AMAZON PRIME AIR AMENDMENT TO OPERATIONS SPECIFICATIONS (OPSPECS)

Written Re-evaluation of the 2022 Final Environmental Assessment and Finding of No Significant Impact/Record of Decision for Amazon Prime Air Drone Package Delivery Test Operations in Pendleton, Oregon

August 2025

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CHAPTER 1

Introduction and Background

1.1 Introduction

This written re-evaluation (WR) evaluates whether supplemental environmental analysis is needed to support the Federal Aviation Administration (FAA) Office of Safety Standards, Flight Standards Service decision to amend Amazon Prime Air's (Prime Air) OpSpecs to allow for the use of their MK30 drone for testing and training operations in the Pendleton Unmanned Aircraft Systems (UAS) Test Range (PUR) in Pendleton, Oregon.

The FAA's issuance of an amended OpSpecs is a major federal action subject to the requirements of the National Environmental Policy Act of 1969 (NEPA). As such, the FAA must assess the potential environmental impacts of issuing the amended OpSpecs. FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures,* provides that the FAA may prepare a WR to determine whether the contents of a previously prepared environmental document remain substantially valid or whether significant changes to a previously analyzed proposed action require the preparation of a supplemental environmental assessment (EA) or environmental impact statement (EIS).[1] The affected environment and environmental impacts of Prime Air's drone operations at the Pendleton UAS Test Range were analyzed in the 2022 *Final Environmental Assessment for Amazon Prime Air Drone Package Delivery Test Operations in Pendleton, Oregon* (2022 EA).[2] The FAA's Finding of No Significant Impact (FONSI) and Record of Decision (ROD) were issued for this action on November 9, 2022. This WR evaluates whether supplemental environmental analysis is needed to support the FAA's decision to amend Prime Air's OpSpecs.

In accordance with Paragraph 9-2.c of FAA Order 1050.1F, the preparation of a new or supplemental EA is not necessary when the following can be documented:

1. The proposed action conforms to plans or projects for which a prior EA and FONSI have been issued or a prior EIS has been filed and there are no substantial changes in the action that are relevant to environmental concerns;
2. Data and analyses contained in the previous EA and FONSI or EIS are still substantially valid and there are no significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts; and

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1 On June 30, 2025, the FAA issued Order 1050.1G, FAA National Environmental Policy Act Implementing Procedures, and rescinded FAA Order 1050.1F, Environmental Impacts: Policies and Procedures. FAA Order 1050.1G provides, "FAA will apply the procedures in this Order to actions initiated on or after the effective date of this Order." Because this written re-evaluation was initiated prior to June 30, 2025, this document relies upon FAA Order 1050.1F.

2 https://www.faa.gov/sites/faa.gov/files/FONSI-ROD%20and%20Final%20EA%20Amazon%20Prime%20Air_Pendleton%20OR_11-9-22%20Final%20Signed%20508.pdf

3. Pertinent conditions and requirements of the prior approval have been, or will be, met in the current action.

This WR provides documentation for the above three factors, as well as the FAA's conclusion that the contents of the 2022 EA remain current and substantially valid and that the decision to amend the OpSpecs does not require the preparation of a new or supplemental EA or EIS.

1.2 Background

The 2022 EA analyzed the potential environmental impacts of Prime Air conducting commercial drone testing and Durability & Reliability (D&R) flights at PUR using the MK27-2 drone. PUR is an FAA-approved UAS Test Site at the Eastern Oregon Regional Airport (PDT) in Pendleton, Oregon. The 2022 EA study area is depicted in **Figure 1** and the drone launch pads are depicted in **Figure 2**. The 2022 EA assessed up to 48 MK27-2 drone testing and D&R operations per day during daylight hours up to five days per week, excluding 10 federal holidays. The 2022 EA did not consider nighttime operations (i.e., after 10 P.M.).

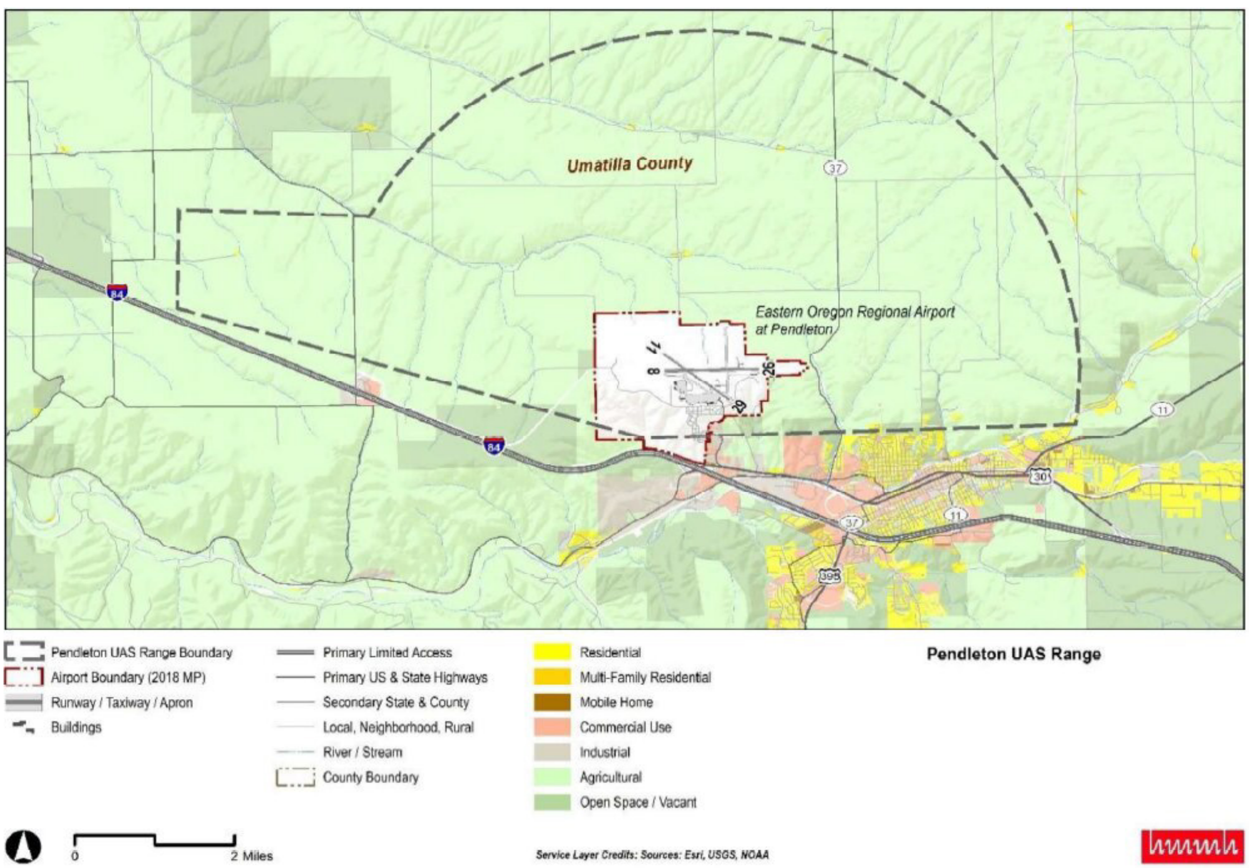

Figure 1
2022 EA Study Area in Pendleton, Oregon

Figure 2
2022 EA Prime Air Delivery Test Flight Launch Pads and Delivery Sites

The MK27-2 drone currently used for testing and D&R operations has a maximum takeoff weight of approximately 92 lbs., including a maximum payload of approximately 5 lbs. 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.

After launch, the MK27-2 drone rises to an altitude below 400 feet above ground level (AGL) and follows a predefined route to its delivery site. Drones will typically fly en route at approximately 160 to 180 feet AGL for delivery test flights, except when descending to drop a package. Packages are carried internally in the drone's fuselage and are dropped by operating a set of payload doors on the aircraft. When making a delivery, the MK27-2 drone descends and packages are dropped to the ground from approximately 13 feet AGL. Prime Air drones do not touch the ground in any other place than the launch pad (except during emergency landings), since they remain airborne while conducting deliveries. After the package is dropped, the drone then climbs vertically and follows the preplanned route to return for landing at the launch pad. The operational test flight profile of the MK27-2 drone is depicted in **Figure 3**.

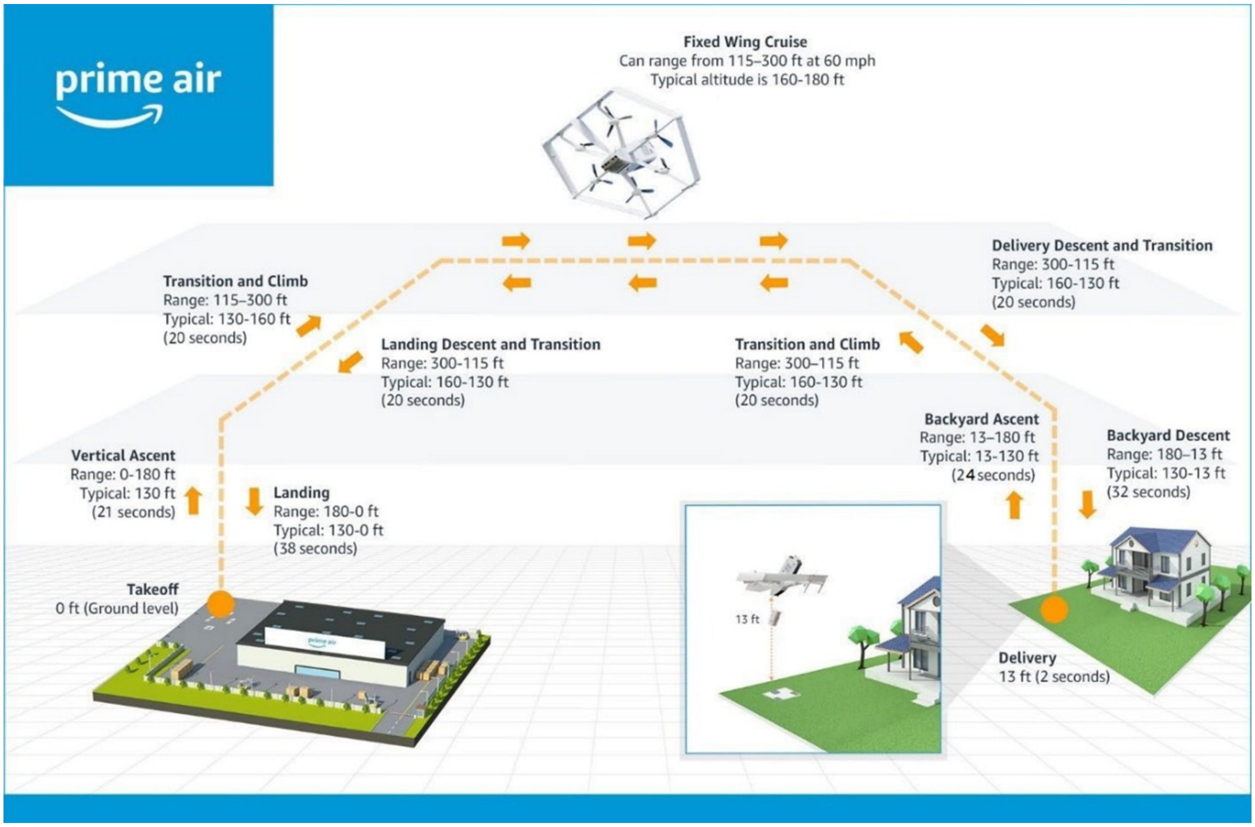

Figure 3

Prime Air MK27-2 Drone Operational Test Flight Profile

CHAPTER 2
Proposed Action

Prime Air has requested an OpSpecs amendment to increase the scope of its operations to include operations related to operator training associated with the use of its MK30 drone. The number of operations, operating area, days of operations, and hours of operation would remain the same as what was previously analyzed in the 2022 EA. Aspects of the Proposed Action that differ from previous NEPA analysis include the inclusion of operator training as an additional reason to conduct drone operations and noise emissions associated with the use of the MK30 drone in lieu of the MK27-2 drone. This difference is analyzed below under the re-evaluation of environmental consequences.

2.1 MK30 Drone Specifications

As depicted in **Figure 4**, the MK30 is an electric powered drone that has a vertical take-off and landing, and transitions to wing borne flight using wing lift during en route flight. The drone systems include hardware and software designed for safety and efficiency. The airframe is composed of staggered wings, the propulsion system includes a rechargeable lithium-ion battery, and six motors that include propellers designed for noise reduction, the package delivery system contains the package in a two-door interior receptacle, and a camera and avionics system that has redundancy for critical systems. The drone weighs 77.9 lbs. and has a maximum takeoff weight of 83.2 lbs., which includes a maximum payload of 5 lbs.

Figure 4
Prime Air MK30 Drone

2.2 MK30 Drone Operations

MK30 flight operations will mirror existing MK27-2 operations, as previously described and as depicted in Figure 3. Prime Air is expected to conduct up to 48 MK30 drone testing, training, and D&R flights per day during daylight hours up to five days per week. MK30 drones would rise to an altitude below 400 feet AGL and follow a predefined route to its delivery site. Drones would typically fly en route at approximately 160 to 180 feet AGL for delivery test and operator training flights, except when descending to drop a package. When making a delivery, the MK30 drones would descend, and packages would be dropped to the ground from approximately 13 feet AGL. The MK30 drones would not touch the ground in any other place than the launch pad (except during emergency landings). After the package is dropped the drones would climb vertically and follow a preplanned route to return for landing at the launch pad.

CHAPTER 3
Affected Environment

The affected environment under the Proposed Action remains largely the same as discussed in the 2022 EA. No substantial changes or alterations have occurred to the environmental impact categories or the study area. Thus, the 2022 EA continues to serve as a valid discussion of the affected environment for the Proposed Action.

CHAPTER 4
Re-evaluation of Environmental Consequences

4.1 Resources Not Analyzed in Detail

As described in Section 3.1 of the 2022 EA, the following environmental impact categories were reviewed and excluded from detailed analysis:

- Air quality and Climate[3]
- Coastal Resources
- Department of Transportation Act, Section 4(f) Resources
- Farmlands
- Hazardous Materials, Solid Waste, and Pollution Prevention
- Land Use
- Natural Resources and Energy Supply
- Socioeconomic Impacts, Environmental Justice, and Safety Risks[4]
- Visual Effects (Light Emissions Only)
- Water Resources (Wetlands, Floodplains, Groundwater, Surface Waters, Wild and Scenic Rivers)

The proposed changes (use of the MK30 drone) to the action analyzed in the 2022 EA (use of the MK27-2 drone) does not change the rationale for excluding those impact categories; as such, all impact categories originally excluded are also not evaluated in this WR. The impact categories that were analyzed in detail in the 2022 EA are re-evaluated below in the context of the changes to the action.

[3] On Jan. 28, 2025, President Trump issued Executive Order 14154, Unleashing American Energy, which directs federal agencies to no longer consider the social cost of greenhouse gases.

[4] On Jan. 20, 2025, President Trump issued Executive Order 14148, Initial Rescissions of Harmful Executive Orders and Actions, rescinding Executive Order 14096, Revitalizing Our Nation's Commitment to Environmental Justice for All (2023). Executive Order 14096 supplemented Executive Order 12898, Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations (1994), establishing a government-wide mandate to advance environmental justice. As a result, FAA no longer evaluates Environmental Justice (EJ) as a part of its NEPA reviews.

4.2 Biological Resources (including Fish, Wildlife, and Plants)

Potential impacts to biological resources under the Proposed Action would be comparable to those impacts described in the 2022 EA. The study area the FAA analyzed for biological resources in the 2022 EA would not change under the Proposed Action. As described in the 2022 EA, Prime Air's MK27-2 drone operations do not involve ground construction or habitat modification; as such, no impacts to fish, reptiles, or terrestrial mammal species are expected. All drone operations would occur within airspace, and typically well above the tree line and away from sensitive habitats. Given the altitude of the flights and low recurrence of operations at any individual location within the operating area, drone operations are not expected to significantly influence wildlife.

The changes to the action analyzed in the 2022 EA—introducing the MK30 drone as part of testing and operator training operations—would not substantially change the potential impacts on biological resources. The proposed changes would likely decrease the level of noise at the testing facility and surrounding environment. Biological resources within the operating area would not experience a greater number of overflights; as such, any disturbance caused by MK30 overflights would not increase stress, reduce reproductive success, or induce injury or mortality outside the range of natural variation for any species.

4.2.1 Special Status Species

Federally Listed Species

The potential for impacts to federally listed species was assessed using the USFWS Information for Planning and Consultation (IPaC) map tool and resource. Through IPaC, the FAA was able to obtain an official species list for the study area, which is included in **Appendix A**. Based on the official species list, there is one federally listed threatened species, two candidate species, and one experimental population, non-essential species with potential to occur in this part of Oregon. These species are the Bull Trout (*Salvelinus confluentus*), a threatened species, the Monarch Butterfly (*Danaus plexippus*), a candidate species, Suckley's Cuckoo Bumble Bee (*Bombus suckleyi*), a candidate species, and California Condor (*Gymnogyps californianus*), an experimental population, non-essential species.

It is important to note that the official species list used to inform the 2022 EA included the federally endangered Gray Wolf (see Appendix A of the 2022 EA). However, it was not identified in the official species list consulted on June 20, 2025.

Bull Trout

Since the MK30 drone operations will be occurring within airspace only, and there will be no construction or ground disturbance associated with the Proposed Action, the FAA has determined that there will be *no effect* on the Bull Trout identified in the official species list.

Monarch Butterfly

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 scientific literature. Based on the information available and the limited scale of operations, the FAA determined that the Proposed Action is not expected to result in significant impacts to the Monarch Butterfly.

Suckley's Cuckoo Bumble Bee

Like most bumble bees, the Suckley's cuckoo bumble bee typically depends upon areas that contain floral resources for nectar and pollen development. Bumble bees also require both above ground and below ground nesting and overwintering sites. Interactions between the Proposed Action and the Suckley's cuckoo bumble bee is highly unlikely, as a majority of the launching sites are within industrialized areas and in-flight operations are at elevations not anticipated to interfere with this species life cycle, therefore, it is anticipated that the Action will have *no effect* on the Suckley's cuckoo bumble bee.

California Condor

The California Condor is the largest bird in North America, and the rarest. In 1987, only 22 California Condors existed within captivity. In 1992, Zoo systems started to release young-captive breed California Condors back into their natural habitat. The typical habitat for the California Condor is considered open mountain areas, where the Proposed Action's in-flight operations would not normally occur. In addition, this population is considered an experimental population that is identified as non-essential. However, since the California Condor covers a large foraging area and utilizes heat thermals, a *May Affect, Not Likely to Adversely Affect* determination for this species, is proposed for the Proposed Action.

State Species of Concern

Based on the habitat present within the study area, and the lack of suitable habitat for Oregon state-listed species, the FAA has determined that the five Oregon state-listed species (California Brown Pelican [*Pelecanus occidentalis californicus*], Gray Whale [*Eschrichtius robustus*], Kit Fox [*Vulpes macrotis*], Washington Ground Squirrel [*Urocitellus washingtoni*], and Wolverine [*Gulo gulo*]) would not be expected to occur in the study area, and therefore no effects to state-listed species are anticipated as a result of the Proposed Action.

Migratory Birds

The official species list identifies 13 Birds of Conservation Concern (BCC) that could occur in the operating area, along with information on the likelihood that they may be nesting in the area. It is not expected that suitable habitat used by the identified BCC species would occur on PDT or nearby property due to the existing aviation and agricultural activity that predominates in study area. Additionally, due to the limited operating area and proposed number of daily operations, occasional drone overflights at approximately 160 to 180 feet AGL are not expected to impact critical lifecycles of wildlife species or their ability to survive. As noted in Appendix A, the Bald Eagle is not a BCC in the study area, but warrants attention because of the Bald and Golden Eagle Protection Act. However, as there are few to no trees in the study area, and no bodies of water, it is not likely that the Bald Eagle would occur in the study area.

Accordingly, the data and analyses contained in the 2022 EA remain substantially valid, and the Proposed Action is not expected to have a significant impact on biological resources.

4.3 Historical, Architectural, Archeological, and Cultural Resources

Historical, architectural, archaeological, and cultural resource impacts associated with the Proposed Action would be comparable to those impacts described in the 2022 EA. The Area of Potential Effects (APE) previously analyzed in the 2022 EA would not change under the proposed action. The FAA previously identified no National Register of Historic Places-listed properties within the APE, although Pendleton Airport is considered an historic property of significance. The FAA previously consulted with the Oregon State Historic Preservation Office (SHPO) and representatives for three Native American tribes that may potentially attach religious or cultural significance to resources in the APE (see Appendix B of the 2022 EA). The Oregon SHPO confirmed that no historic properties would be affected by the action and the FAA did not receive formal responses from any of the three tribes.

The Proposed Action includes the same types of drone operations and locations that were considered in the 2022 EA consultation. Based on the nature of potential effects of the MK30 drone on historic properties - namely limited to non-physical, reversible impacts from visual presence and noise of transiting UAs - and the limited number of daily flights in conjunction with the quieter nature of the MK30 drone, the FAA has determined that the Proposed Action would have little potential to affect historic properties or cultural resources.

Accordingly, the data and analyses contained in the 2022 EA remain substantially valid, and the Proposed Action would not have a significant impact to historic, architectural, archaeological, or cultural resources.

4.4 Noise and Noise-Compatible Land Use

Impacts related to noise and noise-compatible land use under the proposed action would be comparable to those impacts described in the 2022 EA. During the preparation of the 2022 EA, the FAA initiated an analysis of potential noise exposure in the area that could result from implementation of the proposed action. The Day-Night Average Sound Level (DNL) noise exposure analysis concluded that for all flight phases, and even in areas with the highest noise exposure (i.e., the PADDC or airport), noise levels would still be well below FAA's DNL 65 decibel (dB) threshold for noise compatible land use.

In 2025, the DNL noise exposure analysis was conducted for the MK30 and found that, similar to the MK27-2, noise levels would still be well below FAA's DNL 65 dB threshold for noise compatible land use. The FAA's Office of Environment and Energy approved the use of this noise methodology (see **Appendix B**).

The 2022 EA assumed approximately 48 daily operations, for up to five days a week and excludes holidays. This estimate results in 12,000 annual operations, which include 9,390 D&R operations and 2,610 delivery test flight operations.

4.4.1 Noise Exposure for Launch and Landing Locations

Table 1 presents the maximum annual daytime D&R operations and the associated extents of the DNL 45 to DNL 65 dB contours from takeoff and landing locations. Similarly, **Table 2** presents the maximum annual daytime test flight operations for takeoff and landing and the extents of the DNL 45 to DNL 65 dB contours. Note that test flights are either conducted from the launch location from PDT 10, a tether rig located northwest of PDT 10, Pad B located to the north of PDT 10, or Pad GS on the North Gulf Taxiway. As presented in **Table 1** and **Table 2**, the MK30 operations are significantly quieter than those of the MK27-2 and thus would not exceed significance criteria under any delivery scenario and are not expected to contribute adverse effects to the overall noise environment of the study area.

TABLE 1
ESTIMATED EXTENT OF NOISE EXPOSURE AT LAUCH AND LANDING LOCATIONS FOR D&R OPERATIONS

Description	MK30	MK27-2
Annual D&R Flights	9,390	
Annual Average Day D&R Flights	25.72	
DNL45 (feet)	150	475
DNL 50 (feet)	100	275
DNL55 (feet)	50	175
DNL 60 (feet)	21	100
DNL 65 (feet)	21	50

SOURCE: ESA, 2025; HMMH, 2022.
NOTES:
1. When the value for MK30 operations is not specifically defined in the Technical Noise Report Table 6, the next highest value is used. For example, there are 25.72 average daily DNL equivalent operations, the entry for 40 average daily DNL equivalent operations were used.

TABLE 2
ESTIMATED EXTENT OF NOISE EXPOSURE AT LAUCH AND LANDING LOCATIONS FOR TEST FLIGHTS

Description	PDT10		Tether / Pad GS / Pad B	
	MK30	MK27-2	MK30	MK27-2
Annual Test Flights (Daytime)	1957.5		217.5	
Annual Average Day Test Flights (Daytime)	5.36		0.59	
DNL45 (feet)	100	175	21	50
DNL 50 (feet)	50	100	21	32.8
DNL55 (feet)	21	50	21	32.8
DNL 60 (feet)	21	32.8	21	32.8
DNL 65 (feet)	21	32.8	21	32.8

SOURCE: ESA, 2025; HMMH, 2022.
NOTES:
1. When the value for MK30 operations is not specifically defined in the Technical Noise Report Table 6, the next highest value is used. For example, there are 5.36 average daily DNL equivalent operations, the entry for 10 average daily DNL equivalent operations were used.

4.4.2 Noise Exposure for En Route Operations

The MK30 drone operates outbound and inbound en route overflights at the typical operating altitude of 200 and 345 feet AGL, respectively, for operations associated with deliveries to other locations. The outbound en route altitude is expected to be flown between 180 and 279 feet AGL. The inbound en route altitude is expected to be between 279 and 377 feet back to the PADDC.

For a conservative estimate for en route noise exposure from D&R and test flight overflights were estimated using the MK30's maximum weight using Table 8 of the Technical Noise Report. **Table 3** presents a worst-case scenario based on all 9,390 annual D&R flights overflying the same receiver. **Table 4** presents a worst-case scenario based on all annual test flights overflying the same receiver at four locations on the airfield. In all instances, the en route noise of the MK30 is significantly quieter than that of the MK27-2 and would continue to not exceed significance criteria under any delivery scenario and is not expected to contribute adverse effects to the overall noise environment of the study area.

TABLE 3
ESTIMATED EXTENT OF NOISE EXPOSURE DIRECTLY UNDER D&R ENROUTE OPERATIONS

Description	MK30	MK27-2
Annual D&R Flights (Daytime)	9,390	
Annual Average Day D&R Flights (Daytime)	25.72	
Weight for Overflight	Maximum	
Altitude of Overflight (Feet AGL)	200	200
En Route SEL for 1 flight (dB)	63.7	69.7
En Route DNL for 1 Flight (Daytime)	14.5	20.3
DNL for Average Annual Day (dB)	28.6	34.4

SOURCE: ESA, 2025; HMMH, 2022.
NOTES:
1. MK30 noise levels determined from Technical Noise Report Table 8.

TABLE 4
ESTIMATED EXTENT OF NOISE EXPOSURE UNDER EN ROUTE FLIGHT PATH FROM DELIVERY TEST FLIGHTS

Description	PDT10		Tether / Pad GS / Pad B	
	MK30	MK27-2	MK30	MK27-2
Annual Test Flights (Daytime)	1957.5		217.5	
Annual Average Day Test Flights (Daytime)	5.36		0.59	
Weight for Overflight	Maximum		Maximum	
Altitude of Overflight (Feet AGL)	200	165	200	165
En Route SEL for 1 flight (dB)	63.7	70.7	63.7	70.7
En Route DNL for 1 Flight (Daytime)	14.5	21.3	14.5	21.3
DNL for Average Annual Day (dB)	21.8	28.6	12.2	19.1

SOURCE: ESA, 2025; HMMH, 2022.
NOTES:
1. MK30.noise levels determined from Technical Noise Report Table 8.

4.4.3 Noise Exposure for Delivery Operations

The delivery location for all delivery test flights at PUR occur at Lillian Lane, which is shown in Figure 2. The DNL delivery noise exposures assume an inbound and outbound en route flight path over a receiver. The noise exposure for any one delivery point is summarized in **Table 5** for various DNL levels. While the average daily deliveries from the PADCC would be 7.12, the number of overflights would be dispersed across the operating areas and delivery locations would be distributed throughout the operating areas. Since each delivery involves both an outbound and inbound flight path, this equates to 14 daily overflights. At the level of approximately 7 daily DNL equivalent deliveries (including overflights), significant noise effects would not be expected anywhere beyond the immediate point of delivery.

For comparison, the 2022 MK27-2 estimated delivery site exposure of DNL 55 for 7 average daily deliveries extends 125 feet while the MK30 extends 50 feet. Since the delivery noise of the MK30 is significantly quieter than that of the MK27-2, it still would not exceed significance criteria under any delivery scenario and is not expected to contribute adverse effects to the overall noise environment of the study area.

TABLE 5
ESTIMATED EXTENT OF NOISE EXPOSURE FROM THE TEST FLIGHT DELIVERY LOCATION

Description	MK30	MK27-2
Annual Test Flights (Daytime)	2,610	
Annual Average Day Test Flights (Daytime)	7.12	
DNL 45 (feet)	100	175
DNL 50 (feet)	50	125
DNL 55 (feet)	16.4	50
DNL 60 (feet)	16.4	32.8
DNL 65 (feet)	16.4	32.8

SOURCE: ESA, 2025; HMMH, 2022.
NOTES:
1. When the value for MK30 operations is not specifically defined in the Technical Noise Report Table 9, the next highest value is used. For example, there are 5.36 average daily DNL equivalent operations, the entry for 10 average daily DNL equivalent operations were used.

4.4.4 Overall Noise Exposure Results

When considering the noise levels associated with Prime Air's level of operations combined with existing aircraft noise levels in these areas, noise levels would not increase by DNL 1.5 dB within areas of existing aviation noise exposure of DNL 65 dB or newly expose an area to DNL 65 dB as a result of a DNL 1.5 dB increase. Additionally, takeoff and landing, en route, and delivery noise for the MK30 are significantly quieter than that of MK27-2 considered in the 2022 EA.

Accordingly, the data and analyses contained in the 2022 EA remain substantially valid, and the Proposed Action would not be expected to have a significant impact related to noise and noise-compatible land use.

4.5 Visual Effects (including Light Emissions)

The FAA has not established a significance threshold for Visual Resources / Visual Character, nor has the FAA established a significance threshold for Light Emissions. The Proposed Action is not expected to have the potential to:

- Affect the nature of the visual character of the area, including the importance, uniqueness, and aesthetic value of the affected visual resources,
- Contrast with the visual resources and/or visual character in the study area,
- Block or obstruct the views of visual resources, including whether these resources would still be viewable from other locations,
- Create annoyance or interfere with normal activities from light emissions, and
- Affect the visual character of the area due to the light emissions, including the importance, uniqueness, and aesthetic value of the affected visual resources.

Visual effects under the Proposed Action would be comparable to those emissions and impacts described in the 2022 EA. Prime Air's drones, including the currently operating MK30 drone, are equipped with safety lights and a strobe, which are automatically powered during all operations. However, given the relatively low frequency of overflight of any given area and the large size of the operating area, operation of safety lights would not substantially alter the light environment. As such, the Proposed Action does not represent a noticeable change to current lighting conditions already present within the operating area.

The Proposed Action makes no changes to any landforms or land uses; thus, there would be no effect to the visual character of the area. The Proposed Action involves airspace operations that could result in visual impacts to sensitive areas where the visual setting is an important resource of the property; however, the short duration that each drone flight could be seen from any particular resource in the operating area combined with the low number of proposed flights per day minimizes any potential for significant impacts.

Accordingly, the analysis contained in the 2022 EA remains substantially valid, and the Proposed Action would not be expected to have a significant impact related to visual resources and visual character.

CHAPTER 5
Reasonably Foreseeable Effects

An assessment of reasonably foreseeable effects is provided below to determine if the Proposed Action, along with the potential environmental impacts of past, present, and reasonably foreseeable actions, would result in significant impacts.[5]

The noise impacts from daily MK30 drone operations are expected to be less than those associated with the MK27-2 drone and are not anticipated to be significant. Although other drone operations are not currently planned or foreseeable within the operating area, other common sources of noise such as ground vehicle traffic, air traffic (primarily associated with PDT), and construction could contribute additive noise-related effects. However, given the short duration of drone flights and the large scale of the operating area, it is highly unlikely that drone operations included in the Proposed Action would noticeably contribute to the cumulative noise environment of the study area. Therefore, Prime Air operations, when considered in conjunction with other past, present, and reasonably foreseeable actions, would not produce significant impacts.

Accordingly, the analysis contained in the 2022 EA remains substantially valid, and given the Proposed Action's expected minimal environmental impacts and limited potential and duration to overlap with environmental impacts from other past, present, and reasonably foreseeable actions, the Proposed Action is not expected to result in significant impacts.

[5] FAA Order 1050.1F provides for an evaluation of cumulative impacts. The term cumulative effects (impacts) was defined in CEQ's NEPA-implementing regulations. 40 CFR § 1508(i)(3) (2024). However, on February 25, 2025, CEQ published an interim final rule to remove these regulations in accordance with Executive Order 14154, Unleashing American Energy. See 90 Fed. Reg. 36 (February 25, 2025). The rule became effective on April 11, 2025. On Feb. 19, 2025, CEQ issued a memorandum titled Implementation of the National Environmental Policy Act, that provided guidance to Federal agencies on how to implement NEPA. The memo provides, "Federal agencies should analyze the reasonably foreseeable effects of the proposed action consistent with section 102 of NEPA, which does not employ the term "cumulative effects;" NEPA instead requires consideration of "reasonably foreseeable" effects, regardless of whether or not those effects might be characterized as "cumulative." Based on the CEQ memo and on and the U.S. Supreme Court's recent decision in Seven Cnty. Infrastructure Coal. v. Eagle Cnty., Colorado, 145 S.Ct. 1497 (U.S. 2025), this written re-evaluation does not include a discussion of Cumulative Impacts.

CHAPTER 6
Conclusion

The FAA prepared this WR to analyze the potential environmental impacts that may result from FAA's approval of the Part 135 air carrier OpSpecs amendments and other approvals requested by Prime Air to conduct testing and operator training operations in the Pendleton, Oregon area with the MK30 drone.

The areas evaluated for updated environmental impacts included biological resources; historical, architectural, archeological, and cultural resources; noise and noise-compatible land use; and visual effects.

Based on the above review and in conformity with FAA Order 1050.1F, Paragraph 9-2.c, the FAA has concluded Prime Air's amendment to its OpSpecs to allow for the use of the MK30 drone. The proposed changes to testing and training operations conform to the prior environmental documentation and the data contained in the 2022 EA remains substantially valid, there are no significant environmental changes, and all pertinent conditions and requirements of the prior approval have been met or will be met in the Proposed Action. Therefore, the preparation of a supplemental or new EA or EIS is not necessary.

Responsible FAA Official:

Joseph K. Hemler Jr

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Date: 2025.08.27 13:34:49 -04'00'

Joseph Hemler, Jr.
Manager, AFS-752
Office of Safety Standards, Flight Standards Service.

Appendix A
Official Species List

United States Department of the Interior

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

In Reply Refer To: 06/20/2025 18:20:06 UTC
Project Code: 2025-0112190
Project Name: Amazon Prime Air - Pendleton OR

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

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). This is not a consultation.

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

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

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2) (c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

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

https://www.fws.gov/sites/default/files/documents/endangered-species-consultation-handbook.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 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/program/migratory-bird-permit/what-we-do.

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/library/collections/threats-birds.

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

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

Attachment(s):

- Official Species List

OFFICIAL SPECIES LIST

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

This species list is provided by:

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

PROJECT SUMMARY

Project Code: 2025-0112190
Project Name: Amazon Prime Air - Pendleton OR
Project Type: Drones - Use/Operation of Unmanned Aerial Systems
Project Description: UAS Delivery
Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@45.718579500000004,-118.8761698506205,14z

Counties: Umatilla County, Oregon

ENDANGERED SPECIES ACT SPECIES

There is a total of 4 threatened, endangered, or candidate species on this species list.

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

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

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

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

BIRDS

NAME	STATUS
California Condor *Gymnogyps californianus* Population: Pacific Northwest NEP No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8193	Experimental Population, Non-Essential

FISHES

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

INSECTS

NAME	STATUS
Monarch Butterfly *Danaus plexippus* There is **proposed** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/9743	Proposed Threatened
Suckley's Cuckoo Bumble Bee *Bombus suckleyi* Population: No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/10885	Proposed Endangered

CRITICAL HABITATS

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

YOU ARE STILL REQUIRED TO DETERMINE IF YOUR PROJECT(S) MAY HAVE EFFECTS ON ALL ABOVE LISTED SPECIES.

IPAC USER CONTACT INFORMATION

Agency: Private Entity
Name: Theodore Reese
Address: 545 Brent Lane
City: Pensacola
State: FL
Zip: 32504
Email treese@esassoc.com
Phone: 8504284687

Appendix B
MK30 Noise Methodology

Federal Aviation Administration

Memorandum

Date: June 4, 2025

To: Chris Hurst, Flight Standards (AFS), General Aviation and Commercial Branch (AFS-752)

From: Dave Senzig, Manager (Acting), Noise Division, Office of Environment and Energy (AEE-100)

DAVID ALAN SENZIG
2025.06.04 14:13:14 -04'00'

Subject: Environmental Assessment (EA) Noise Methodology Approval Request for Amazon Prime Air Commercial Package Delivery Operations with the MK30 Unmanned Aircraft (UA) from Multiple Texas Metropolitan (Metro) Areas

The Office of Environment and Energy (AEE) has reviewed the proposed non-standard noise modeling methodology to be used for Amazon Prime Air (Amazon) operations using the MK30 unmanned aircraft (UA) from multiple metropolitan (metro) areas in 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 the five Texas metro areas of Austin, Dallas-Fort Worth, El Paso, Houston, and San Antonio.

The Proposed Action is for Amazon to use the MK30 UA to conduct package delivery operations under its existing Part 135 air carrier certificate from 22 Prime Air Drone Delivery Centers (PADCCs) located in the five Texas metro areas detailed above to potential delivery locations such as residential homes within proposed associated operating areas. Typical operations of the MK30 UA will consist of departure from a launch/takeoff pad at the PADCC followed by a vertical climb to a typical en route altitude of 180 to 377 feet above ground level (AGL). The UA then transitions from vertical to horizontal wing borne flight (WBF) for transit to a delivery location. Approaching the delivery location, the UA will transition from horizontal WBF to vertical flight, and then descend vertically over the delivery point. At 13 feet AGL, the UA drops the package at the delivery point, and ascends vertically back to en route altitude. Once back at en route altitude, the UA again transitions from vertical to horizontal WBF for transit back to its originating PADDC. When the UA arrives at the PADDC, the UA will transition from horizontal WBF to vertical flight and descend vertically to its assigned landing pad. After landing, the UA is serviced and prepared for the next delivery.

Under the scope of the Proposed Action Amazon projects conducting a maximum of 365,000 annual deliveries during daytime hours, with no nighttime flights (10 PM – 7 AM), with 1,000 total deliveries on an average annual daily (AAD) basis at each of the 22 PADCC's and associated operating areas. 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 and maximum of 4.0 per day at any one location within the proposed operating area on an AAD basis.

As the FAA does not currently have a standard approved noise model for assessing UA, and in accordance with FAA Order 1050.1F, all non-standard noise analysis in support of the noise impact analysis for the National Environmental Policy Act (NEPA) must be approved by AEE. This letter serves as AEE's response to the method developed in ESA Report No. 202200549.04 for the "Estimated Noise Levels for Amazon Prime Air MK30 Drone Technical Noise Report" dated April 2025.

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.

Federal Aviation Administration

Memorandum

Date: May 19, 2025

To: Dave Senzig, Manager (Acting), Noise Division, Office of Environment and Energy (AEE-100)

From: Chris Hurst, Flight Standards (AFS), General Aviation and Commercial Branch, AFS-752
CHRISTOPHER A HURST Digitally signed by CHRISTOPHER A HURST Date: 2025.05.19 12:22:09 -05'00'

Subject: Environmental Assessment (EA) Noise Methodology Approval Request for MK-30 Amazon Prime Air Operations in Multiple Texas Metropolitan (Metro) Areas

AFS requests AEE approval of the noise methodology to be used for the Environmental Assessment (EA) for Amazon Prime Air (Amazon) to expand its package delivery services as a 14 CFR Part 135 operator using the Amazon MK30 unmanned aircraft (UA) in 5(five) Texas metro areas listed below:

- Austin, TX
- Dallas-Fort Worth, TX
- El Paso, TX
- Houston, TX
- San Antonio, TX

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

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

Description of Aircraft and Proposed Operations

AFS is evaluating Amazon's proposal to conduct package delivery operations from 22 Prime Air Drone Delivery Centers (PADCCs) located in five metro areas throughout Texas and associated operating areas under its existing Part 135 air carrier certificate and related operating authorizations using the MK30 UA. Amazon is proposing to perform package delivery operations within the proposed five metro areas to transport packages to delivery sites including residential homes.

The MK30 UA has six (6) propulsors allowing it to take-off and land vertically and transition to wing borne flight (WBF). Its airframe is composed of staggered tandem wings for stable WBF. The drone weighs 77.9 lbs. (35.5 kg) and has a maximum takeoff weight of 83.2 lbs. (37.8 kg), which includes a maximum payload of 5 lbs. (3 kg). It has a maximum operating range of 7.5 mi (12 km). It is a hybrid multicopter fixed-wing UA that uses electric power from rechargeable lithium- ion batteries and can fly up to 400 ft (122 m) above ground level (AGL) at a maximum cruise speed of 73 mph (64 knots) during WBF. It is launched vertically using powered lift and converts to using wing lift during en route flight. A typical flight profile can be broken into the following general flight phases: launch, en route outbound, delivery, en route inbound, and landing. After launch, Amazon's MK30 UA would rise to an altitude of less than 400 ft (122 m) AGL and follow a predefined route to its delivery site.

Aircraft would typically fly en route at between approximately 180 to 377 ft (55 to 115 m) AGL, except when descending to drop a package. Packages would be carried internally in the UA's fuselage. When making a delivery, the UA descends, opens a set of payload doors, and drops the package to the ground from approximately 13 ft (4 m) AGL.

Amazon's UA would not touch the ground in any place other than the PADDC (except during safe contingent landings) and will remain airborne throughout the operation including the delivery stage. After the package is dropped, the MK30 UA climbs vertically and follows its predefined route back to the PADDC at its assigned altitude.

Amazon is seeking to amend its current Operation Specifications (OpSpec) and other Federal Aviation Administration (FAA) authorizations needed to integrate the MK30 and expand drone commercial package delivery operations.

Prime Air anticipates operating up to 1,000 delivery flights per operating day, up to 10 hours per day, and 7 days per week, from each of the 22 PADDCs. These operational levels would result in a projected total of approximately 365 operating days and 365,000 delivery operations per year for each PADDC, based on the scope of the Proposed Action. The operations would occur between 7 A.M. and 10 P. M. and are anticipated to be distributed evenly across each operating area. The MK30's proposed operating range is 7.5 mi from each PADDC, with a potential operating area of 3,828 sq mi. The drone departure and arrival paths from and to each PADDC would generally correspond to the geographical location of the package delivery address. Based on those overall levels Amazon expects deliveries to be distributed among delivery locations throughout the operating area with a minimum number of 0.1 deliveries per day or less and maximum of 4.0 per day at any one location on an AAD basis.

Noise Analysis Methodology

AFS requests to use the noise analysis methodology described in ESA Report No. 202200549.04 for the "Estimated Noise Levels for Amazon Prime Air MK30 Drone Technical Noise Report" dated April 2025.

ESTIMATED NOISE LEVELS FOR AMAZON PRIME AIR MK30 DRONE

Technical Noise Report

April 2025

ESTIMATED NOISE LEVELS FOR AMAZON PRIME AIR MK30 DRONE

Technical Noise Report

April 2025

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

Bend	Orlando	San Jose
Camarillo	Pasadena	Santa Monica
Delray Beach	Petaluma	Sarasota
Destin	Portland	Seattle
Irvine	Sacramento	Tampa
Los Angeles	San Diego	
Oakland	San Francisco	

202200549.04

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1 Introduction

This document presents the methodology and estimation of noise exposure of Amazon Prime Air (Prime Air) package delivery operations under 14 CFR Part 135. Prime Air is proposing to conduct package delivery operations with the MK30 drone at selected distribution hubs (the Prime Air Drone Delivery Center, or PADDC).

The MK30 is an electric powered drone that uses a vertical take-off and landing (VTOL) then transitions to fixed-wing flight using wing lift during en route flight. The drone systems include hardware and software designed for safety and efficiency. The airframe is composed of staggered wings, the propulsion system includes a rechargeable lithium-ion battery, and six (6) motors that include propellers designed for noise reduction. The package delivery system contains the package in a two-door interior receptacle, and a camera and avionics system that has redundancy for critical systems. The drone weighs approximately 78 lbs. and has a maximum takeoff weight of 83.2 lbs., which includes a maximum payload of 5 lbs. It has a maximum operating range of 7.5 mi and can fly up to 400 ft above ground level (AGL) at a maximum cruise speed of 73 mph (64 knots) during horizontal flight. An image of the MK30 drone is shown in **Figure 1**.

The MK30 operational flight profiles can be broken into the following general flight phases: launch, en route outbound, delivery, en route inbound, and landing. After launch, the MK30 would ascend to an altitude of less than 400 ft AGL and follow a predefined route to its delivery site.[1] The MK30 would typically fly en route at between approximately 180 to 377 ft AGL, except when descending to drop a package. Packages would be carried internally in the drone's fuselage. When making a delivery, the drone descends, opens a set of payload doors, and drops the package to the ground from approximately 13 ft AGL. Prime Air's drone would not touch the ground in any place other than the PADDC (except during safe contingent landings) and will remain airborne throughout the operation including the delivery phase.[2] After the package is dropped, the MK30 drone climbs vertically and follows its predefined route back to the PADDC at its assigned altitude.

