F.	ILHS-HAA	Project	Noise	Technical	Report

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### 1 Introduction

The National Environmental Policy Act of 1969 (NEPA) [42 United States Code (U.S.C.) § 4321 et seq.], requires federal agencies to disclose to decision makers a clear, accurate description of the potential environmental impacts that could arise from proposed federal actions. Through NEPA, Congress has directed federal agencies to consider environmental factors in their planning and decision-making processes and to encourage public involvement in decisions that affect the quality of the human environment. As part of the NEPA process, federal agencies are required to consider the environmental effects of a proposed action and reasonable alternatives. The Federal Aviation Administration (FAA) has established a process to ensure compliance with the provisions of NEPA through FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures* (FAA Order 1050.1F).

This noise study is called the Instrument Flight Procedures Low-level Helicopter System (ILHS) to support Helicopter Air Ambulance (HAA). The procedures designed for this project would be used by arriving and departing helicopters at study airports and heliports. This noise technical report, prepared in accordance with FAA Order 1050.1F, documents the potential effects to the environment that may result from the creation and optimization of procedures at the study airports and heliports.

### 1.1 Project Background

The FAA desired to conduct a helicopter noise analysis of proposed helicopter area navigation (RNAV) routes primarily within the state of Maine, as well as the nearby states of New Hampshire and Massachusetts to a small degree. The purpose of the noise analysis is to discern the potential noise impact of the proposed helicopter RNAV routes given a defined RNAV routes structure, a set of heliport/airport pairs, a defined aircraft type, existing and future aircraft operational usage, and a herein defined set of assumptions and inputs enabling the noise analysis and subsequent results.

### 1.2 Noise Model Background

To comply with NEPA requirements, the FAA has issued guidance on assessing aircraft noise in FAA Order 1050.1F. This guidance requires that aircraft noise analysis use the yearly Day-Night Average Sound Level (DNL) noise metric. The DNL metric is a single value representing the aircraft sound level over a 24-hour period and includes all of the sound energy generated within that period. The DNL metric includes a 10-decibel (dB) weighting for noise events occurring from 10:00 pm to 7:00 am (nighttime). This weighting helps account for the greater level of annoyance caused by nighttime noise events. Accordingly, the metric essentially equates one nighttime flight to ten daytime flights. Specifically, the FAA uses DNL to measure cumulative noise exposure from aviation activities that occur over the course of an Average Annual Day (AAD), during a given year of interest. The DNL metric is built upon other fundamental concepts and metrics, which all help to analyze airport and airspace noise environments.

Order 1050.1F requires the FAA to evaluate aircraft noise using an approved noise model, one of which is the Aviation Environmental Design Tool (AEDT). AEDT is a comprehensive software tool that provides aircraft noise, fuel burn, and emissions information to the FAA and its stakeholders. AEDT facilitates environmental review activities required under the NEPA by consolidating the modeling of these environmental impacts in a single tool. For this noise screening, AEDT version 3d, released on March 29, 2021, is used to analyze noise.

## 1.3 Project Characteristics

### 1.3.1 Study Airports and Heliports

Study airports and heliports for this project are the unique set of facilities named in the historical operations spreadsheet provided (see Section 2). The collection of study airports and heliports is diverse and contains a breadth of both public and private airports, heliports, and helipads. Within the set of study airports and heliports are airports with runways serving fixed-wing aviation operations for various uses

(e.g., military, commercial, air taxi, and general aviation) such as KPWM and KSFM. These airports have published instrument procedures such as Standard Terminal Arrivals (STARs), Standard Instrument Approach Procedures (SIAPs), and/or Standard Instrument Departures (SIDs). Many of the heliports have third-party special Instrument Flight Procedures (IFPs), which were acquired from the FAA. These IFPs are intended only for authorized users, and may be developed based on unique aircraft performance, aircraft equipment, or flight crew training requirements. Supplement Section 6.1 contains images of the procedure plates for these IFPs. Screenshots from TARGETS (see Section 2.1) are provided where procedure plates were unavailable.

**Table 1** presents the airport/heliport site code and name for each of the 39 study airports and heliports. The study airports and heliports also include heliports/helipads at health-related facilities such as health care centers (e.g., 60ME), regional hospitals (e.g., 79ME), county hospitals (e.g., 98ME), health clinics (e.g., 59B), and medical centers (e.g., 68ME, ME02). Additionally, study airports and heliports exist at heliports/helipads on coastal islands (e.g., ME78, ME55, ME5, ME77).

-

<sup>&</sup>lt;sup>1</sup> FAA Order 8260.60B, December 11, 2020

**Table 1 Study Airports and Heliports** 

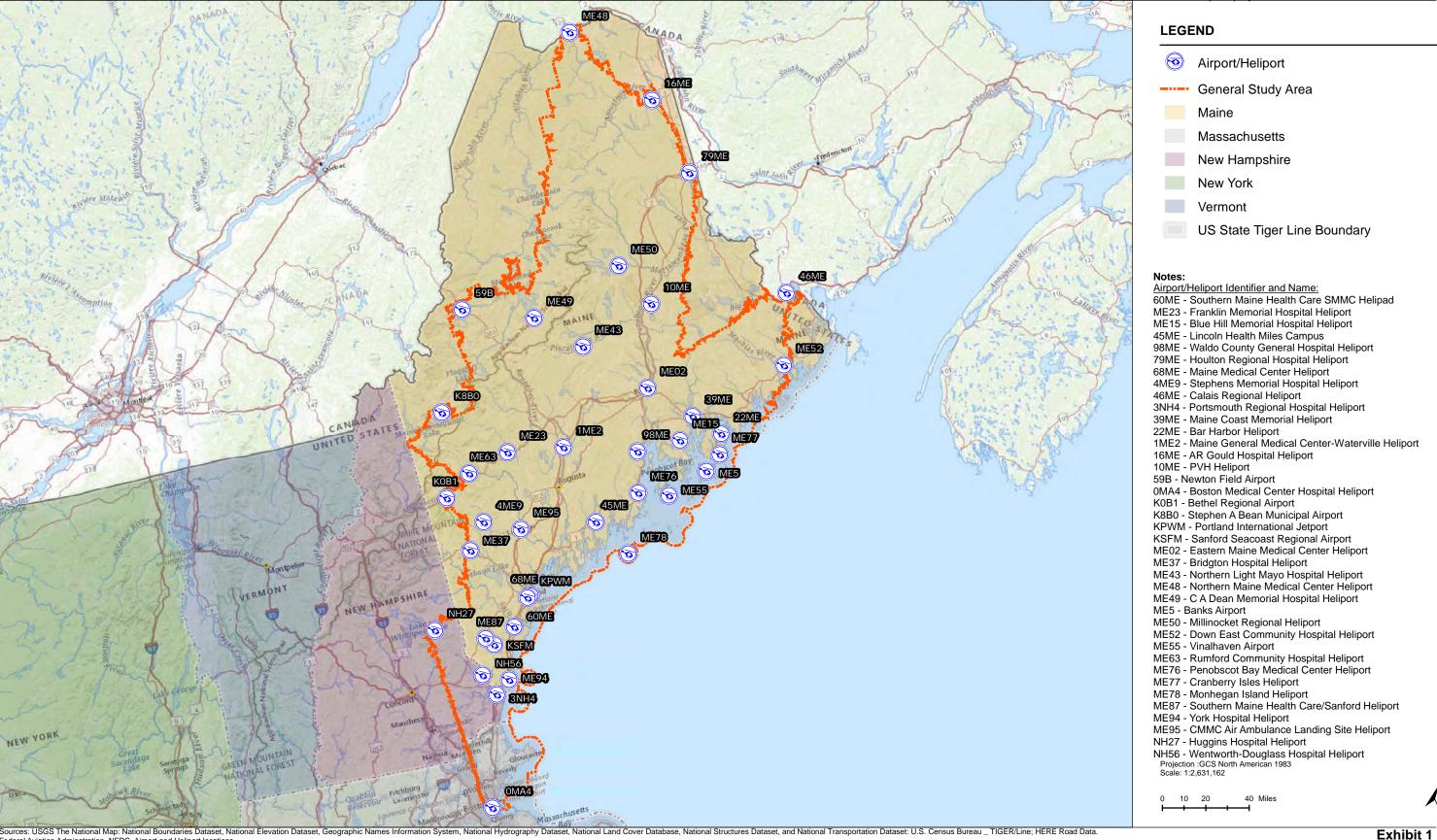
Airport/Heliport Code	Airport/Heliport Name
0MA4	Boston Medical Center Hospital Heliport
10ME	PVH Heliport
16ME	AR Gould Hospital Heliport
1ME2	Maine General Medical Center Waterville Heliport
22ME	Bar Harbor Heliport
39ME	Maine Coast Memorial Heliport
3NH4	Portsmouth Regional Hospital Heliport
45ME	Lincoln Health Miles Campus
46ME	Calais Regional Heliport
4ME9	Stephens Memorial Hospital Heliport
59B	Newton Field Airport
60ME	Southern Maine Health Care SMMC Helipad
68ME	Maine Medical Center Heliport
79ME	Houlton Regional Hospital Heliport
98ME	Waldo County General Hospital Heliport
K0B1	Bethel Regional Airport
K8B0	Stephen A Bean Municipal Airport
KPWM	Portland International Jetport
KSFM	Sanford Seacoast Regional Airport
ME02	Eastern Maine Medical Center Heliport
ME15	Blue Hill Memorial Hospital Heliport
ME23	Franklin Memorial Hospital Heliport
ME37	Bridgton Hospital Heliport
ME43	Northern Light Mayo Hospital Heliport
ME48	Northern Maine Medical Center Heliport
ME49	C A Dean Memorial Hospital Heliport
ME5	Banks Airport
ME50	Millinocket Regional Heliport
ME52	Down East Community Hospital Heliport
ME55	Vinalhaven Airport
ME63	Rumford Community Hospital Heliport
ME76	Penobscot Bay Medical Center Heliport
ME77	Cranberry Isles Heliport
ME78	Monhegan Island Heliport
ME87	Southern Maine Health Care/Sanford Heliport
ME94	York Hospital Heliport
ME95	CMMC Air Ambulance Landing Site Heliport
NH27	Huggins Hospital Heliport
NH56	Wentworth Douglass Hospital Heliport

