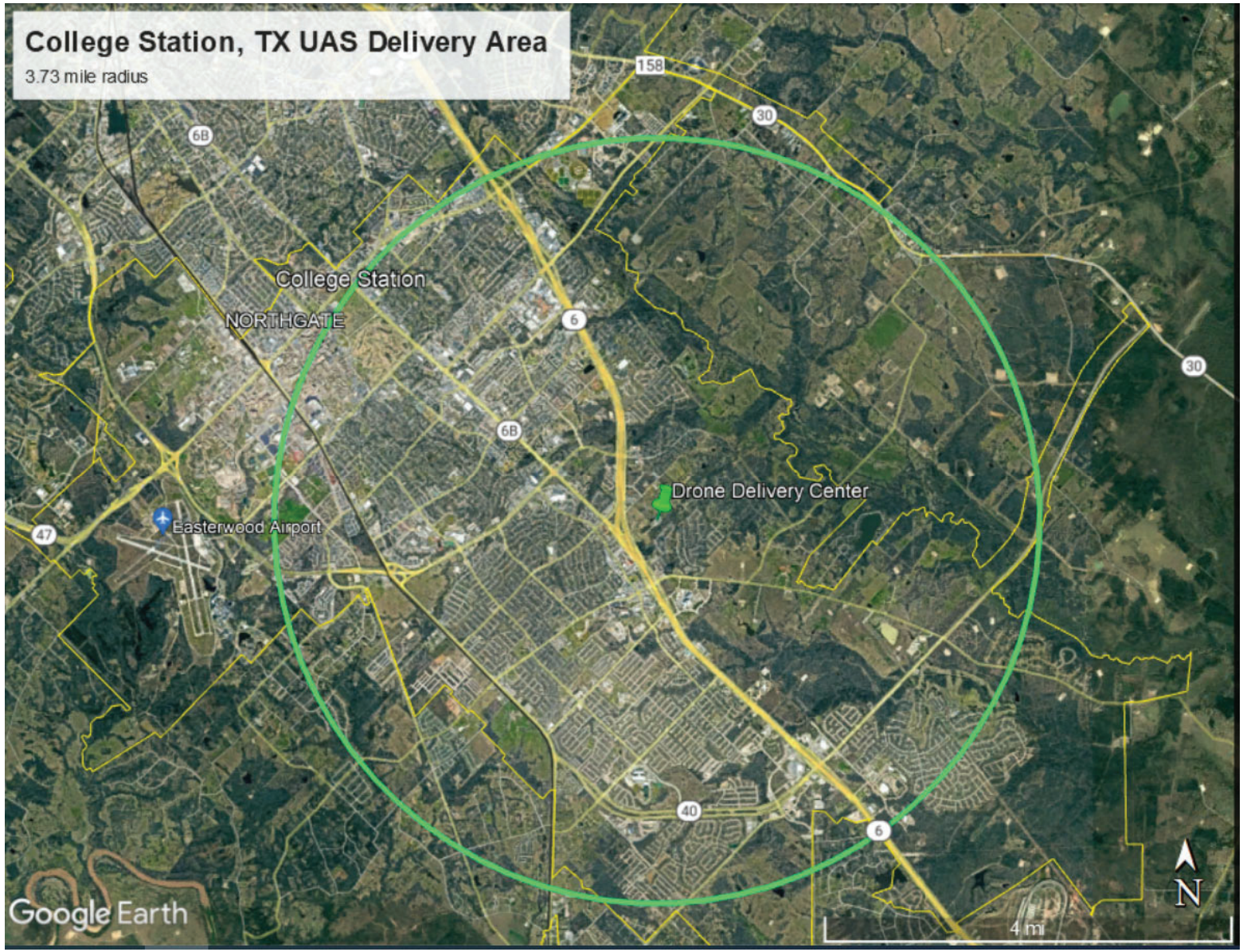
Sincerely,

DAVID M MENZIMER

Digitally signed by DAVID M MENZIMER
Date: 2022.07.12 11:00:01 -07'00'

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

Enclosure


College Station, TX UAS Delivery Area
3.73 mile radius
158
30
6B
College Station
NORTHGATE
6
30
6B
Drone Delivery Center
Easterwood Airport
47
40
6
Google Earth
4 mi
N

From: noreply@thc.state.tx.us
Sent: Thursday, August 4, 2022 2:27 PM
To: Millard, Mike (FAA); reviews@thc.state.tx.us
Subject: Section 106 Submission

TEXAS HISTORICAL COMMISSION
real places telling real stories

Re: Project Review under Section 106 of the National Historic Preservation Act
THC Tracking #202212464
Date: 08/04/2022
Unmanned Aircraft System (UAS) delivery operation in College Station, TX.
400 Technology Parkway
College Station,TX 77845

Description: FAA approval of a Certificate of Waiver and/or Exemption for an Unmanned Aircraft System (UAS) delivery operation in College Station, TX.

Dear Mike Millard:
Thank you for your submittal regarding the above-referenced project. This response represents the comments of the State Historic Preservation Officer, the Executive Director of the Texas Historical Commission (THC), pursuant to review under Section 106 of the National Historic Preservation Act.

The review staff, led by Justin Kockritz and Marie Archambeault, has completed its review and has made the following determinations based on the information submitted for review:

Above-Ground Resources

- No historic properties are present or affected by the project as proposed. However, if historic properties are discovered or unanticipated effects on historic properties are found, work should cease in the immediate area; work can continue where no historic properties are present. Please contact the THC's History Programs Division at 512-463-5853 to consult on further actions that may be necessary to protect historic properties.

Archeology Comments

- No historic properties affected. However, if cultural materials are encountered during construction or disturbance activities, work should cease in the immediate area; work can continue where no cultural materials are present. Please contact the THC's Archeology Division at 512-463-6096 to consult on further actions that may be necessary to protect the cultural remains.
- THC/SHPO concurs with information provided.

We look forward to further consultation with your office and hope to maintain a partnership that will foster effective historic preservation. Thank you for your cooperation in this review process, and for your efforts to preserve the irreplaceable heritage of Texas. If the project changes, or if new historic properties are found, please contact the review staff. If you have any questions concerning our review or if we can be of further assistance, please email the following reviewers: justin.kockritz@thc.texas.gov, marie.archambeault@thc.texas.gov.

This response has been sent through the electronic THC review and compliance system (eTRAC). Submitting your project via eTRAC eliminates mailing delays and allows you to check the status of the review, receive an electronic response, and generate reports on your submissions. For more information, visit http://thc.texas.gov/etrac-system.

Sincerely,

for Mark Wolfe, State Historic Preservation Officer
Executive Director, Texas Historical Commission

Please do not respond to this email.

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

Aviation Safety

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

THPO Kristian Poncho
Coushatta Tribe of Louisiana
PO Box 10
Elton, LA, 70532

Dear Mr. Poncho:

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 11:25:28 -07'00'

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

Enclosure

From: Kassie Dawsey <KDawsey@coushatta.org>
Sent: Thursday, July 28, 2022 4:24 PM
To: 9-AWA-AVS-AFS-ENVIRONMENTAL (FAA)
Subject: Certificate of Waiver and/or Exemption, or Operations Specifications for an Unmanned Aircraft System(UAS) operation area in College Station, TX

Thank you for requesting our 106/EA determination. Based on the information provided, I do not believe that this project will have a negative impact on any archaeological, historic, or cultural resources of the Coushatta people. Accordingly, we do not wish to consult further on this project. If any inadvertent discoveries are made in the course of this project, we expect to be contacted immediately and reserve the right to consult with you at that time.

Aliilamo (thank you),

Kassie Dawsey
Section 106 Coordinator
Coushatta Tribe of Louisiana
Coushatta Heritage Department

Phone 337-246-1275
Email kdawsey@coushatta.org
P.O. Box 10, Elton, LA 70532

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

Aviation Safety

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

Chairman Bobby Komardley
Apache Tribe of Oklahoma
PO Box 1330
Anadarko, OK, 73005

Dear Mr. Komardley:

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 11:35:33 -07'00'

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

Enclosure

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

Aviation Safety

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

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.

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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

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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

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

Aviation Safety

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

THPO Martina Minthorn
Comanche Nation, Oklahoma
6 SW D Avenue
Lawton, OK, 73502

Dear Ms. Minthorn:

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

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Date: 2022.07.13 11:24:53 -07'00'

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

Enclosure

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

Aviation Safety

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

THPO Lauren Norman-Brown
Tonkawa Tribe of Indians of Oklahoma
1 Rush Buffalo Road
Tonkawa, OK, 74653

Dear Ms. Norman-Brown:

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.

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Sincerely,

DAVID M MENZIMER

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Date: 2022.07.13 11:25:54 -07'00'

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

Enclosure

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

Aviation Safety

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

THPO Gary McAdams
Wichita and Affiliated Tribes (Wichita, Keechi, Waco & Tawakonie), Oklahoma
PO Box 729
Anadarko, OK, 73005

Dear Mr. McAdams:

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.

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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 11:26:21 -07'00'

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

Enclosure

Appendix C

Noise Analysis Report

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

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

Final

HMMH Report No. 309990.003-7

August 19, 2022

Prepared for:

JD RoVolus, LLC
121 Pearl Street
Ypsilanti, MI 48197

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

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

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

Final

HMMH Report No. 309990.003-7

August 19, 2022

Prepared for:

JD RoVolus, LLC
121 Pearl Street
Ypsilanti, MI 48197

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

Prepared by:

David Crandall
Paul Krusell
Brandon Robinette

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

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Contents

Figures

Tables

1 Introduction and Background

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

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

Figure 1 depicts the UA considered in this report.