This document outlines the methodology and estimation of noise exposure expected with the proposed use of Prime Air's drone package delivery operations.[3] The methods presented below are suitable for the evaluation of Federal actions in compliance with the National Environmental Policy Act (NEPA) and other applicable environmental regulations or federal review standards at the discretion and approval of the FAA. In particular, this report is intended to function as a nonstandard equivalent methodology under FAA Order 1050.1F, and therefore requires prior written consent from the FAA's Office of Environment and Energy (AEE) for each project seeking a NEPA determination.[4] The results of the noise analysis are presented in terms of the annual Day-Night Average Sound Level (DNL), considering varying levels of operations for areas at ground level below each flight phase.

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

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

[3] Environmental Assessment (EA) Noise Methodology Approval Request for Amazon Prime Air Commercial Package Delivery Operations with the MK30 Unmanned Aircraft (UA) from Kansas City, Missouri, May 2025. (See Attachment A).

[4] See FAA Order 1050.1F, July 16, 2015,
Appendix B, Section B-1.2, for discussion on the use of "equivalent methodology", available online at https://www.faa.gov/documentLibrary/media/Order/FAA_Order_1050_1F.pdf#page=113

Figure 1. Amazon Prime Air MK30 Drone

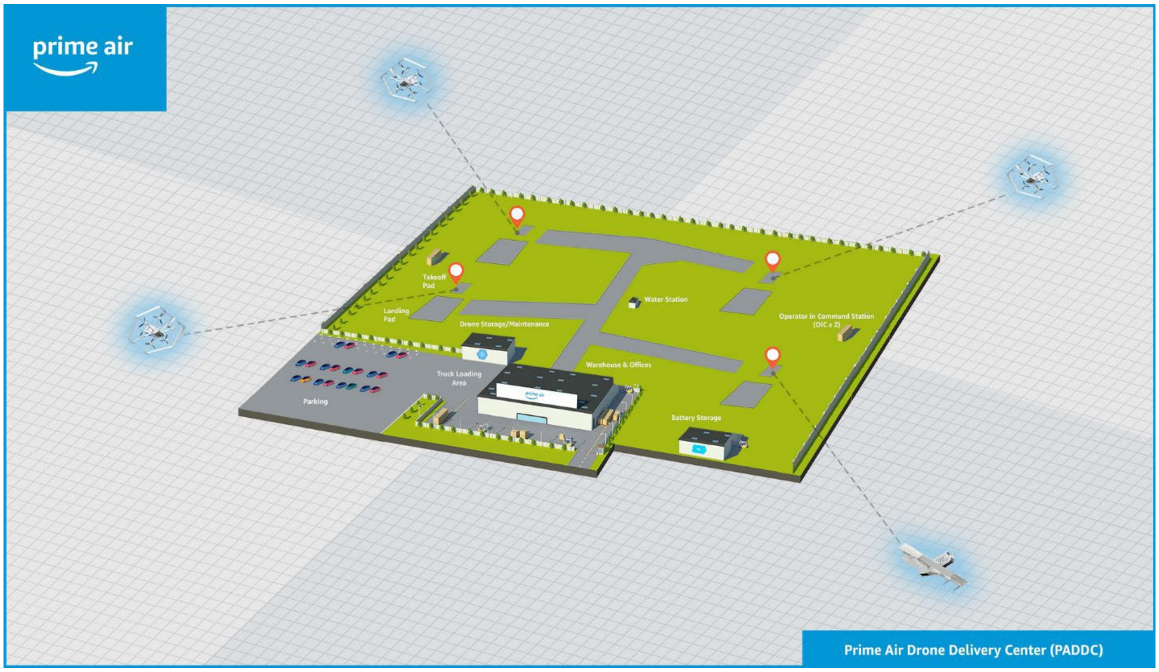
Source: Amazon Prime Air, 2023.

2 Drone Delivery Operations

The PADDC and its associated flight routes are determined by Prime Air's business and operational needs. Takeoff pads at the PADDC are four meters by four meters. Landing pads are eight meters by eight meters. Both pads are contained within a launch area approximately 35 meters by 45 meters. A diagram of a representative PADDC layout is presented in **Figure 2**.

The MK30 drone is capable of vertical ascent and descent, hovering, and flying upright with forward-facing propellers for en route travel. Airspeeds during normal en route flight are expected to be approximately 58.3 knots. A typical flight will commence with a vertical ascent from the launch pad to the transition altitude of approximately 115 feet, from which it will continue a forward-facing climb to an outbound en route altitude between 180 and 279 feet AGL. The drone then maintains altitude and follows a predetermined route, traveling at 58.3 knots toward the designated delivery point. Prior to arrival at the delivery point, the drone will begin its descent down to a transition altitude of 140 feet and decelerate to zero-speed at which time it will arrive at the delivery point. The drone then begins a vertical descent to 13 feet AGL at which time the package is released. The drone will ascend back to a transition altitude of 197 feet, begin the outbound transition and climb phase to 345 feet, while accelerating to 58.3 knots until it reaches the inbound en route altitude between 279 and 377 feet along the predetermined route back to the PADDC. Prior to arriving at the PADDC, the drone will descend to the transition altitude of 197 feet, decelerate to zero speed, and begin a vertical descent to the landing pad.

Figure 2. Representative PADDC Layout



Source: Amazon Prime Air, 2022.

2.1 Flight Profiles

Flight profiles of drone operations are broken into five general phases: takeoff, transitions to and from vertical and horizontal flight, en route, delivery, and landing. These phases can be combined to represent the typical operational profile of the drone as outlined below. A graphical representation of the operational profile is presented in **Figure 3** and each phase is summarized in **Table 1**.

Takeoff, Vertical Ascent, Transition, and Outbound Climb

The drone departs from the launch pad once cleared for takeoff. It will ascend vertically to the transition altitude of 115 feet AGL in vertical flight mode.

Upon reaching the transition altitude, and while still positioned above the launch pad, the drone transitions from zero speed to its cruise speed of 58.3 knots and continues an outbound climb to the typical cruise altitude of 200 feet AGL (ranges from 180 and 279 feet AGL). This transition is accompanied by a shift from vertical flight mode to horizontal flight mode.

Fixed-wing Outbound Cruise

The drone proceeds to fly at the typical cruise altitude of 200 feet AGL (ranges from 180 to 279 feet AGL) and 58.3 knots to the backyard descent and transition.

Backyard Descent, Delivery, Ascent, Transition, and Inbound Climb

The drone decelerates from the en route speed of 58.3 knots and descends from the typical outbound cruise altitude of 200 feet AGL (ranges from 180 to 279 feet AGL) to a transition altitude of 140 feet AGL. The drone then transitions to vertical flight mode, where it will be positioned over the delivery point at zero speed.

The drone begins a vertical descent from the transition altitude to 13 feet AGL while maintaining position above the delivery point. Once at 13 feet AGL, the drone drops the package and ascends vertically back to the transition altitude of 197 feet AGL. The nearest allowable proximity of any individual, animal, or other obstacles to the delivery point during this maneuver is 16.4 feet.

Once at the transition altitude and positioned above the delivery point, the drone transitions from zero speed to en route speed while changing from vertical flight to horizontal flight and continues to climb to the typical inbound cruise altitude of 345 feet AGL (ranges from 279 to 377 feet AGL).

Fixed-wing Inbound Cruise

The drone continues to fly at the typical en route altitude of 345 feet AGL (ranges from 279 to 377 feet AGL) and speed of 58.3 knots towards the PADDC.

Landing Descent, Transition, Vertical Descent, and Landing

The drone decelerates as it approaches the PADDC and descends to the transition altitude of 197 feet AGL and where it transitions from horizontal flight to vertical flight, coming to a zero-speed position over its assigned landing pad.

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

Table 1. Representative Operational Profile by Phase of Flight

Phase of Flight	Altitude (feet AGL)	Ground Speed (knots)	Duration (seconds)
Takeoff and Vertical Ascent	Ascent from 0 to 115	0	15
Transition and Outbound Climb	115 to 279	0 to 58.3	40
Fixed Wing Outbound Cruise	200[1]	58.3	Variable[3]
Delivery Descent and Transition	Descent from 200 to 140	58.3 to 0	30
Backyard Descent	Descent from 140 to 13	0	27
Delivery	13	0	4
Backyard Ascent	Ascent from 13 to 197	0	30
Transition and Inbound Climb	Ascent from 197 to 377	0 to 58.3	40
Fixed-Wing Inbound Cruise	377[2]	58.3	Variable[3]
Landing Descent and Transition	Descent from 377 to 197	58.3 to 0	30
Vertical Descent and landing	Descent from 197 to 0	0	35

SOURCE: Amazon Prime Air, February 2025

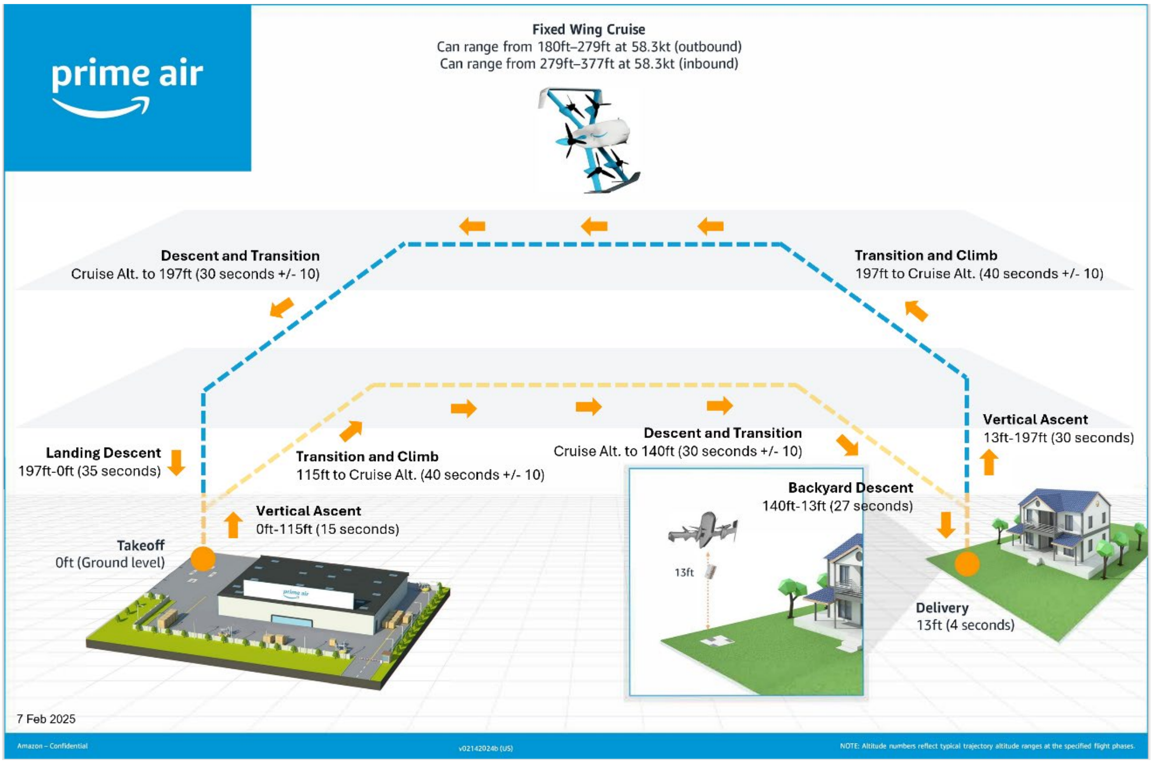
Notes:

[1] The outbound enroute altitude may range from 180 – 279 feet. For this analysis the outbound cruise altitude was assumed to be 200 feet.

[2] The inbound enroute altitude may range from 279 – 377 feet. For this analysis the inbound cruise altitude was assumed to be 345 feet.

[3] Duration of inbound and outbound cruise flight time varies based on distance to customer.

Figure 3. Representative Operational Profile of the MK30



Source: Prime Air, 2025.

3 Methodology

As previously mentioned, there is not a standardized process for drone noise assessments. Therefore, ESA is applying technical guidance that was previously approved by the FAA Office of Environment and Energy for past analyses. The following subsections outline this methodology.

Prime Air conducted noise measurements of the MK30 drone in October 2024 at the Pendleton UAS Range located at the Eastern Oregon Regional Airport (KPDT). ESA, in coordination with the FAA, processed and analyzed the measurement data and calculated the noise levels for each of the flight phases.[5] The following subsections show either the A-weighted Sound Exposure Levels (SEL) or formulas to calculate the SELs used for this analysis, which can be matched to each flight phase detailed in **Table 1**.

3.1 Daytime Equivalent Operations and DNL

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

[5] Prime Air MK30 Done Noise Measurement Report, Environmental Science Associates, April 2025. (See Attachment B).

$$eq.1.\ N_{Equiv,i} = W_{Day} \text{ x } N_{Day,i} + W_{Eve} \text{ x } N_{Eve,i} + W_{Night} \text{ x } N_{Night,i}$$

Where:

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

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

$$eq.2.\ N_{DNL,i} = N_{Day,i} + N_{Eve,i} + 10 \text{ x } N_{Night,i}$$

3.2 PADDC Infrastructure

Each PADDC accommodates four sets of launch and landing pads. In the context of this noise analysis, it is assumed that all operations would occur at one launch/landing pad, where it would be the closest to the noise-sensitive areas. This assumption is considered acoustically conservative. If the precise location of the nearest single launch or landing pad is unknown, the respective PADDC boundary should be used for the analysis.

3.3 Application of Acoustical Data

The summation of the SELs presented in subsequent sections are used to estimate the DNL for Prime Air's drone operations covered in this report. SEL results are detailed in the measurement report found in **Attachment B**.

For calculating SEL, four specific activities are considered:

- The drone taking off from the PADDC (includes transition between vertical and horizontal flight)
- En route travel of the drone in horizontal flight between the PADDC and the delivery point
- Delivery
- The drone landing at the PADDC (includes transition between vertical and horizontal flight)

3.3.1 Takeoff

The process for estimating SELs associated with takeoff as a function of distance from the PADDC is presented in Equation 3 and incorporates the parameters detailed in **Table 2**.

$$eq.3.\ SEL = m \text{ x } Log_{10}(d) + b(dB)$$

Where:

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

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

Range for d (feet from launch pad)	m	b
20 to 76	-14.51	109.35
76 to 195	-13.51	107.46
195 to 372	-14.66	110.09
372 to 772	-17.08	116.32
772 to 1,205	-17.05	116.23
1,205 and greater	0.00	63.7

SOURCE: ESA, 2025.

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

Application of the SEL is based on the position of the launch/landing pad, where it would be the closest to the noise-sensitive areas. However, if the exact location of the launch pad is not known, the outer boundary of the PADDC, at a point closest to the receiver, should be used as it considered to be acoustically conservative. It should be noted that the SEL values include the transition to horizontal flight and the acceleration to en route speed that would occur during the climb.

3.3.2 En Route

The anticipated outbound flight speed of the drone en route is 58.3 knots at a cruise altitude of 200 feet AGL. For inbound flight the anticipated cruise altitude is 345 feet AGL with the same 58.3 knot flight speed. As discussed in **Appendix B**, adjustments were applied to the measured data to account for how the varying speed impacts the duration of the overflight at the stationary receptor.

As shown in **Table 3**, the SEL is 63.7 dB when the drone is at maximum weight, at 200 feet from the stationary receiver and traveling at approximately 58.3 knots. The SEL is 60.9 dB when the drone is at empty weight, 345 feet from the stationary receiver, and traveling at approximately 58.3 knots.

Table 3. Estimates of En Route Sound Exposure Level

Aircraft Configuration	Reference Air Speed (knots)	Reference Altitude (feet AGL)	Uncorrected Speed (knots)	Uncorrected Altitude (feet AGL)	Uncorrected SEL (dBA)	Corrected SEL (dBA)
Maximum Weight	58.3	200	60.8	116	66.1	63.7
Empty Wight	58.3	345	60.8	98	66.9	60.9

SOURCE: ESA, 2025.

3.3.3 Delivery

The process for estimating SELs associated with delivery as a function of distance from a receiver relative to the position of the delivery point is presented in Equation 3 and incorporates the parameters detailed in **Table 4**.

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

Range for d (feet from launch pad)	m	b
25 to 76	-13.18	110.56
76 to 175	-18.65	120.84
175 to 372	-13.86	110.11
372 to 772	-15.63	114.67
772 to 1,820	-15.63	114.65
1,820	0.00	63.7

SOURCE: ESA, 2025.

Note: Distance is along ground from delivery point to receiver.

The minimum distance used for calculation between the delivery point and a person is 16.4 feet.[6] The values in **Table 4** are valid for distances from the delivery point of 25 feet or greater. SEL values for distances between 16 and 25 feet are adjusted by distance to the delivery point and sound level adjustment of a stationary source as provided by Equation 4.

$$eq. 4.\ SEL_{Delivery} = 92.1 + 12.5 \text{ x } Log_{10} \frac{25}{Distance\ from\ Delivery\ Point\ (ft)}$$

It should be noted that the SEL values include the noise contribution from the horizontal flight associated with the drone transition from en route to descent and transition, including the transition to vertical flight and transition back to en route altitude.

3.3.4 Landing

The process for estimating SELs associated with landing as a function of distance from the PADDC is presented in Equation 3 and incorporates the parameters detailed in **Table 5**.

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

Range for d (feet from launch pad)	m	b
20 to 76	-14.95	111.28
76 to 195	-16.17	113.58
195 to 375	-21.10	124.86
375 to 1,074	-21.10	124.87
1,074	0.00	60.9

SOURCE: ESA, 2025.

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

If the location of the landing pad is known, the outer boundary of the PADDC (at a point closest to the noise sensitive receiver), should be used for the modeling location as a conservative approach. It should be noted that the SEL values include the descent from en route altitude and the deceleration from en route speed, and the transition to vertical flight that would occur after the initial descent.

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

3.4 DNL Estimation Methodology

The number of operations flying over a specific receiver's ground location will fluctuate depending on the proposed operating area and demand. For a given receiver location, *i*, and a single instance of sound source, *A*, the SEL for that sound source SEL_{iA} is (energy) summed for the average annual daily number of DNL daytime equivalent operations ($N_{DNL,iA}$) to compute the equivalent DNL in Equation 5.

$$eq. 5.\ DNL_{iA} = SEL_{iA} + 10 \text{ x } Log_{10}(N_{DNL,iA}) - 49.4, dB$$

The above equation applies to an SEL value representing one noise source such as a drone takeoff or landing. For cases where a receiver would be exposed to multiple noise sources (e.g. takeoff, transiting, en route, and departure), the complete DNL at that point was calculated with Equation 6.

$$eq. 6.\ DNL_i = 10 \text{ x } Log_{10}\left(10^{\left(\frac{DNL_{ia}}{10}\right)} + 10^{\left(\frac{DNL_{ib}}{10}\right)} + \cdots + 10^{\left(\frac{DNL_{iz}}{10}\right)}\right), dB$$

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

3.4.1 DNL at PADDC

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

Takeoff operations are represented by two phases of flight. The drone will take off and climb to the transition altitude as discussed in **Section 2**. The drone will then transition from vertical flight to horizontal flight and accelerate to en route speed of 58.3 knots and climb to en route altitude.

Landing operations are also represented by two phases of flight. The drone flies to the PADDC at en route altitude until it begins to descend to the transition altitude while slowing down and transitions from horizontal to vertical flight as described in **Section 2**. Then the drone descends from the transition altitude to the ground and shuts down.

The two noise sources representing the complete takeoff and landing cycle associated with a single delivery departing and returning at the PADDC were added together using Equation 6.

3.4.2 DNL for En Route

A receiver will be positioned directly under the flight path, and the DNL will be calculated based on the altitude and speed-adjusted delivery SEL presented in **Table 3**. The number of operations would be based on relevant materials and assume that a drone directly overflies the receiver while at maximum and empty weight for outbound and inbound flight, respectively, for a single delivery. The en route outbound and inbound noise level are added together with Equation 6.

3.4.3 DNL for Delivery Points

Delivery operations are represented by the deceleration of the drone from en route speed and transition from horizontal flight to vertical flight over the delivery point at the transition altitude of 140 feet AGL. The drone then begins a vertical descent to where the package is dropped at the delivery point at 13 feet AGL. The drone then climbs back to the transition altitude of 197 feet AGL where it will transition from vertical flight to horizontal flight, accelerating to en route speed.

4 Estimated Noise Exposure

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

The DNL equivalent deliveries, $N_{DNL,i}$ as described in **Section 4.1**, is presented below as Equation 7.

$$eq. 7.\ Deliveries_{DNL,i} = Deliveries_{Day} + 10 \text{ x } Deliveries_{Night}$$

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

For estimating noise exposure, the noise levels for each flight phase are considered separate based on the level of proposed operations for a given location. When a particular receptor is at the transition of different flight phases, the noise exposure is then determined by adding the noise from each phase.

4.1 Noise Exposure for Operations at the PADDC

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

Table 6 presents estimated extent of noise exposure for the number of average daily DNL equivalent deliveries (including the takeoff and climb, transition to en route outbound, transition from en route inbound, and descent and landing as detailed in **Section 2**) under the flight path for the PADDC. The analyses presented were rounded up conservatively to the nearest interval available from the data outlined in this section.

Table 6. Estimated Extent of Noise Exposure from PADDC per Number of Deliveries

Number of DNL Equivalent Deliveries		Estimated Extent of Noise Exposure (feet)				
Average Daily	Annual	DNL 45	DNL 50	DNL 55	DNL 60	DNL 65
<= 1	<= 365	21	21	21	21	21
<= 5	<= 1,825	50	21	21	21	21
<= 10	<= 3,650	100	50	21	21	21
<= 15	<= 5,475	100	50	21	21	21
<= 20	<= 7,300	100	50	21	21	21
<= 40	<= 14,600	150	100	50	21	21
<= 60	<= 21,900	200	100	50	21	21
<= 80	<= 29,200	250	150	50	21	21
<= 100	<= 36,500	300	150	100	50	21
<= 120	<= 43,800	350	150	100	50	21
<= 140	<= 51,100	350	200	100	50	21
<= 160	<= 58,400	400	200	100	50	21
<= 180	<= 65,700	450	200	100	50	21
<= 200	<= 73,000	450	200	100	50	21
<= 220	<= 80,300	500	250	100	50	21
<= 240	<= 87,600	500	250	100	50	21
<= 260	<= 94,900	500	250	150	50	21
<= 280	<= 102,200	550	300	150	50	50
<= 300	<= 109,500	550	300	150	100	50
<=320	<= 116,800	600	300	150	100	50
<= 340	<= 124,100	600	300	150	100	50
<= 360	<= 131,400	600	300	150	100	50
<= 380	<= 138,700	650	350	150	100	50
<= 400	<= 146,000	650	350	150	100	50
<= 420	<= 153,300	700	350	150	100	50
<= 440	<= 160,600	700	350	200	100	50
<= 460	<= 167,900	700	400	200	100	50
<= 480	<= 175,200	750	400	200	100	50
<= 500	<= 182,500	750	400	200	100	50
<= 520	<= 189,800	750	400	200	100	50
<= 540	<= 197,100	800	400	200	100	50
<= 560	<= 204,400	800	400	200	100	50
<= 580	<= 211,700	800	450	200	100	50
<= 600	<= 219,000	850	450	200	100	50
<= 620	<= 226,300	850	450	200	100	50
<= 640	<= 233,600	850	450	250	100	50
<= 660	<= 240,900	900	450	250	100	50
<= 680	<= 248,200	900	450	250	100	50
<= 700	<= 255,500	900	500	250	100	50
<= 720	<= 262,800	950	500	250	100	50
<= 740	<= 270,100	950	500	250	100	50
<= 760	<= 277,400	950	500	250	100	50
<= 780	<= 284,700	950	500	250	100	50
<= 800	<= 292,000	1,000	500	250	150	50
<= 820	<= 299,300	1,000	500	250	150	50

Number of DNL Equivalent Deliveries		Estimated Extent of Noise Exposure (feet)				
Average Daily	Annual	DNL 45	DNL 50	DNL 55	DNL 60	DNL 65
<= 840	<= 306,600	1,000	550	250	150	50
<= 860	<= 313,900	1,050	550	250	150	50
<= 880	<= 321,200	1,050	550	250	150	50
<= 900	<= 328,500	1,050	550	300	150	50
<= 920	<= 335,800	1,050	550	300	150	50
<= 940	<= 343,100	Note 3	550	300	150	50
<= 960	<= 350,400	Note 3	550	300	150	100
<= 980	<= 357,700	Note 3	600	300	150	100
<= 1,000	<= 365,000	Note 3	600	300	150	100

SOURCE: ESA, 2025.

Notes:

1. One delivery accounts for the outbound takeoff and inbound landing and is representative of two operations.
2. If a value for deliveries is not specifically defined in this table, use the next highest value. For example, if there are 50 average daily DNL equivalent deliveries, use the entry for 60 average daily DNL equivalent deliveries.
3. The DNL noise level extends more than 1,074 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

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

Table 7 provides the estimated DNL for a receiver on the ground directly under an en route path for various counts of daily average DNL equivalent deliveries. The en route noise calculated for each delivery includes both the outbound traversal of the en route path at 200 feet AGL and a ground speed of 58.3 knots and the inbound traversal of the en route path at 345 feet AGL and the same ground speed of 58.3 knots.

The drone may overfly locations at operational levels that differ from both an inbound and outbound traversal of the en route path by the drone as described above and presented in **Table 7**. For these circumstances, **Table 8** presents the equations for calculating the estimated DNL for a receiver directly under a specified given number of DNL equivalent average daily individual overflights, defined as N_o.

Table 7. Estimated Noise Exposure Directly Under En Route Flight Paths

Number of DNL Equivalent Deliveries		Estimated Extent of Noise Exposure		
Average Daily	Annual	Outbound DNL[1]	Inbound DNL[2]	Total En Route DNL
<= 1	<= 365	14.3	11.5	16.1
<= 5	<= 1,825	21.3	18.5	23.1
<= 10	<= 3,650	24.3	21.5	26.1
<= 15	<= 5,475	26.1	23.3	27.9
<= 20	<= 7,300	27.3	24.5	29.1
<= 40	<= 14,600	30.3	27.5	32.2
<= 60	<= 21,900	32.1	29.3	33.9
<= 80	<= 29,200	33.3	30.5	35.2
<= 100	<= 36,500	34.3	31.5	36.1
<= 120	<= 43,800	35.1	32.3	36.9
<= 140	<= 51,100	35.8	33.0	37.6
<= 160	<= 58,400	36.3	33.5	38.2
<= 180	<= 65,700	36.9	34.1	38.7
<= 200	<= 73,000	37.3	34.5	39.1
<= 220	<= 80,300	37.7	34.9	39.6
<= 240	<= 87,600	38.1	35.3	39.9
<= 260	<= 94,900	38.4	35.6	40.3
<= 280	<= 102,200	38.8	36.0	40.6
<= 300	<= 109,500	39.1	36.3	40.9
<=320	<= 116,800	39.4	36.6	41.2
<= 340	<= 124,100	39.6	36.8	41.4
<= 360	<= 131,400	39.9	37.1	41.7
<= 380	<= 138,700	40.1	37.3	41.9
<= 400	<= 146,000	40.3	37.5	42.2
<= 420	<= 153,300	40.5	37.7	42.4
<= 440	<= 160,600	40.7	37.9	42.6
<= 460	<= 167,900	40.9	38.1	42.8
<= 480	<= 175,200	41.1	38.3	42.9
<= 500	<= 182,500	41.3	38.5	43.1
<= 520	<= 189,800	41.5	38.7	43.3
<= 540	<= 197,100	41.6	38.8	43.5
<= 560	<= 204,400	41.8	39.0	43.6
<= 580	<= 211,700	41.9	39.1	43.8
<= 600	<= 219,000	42.1	39.3	43.9
<= 620	<= 226,300	42.2	39.4	44.1
<= 640	<= 233,600	42.4	39.6	44.2
<= 660	<= 240,900	42.5	39.7	44.3
<= 680	<= 248,200	42.6	39.8	44.5
<= 700	<= 255,500	42.8	40.0	44.6
<= 720	<= 262,800	42.9	40.1	44.7
<= 740	<= 270,100	43.0	40.2	44.8
<= 760	<= 277,400	43.1	40.3	44.9
<= 780	<= 284,700	43.2	40.4	45.1
<= 800	<= 292,000	43.3	40.5	45.2
<= 820	<= 299,300	43.4	40.6	45.3

Number of DNL Equivalent Deliveries		Estimated Extent of Noise Exposure		
Average Daily	Annual	Outbound DNL[1]	Inbound DNL[2]	Total En Route DNL
<= 840	<= 306,600	43.5	40.7	45.4
<= 860	<= 313,900	43.6	40.8	45.5
<= 880	<= 321,200	43.7	40.9	45.6
<= 900	<= 328,500	43.8	41.0	45.7
<= 920	<= 335,800	43.9	41.1	45.8
<= 940	<= 343,100	44.0	41.2	45.9
<= 960	<= 350,400	44.1	41.3	46.0
<= 980	<= 357,700	44.2	41.4	46.0
<= 1,000	<= 365,000	44.3	41.5	46.1

SOURCE: ESA, 2025.

Notes:

1. The max weight en route noise calculated for each delivery includes both the outbound traversal of the en route path at 200 feet AGL and a ground speed of 58.3 knots.
2. The empty weight en route noise calculated for each delivery includes both the inbound traversal of the en route path at 345 feet AGL and a ground speed of 58.3 knots.

Table 8. Estimated Noise Exposure Directly Under Overflights

Altitude of Overflight	SEL for One Overflight (dB)	DNL for One Overflight Between 7 A.M. and 10 P.M. (dB)	DNL Equation for the Number of DNL Equivalent Overflights
115 feet AGL	66.7	17.5	10 x $\log_{10}(No)$ + 17.5
160 feet AGL	64.9	15.7	10 x $\log_{10}(No)$ + 15.5
165 feet AGL	64.7	15.5	10 x $\log_{10}(No)$ + 15.5
180 feet AGL	64.3	15.1	10 x $\log_{10}(No)$ + 15.1
200 feet AGL	63.7	14.5	10 x $\log_{10}(No)$ +14.5
300 feet AGL	61.5	12.3	10 x $\log_{10}(No)$ + 12.3
345 feet AGL	60.7	11.5	10 x $\log_{10}(No)$ + 11.5
N Feet AGL	12.5 x $\log_{10}(200/N_{ft})$ + 63.7	SEL_1 – 49.4	10 x $\log_{10}(No)$ + DNL_1

SOURCE: ESA, 2025.

Notes:

1. The DNL value for a given number of average DNL Equivalent Operations, N_o, can be found by using the equations associated with operation of the drone at a specified altitude and speed interval. In this case, one operation represents a single overflight.
2. All values in this table are for level flight at maximum weight and 58.3 knots.

4.3 Noise Exposure for Operations at Delivery Point

Table 9 presents the estimated DNL values for a range of potential daily average DNL equivalent delivery counts at a delivery point. The DNL values include the transition from en route speed to vertical flight at transition altitude, the delivery maneuver, and the transition from vertical flight at transition 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. Values are also presented at 25 feet from the delivery point which corresponds to minimum distance from the available measurement data and analysis. Values were also calculated at distances of 50 feet, 75 feet, 100 feet, and 125 feet from the delivery point and are representative of distances from which nearby properties may experience noise from a delivery.[7]

Table 9. Estimated Noise Exposure at Various Distances from a Delivery Point per Number of DNL Equivalent Deliveries

Average Daily Deliveries	Annual Deliveries	DNL at 16.4 feet[1]	DNL at 25 feet[2]	DNL at 50 feet	DNL at 75 feet	DNL at 100 feet	DNL at 125 feet
<= 1	<= 365	45.0	42.7	38.8	36.4	34.1	32.3
<= 5	<= 1,825	52.0	49.7	45.8	43.4	41.1	39.3
<= 10	<= 3,650	55.0	52.7	48.8	46.4	44.1	42.3
<= 15	<= 5,475	56.7	54.5	50.5	48.2	45.9	44.1
<= 20	<= 7,300	58.0	55.7	51.8	49.5	47.2	45.3
<= 40	<= 14,600	61.0	58.7	54.8	52.5	50.2	48.4
<= 60	<= 21,900	62.8	60.5	56.5	54.2	51.9	50.1
<= 80	<= 29,200	64.0	61.7	57.8	55.5	53.2	51.4
<= 100	<= 36,500	65.0	62.7	58.8	56.4	54.1	52.3
<= 120	<= 43,800	65.8	63.5	59.6	57.2	54.9	53.1
<= 140	<= 51,100	66.4	64.2	60.2	57.9	55.6	53.8
<= 160	<= 58,400	67.0	64.7	60.8	58.5	56.2	54.4
<= 180	<= 65,700	67.5	65.3	61.3	59.0	56.7	54.9
<= 200	<= 73,000	68.0	65.7	61.8	59.5	57.2	55.3
<= 220	<= 80,300	68.4	66.1	62.2	59.9	57.6	55.8
<= 240	<= 87,600	68.8	66.5	62.6	60.2	57.9	56.1
<= 260	<= 94,900	69.1	66.8	62.9	60.6	58.3	56.5
<= 280	<= 102,200	69.5	67.2	63.2	60.9	58.6	56.8
<= 300	<= 109,500	69.8	67.5	63.5	61.2	58.9	57.1
<=320	<=116,800	70.0	67.8	63.8	61.5	59.2	57.4
<= 340	<= 124,100	70.3	68.0	64.1	61.8	59.5	57.6
<= 360	<= 131,400	70.6	68.3	64.3	62.0	59.7	57.9
<= 380	<= 138,700	70.8	68.5	64.6	62.2	59.9	58.1
<= 400	<= 146,000	71.0	68.7	64.8	62.5	60.2	58.4
<= 420	<= 153,300	71.2	68.9	65.0	62.7	60.4	58.6
<= 440	<= 160,600	71.4	69.1	65.2	62.9	60.6	58.8
<= 460	<= 167,900	71.6	69.3	65.4	63.1	60.8	59.0
<= 480	<= 175,200	71.8	69.5	65.6	63.3	61.0	59.1
<= 500	<= 182,500	72.0	69.7	65.8	63.4	61.1	59.3
<= 520	<= 189,800	72.1	69.9	65.9	63.6	61.3	59.5
<= 540	<= 197,100	72.3	70.0	66.1	63.8	61.5	59.7
<= 560	<= 204,400	72.5	70.2	66.2	63.9	61.6	59.8
<= 580	<= 211,700	72.6	70.3	66.4	64.1	61.8	60.0
<= 600	<= 219,000	72.8	70.5	66.5	64.2	61.9	60.1
<= 620	<= 226,300	72.9	70.6	66.7	64.4	62.1	60.3
<= 640	<= 233,600	73.1	70.8	66.8	64.5	62.2	60.4
<= 660	<= 240,900	73.2	70.9	67.0	64.6	62.3	60.5

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

Average Daily Deliveries	Annual Deliveries	DNL at 16.4 feet[1]	DNL at 25 feet[2]	DNL at 50 feet	DNL at 75 feet	DNL at 100 feet	DNL at 125 feet
<= 680	<= 248,200	73.3	71.0	67.1	64.8	62.5	60.7
<= 700	<= 255,500	73.4	71.2	67.2	64.9	62.6	60.8
<= 720	<= 262,800	73.6	71.3	67.3	65.0	62.7	60.9
<= 740	<= 270,100	73.7	71.4	67.5	65.1	62.8	61.0
<= 760	<= 277,400	73.8	71.5	67.6	65.3	62.9	61.1
<= 780	<= 284,700	73.9	71.6	67.7	65.4	63.1	61.3
<= 800	<= 292,000	74.0	71.7	67.8	65.5	63.2	61.4
<= 820	<= 299,300	74.1	71.8	67.9	65.6	63.3	61.5
<= 840	<= 306,600	74.2	71.9	68.0	65.7	63.4	61.6
<= 860	<= 313,900	74.3	72.0	68.1	65.8	63.5	61.7
<= 880	<= 321,200	74.4	72.1	68.2	65.9	63.6	61.8
<= 900	<= 328,500	74.5	72.2	68.3	66.0	63.7	61.9
<= 920	<= 335,800	74.6	72.3	68.4	66.1	63.8	62.0
<= 940	<= 343,100	74.7	72.4	68.5	66.2	63.9	62.1
<= 960	<= 350,400	74.8	72.5	68.6	66.3	64.0	62.2
<= 980	<= 357,700	74.9	72.6	68.7	66.4	64.1	62.2
<= 1,000	<= 365,000	75.0	72.7	68.8	66.4	64.1	62.3

SOURCE: ESA, 2025.

Notes:

1. Minimum possible listener distance from drone.
2. Minimum measured distance to listener from drone.
3. The DNL values presented in this table reflect the drone conducting delivery descent and transition, backyard descent, delivery, backyard ascent, and transition and inbound climb flight maneuvers associated with a delivery.
4. If a value for deliveries is not specifically defined in this table, use the next highest value. For example, if there are 50 average daily DNL equivalent deliveries, use the entry for 60 average daily DNL equivalent deliveries.

Attachment A

Attachment B

PRIME AIR MK30 DRONE NOISE MEASUREMENT REPORT

Technical Report

April 2025

PRIME AIR MK30 DRONE NOISE MEASUREMENT REPORT

Technical Report

April 2025

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1 Introduction

This document details Amazon Prime Air's (Prime Air's) recent National Environmental Policy Act (NEPA) Noise Data Collection Campaign, aimed at estimating the noise signature of the MK30 drone. The collected data will be used to evaluate operations under NEPA. The test campaign took place at the Pendleton UAS Range, situated at the Eastern Oregon Regional Airport (KPDT) in Pendleton, Oregon. The data analyzed in this report comes from flights conducted on October 11, 12, 15, 16, 19, and 23, 2024.

Prime Air's package delivery operations are managed through a network of Prime Air Drone Delivery Centers (PADDCs). Each PADDC serves a specific area, preventing an over-concentration of flights around any single center. The MK30 drone has a round-trip range of approximately 15 miles. PADDCs are strategically located in established, and planned development, parking lots of Amazon Prime warehouses, and adhere to local zoning and land use regulations.

The MK30 is an electric powered drone that uses a vertical take-off and landing (VTOL) then transitions to fixed-wing flight using wing lift during en route flight. The drone systems include hardware and software designed for safety and efficiency. The airframe is composed of staggered wings, the propulsion system includes a rechargeable lithium-ion battery, and six (6) motors that include propellers designed for noise reduction. The package delivery system contains the package in a two-door interior receptacle, and a camera and avionics system that has redundancy for critical systems. The drone weighs approximately 78 lbs. and has a maximum takeoff weight of 83.2 lbs., which includes a maximum payload of 5 lbs. It has a maximum operating range of 7.5 mi and can fly up to 400 ft above ground level (AGL) at a maximum cruise speed of 73 mph (64 knots) during horizontal flight. An image of the MK30 drone is shown in **Figure 1**.

The MK30 operational flight profiles can be broken into the following general flight phases: launch, en route outbound, delivery, en route inbound, and landing. After launch, the MK30 would ascend to an altitude of less than 400 ft AGL and follow a predefined route to its delivery site.[1] The MK30 would typically fly en route at between approximately 180 to 377 ft AGL, except when descending to drop a package. Packages would be carried internally in the drone's fuselage. When making a delivery, the drone descends, opens a set of payload doors, and drops the package to the ground from approximately 13 ft AGL. Prime Air's drone would not touch the ground in any place other than the PADDC (except during safe contingent landings) and will remain airborne throughout the operation including the delivery stage.[2] After the package is dropped, the MK30 drone climbs vertically and follows its predefined route back to the PADDC at its assigned altitude. The typical operational flight parameters can be seen below in **Table 1** and **Figure 2**. Note that these are the flight profiles for operational flights and not the flight test profiles for this noise flight test campaign.

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

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

A custom measurement system was utilized, employing GRAS 46AO 1/2" pressure microphones and National Instruments data acquisition hardware, following the FAA's draft UA package delivery noise measurement protocol.[3] Flights were conducted across three flight profiles, which included takeoff/landing/delivery, hover, and overflight, to characterize the sound exposure levels (SEL) of the MK30 drone. These SEL values will be a key input to the NEPA Environmental Assessment for assessing the potential noise impact of Prime Air's proposed drone package delivery operations.

Figure 1. Amazon Prime Air MK30 Drone

Source: Amazon Prime Air, 2024.

[3] Measuring Drone Noise for Environmental Review Process, October 2023.

Table 1. Phases of Flight for Typical Flight Profile of the MK30 Drone

Phase of Flight	Altitude (feet AGL)	Ground Speed (knots)	Duration (seconds)
Takeoff and Vertical Ascent	Ascent from 0 to 115	0	15
Transition and Outbound Climb	115 to 200	0 to 58.3	40
Fixed Wing Outbound Cruise	200[1]	58.3	Variable[3]
Delivery Descent and Transition	Descent from 200 to 140	58.3 to 0	30
Backyard Descent	Descent from 140 to 13	0	27
Delivery	13	0	4
Backyard Ascent	Ascent from 13 to 197	0	30
Transition and Inbound Climb	Ascent from 197 to 345	0 to 58.3	40
Fixed-Wing Inbound Cruise	377[2]	58.3	Variable[3]
Landing Descent and Transition	Descent from 345 to 197	58.3 to 0	30
Vertical Descent and landing	Descent from 197 to 0	0	35

Source: Prime Air, 2025.

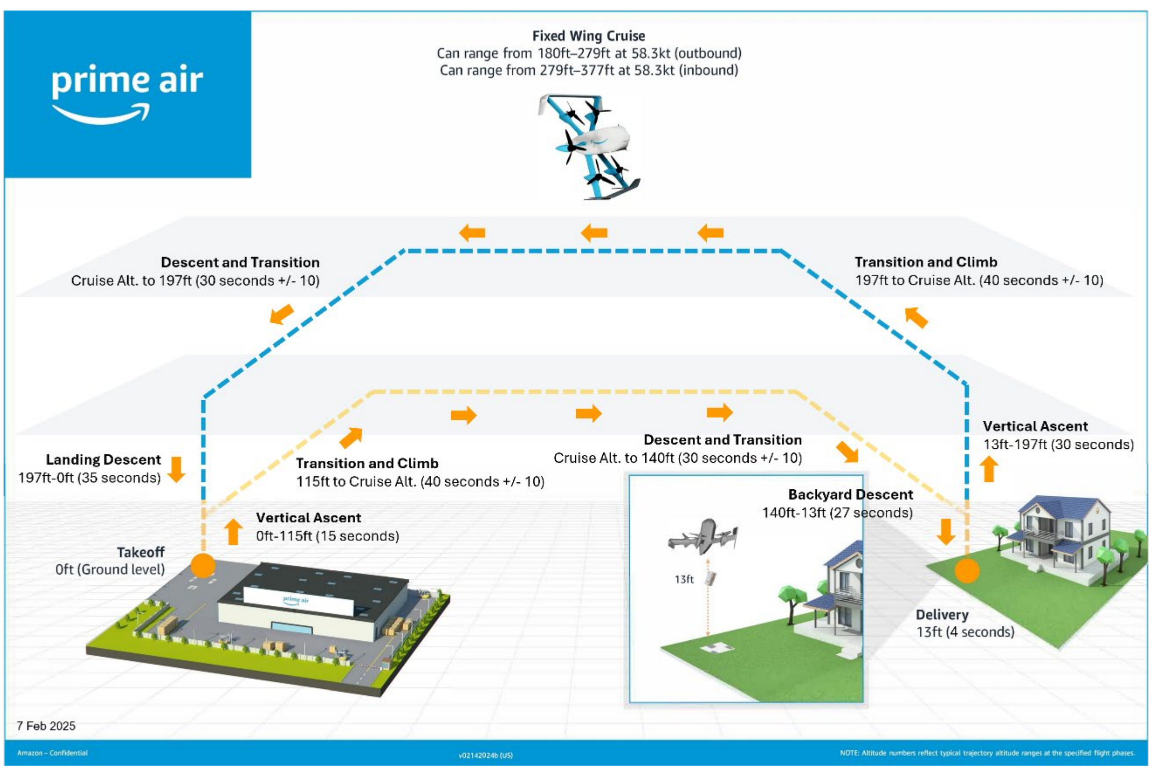
Notes:

[1] The outbound enroute altitude may range from 180 – 279 feet. For this analysis the outbound cruise altitude was assumed to be 200 feet.

[2] The inbound enroute altitude may range from 279 – 377 feet. For this analysis the inbound cruise altitude was assumed to be 345 feet.

[3] Duration of inbound and outbound cruise flight time varies based on distance to customer.

Figure 2. Representative Operational Profile of the MK30



Source: Prime Air, 2025.