Source: A Medical Helicopter Operator in the state of Maine through FAA staff in Air Traffic Organization, November

2021

Prepared by: ATAC, December 2021

The location of each of the study airports and heliports in **Table 1** is plotted on a map in **Exhibit 1**. The exhibit shows study airports and heliports, denoted with a helicopter icon, with a label for the associated landing site code.



National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset: U.S. Census Bureau \_ TIGER/Line; HERE Road Data. Sources: USGS The National Map; National Boundaries Dataset, National Elevation Dataset, Geographic Federal Aviation Adminstration, NFDC, Airport and Heliport locations.

ILHS-HAA Environmental Assessment

## **General Study Area**

#### 1.3.2 Scenarios

This section discusses four scenarios developed to characterize the impact of proposed helicopter procedures (see Section **2.1**): No Action 2023 (NA2023), Proposed Action Alternative 2023 (PA2023), No Action 2028 (NA2028), and Proposed Action Alternative 2028 (PA2028). It is assumed that 2023 is the year in which the proposed helicopter procedures are published. The year 2028 represents the plus five-year outlook.

#### 1.3.2.1 No Action 2023

The NA2023 scenario represents current-day flights from a major medical helicopter operator based in the state of Maine. In this scenario, flight trajectories are intended to be representative of current traffic patterns among study airports and heliports (see Section 1.3.1 for details). To represent the NA2023 scenario, flight trajectories follow the departure IFP associated with the origin heliport (as applicable), then continue on a straight-line path entering at the arrival IFP represented at the destination heliport (as applicable), see Exhibit 12. For airports that do not have departure nor arrival IFPs, a straight-line path was assumed. These assumptions were verified by observing historical radar data (see Section 2.3). This assumption adequately represents current traffic patterns for the NA2023 Scenario.

Operations in this scenario are based on forecasted values from historical counts provided by a medical helicopter operator based in Maine (see Section 3.3). The count of operations is based on historical data and an interview provided by the medical helicopter operator's Subject Matter Experts (SMEs) (discussed in Section 2.2). The modeled operation counts were based on three years of operations to/from the 39 airports/heliports (discussed in Section 1.3.1). Based on SME input, year-over-year operation counts are relatively steady; therefore, annual operation counts can be represented by taking the average. In addition, SMEs expect an 8% increase in operations in the near future. Thus, modeled operation counts are calculated based on a three-year average with an additional 8% increase.

#### 1.3.2.2 Proposed Action Alternative 2023

The PA2023 scenario represents the flights from a major Maine medical helicopter operator in an environment where the proposed helicopter procedures are published and utilized. In this scenario, flight tracks are intended to be representative of proposed traffic patterns along helicopter procedures among study airports and heliports (see Section 1.3.1 for details).

ATAC reviewed approximately 152 origin-destination pairs among 39 study airports and heliports (see Section 1.3.1). PA2023 flight tracks are created following the departure IFP associated with the origin heliport (as applicable), then continue on a straight-line path to the nearest reasonable procedure waypoint, following the proposed "ZK" procedure(s) (see Section 2.1), exiting at a reasonable waypoint to enter the arrival IFP represented at the destination (as applicable). For airports that do not have IFPs, a straight-line path was assumed. In cases where this assumption created an unreasonable track (e.g., unnecessarily and significantly increasing track distance), the NA2023 scenario flight track was used.

In order to isolate the impact of PA2023 flight tracks, operation counts between the NA2023 and PA2023 scenarios are kept consistent.

#### 1.3.2.3 No Action 2028

The NA2028 flight trajectories are intended to be representative of current traffic patterns among study airports and heliports, with an 8% increase in operations. It was assumed that an additional 8% increase in operations could be expected in the plus five-year outlook scenarios. The flight trajectories in this scenario are identical to the NA2023 scenario discussed in Section 1.3.2.1.

#### 1.3.2.4 Proposed Action Alternative 2028

The PA2028 scenario flight tracks are intended to be representative of the proposed traffic patterns along helicopter procedures among study airports and heliports with an 8% increase in operations from current-day. The flight trajectories in this scenario are identical to the PA2023 scenario discussed in Section 1.3.2.2.

Similarly, in order to isolate the impact of the PA2028 flight tracks, operation counts between NA2028 and PA2028 scenarios are kept consistent (see **Section 3.3**).