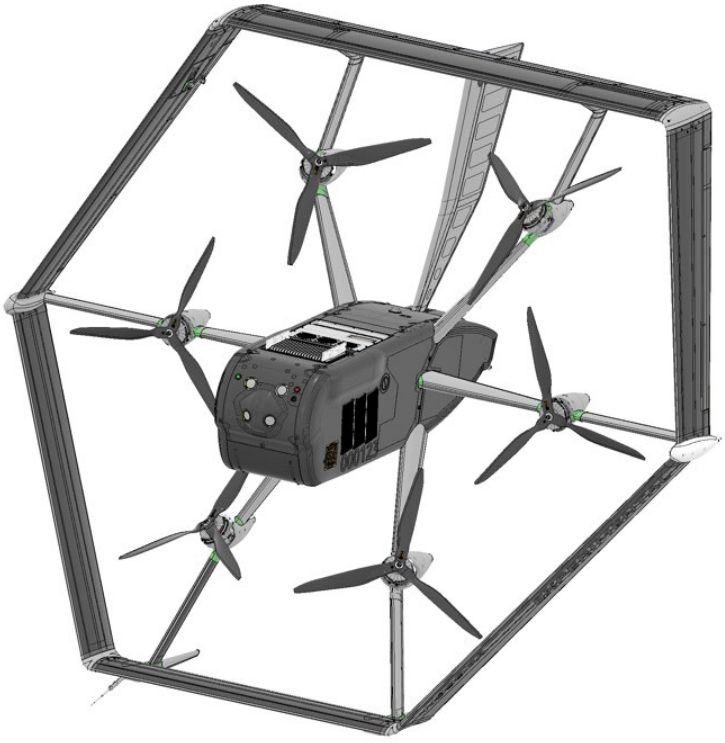

Figure 1: Amazon Prime Air MK27-2 Unmanned Aircraft

Source: Amazon

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

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

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

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

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

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

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

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

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

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

2 Unmanned Aircraft Delivery Operations and Noise Measurement Data Set Descriptions

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

2.1 Operations, Flight Paths, and Flight Profile Data

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

2.1.1 Operations

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

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

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

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

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

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

2.1.2 Flight Paths and Profiles

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

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

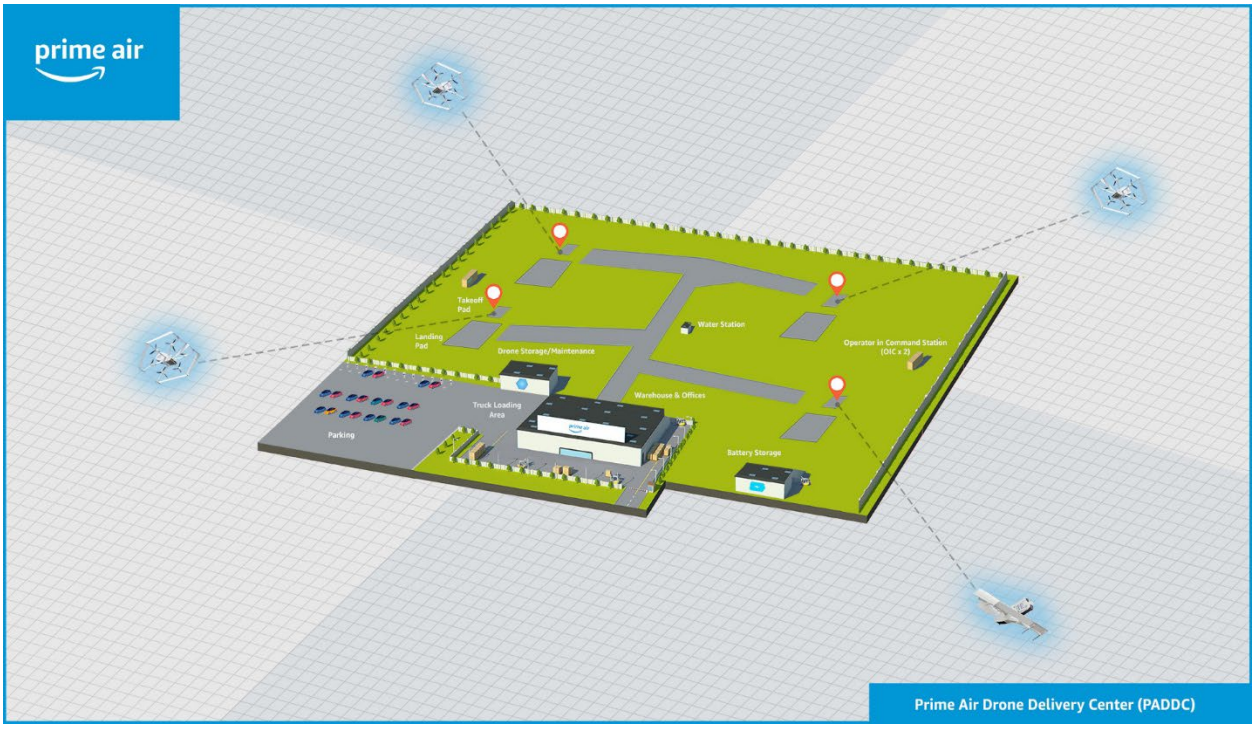

Figure 2: Representative PADDC Layout

Source: Amazon, August 2022

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

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

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

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

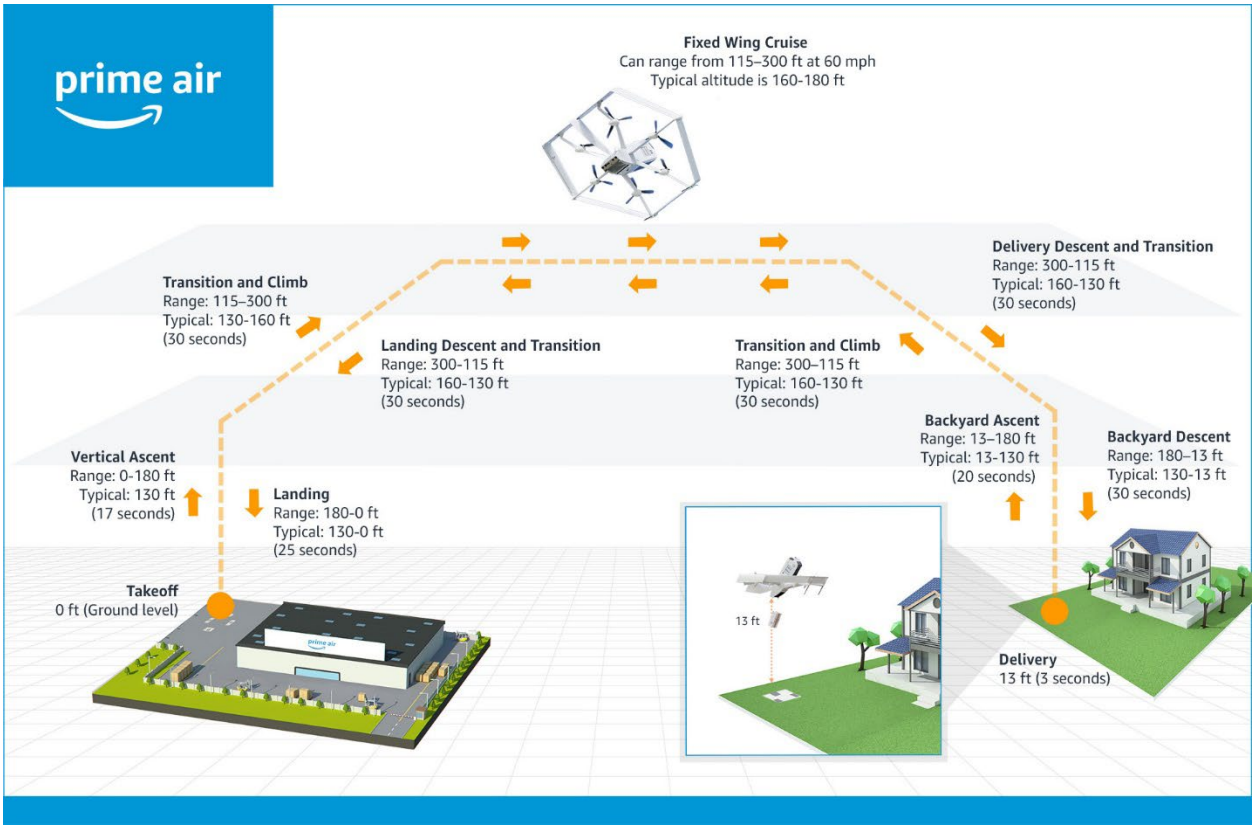

Figure 3: Graphical Depiction of the Proposed Amazon Prime Air MK27-2 Flight Profile to a Destination

Source: Amazon, August 2022

2.1.2.1 Takeoff and vertical ascent

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

2.1.2.2 Transition and climb outbound

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

2.1.2.3 Fixed-wing cruise outbound

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

2.1.2.4 Delivery descent and transition

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

2.1.2.5 Backyard descent, delivery, and ascent

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

2.1.2.6 Transition and climb inbound

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

2.1.2.7 Fixed wing crusie Inbound

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

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

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

2.1.2.8 Landing descent and transition

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

2.1.2.9 Landing

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

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

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

Source: FAA August 4, 2022 (Attachment A)

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

2.2 Acoustical Data

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

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

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

Where:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Table 6. Estimates of En Route SEL

Source: FAA August 4, 2022 (Attachment A)

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

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3 Methodology for Data Analysis

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

3.1 Application of Operations

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

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

Where:

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

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

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

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

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

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

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

3.2 PADDC Infrastructure

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

3.3 Application of Acoustical Data

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

For calculating SEL, five specific activities are considered:

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

3.3.1 General Assumptions

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

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

3.3.2 Takeoff

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

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

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

3.3.3 Transitions between Vertical and Horizontal Flight Modes

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

3.3.4 En Route

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

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

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

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

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

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

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

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

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

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

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

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

3.3.5 Delivery

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

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

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

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

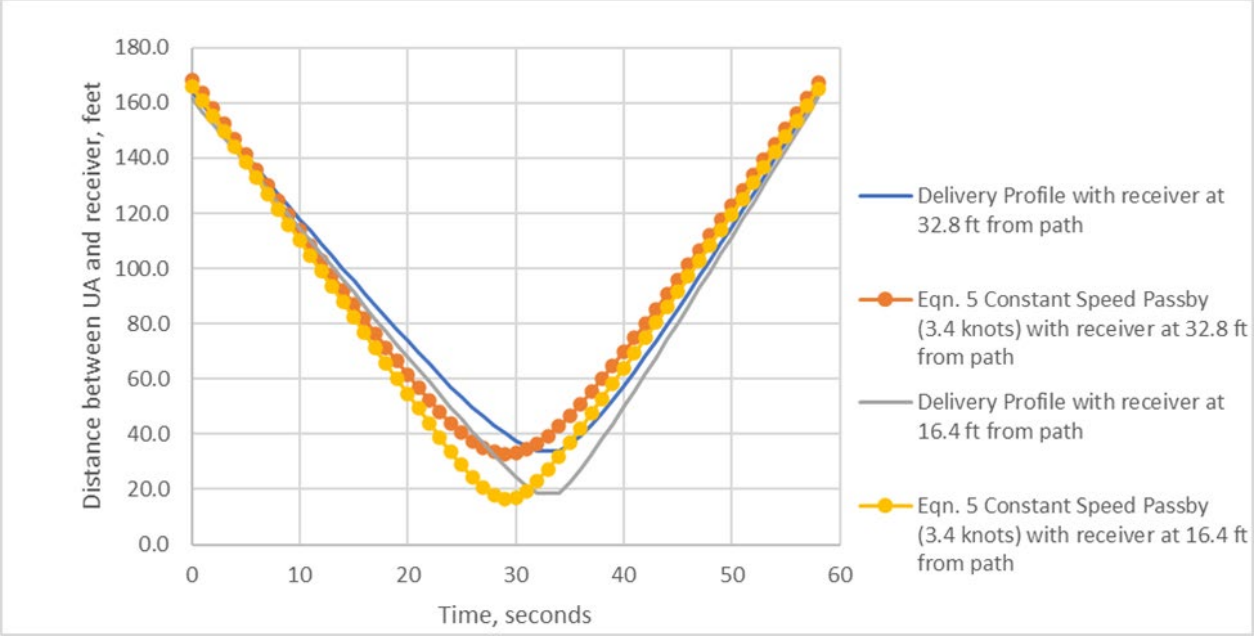

Figure 4: Comparison of Distance versus Time from a Receiver

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

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

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

3.3.6 Landing

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

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

3.4 Proposed DNL/CNEL Estimation Methodology

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

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

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

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

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

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

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

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

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

3.4.1 DNL/CNEL for PADDC

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

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

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

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

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

3.4.2 DNL/CNEL for En Route

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

3.4.3 DNL/CNEL for Delivery Points

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

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

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

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4 Noise Exposure Estimate Results

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

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

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

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

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

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

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

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

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

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

4.1 Noise Exposure for Operations at the PADDC

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

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

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

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

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

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

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

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

4.2 Noise Exposure under En Route Paths

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

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

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

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

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

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

Table 9. Estimated Noise Exposure Directly Under Overflights

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

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

4.3 Noise Exposure for Operations at Delivery Point

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

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

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

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

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

Attachment A

Federal Aviation Administration

Date: August 4, 2022

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

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

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

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

1. Flight Profile and Segment Noise

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

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

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

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

1.1 Transition Noise

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

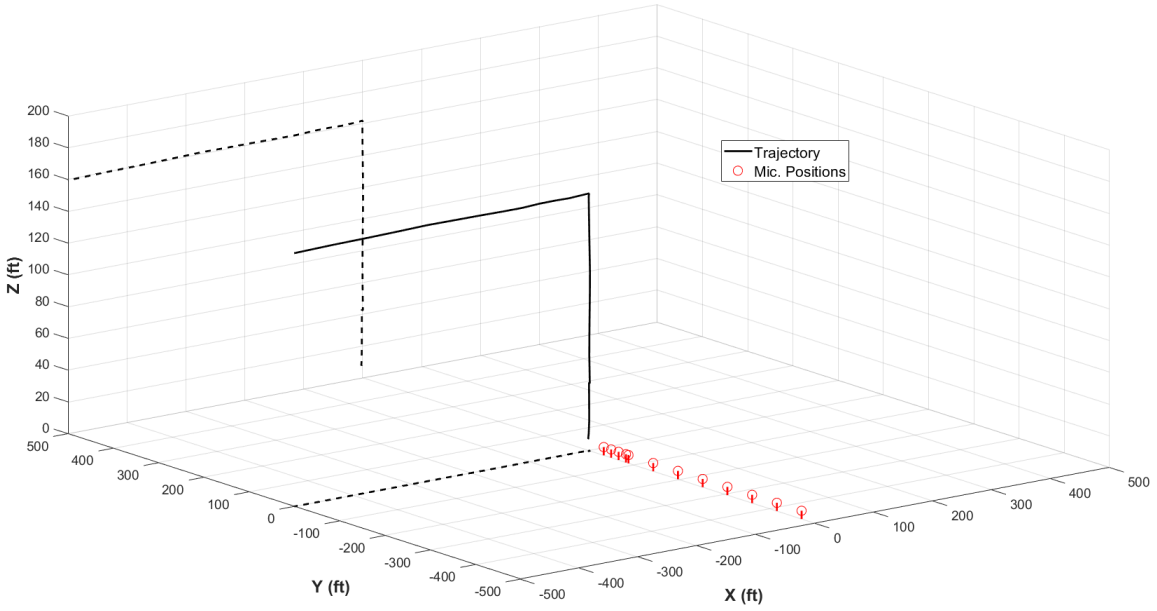


Figure 1. Microphone locations for takeoff, delivery, and landing measurements for MK27-2 UA with example takeoff trajectory.

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

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

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

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

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

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

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

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

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

Distance from PADDC (ft)	Sound Exposure Level (dBA)[1]
0	69.9
100	70.6
200	70.3
400	69.4
800	68.2
1600	67.7
3200	67.7

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

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

1.2 Takeoff and Landing Noise

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

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

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

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

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

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

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

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

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

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

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

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

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

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

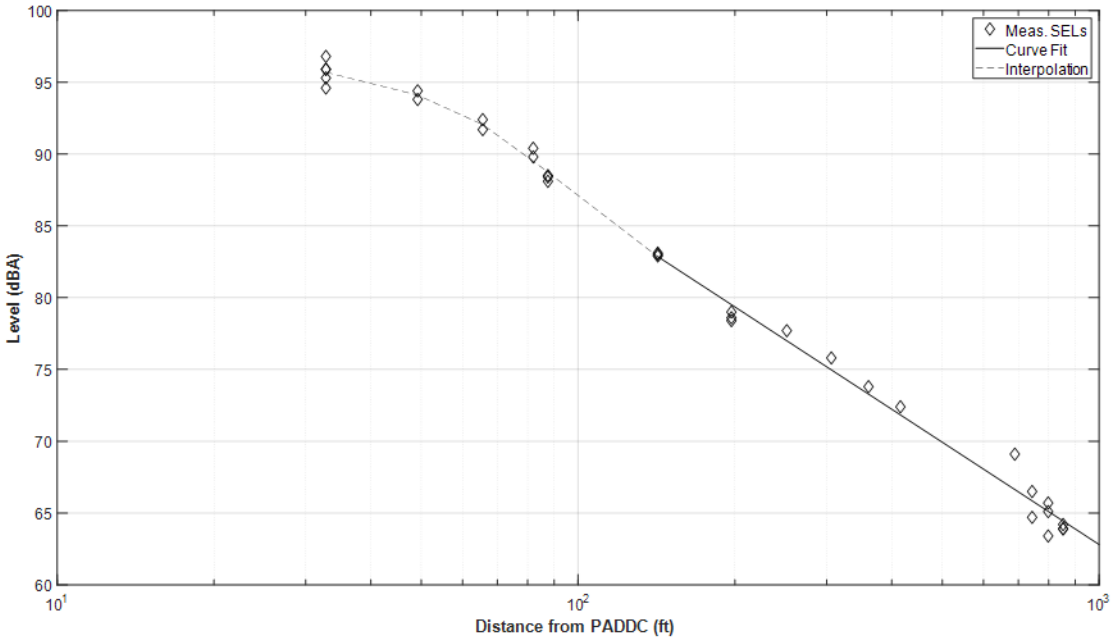


Figure 2. Measured sound exposure levels during takeoffs as described in Table 4.

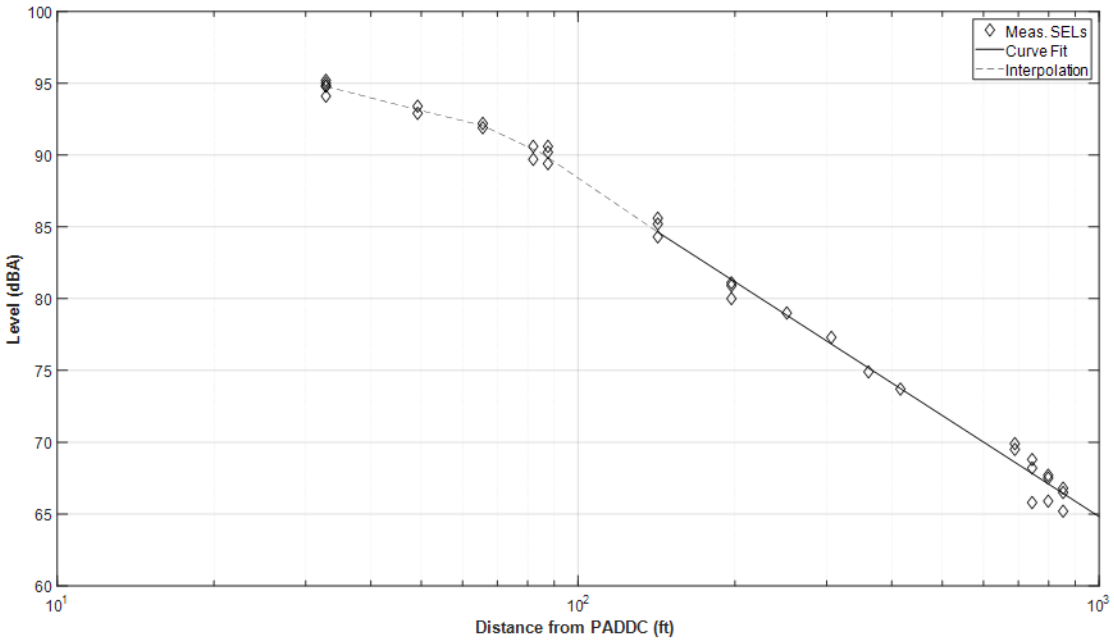


Figure 3. Measured sound exposure levels during landings as described in Table 4.