2 Test Descriptions

2.1 Overview

This section describes the methodology utilized to characterize the noise signature of the MK30 drone. The following sections describe the measurement system, and detailed description of the test plan, including flight trajectories and microphone locations.

2.2 Measurement System

Prime Air utilized a proprietary Mobile Acoustic Noise Test Array (MANTA) system for experimental measurements. This system provides time synchronized audio with respect to the drone. Microphone locations are surveyed for accurate positioning. The audio, drone-synchronized time and location data allow accurate determination of sound pressure level (SPL), distance, and incidence angle required for post-processing.

The system is composed of commercially available hardware with internal and external calibrations. The data acquisition system (DAQ) is a series of daisy-chained National Instruments cDAQ-9185 units and cDAQ-9189 units with NI-9234 analog modules capable of 51.2 kHz sampling rate at 24-bit resolution. New and calibrated GRAS 46AO ½" CCP Pressure Standard Microphones were used with the factory sensitivity values for the test. Calibration tones of the microphones were collected using a GRAS 42AG sound calibrator with a 1000 Hz signal at 114dB at the start and completion of each flight. Sensitivity values can be found in **Table 2**. While the primary components of the system are detailed above, the complete system hardware can be found in **Table 3**.

Measurement accuracy can be decomposed into system and field-installation components. Although MANTA has a GPS assigned to each microphone unit, only the time solution is used in the final product. By assigning a separate GPS unit to each microphone, the system is able to time synchronize with the on-board vehicle system to within 1 ms accuracy. Although the GPS location solution is not part of the delivered data product, it is used to confirm microphone placement with respect to desired survey locations using a nearest neighbor algorithm. This reduces geographic microphone placement from ±1 m to ±5 mm before installation error. When including a ±30°. installation error via a 1.6m tall tripod on non-level ground, horizontal and vertical location accuracy approach ±0.8m and ±0.1m, respectively.

Table 2. Microphone Data

Microphone ID	Hardware	Serial Number	Sensitivity (mV/Pa)
00	GRAS 46AO	573631	10.77
01	GRAS 46AO	573508	9.47
02	GRAS 46AO	573632	11.60
03	GRAS 46AO	573507	12.54
04	GRAS 46AO	573633	10.81
05	GRAS 46AO	573636	10.41
06	GRAS 46AO	573506	11.12
07	GRAS 46AO	573505	12.78
08	GRAS 46AO	573504	9.39
08	GRAS 46AO	573504	9.39
10	GRAS 46AO	573521	10.10
11	GRAS 46AO	573626	10.19
12	GRAS 46AO	573639	9.78

Source: Prime Air, 2024.

Note: Microphones calibrated with GRAS 42AG; Serial Number: 282324.

Table 3. Measurement System Hardware

Hardware	Quantity	Description
National Instruments cDAQ-9185	7	National Instruments cDAQ chassis with 4 module slots. 1 slot was utilized and populated with a NI-9234 4 channel Sound and Vibration module. 1 channel input was used for the GRAS 46AO microphone input.
National Instruments cDAQ-9189	3	National Instruments cDAQ chassis with 8 module slots. 1 slot was utilized and populated with a NI-9234 4 channel Sound and Vibration module. 2 channel inputs were used for the GRAS 46AO microphone input.
National Instruments Sound and Vibration Module NI-9234	10	The Sound and Vibration module used for microphone input to the system. The nidaqmx task was configured to capture microphone input at 51.2kHz at 24bits.

Source: Prime Air, 2024.

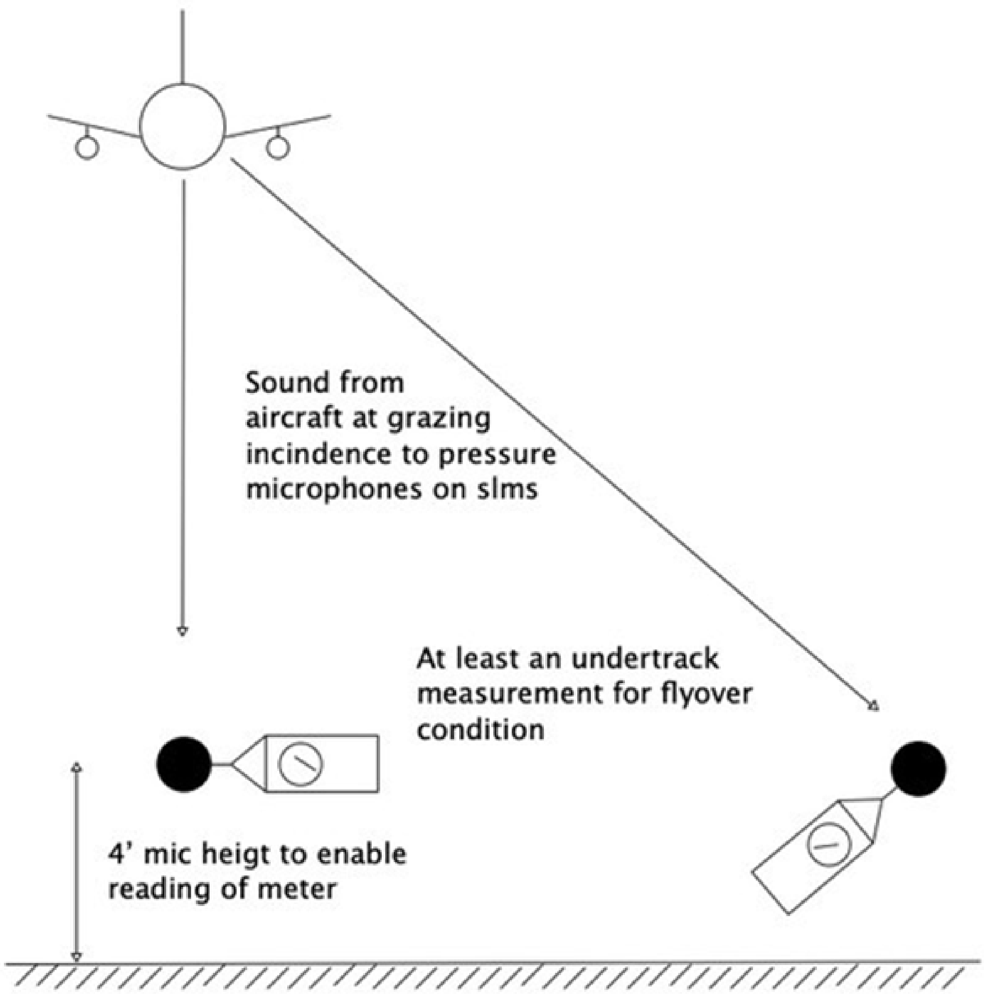
Note: All cDAQs were daisy chained together and utilized the Time-Sensitive Networking protocol to keep all data synchronized.

2.3 Microphone Locations

The microphone setup consisted of 13 pressure field microphones. In accordance with the FAA guidelines, each microphone was placed at 90 degree incidence to the sound source (drone) and is illustrated in **Figure 3**. There were no corrections applied to the measurement data due to the orientation of the microphones.

As shown in **Table 4**, microphones 00-04 were located under the takeoff, delivery, and landing flight trajectory. Microphones 05-08 were located behind the flight trajectory. Microphones 09-12 were located lateral to the flight trajectory. The table identifies the microphones used in calculating the various flight profiles. **Figure 4** provides the layout of microphones over an aerial basemap.

Figure 3. Microphone Orientation



Source: FAA.

Table 4. Microphone Location and Applicable Flight Profile

Microphone ID (position)	Distance from VTOL / Delivery (ft)	Latitude	Longitude	Applicable Flight Profile		
				Takeoff/ Landing	Delivery	Enroute/ Overflight
00 (Undertrack)	772	45.70246	-118.8586	Yes	Yes	No
01 (Undertrack)	372	45.70247	-118.8571	Yes	Yes	No
02 (Undertrack)	195	45.70247	-118.8563	Yes	Yes	No
03 (Undertrack)	75	45.70247	-118.8559	Yes	Yes	No
04 (Undertrack)	20	45.70247	-118.8557	Yes	Yes	No
05 (Behind)	19	45.70246	-118.8555	Yes	Yes	No
06 (Behind)	79	45.70247	-118.8553	Yes	Yes	No
07 (Behind)	176	45.70247	-118.8549	Yes	Yes	No
08 (Behind)	375	45.70247	-118.8541	Yes	Yes	No
09 (Lateral)	25	45.7024	-118.8556	Yes	Yes	Yes
10 (Lateral)	76	45.70227	-118.8556	Yes	Yes	Yes
11 (Lateral)	175	45.70199	-118.8556	Yes	Yes	Yes
12 (Lateral)	375	45.70144	-118.8556	Yes	Yes	Yes

Source: Prime Air, 2024.

Figure 4. Location of Microphones to Launch Pad

Source: Prime Air, 2024; ESA, 2025.

2.4 Test Limitations

The test plan consists of flights with a “dog-bone” and “half dog-bone” trajectory while the MANTA (detailed in 2.2) is positioned at the vicinity of the delivery/takeoff/landing PADDC and along a parallel and perpendicular line to the flyover trajectory. Close-in and distant measurements were captured for all VTOL phases of flight.

Additionally, some phases of the test flight profiles were slightly modified from typical operations. The duration of the delivery backyard climb was, on average, 16 seconds shorter than expected for typical operation. During the test flight the drone also climbed to a lower altitude of approximately 200 feet AGL, compared to the typical 345-foot AGL ceiling. To adjust, noise measurements were manually added at the point just before the MK30 stops climbing, where the climb rate is constant, to account for the total missing duration.

Similarly, for the return to the PADDC, the VTOL descent was, on average, 10 seconds shorter than typical operations. To adjust, noise measurements were manually added at the point just after the MK30 starts its vertical descent, where the descent rate is constant, to account for the total missing duration. Both adjustments provided a conservative (i.e., louder) approach to assessing noise exposure of the MK30.

3 Measurement Profiles

3.1 Overview

The noise measurement data for each test was reviewed and takeoff, delivery, landing, and overflight events were hand-selected for each test flight based on the drone’s altitude, speed, location, and distance from the PADDC and MANTA. Events were reviewed for each test flight and each microphone in the MANTA was checked for data quality, and were discarded based on the following criteria:

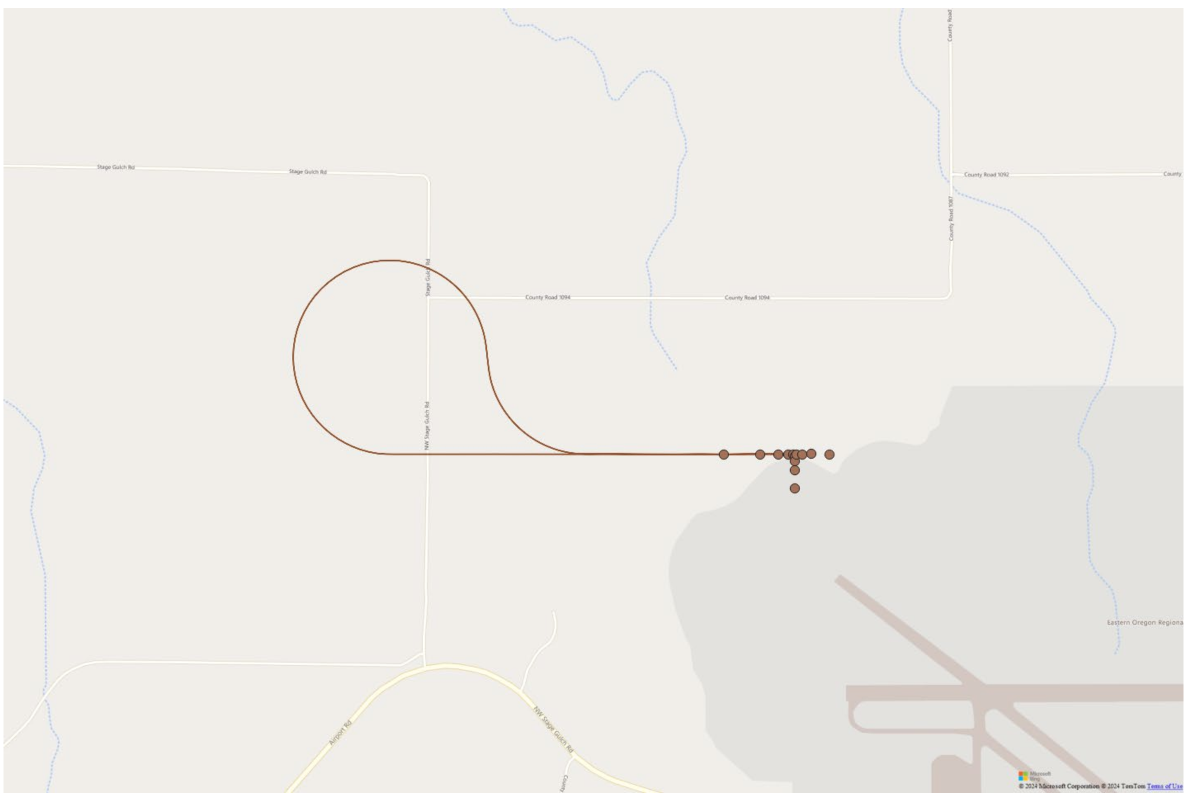
- Ambient noise level of the microphone is not reasonably close to the other microphones in the MANTA array.
- Average wind speed exceeding 5 knots during the event.
- Maximum sound level as measured by the 1-second Leq time history of the noise event not exceeding 10 dBA above the ambient noise level.
- Suspected contamination of the noise data (e.g. elevated or inconsistent ambient, sharp spikes in noise level, etc.).
- For overflight tests, data from the undertrack microphones (parallel to the direction of flight) were discarded.

3.2 Flight Test Profiles

3.2.1 Takeoff – Delivery – Landing (VTOL)

Two sets of tests were conducted with the drone performing VTOL flights at the PADDC location at the center of the MANTA to simulate takeoff, delivery, and landing operations. A total of six test flights were measured with the drone carrying no payload, and an additional seven test flights were measured with the drone carrying maximum payload. For each of these test flights the drone was flown in a "half dog-bone" flight pattern, as shown in **Figure 5**. As depicted, the drone takes off from the PADDC, and heads west before making a righthand turn through a full 270 degrees while attaining a cruise altitude of approximately 200 feet AGL. The drone then makes a left-hand 90 degree turn to re-align with the outbound flight path while descending back to PADDC elevation. The drone performs this flight pattern twice per test flight. The first outbound leg represents the takeoff phase of flight, the first inbound and second outbound legs combined represent the delivery phase of flight, and the second inbound leg represents the landing phase of flight. The drone only touches down after the second inbound leg representing the landing phase.

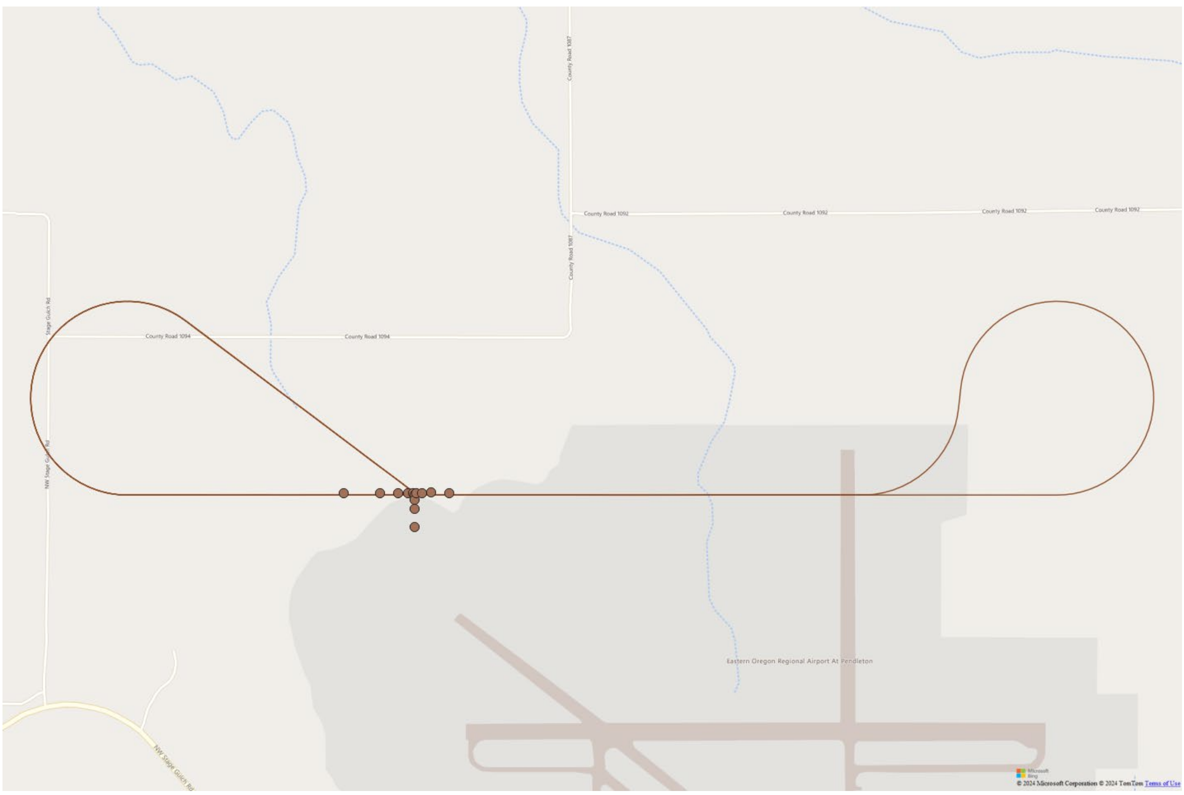
Figure 5. Takeoff, Delivery, and Landing Flight Pattern (Empty and MTOW)



3.2.2 Forward Flight (Flyover)

Two sets of tests were conducted with the drone overflying the MANTA to simulate an en route pass-by. A total of seven overflights were measured with the drone carrying no payload, and an additional six overflights were measured with the drone carrying maximum payload. For each of these overflights the drone was flown in a "dog-bone" flight pattern, as shown in **Figure 6**. As depicted, the drone takes off from the PADDC, heads northwest to transition and makes a lefthand turn while attaining a cruise altitude of 104 feet AGL at empty weight and 123 feet AGL at max weight.[4] It then flies over the MANTA, then performs another lefthand turn through a full 270 degrees before turning right 90 degrees to realign with the eastbound portion of the flight path before overflying the MANTA again, and finally reversing the original outbound route back to the PADDC. This maneuver was repeated for each flight in both the max and empty weight test scenarios.

Figure 6. Flyover Flight Pattern (Empty and MTOW)



[4] Empty and max weight en route flight tests were flown at different altitudes to ensure measurement was above ambient noise levels.

3.3 Test Condition: Takeoff (Max Weight)

3.3.1 Weather Conditions

The average weather conditions for each test at max weight are shown in **Table 5**. There were no weather exceedances that would deem measurements invalid.

Table 5. Takeoff (Max Weight) Weather Conditions

Test Number	Temperature (°F)	Average Wind Speed (knots)	Wind Direction (Degrees)	Average Wind Gust Speed (knots)	Relative Humidity (%)
1	49.3	4.4	114	6.2	56.5
2	55.5	2.0	165	3.5	43.9
3	59.7	4.0	275	7.4	36.4
4	60.1	3.6	233	7.0	35.6
5	50.0	3.4	101	4.3	52.7
6	45.8	4.0	90	4.9	62.5
7	47.8	4.0	121	6.2	60.2

Source: Prime Air, 2024; ESA, 2025.

3.3.2 Test Points and Validity

Appendix B and **Appendix C** present the tabulated and time history results, respectively, for all measurements. Out of the 91 data points, 17 were identified as invalid, as detailed in the **Table 6**. Therefore, 74 data points were deemed valid.

Table 6. Takeoff (Max Weight) Excluded Measurements

Microphone ID (position)	Test Number	Reason Not Included
Mic 00 (Undertrack)	7	Measurement too close to ambient
Mic 05 (Behind)	4	Elevated ambient levels across measurement
Mic 08 (Behind)	1, 5, 6, 7	Measurement too close to ambient
Mic 09 (Lateral)	1, 2, 3, 4, 5	Elevated ambient levels across measurement
Mic 12 (Lateral)	2, 3, 4, 5, 6, 7	Measurement too close to ambient

Source: Prime Air, 2024; ESA, 2025.

Notes: Measurement data that has been excluded under this noise analysis are presented in Appendix B and Appendix C.

3.4 Test Condition: Delivery (Max Weight)

3.4.1 Weather Conditions

The average weather conditions for each test at max weight are shown in **Table 7**. There were no weather exceedances that would deem measurements invalid.

Table 7. Delivery (Max Weight) Weather Conditions

Test Number	Temperature (°F)	Average Wind Speed (knots)	Wind Direction (Degrees)	Average Wind Gust Speed (knots)	Relative Humidity (%)
1	49.1	4.1	123	6.0	56.6
2	55.6	1.2	260	3.7	43.5
3	59.8	5.0	283	7.4	36.3
4	60.3	4.6	222	6.2	35.2
5	50.6	2.9	92	4.3	52.3
6	45.8	4.5	93	4.9	62.8
7	47.9	4.2	112	6.2	59.7

Source: Prime Air, 2024; ESA, 2025.

3.4.2 Test Points and Validity

Appendix B and **Appendix C** present the tabulated and time history results, respectively, for all measurements. Out of the 91 data points, 14 were identified as invalid, as detailed in **Table 8**. Therefore, 77 data points were deemed valid.

Table 8. Delivery (Max Weight) Excluded Measurements

Microphone ID (position)	Test Number	Reason Not Included
Mic 00 (Undertrack)	7	Elevated ambient levels across measurement
Mic 08 (Behind)	5, 6, 7	Measurement too close to ambient
Mic 09 (Lateral)	1, 2, 3, 4, 5	Elevated ambient levels across measurement
Mic 12 (Lateral)	2, 3, 4	Elevated ambient levels across measurement
Mic 12 (Lateral)	5, 6	Measurement too close to ambient

Source: Prime Air, 2024; ESA, 2025.

Notes: Measurement data that has been excluded under this noise analysis are presented in Appendix B and Appendix C.

3.5 Test Condition: Landing (Empty Weight)

3.5.1 Weather Conditions

The average weather conditions for each test at empty weight are in **Table 9**. Test 3 wind speed exceeded the weather threshold for wind and would invalidate the measurement.

Table 9. Landing (Empty Weight) Weather Conditions

Test Number	Temperature (°F)	Average Wind Speed (knots)	Wind Direction (Degrees)	Average Wind Gust Speed (knots)	Relative Humidity (%)
1	51.5	3.4	309	6.8	61.3
2	62.4	1.2	298	6.0	33.0
3	61.4	5.2	321	7.8	34.7
4	59.9	3.4	271	5.2	44.6
5	42.6	4.8	118	5.6	83.0
6	56.8	1.0	108	2.1	51.1

Source: Prime Air, 2024; ESA, 2025.

3.5.2 Test Points and Validity

Appendix B and **Appendix C** present the tabulated and time history results, respectively, for all measurements. Out of the 78 data points, 35 were identified as invalid, as detailed in **Table 10**. Therefore, 43 data points were deemed valid.

Table 10. Landing (Empty Weight) Excluded Measurements

Microphone ID (position)	Test Number	Reason Not Included
Mic 00-12 (all)	3[1]	Exceeds crosswind component
Mic 01	4	Elevated ambient levels across measurement
Mic 05	1, 4, 6	Elevated ambient levels across measurement
Mic 08	4, 5, 6	Elevated ambient levels across measurement
Mic 09	1, 6	Elevated ambient levels across measurement
Mic 10	2	Elevated ambient levels across measurement
Mic 12	2	Elevated ambient levels across measurement
Mic 00	1, 2, 4, 5, 6	Measurement too close to ambient
Mic 01	5	Measurement too close to ambient
Mic 08	1	Measurement too close to ambient
Mic 11	5	Measurement too close to ambient
Mic 12	1, 4, 6	Measurement too close to ambient

Source: Prime Air, 2024; ESA, 2025.

Notes:

Measurement data that has been excluded under this noise analysis are presented in Appendix B and Appendix C.

[1] Test 3 was invalid for all microphone positions and accounts for 13 data points.

3.6 Test Condition: Flyover (Empty Weight)

3.6.1 Weather Conditions

The average weather conditions for each test at empty weight are shown in **Table 11**. Test 3-1, 3-2, and 4-2 wind speeds exceeded the weather threshold for wind and would invalidate the measurement.

Table 11. Flyover (Empty Weight) Weather Conditions

Test Number	Temperature (°F)	Average Wind Speed (knots)	Wind Direction (Degrees)	Average Wind Gust Speed (knots)	Relative Humidity (%)
1-1	45.3	4.0	102	4.5	62.8
1-2	45.5	3.8	93	4.5	62.2
2-1	65.1	2.4	177	4.1	38.7
2-2	65.1	3.0	213	4.1	38.4
3-1	62.2	5.9	326.2	10.9	34.6
3-2	62.8	7.5	312.6	10.9	35.6
4-1	63.3	4.3	300	11.1	34.1
4-2	63.9	6.4	353.4	10.7	33.9
5-1	61.3	2.2	320	9.9	37.8
5-2	61.7	3.0	341	9.9	37.4
6-1	61.3	4.4	34	9.1	37.3
6-2	61.0	2.6	22	7.4	37.0
7-1	45.5	4.2	102	4.7	61.5
7-2	45.7	3.9	105	4.7	61.3

Source: Prime Air, 2024; ESA, 2025.

3.6.2 Test Points and Validity

Appendix B and **Appendix C** present the tabulated and time history results, respectively, for all measurements. Out of the 56 data points, 25 were identified as invalid, as detailed in **Table 12**. Therefore, 31 data points were deemed valid.

Table 12. Flyover (Empty Weight) Excluded Measurements

Microphone ID (position)	Test Number	Reason Not Included
Mic 09 - 12	3-1, 3-2, 4-2	Exceeds crosswind component
Mic 09	4-1	Measurement too close to ambient
Mic 10	6-2	Measurement too close to ambient
Mic 11	6-1	Elevated ambient levels across measurement
Mic 12	1-1, 1-2, 2-2, 4-1, 5-1, 5-2, 6-1, 6-2, 7-1, 7-2	Measurement too close to ambient

Source: Prime Air, 2024; ESA, 2025.

Notes: Measurement data that has been excluded under this noise analysis are presented in Appendix B and Appendix C.

3.7 Test Condition: Flyover (Max Weight)

3.7.1 Weather Conditions

The average weather conditions for each test at max weight are shown in **Table 13**. There were no weather exceedances that would deem measurements invalid.

Table 13. Flyover (Max Weight) Weather Conditions

Test Number	Temperature (°F)	Average Wind Speed (knots)	Wind Direction (Degrees)	Average Wind Gust Speed (knots)	Relative Humidity (%)
1-1	53.4	1.6	96.6	4.4	53.8
1-2	53.2	2.9	82.3	4.1	53.6
2-1	48.4	3.3	77.3	5.8	62.8
2-2	49.3	3.6	123.5	5.8	60.9
3-1	54.5	1.7	132.1	3.5	52.2
3-2	54.9	2.2	306.5	3.5	51.3
4-1	56.7	2.1	170.8	3.9	48.7
4-2	56.1	1.9	214.0	4.1	49.2
5-1	50.9	3.3	116.9	4.7	59.1
5-2	51.1	2.7	131.5	4.7	58.6
6-1	65.5	1.6	191.3	4.1	53.5
6-2	65.3	3.7	245.7	7.0	56.7

Source: Prime Air, 2024; ESA, 2025.

3.7.2 Test Points and Validity

Appendix B and **Appendix C** present the tabulated and time history results, respectively, for all measurements. Out of the 48 data points, 12 were identified as invalid, as detailed in **Table 14**. Therefore, 36 data points were deemed valid.

Table 14. Flyover (Max Weight) Excluded Measurements

Microphone ID (position)	Test Number	Reason Not Included
Mic 12	All	Measurement too close to ambient

Source: Prime Air, 2024; ESA, 2025.

Notes: Measurement data that has been excluded under this noise analysis are presented in Appendix B and Appendix C.

4 Measurement Analysis

A range of metrics were calculated for each event and at each microphone. These metrics include ambient noise level (defined as the noise level when the drone's rotors are not powered), Leq, Maximum Sound Level (Lmax), and SEL. Additional parameters regarding flight performance and weather conditions were also considered. It should be noted that the empty weight takeoff and max weight landing cases are not used in any subsequent analyses.

4.1 Overflight Analysis

As noted in the previous section, only the microphones positioned perpendicular to the flight path were utilized for analyzing the overflight data. For each event and microphone, the measured SEL was adjusted using correction factors to normalize the noise to the speed and distances specified by Prime Air's typical flight profile, as described in Section 1. **Table 15** below outlines the parameters used for normalization.

Table 15. Enroute Normalization Parameters

Test Case	Normalization Speed (knots)	Normalization Distance (ft)
Empty Weight	58.3	345
Max Weight	58.3	200

Source: Prime Air, 2024; ESA, 2025.

The SELs for each microphone were averaged and the highest resulting SEL was selected for use as the computed en route noise level. The results of this analysis are presented in **Table 16** below along with the undertrack distance and point of closest approach (POCA) slant distance. The most conservative empty-weight en route noise level was computed to be 61.0 dBA. The most conservative max-weight en route noise level was computed to be 63.9 dBA. **Figure 7** and **Figure 8** present the range of measured en route SEL's for empty weight and max weight, respectively.

Table 16. En Route Averaged A-Weighted SELs (Empty and Max Weight)

Test Case	Microphone ID (Position)	Undertrack Distance (ft)	POCA Slant Distance (ft)	Normalized SEL[1] (dBA)
Empty Weight	09 (Lateral)	18.4	99.3	60.4
	10 (Lateral)	57.8	112.8	60.9
	11 (Lateral)	152.8	180.8	59.1
Max Weight	09 (Lateral)	20.0	118.4	63.0
	10 (Lateral)	56.0	128.9	63.7
	11 (Lateral)	152.7	191.7	61.7

Source: Prime Air, 2024; ESA, 2025.

Notes: Microphone ID 12 (lateral) is excluded as results were not sufficiently above ambient noise levels.

[1] Measured levels normalized to 58.3 kts before averaging. Using 12.5*log10(POCA Slant / Normalized Adjustment Slant); empty weight normalized to 345 feet; max weight normalized to 200 feet.

Figure 7. Range of MK30 Averaged A-Weighted SELs from En Route at Empty Weight

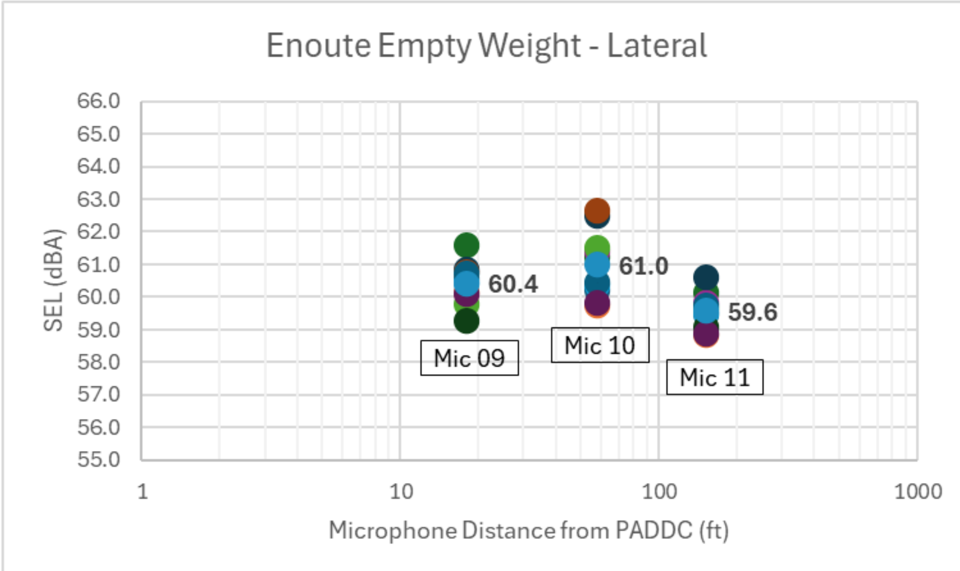
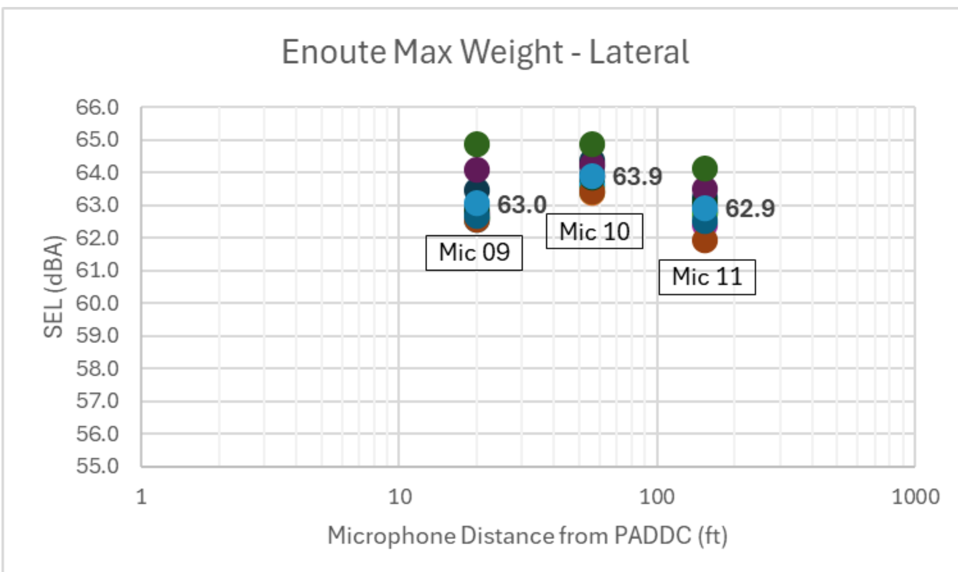


Figure 8. Range of MK30 Averaged A-Weighted SELs from En Route at Max Weight



4.2 VTOL Analysis

For each microphone and each test flight, the takeoff, delivery, and landing SELs were averaged. **Table 17** presents the results for takeoff, delivery, and landing. Scatter plots for these measurements are shown in **Figure 9** through **Figure 17**.

Table 17. Takeoff, Delivery, and Landing Averaged A-Weighted SELs

Distance to PADDC (ft)	Max Weight		Empty Weight
	Takeoff	**Delivery**	**Landing**
Undertrack			
20	90.5	91.7	91.8
75	81.6	83.7	82.8
195	76.5	78.8	76.5
372	72.4	74.5	70.4
772	-	69.5	-
Behind			
19	89.8	92.0	91.2
79	80.0	83.2	81.6
176	73.5	77.3	75.3
375	67.3	71.3	70.5
Lateral			
25	88.8	92.1	89.9
76	82.1	85.8	83.2
175	75.5	79.0	76.3
375	68.2	71.1	-

Source: Prime Air, 2024; ESA, 2025.

Figure 9. Range of MK30 Averaged A-Weighted SELs from Takeoff at Max Weight – Undertrack

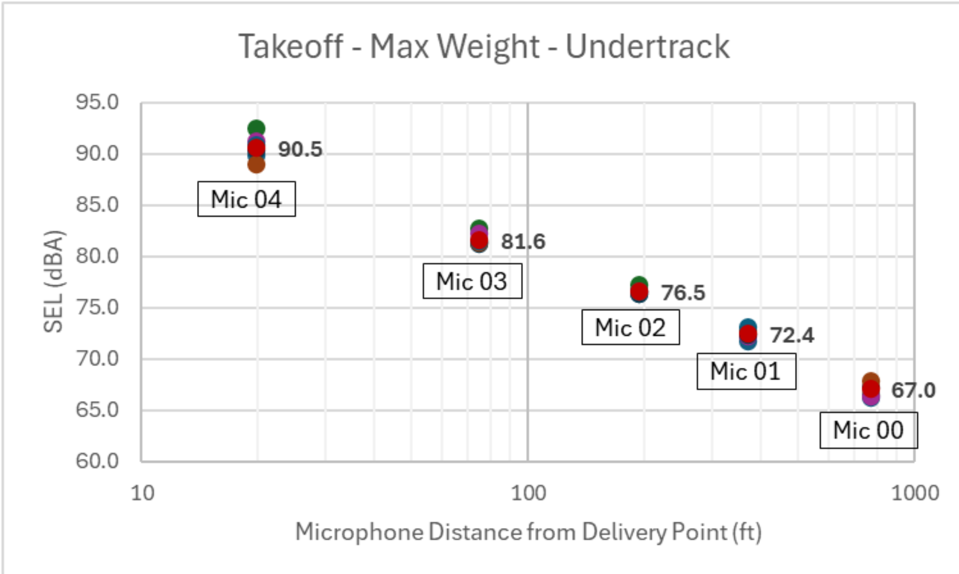


Figure 10. Range of MK30 Averaged A-Weighted SELs from Takeoff at Max Weight – Behind

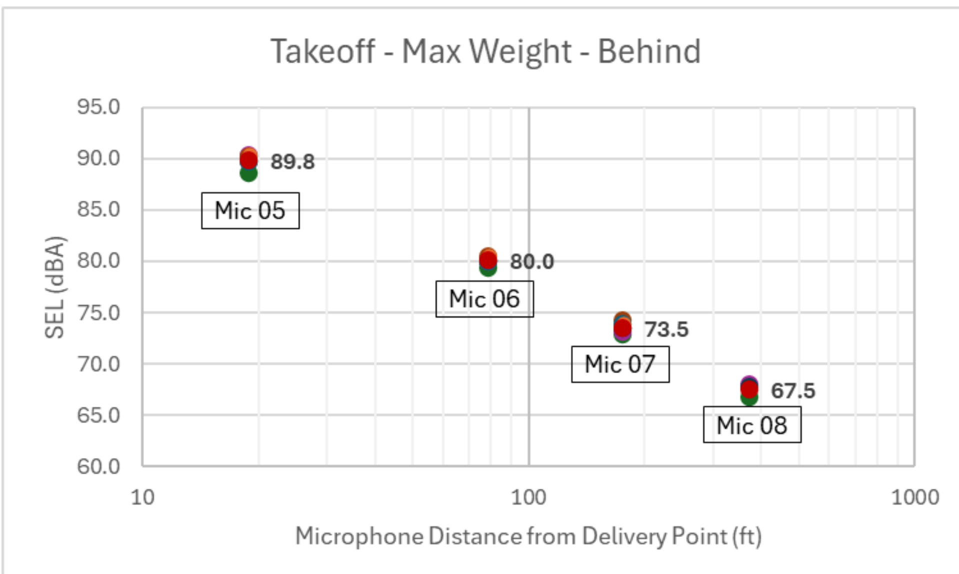


Figure 11. Range of MK30 Averaged A-Weighted SELs from Takeoff at Max Weight – Lateral

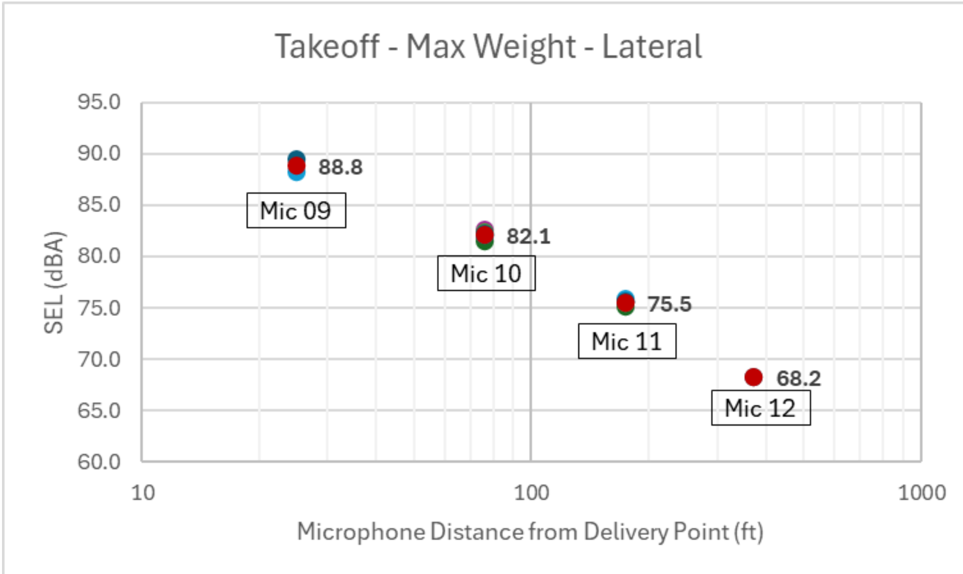


Figure 12. Range of MK30 Averaged A-Weighted SELs from Landing at Empty Weight – Undertrack

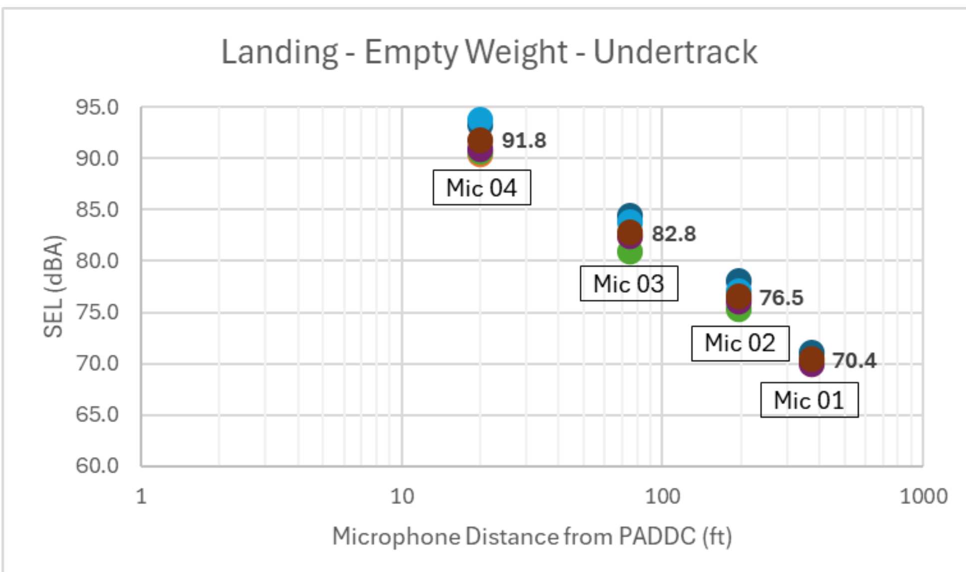


Figure 13. Range of MK30 Averaged A-Weighted SELs from Landing at Empty Weight – Behind

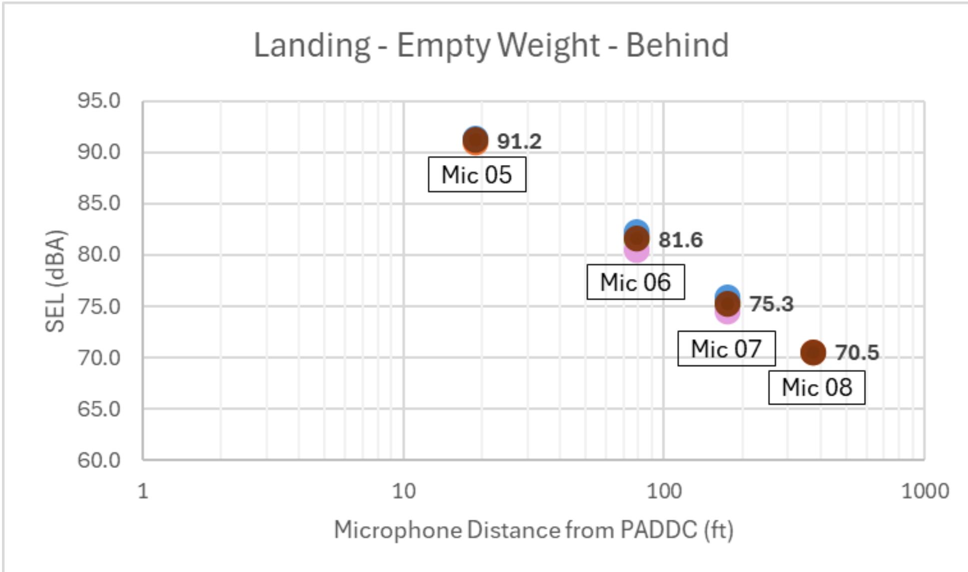


Figure 14. Range of MK30 Averaged A-Weighted SELs from Landing at Empty Weight – Lateral