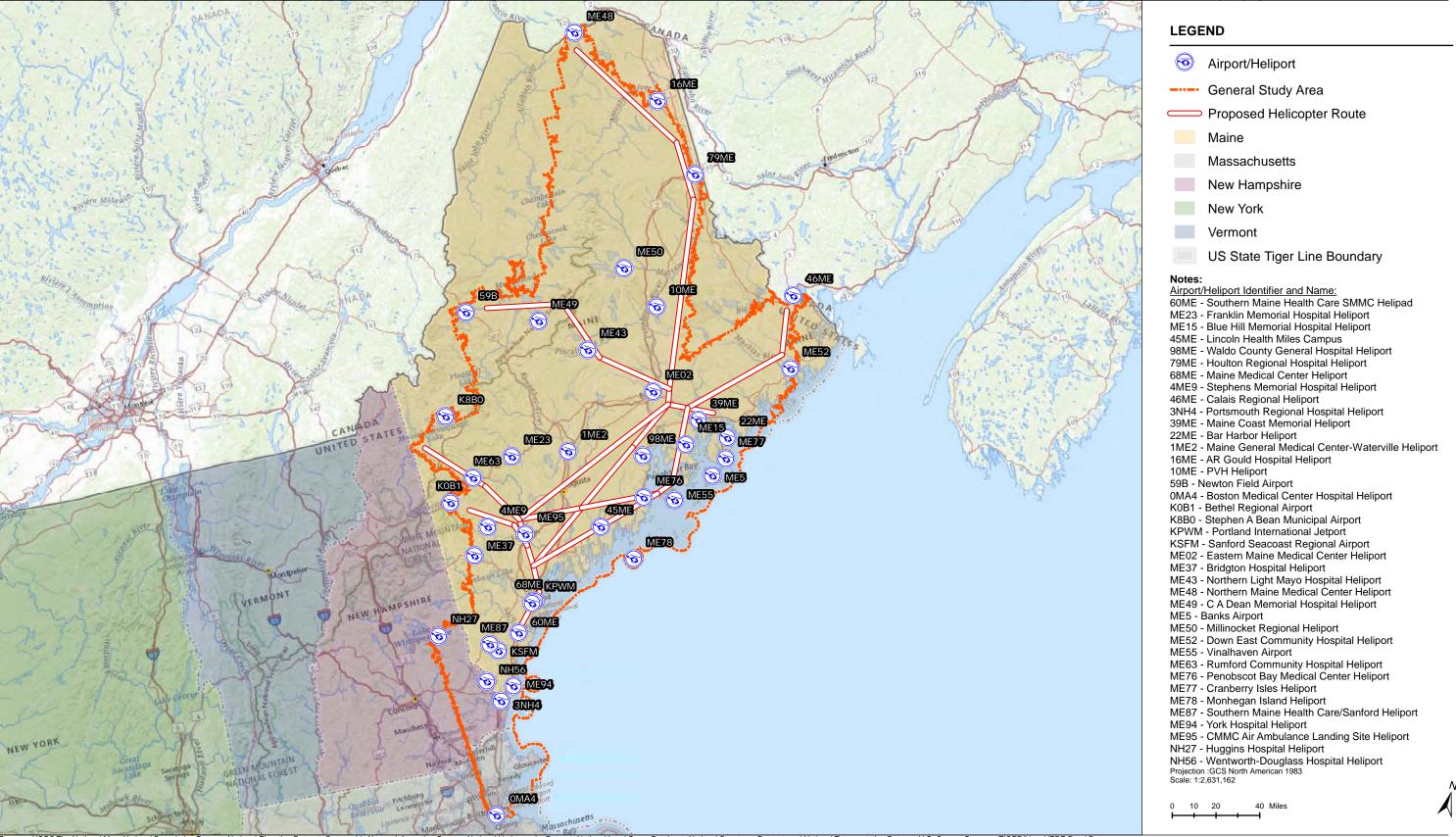
### 2 Data Sources

The data sources used for this noise screening were: Terminal Area Route Generation Evaluation and Traffic Simulation (TARGETS) packages, a historical operations spreadsheet, historical radar data, documents related to third-party special procedures, and email correspondence. A teleconference with SMEs on November 10, 2021 was also used to confirm assumptions and answer questions.

### 2.1 TARGETS Packages and Instrument Flight Procedure Charts

Several TARGETS packages were received and reviewed throughout the noise analysis process. Some of these TARGETS packages defined some of the third-party special IFPs (see Section 1.3.1). Information for other third-party special IFPs were provided as procedure plates (see Section 6.1).

The main TARGETS package defines eight proposed helicopter procedures (waypoint names and coordinates per procedure). The latest version of this TARGETS package was received on January 25, 2023, which is the version used for the noise model development. Email correspondence on July 22, 2021 describes procedures and their potential use. **Exhibit 2** presents the eight proposed helicopter procedures as defined in the TARGETS package.



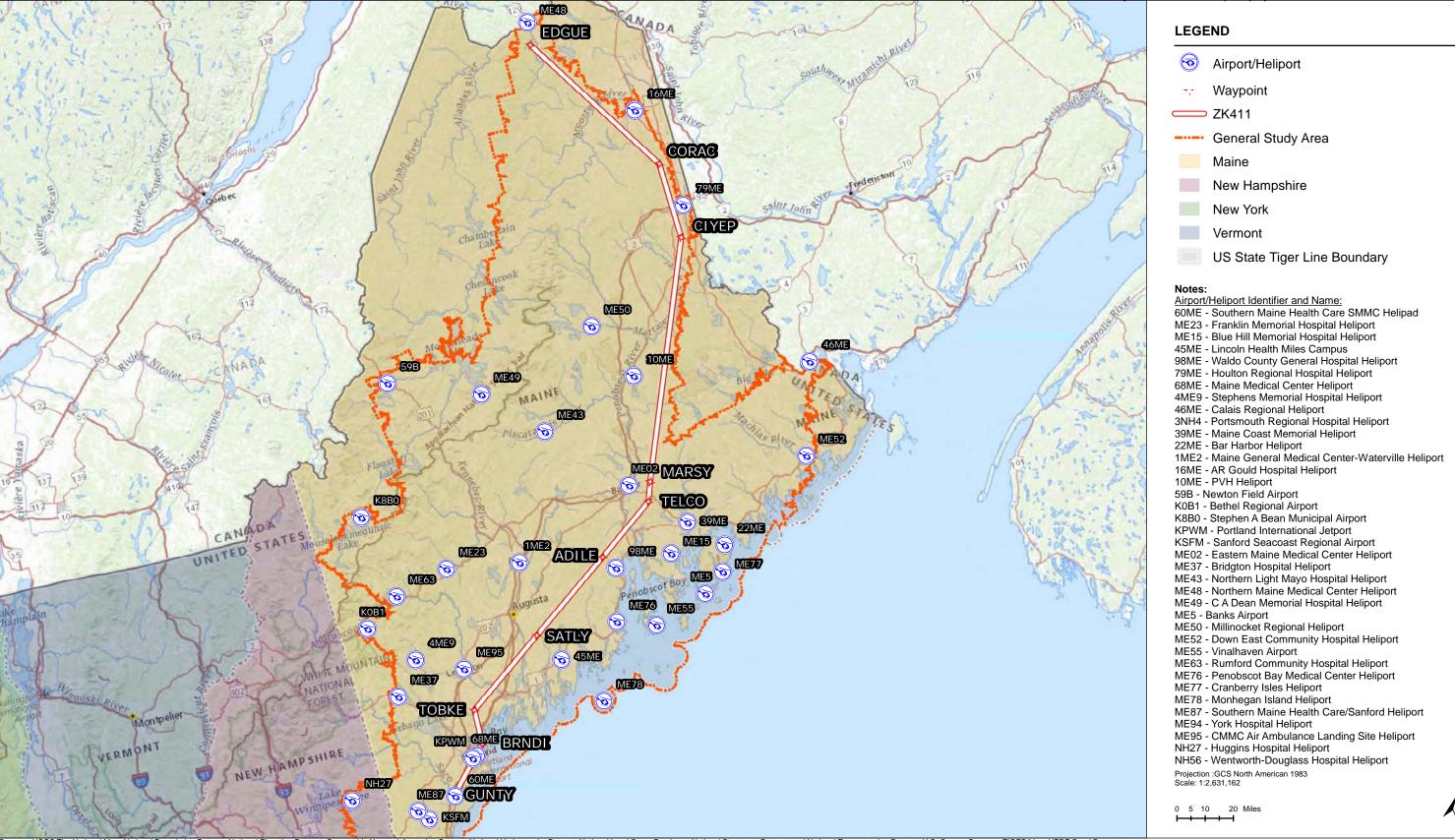
Sources: USGS The National Map: National Boundaries Dataset, National Elevation Dataset, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset: U.S. Census Bureau \_TIGER/Line; HERE Road Data.
Federal Aviation Administration, NFDC, Airport and Heliport locations, Proposed Heliport loca

Exhibit 2

## **Proposed Helicopter Routes**

The ZK411 procedur to CIYEP to TELCO ME02, KPWM and k	to MARSY to WP4	64 to WP14468 to	TOBKE to WP139	20 to GUNTY. It c	onnects