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

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

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

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

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

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

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

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

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

1.3 En Route Noise

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

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

Table 9. Average Sound Exposure Levels Measured During Level Overflights

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

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

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

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

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

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

1.4 Delivery Noise

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

Table 10. MK27-2 UA Delivery Profile Details

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

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

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

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

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

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

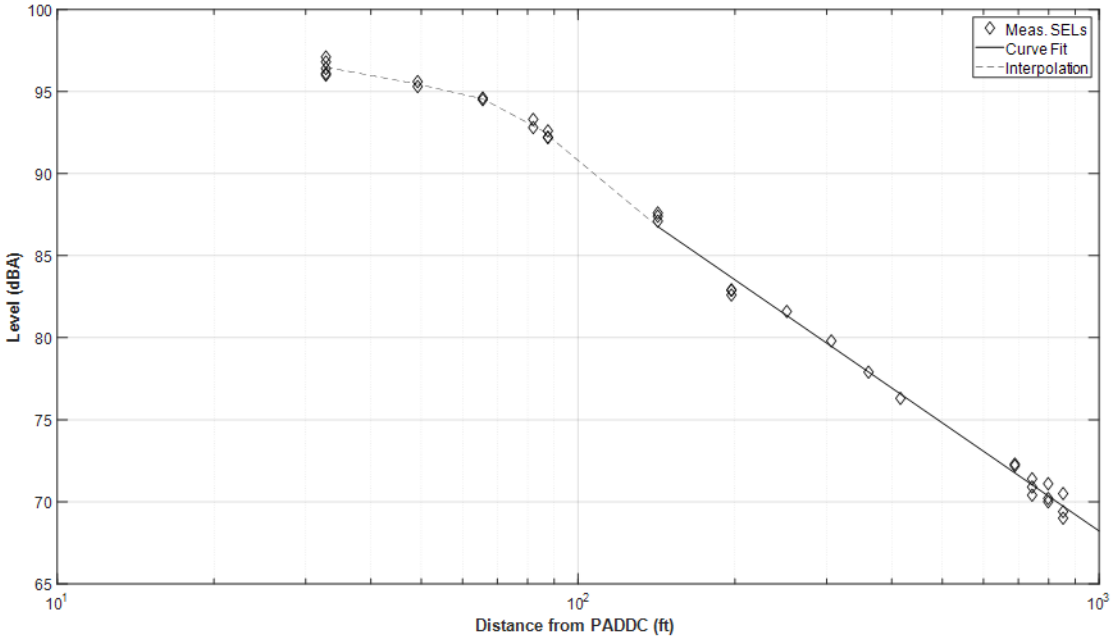


Figure 4. Measured Sound Exposure Levels during deliveries as described in Table 10.

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

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

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

2. Analysis

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

3. Conclusion

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

Appendix D

Non-Standard Noise Methodology Memos

Federal Aviation Administration

Memorandum

Date: 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)

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.

Appendix E

EJSCREEN Report

EJScreen Report (Version 2.0)

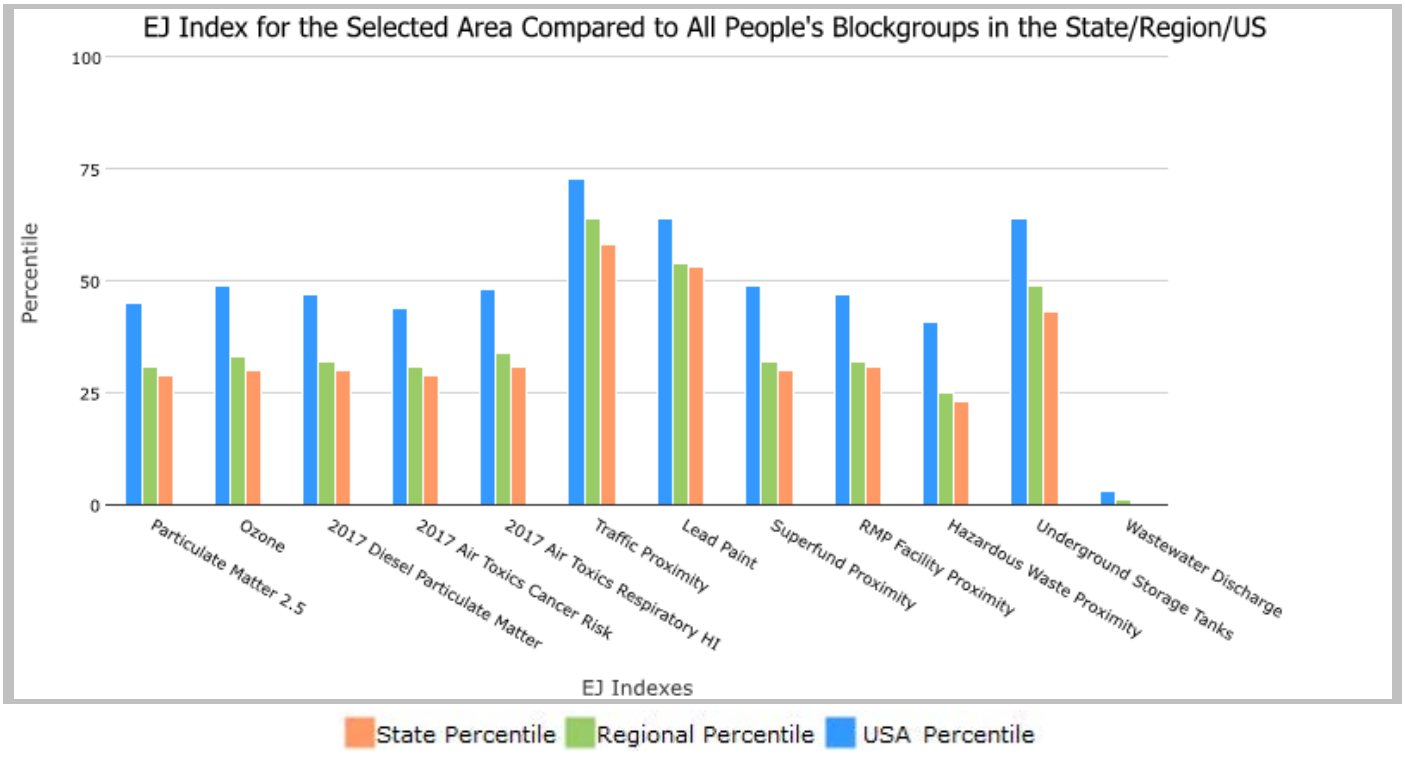
the User Specified Area, TEXAS, EPA Region 6

Approximate Population: 101,719

Input Area (sq. miles): 43.48

College Station-3.73 mile radius

Selected Variables	State Percentile	EPA Region Percentile	USA Percentile
Environmental Justice Indexes			
EJ Index for Particulate Matter 2.5	29	31	45
EJ Index for Ozone	30	33	49
EJ Index for 2017 Diesel Particulate Matter*	30	32	47
EJ Index for 2017 Air Toxics Cancer Risk*	29	31	44
EJ Index for 2017 Air Toxics Respiratory HI*	31	34	48
EJ Index for Traffic Proximity	58	64	73
EJ Index for Lead Paint	53	54	64
EJ Index for Superfund Proximity	30	32	49
EJ Index for RMP Facility Proximity	31	32	47
EJ Index for Hazardous Waste Proximity	23	25	41
EJ Index for Underground Storage Tanks	43	49	64
EJ Index for Wastewater Discharge	0	1	3