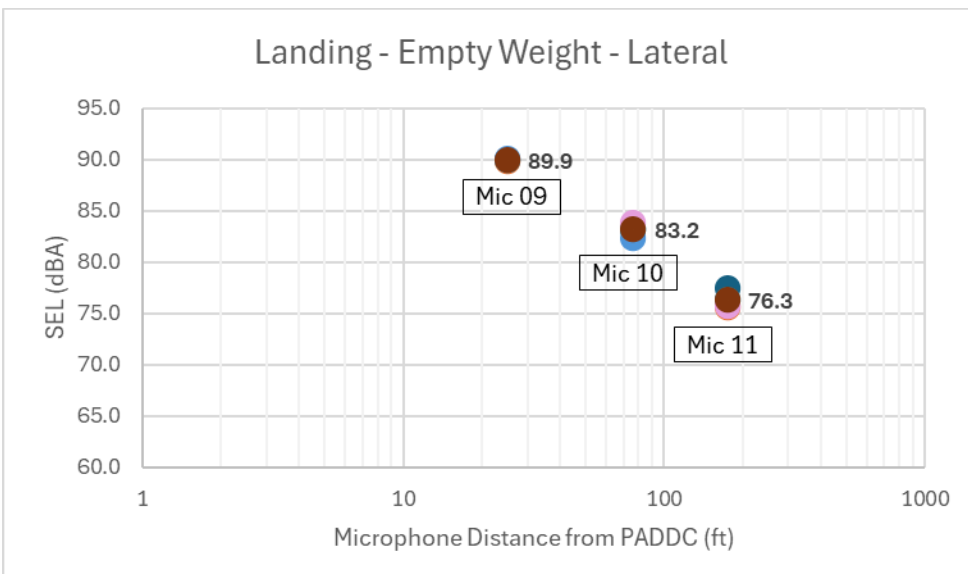


Figure 15. Range of MK30 Averaged A-Weighted SELs from Delivery at Max Weight – Undertrack

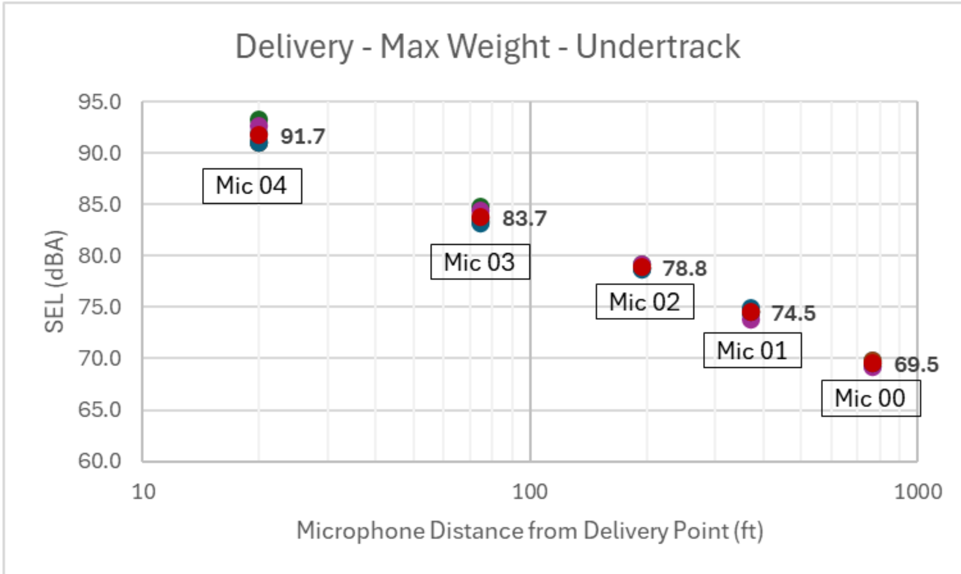


Figure 16. Range of MK30 Averaged A-Weighted SELs from Delivery at Max Weight – Behind

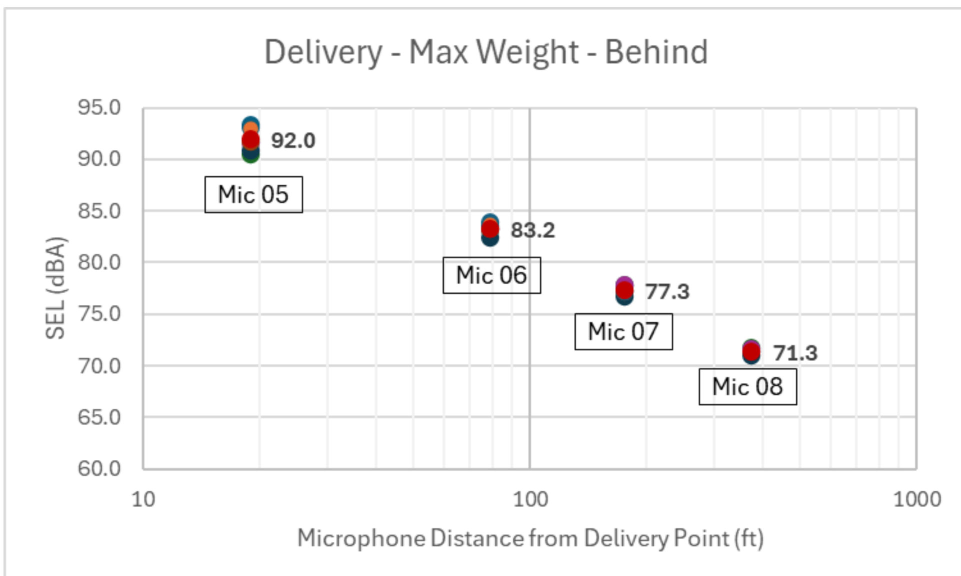
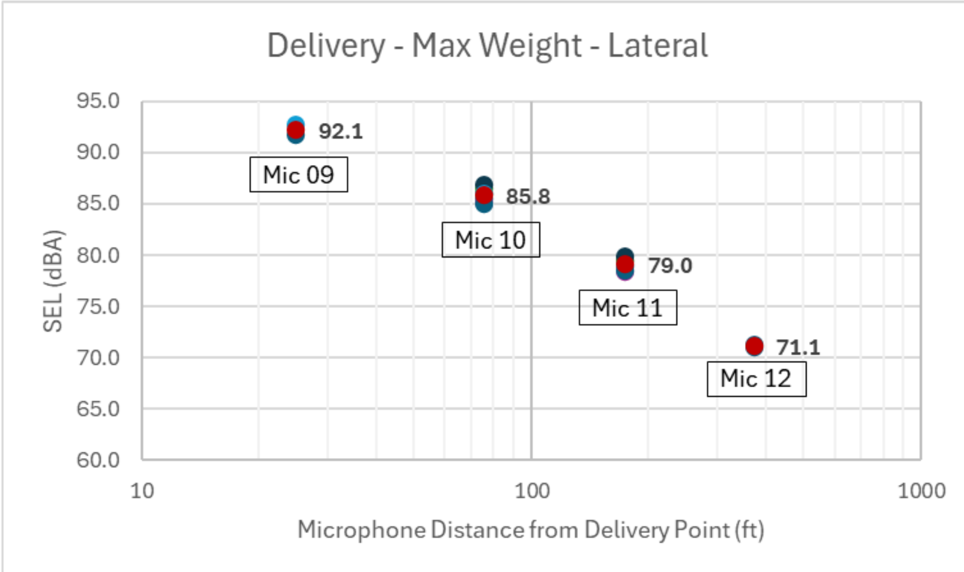


Figure 17. Range of MK30 Averaged A-Weighted SELs from Delivery at Max Weight – Lateral



The maximum SEL values from each test outline in **Table 17** were utilized to determine the composite, maximum A-weight SELs for takeoff, delivery, and landings, as shown in **Table 18** through **Table 20**. Additionally, speed- and altitude-corrected en route noise was factored in to calculate the interpolated distances to the PADDCs. **Figure 18** illustrates the noise levels and corresponding distances associated with takeoff, delivery, and landing.

Table 18. Maximum Takeoff A-Weighted SELs

Distance to PADDC (ft)	Max Weight Delivery
	SEL[1]
20	90.5
76	82.1
195	76.5
372	72.4
772	67.0
1,205[2]	63.7[2]

Source: Prime Air, 2024; ESA, 2025.

Notes:

[1] Maximum SEL derived from Table 17.

[2] Calculated distanced to the PADDC derived from the altitude and speed corrected max weight enroute measurement.

Table 19. Maximum A-Weighted SELs - Delivery

Distance to PADDC (ft)	Max Weight Delivery
	SEL[1]
25	92.1
76	85.8
175	79.0
372	74.5
772	69.5
1,820[2]	63.7[2]

Source: Prime Air, 2024; ESA, 2025.

Notes:

[1] Maximum SEL derived from Table 17.

[2] Calculated distanced to the PADDC derived from the altitude and speed corrected max weight enroute measurement.

Table 20. Maximum A-Weighted SELs - Landing

Distance to PADDC (ft)	Empty Weight Landing
	SEL[1]
20	91.8
76	83.2
195	76.5
375	70.5
1,074[2]	60.9[2]

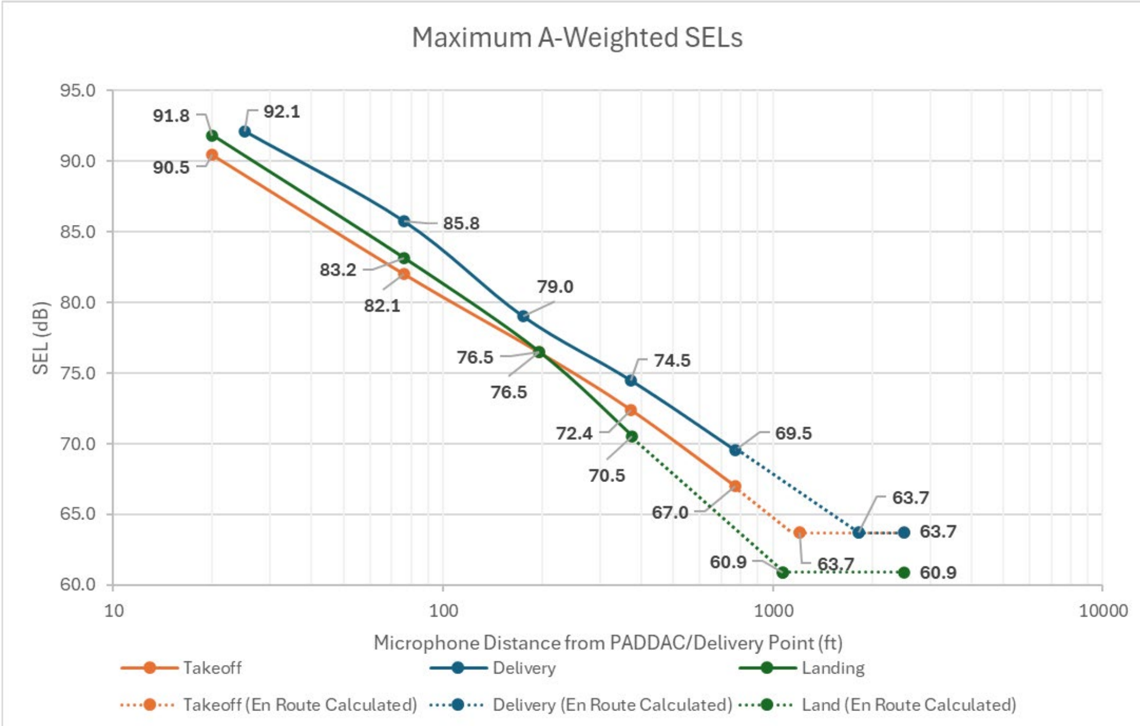
Source: Prime Air, 2024; ESA, 2025.

Notes:

[1] Maximum SEL derived from Table 17.

[2] Calculated distanced to the PADDC derived from the speed and altitude corrected empty weight enroute measurement.

Figure 18. MK30 Maximum A-Weighted SELs



Using the maximum A-weight SELs from takeoff, delivery, and landing, parameters were determined to estimate SELs as a function of distance from the PADDC launch pad and delivery location. **Table 21** provides parameters to estimate SELs associated with takeoff as a function of distance from the PADDC launch pad to the receiver. **Table 22** provides parameters to estimate the SEL associated with delivery, as a function of distance from the delivery point to the receiver. **Table 23** provides parameters to estimate SELs associated with landing as a function of distance from the PADDC launch pad to the receiver. In these tables, constants "m" and "b" are components of the slope intercept linear equation y = mx +b. Constant "m" represents the slope of the line. Constant "b" represents the point at which the slope crosses the y-axis.

Table 21. Parameters for Estimating Sound Exposure Level for Takeoff versus Distance

Range for Distance (feet from launch pad)	m	b
20 to 76	-14.51	109.30
76 to 195	-13.51	107.46
195 to 372	-14.66	110.09
372 to 772	-17.08	116.32
772 to 1,205	-17.05	116.23
1,205 and greater	0.00	63.7

Source: Prime Air, 2024; ESA, 2025.

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

Table 22. Parameters for Estimating Sound Exposure Level for Delivery versus Distance

Range for Distance (feet from delivery point)	m	b
25 to 76	-13.18	110.56
76 to 175	-18.65	120.84
175 to 372	-13.86	110.11
372 to 772	-15.63	114.67
772 to 1,820	-15.63	114.65
1,820 and greater	0.00	63.7

Source: Prime Air, 2024; ESA, 2025.

Notes: Distance is along ground from delivery point to receiver.

Table 23. Parameters for Estimating Sound Exposure Level for Landing versus Distance

Range for Distance (feet from launch pad)	m	b
20 to 76	-14.95	111.28
76 to 195	-16.17	113.58
195 to 375	-21.10	124.86
375 to 1,074	-21.10	124.87
1,074 and greater	0.00	60.9

Source: Prime Air, 2024; ESA, 2025.

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

Appendix A:
Flight Profile Measurements

Phase of Flight	Minimum Altitude (ft AGL)	Maximum Altitude (ft AGL)	Average Altitude (ft AGL)	Minimum Duration (seconds)	Maximum Duration (seconds)	Average Duration (seconds)	Minimum True Airspeed (knots)	Maximum True Airspeed (knots)	Average True Airspeed (knots)
Takeoff and Vertical Ascent	3.2	137.4	64.9	19	24	20	0.7	9.4	5.5
Transition and Outbound Climb	132.1	201.2	160.7	58	63	60	0.8	62.4	42.9
Fixed Wing Outbound Cruise	194.7	205.9	200.5	Variable	Variable	Variable	57.6	62.6	59.7
Delivery Descent and Transition	130.6	202.8	158.1	30	36	34	0.6	60.2	36.9
Backyard Descent	17.7	135.8	77.6	18	22	19	1.5	7.7	5.4
Delivery	14.4	23.0	18.5	2	2	2	2.8	7.2	4.5
Backyard Ascent	16.4	138.6	105.8	24	30	29	1.1	8.9	7.1
Transition and Inbound Climb	133.0	203.3	160.9	57	62	60	1.4	62.5	43.0
Fixed-wing Inbound Cruise	194.8	207.8	201.2	Variable	Variable	Variable	66.0	71.0	68.7
Landing Descent and Transition	133.7	201.9	160.3	32	39	36	1.5	70.5	42.7
Vertical Descent and Landing	1.1	134.6	78.3	33	34	34	0.2	6.7	5.1

Source: Prime Air, 2024; ESA, 2025.

Appendix B:
Noise Event Tables

Table B-1. Max Weight Takeoff Measurements

Distance to PADDC (ft)	Test#	Ambient (dBA)	LAEQ (dBA)	LMAX (dBA)	SEL (dBA)	Average Altitude (ft)	Average True Air Speed (kts)	Drone Heading (deg.)	Cross Wind (kts)	Wind Speed (kts)	Wind Direction (deg.)	Wind Gust Speed (kts)	Temp (°f)	Relative Humidity (%)	Valid
Mic 00 (Undertrack)															
772	1-1	45.2	50.6	60.1	68.1	200.3	59.7	242	-0.7	4.3	112	6.2	49.3	56.5	Yes
772	2-1	42.3	48.6	57.2	66.2	201.5	59.7	335	-1.4	2.0	173	3.5	55.5	43.9	Yes
772	3-1	42.4	48.4	57.8	66.4	198.7	59.7	332	-1.9	4.1	274	7.4	59.7	36.4	Yes
772	4-1	42.4	48.4	57.7	66.3	202.1	59.8	339	-2.8	3.5	233	7.0	60.1	35.6	Yes
772	5-1	47.3	49.7	59.1	67.2	200.4	59.7	251	0.8	3.4	101	4.3	50.0	52.7	Yes
772	6-1	44.5	50.4	59.6	67.8	202.0	59.7	247	0.2	4.0	90	4.9	45.8	62.5	Yes
772	7-1	46.0	51.6	60.8	69.7	198.4	59.7	246	-0.9	4.0	121	6.2	47.8	60.2	No
Mic 00 Average		**44.3**	**49.7**	**58.9**	**67.4**	**200.5**	**59.7**								
Mic 01 (Undertrack)															
372	1-1	45.5	55.3	64.2	72.8	200.3	59.7	242	-0.7	4.3	112	6.2	49.3	56.5	Yes
372	2-1	43.5	54.0	62.8	71.6	201.5	59.7	335	-1.4	2.0	173	3.5	55.5	43.9	Yes
372	3-1	43.7	54.4	62.5	72.4	198.7	59.7	332	-1.9	4.1	274	7.4	59.7	36.4	Yes
372	4-1	43.6	54.3	63.1	72.1	202.1	59.8	339	-2.8	3.5	233	7.0	60.1	35.6	Yes
372	5-1	48.3	54.8	64.1	72.3	200.4	59.7	251	0.8	3.4	101	4.3	50.0	52.7	Yes
372	6-1	45.7	55.3	64.1	72.7	202.0	59.7	247	0.2	4.0	90	4.9	45.8	62.5	Yes
372	7-1	45.9	54.9	64.4	73.0	198.4	59.7	246	-0.9	4.0	121	6.2	47.8	60.2	Yes
Mic 01 Average		**45.2**	**54.7**	**63.6**	**72.4**	**200.5**	**59.7**								
Mic 02 (Undertrack)															
195	1-1	44.2	59.0	65.2	76.5	200.3	59.7	242	-0.7	4.3	112	6.2	49.3	56.5	Yes
195	2-1	42.0	58.7	65.0	76.3	201.5	59.7	335	-1.4	2.0	173	3.5	55.5	43.9	Yes
195	3-1	42.0	59.2	65.6	77.2	198.7	59.7	332	-1.9	4.1	274	7.4	59.7	36.4	Yes
195	4-1	42.3	58.5	63.9	76.4	202.1	59.8	339	-2.8	3.5	233	7.0	60.1	35.6	Yes
195	5-1	47.8	58.8	64.1	76.3	200.4	59.7	251	0.8	3.4	101	4.3	50.0	52.7	Yes
195	6-1	45.4	59.1	64.4	76.5	202.0	59.7	247	0.2	4.0	90	4.9	45.8	62.5	Yes
195	7-1	44.4	58.4	65.0	76.5	198.4	59.7	246	-0.9	4.0	121	6.2	47.8	60.2	Yes
Mic 02 Average		**44.0**	**58.8**	**64.7**	**76.5**	**200.5**	**59.7**								
Mic 03 (Undertrack)															
75	1-1	43.9	63.7	71.1	81.2	200.3	59.7	242	-0.7	4.3	112	6.2	49.3	56.5	Yes
75	2-1	42.3	63.6	69.1	81.2	201.5	59.7	335	-1.4	2.0	173	3.5	55.5	43.9	Yes
75	3-1	41.7	64.6	70.3	82.6	198.7	59.7	332	-1.9	4.1	274	7.4	59.7	36.4	Yes
75	4-1	43.1	64.3	70.5	82.1	202.1	59.8	339	-2.8	3.5	233	7.0	60.1	35.6	Yes

Distance to PADDC (ft)	Test#	Ambient (dBA)	LAEQ (dBA)	LMAX (dBA)	SEL (dBA)	Average Altitude (ft)	Average True Air Speed (kts)	Drone Heading (deg.)	Cross Wind (kts)	Wind Speed (kts)	Wind Direction (deg.)	Wind Gust Speed (kts)	Temp (°f)	Relative Humidity (%)	Valid
75	5-1	48.2	63.6	71.6	81.1	200.4	59.7	251	0.8	3.4	101	4.3	50.0	52.7	Yes
75	6-1	45.3	63.9	71.0	81.3	202.0	59.7	247	0.2	4.0	90	4.9	45.8	62.5	Yes
75	7-1	44.3	63.3	70.6	81.3	198.4	59.7	246	-0.9	4.0	121	6.2	47.8	60.2	Yes
Mic 03 Average		**44.1**	**63.8**	**70.6**	**81.6**	**200.5**	**59.7**								
Mic 04 (Undertrack)															
20	1-1	48.0	72.6	82.1	90.0	200.3	59.7	242	-0.7	4.3	112	6.2	49.3	56.5	Yes
20	2-1	47.0	72.1	81.0	89.8	201.5	59.7	335	-1.4	2.0	173	3.5	55.5	43.9	Yes
20	3-1	45.9	74.4	81.9	92.4	198.7	59.7	332	-1.9	4.1	274	7.4	59.7	36.4	Yes
20	4-1	47.4	73.3	81.8	91.2	202.1	59.8	339	-2.8	3.5	233	7.0	60.1	35.6	Yes
20	5-1	51.3	72.8	82.0	90.3	200.4	59.7	251	0.8	3.4	101	4.3	50.0	52.7	Yes
20	6-1	49.0	71.4	81.9	88.8	202.0	59.7	247	0.2	4.0	90	4.9	45.8	62.5	Yes
20	7-1	47.4	72.7	81.7	90.8	198.4	59.7	246	-0.9	4.0	121	6.2	47.8	60.2	Yes
Mic 04 Average		**48.0**	**72.8**	**81.8**	**90.5**	**200.5**	**59.7**								
Mic 05 (Behind)															
19	1-1	48.1	72.2	81.6	89.7	200.3	59.7	242	-0.7	4.3	112	6.2	49.3	56.5	Yes
19	2-1	47.0	70.9	79.6	88.5	201.5	59.7	335	-1.4	2.0	173	3.5	55.5	43.9	Yes
19	3-1	46.1	72.3	80.1	90.3	198.7	59.7	332	-1.9	4.1	274	7.4	59.7	36.4	Yes
19	4-1	50.8	72.0	79.9	89.9	202.1	59.8	339	-2.8	3.5	233	7.0	60.1	35.6	No
19	5-1	50.5	72.7	81.3	90.2	200.4	59.7	251	0.8	3.4	101	4.3	50.0	52.7	Yes
19	6-1	49.2	72.3	81.3	89.7	202.0	59.7	247	0.2	4.0	90	4.9	45.8	62.5	Yes
19	7-1	47.4	72.3	80.8	90.3	198.4	59.7	246	-0.9	4.0	121	6.2	47.8	60.2	Yes
Mic 05 Average		**48.1**	**72.1**	**80.8**	**89.8**	**200.2**	**59.7**								
Mic 06 (Behind)															
79	1-1	44.7	62.5	70.7	80.0	200.3	59.7	242	-0.7	4.3	112	6.2	49.3	56.5	Yes
79	2-1	43.4	61.7	68.8	79.3	201.5	59.7	335	-1.4	2.0	173	3.5	55.5	43.9	Yes
79	3-1	42.7	61.9	69.1	79.9	198.7	59.7	332	-1.9	4.1	274	7.4	59.7	36.4	Yes
79	4-1	43.3	62.2	69.4	80.0	202.1	59.8	339	-2.8	3.5	233	7.0	60.1	35.6	Yes
79	5-1	48.6	62.9	70.5	80.4	200.4	59.7	251	0.8	3.4	101	4.3	50.0	52.7	Yes
79	6-1	46.0	62.6	70.2	80.0	202.0	59.7	247	0.2	4.0	90	4.9	45.8	62.5	Yes
79	7-1	45.0	62.4	70.4	80.4	198.4	59.7	246	-0.9	4.0	121	6.2	47.8	60.2	Yes
Mic 06 Average		**44.8**	**62.3**	**69.9**	**80.0**	**200.5**	**59.7**								
Mic 07 (Behind)															
176	1-1	43.5	55.9	61.4	73.4	200.3	59.7	242	-0.7	4.3	112	6.2	49.3	56.5	Yes
176	2-1	41.7	55.2	61.1	72.8	201.5	59.7	335	-1.4	2.0	173	3.5	55.5	43.9	Yes
176	3-1	41.2	55.0	60.3	73.0	198.7	59.7	332	-1.9	4.1	274	7.4	59.7	36.4	Yes
176	4-1	45.0	55.6	60.6	73.4	202.1	59.8	339	-2.8	3.5	233	7.0	60.1	35.6	Yes
176	5-1	48.1	56.7	62.5	74.1	200.4	59.7	251	0.8	3.4	101	4.3	50.0	52.7	Yes
176	6-1	44.5	56.5	61.4	73.9	202.0	59.7	247	0.2	4.0	90	4.9	45.8	62.5	Yes
176	7-1	43.9	55.8	62.5	73.9	198.4	59.7	246	-0.9	4.0	121	6.2	47.8	60.2	Yes

Distance to PADDC (ft)	Test#	Ambient (dBA)	LAEQ (dBA)	LMAX (dBA)	SEL (dBA)	Average Altitude (ft)	Average True Air Speed (kts)	Drone Heading (deg.)	Cross Wind (kts)	Wind Speed (kts)	Wind Direction (deg.)	Wind Gust Speed (kts)	Temp (°f)	Relative Humidity (%)	Valid
	Mic 07 Average	**44.0**	**55.8**	**61.4**	**73.5**	**200.5**	**59.7**								
Mic 08 (Behind)															
375	1-1	45.0	49.7	53.5	67.1	200.3	59.7	242	-0.7	4.3	112	6.2	49.3	56.5	No
375	2-1	43.7	49.1	53.5	66.7	201.5	59.7	335	-1.4	2.0	173	3.5	55.5	43.9	Yes
375	3-1	45.0	49.9	54.3	67.9	198.7	59.7	332	-1.9	4.1	274	7.4	59.7	36.4	Yes
375	4-1	44.6	49.9	54.1	67.8	202.1	59.8	339	-2.8	3.5	233	7.0	60.1	35.6	Yes
375	5-1	51.3	51.5	55.5	69.0	200.4	59.7	251	0.8	3.4	101	4.3	50.0	52.7	No
375	6-1	47.6	51.5	55.6	68.9	202.0	59.7	247	0.2	4.0	90	4.9	45.8	62.5	No
375	7-1	50.8	54.3	58.1	72.4	198.4	59.7	246	-0.9	4.0	121	6.2	47.8	60.2	No
	Mic 08 (Average)	**44.4**	**49.6**	**54.0**	**67.5**	**200.8**	**59.7**								
Mic 09 (Lateral)															
25	1-1	51.4	70.8	80.1	88.3	200.3	59.7	242	-0.7	4.3	112	6.2	49.3	56.5	No
25	2-1	50.6	70.6	78.8	88.3	201.5	59.7	335	-1.4	2.0	173	3.5	55.5	43.9	No
25	3-1	49.8	71.3	79.6	89.3	198.7	59.7	332	-1.9	4.1	274	7.4	59.7	36.4	No
25	4-1	51.4	70.4	79.0	88.2	202.1	59.8	339	-2.8	3.5	233	7.0	60.1	35.6	No
25	5-1	53.5	71.0	79.9	88.5	200.4	59.7	251	0.8	3.4	101	4.3	50.0	52.7	No
25	6-1	52.8	70.7	79.9	88.1	202.0	59.7	247	0.2	4.0	90	4.9	45.8	62.5	Yes
25	7-1	50.4	71.4	80.1	89.4	198.4	59.7	246	-0.9	4.0	121	6.2	47.8	60.2	Yes
	Mic 09 (Average)	**51.6**	**71.0**	**80.0**	**88.8**	**200.2**	**59.7**								
Mic 10 (Lateral)															
76	1-1	46.1	64.4	70.3	81.9	200.3	59.7	242	-0.7	4.3	112	6.2	49.3	56.5	Yes
76	2-1	44.5	63.8	71.0	81.4	201.5	59.7	335	-1.4	2.0	173	3.5	55.5	43.9	Yes
76	3-1	43.7	64.5	71.0	82.5	198.7	59.7	332	-1.9	4.1	274	7.4	59.7	36.4	Yes
76	4-1	44.4	64.4	70.2	82.2	202.1	59.8	339	-2.8	3.5	233	7.0	60.1	35.6	Yes
76	5-1	49.6	64.6	70.0	82.1	200.4	59.7	251	0.8	3.4	101	4.3	50.0	52.7	Yes
76	6-1	47.5	64.6	70.7	82.0	202.0	59.7	247	0.2	4.0	90	4.9	45.8	62.5	Yes
76	7-1	45.6	64.2	70.9	82.2	198.4	59.7	246	-0.9	4.0	121	6.2	47.8	60.2	Yes
	Mic 10 (Average)	**45.9**	**64.4**	**70.6**	**82.1**	**200.5**	**59.7**								
Mic 11 (Lateral)															
175	1-1	44.9	58.1	63.4	75.5	200.3	59.7	242	-0.7	4.3	112	6.2	49.3	56.5	Yes
175	2-1	43.5	57.4	61.9	75.0	201.5	59.7	335	-1.4	2.0	173	3.5	55.5	43.9	Yes
175	3-1	43.2	57.4	62.6	75.4	198.7	59.7	332	-1.9	4.1	274	7.4	59.7	36.4	Yes
175	4-1	43.5	57.5	62.2	75.4	202.1	59.8	339	-2.8	3.5	233	7.0	60.1	35.6	Yes
175	5-1	48.7	58.0	63.1	75.5	200.4	59.7	251	0.8	3.4	101	4.3	50.0	52.7	Yes
175	6-1	46.6	58.5	64.4	75.9	202.0	59.7	247	0.2	4.0	90	4.9	45.8	62.5	Yes
175	7-1	45.2	57.5	62.5	75.5	198.4	59.7	246	-0.9	4.0	121	6.2	47.8	60.2	Yes
	Mic 11 (Average)	**45.1**	**57.8**	**62.9**	**75.5**	**200.5**	**59.7**								
Mic 12 (Lateral)															
375	1-1	45.1	50.7	55.6	68.2	200.3	59.7	242	-0.7	4.3	112	6.2	49.3	56.5	Yes

Distance to PADDC (ft)	Test#	Ambient (dBA)	LAEQ (dBA)	LMAX (dBA)	SEL (dBA)	Average Altitude (ft)	Average True Air Speed (kts)	Drone Heading (deg.)	Cross Wind (kts)	Wind Speed (kts)	Wind Direction (deg.)	Wind Gust Speed (kts)	Temp (°f)	Relative Humidity (%)	Valid
375	2-1	44.8	50.8	54.5	68.4	201.5	59.7	335	-1.4	2.0	173	3.5	55.5	43.9	No
375	3-1	50.0	52.2	55.5	70.2	198.7	59.7	332	-1.9	4.1	274	7.4	59.7	36.4	No
375	4-1	45.3	50.6	53.8	68.5	202.1	59.8	339	-2.8	3.5	233	7.0	60.1	35.6	No
375	5-1	48.7	51.2	55.9	68.6	200.4	59.7	251	0.8	3.4	101	4.3	50.0	52.7	No
375	6-1	47.3	51.7	56.1	69.1	202.0	59.7	247	0.2	4.0	90	4.9	45.8	62.5	No
375	7-1	45.7	50.7	54.4	68.7	198.4	59.7	246	-0.9	4.0	121	6.2	47.8	60.2	No
Mic 12 (Average)		**45.1**	**50.7**	**55.6**	**68.2**	**200.3**	**59.7**								

Source: Prime Air, 2024; ESA, 2025.

Notes: Greyed out cells we determined to not be valid measurements and were not included in SEL calculations.

Table B-2. Max Weight Delivery Measurements

Distance to PADDC (ft)	Test#	Ambient (dBA)	LAEQ (dBA)	LMAX (dBA)	SEL (dBA)	Average Altitude (ft)	Average True Air Speed (kts)	Drone Heading (deg.)	Cross Wind (kts)	Wind Speed (kts)	Wind Direction (deg.)	Wind Gust Speed (kts)	Temp (°f)	Relative Humidity (%)	Valid
Mic 00 (Undertrack)															
772	1-1	45.2	49.6	59.3	70.0	96.6	6.0	127	-0.5	4.1	123	6.0	49.1	56.6	Yes
772	2-1	42.3	48.9	59.4	69.7	95.5	5.0	84	0.0	1.2	260	3.7	55.6	43.5	Yes
772	3-1	42.4	49.1	57.4	69.2	96.7	5.6	31	-3.0	5.0	283	7.4	59.8	36.3	Yes
772	4-1	42.4	48.9	57.5	69.1	99.4	7.5	271	-2.6	4.6	222	6.2	60.3	35.2	Yes
772	5-1	47.3	49.3	59.0	69.5	90.3	5.5	115	-0.6	2.9	92	4.3	50.6	52.3	Yes
772	6-1	44.5	49.8	60.2	69.8	89.3	6.1	115	-1.4	4.5	93	4.9	45.8	62.8	Yes
772	7-1	46.0	50.2	60.5	70.4	94.7	7.3	117	-0.2	4.2	112	6.2	47.9	59.7	No
Mic 00 Average		**44.0**	**49.3**	**58.8**	**69.5**	**94.6**	**6.0**								
Mic 01 (Undertrack)															
372	1-1	45.5	54.3	64.0	74.7	96.6	6.0	127	-0.5	4.1	123	6.0	49.1	56.6	Yes
372	2-1	43.5	53.5	62.2	74.3	95.5	5.0	84	0.0	1.2	260	3.7	55.6	43.5	Yes
372	3-1	43.7	54.4	62.8	74.5	96.7	5.6	31	-3.0	5.0	283	7.4	59.8	36.3	Yes
372	4-1	43.6	53.6	62.3	73.8	99.4	7.5	271	-2.6	4.6	222	6.2	60.3	35.2	Yes
372	5-1	48.3	54.4	63.7	74.5	90.3	5.5	115	-0.6	2.9	92	4.3	50.6	52.3	Yes
372	6-1	45.7	54.7	64.2	74.7	89.3	6.1	115	-1.4	4.5	93	4.9	45.8	62.8	Yes
372	7-1	45.9	54.8	64.9	74.9	94.7	7.3	117	-0.2	4.2	112	6.2	47.9	59.7	Yes
Mic 01 Average		**45.2**	**54.2**	**63.4**	**74.5**	**94.6**	**6.1**								
Mic 02 (Undertrack)															
195	1-1	44.2	58.4	64.9	78.7	96.6	6.0	127	-0.5	4.1	123	6.0	49.1	56.6	Yes
195	2-1	42.0	57.9	64.9	78.7	95.5	5.0	84	0.0	1.2	260	3.7	55.6	43.5	Yes
195	3-1	42.0	58.9	64.6	79.1	96.7	5.6	31	-3.0	5.0	283	7.4	59.8	36.3	Yes
195	4-1	42.3	58.9	64.6	79.1	99.4	7.5	271	-2.6	4.6	222	6.2	60.3	35.2	Yes
195	5-1	47.8	58.7	65.0	78.8	90.3	5.5	115	-0.6	2.9	92	4.3	50.6	52.3	Yes
195	6-1	45.4	58.8	65.0	78.8	89.3	6.1	115	-1.4	4.5	93	4.9	45.8	62.8	Yes
195	7-1	44.4	58.5	64.7	78.6	94.7	7.3	117	-0.2	4.2	112	6.2	47.9	59.7	Yes
Mic 02 Average		**44.0**	**58.6**	**64.8**	**78.8**	**94.6**	**6.1**								
Mic 03 (Undertrack)															
75	1-1	43.9	63.2	69.1	83.5	96.6	6.0	127	-0.5	4.1	123	6.0	49.1	56.6	Yes
75	2-1	42.3	62.5	67.9	83.3	95.5	5.0	84	0.0	1.2	260	3.7	55.6	43.5	Yes
75	3-1	41.7	64.6	71.5	84.8	96.7	5.6	31	-3.0	5.0	283	7.4	59.8	36.3	Yes
75	4-1	43.1	64.2	69.5	84.4	99.4	7.5	271	-2.6	4.6	222	6.2	60.3	35.2	Yes
75	5-1	48.2	63.5	68.6	83.6	90.3	5.5	115	-0.6	2.9	92	4.3	50.6	52.3	Yes
75	6-1	45.3	63.2	68.5	83.2	89.3	6.1	115	-1.4	4.5	93	4.9	45.8	62.8	Yes
75	7-1	44.3	62.9	68.8	83.0	94.7	7.3	117	-0.2	4.2	112	6.2	47.9	59.7	Yes
Mic 03 Average		**44.1**	**63.4**	**69.1**	**83.7**	**94.6**	**6.1**								
Mic 04 (Undertrack)															

Distance to PADDC (ft)	Test#	Ambient (dBA)	LAEQ (dBA)	LMAX (dBA)	SEL (dBA)	Average Altitude (ft)	Average True Air Speed (kts)	Drone Heading (deg.)	Cross Wind (kts)	Wind Speed (kts)	Wind Direction (deg.)	Wind Gust Speed (kts)	Temp (°f)	Relative Humidity (%)	Valid
20	1-1	48.0	71.1	82.9	91.4	96.6	6.0	127	-0.5	4.1	123	6.0	49.1	56.6	Yes
20	2-1	47.0	71.0	80.8	91.8	95.5	5.0	84	0.0	1.2	260	3.7	55.6	43.5	Yes
20	3-1	45.9	73.1	83.7	93.3	96.7	5.6	31	-3.0	5.0	283	7.4	59.8	36.3	Yes
20	4-1	47.4	72.4	83.8	92.6	99.4	7.5	271	-2.6	4.6	222	6.2	60.3	35.2	Yes
20	5-1	51.3	70.8	81.8	90.9	90.3	5.5	115	-0.6	2.9	92	4.3	50.6	52.3	Yes
20	6-1	49.0	71.0	82.0	91.0	89.3	6.1	115	-1.4	4.5	93	4.9	45.8	62.8	Yes
20	7-1	47.4	70.8	81.9	90.9	94.7	7.3	117	-0.2	4.2	112	6.2	47.9	59.7	Yes
Mic 04 Average		**48.0**	**71.5**	**82.4**	**91.7**	**94.6**	**6.1**								
Mic 05 (Behind)															
19	1-1	48.1	72.7	84.1	93.0	96.6	6.0	127	-0.5	4.1	123	6.0	49.1	56.6	Yes
19	2-1	47.0	69.6	80.7	90.4	95.5	5.0	84	0.0	1.2	260	3.7	55.6	43.5	Yes
19	3-1	46.1	71.5	81.7	91.6	96.7	5.6	31	-3.0	5.0	283	7.4	59.8	36.3	Yes
19	4-1	50.8	70.6	81.5	90.8	99.4	7.5	271	-2.6	4.6	222	6.2	60.3	35.2	Yes
19	5-1	50.5	71.6	81.4	91.7	90.3	5.5	115	-0.6	2.9	92	4.3	50.6	52.3	Yes
19	6-1	49.2	73.3	84.2	93.3	89.3	6.1	115	-1.4	4.5	93	4.9	45.8	62.8	Yes
19	7-1	47.4	72.7	84.0	92.9	94.7	7.3	117	-0.2	4.2	112	6.2	47.9	59.7	Yes
Mic 05 Average		**48.5**	**71.7**	**82.5**	**92.0**	**94.6**	**6.1**								
Mic 06 (Behind)															
79	1-1	44.7	63.6	70.4	83.9	96.6	6.0	127	-0.5	4.1	123	6.0	49.1	56.6	Yes
79	2-1	43.4	62.2	68.8	83.0	95.5	5.0	84	0.0	1.2	260	3.7	55.6	43.5	Yes
79	3-1	42.7	63.1	68.9	83.2	96.7	5.6	31	-3.0	5.0	283	7.4	59.8	36.3	Yes
79	4-1	43.3	62.1	67.8	82.3	99.4	7.5	271	-2.6	4.6	222	6.2	60.3	35.2	Yes
79	5-1	48.6	63.0	68.4	83.2	90.3	5.5	115	-0.6	2.9	92	4.3	50.6	52.3	Yes
79	6-1	46.0	63.4	69.1	83.4	89.3	6.1	115	-1.4	4.5	93	4.9	45.8	62.8	Yes
79	7-1	45.0	63.5	69.8	83.6	94.7	7.3	117	-0.2	4.2	112	6.2	47.9	59.7	Yes
Mic 06 Average		**44.8**	**63.0**	**69.0**	**83.2**	**94.6**	**6.1**								
Mic 07 (Behind)															
176	1-1	43.5	57.3	62.5	77.7	96.6	6.0	127	-0.5	4.1	123	6.0	49.1	56.6	Yes
176	2-1	41.7	56.9	61.1	77.7	95.5	5.0	84	0.0	1.2	260	3.7	55.6	43.5	Yes
176	3-1	41.2	57.6	62.0	77.7	96.7	5.6	31	-3.0	5.0	283	7.4	59.8	36.3	Yes
176	4-1	45.0	56.5	62.2	76.7	99.4	7.5	271	-2.6	4.6	222	6.2	60.3	35.2	Yes
176	5-1	48.1	57.0	61.1	77.1	90.3	5.5	115	-0.6	2.9	92	4.3	50.6	52.3	Yes
176	6-1	44.5	57.1	62.0	77.1	89.3	6.1	115	-1.4	4.5	93	4.9	45.8	62.8	Yes
176	7-1	43.9	57.1	62.8	77.3	94.7	7.3	117	-0.2	4.2	112	6.2	47.9	59.7	Yes
Mic 07 Average		**44.0**	**57.1**	**61.9**	**77.3**	**94.6**	**6.1**								
Mic 08 (Behind)															
375	1-1	45.0	50.9	56.9	71.2	96.6	6.0	127	-0.5	4.1	123	6.0	49.1	56.6	Yes
375	2-1	43.7	50.8	55.3	71.6	95.5	5.0	84	0.0	1.2	260	3.7	55.6	43.5	Yes
375	3-1	45.0	51.4	54.4	71.5	96.7	5.6	31	-3.0	5.0	283	7.4	59.8	36.3	Yes

Distance to PADDC (ft)	Test#	Ambient (dBA)	LAEQ (dBA)	LMAX (dBA)	SEL (dBA)	Average Altitude (ft)	Average True Air Speed (kts)	Drone Heading (deg.)	Cross Wind (kts)	Wind Speed (kts)	Wind Direction (deg.)	Wind Gust Speed (kts)	Temp (°f)	Relative Humidity (%)	Valid
375	4-1	44.6	50.7	55.0	70.9	99.4	7.5	271	-2.6	4.6	222	6.2	60.3	35.2	Yes
375	5-1	51.3	51.1	56.1	71.3	90.3	5.5	115	-0.6	2.9	92	4.3	50.6	52.3	No
375	6-1	47.6	51.6	56.0	71.6	89.3	6.1	115	-1.4	4.5	93	4.9	45.8	62.8	No
375	7-1	50.8	51.7	55.1	71.8	94.7	7.3	117	-0.2	4.2	112	6.2	47.9	59.7	No
	Mic 08 Average	**44.6**	**51.0**	**55.4**	**71.3**	**97.0**	**6.0**								
Mic 09 (Lateral)															
25	1-1	51.4	71.5	83.1	91.8	96.6	6.0	127	-0.5	4.1	123	6.0	49.1	56.6	No
25	2-1	50.6	71.1	82.4	91.9	95.5	5.0	84	0.0	1.2	260	3.7	55.6	43.5	No
25	3-1	49.8	70.8	82.3	90.9	96.7	5.6	31	-3.0	5.0	283	7.4	59.8	36.3	No
25	4-1	51.4	72.7	83.9	92.9	99.4	7.5	271	-2.6	4.6	222	6.2	60.3	35.2	No
25	5-1	53.5	73.5	84.4	93.6	90.3	5.5	115	-0.6	2.9	92	4.3	50.6	52.3	No
25	6-1	52.8	72.7	83.2	92.7	89.3	6.1	115	-1.4	4.5	93	4.9	45.8	62.8	Yes
25	7-1	50.4	71.4	82.4	91.6	94.7	7.3	117	-0.2	4.2	112	6.2	47.9	59.7	Yes
	Mic 09 Average	**51.6**	**72.1**	**82.8**	**92.1**	**92.0**	**6.7**								
Mic 10 (Lateral)															
76	1-1	46.1	65.1	71.0	85.4	96.6	6.0	127	-0.5	4.1	123	6.0	49.1	56.6	Yes
76	2-1	44.5	65.1	71.1	86.0	95.5	5.0	84	0.0	1.2	260	3.7	55.6	43.5	Yes
76	3-1	43.7	64.9	71.2	85.0	96.7	5.6	31	-3.0	5.0	283	7.4	59.8	36.3	Yes
76	4-1	44.4	66.3	71.7	86.4	99.4	7.5	271	-2.6	4.6	222	6.2	60.3	35.2	Yes
76	5-1	49.6	66.6	72.6	86.7	90.3	5.5	115	-0.6	2.9	92	4.3	50.6	52.3	Yes
76	6-1	47.5	65.9	70.9	85.9	89.3	6.1	115	-1.4	4.5	93	4.9	45.8	62.8	Yes
76	7-1	45.6	64.8	70.4	85.0	94.7	7.3	117	-0.2	4.2	112	6.2	47.9	59.7	Yes
	Mic 10 Average	**45.9**	**65.5**	**71.3**	**85.8**	**94.6**	**6.1**								
Mic 11 (Lateral)															
175	1-1	44.9	58.5	63.9	78.8	96.6	6.0	127	-0.5	4.1	123	6.0	49.1	56.6	Yes
175	2-1	43.5	58.4	64.1	79.2	95.5	5.0	84	0.0	1.2	260	3.7	55.6	43.5	Yes
175	3-1	43.2	58.2	63.2	78.4	96.7	5.6	31	-3.0	5.0	283	7.4	59.8	36.3	Yes
175	4-1	43.5	59.3	63.4	79.5	99.4	7.5	271	-2.6	4.6	222	6.2	60.3	35.2	Yes
175	5-1	48.7	59.7	65.2	79.8	90.3	5.5	115	-0.6	2.9	92	4.3	50.6	52.3	Yes
175	6-1	46.6	59.0	63.2	79.0	89.3	6.1	115	-1.4	4.5	93	4.9	45.8	62.8	Yes
175	7-1	45.2	58.2	62.8	78.4	94.7	7.3	117	-0.2	4.2	112	6.2	47.9	59.7	Yes
	Mic 11 Average	**45.1**	**58.8**	**63.7**	**79.0**	**94.6**	**6.1**								
Mic 12 (Lateral)															
375	1-1	45.1	50.9	55.7	71.2	96.6	6.0	127	-0.5	4.1	123	6.0	49.1	56.6	Yes
375	2-1	44.8	53.3	58.9	74.1	95.5	5.0	84	0.0	1.2	260	3.7	55.6	43.5	No
375	3-1	50.0	53.6	57.6	73.7	96.7	5.6	31	-3.0	5.0	283	7.4	59.8	36.3	No
375	4-1	45.3	52.0	57.1	72.2	99.4	7.5	271	-2.6	4.6	222	6.2	60.3	35.2	No
375	5-1	48.7	51.6	57.3	71.7	90.3	5.5	115	-0.6	2.9	92	4.3	50.6	52.3	No
375	6-1	47.3	52.1	56.0	72.1	89.3	6.1	115	-1.4	4.5	93	4.9	45.8	62.8	No

Distance to PADDC (ft)	Test#	Ambient (dBA)	LAEQ (dBA)	LMAX (dBA)	SEL (dBA)	Average Altitude (ft)	Average True Air Speed (kts)	Drone Heading (deg.)	Cross Wind (kts)	Wind Speed (kts)	Wind Direction (deg.)	Wind Gust Speed (kts)	Temp (°f)	Relative Humidity (%)	Valid
375	7-1	45.7	50.8	55.5	70.9	94.7	7.3	117	-0.2	4.2	112	6.2	47.9	59.7	Yes
	Mic 12 Average	**45.4**	**50.8**	**55.6**	**71.1**	**95.6**	**6.6**								

Source: Prime Air, 2024; ESA, 2025.