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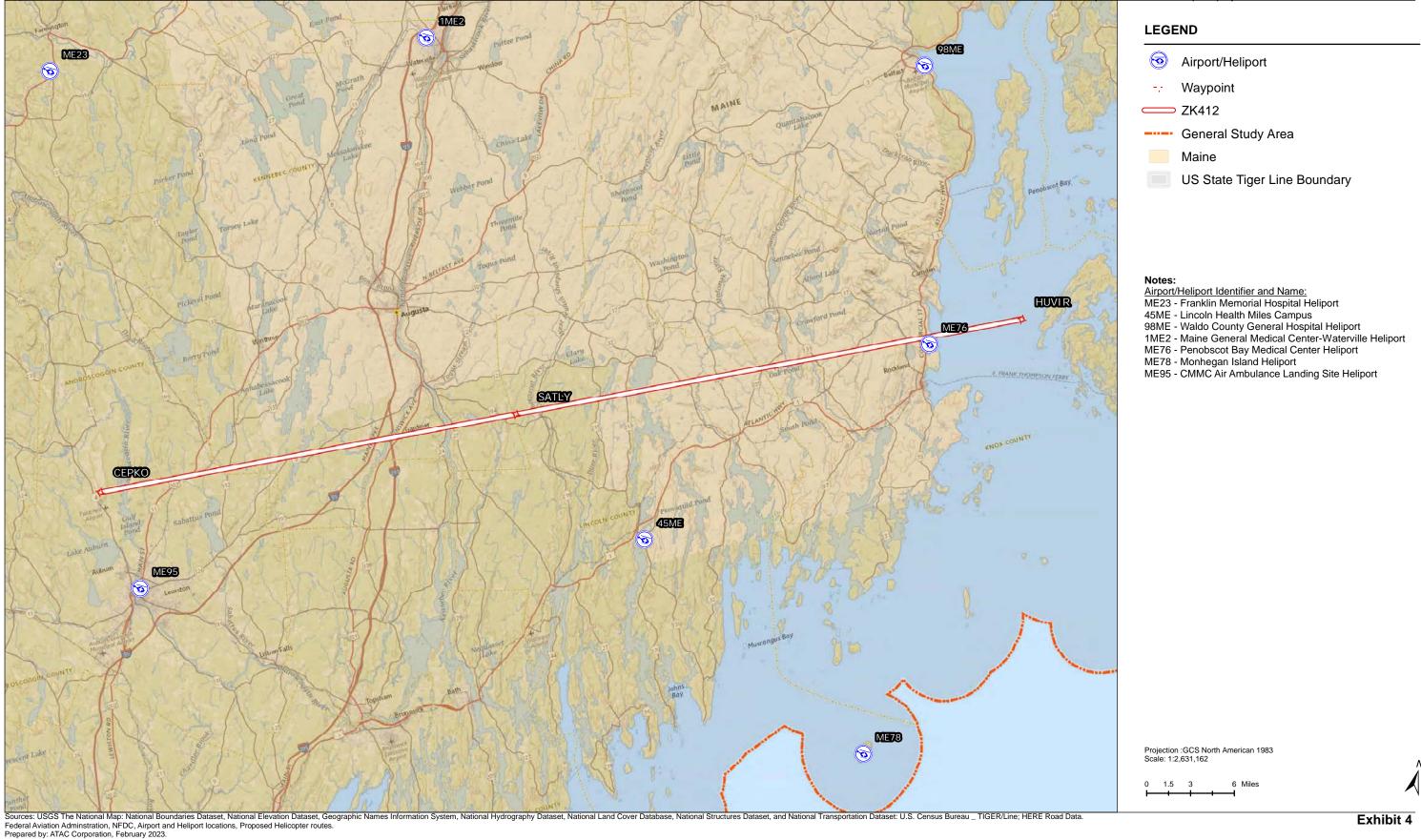
Sources: USGS The National Map: National Boundaries Dataset, National Elevation Dataset, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset: U.S. Census Bureau \_ TIGER/Line; HERE Road Data. Federal Aviation Administration, NFDC, Insport and Heliport locations, Proposed Helicopter routes.

Exhibit 3

# ILHS-HAA Environmental Assessment

## **Proposed Helicopter Route - ZK411**

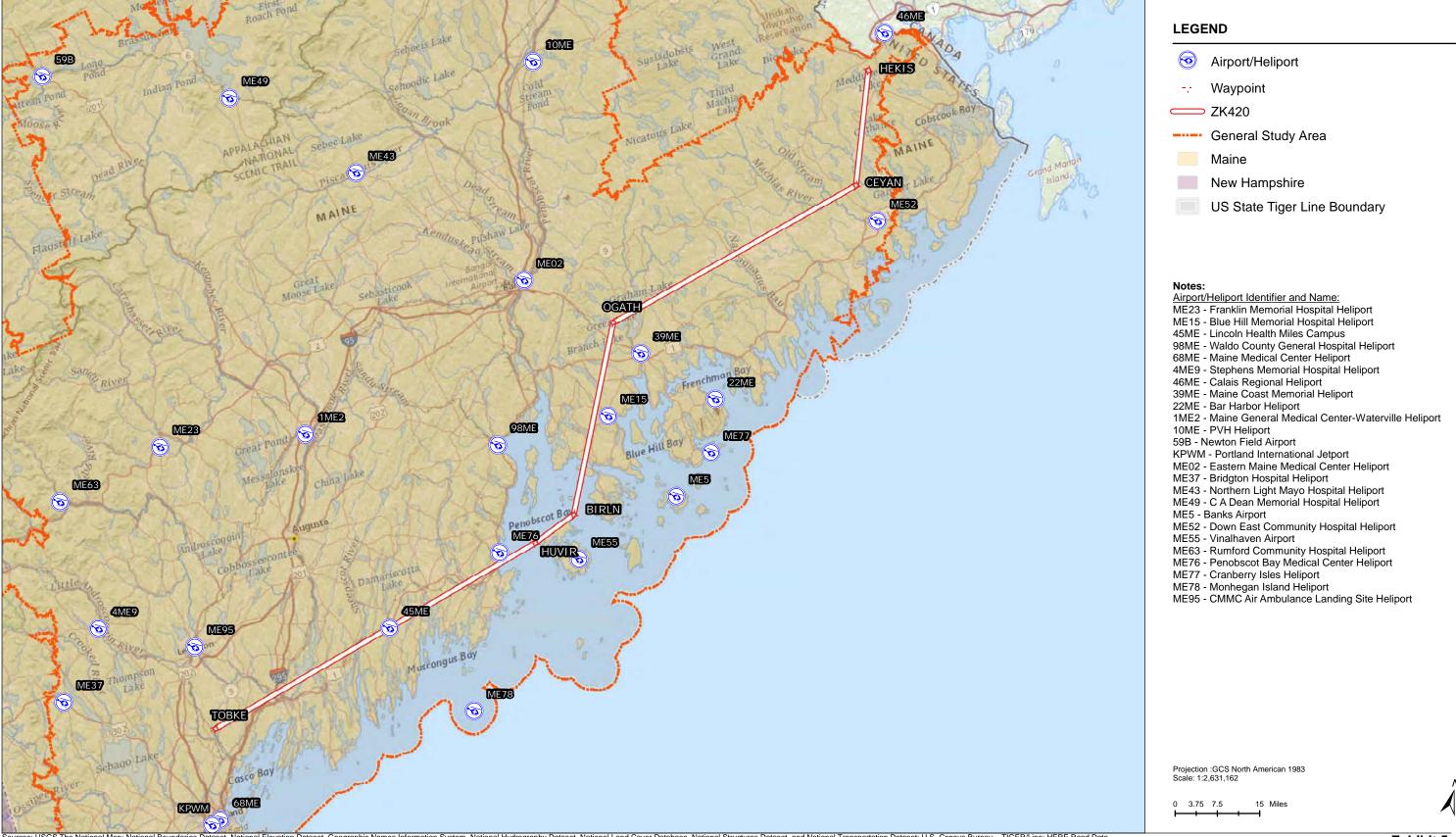
The ZK412 procedure WP14468 to HUVIR. It	depicted in <b>E</b> xconnects ME95	<b>xhibit 4</b> is to ME76.	an East/West	procedure	that	traverses	CEPKO	to
	: 15							



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**Proposed Helicopter Route - ZK412** 