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

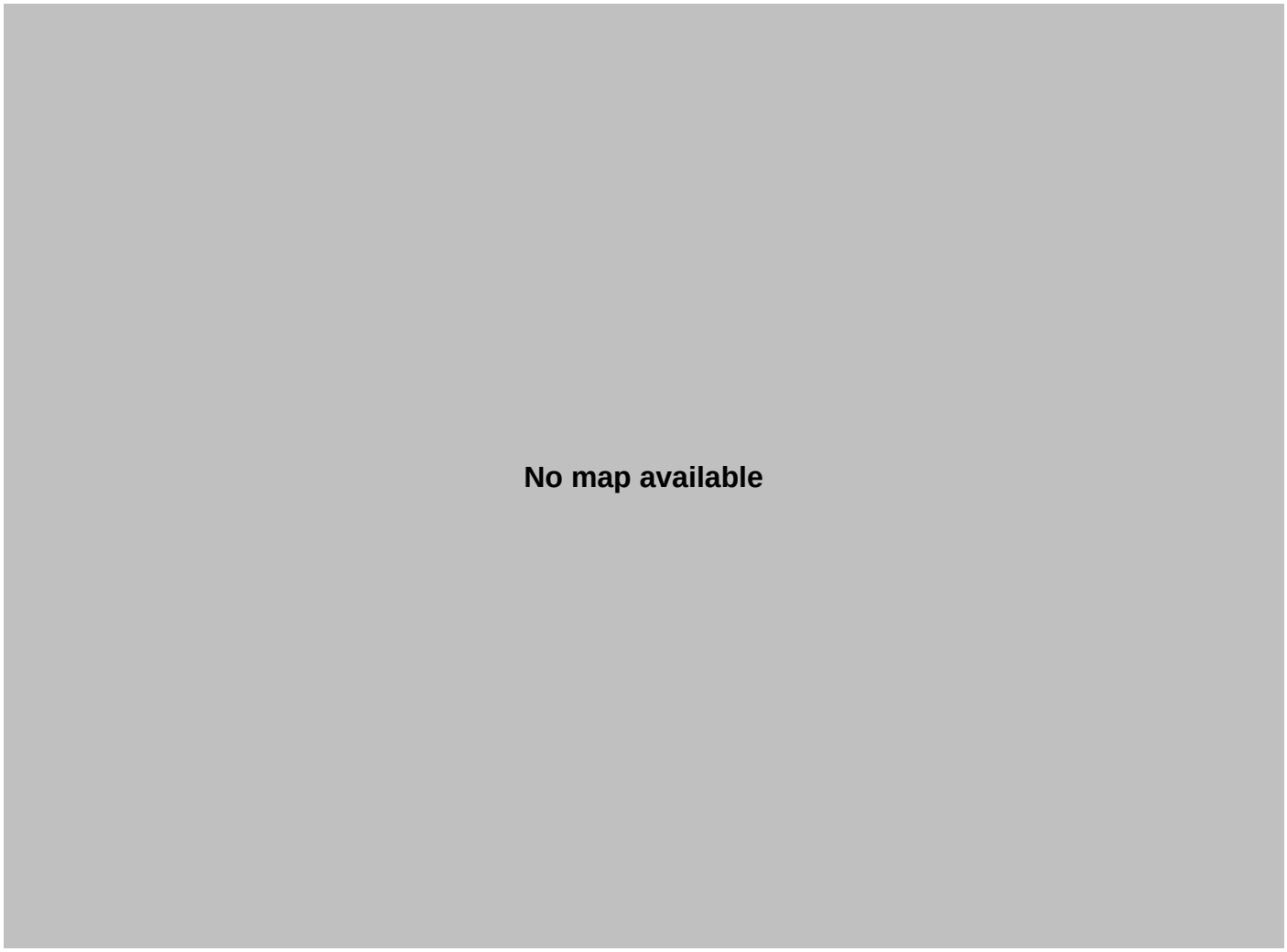
EJScreen Report (Version 2.0)

the User Specified Area, TEXAS, EPA Region 6

Approximate Population: 101,719

Input Area (sq. miles): 43.48

College Station-3.73 mile radius



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

EJScreen Report (Version 2.0)

the User Specified Area, TEXAS, EPA Region 6

Approximate Population: 101,719

Input Area (sq. miles): 43.48

College Station-3.73 mile radius

Selected Variables	Value	State Avg.	%ile in State	EPA Region Avg.	%ile in EPA Region	USA Avg.	%ile in USA
Pollution and Sources							
Particulate Matter 2.5 (µg/m^3)	9.56	9.57	39	9.32	48	8.74	76
Ozone (ppb)	37.1	40	29	41.1	24	42.6	17
2017 Diesel Particulate Matter* (µg/m^3)	0.233	0.214	58	0.219	50-60th	0.295	<50th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	30	31	83	32	70-80th	29	80-90th
2017 Air Toxics Respiratory HI*	0.31	0.36	48	0.37	<50th	0.36	50-60th
Traffic Proximity (daily traffic count/distance to road)	540	510	75	470	77	710	70
Lead Paint (% Pre-1960 Housing)	0.035	0.15	47	0.16	40	0.28	24
Superfund Proximity (site count/km distance)	0.022	0.084	28	0.08	30	0.13	19
RMP Facility Proximity (facility count/km distance)	0.6	0.92	55	0.83	59	0.75	63
Hazardous Waste Proximity (facility count/km distance)	0.19	0.72	39	0.8	40	2.2	29
Underground Storage Tanks (count/km^2)	2.2	2.2	64	2	67	3.9	61
Wastewater Discharge (toxicity-weighted concentration/m distance)	1.1	0.33	98	0.5	97	12	93
Socioeconomic Indicators							
Demographic Index	39%	46%	42	44%	47	36%	62
People of Color	35%	58%	26	52%	35	40%	53
Low Income	46%	34%	69	36%	68	31%	76
Unemployment Rate	4%	5%	45	5%	44	5%	45
Linguistically Isolated	4%	8%	51	6%	60	5%	68
Less Than High School Education	6%	16%	29	15%	27	12%	35
Under Age 5	5%	7%	35	7%	37	6%	46
Over Age 64	7%	12%	27	13%	22	16%	14

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

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

EJSCREEN ACS Summary Report

Location: User-specified polygonal location
Ring (buffer): 0-miles radius
Description: College Station-3.73 mile radius

Summary of ACS Estimates	2015 - 2019
Population	101,719
Population Density (per sq. mile)	2,446
People of Color Population	35,992
% People of Color Population	35%
Households	36,160
Housing Units	41,346
Housing Units Built Before 1950	569
Per Capita Income	28,086
Land Area (sq. miles) (Source: SF1)	41.59
% Land Area	100%
Water Area (sq. miles) (Source: SF1)	0.09
% Water Area	0%

	2015 - 2019 ACS Estimates	Percent	MOE (±)
Population by Race			
Total	101,719	100%	846
Population Reporting One Race	98,917	97%	2,121
White	79,930	79%	786
Black	7,546	7%	358
American Indian	302	0%	110
Asian	9,735	10%	379
Pacific Islander	36	0%	44
Some Other Race	1,369	1%	444
Population Reporting Two or More Races	2,802	3%	183
Total Hispanic Population	16,750	16%	546
Total Non-Hispanic Population	84,969		
White Alone	65,727	65%	698
Black Alone	7,189	7%	358
American Indian Alone	245	0%	110
Non-Hispanic Asian Alone	9,666	10%	404
Pacific Islander Alone	36	0%	44
Other Race Alone	166	0%	73
Two or More Races Alone	1,940	2%	183
Population by Sex			
Male	52,032	51%	660
Female	49,687	49%	481
Population by Age			
Age 0-4	5,406	5%	191
Age 0-17	16,923	17%	325
Age 18+	84,795	83%	709
Age 65+	7,111	7%	193

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

EJSCREEN ACS Summary Report

Location: User-specified polygonal location
Ring (buffer): 0-miles radius
Description: College Station-3.73 mile radius

	2015 - 2019 ACS Estimates	Percent	MOE (±)
Population 25+ by Educational Attainment			
Total	46,422	100%	441
Less than 9th Grade	979	2%	115
9th - 12th Grade, No Diploma	1,777	4%	133
High School Graduate	5,528	12%	220
Some College, No Degree	8,155	18%	335
Associate Degree	3,534	8%	211
Bachelor's Degree or more	26,450	57%	331
Population Age 5+ Years by Ability to Speak English			
Total	96,313	100%	829
Speak only English	76,083	79%	697
Non-English at Home[1+2+3+4]	20,230	21%	393
[1]Speak English "very well"	14,012	15%	278
[2]Speak English "well"	4,388	5%	237
[3]Speak English "not well"	1,534	2%	194
[4]Speak English "not at all"	296	0%	133
[3+4]Speak English "less than well"	1,830	2%	206
[2+3+4]Speak English "less than very well"	6,218	6%	247
Linguistically Isolated Households*			
Total	1,480	100%	112
Speak Spanish	304	21%	75
Speak Other Indo-European Languages	82	6%	37
Speak Asian-Pacific Island Languages	980	66%	108
Speak Other Languages	113	8%	69
Households by Household Income			
Household Income Base	36,160	100%	254
< $15,000	7,421	21%	216
$15,000 - $25,000	4,013	11%	204
$25,000 - $50,000	7,397	20%	219
$50,000 - $75,000	4,649	13%	148
$75,000 +	12,679	35%	315
Occupied Housing Units by Tenure			
Total	36,160	100%	254
Owner Occupied	13,896	38%	217
Renter Occupied	22,263	62%	254
Employed Population Age 16+ Years			
Total	86,660	100%	713
In Labor Force	52,238	60%	542
Civilian Unemployed in Labor Force	1,947	2%	181
Not In Labor Force	34,422	40%	563

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

EJSCREEN ACS Summary Report

Location: User-specified polygonal location
Ring (buffer): 0-miles radius
Description: College Station-3.73 mile radius

	2015 - 2019 ACS Estimates	Percent	MOE (±)
Population by Language Spoken at Home*			
Total (persons age 5 and above)	93,813	100%	989
English	73,963	79%	876
Spanish	8,526	9%	443
French	197	0%	212
French Creole	N/A	N/A	N/A
Italian	N/A	N/A	N/A
Portuguese	N/A	N/A	N/A
German	365	0%	140
Yiddish	N/A	N/A	N/A
Other West Germanic	N/A	N/A	N/A
Scandinavian	N/A	N/A	N/A
Greek	N/A	N/A	N/A
Russian	N/A	N/A	N/A
Polish	N/A	N/A	N/A
Serbo-Croatian	N/A	N/A	N/A
Other Slavic	N/A	N/A	N/A
Armenian	N/A	N/A	N/A
Persian	N/A	N/A	N/A
Gujarathi	N/A	N/A	N/A
Hindi	N/A	N/A	N/A
Urdu	N/A	N/A	N/A
Other Indic	N/A	N/A	N/A
Other Indo-European	2,654	3%	279
Chinese	3,383	4%	322
Japanese	N/A	N/A	N/A
Korean	1,329	1%	243
Mon-Khmer, Cambodian	N/A	N/A	N/A
Hmong	N/A	N/A	N/A
Thai	N/A	N/A	N/A
Laotian	N/A	N/A	N/A
Vietnamese	394	0%	85
Other Asian	1,268	1%	172
Tagalog	360	0%	126
Other Pacific Island	N/A	N/A	N/A
Navajo	N/A	N/A	N/A
Other Native American	N/A	N/A	N/A
Hungarian	N/A	N/A	N/A
Arabic	515	1%	214
Hebrew	N/A	N/A	N/A
African	N/A	N/A	N/A
Other and non-specified	418	0%	199
Total Non-English	19,850	21%	1,321