Notes: Greyed out cells we determined to not be valid measurements and were not included in SEL calculations.

Table B-3. Empty Weight Landing Measurements

Distance to PADDC (ft)	Test#	Ambient (dBA)	LAEQ (dBA)	LMAX (dBA)	SEL (dBA)	Average Altitude (ft)	Average True Air Speed (kts)	Drone Heading (deg.)	Cross Wind (kts)	Wind Speed (kts)	Wind Direction (deg.)	Wind Gust Speed (kts)	Temp (°f)	Relative Humidity (%)	Valid
Mic 00 (Undertrack)															
772	1-1	42.4	48.3	55.7	66.2	202.5	68.7	24	-3.1	3.4	309	6.8	51.5	61.3	No
772	2-1	42.3	46.4	51.9	64.2	200.6	68.7	166	0.3	1.2	298	6.0	62.4	33.0	No
772	3-1	42.3	47.6	55.8	65.8	201.7	68.8	23	-4.1	5.2	321	7.8	61.4	34.7	No
772	4-1	44.3	49.0	55.7	67.2	201.4	68.7	38	-2.4	3.4	271	5.2	59.9	44.6	No
772	5-1	47.6	48.3	53.8	66.2	201.5	68.7	152	-1.2	4.8	118	5.6	42.6	83.0	No
772	6-1	43.3	48.1	55.9	66.0	198.9	68.7	225	-0.3	1.0	108	2.1	56.8	51.1	No
Mic 00 Average		-	-	-	-	-	-								
Mic 01 (Undertrack)															
372	1-1	45.0	53.2	60.4	71.1	202.5	68.7	24	-3.1	3.4	309	6.8	51.5	61.3	Yes
372	2-1	43.6	52.5	59.3	70.3	200.6	68.7	166	0.3	1.2	298	6.0	62.4	33.0	Yes
372	3-1	43.5	52.4	59.8	70.6	201.7	68.8	23	-4.1	5.2	321	7.8	61.4	34.7	No
372	4-1	44.9	52.9	59.5	71.1	201.4	68.7	38	-2.4	3.4	271	5.2	59.9	44.6	No
372	5-1	47.9	52.3	58.4	70.2	201.5	68.7	152	-1.2	4.8	118	5.6	42.6	83.0	No
372	6-1	44.4	52.0	60.0	69.9	198.9	68.7	225	-0.3	1.0	108	2.1	56.8	51.1	Yes
Mic 01 Average		**44.3**	**52.6**	**59.9**	**70.4**	**200.7**	**68.7**								
Mic 02 (Undertrack)															
195	1-1	42.0	60.1	63.1	78.0	202.5	68.7	24	-3.1	3.4	309	6.8	51.5	61.3	Yes
195	2-1	42.1	58.5	62.2	76.3	200.6	68.7	166	0.3	1.2	298	6.0	62.4	33.0	Yes
195	3-1	42.0	58.9	62.4	77.1	201.7	68.8	23	-4.1	5.2	321	7.8	61.4	34.7	No
195	4-1	43.5	58.8	62.9	77.0	201.4	68.7	38	-2.4	3.4	271	5.2	59.9	44.6	Yes
195	5-1	47.0	57.5	62.2	75.3	201.5	68.7	152	-1.2	4.8	118	5.6	42.6	83.0	Yes
195	6-1	43.5	58.1	63.0	76.0	198.9	68.7	225	-0.3	1.0	108	2.1	56.8	51.1	Yes
Mic 02 Average		**43.6**	**58.6**	**62.7**	**76.5**	**201.0**	**68.7**								
Mic 03 (Undertrack)															
75	1-1	41.9	66.5	70.7	84.4	202.5	68.7	24	-3.1	3.4	309	6.8	51.5	61.3	Yes
75	2-1	42.0	64.6	68.7	82.4	200.6	68.7	166	0.3	1.2	298	6.0	62.4	33.0	Yes
75	3-1	43.0	65.7	71.2	83.9	201.7	68.8	23	-4.1	5.2	321	7.8	61.4	34.7	No
75	4-1	43.5	65.7	70.4	83.9	201.4	68.7	38	-2.4	3.4	271	5.2	59.9	44.6	Yes
75	5-1	46.0	63.1	67.9	81.0	201.5	68.7	152	-1.2	4.8	118	5.6	42.6	83.0	Yes
75	6-1	43.4	64.5	69.7	82.4	198.9	68.7	225	-0.3	1.0	108	2.1	56.8	51.1	Yes
Mic 03 Average		**43.4**	**64.9**	**69.5**	**82.8**	**201.0**	**68.7**								
Mic 04 (Undertrack)															
20	1-1	46.1	75.4	83.1	93.3	202.5	68.7	24	-3.1	3.4	309	6.8	51.5	61.3	Yes
20	2-1	46.1	72.7	80.6	90.5	200.6	68.7	166	0.3	1.2	298	6.0	62.4	33.0	Yes
20	3-1	45.7	75.0	83.5	93.2	201.7	68.8	23	-4.1	5.2	321	7.8	61.4	34.7	No
20	4-1	46.5	75.6	84.1	93.8	201.4	68.7	38	-2.4	3.4	271	5.2	59.9	44.6	Yes

Distance to PADDC (ft)	Test#	Ambient (dBA)	LAEQ (dBA)	LMAX (dBA)	SEL (dBA)	Average Altitude (ft)	Average True Air Speed (kts)	Drone Heading (deg.)	Cross Wind (kts)	Wind Speed (kts)	Wind Direction (deg.)	Wind Gust Speed (kts)	Temp (°f)	Relative Humidity (%)	Valid
20	5-1	49.0	72.8	81.0	90.7	201.5	68.7	152	-1.2	4.8	118	5.6	42.6	83.0	Yes
20	6-1	46.7	73.0	80.3	90.9	198.9	68.7	225	-0.3	1.0	108	2.1	56.8	51.1	Yes
Mic 04 Average		**46.9**	**73.9**	**81.8**	**91.8**	**201.0**	**68.7**								
Mic 05 (Behind)															
19	1-1	52.0	72.6	80.1	90.6	202.5	68.7	24	-3.1	3.4	309	6.8	51.5	61.3	No
19	2-1	46.5	73.2	81.3	91.0	200.6	68.7	166	0.3	1.2	298	6.0	62.4	33.0	Yes
19	3-1	45.8	72.3	79.9	90.5	201.7	68.8	23	-4.1	5.2	321	7.8	61.4	34.7	No
19	4-1	51.9	77.4	91.2	95.6	201.4	68.7	38	-2.4	3.4	271	5.2	59.9	44.6	No
19	5-1	49.3	73.5	81.5	91.4	201.5	68.7	152	-1.2	4.8	118	5.6	42.6	83.0	Yes
19	6-1	59.4	72.4	81.7	90.3	198.9	68.7	225	-0.3	1.0	108	2.1	56.8	51.1	No
Mic 05 Average		**47.9**	**73.4**	**81.4**	**91.2**	**201.0**	**68.7**								
Mic 06 (Behind)															
79	1-1	42.8	63.8	67.8	81.7	202.5	68.7	24	-3.1	3.4	309	6.8	51.5	61.3	Yes
79	2-1	43.0	64.2	68.0	82.0	200.6	68.7	166	0.3	1.2	298	6.0	62.4	33.0	Yes
79	3-1	42.7	63.7	69.2	81.9	201.7	68.8	23	-4.1	5.2	321	7.8	61.4	34.7	No
79	4-1	43.7	63.3	68.2	81.5	201.4	68.7	38	-2.4	3.4	271	5.2	59.9	44.6	Yes
79	5-1	47.2	64.4	68.8	82.3	201.5	68.7	152	-1.2	4.8	118	5.6	42.6	83.0	Yes
79	6-1	44.0	62.5	66.8	80.5	198.9	68.7	225	-0.3	1.0	108	2.1	56.8	51.1	Yes
Mic 06 Average		**44.1**	**63.6**	**67.9**	**81.6**	**201.0**	**68.7**								
Mic 07 (Behind)															
176	1-1	41.2	57.5	61.6	75.5	202.5	68.7	24	-3.1	3.4	309	6.8	51.5	61.3	Yes
176	2-1	43.4	57.6	61.4	75.4	200.6	68.7	166	0.3	1.2	298	6.0	62.4	33.0	Yes
176	3-1	41.4	57.4	62.0	75.6	201.7	68.8	23	-4.1	5.2	321	7.8	61.4	34.7	No
176	4-1	43.8	56.9	60.1	75.1	201.4	68.7	38	-2.4	3.4	271	5.2	59.9	44.6	Yes
176	5-1	46.8	58.0	62.4	75.8	201.5	68.7	152	-1.2	4.8	118	5.6	42.6	83.0	Yes
176	6-1	43.2	56.6	60.9	74.5	198.9	68.7	225	-0.3	1.0	108	2.1	56.8	51.1	Yes
Mic 07 Average		**43.7**	**57.3**	**61.3**	**75.3**	**201.0**	**68.7**								
Mic 08 (Behind)															
375	1-1	43.6	50.4	53.6	68.3	202.5	68.7	24	-3.1	3.4	309	6.8	51.5	61.3	No
375	2-1	44.7	52.8	57.4	70.5	200.6	68.7	166	0.3	1.2	298	6.0	62.4	33.0	Yes
375	3-1	46.7	55.7	57.4	73.9	201.7	68.8	23	-4.1	5.2	321	7.8	61.4	34.7	No
375	4-1	46.7	65.6	80.6	83.8	201.4	68.7	38	-2.4	3.4	271	5.2	59.9	44.6	No
375	5-1	52.1	51.2	53.9	69.0	201.5	68.7	152	-1.2	4.8	118	5.6	42.6	83.0	No
375	6-1	48.6	69.8	84.7	87.7	198.9	68.7	225	-0.3	1.0	108	2.1	56.8	51.1	No
Mic 08 Average		**44.7**	**52.8**	**57.4**	**70.5**	**200.6**	**68.7**								
Mic 09 (Lateral)															
25	1-1	48.3	72.2	80.6	90.2	202.5	68.7	24	-3.1	3.4	309	6.8	51.5	61.3	No
25	2-1	50.1	72.0	79.7	89.8	200.6	68.7	166	0.3	1.2	298	6.0	62.4	33.0	Yes
25	3-1	49.7	72.4	80.8	90.6	201.7	68.8	23	-4.1	5.2	321	7.8	61.4	34.7	No

Distance to PADDC (ft)	Test#	Ambient (dBA)	LAEQ (dBA)	LMAX (dBA)	SEL (dBA)	Average Altitude (ft)	Average True Air Speed (kts)	Drone Heading (deg.)	Cross Wind (kts)	Wind Speed (kts)	Wind Direction (deg.)	Wind Gust Speed (kts)	Temp (°f)	Relative Humidity (%)	Valid
25	4-1	50.1	71.7	81.1	89.9	201.4	68.7	38	-2.4	3.4	271	5.2	59.9	44.6	Yes
25	5-1	49.8	72.2	80.2	90.1	201.5	68.7	152	-1.2	4.8	118	5.6	42.6	83.0	Yes
25	6-1	49.7	73.4	81.5	91.4	198.9	68.7	225	-0.3	1.0	108	2.1	56.8	51.1	No
Mic 09 Average		**50.0**	**72.0**	**80.4**	**89.9**	**201.2**	**68.7**								
Mic 10 (Lateral)															
76	1-1	43.6	65.3	70.0	83.2	202.5	68.7	24	-3.1	3.4	309	6.8	51.5	61.3	Yes
76	2-1	44.8	65.1	69.1	82.9	200.6	68.7	166	0.3	1.2	298	6.0	62.4	33.0	No
76	3-1	43.8	65.4	69.7	83.6	201.7	68.8	23	-4.1	5.2	321	7.8	61.4	34.7	No
76	4-1	44.8	65.1	69.2	83.3	201.4	68.7	38	-2.4	3.4	271	5.2	59.9	44.6	Yes
76	5-1	47.5	64.5	70.0	82.4	201.5	68.7	152	-1.2	4.8	118	5.6	42.6	83.0	Yes
76	6-1	44.7	65.9	70.8	83.8	198.9	68.7	225	-0.3	1.0	108	2.1	56.8	51.1	Yes
Mic 10 Average		**45.2**	**65.2**	**70.0**	**83.2**	**201.1**	**68.7**								
Mic 11 (Lateral)															
175	1-1	43.2	59.5	63.3	77.4	202.5	68.7	24	-3.1	3.4	309	6.8	51.5	61.3	Yes
175	2-1	43.4	57.8	62.5	75.6	200.6	68.7	166	0.3	1.2	298	6.0	62.4	33.0	Yes
175	3-1	43.2	58.3	61.2	76.4	201.7	68.8	23	-4.1	5.2	321	7.8	61.4	34.7	No
175	4-1	44.8	58.2	61.1	76.4	201.4	68.7	38	-2.4	3.4	271	5.2	59.9	44.6	Yes
175	5-1	47.5	57.2	60.4	75.1	201.5	68.7	152	-1.2	4.8	118	5.6	42.6	83.0	No
175	6-1	44.2	57.8	61.5	75.8	198.9	68.7	225	-0.3	1.0	108	2.1	56.8	51.1	Yes
Mic 11 Average		**43.9**	**58.3**	**62.1**	**76.3**	**200.9**	**68.7**								
Mic 12 (Lateral)															
375	1-1	44.2	51.1	55.1	69.1	202.5	68.7	24	-3.1	3.4	309	6.8	51.5	61.3	No
375	2-1	47.9	51.9	55.3	69.7	200.6	68.7	166	0.3	1.2	298	6.0	62.4	33.0	No
375	3-1	58.2	54.2	56.9	72.4	201.7	68.8	23	-4.1	5.2	321	7.8	61.4	34.7	No
375	4-1	45.5	50.9	55.1	69.1	201.4	68.7	38	-2.4	3.4	271	5.2	59.9	44.6	No
375	5-1	51.3	58.8	72.3	76.6	201.5	68.7	152	-1.2	4.8	118	5.6	42.6	83.0	No
375	6-1	44.6	50.1	52.8	68.0	198.9	68.7	225	-0.3	1.0	108	2.1	56.8	51.1	No
Mic 12 Average		**-**	**-**	**-**	**-**	**-**	**-**								

Source: Prime Air, 2024; ESA, 2025.

Notes: Greyed out cells we determined to not be valid measurements and were not included in SEL calculations.

Table B-4. Max Weight En Route Measurements

Distance to PADDC (ft)	Test#	Undertrack Distance (ft)	POCA Slant (ft)	Ambient (dBA)	LAEQ (dBA)	LMAX (dBA)	SEL (dBA)	Average Altitude (ft)	Average True Air Speed (kts)	Median Drone Heading (deg.)	Cross Wind (kts)	Wind Speed (kts)	Wind Direction (deg.)	Wind Gust Speed (kts)	Temp (°f)	Relative Humidity (%)	Valid
Mic 09 (Lateral)																	
25	1-1	17.5	117.1	46.7	56.1	60.3	65.7	122.2	60.2	77	0.6	1.6	96.6	4.4	53.4	53.8	Yes
25	1-2	6.1	117.7	46.7	55.9	60.1	65.4	122.9	60.1	255	-0.4	2.9	82.3	4.1	53.2	53.6	Yes
25	2-1	9.5	117.6	45.8	55.7	59.7	65.3	122.4	61.6	77	0.0	3.3	77.3	5.8	48.4	62.8	Yes
25	2-2	33.8	120.4	45.8	56.1	60.1	65.1	121.0	60.9	252	-2.8	3.6	123.5	5.8	49.3	60.9	Yes
25	3-1	43.8	122.8	46.3	55.7	59.7	65.3	121.8	60.1	76	1.3	1.7	132.1	3.5	54.5	52.2	Yes
25	3-2	5.5	115.3	46.3	55.9	60.0	65.4	121.3	60.8	255	1.7	2.2	306.5	3.5	54.9	51.3	Yes
25	4-1	24.8	119.7	47.8	56.0	60.4	66.0	122.3	61.3	74	2.1	2.1	170.8	3.9	56.7	48.7	Yes
25	4-2	13.4	117.6	47.8	55.2	59.5	65.2	125.5	61.7	258	-1.3	1.9	214.0	4.1	56.1	49.2	Yes
25	5-1	17.1	118.2	46.9	55.5	59.7	65.5	123.0	60.8	78	2.0	3.3	116.9	4.7	50.9	59.1	Yes
25	5-2	7.9	116.4	46.9	55.9	60.1	65.4	122.3	60.6	254	-2.2	2.7	131.5	4.7	51.1	58.6	Yes
25	6-1	16.9	117.3	50.9	57.7	61.8	66.8	123.6	61.4	74	1.5	1.6	191.3	4.1	65.5	53.5	Yes
25	6-2	43.2	120.2	50.9	57.5	61.7	67.5	121.5	59.9	256	-0.6	3.7	245.7	7.0	65.3	56.7	Yes
Mic 09 Average		20.0	118.4	47.4	56.1	60.3	65.7	122.5	60.8								
Mic 10 (Lateral)																	
76	1-1	54.2	127.8	50.0	57.0	61.3	66.5	122.2	60.2	77	0.6	1.6	96.6	4.4	53.4	53.8	Yes
76	1-2	50.9	128.1	50.0	56.1	60.2	65.7	122.9	60.1	255	-0.4	2.9	82.3	4.1	53.2	53.6	Yes
76	2-1	52.6	128.5	49.0	56.2	60.1	65.7	122.4	61.6	77	0.0	3.3	77.3	5.8	48.4	62.8	Yes
76	2-2	60.6	130.5	49.0	56.8	60.7	65.8	121.0	60.9	252	-2.8	3.6	123.5	5.8	49.3	60.9	Yes
76	3-1	69.3	134.0	50.2	56.4	60.5	65.9	121.8	60.1	76	1.3	1.7	132.1	3.5	54.5	52.2	Yes
76	3-2	49.6	125.4	50.2	56.2	60.2	65.8	121.3	60.8	255	1.7	2.2	306.5	3.5	54.9	51.3	Yes
76	4-1	57.5	130.5	50.5	56.4	61.2	66.4	122.3	61.3	74	2.1	2.1	170.8	3.9	56.7	48.7	Yes
76	4-2	52.3	128.1	50.5	55.6	59.7	65.6	125.5	61.7	258	-1.3	1.9	214.0	4.1	56.1	49.2	Yes
76	5-1	54.1	128.9	49.9	56.1	60.5	66.1	123.0	60.8	78	2.0	3.3	116.9	4.7	50.9	59.1	Yes
76	5-2	52.7	127.5	49.9	56.7	61.0	66.2	122.3	60.6	254	-2.2	2.7	131.5	4.7	51.1	58.6	Yes
76	6-1	51.1	126.8	47.5	57.4	61.6	66.5	123.6	61.4	74	1.5	1.6	191.3	4.1	65.5	53.5	Yes
76	6-2	66.8	130.5	47.5	57.1	61.2	67.1	121.5	59.9	256	-0.6	3.7	245.7	7.0	65.3	56.7	Yes
Mic 10 Average		56.0	128.9	49.5	56.5	60.7	66.1	122.5	60.8								
Mic 11 (Lateral)																	
175	1-1	152.4	191.4	44.9	53.3	57.1	62.9	122.2	60.2	77	0.6	1.6	96.6	4.4	53.4	53.8	Yes
175	1-2	150.4	190.9	44.9	53.5	57.3	63.0	122.9	60.1	255	-0.4	2.9	82.3	4.1	53.2	53.6	Yes
175	2-1	151.7	191.7	43.7	53.3	57.4	62.8	122.4	61.6	77	0.0	3.3	77.3	5.8	48.4	62.8	Yes
175	2-2	154.5	192.9	43.7	53.8	57.4	62.8	121.0	60.9	252	-2.8	3.6	123.5	5.8	49.3	60.9	Yes
175	3-1	158.9	196.0	43.4	52.8	56.5	62.4	121.8	60.1	76	1.3	1.7	132.1	3.5	54.5	52.2	Yes
175	3-2	149.1	188.4	43.4	53.4	57.2	62.9	121.3	60.8	255	1.7	2.2	306.5	3.5	54.9	51.3	Yes
175	4-1	154.2	193.6	43.3	53.2	57.6	63.2	122.3	61.3	74	2.1	2.1	170.8	3.9	56.7	48.7	Yes

Distance to PADDC (ft)	Test#	Undertrack Distance (ft)	POCA Slant (ft)	Ambient (dBA)	LAEQ (dBA)	LMAX (dBA)	SEL (dBA)	Average Altitude (ft)	Average True Air Speed (kts)	Median Drone Heading (deg.)	Cross Wind (kts)	Wind Speed (kts)	Wind Direction (deg.)	Wind Gust Speed (kts)	Temp (°f)	Relative Humidity (%)	Valid
175	4-2	151.2	191.1	43.3	51.9	55.7	61.9	125.5	61.7	258	-1.3	1.9	214.0	4.1	56.1	49.2	Yes
175	5-1	151.8	191.6	44.3	53.1	57.0	63.1	123.0	60.8	78	2.0	3.3	116.9	4.7	50.9	59.1	Yes
175	5-2	152.0	191.2	44.3	53.0	56.9	62.6	122.3	60.6	254	-2.2	2.7	131.5	4.7	51.1	58.6	Yes
175	6-1	148.7	188.6	46.5	54.5	58.3	63.6	123.6	61.4	74	1.5	1.6	191.3	4.1	65.5	53.5	Yes
175	6-2	157.5	193.4	46.5	54.2	57.8	64.2	121.5	59.9	256	-0.6	3.7	245.7	7.0	65.3	56.7	Yes
Mic 11 Average		152.7	191.7	44.4	53.3	57.2	62.9	122.5	60.8								
Mic 12 (Lateral)																	
375	1-1	351.5	370.1	45.2	48.6	50.0	58.1	122.2	60.2	77	0.6	1.6	96.6	4.4	53.4	53.8	No
375	1-2	349.8	369.0	45.2	48.8	50.3	58.3	122.9	60.1	255	-0.4	2.9	82.3	4.1	53.2	53.6	No
375	2-1	351.0	370.1	44.2	48.2	49.3	57.7	122.4	61.6	77	0.0	3.3	77.3	5.8	48.4	62.8	No
375	2-2	352.2	370.6	44.2	49.2	50.5	58.2	121.0	60.9	252	-2.8	3.6	123.5	5.8	49.3	60.9	No
375	3-1	354.8	372.9	44.4	48.2	49.8	57.7	121.8	60.1	76	1.3	1.7	132.1	3.5	54.5	52.2	No
375	3-2	348.6	367.1	44.4	48.7	49.9	58.3	121.3	60.8	255	1.7	2.2	306.5	3.5	54.9	51.3	No
375	4-1	352.7	371.6	44.3	48.5	50.1	58.5	122.3	61.3	74	2.1	2.1	170.8	3.9	56.7	48.7	No
375	4-2	350.5	369.5	44.3	47.8	48.5	57.8	125.5	61.7	258	-1.3	1.9	214.0	4.1	56.1	49.2	No
375	5-1	350.7	369.7	45.2	50.4	51.5	60.4	123.0	60.8	78	2.0	3.3	116.9	4.7	50.9	59.1	No
375	5-2	351.4	370.0	45.2	52.0	52.9	61.5	122.3	60.6	254	-2.2	2.7	131.5	4.7	51.1	58.6	No
375	6-1	347.6	366.4	49.6	50.2	51.4	59.3	123.6	61.4	74	1.5	1.6	191.3	4.1	65.5	53.5	No
375	6-2	354.0	371.3	49.6	50.5	51.6	60.5	121.5	59.9	256	-0.6	3.7	245.7	7.0	65.3	56.7	No
Mic 12 Average		351.2	369.9	-	-	-	-	-	-								

Source: Prime Air, 2024; ESA, 2025.

Notes: Greyed out cells we determined to not be valid measurements and were not included in SEL calculations.

Table B-5. Empty Weight En Route Measurements

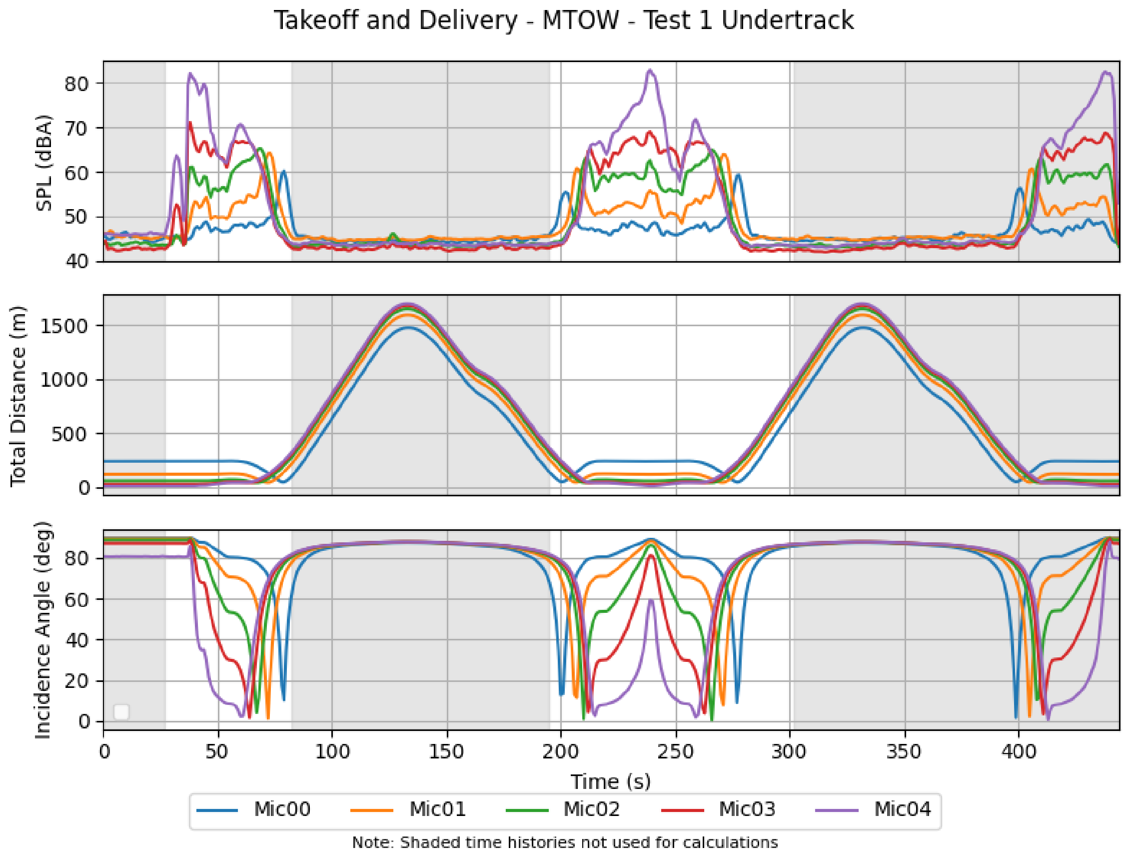
Distance to PADDC (ft)	Test#	Undertrack Distance (ft)	POCA Slant (ft)	Ambient (dBA)	LAEQ (dBA)	LMAX (dBA)	SEL (dBA)	Average Altitude (ft)	Average True Air Speed (kts)	Median Drone Heading (deg.)	Cross Wind (kts)	Wind Speed (kts)	Wind Direction (deg.)	Wind Gust Speed (kts)	Temp (°f)	Relative Humidity (%)	Valid
Mic 09 (Lateral)																	
25	1-1	0.4	101.8	50.8	57.5	62.1	67.1	107.2	59.8	76	1.8	4.0	102.4	4.5	45.3	62.8	Yes
25	1-2	17.6	103.4	50.8	57.0	61.6	66.6	107.6	59.7	254	-1.2	3.8	93.1	4.5	45.5	62.2	Yes
25	2-1	44.8	94.2	50.1	59.3	63.6	68.4	90.4	61.9	76	2.4	2.4	177.4	4.1	65.1	38.7	Yes
25	2-2	5.7	81.4	50.1	58.6	63.3	68.1	90.1	60.4	255	-2.0	3.0	212.8	4.1	65.1	38.4	Yes
25	3-1	36.0	107.7	46.8	56.9	61.2	66.5	110.3	61.5	68	-5.7	5.9	326.2	10.9	62.2	34.6	No
25	3-2	20.1	103.3	46.8	56.1	60.8	66.1	109.7	61.1	261	6.0	7.5	312.6	10.9	62.8	35.6	No
25	4-1	43.9	110.3	62.9	62.9	64.3	73.3	107.0	62.4	68	-3.1	4.3	300.5	11.1	63.3	34.1	No
25	4-2	52.4	112.5	62.9	64.8	65.9	74.3	105.2	60.3	264	6.4	6.4	353.4	10.7	63.9	33.9	No
25	5-1	3.6	96.7	47.0	57.5	61.7	66.5	104.3	60.6	69	-2.0	2.2	319.7	9.9	61.3	37.8	Yes
25	5-2	8.5	94.9	47.0	57.7	62.7	67.7	102.3	60.8	257	3.0	3.0	341.0	9.9	61.7	37.4	Yes
25	6-1	48.9	110.8	47.6	55.6	60.5	66.8	106.5	60.7	71	-2.5	4.4	34.0	9.1	61.3	37.3	Yes
25	6-2	9.2	100.6	47.6	55.2	60.1	65.6	107.7	63.2	258	2.2	2.6	21.8	7.4	61.0	37.0	Yes
25	7-1	22.4	104.3	50.7	57.1	61.5	67.1	107.2	59.6	78	1.7	4.2	102.3	4.7	45.5	61.5	Yes
25	7-2	23.1	105.2	50.7	56.9	61.3	66.4	107.9	59.9	252	-2.1	3.9	104.6	4.7	45.7	61.3	Yes
	Mic 09 Average	18.4	99.3	49.2	57.2	61.8	67.0	103.1	60.7								
Mic 10 (Lateral)																	
76	1-1	50.7	113.7	44.9	56.6	61.1	66.1	107.2	59.8	76	1.8	4.0	102.4	4.5	45.3	62.8	Yes
76	1-2	54.7	115.6	44.9	56.1	60.8	65.6	107.6	59.7	254	-1.2	3.8	93.1	4.5	45.5	62.2	Yes
76	2-1	69.0	107.9	44.5	58.3	62.6	67.3	90.4	61.9	76	2.4	2.4	177.4	4.1	65.1	38.7	Yes
76	2-2	51.4	96.1	44.5	57.6	62.4	67.2	90.1	60.4	255	-2.0	3.0	212.8	4.1	65.1	38.4	Yes
76	3-1	63.0	119.5	51.1	58.0	62.3	67.6	110.3	61.5	68	-5.7	5.9	326.2	10.9	62.2	34.6	No
76	3-2	56.0	115.8	51.1	56.9	61.2	66.9	109.7	61.1	261	6.0	7.5	312.6	10.9	62.8	35.6	No
76	4-1	66.9	121.3	49.1	56.4	60.9	66.8	107.0	62.4	68	-3.1	4.3	300.5	11.1	63.3	34.1	Yes
76	4-2	72.9	123.5	49.1	58.0	62.4	67.5	105.2	60.3	264	6.4	6.4	353.4	10.7	63.9	33.9	No
76	5-1	50.5	109.1	50.6	58.6	62.5	67.6	104.3	60.6	69	-2.0	2.2	319.7	9.9	61.3	37.8	Yes
76	5-2	52.4	108.1	50.6	58.6	63.5	68.6	102.3	60.8	257	3.0	3.0	341.0	9.9	61.7	37.4	Yes
76	6-1	70.0	122.6	51.7	56.9	61.6	68.1	106.5	60.7	71	-2.5	4.4	34.0	9.1	61.3	37.3	Yes
76	6-2	53.1	113.4	51.7	56.2	60.7	66.7	107.7	63.2	258	2.2	2.6	21.8	7.4	61.0	37.0	No
76	7-1	56.8	116.6	45.3	56.2	60.7	66.2	107.2	59.6	78	1.7	4.2	102.3	4.7	45.5	61.5	Yes
76	7-2	55.9	116.8	45.3	56.0	60.7	65.6	107.9	59.9	252	-2.1	3.9	104.6	4.7	45.7	61.3	Yes
	Mic 10 Average	57.8	112.8	47.1	57.1	61.7	66.9	103.0	60.6								
Mic 11 (Lateral)																	
175	1-1	150.5	181.7	44.5	53.3	57.1	62.8	107.2	59.8	76	1.8	4.0	102.4	4.5	45.3	62.8	Yes
175	1-2	152.3	183.2	44.5	52.6	56.7	62.2	107.6	59.7	254	-1.2	3.8	93.1	4.5	45.5	62.2	Yes
175	2-1	158.0	178.4	43.8	54.4	57.9	63.5	90.4	61.9	76	2.4	2.4	177.4	4.1	65.1	38.7	Yes

Distance to PADDC (ft)	Test#	Undertrack Distance (ft)	POCA Slant (ft)	Ambient (dBA)	LAEQ (dBA)	LMAX (dBA)	SEL (dBA)	Average Altitude (ft)	Average True Air Speed (kts)	Median Drone Heading (deg.)	Cross Wind (kts)	Wind Speed (kts)	Wind Direction (deg.)	Wind Gust Speed (kts)	Temp (°f)	Relative Humidity (%)	Valid
175	2-2	150.9	171.3	43.8	53.6	57.3	63.2	90.1	60.4	255	-2.0	3.0	212.8	4.1	65.1	38.4	Yes
175	3-1	155.1	185.4	44.9	53.7	57.4	63.3	110.3	61.5	68	-5.7	5.9	326.2	10.9	62.2	34.6	No
175	3-2	153.7	184.1	44.9	53.0	56.8	63.0	109.7	61.1	261	6.0	7.5	312.6	10.9	62.8	35.6	No
175	4-1	155.6	185.7	43.0	52.5	56.6	62.9	107.0	62.4	68	-3.1	4.3	300.5	11.1	63.3	34.1	Yes
175	4-2	159.4	188.0	43.0	53.8	57.9	63.3	105.2	60.3	264	6.4	6.4	353.4	10.7	63.9	33.9	No
175	5-1	150.3	178.7	45.7	54.0	57.7	63.1	104.3	60.6	69	-2.0	2.2	319.7	9.9	61.3	37.8	Yes
175	5-2	151.6	178.6	45.7	54.0	58.3	64.0	102.3	60.8	257	3.0	3.0	341.0	9.9	61.7	37.4	Yes
175	6-1	158.5	187.6	45.2	53.5	57.5	64.7	106.5	60.7	71	-2.5	4.4	34.0	9.1	61.3	37.3	No
175	6-2	152.5	182.5	45.2	51.8	55.7	62.2	107.7	63.2	258	2.2	2.6	21.8	7.4	61.0	37.0	Yes
175	7-1	153.2	184.0	44.7	53.0	56.7	63.0	107.2	59.6	78	1.7	4.2	102.3	4.7	45.5	61.5	Yes
175	7-2	152.9	184.1	44.7	52.6	56.6	62.2	107.9	59.9	252	-2.1	3.9	104.6	4.7	45.7	61.3	Yes
Mic 11 Average		152.8	180.8	44.6	53.2	57.1	62.9	103.2	60.8								
Mic 12 (Lateral)																	
375	1-1	350.1	364.5	45.5	48.7	49.9	58.2	107.2	59.8	76	1.8	4.0	102.4	4.5	45.3	62.8	No
375	1-2	351.1	365.6	45.5	48.4	49.4	57.9	107.6	59.7	254	-1.2	3.8	93.1	4.5	45.5	62.2	No
375	2-1	353.6	363.2	45.7	49.7	51.1	58.7	90.4	61.9	76	2.4	2.4	177.4	4.1	65.1	38.7	No
375	2-2	350.3	359.6	45.7	49.5	50.7	59.0	90.1	60.4	255	-2.0	3.0	212.8	4.1	65.1	38.4	No
375	3-1	352.0	366.4	46.7	49.1	50.2	58.7	110.3	61.5	68	-5.7	5.9	326.2	10.9	62.2	34.6	No
375	3-2	352.7	366.9	46.7	50.4	51.8	60.4	109.7	61.1	261	6.0	7.5	312.6	10.9	62.8	35.6	No
375	4-1	351.3	365.6	44.6	49.2	50.2	59.7	107.0	62.4	68	-3.1	4.3	300.5	11.1	63.3	34.1	No
375	4-2	354.0	367.8	44.6	49.6	51.1	59.2	105.2	60.3	264	6.4	6.4	353.4	10.7	63.9	33.9	No
375	5-1	349.8	362.9	49.7	49.2	50.4	58.2	104.3	60.6	69	-2.0	2.2	319.7	9.9	61.3	37.8	No
375	5-2	350.9	363.4	49.7	55.9	56.7	65.9	102.3	60.8	257	3.0	3.0	341.0	9.9	61.7	37.4	No
375	6-1	354.1	367.7	49.1	51.0	52.4	62.1	106.5	60.7	71	-2.5	4.4	34.0	9.1	61.3	37.3	No
375	6-2	352.0	366.0	49.1	48.7	49.5	59.2	107.7	63.2	258	2.2	2.6	21.8	7.4	61.0	37.0	No
375	7-1	351.7	366.1	45.2	49.5	50.5	59.5	107.2	59.6	78	1.7	4.2	102.3	4.7	45.5	61.5	No
375	7-2	351.6	366.2	45.2	48.3	49.5	57.9	107.9	59.9	252	-2.1	3.9	104.6	4.7	45.7	61.3	No
Mic 12 Average		-	-	-	-	-	-	-	-								

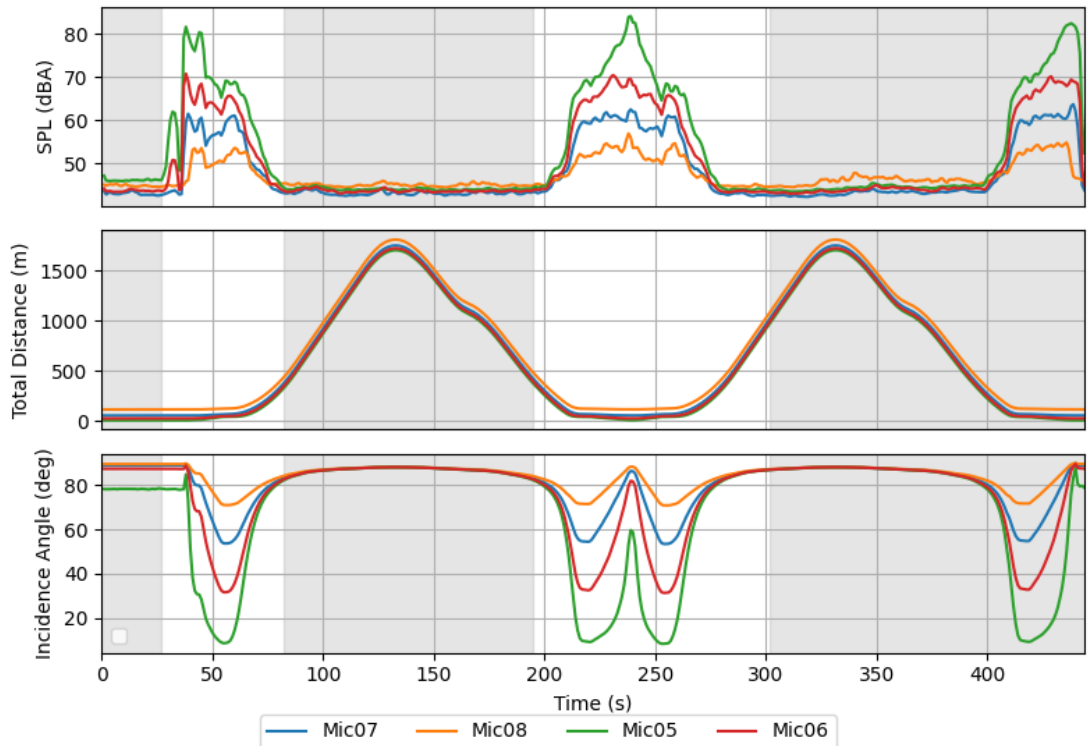
Source: Prime Air, 2024; ESA, 2025.

Notes: Greyed out cells we determined to not be valid measurements and were not included in SEL calculations.