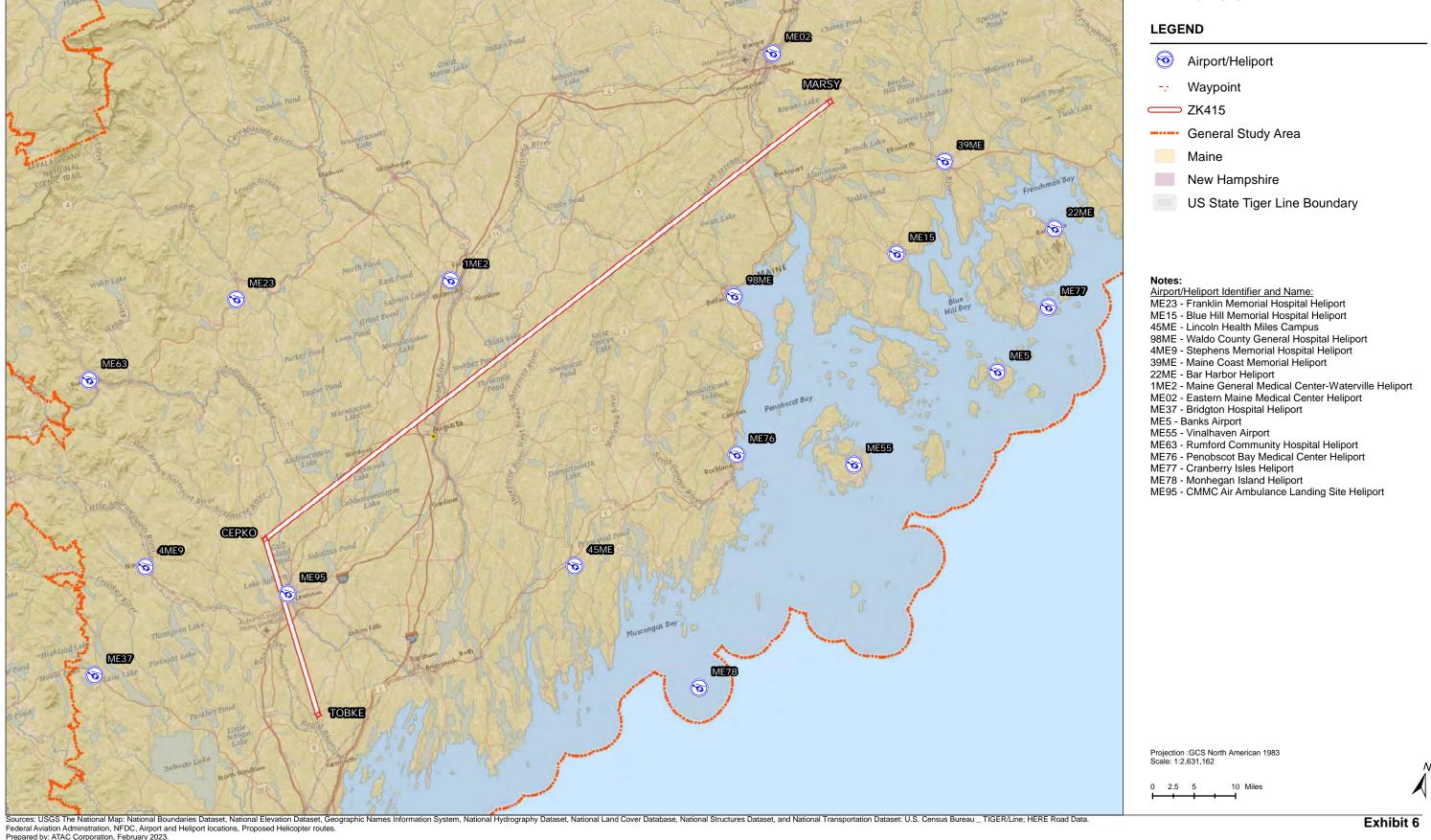
The ZK420 procedure depicted in **Exhibit 5** is a Northeast/Southwest procedure that traverses HEKIS to CEYAN to WP14872 to BIRLN to HUVIR to TOBKE. It connects 46ME to ME02. It also connects to the ZK411 procedure (**Exhibit 3**) to serve operations to KPWM and/or KSFM, as well as the ZK412 procedure (**Exhibit 4**) to serve operations to the West.



Sources: USGS The National Map: National Boundaries Dataset, National Elevation Dataset, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset: U.S. Census Bureau \_\_TIGER/Line; HERE Road Data. Federal Aviation Administration, NED, April 2013

Exhibit 5

## **Proposed Helicopter Route - ZK420**

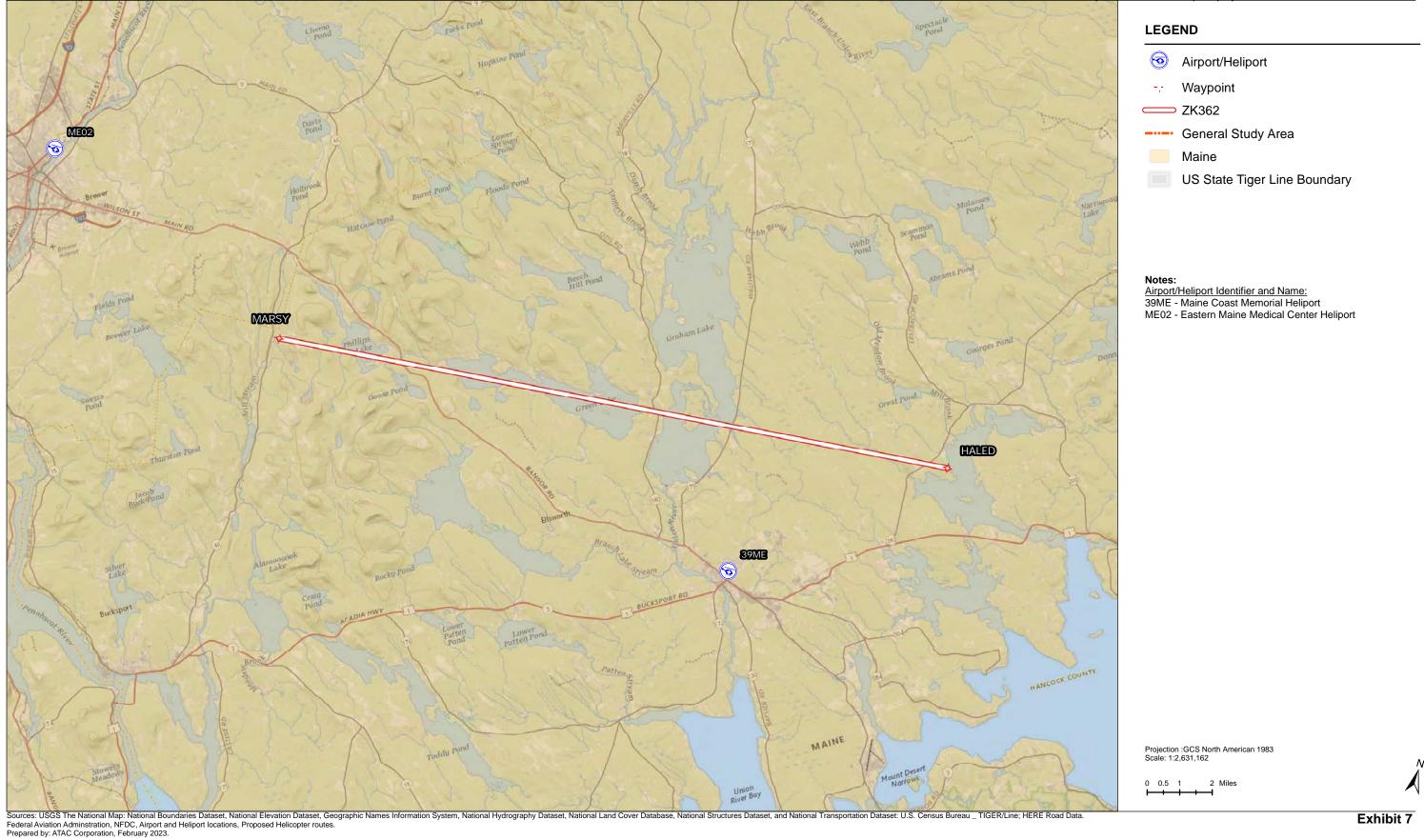


**ILHS-HAA Environmental Assessment** 

**Proposed Helicopter Route - ZK415** 

The ZK362 procedure delight serves operations to operations to KPWM an	epicted in <b>Exhibit</b> 7 o/from 22ME. It ale od/or KSFM.	<b>7</b> is an East/West so connects to t	procedure that tra he ZK415 proce	averses HALED to dure ( <b>Exhibit 6</b> )	o MARSY. to serve

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**ILHS-HAA Environmental Assessment** 

**Proposed Helicopter Route - ZK362** 

The ZK421 proce to WP331. This p	edure depicted in <b>Ex</b> procedure connects	<b>hibit 8</b> is a North/S 4ME9 to KPWM ar	South procedure that omage of the omage of t	nat traverses FARA	M to FIGOP
IIIIS IIAA Drojoet No	sica Tachnical Papart (DI	DAFT)			March 2022