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

Appendix F

AEDT Census Block Group Data

College Station Operating Area Block Group ACS 2020 5-Year Estimate Data

State	County	Block Group/Census Tract	Population Total	Population Minority	Percent Minority	Population Low-Income	Percent Low-income
TX	Brazos County	Block Group 3, Census Tract 13.02, Brazos County, Texas	948	733	77.3	468	50.5
TX	Brazos County	Block Group 2, Census Tract 16.05, Brazos County, Texas	2575	1890	73.4	687	26.7
TX	Brazos County	Block Group 4, Census Tract 13.02, Brazos County, Texas	1050	734	69.9	343	36
TX	Brazos County	Block Group 1, Census Tract 16.08, Brazos County, Texas	610	397	65.1	425	69.7
TX	Brazos County	Block Group 1, Census Tract 20.23, Brazos County, Texas	446	286	64.1	231	51.8
TX	Brazos County	Block Group 1, Census Tract 13.01, Brazos County, Texas	1724	1094	63.5	705	40.9
TX	Brazos County	Block Group 5, Census Tract 16.04, Brazos County, Texas	952	592	62.2	187	19.6
TX	Brazos County	Block Group 1, Census Tract 20.24, Brazos County, Texas	866	521	60.2	497	57.4
TX	Brazos County	Block Group 2, Census Tract 16.06, Brazos County, Texas	1930	1159	60.1	913	49.8
TX	Brazos County	Block Group 1, Census Tract 20.19, Brazos County, Texas	1696	994	58.6	21	1.2
TX	Brazos County	Block Group 2, Census Tract 17.04, Brazos County, Texas	993	552	55.6	219	22.1
TX	Brazos County	Block Group 2, Census Tract 13.03, Brazos County, Texas	1200	650	54.2	624	52
TX	Brazos County	Block Group 1, Census Tract 17.03, Brazos County, Texas	1532	828	54	561	36.6
TX	Brazos County	Block Group 4, Census Tract 16.04, Brazos County, Texas	1151	580	50.4	114	9.9
TX	Brazos County	Block Group 1, Census Tract 18.03, Brazos County, Texas	3007	1495	49.7	518	17.2
TX	Brazos County	Block Group 1, Census Tract 18.04, Brazos County, Texas	1717	835	48.6	507	30.1
TX	Brazos County	Block Group 1, Census Tract 17.04, Brazos County, Texas	1123	545	48.5	419	37.3
TX	Brazos County	Block Group 1, Census Tract 18.01, Brazos County, Texas	3539	1686	47.6	577	16.3
TX	Brazos County	Block Group 2, Census Tract 17.02, Brazos County, Texas	1420	675	47.5	571	40.2
TX	Brazos County	Block Group 1, Census Tract 17.02, Brazos County, Texas	1491	702	47.1	864	57.9
TX	Brazos County	Block Group 3, Census Tract 16.04, Brazos County, Texas	1558	716	46	492	31.6
TX	Brazos County	Block Group 3, Census Tract 17.03, Brazos County, Texas	1399	639	45.7	865	61.8
TX	Brazos County	Block Group 2, Census Tract 20.26, Brazos County, Texas	4539	1996	44	343	7.6
TX	Brazos County	Block Group 1, Census Tract 16.07, Brazos County, Texas	1813	778	42.9	573	31.6
TX	Brazos County	Block Group 3, Census Tract 21, Brazos County, Texas	10016	4091	40.8	434	64.7
TX	Brazos County	Block Group 1, Census Tract 20.26, Brazos County, Texas	1344	528	39.3	0	0
TX	Brazos County	Block Group 3, Census Tract 13.03, Brazos County, Texas	1153	445	38.6	236	36.4
TX	Brazos County	Block Group 2, Census Tract 20.23, Brazos County, Texas	2309	863	37.4	1906	82.5
TX	Brazos County	Block Group 2, Census Tract 20.19, Brazos County, Texas	2892	1058	36.6	198	6.8
TX	Brazos County	Block Group 1, Census Tract 20.16, Brazos County, Texas	2520	902	35.8	532	21.1
TX	Brazos County	Block Group 2, Census Tract 13.01, Brazos County, Texas	947	333	35.2	435	45.9
TX	Brazos County	Block Group 4, Census Tract 13.03, Brazos County, Texas	1147	399	34.8	594	51.8
TX	Brazos County	Block Group 2, Census Tract 17.03, Brazos County, Texas	1017	345	33.9	506	49.8
TX	Brazos County	Block Group 1, Census Tract 20.17, Brazos County, Texas	1521	514	33.8	678	74.4
TX	Brazos County	Block Group 2, Census Tract 18.03, Brazos County, Texas	2335	789	33.8	205	9.4
TX	Brazos County	Block Group 1, Census Tract 16.06, Brazos County, Texas	1210	400	33.1	404	33.4
TX	Brazos County	Block Group 1, Census Tract 20.06, Brazos County, Texas	1512	476	31.5	141	9.3
TX	Brazos County	Block Group 2, Census Tract 20.11, Brazos County, Texas	4236	1308	30.9	108	2.5
TX	Brazos County	Block Group 2, Census Tract 20.24, Brazos County, Texas	1599	487	30.5	1283	80.2
TX	Brazos County	Block Group 1, Census Tract 20.20, Brazos County, Texas	681	208	30.5	196	28.8
TX	Brazos County	Block Group 2, Census Tract 20.25, Brazos County, Texas	2940	895	30.4	107	3.6
TX	Brazos County	Block Group 1, Census Tract 16.05, Brazos County, Texas	1925	585	30.4	570	29.6
TX	Brazos County	Block Group 3, Census Tract 20.09, Brazos County, Texas	809	239	29.5	34	4.2
TX	Brazos County	Block Group 2, Census Tract 20.18, Brazos County, Texas	1979	559	28.2	313	15.8
TX	Brazos County	Block Group 1, Census Tract 13.03, Brazos County, Texas	1604	449	28	718	44.8
TX	Brazos County	Block Group 1, Census Tract 20.18, Brazos County, Texas	1809	500	27.6	280	15.5
TX	Brazos County	Block Group 2, Census Tract 20.22, Brazos County, Texas	1746	456	26.1	55	3.2
TX	Brazos County	Block Group 1, Census Tract 13.02, Brazos County, Texas	2489	636	25.6	591	23.7
TX	Brazos County	Block Group 1, Census Tract 20.01, Brazos County, Texas	3107	789	25.4	263	8.5
TX	Brazos County	Block Group 1, Census Tract 20.21, Brazos County, Texas	2592	658	25.4	1626	62.7
TX	Brazos County	Block Group 1, Census Tract 20.09, Brazos County, Texas	1506	352	23.4	33	2.2
TX	Brazos County	Block Group 2, Census Tract 20.09, Brazos County, Texas	2735	625	22.9	20	0.7
TX	Brazos County	Block Group 2, Census Tract 20.14, Brazos County, Texas	1938	442	22.8	1363	70.3
TX	Brazos County	Block Group 2, Census Tract 20.21, Brazos County, Texas	2572	575	22.4	383	14.9
TX	Brazos County	Block Group 2, Census Tract 13.02, Brazos County, Texas	656	147	22.4	166	25.3
TX	Brazos County	Block Group 3, Census Tract 18.01, Brazos County, Texas	1466	269	18.3	213	14.5
TX	Brazos County	Block Group 2, Census Tract 20.16, Brazos County, Texas	992	180	18.1	15	1.6
TX	Brazos County	Block Group 2, Census Tract 20.10, Brazos County, Texas	2023	332	16.4	73	3.6
TX	Brazos County	Block Group 1, Census Tract 20.25, Brazos County, Texas	2372	328	13.8	45	1.9
TX	Brazos County	Block Group 3, Census Tract 1.06, Brazos County, Texas	1359	181	13.3	0	0
TX	Brazos County	Block Group 3, Census Tract 18.03, Brazos County, Texas	1599	195	12.2	505	31.6
TX	Brazos County	Block Group 2, Census Tract 20.01, Brazos County, Texas	2213	263	11.9	87	3.9
TX	Brazos County	Block Group 1, Census Tract 16.04, Brazos County, Texas	1206	142	11.8	979	81.2
TX	Brazos County	Block Group 2, Census Tract 18.01, Brazos County, Texas	1201	132	11	147	12.2
TX	Brazos County	Block Group 2, Census Tract 16.08, Brazos County, Texas	1679	105	6.3	837	49.9
TX	Brazos County	Block Group 2, Census Tract 20.20, Brazos County, Texas	1634	64	3.9	100	6.1
TX	Brazos County	Block Group 2, Census Tract 16.04, Brazos County, Texas	707	25	3.5	207	29.3
			124576	**44346**	**36.17462687**	**29310**	**30.05373134**