Appendix C:
Time History Graphs

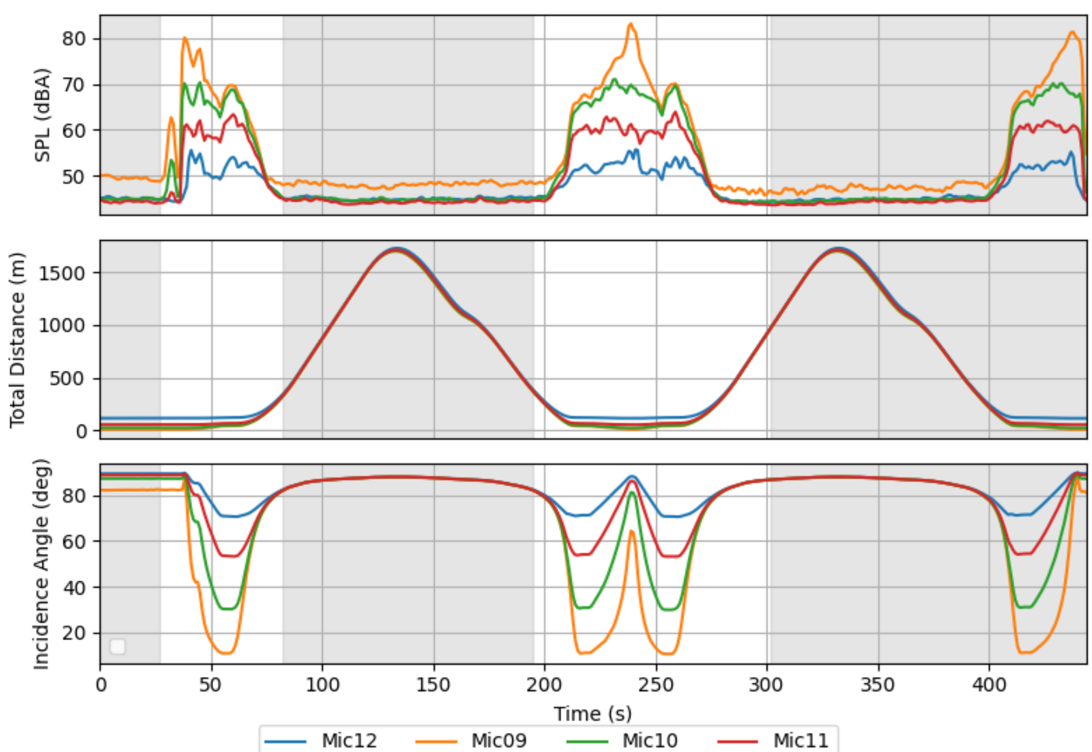


Takeoff and Delivery - MTOW - Test 1 Behind

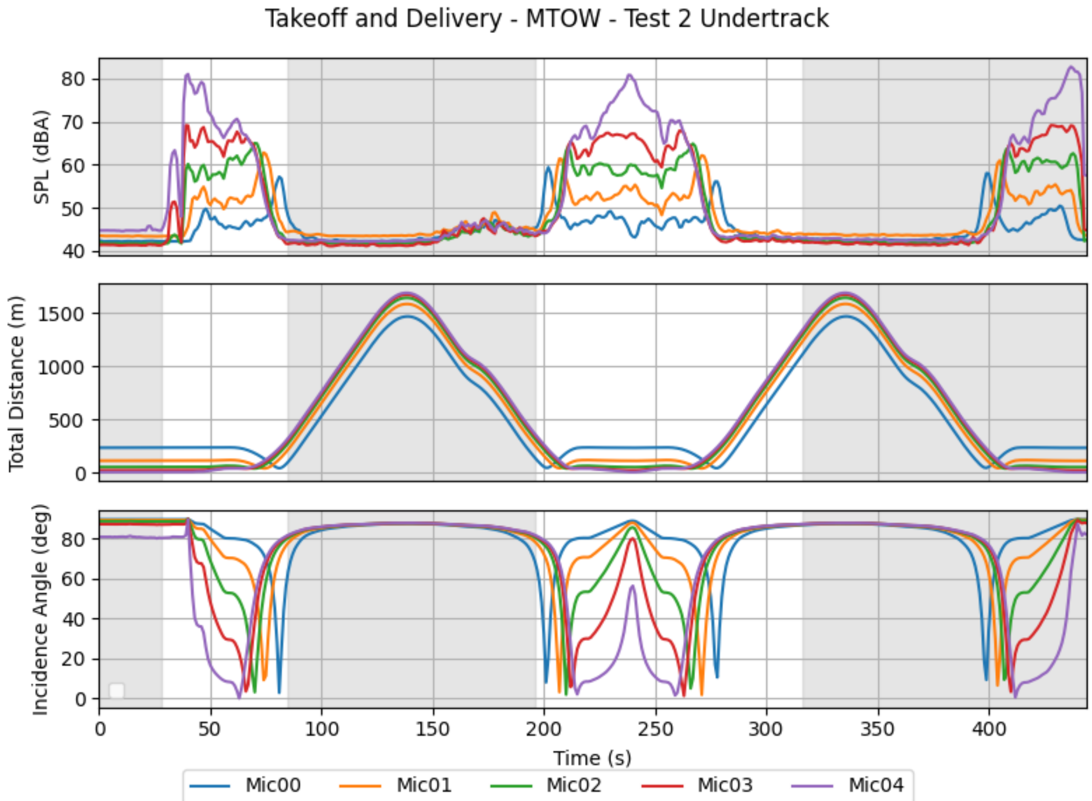


Note: Shaded time histories not used for calculations

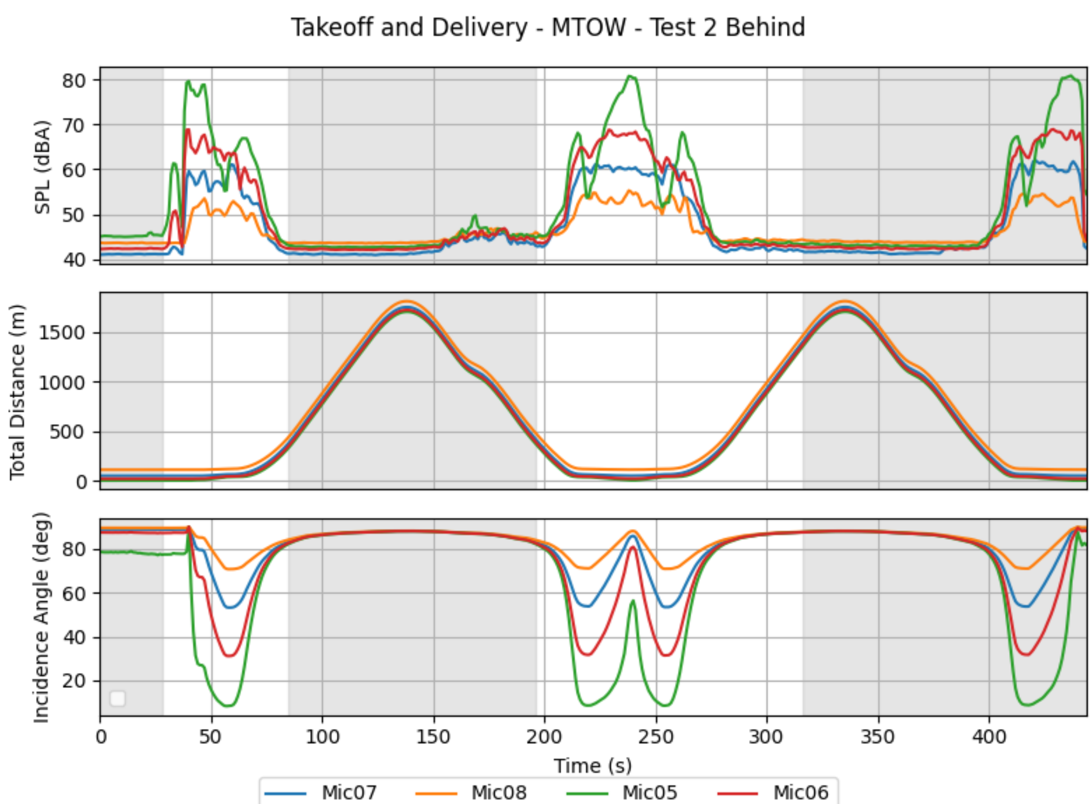
Takeoff and Delivery - MTOW - Test 1 Lateral



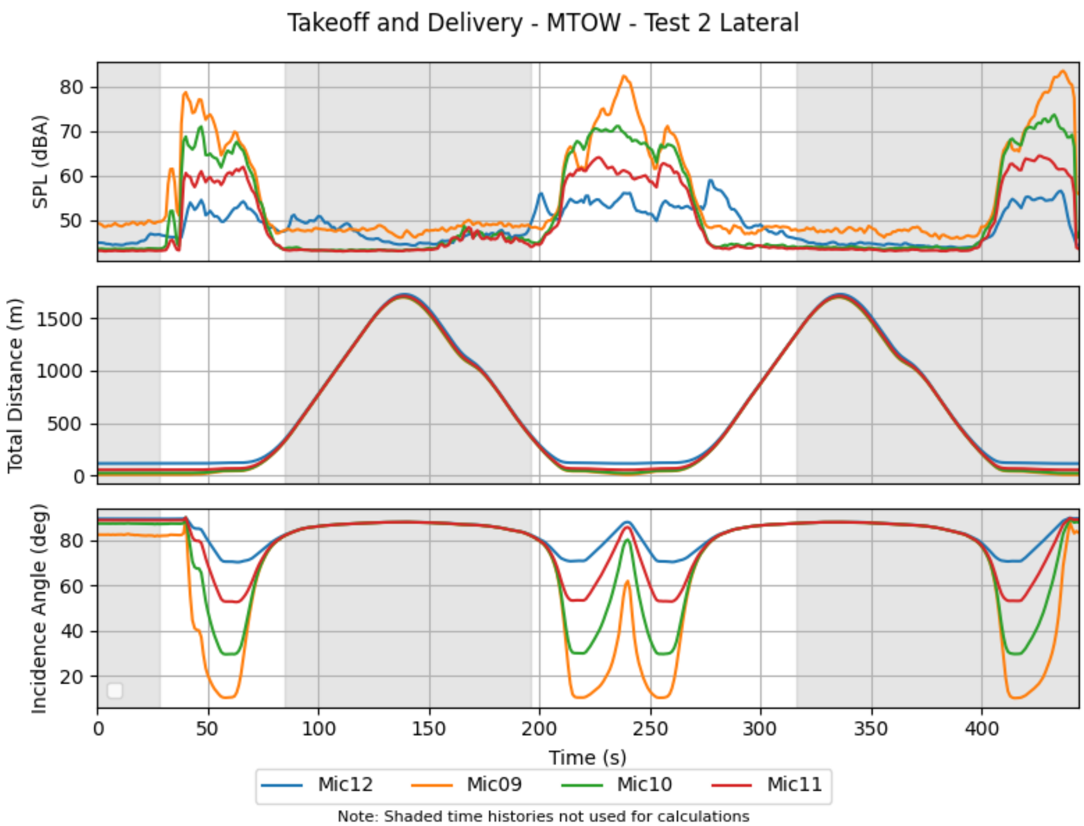
Note: Shaded time histories not used for calculations

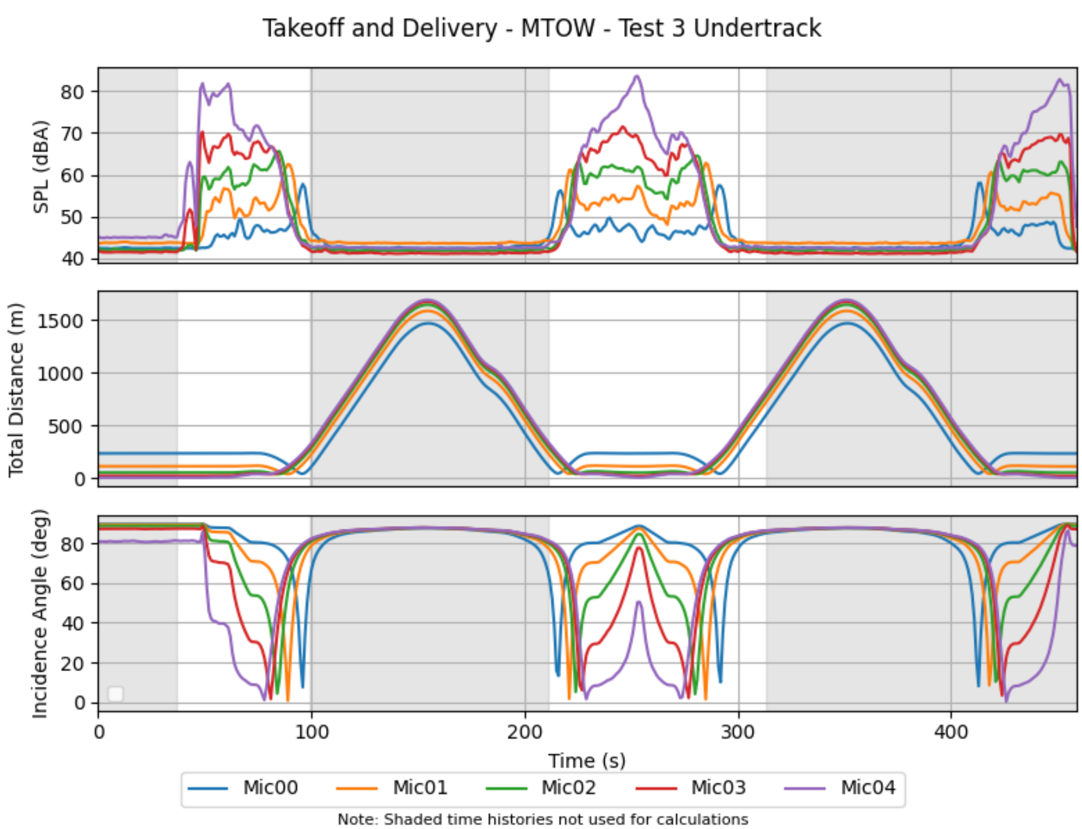


Note: Shaded time histories not used for calculations

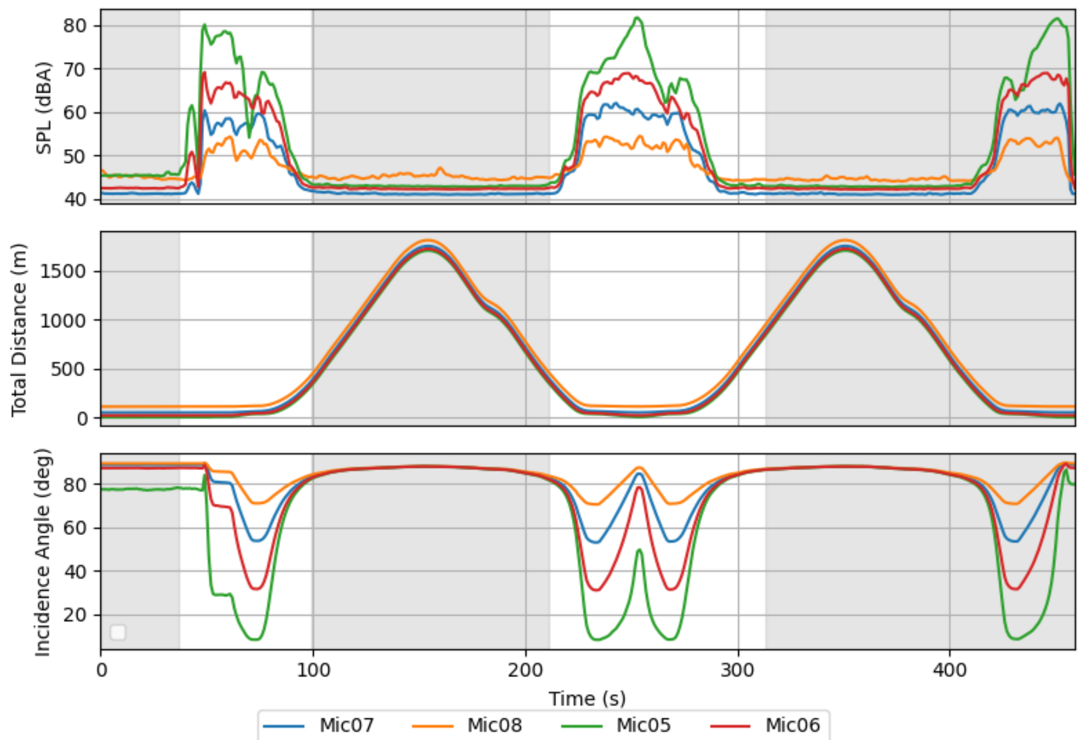


Note: Shaded time histories not used for calculations


Takeoff and Delivery - MTOW - Test 2 Lateral
SPL (dBA)
Total Distance (m)
Incidence Angle (deg)
Time (s)
Mic12
Mic09
Mic10
Mic11
Note: Shaded time histories not used for calculations

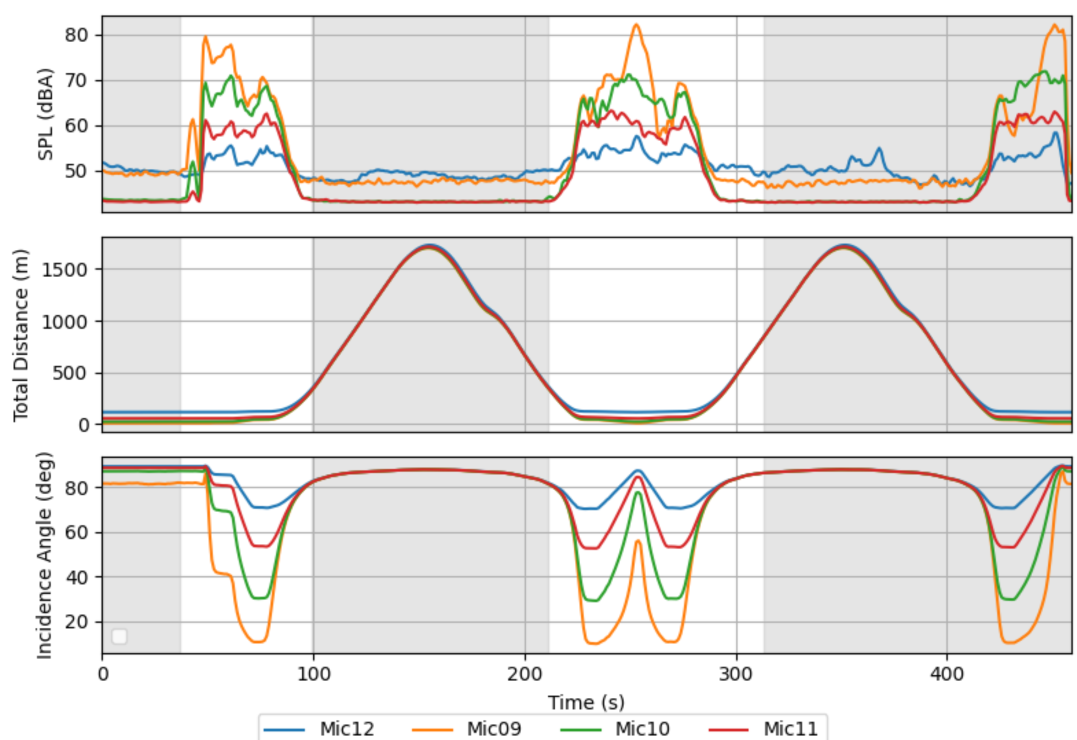

Takeoff and Delivery - MTOW - Test 3 Undertrack
SPL (dBA)
Total Distance (m)
Incidence Angle (deg)
Time (s)
Mic00
Mic01
Mic02
Mic03
Mic04
Note: Shaded time histories not used for calculations

Takeoff and Delivery - MTOW - Test 3 Behind



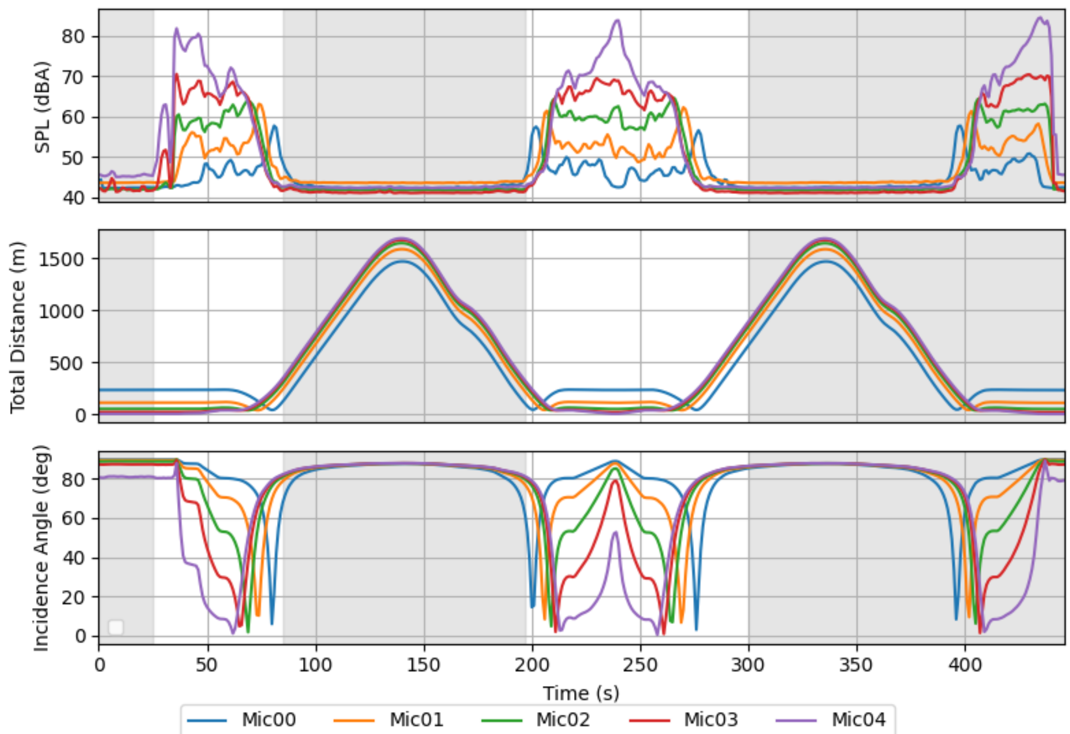
Note: Shaded time histories not used for calculations

Takeoff and Delivery - MTOW - Test 3 Lateral



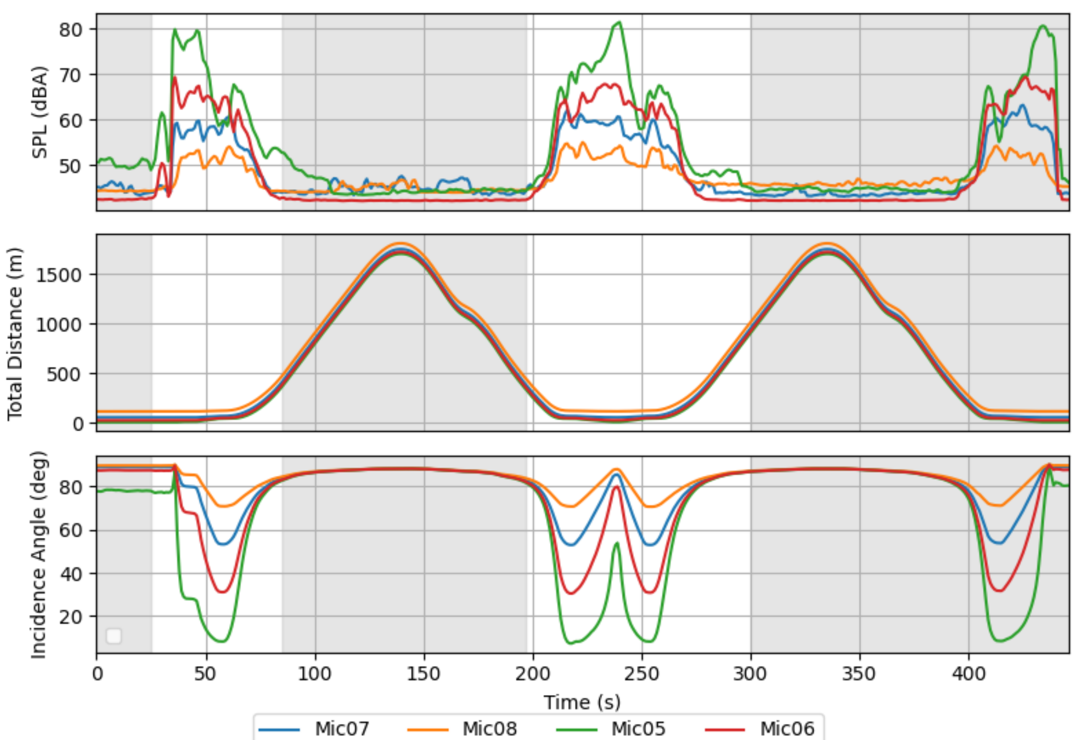
Note: Shaded time histories not used for calculations

Takeoff and Delivery - MTOW - Test 4 Undertrack



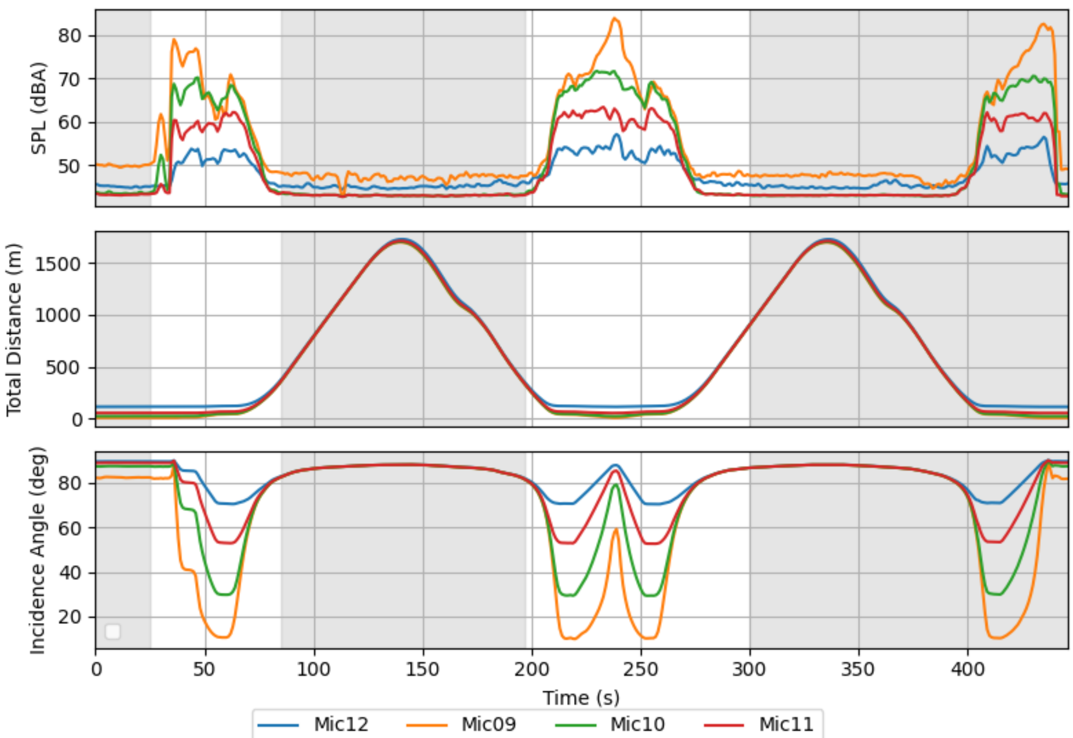
Note: Shaded time histories not used for calculations

Takeoff and Delivery - MTOW - Test 4 Behind



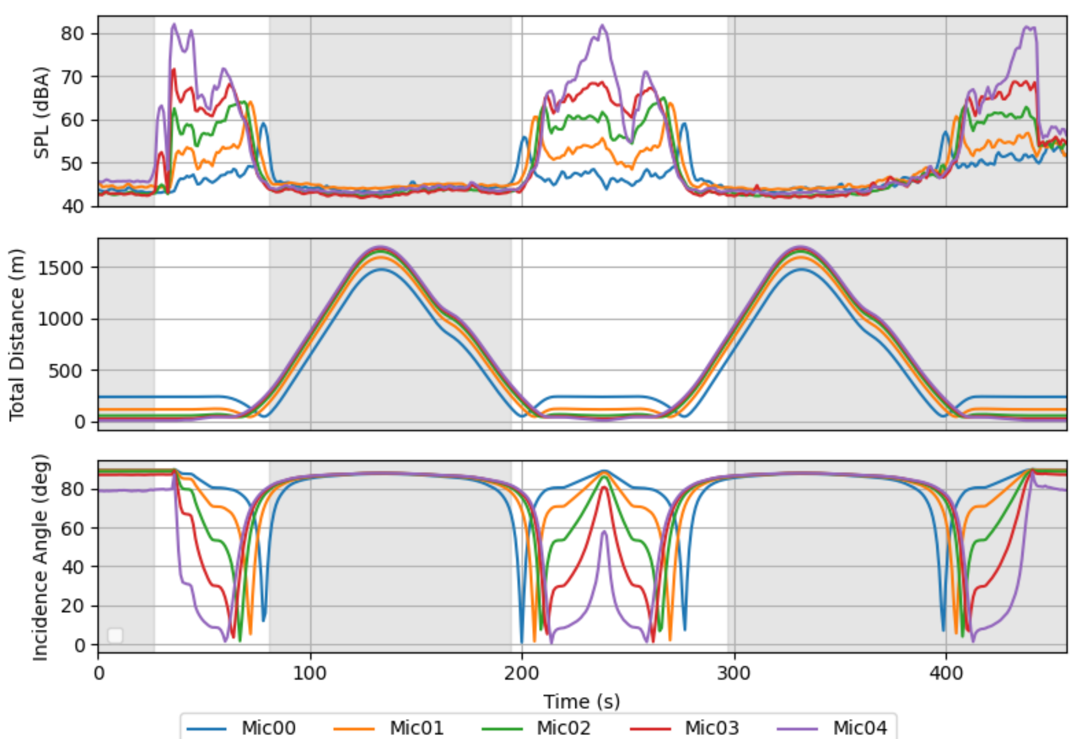
Note: Shaded time histories not used for calculations

Takeoff and Delivery - MTOW - Test 4 Lateral

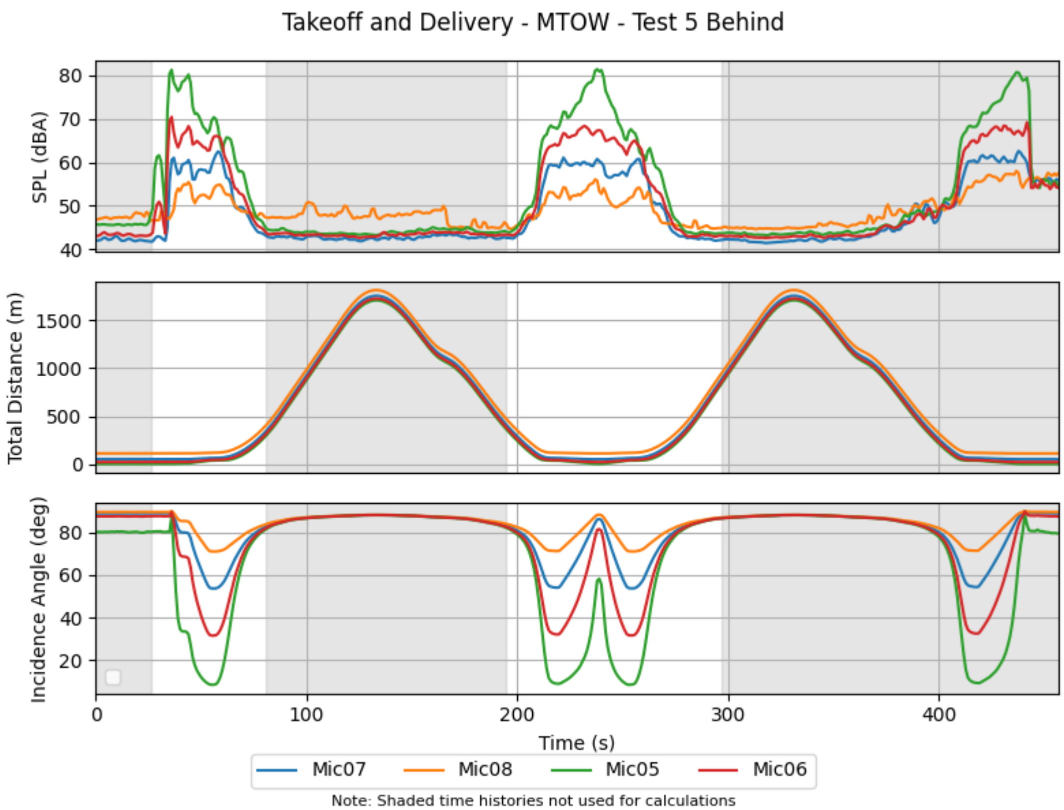


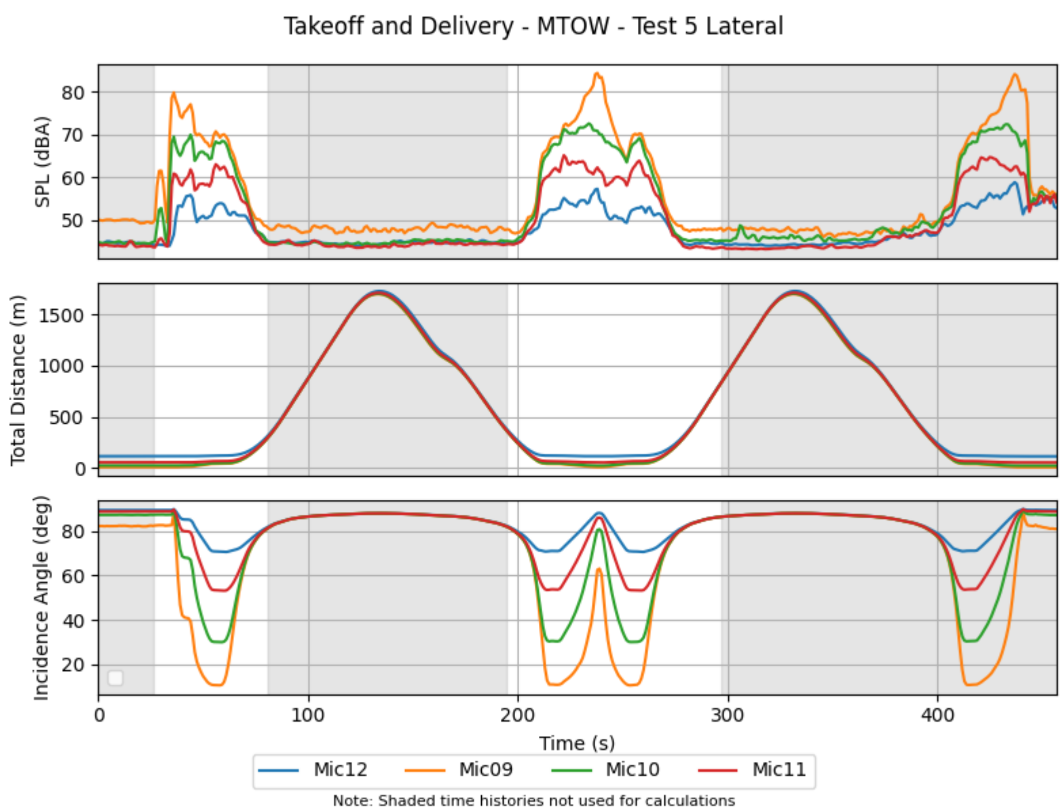
Note: Shaded time histories not used for calculations

Takeoff and Delivery - MTOW - Test 5 Undertrack

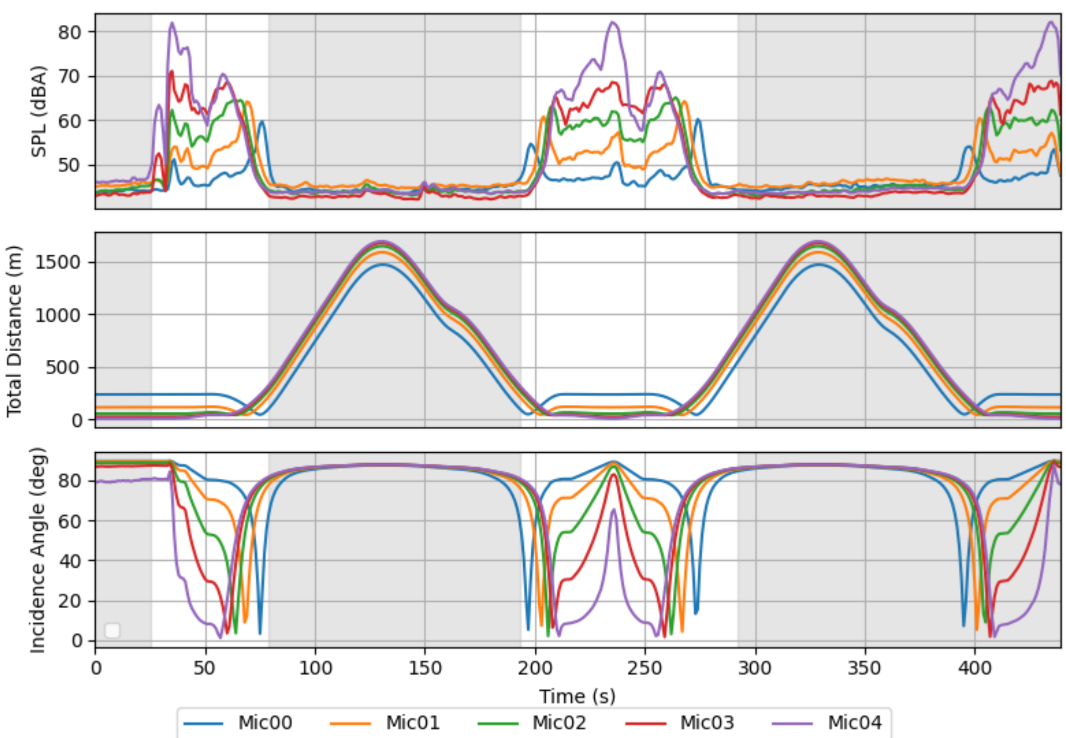


Note: Shaded time histories not used for calculations


Takeoff and Delivery - MTOW - Test 5 Behind
SPL (dBA)
Total Distance (m)
Incidence Angle (deg)
Time (s)
Mic07
Mic08
Mic05
Mic06
Note: Shaded time histories not used for calculations

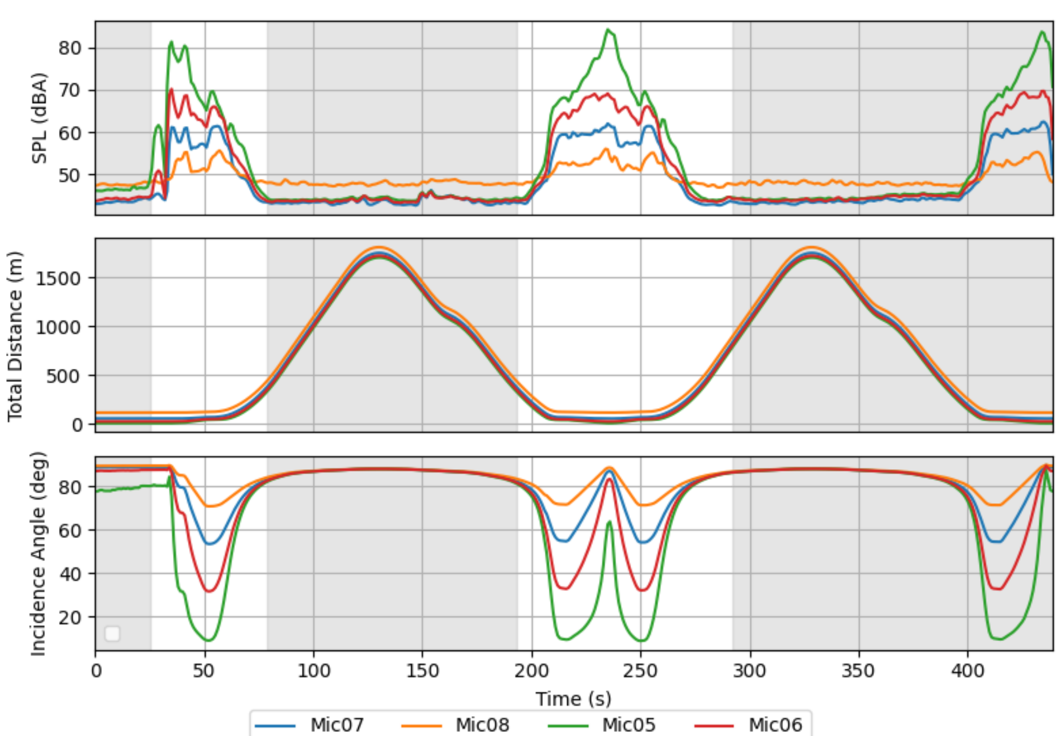

Takeoff and Delivery - MTOW - Test 5 Lateral
SPL (dBA)
Total Distance (m)
Incidence Angle (deg)
Time (s)
Mic12
Mic09
Mic10
Mic11
Note: Shaded time histories not used for calculations

Takeoff and Delivery - MTOW - Test 6 Undertrack

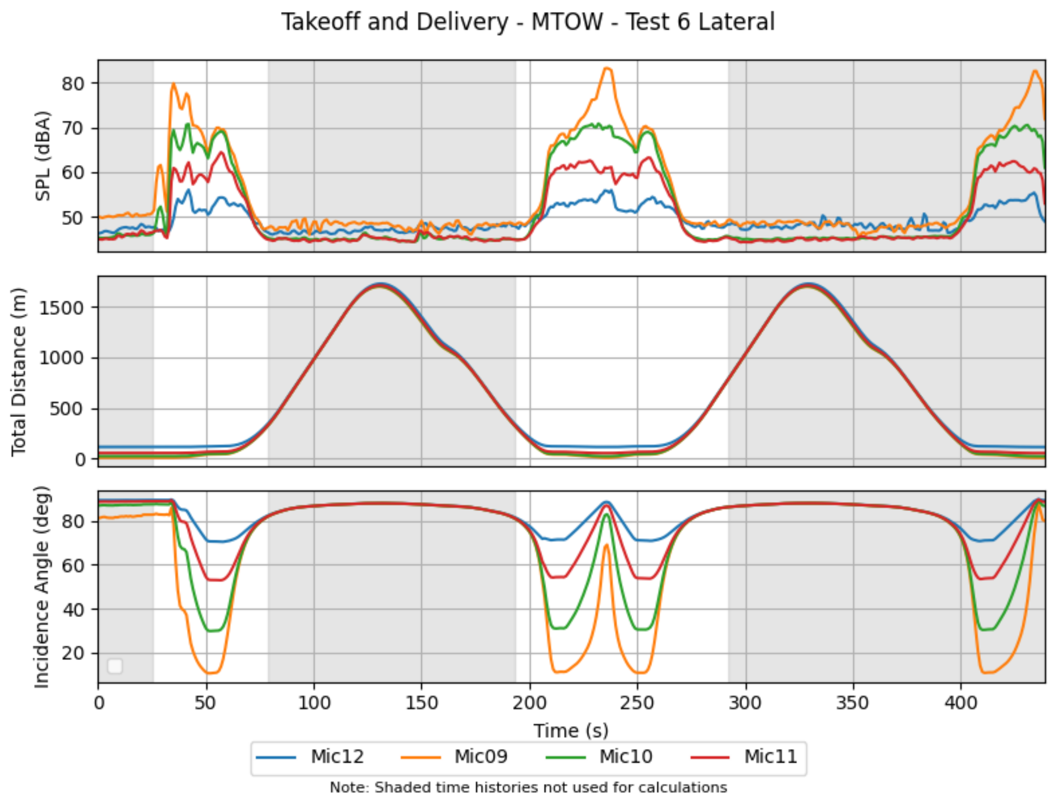


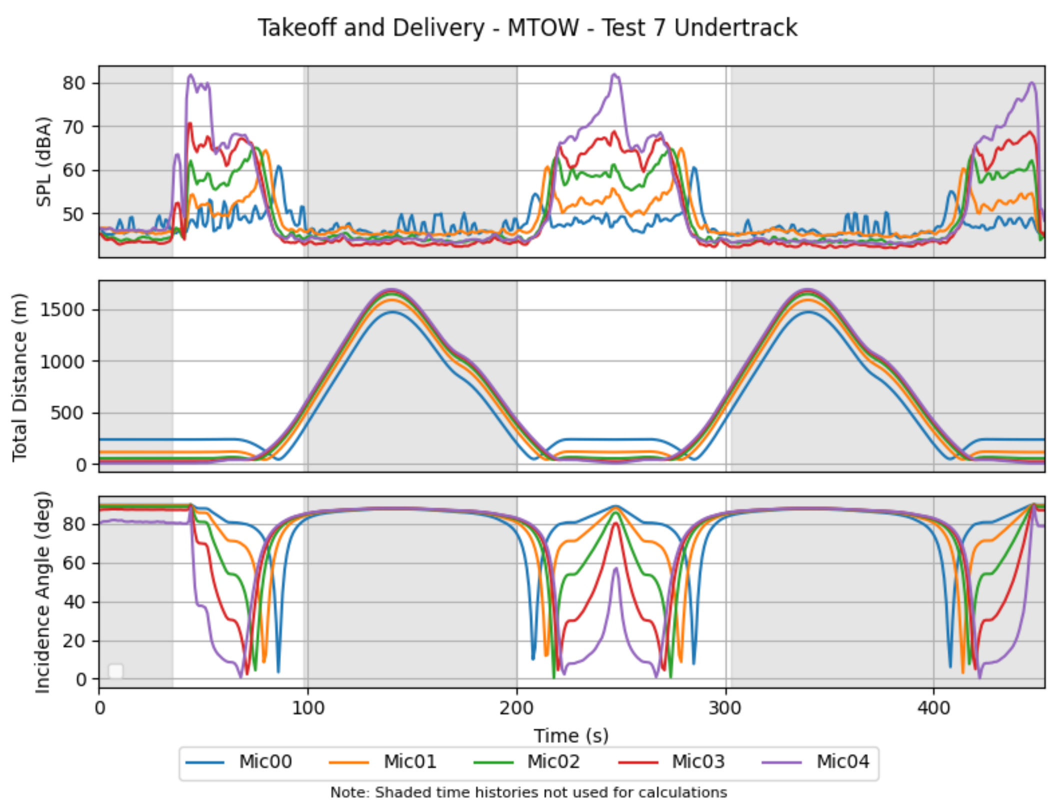
Note: Shaded time histories not used for calculations