Instrument Flight Procedures Low-level Helicopter System (ILHS) to support Helicopter Air Ambulance (HAA) Operations Environmental Assessment

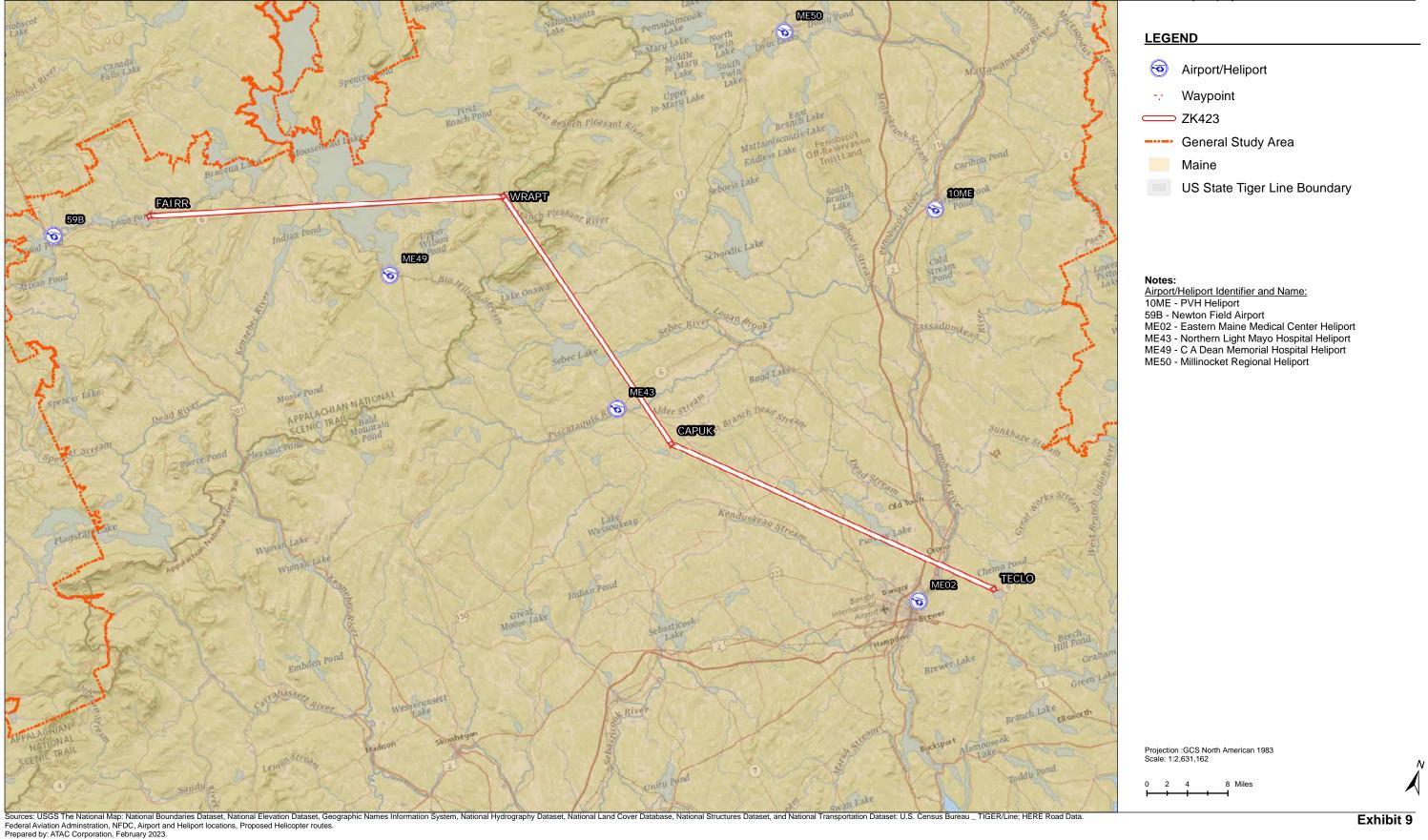


ILHS-HAA Environmental Assessment

**Proposed Helicopter Route - ZK421** 

The ZK423 procedure depicted in <b>Exhibit 9</b> is a Northwest/Southeast procedure that traverses FETOG to WRAPT to CAPUK to TELCO. It connects 59B to ME02 and ME95; ME49 to KPWM and 0MA4; and ME43 to ME95, KPWM, and 0MA4.

Instrument Flight Procedures Low-level Helicopter System (ILHS) to support Helicopter Air Ambulance (HAA) Operations Environmental Assessment



**ILHS-HAA Environmental Assessment** 

**Proposed Helicopter Route - ZK423** 

The ZK422 procedure dep SHINY to FEPUV to CEP procedure connects to the	picted in <b>Exhibit 10</b> is KO. It connects K8B e ZK415 procedure ( <b>E</b>	s a North/South proc 0 to ME63, and ME E <b>xhibit 4</b> ) to serve o	cedure in western Ma 23 to ME95, KPWM operations to ME76 a	ine that traverses , and MA04. This and ME55.

Instrument Flight Procedures Low-level Helicopter System (ILHS) to support Helicopter Air Ambulance (HAA) Operations Environmental Assessment LEGEND Airport/Heliport -- Waypoints ZKXXX CEPKO - FEPVU - SHINY (8B0, ME63, ME23) ---- General Study Area Maine New Hampshire Vermont SHINY US State Tiger Line Boundary Notes: Airport/Heliport Identifier and Name: ME23 - Franklin Memorial Hospital Heliport 4ME9 - Stephens Memorial Hospital Heliport ME63 1ME2 - Maine General Medical Center-Waterville Heliport K0B1 - Bethel Regional Airport K8B0 - Stephen A Bean Municipal Airport ME37 - Bridgton Hospital Heliport FEPUV ME63 - Rumford Community Hospital Heliport ME95 - CMMC Air Ambulance Landing Site Heliport **CEPKO** ME95

Sources: USGS The National Map: National Boundaries Dataset, National Elevation Dataset, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset: U.S. Census Bureau \_ TIGER/Line; HERE Road Database, National Administration, NFDC, Airport and Heliport locations, Proposed Helicopter routes.

Prepared by: ATAC Corporation, February 2023.

Exhibit 10

**Proposed Helicopter Route - ZK422** 

Projection :GCS North American 1983 Scale: 1:2,631,162

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The information from the TARGETS package and the description of procedures from email correspondence provided the basis for the track creation needed for the noise modeling (see Section **3.4**).

### 2.2 Operations Spreadsheet

A spreadsheet containing a three-year (February 2018 to February 2021) record of helicopter operations was provided by a SME from a medical helicopter operator based in Maine. This spreadsheet provided helicopter operation counts by regions named: The County, Downeast, ZK, NW, Coastal 1, Coastal 2, Western North West, Western, and South and NH. **Table 2** below presents the operations counts over a three-year period by region.

Table 2 Three-Year Medical Helicopter Operation Counts by Region

				Receiving				
Region	Origin	From		ME02	ME95	KPWM	BOSTON	3NH4
The Magazine		16ME	AR Gould Hospital Heliport	150	6	27	9	0
		ME48	Northern Maine Medical Center Heliport	143	4	21	11	0
County	ME02	79ME	Houlton Regional Hospital Heliport	136	6	23	5	0
		10ME	PVH Heliport	124	6	28	2	0
		ME50	Millinocket Regional Heliport	54	4	19	0	0
Downeast	ME02	ME52	Down East Community Hospital Heliport	210	7	27	1	0
		46ME	Calais Regional Heliport	161	11	23	5	0
		ME02	Eastern Maine Medical Center Heliport	0	2	183	186	0
ZK	ME02	39ME	Maine Coast Memorial Heliport	267	6	32	12	0
ZΝ	IVIEUZ	22ME	Bar Harbor Heliport	162	3	38	8	0
		ME15	Blue Hill Memorial Hospital Heliport	101	3	16	2	0
		ME43	Northern Light Mayo Hospital Heliport	190	5	40	3	0
NW	ME02	59B	Newton Field Airport	8	1	0	0	0
		ME49	C A Dean Memorial Hospital Heliport	29	0	4	1	0
		98ME	Waldo County General Hospital Heliport	178	9	52	6	0
Coastal 1		ME55	Vinalhaven Airport	42	8	3	0	0
		ME5	Banks Airport	21	0	0	1	0
		ME77	Cranberry Isles Heliport	1	0	0	0	0
Coastal 2 ME95	ME76	Penobscot Bay Medical Center Heliport	12	18	248	10	0	
	ME95	ME78	Monhegan Island Heliport	0	5	2	0	0
		45ME	Lincoln Health Miles Campus	4	10	78	4	0
Western	ME95	ME63	Rumford Community Hospital Heliport	3	146	46	3	0
North ME95 West	MESS	ME23	Franklin Memorial Hospital Heliport	0	56	77	2	0