Brazos County Block Group ACS 2020 5-Year Estimate Data

State	County	Block Group/Census Tract	Population Total	Population Minority	Percent Minority	Population Low-Income	Percent Low-income
TX	Brazos County	Block Group 2, Census Tract 6.06, Brazos County, Texas	771	724	93.9	68	8.8
TX	Brazos County	Block Group 2, Census Tract 20.10, Brazos County, Texas	2023	332	16.4	73	3.6
TX	Brazos County	Block Group 3, Census Tract 13.03, Brazos County, Texas	1153	445	38.6	236	36.4
TX	Brazos County	Block Group 3, Census Tract 21, Brazos County, Texas	10016	4091	40.8	434	64.7
TX	Brazos County	Block Group 3, Census Tract 11.01, Brazos County, Texas	784	50	6.4	157	20
TX	Brazos County	Block Group 5, Census Tract 2.04, Brazos County, Texas	1519	1003	66	886	58.3
TX	Brazos County	Block Group 1, Census Tract 1.07, Brazos County, Texas	1988	447	22.5	68	3.4
TX	Brazos County	Block Group 4, Census Tract 13.02, Brazos County, Texas	1050	734	69.9	343	36
TX	Brazos County	Block Group 2, Census Tract 20.18, Brazos County, Texas	1979	559	28.2	313	15.8
TX	Brazos County	Block Group 1, Census Tract 20.01, Brazos County, Texas	3107	789	25.4	263	8.5
TX	Brazos County	Block Group 2, Census Tract 6.03, Brazos County, Texas	975	920	94.4	374	38.4
TX	Brazos County	Block Group 1, Census Tract 6.05, Brazos County, Texas	547	547	100	180	32.9
TX	Brazos County	Block Group 2, Census Tract 17.04, Brazos County, Texas	993	552	55.6	219	22.1
TX	Brazos County	Block Group 3, Census Tract 13.02, Brazos County, Texas	948	733	77.3	468	50.5
TX	Brazos County	Block Group 2, Census Tract 20.26, Brazos County, Texas	4539	1996	44	343	7.6
TX	Brazos County	Block Group 4, Census Tract 10.02, Brazos County, Texas	1164	595	51.1	617	53
TX	Brazos County	Block Group 2, Census Tract 16.04, Brazos County, Texas	707	25	3.5	207	29.3
TX	Brazos County	Block Group 2, Census Tract 2.04, Brazos County, Texas	408	232	56.9	104	25.5
TX	Brazos County	Block Group 5, Census Tract 16.04, Brazos County, Texas	952	592	62.2	187	19.6
TX	Brazos County	Block Group 2, Census Tract 18.03, Brazos County, Texas	2335	789	33.8	205	9.4
TX	Brazos County	Block Group 1, Census Tract 9, Brazos County, Texas	1143	805	70.4	404	35.3
TX	Brazos County	Block Group 1, Census Tract 7, Brazos County, Texas	876	827	94.4	521	59.5
TX	Brazos County	Block Group 4, Census Tract 6.05, Brazos County, Texas	2206	2063	93.5	569	25.8
TX	Brazos County	Block Group 1, Census Tract 20.20, Brazos County, Texas	681	208	30.5	196	28.8
TX	Brazos County	Block Group 3, Census Tract 10.01, Brazos County, Texas	1552	927	59.7	1013	65.3
TX	Brazos County	Block Group 3, Census Tract 18.01, Brazos County, Texas	1466	269	18.3	213	14.5
TX	Brazos County	Block Group 1, Census Tract 20.24, Brazos County, Texas	866	521	60.2	497	57.4
TX	Brazos County	Block Group 1, Census Tract 13.03, Brazos County, Texas	1604	449	28	718	44.8
TX	Brazos County	Block Group 1, Census Tract 21, Brazos County, Texas	282	82	29.1	41	14.5
TX	Brazos County	Block Group 1, Census Tract 11.01, Brazos County, Texas	875	525	60	239	29.9
TX	Brazos County	Block Group 2, Census Tract 16.08, Brazos County, Texas	1679	105	6.3	837	49.9
TX	Brazos County	Block Group 2, Census Tract 1.06, Brazos County, Texas	733	103	14.1	44	6.1
TX	Brazos County	Block Group 3, Census Tract 2.04, Brazos County, Texas	1131	1018	90	198	17.5
TX	Brazos County	Block Group 2, Census Tract 16.05, Brazos County, Texas	2575	1890	73.4	687	26.7
TX	Brazos County	Block Group 2, Census Tract 9, Brazos County, Texas	1326	1085	81.8	722	54.4
TX	Brazos County	Block Group 3, Census Tract 18.03, Brazos County, Texas	1599	195	12.2	505	31.6
TX	Brazos County	Block Group 1, Census Tract 20.17, Brazos County, Texas	1521	514	33.8	678	74.4
TX	Brazos County	Block Group 2, Census Tract 4.01, Brazos County, Texas	1432	1099	76.7	207	14.5
TX	Brazos County	Block Group 4, Census Tract 7, Brazos County, Texas	881	329	37.3	35	4
TX	Brazos County	Block Group 1, Census Tract 5.02, Brazos County, Texas	896	896	100	165	18.4
TX	Brazos County	Block Group 2, Census Tract 10.02, Brazos County, Texas	274	200	73	134	48.9
TX	Brazos County	Block Group 5, Census Tract 8, Brazos County, Texas	980	636	64.9	117	13.1
TX	Brazos County	Block Group 1, Census Tract 3.02, Brazos County, Texas	2500	1707	68.3	204	8.2
TX	Brazos County	Block Group 2, Census Tract 20.25, Brazos County, Texas	2940	895	30.4	107	3.6
TX	Brazos County	Block Group 1, Census Tract 19.02, Brazos County, Texas	729	278	38.1	0	0
TX	Brazos County	Block Group 1, Census Tract 13.02, Brazos County, Texas	2489	636	25.6	591	23.7
TX	Brazos County	Block Group 3, Census Tract 17.03, Brazos County, Texas	1399	639	45.7	865	61.8
TX	Brazos County	Block Group 1, Census Tract 11.02, Brazos County, Texas	765	255	33.3	235	30.7
TX	Brazos County	Block Group 1, Census Tract 17.02, Brazos County, Texas	1491	702	47.1	864	57.9
TX	Brazos County	Block Group 3, Census Tract 8, Brazos County, Texas	726	191	26.3	145	20
TX	Brazos County	Block Group 2, Census Tract 18.01, Brazos County, Texas	1201	132	11	147	12.2
TX	Brazos County	Block Group 2, Census Tract 20.01, Brazos County, Texas	2213	263	11.9	87	3.9
TX	Brazos County	Block Group 3, Census Tract 20.09, Brazos County, Texas	809	239	29.5	34	4.2
TX	Brazos County	Block Group 3, Census Tract 20.22, Brazos County, Texas	2143	822	38.4	254	11.9
TX	Brazos County	Block Group 1, Census Tract 5.01, Brazos County, Texas	2368	1928	81.4	634	59.5
TX	Brazos County	Block Group 1, Census Tract 17.04, Brazos County, Texas	1123	545	48.5	419	37.3
TX	Brazos County	Block Group 2, Census Tract 19.02, Brazos County, Texas	1066	450	42.2	93	8.7
TX	Brazos County	Block Group 2, Census Tract 20.09, Brazos County, Texas	2735	625	22.9	20	0.7
TX	Brazos County	Block Group 3, Census Tract 10.02, Brazos County, Texas	1299	303	23.3	812	62.5