Takeoff and Delivery - MTOW - Test 6 Behind

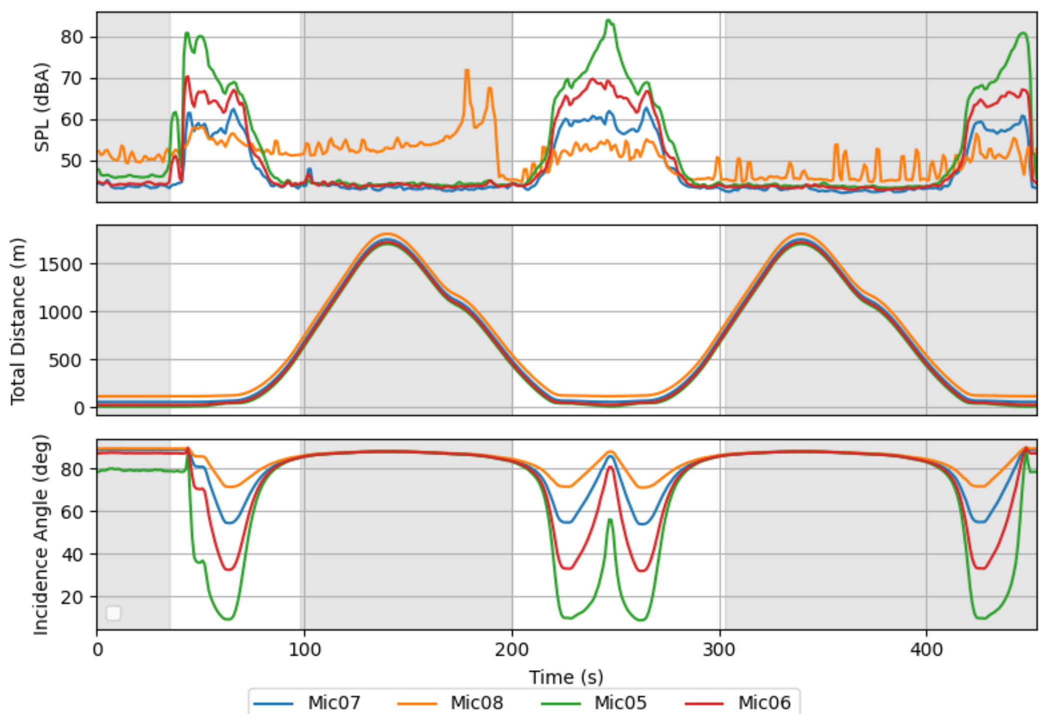


Note: Shaded time histories not used for calculations


Takeoff and Delivery - MTOW - Test 6 Lateral
SPL (dBA)
Total Distance (m)
Incidence Angle (deg)
Time (s)
Mic12
Mic09
Mic10
Mic11
Note: Shaded time histories not used for calculations

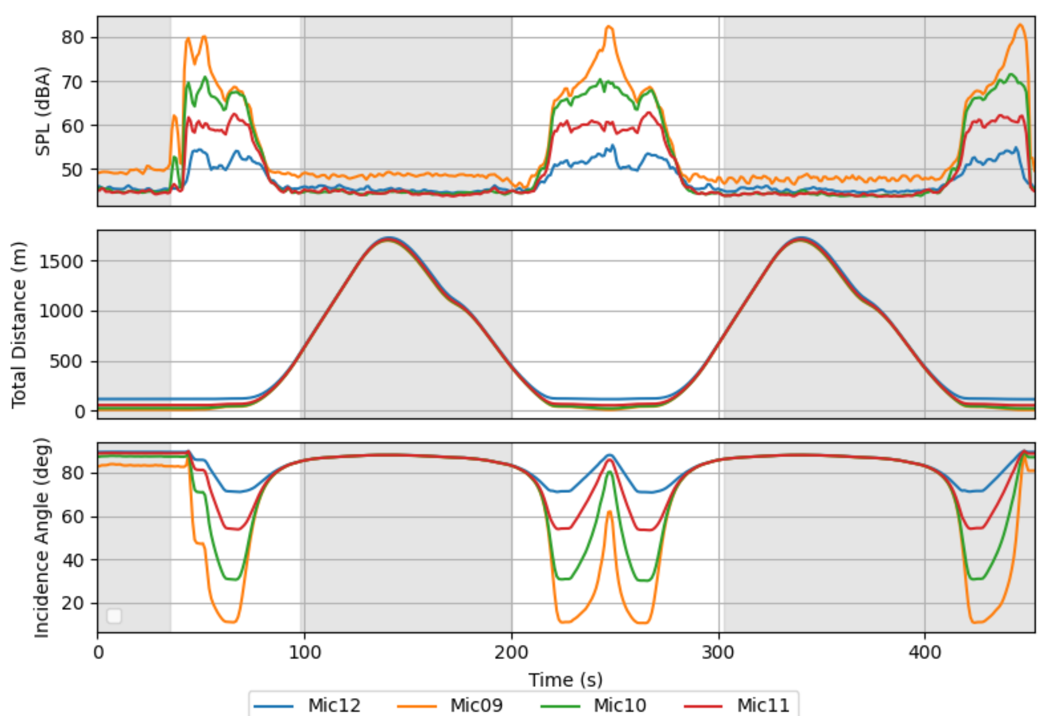

Takeoff and Delivery - MTOW - Test 7 Undertrack
SPL (dBA)
Total Distance (m)
Incidence Angle (deg)
Time (s)
Mic00
Mic01
Mic02
Mic03
Mic04
Note: Shaded time histories not used for calculations

Takeoff and Delivery - MTOW - Test 7 Behind

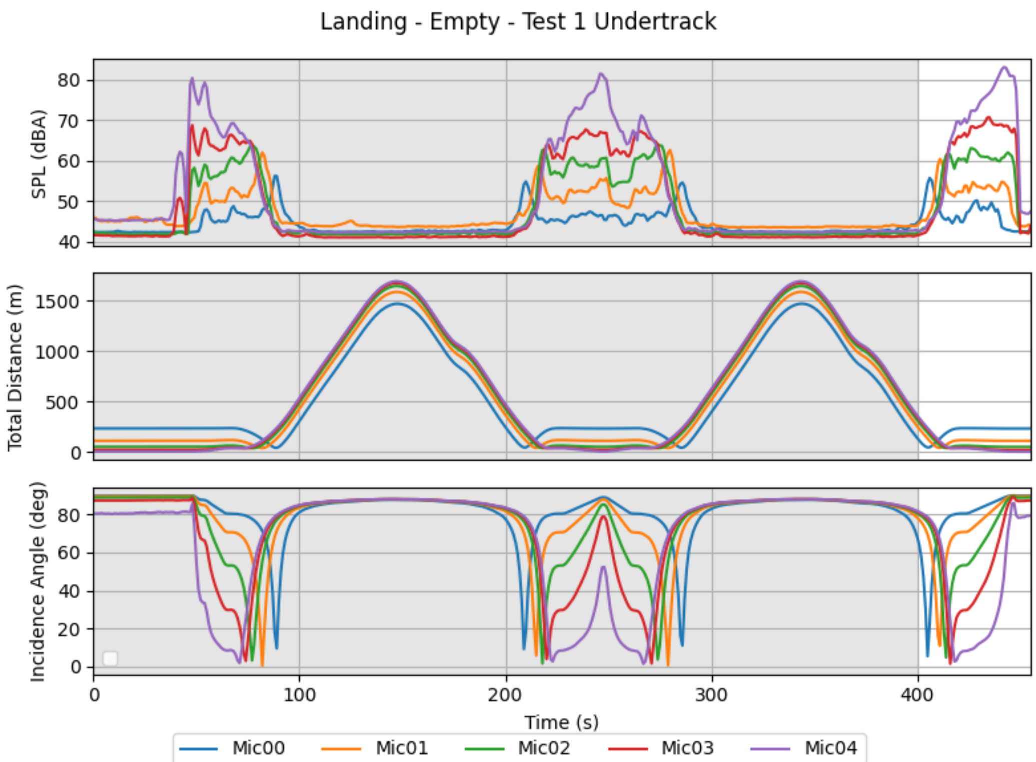


Note: Shaded time histories not used for calculations

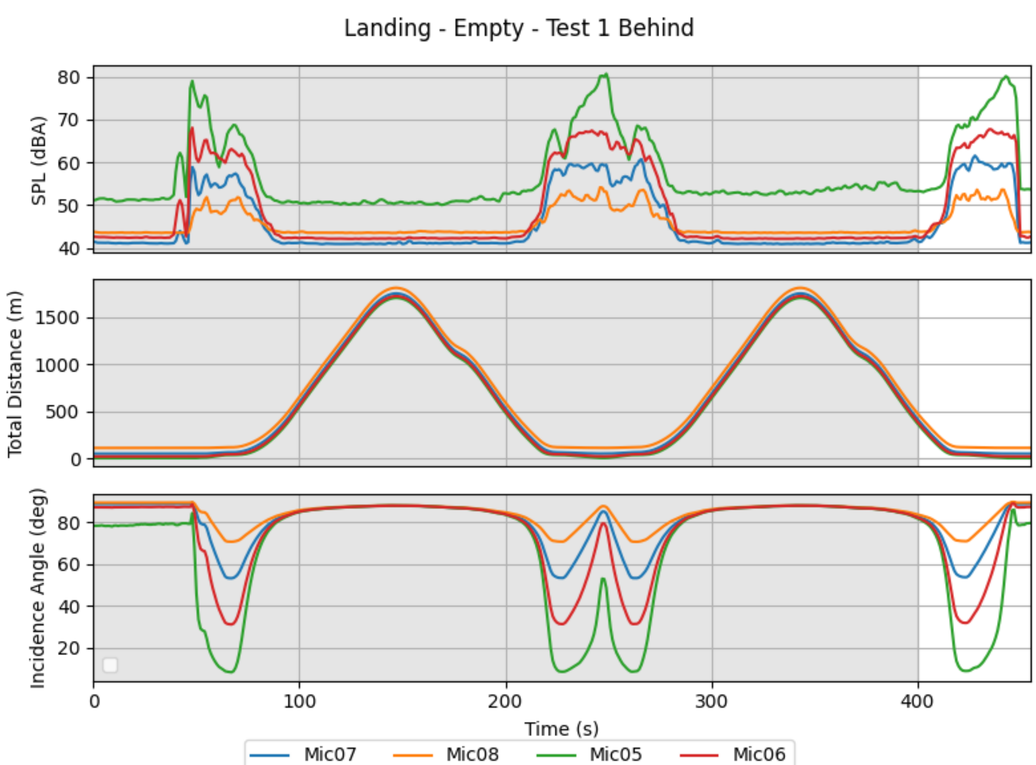
Takeoff and Delivery - MTOW - Test 7 Lateral



Note: Shaded time histories not used for calculations

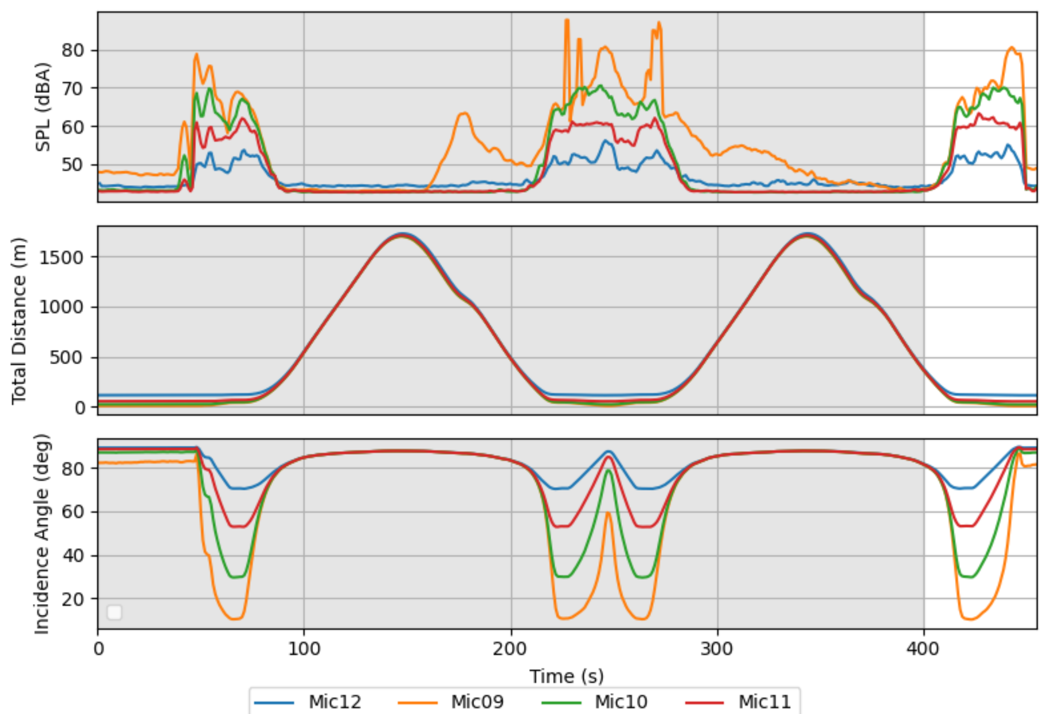


Note: Shaded time histories not used for calculations



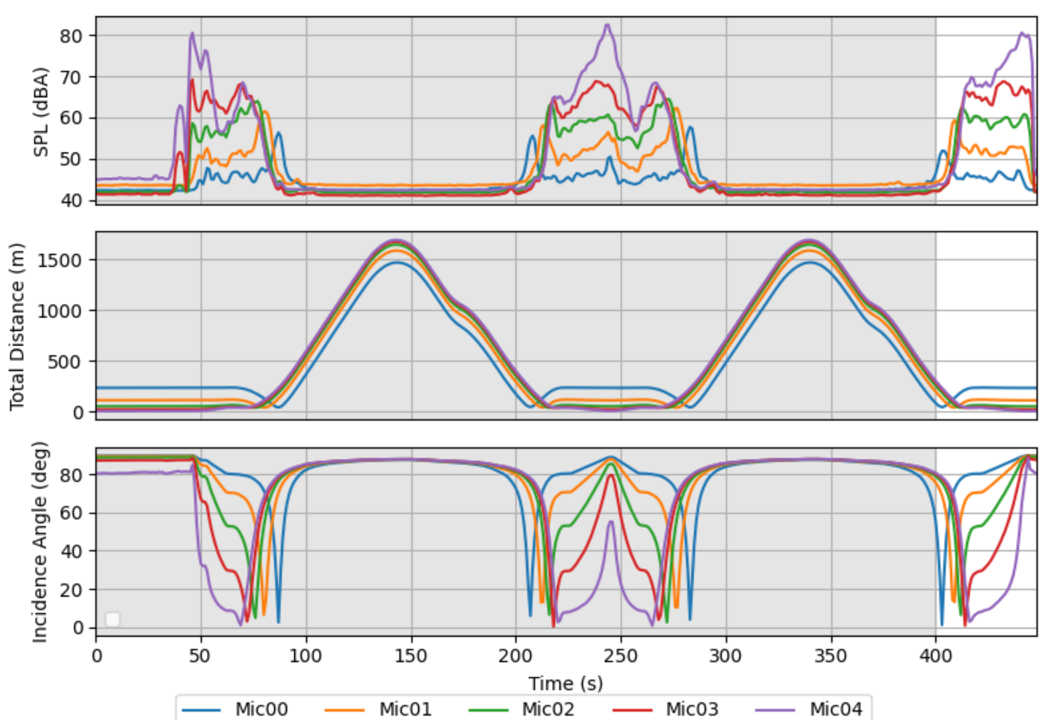
Note: Shaded time histories not used for calculations

Landing - Empty - Test 1 Lateral

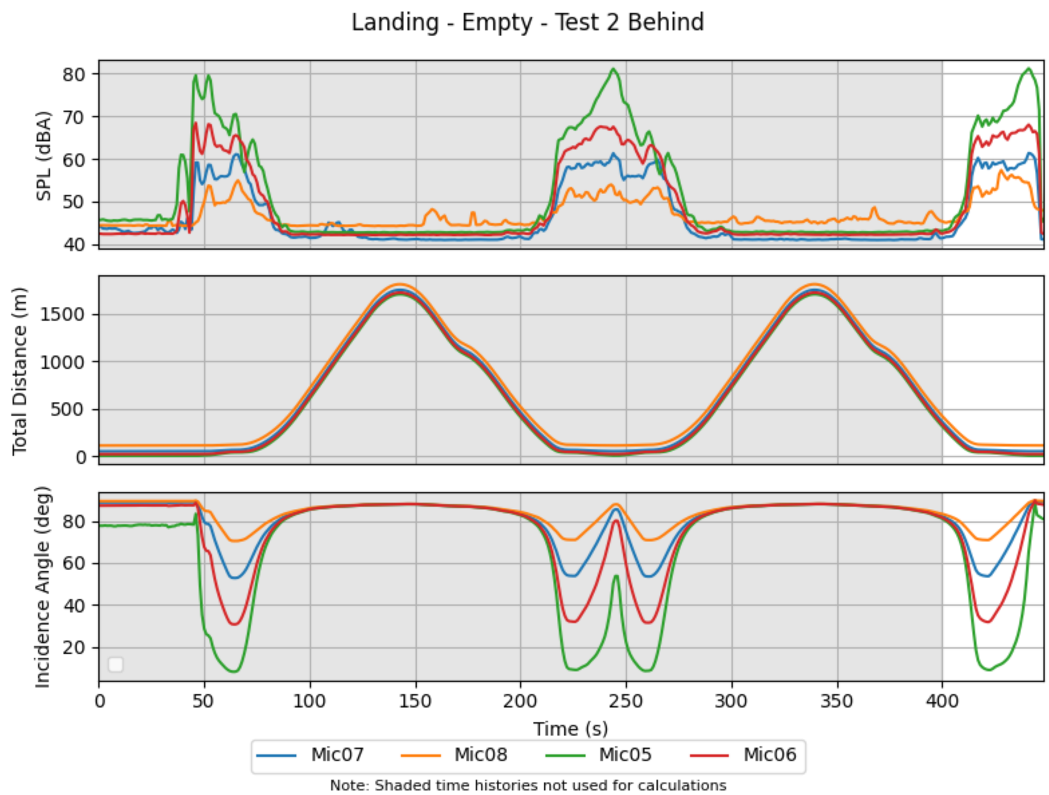


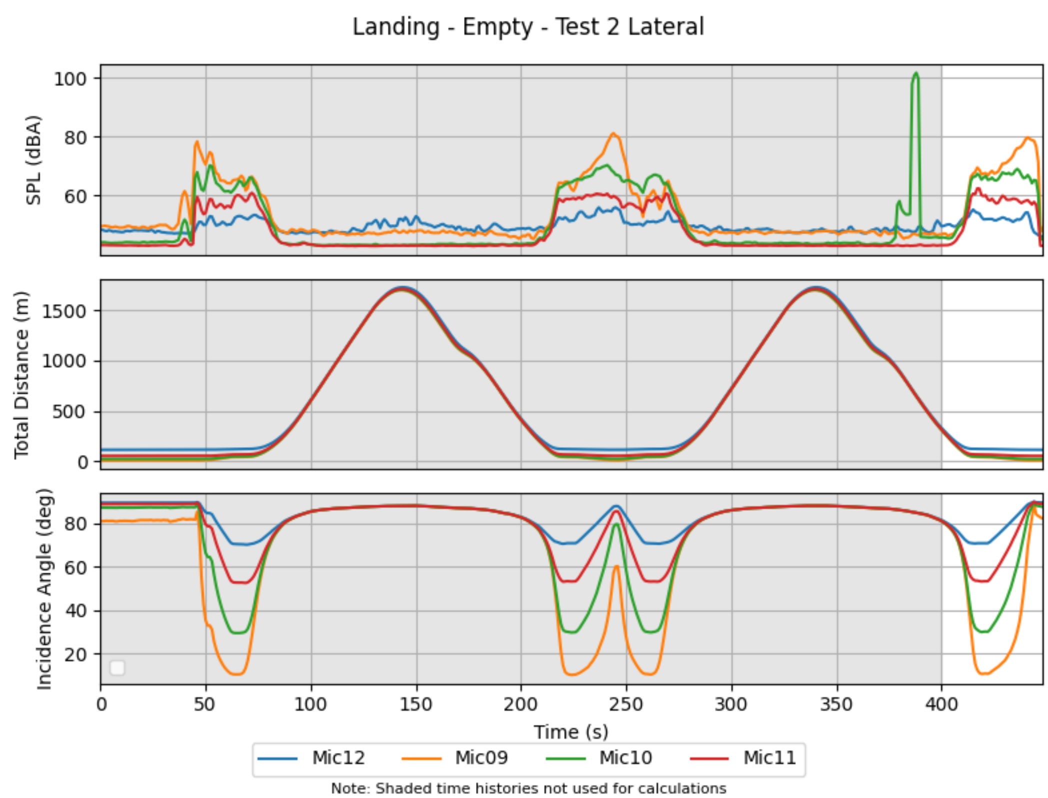
Note: Shaded time histories not used for calculations

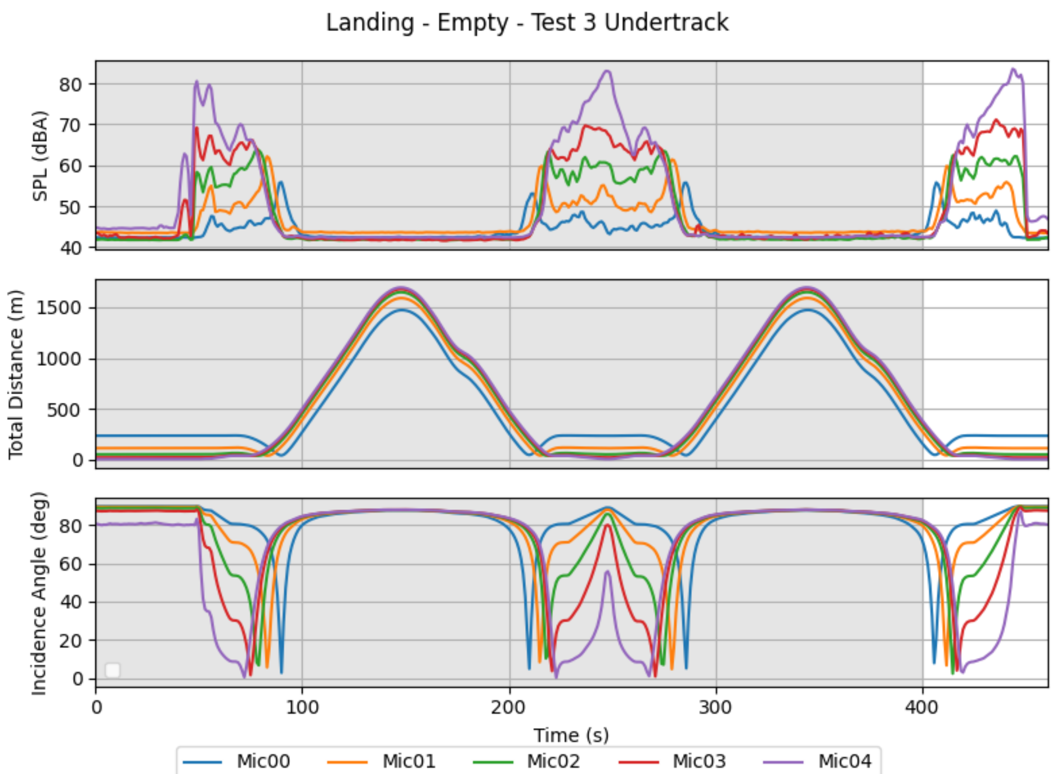
Landing - Empty - Test 2 Undertrack



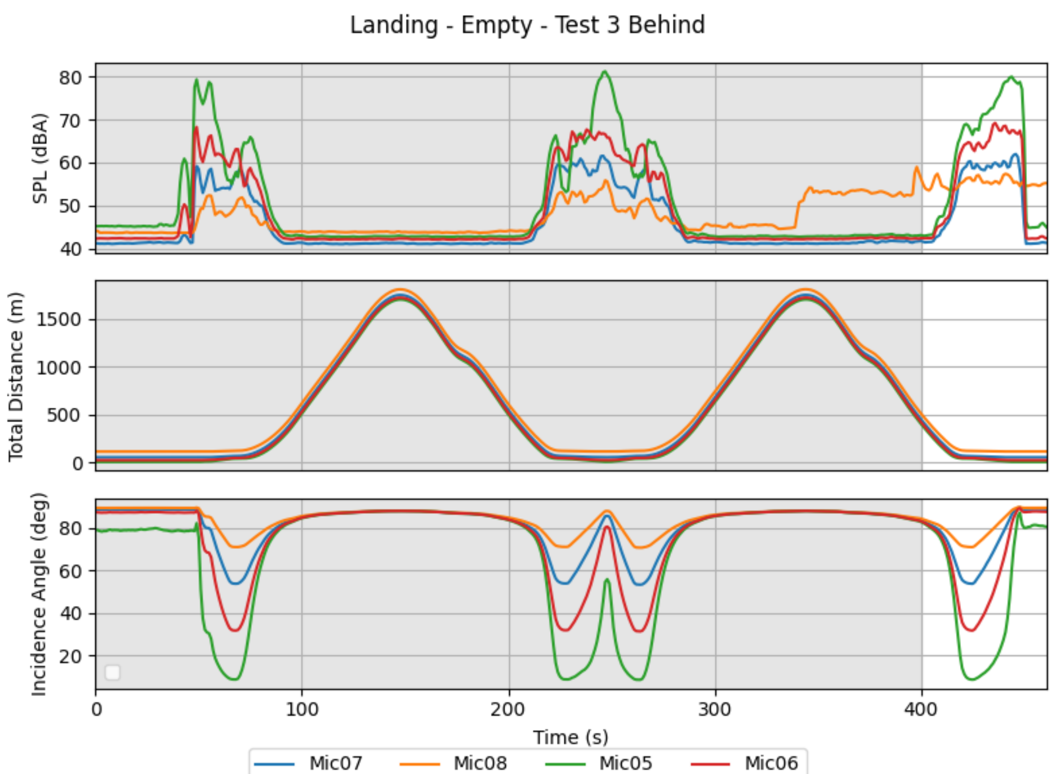
Note: Shaded time histories not used for calculations


Landing - Empty - Test 2 Behind
SPL (dBA)
Total Distance (m)
Incidence Angle (deg)
Time (s)
Mic07
Mic08
Mic05
Mic06
Note: Shaded time histories not used for calculations


Landing - Empty - Test 2 Lateral
SPL (dBA)
Total Distance (m)
Incidence Angle (deg)
Time (s)
Mic12
Mic09
Mic10
Mic11
Note: Shaded time histories not used for calculations

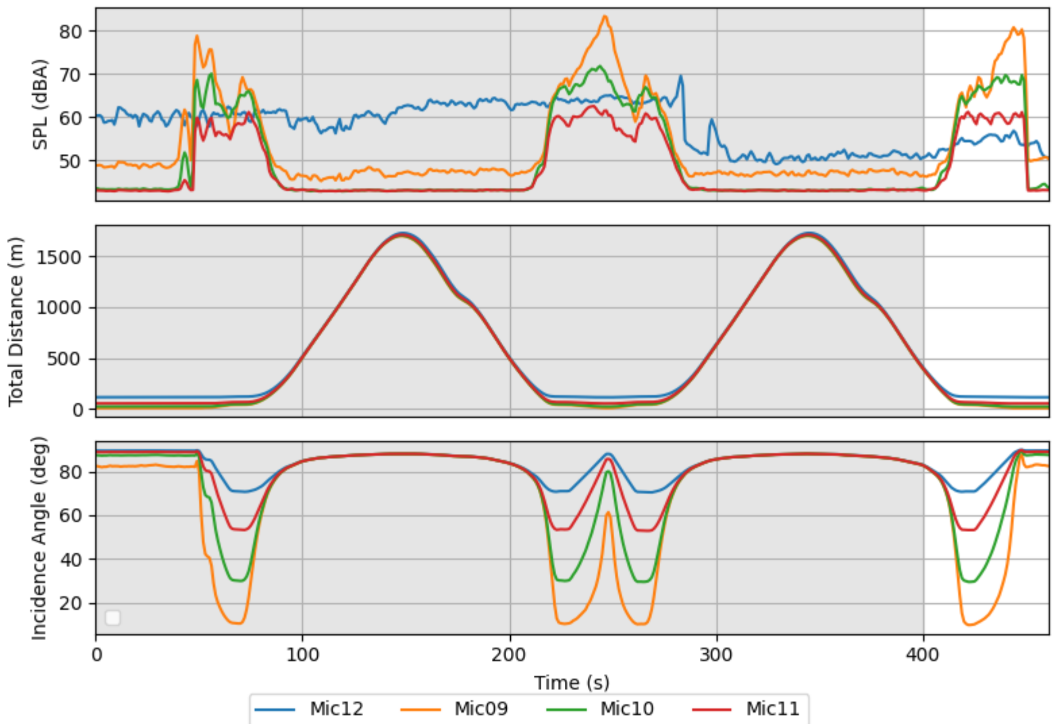


Note: Shaded time histories not used for calculations



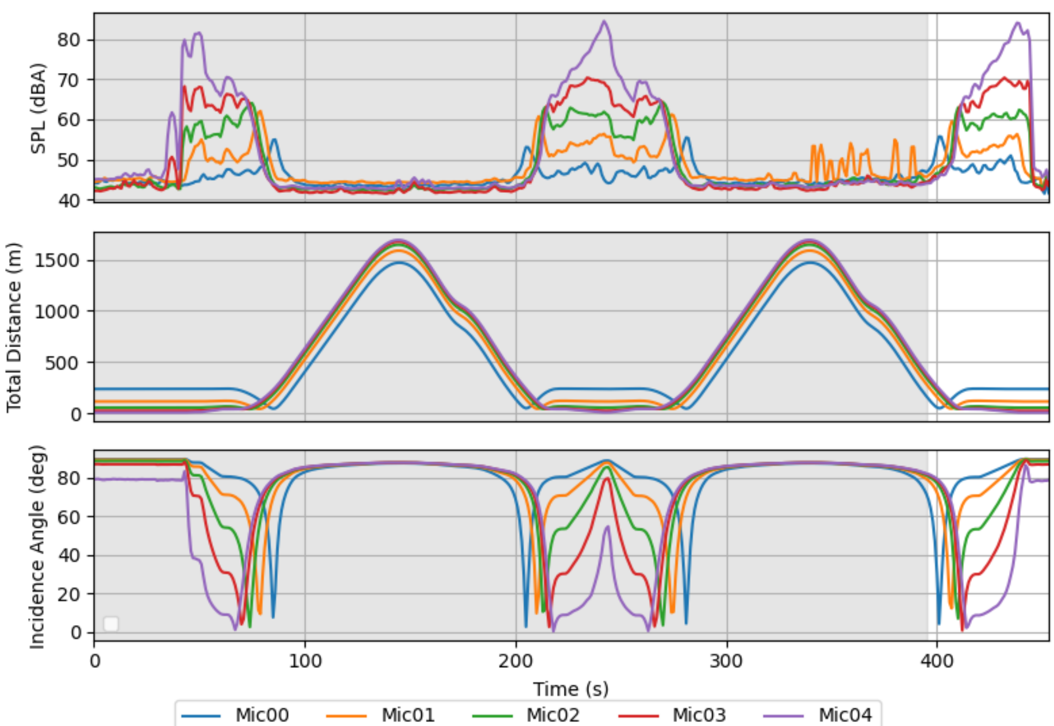
Note: Shaded time histories not used for calculations

Landing - Empty - Test 3 Lateral

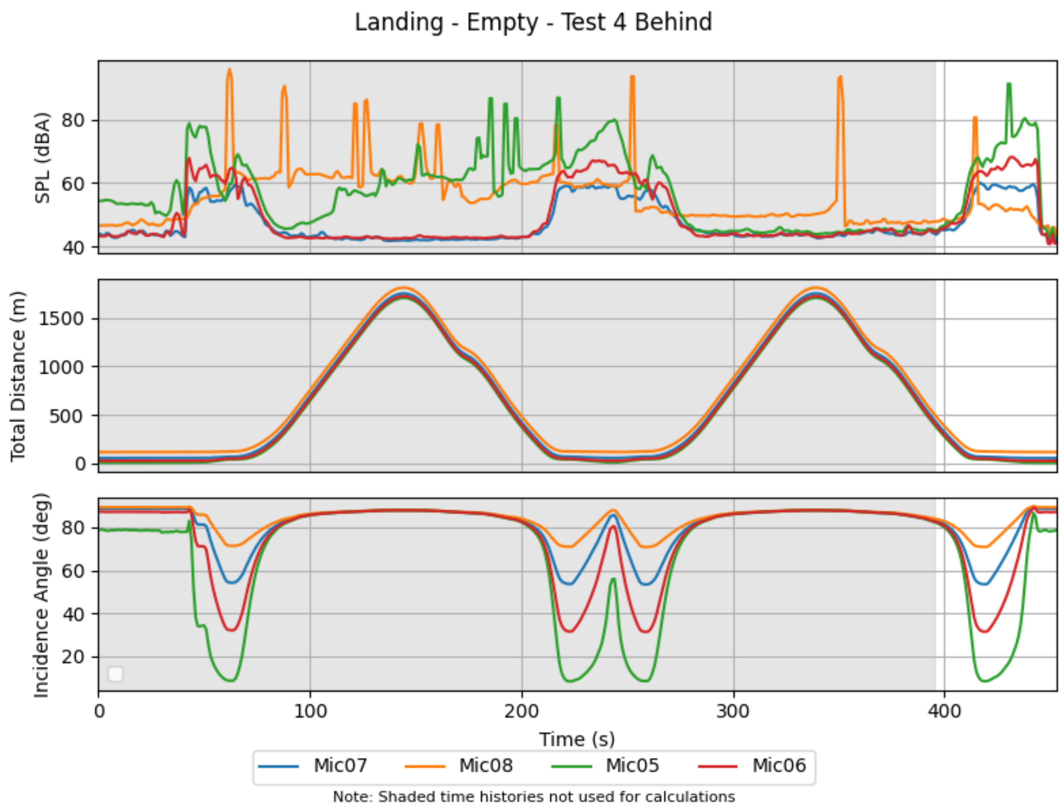


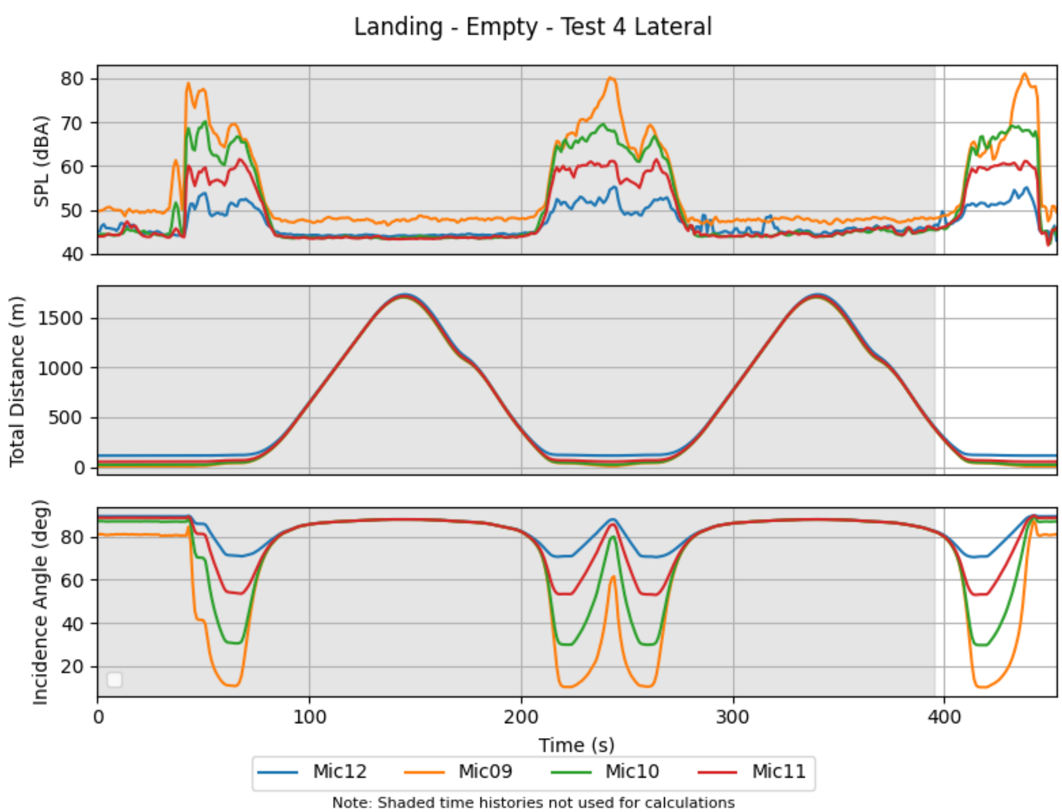
Note: Shaded time histories not used for calculations

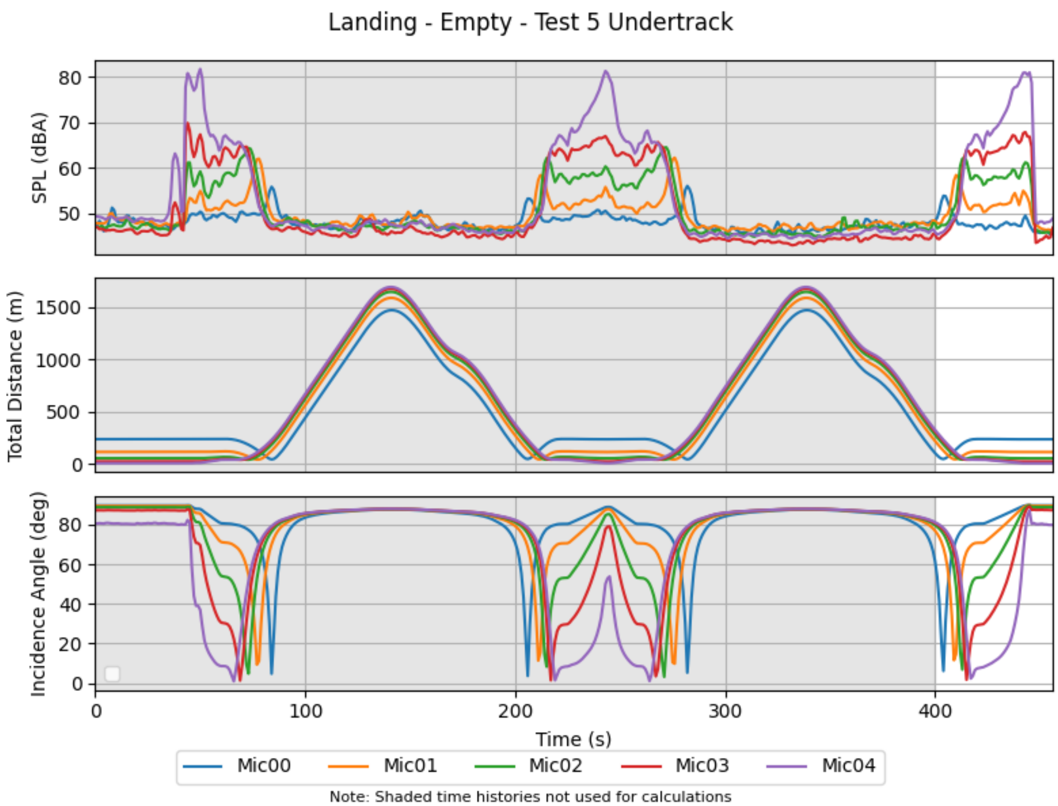
Landing - Empty - Test 4 Undertrack

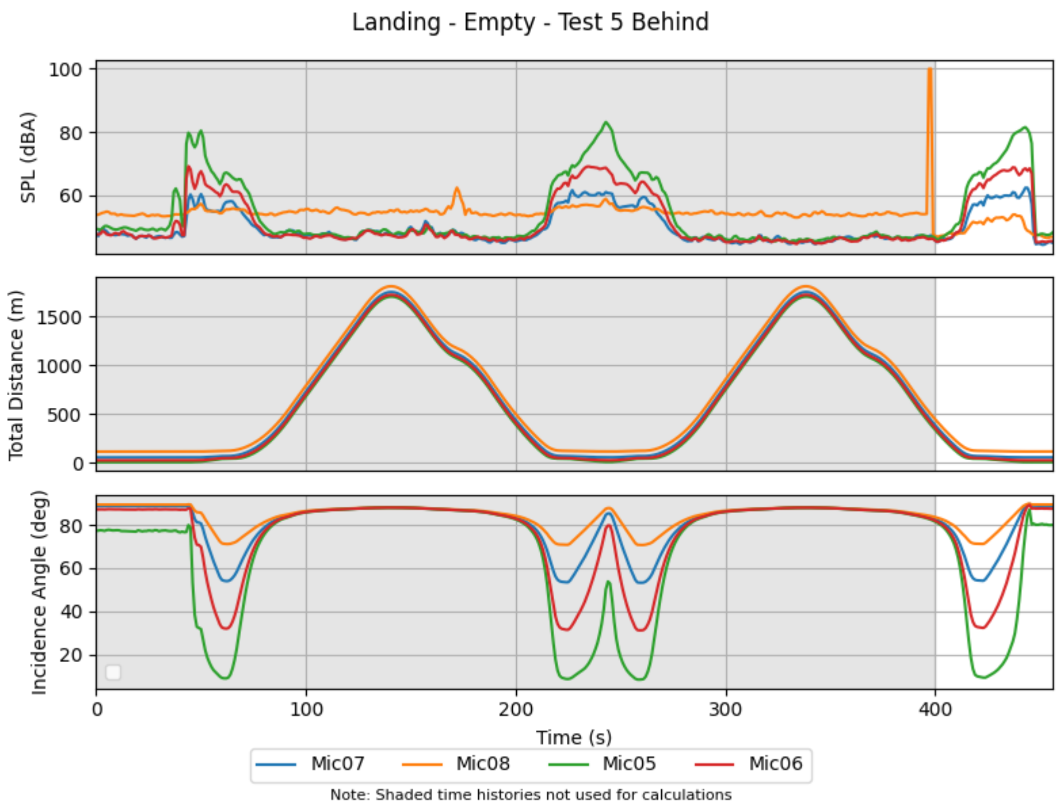


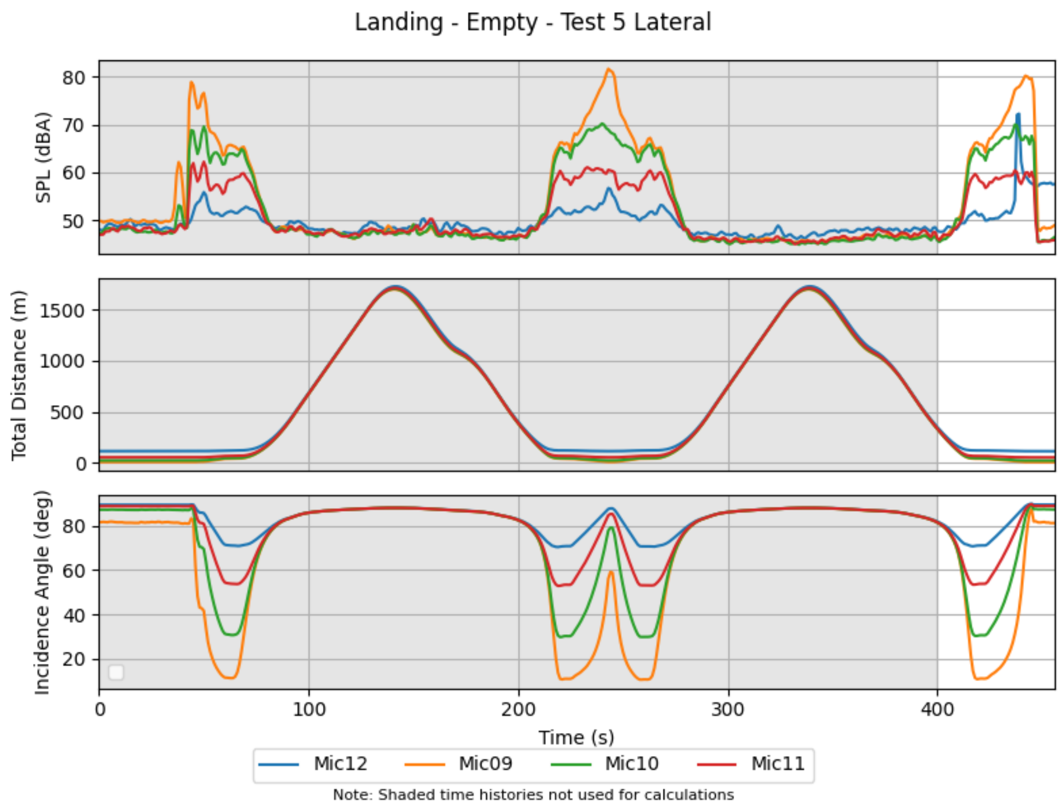
Note: Shaded time histories not used for calculations


Landing - Empty - Test 4 Behind
SPL (dBA)
Total Distance (m)
Incidence Angle (deg)
Time (s)
Mic07
Mic08
Mic05
Mic06
Note: Shaded time histories not used for calculations