						Receiving		
Region	Origin	From		ME02	ME95	KPWM	BOSTON	3NH4
		1ME2	Maine General Medical Center Waterville Heliport	11	3	47	3	0
		ME37	Bridgton Hospital Heliport	0	126	68	6	0
Western	Western ME95	4ME9	Stephens Memorial Hospital Heliport	0	14	53	1	0
		68ME	Maine Medical Center Heliport	5	0	1	50	0
	ME87	Southern Maine Health Care/Sanford Heliport	0	0	111	8	11	
	NH56	Wentworth-Douglass Hospital Heliport	0	0	8	59	0	
South and	South and NH KSFM	ME94	York Hospital Heliport	0	0	23	42	20
I KSE		3NH4	Portsmouth Regional Hospital Heliport	0	0	1	3	0
		60ME	Southern Maine Health Care SMMC Helipad	0	1	30	17	6
		NH27	Huggins Hospital Heliport	0	0	7	3	3

Source: LifeFlight Aviation Services through FAA staff in Air Traffic Organization, November 2021

Prepared by: ATAC, December 2021

For modeling purposes, "BOSTON" was modeled as "0MA4," Boston Medical Center Hospital Heliport. The unique set of airports and heliports mentioned in the spreadsheet was used for the study airports and heliports (see Section 1.3.1)

The spreadsheet also provided a list of dates and times when each flight was dispatched. The information from this spreadsheet, along with the interview with the SMEs, provided the basis for operations counts, day/night split, as well as the airports/heliports for the noise modeling (see Section 3.3).

Note that the count of operations in **Table 2** are not counted in the same manner as what is required in the noise model. Each value in the table is representative of up to six operations in the noise model. For example, the value of 27 in the first row representing operations from 16ME to KPWM represents the following operations in the noise model:

- 1. 27 departures from ME02
- 2. 27 arrivals to 16ME
- 3. 27 departures from 16ME
- 4. 27 arrivals to KPWM
- 5. 27 departures from KPWM
- 6. 27 arrivals to ME02

Also note that three-year operation counts were averaged to represent annual counts in the model. SMEs concurred that taking the average count of operations was an acceptable estimate for modeling purposes.

For each origin-destination pair, the distribution of day and night flights were calculated based on the dispatch time of the operations on that route.

During the interview with the SMEs, it was noted that they are expecting an increase in operations of approximately 8% in the near future. This 8% increase was applied to the NA2023 and PA2023 scenarios. An additional 8% increase on top of the 2023 operations was assumed for the five-year outlook scenarios, NA2028 and PA2028. See Section **3.3** for details regarding modeled operation counts.

#### 2.2.1 Operations Serving K8B0 and K0B1

The operations spreadsheet described in this section does not include operations to/from K8B0. However, the TARGETS package and accompanying documents described in **Section 2.1** mention the use of the ZK422 route to serve K8B0. For modeling purposes, it was assumed that K8B0 would follow a similar operations loading as 59B. The operations modeled are K8B0 to ME63, and ME63 to K8B0 via the ZK422 Procedure (**Exhibit 10**).

Similarly, the operations spreadsheet does not include operations to/from K0B1. However, the proposed routes mention the use of a ZK421 route to serve K0B1. For modeling purposes, it was assumed that K0B1 would follow a similar operations loading as 4ME9. The operations modeled are K0B1 to ME95, and ME95 to K0B1 via the ZK421 Procedure (**Exhibit 8**).TARGETS Package

#### 2.3 Historical Radar Data

Historical radar data from January 2020 to November 2021 containing helicopter operations from an operator in Maine was acquired and analyzed. Data was acquired from ATAC's A90 System Wide Information Management (SWIM) data feed. This feed captures operations in Boston (A90) Terminal Radar Approach Control (TRACON), as well as the Bangor (BGR) and Portland (PWM) Towers. This source provides low level altitude coverage, including VFR traffic, over a majority of Maine. The data has transponder information including Mode S data containing a unique assigned identifier for a given aircraft. The data source also captures VFR flights, which is especially important to ensure that helicopter flights are captured by the data source.

To identify the medical helicopter operations in SWIM data, aircraft registration numbers (also known as "N-Numbers") were collected from the organization's website. Using the Aircraft Registration Master File, <sup>2</sup> produced by the Aircraft Registration Branch (AFS-750) of the FAA, data can be looked up based on registration number.<sup>3</sup> One field included in the dataset is Mode S code that can contain a unique address code per aircraft. Mode S code information was obtained by cross-referencing each registration number of the medical helicopter operator in Maine with the registration number in the Master File. As SWIM data contains Mode S code information, the medical helicopter operator Mode S codes are used to filter SWIM data for the respective medical flights. This technique of utilizing Mode S codes to identify flights improves flight identification compared to traditional methods based on beacon code or call sign. **Table 3** presents the Mode S codes and registration numbers that were used to identify the helicopter flights.

Table 3 Medical Helicopter Operator in Maine Registration Numbers and Mode S Codes

Registration Number	Mode S
N901EM	AC7353
N901CM	AC7321
N901LF	AC73E3
N901XM	AC74FC
N901WM	AC74E3
N710SB	A97D9F
N102H	A00CD1

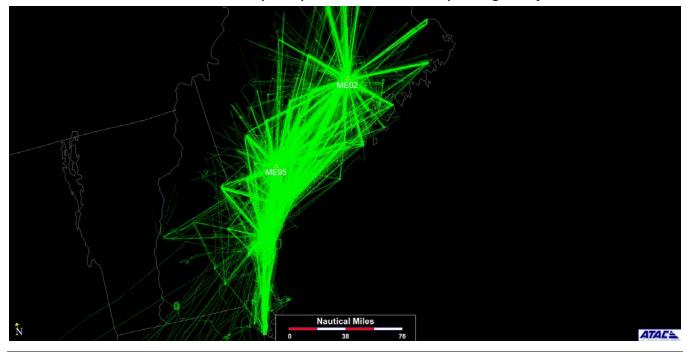
Source: FAA, November 2021 Prepared by: ATAC, December 2021

<sup>&</sup>lt;sup>2</sup> FAA Aircraft Registry Database Download. Retrieved from

http://www.faa.gov/licenses\_certificates/aircraft\_certification/aircraft\_registry/releasable\_aircraft\_download/

<sup>&</sup>lt;sup>3</sup> Retrieved from https://registry.faa.gov/aircraftinguiry/Search/NNumberInquiry on December 21, 2021

**Exhibit 11** presents the helicopter flight trajectories, captured in ATAC's SWIM data feed, of the major medical helicopter operator in Maine.



**Exhibit 11 Medical Helicopter Operator in Maine Helicopter Flight Trajectories** 

Source:

A90 SWIM Data Feed, January 2020 - November 2021

Prepared by: ATAC, December 2021

The helicopter trajectories following the IFPs serving the airports, operate at altitudes consistent with the procedure plate. Where there was no IFP, the analysis of the historical helicopter trajectory data was used to determine a cruising altitude and speed. Based on this analysis, an altitude of 2,000 feet MSL and cruising speed of 145 knots was chosen. These two assumptions are used in the modeling and is representative of typical operations. However, the elevation of the K8B0 heliport is 1,821 feet MSL. It would not be realistic to fly ~200 feet above the heliport, thus the operations arriving to K8B0 were modeled with a cruising altitude of 3,000 ft MSL. This information provided the basis for the user-defined helicopter profiles created in AEDT that were developed for the noise modeling (see Section 3.5).