TX	Brazos County	Block Group 1, Census Tract 10.01, Brazos County, Texas	1059	681	64.3	523	50.3
TX	Brazos County	Block Group 2, Census Tract 1.05, Brazos County, Texas	605	72	11.9	0	0
TX	Brazos County	Block Group 1, Census Tract 16.07, Brazos County, Texas	1813	778	42.9	573	31.6
TX	Brazos County	Block Group 2, Census Tract 17.02, Brazos County, Texas	1420	675	47.5	571	40.2
TX	Brazos County	Block Group 3, Census Tract 16.04, Brazos County, Texas	1558	716	46	492	31.6
TX	Brazos County	Block Group 1, Census Tract 1.08, Brazos County, Texas	839	19	2.3	7	0.8
TX	Brazos County	Block Group 1, Census Tract 18.03, Brazos County, Texas	3007	1495	49.7	518	17.2
TX	Brazos County	Block Group 4, Census Tract 8, Brazos County, Texas	2000	1087	54.4	350	18.5
TX	Brazos County	Block Group 2, Census Tract 7, Brazos County, Texas	1055	853	80.9	163	15.5
TX	Brazos County	Block Group 2, Census Tract 3.02, Brazos County, Texas	1211	732	60.4	0	0
TX	Brazos County	Block Group 1, Census Tract 20.23, Brazos County, Texas	446	286	64.1	231	51.8
TX	Brazos County	Block Group 1, Census Tract 6.06, Brazos County, Texas	1007	894	88.8	331	32.9
TX	Brazos County	Block Group 2, Census Tract 20.14, Brazos County, Texas	1938	442	22.8	1363	70.3
TX	Brazos County	Block Group 2, Census Tract 20.20, Brazos County, Texas	1634	64	3.9	100	6.1
TX	Brazos County	Block Group 4, Census Tract 13.03, Brazos County, Texas	1147	399	34.8	594	51.8
TX	Brazos County	Block Group 1, Census Tract 19.01, Brazos County, Texas	1587	531	33.5	170	10.7
TX	Brazos County	Block Group 2, Census Tract 20.24, Brazos County, Texas	1599	487	30.5	1283	80.2
TX	Brazos County	Block Group 1, Census Tract 20.11, Brazos County, Texas	2033	423	20.8	107	5.3
TX	Brazos County	Block Group 1, Census Tract 3.01, Brazos County, Texas	754	723	95.9	0	0
TX	Brazos County	Block Group 4, Census Tract 10.01, Brazos County, Texas	452	149	33	192	42.5
TX	Brazos County	Block Group 1, Census Tract 16.06, Brazos County, Texas	1210	400	33.1	404	33.4
TX	Brazos County	Block Group 1, Census Tract 17.03, Brazos County, Texas	1532	828	54	561	36.6
TX	Brazos County	Block Group 1, Census Tract 2.05, Brazos County, Texas	1227	584	47.6	219	18.1
TX	Brazos County	Block Group 3, Census Tract 1.06, Brazos County, Texas	1359	181	13.3	0	0
TX	Brazos County	Block Group 1, Census Tract 14.01, Brazos County, Texas	1188	643	54.1	300	65.6
TX	Brazos County	Block Group 1, Census Tract 20.19, Brazos County, Texas	1696	994	58.6	21	1.2
TX	Brazos County	Block Group 1, Census Tract 8, Brazos County, Texas	818	684	83.6	39	4.8
TX	Brazos County	Block Group 1, Census Tract 13.01, Brazos County, Texas	1724	1094	63.5	705	40.9
TX	Brazos County	Block Group 3, Census Tract 4.01, Brazos County, Texas	820	505	61.6	0	0
TX	Brazos County	Block Group 2, Census Tract 6.05, Brazos County, Texas	939	834	88.8	292	31.1
TX	Brazos County	Block Group 3, Census Tract 6.03, Brazos County, Texas	2554	2350	92	947	37.3
TX	Brazos County	Block Group 1, Census Tract 20.22, Brazos County, Texas	1659	388	23.4	111	7.2
TX	Brazos County	Block Group 2, Census Tract 1.04, Brazos County, Texas	1222	610	49.9	85	7.1
TX	Brazos County	Block Group 1, Census Tract 2.06, Brazos County, Texas	1908	1045	54.8	46	2.4
TX	Brazos County	Block Group 2, Census Tract 1.07, Brazos County, Texas	2035	790	38.8	70	3.4
TX	Brazos County	Block Group 2, Census Tract 2.03, Brazos County, Texas	1211	461	38.1	39	3.2
TX	Brazos County	Block Group 1, Census Tract 1.05, Brazos County, Texas	2331	456	19.6	123	5.3
TX	Brazos County	Block Group 1, Census Tract 20.14, Brazos County, Texas	742	67	9	0	0
TX	Brazos County	Block Group 1, Census Tract 1.03, Brazos County, Texas	1814	557	30.7	246	13.6
TX	Brazos County	Block Group 2, Census Tract 20.21, Brazos County, Texas	2572	575	22.4	383	14.9
TX	Brazos County	Block Group 2, Census Tract 2.07, Brazos County, Texas	1657	564	34	125	7.6
TX	Brazos County	Block Group 2, Census Tract 20.16, Brazos County, Texas	992	180	18.1	15	1.6
TX	Brazos County	Block Group 1, Census Tract 4.01, Brazos County, Texas	1579	1538	97.4	885	56.7
TX	Brazos County	Block Group 3, Census Tract 5.01, Brazos County, Texas	1796	1796	100	705	39.3
TX	Brazos County	Block Group 3, Census Tract 19.02, Brazos County, Texas	1309	441	33.7	136	10.4
TX	Brazos County	Block Group 1, Census Tract 20.09, Brazos County, Texas	1506	352	23.4	33	2.2
TX	Brazos County	Block Group 3, Census Tract 2.05, Brazos County, Texas	1957	1156	59.1	20	2.9
TX	Brazos County	Block Group 2, Census Tract 20.23, Brazos County, Texas	2309	863	37.4	1906	82.5
TX	Brazos County	Block Group 1, Census Tract 4.02, Brazos County, Texas	1245	840	67.5	216	17.3
TX	Brazos County	Block Group 2, Census Tract 13.01, Brazos County, Texas	947	333	35.2	435	45.9
TX	Brazos County	Block Group 1, Census Tract 18.01, Brazos County, Texas	3539	1686	47.6	577	16.3
TX	Brazos County	Block Group 1, Census Tract 2.03, Brazos County, Texas	1252	677	54.1	42	3.4
TX	Brazos County	Block Group 1, Census Tract 10.02, Brazos County, Texas	1136	375	33	154	13.6
TX	Brazos County	Block Group 2, Census Tract 19.01, Brazos County, Texas	1395	355	25.4	383	28.4
TX	Brazos County	Block Group 1, Census Tract 1.04, Brazos County, Texas	864	360	41.7	134	15.5
TX	Brazos County	Block Group 1, Census Tract 20.25, Brazos County, Texas	2372	328	13.8	45	1.9
TX	Brazos County	Block Group 2, Census Tract 5.02, Brazos County, Texas	1001	969	96.8	593	59.2
TX	Brazos County	Block Group 1, Census Tract 20.21, Brazos County, Texas	2592	658	25.4	1626	62.7
TX	Brazos County	Block Group 1, Census Tract 6.03, Brazos County, Texas	1021	537	52.6	148	14.5
TX	Brazos County	Block Group 3, Census Tract 7, Brazos County, Texas	566	353	62.4	57	10.1
TX	Brazos County	Block Group 1, Census Tract 18.04, Brazos County, Texas	1717	835	48.6	507	30.1
TX	Brazos County	Block Group 1, Census Tract 20.18, Brazos County, Texas	1809	500	27.6	280	15.5
TX	Brazos County	Block Group 2, Census Tract 11.02, Brazos County, Texas	700	437	62.4	46	6.6
TX	Brazos County	Block Group 1, Census Tract 16.08, Brazos County, Texas	610	397	65.1	425	69.7
TX	Brazos County	Block Group 1, Census Tract 16.05, Brazos County, Texas	1925	585	30.4	570	29.6

TX	Brazos County	Block Group 1, Census Tract 1.06, Brazos County, Texas	573	148	25.8	66	11.9
TX	Brazos County	Block Group 2, Census Tract 11.01, Brazos County, Texas	1273	363	28.5	100	7.9
TX	Brazos County	Block Group 4, Census Tract 2.04, Brazos County, Texas	680	613	90.1	320	47.1
TX	Brazos County	Block Group 2, Census Tract 21, Brazos County, Texas	855	702	82.1	506	59.5
TX	Brazos County	Block Group 1, Census Tract 20.10, Brazos County, Texas	1517	346	22.8	0	0
TX	Brazos County	Block Group 2, Census Tract 13.03, Brazos County, Texas	1200	650	54.2	624	52
TX	Brazos County	Block Group 2, Census Tract 10.01, Brazos County, Texas	306	98	32	194	63.4
TX	Brazos County	Block Group 1, Census Tract 2.07, Brazos County, Texas	553	300	54.2	124	22.4
TX	Brazos County	Block Group 4, Census Tract 6.03, Brazos County, Texas	1694	1567	92.5	175	10.3
TX	Brazos County	Block Group 3, Census Tract 6.05, Brazos County, Texas	1486	1166	78.5	719	48.4
TX	Brazos County	Block Group 2, Census Tract 20.22, Brazos County, Texas	1746	456	26.1	55	3.2
TX	Brazos County	Block Group 1, Census Tract 20.16, Brazos County, Texas	2520	902	35.8	532	21.1
TX	Brazos County	Block Group 2, Census Tract 8, Brazos County, Texas	1017	80	7.9	18	1.8
TX	Brazos County	Block Group 2, Census Tract 5.01, Brazos County, Texas	1402	1349	96.2	799	57
TX	Brazos County	Block Group 2, Census Tract 20.19, Brazos County, Texas	2892	1058	36.6	198	6.8
TX	Brazos County	Block Group 4, Census Tract 16.04, Brazos County, Texas	1151	580	50.4	114	9.9
TX	Brazos County	Block Group 2, Census Tract 16.06, Brazos County, Texas	1930	1159	60.1	913	49.8
TX	Brazos County	Block Group 1, Census Tract 2.04, Brazos County, Texas	596	350	58.7	14	2.3
TX	Brazos County	Block Group 2, Census Tract 17.03, Brazos County, Texas	1017	345	33.9	506	49.8
TX	Brazos County	Block Group 1, Census Tract 20.06, Brazos County, Texas	1512	476	31.5	141	9.3
TX	Brazos County	Block Group 2, Census Tract 13.02, Brazos County, Texas	656	147	22.4	166	25.3
TX	Brazos County	Block Group 3, Census Tract 1.04, Brazos County, Texas	1860	627	33.7	161	8.8
TX	Brazos County	Block Group 2, Census Tract 2.05, Brazos County, Texas	711	291	40.9	151	21.2
TX	Brazos County	Block Group 2, Census Tract 3.01, Brazos County, Texas	2384	1810	75.9	459	19.3
TX	Brazos County	Block Group 1, Census Tract 20.26, Brazos County, Texas	1344	528	39.3	0	0
TX	Brazos County	Block Group 2, Census Tract 20.11, Brazos County, Texas	4236	1308	30.9	108	2.5
TX	Brazos County	Block Group 1, Census Tract 16.04, Brazos County, Texas	1206	142	11.8	979	81.2
			226370	**101739**	**46.9483444**	**50360**	**25.86092715**

Appendix G

Acronyms and Abbreviations

Appendix G: Acronyms and Abbreviations

ACS - American Community Survey

AEDT - Aviation Environmental Design Tool

AGL - Above Ground Level

APE - Area of Potential Effects

BCC - Birds of Conservation Concern

BVLOS - Beyond Visual Line of Sight

CEQ - Council on Environmental Quality

CFR - Code of Federal Regulations

COA - Certificate of Waiver or Authorization

CZMP - Coastal Zone Management Plan

dB - Decibel

DNL - Day-Night Average Sound Level

DOT - Department of Transportation

EA - Environmental Assessment

EJSCREEN - Environmental Justice Screening and Mapping Tool

EO - Executive Order

EPA - Environmental Protection Agency

ESA - Endangered Species Act

FAA - Federal Aviation Administration

FEMA - Federal Emergency Management Agency

FHWA - Federal Highway Administration

IPaC - Information for Planning and Consultation

NAS - National Airspace System

NEPA - National Environmental Policy Act

NHPA - National Historic Preservation Act

NMFS - National Marine Fisheries Service

NOA - Notice of Availability

NOAA - National Oceanic and Atmospheric Administration

NPDES - National Pollutant Discharge Elimination System

NRHP - National Register of Historic Places

NRI - Nationwide Rivers Inventory

NTSB - National Transportation Safety Board

OpSpecs - Operations Specifications

PADDC - Prime Air Drone Delivery Center

Prime Air - Amazon Prime Air

PSP - Partnership for Safety Program

SE - Listed as Endangered by the State of Texas

ST - Listed as Threatened by the State of Texas

SR - Listed as Rare by the State of Texas

SHPO - State Historic Preservation Office(r)

THPO - Tribal Historic Preservation Office(r)

TCEQ - Texas Commission on Environmental Quality

U.S.C - United States Code

UA - Unmanned Aircraft

UAS - Unmanned Aircraft Systems

USFWS - United States Fish and Wildlife Service

VOs - Visual Observers

WSRS - National Wild and Scenic Rivers System