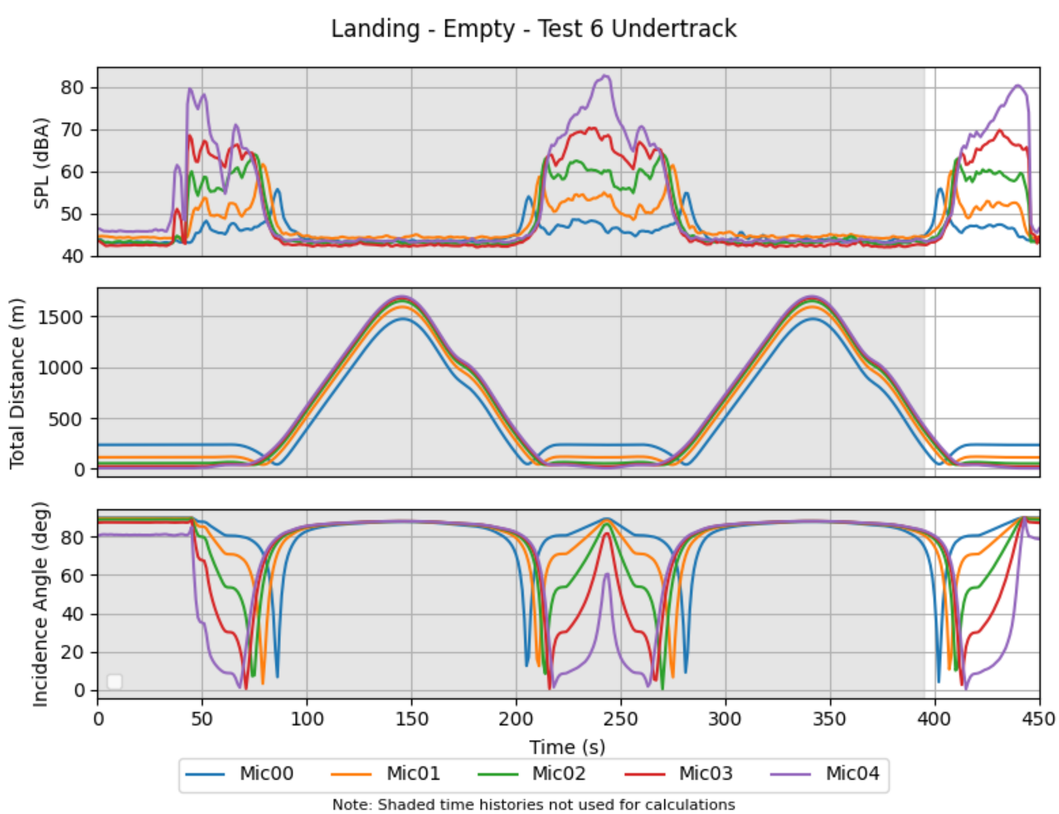

Landing - Empty - Test 4 Lateral
SPL (dBA)
Total Distance (m)
Incidence Angle (deg)
Time (s)
Mic12
Mic09
Mic10
Mic11
Note: Shaded time histories not used for calculations


Landing - Empty - Test 5 Undertrack
SPL (dBA)
Total Distance (m)
Incidence Angle (deg)
Time (s)
Mic00
Mic01
Mic02
Mic03
Mic04
Note: Shaded time histories not used for calculations

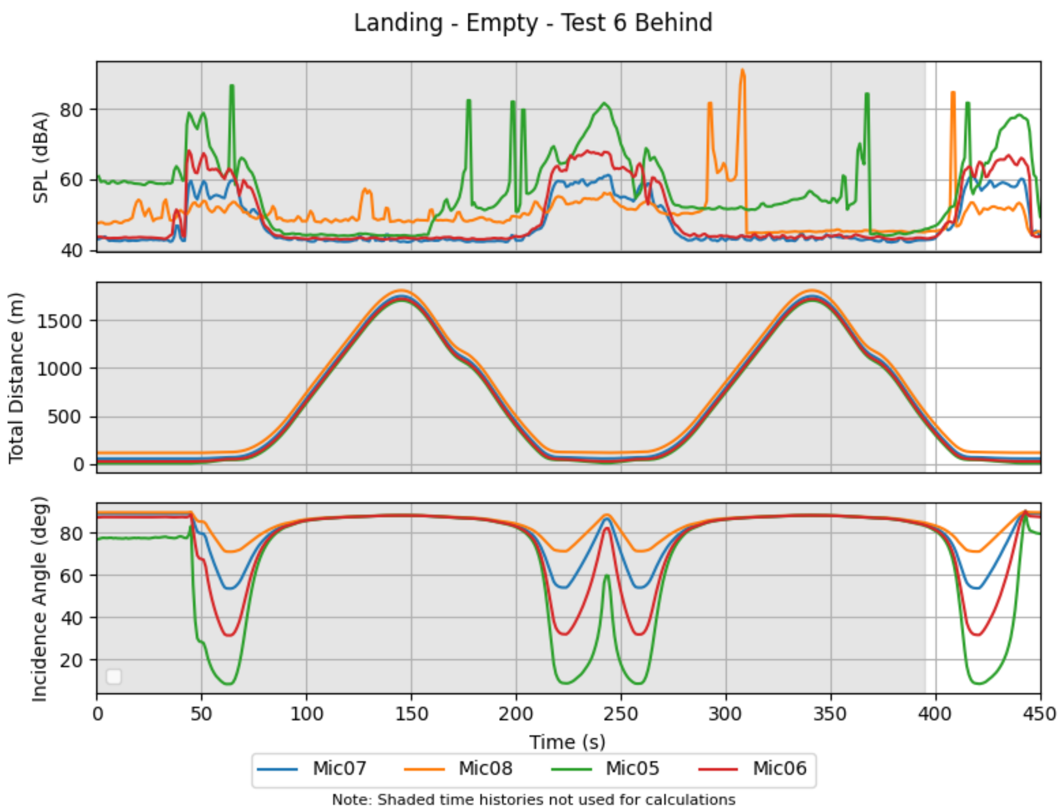

Landing - Empty - Test 5 Behind
SPL (dBA)
Total Distance (m)
Incidence Angle (deg)
Time (s)
Mic07
Mic08
Mic05
Mic06
Note: Shaded time histories not used for calculations

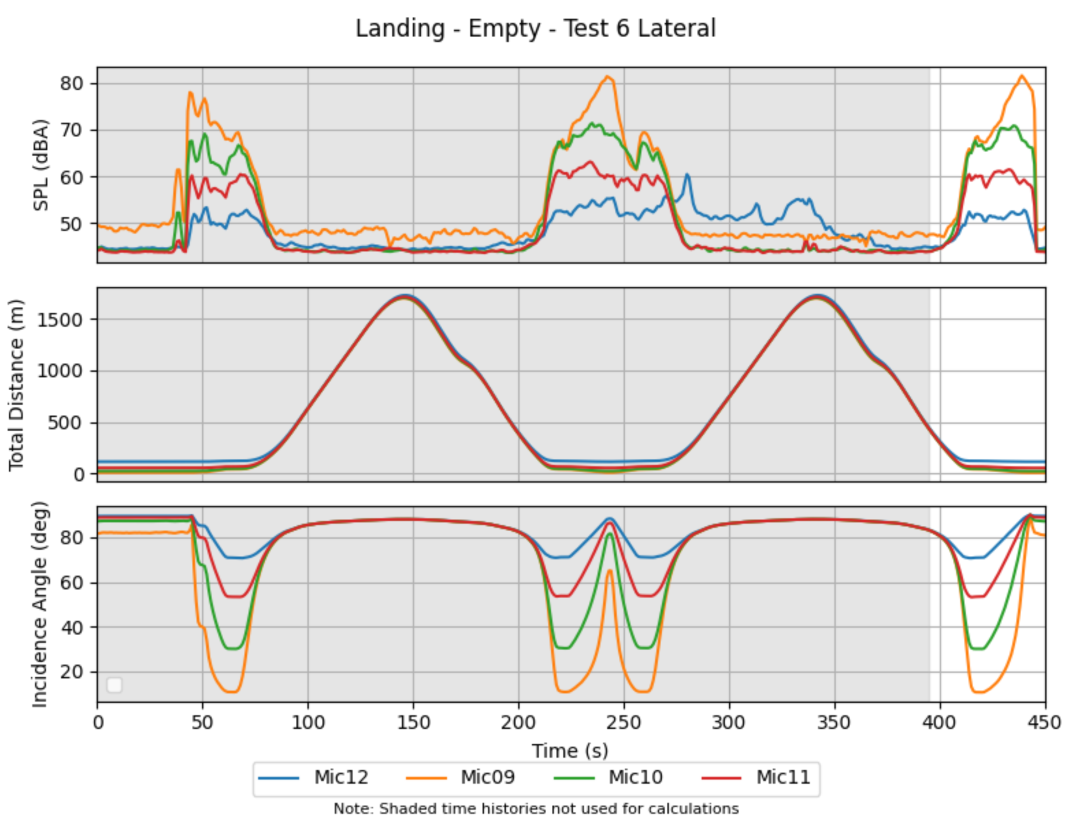


Landing - Empty - Test 5 Lateral
SPL (dBA)
Total Distance (m)
Incidence Angle (deg)
Time (s)
Mic12
Mic09
Mic10
Mic11
Note: Shaded time histories not used for calculations

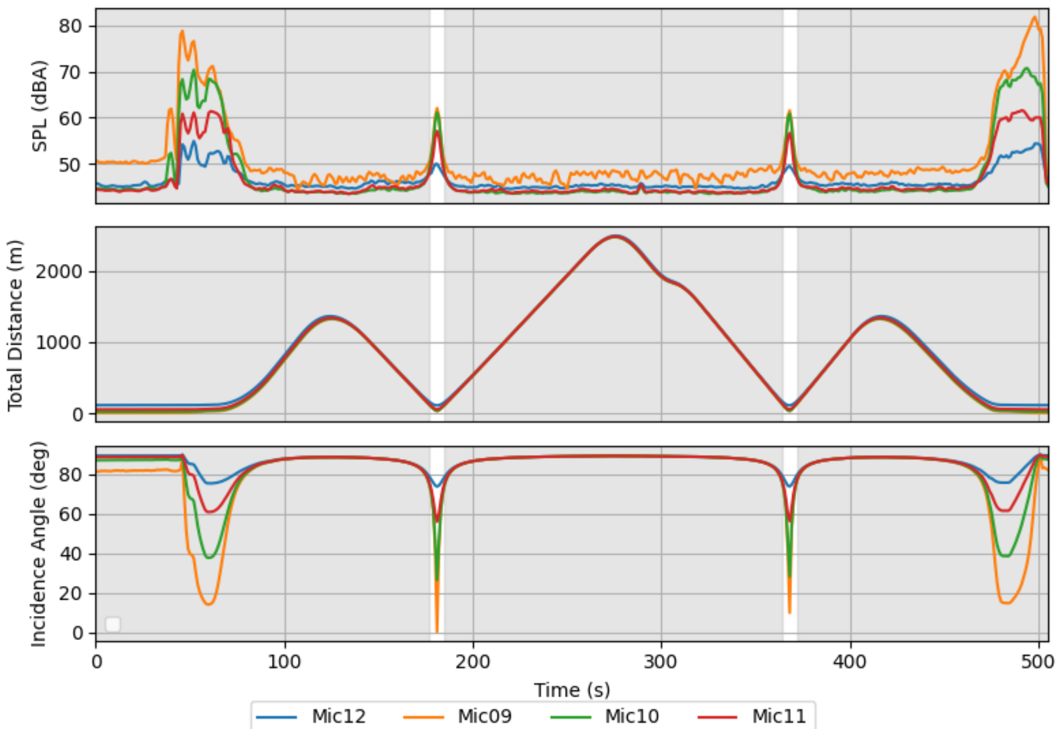


Landing - Empty - Test 6 Undertrack
SPL (dBA)
Total Distance (m)
Incidence Angle (deg)
Time (s)
Mic00
Mic01
Mic02
Mic03
Mic04
Note: Shaded time histories not used for calculations


Landing - Empty - Test 6 Behind
SPL (dBA)
Total Distance (m)
Incidence Angle (deg)
Time (s)
Mic07
Mic08
Mic05
Mic06
Note: Shaded time histories not used for calculations

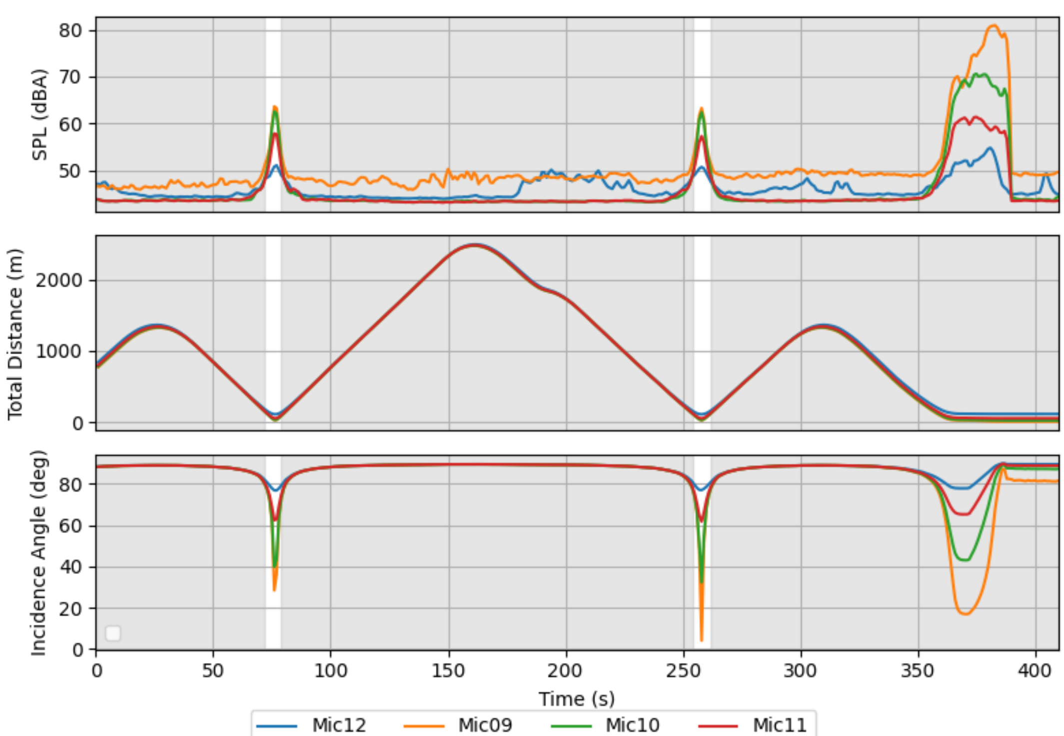

Landing - Empty - Test 6 Lateral
SPL (dBA)
Total Distance (m)
Incidence Angle (deg)
Time (s)
Mic12
Mic09
Mic10
Mic11
Note: Shaded time histories not used for calculations

Overflight/En Route - Empty - Test 1 Lateral



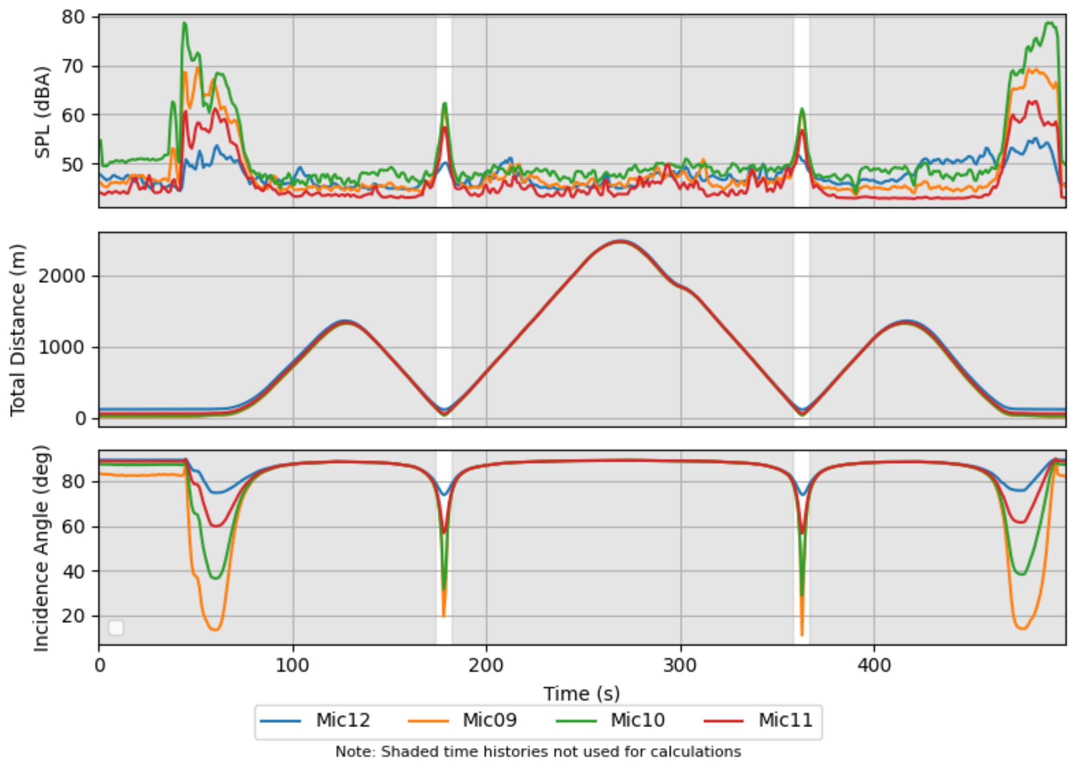
Note: Shaded time histories not used for calculations

Overflight/En Route - Empty - Test 2 Lateral

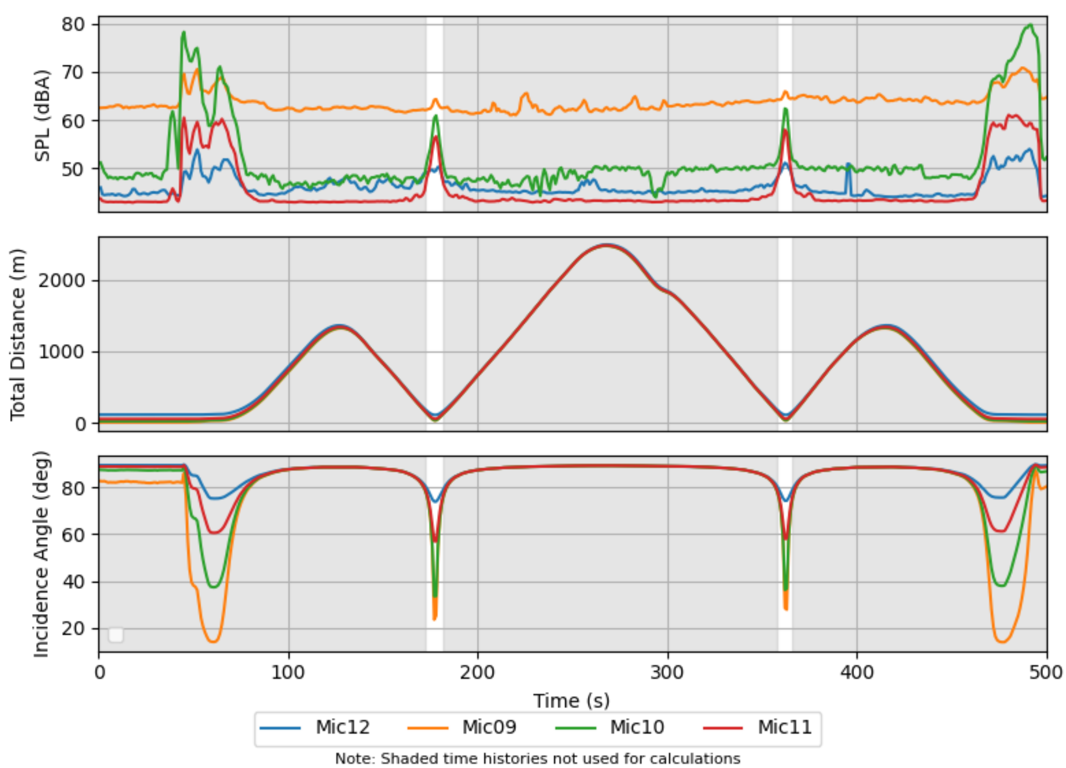


Note: Shaded time histories not used for calculations

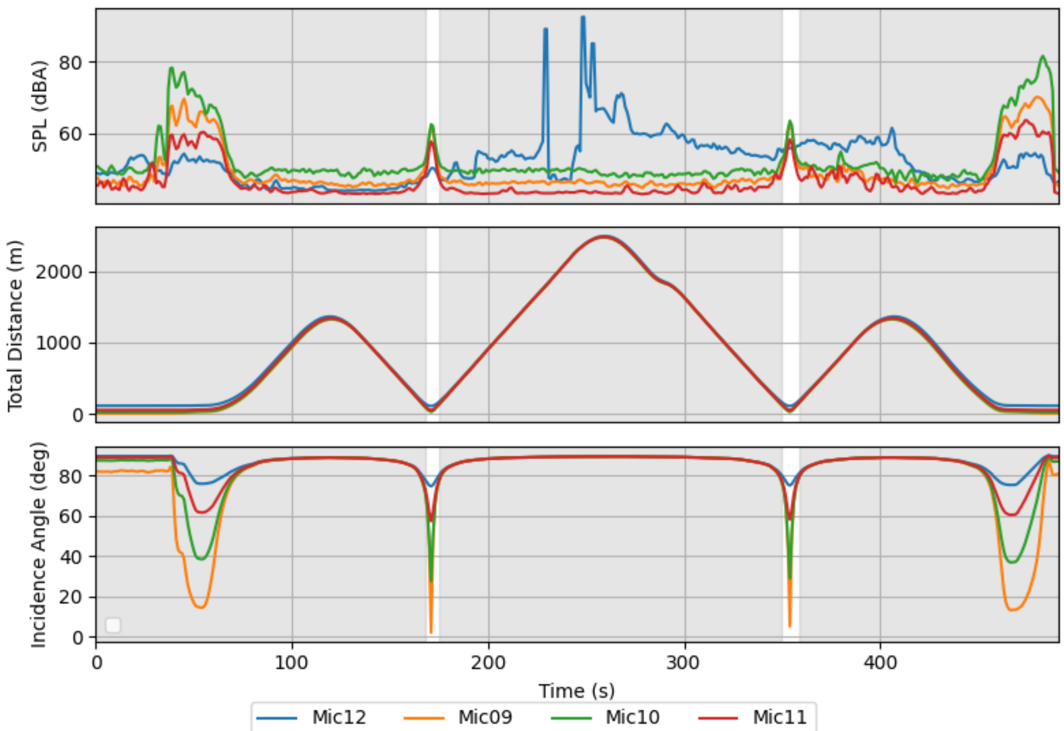
Overflight/En Route - Empty - Test 3 Lateral



Overflight/En Route - Empty - Test 4 Lateral

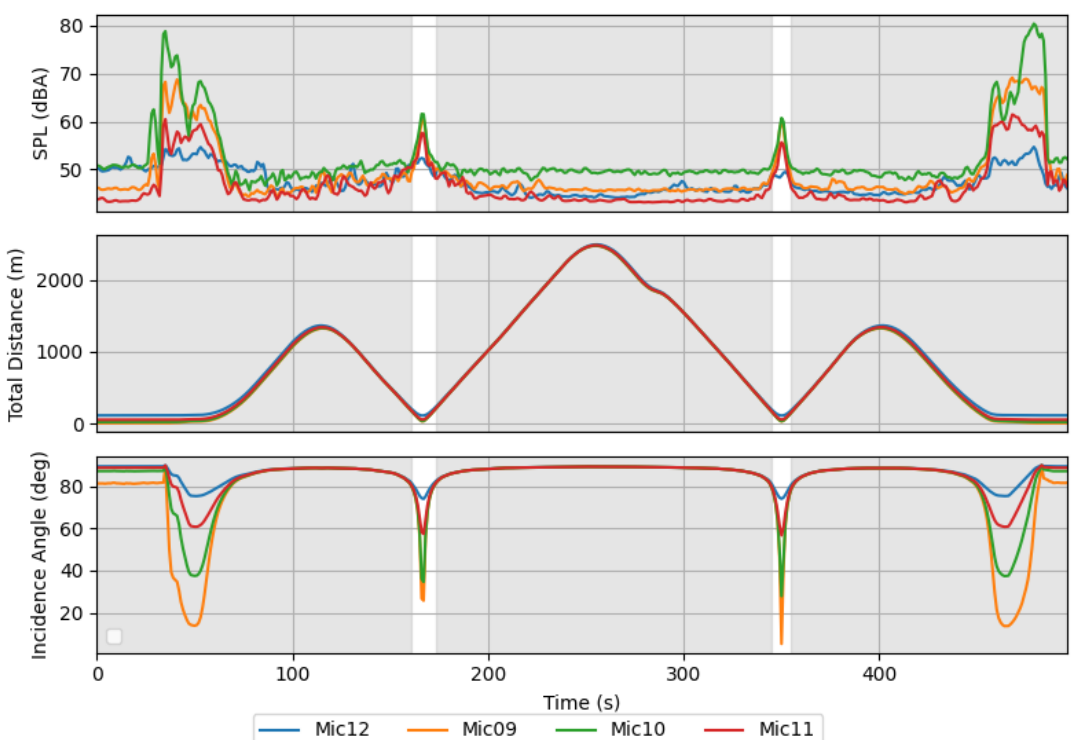


Overflight/En Route - Empty - Test 5 Lateral

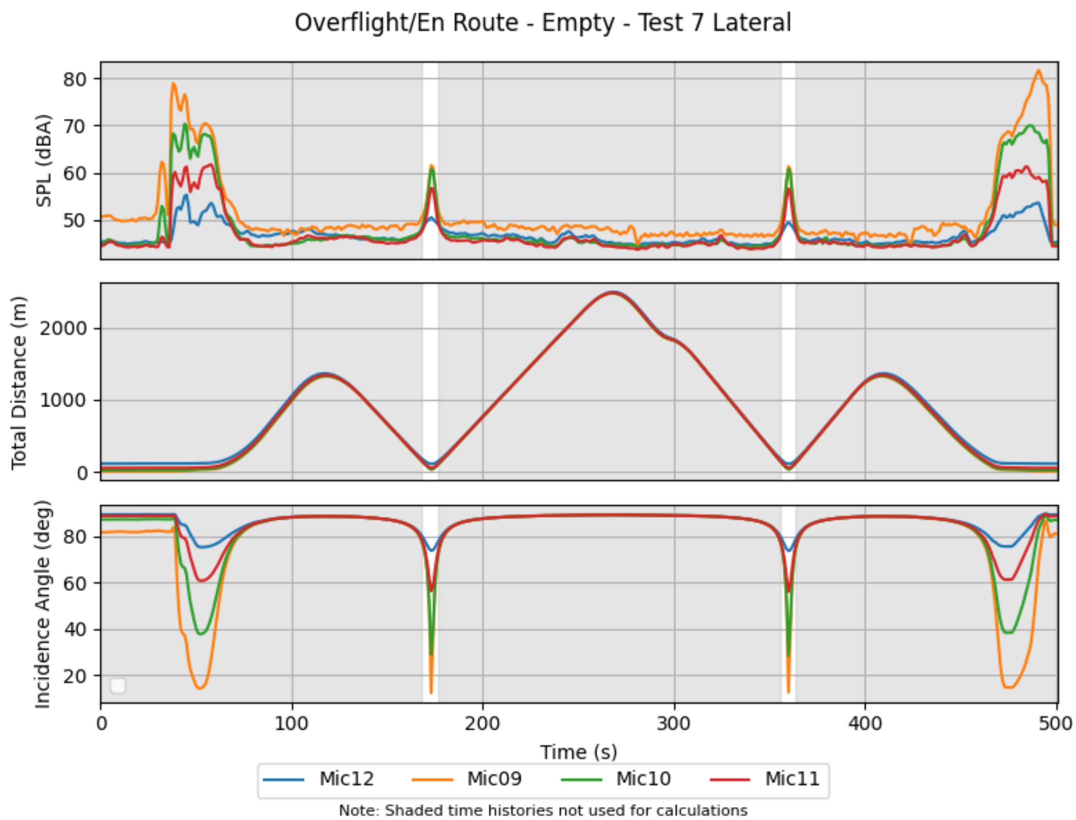


Note: Shaded time histories not used for calculations

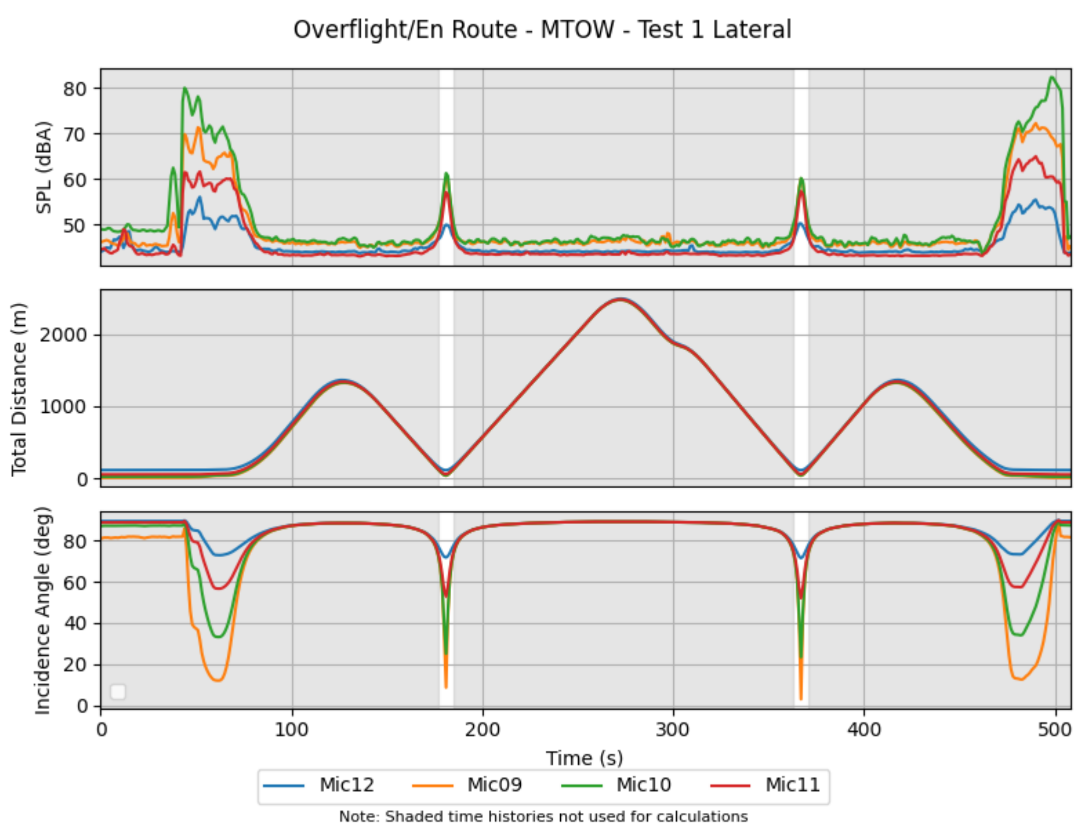
Overflight/En Route - Empty - Test 6 Lateral



Note: Shaded time histories not used for calculations

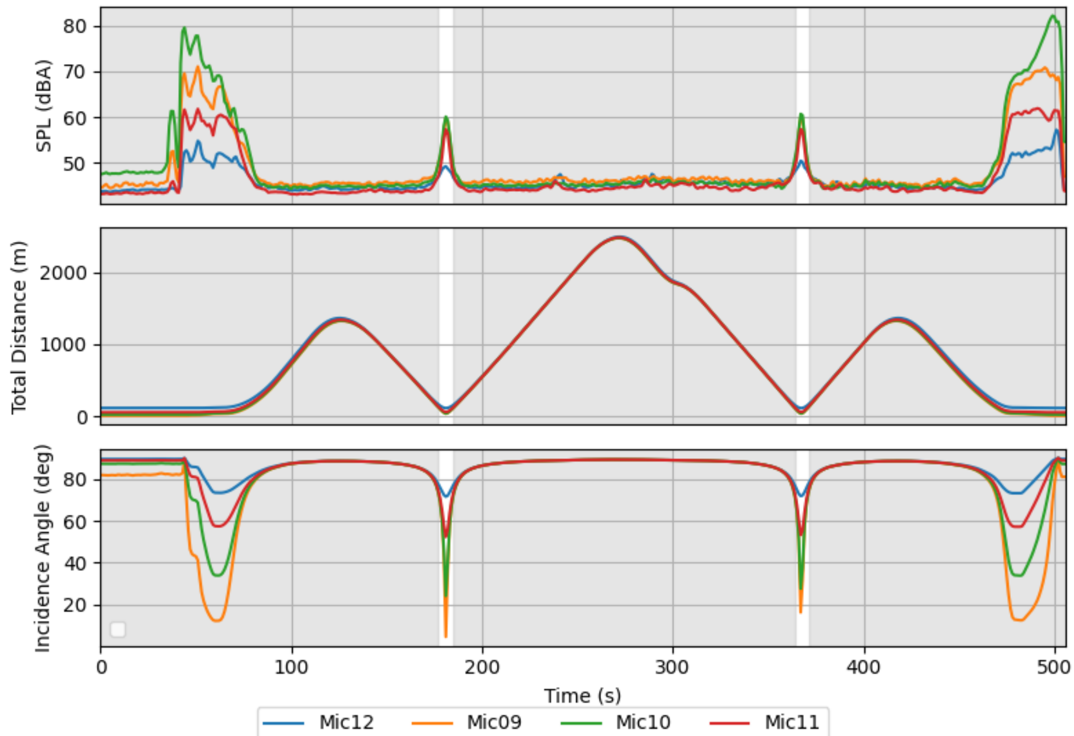


Overflight/En Route - Empty - Test 7 Lateral
SPL (dBA)
Total Distance (m)
Incidence Angle (deg)
Time (s)
Mic12
Mic09
Mic10
Mic11
Note: Shaded time histories not used for calculations



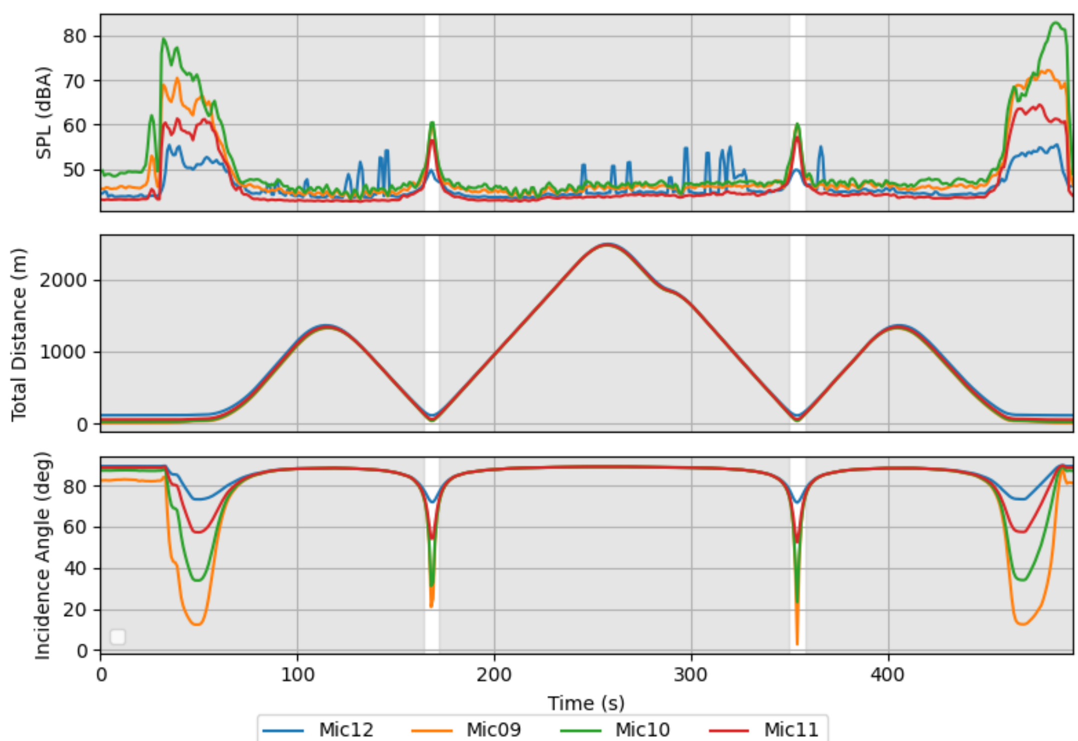
Overflight/En Route - MTOW - Test 1 Lateral
SPL (dBA)
Total Distance (m)
Incidence Angle (deg)
Time (s)
Mic12
Mic09
Mic10
Mic11
Note: Shaded time histories not used for calculations

Overflight/En Route - MTOW - Test 2 Lateral



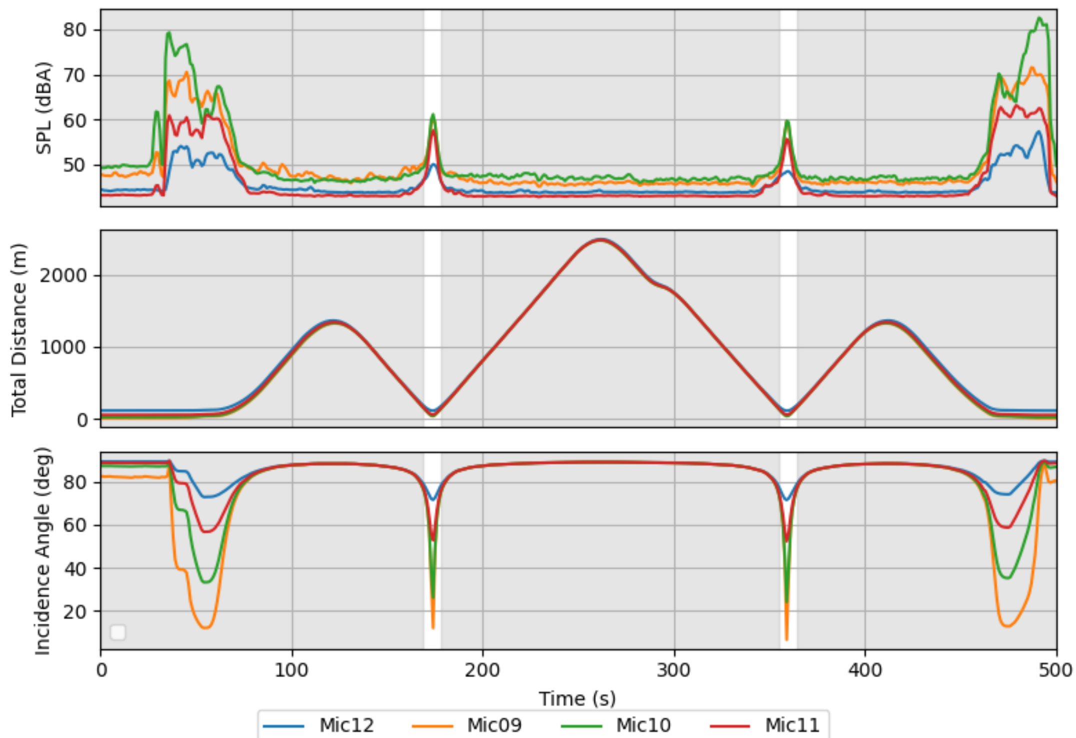
Note: Shaded time histories not used for calculations

Overflight/En Route - MTOW - Test 3 Lateral



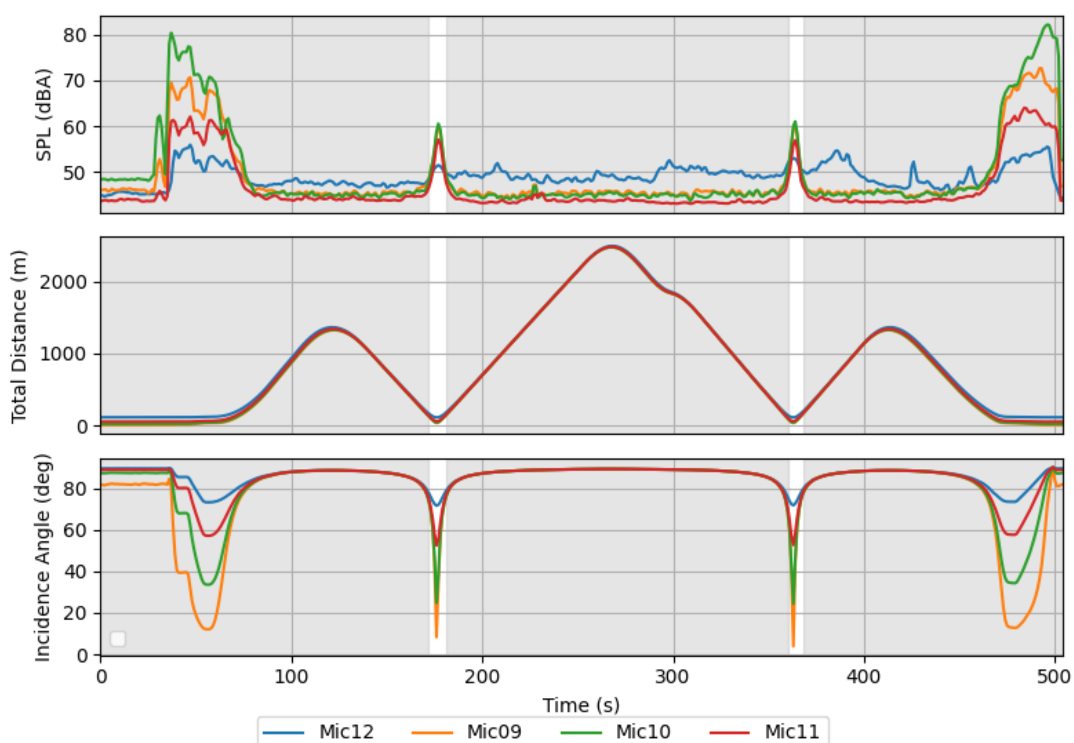
Note: Shaded time histories not used for calculations

Overflight/En Route - MTOW - Test 4 Lateral

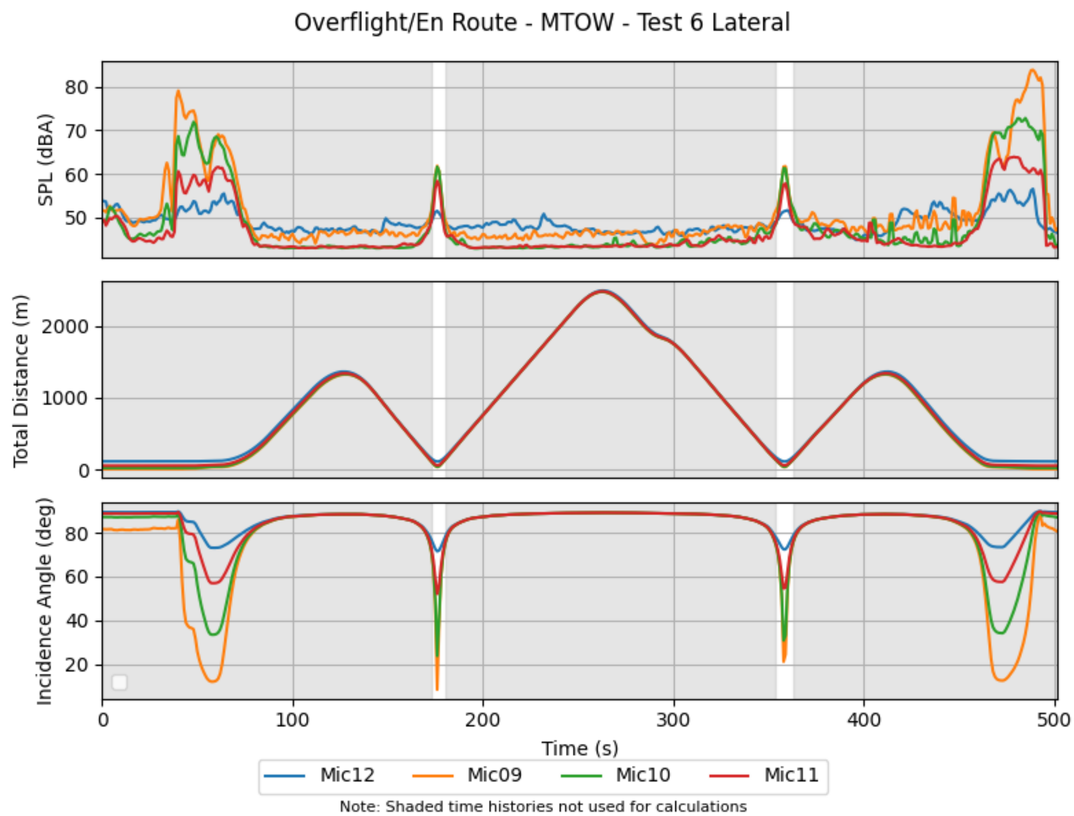


Note: Shaded time histories not used for calculations

Overflight/En Route - MTOW - Test 5 Lateral



Note: Shaded time histories not used for calculations


Overflight/En Route - MTOW - Test 6 Lateral
SPL (dBA)
80
70
60
50
Total Distance (m)
2000
1000
0
Incidence Angle (deg)
80
60
40
20
0
100
200
300
400
500
Time (s)
Mic12
Mic09
Mic10
Mic11
Note: Shaded time histories not used for calculations