## 3 Methodology

## 3.1 Modeling Assumptions

## 3.1.1 Aircraft Type

Internet research of the medical helicopter operator showed that operations were conducted using "twinengine Agusta helicopters." ATAC reviewed the available helicopter aircraft types in AEDT 3d and selected the "A109" helicopter type to model all operations. AEDT describes this helicopter type as "Agusta A-109"; thus, the actual helicopter type and selected helicopter type to be modeled has a direct mapping.

 $<sup>4\</sup> Retrieved\ from\ \textit{https://www.lifeflightmaine.org/Explore-Lifeflight/Helicopter.aspx}\ on\ December\ 22,\ 2021.$ 

To model A109 operations, ATAC uses non-default AEDT data in the form of user-defined helicopter procedure steps (see Section **3.5**). All other data (including noise-power-distance data) necessary for AEDT to model helicopter performance and noise comes from HELO\_ID "A109."

#### 3.1.2 Terrain

AEDT's option to utilize terrain data when calculating noise values is enabled using data from the United States Geological Survey (USGS). Data from the USGS's digital elevation model in 1 arc second (~ 30 meters) resolution was downloaded, input, and used during runtime for the noise values for both scenarios.

#### 3.1.3 Weather

AEDT supports a variety of weather data sources for aircraft performance modelling. The source for weather data included in the AEDT Airport database is the most recent data from the Integrated Surface Database from the National Oceanic and Atmospheric Administration (NOAA) at the time of the AEDT release. This project used a 10-year average of weather data values where available. When data is not available, AEDT uses International Standard Atmosphere (ISA) functions of air temperature, pressure, and density versus aircraft altitude above mean sea level for aircraft performance calculations.

#### 3.1.4 Annualization

AEDT allows for weighting and scaling factors to be applied to operation groups called annualization. This project uses annualization to scale operations to represent a daily value. Operations counts input into the model represent average annual counts (see Section 3.3). To properly annualize the data to yield a daily value, a scaling factor equal to 1/365 (~0.00273972602739726) is used.

## 3.2 User-Defined Heliports/Helipads

AEDT relies on pre-packaged databases, one of which ("AIRPORT") contains data about a global set of airports and airport data. AEDT uses data from this database to populate necessary inputs for the specific study. As the database is incomplete, not all required data for each study airport/heliport (see **Table 1**) exists in the database. As a result, missing requisite data was gathered for each study airport and heliport and inserted into the model.

## 3.3 Operations Counts

Based on the three-year historical operations spreadsheet (see Section **2.2**), there was an average of 3,435.3 annual helicopter operations. An 8% increase was added to this average value to represent the NA2023 and PA2023 scenarios. An additional 8% increase on top of the NA2023/PA2023 values was included to represent the five-year outlook scenarios, NA2028 and PA2028. **Table 4** presents the day and night operation counts modeled in AEDT, per scenario. The day operations accounted for 78% of the total operations, while the night operations accounted for 22% of the total operations.

Scenario **Day Count Operations Night Count Operations** Total No Action 2023 2,887.9 822.3 3710.2 Proposed Action 2023 2.887.9 822.3 3710.2 3,118.9 888.1 4007.0 No Action 2028 4007.0 3,118.9 888.1 Proposed Action 2028

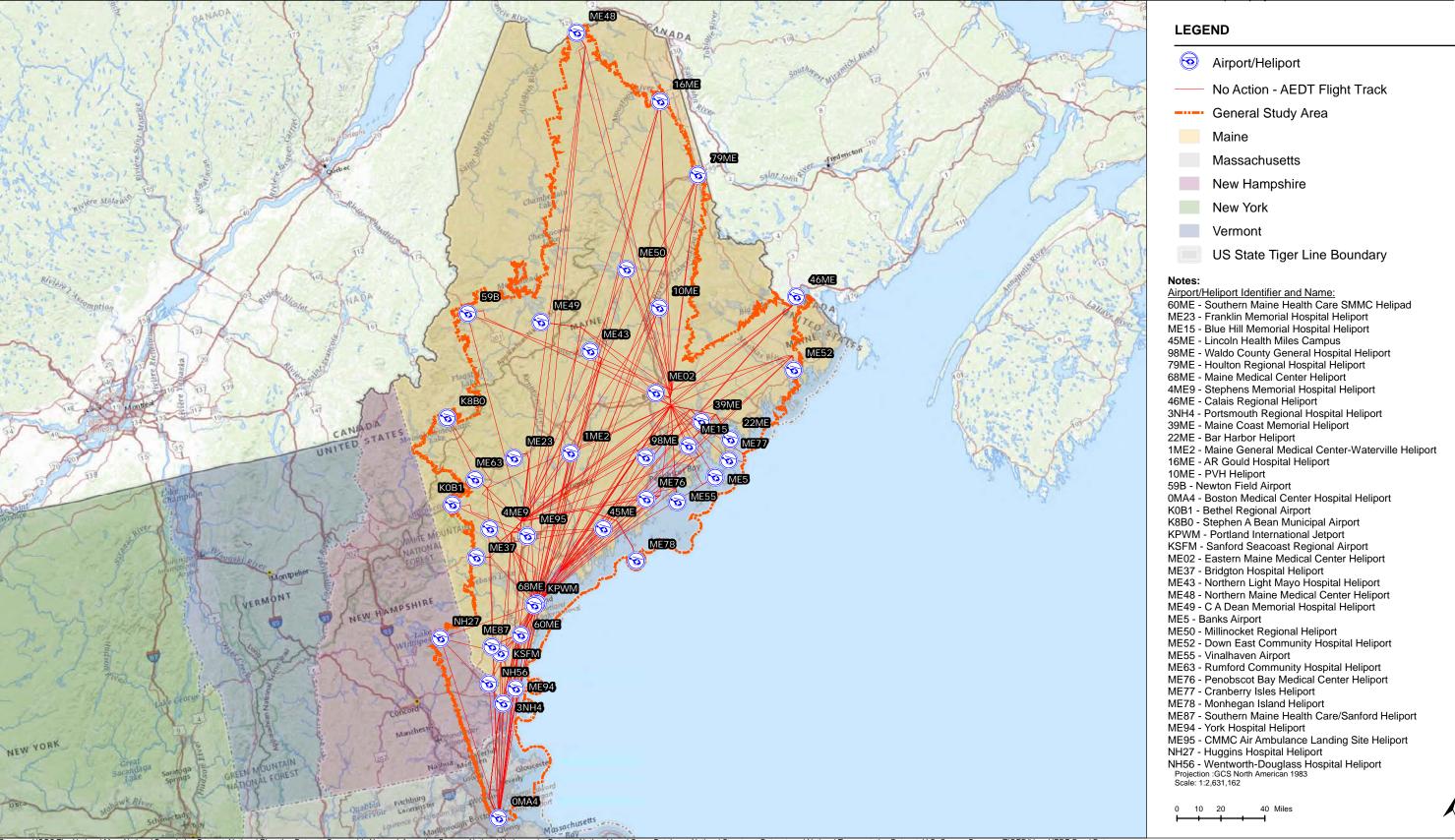
**Table 4 Scenario Operation Counts** 

Source: ATAC, January 2023 Prepared by: ATAC, January 2023 The modeled operations counts between the NA2023 and PA2023, and the NA2028 and PA2028 scenarios (discussed in Section **1.3.2**) were kept consistent, in order to isolate the impact of the Proposed Action Alternative scenarios.

#### 3.4 Track Generation

As discussed in Section Error! Reference source not found., No Action scenario flight tracks are modeled to follow the departure IFP associated with the origin heliport (as applicable), continuing on a straight-line path, entering at the arrival IFP (as applicable) represented at the destination heliport. For airports that do not have IFPs, a straight-line path was assumed. The modeled flight tracks for the No Action scenarios are presented in **Exhibit 12** below.

Instrument Flight Procedures Low-level Helicopter System (ILHS) to support Helicopter Air Ambulance (HAA) Operations Environmental Assessment



Sources: USGS The National Map: National Boundaries Dataset, National Elevation Dataset, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset: U.S. Census Bureau \_\_TIGER/Line; HERE Road Data. Federal Aviation Administration, NFDC, Airport and Heliport locations. ATAC, AEDT Flight Tracks.

# **ILHS-HAA Environmental Assessment**

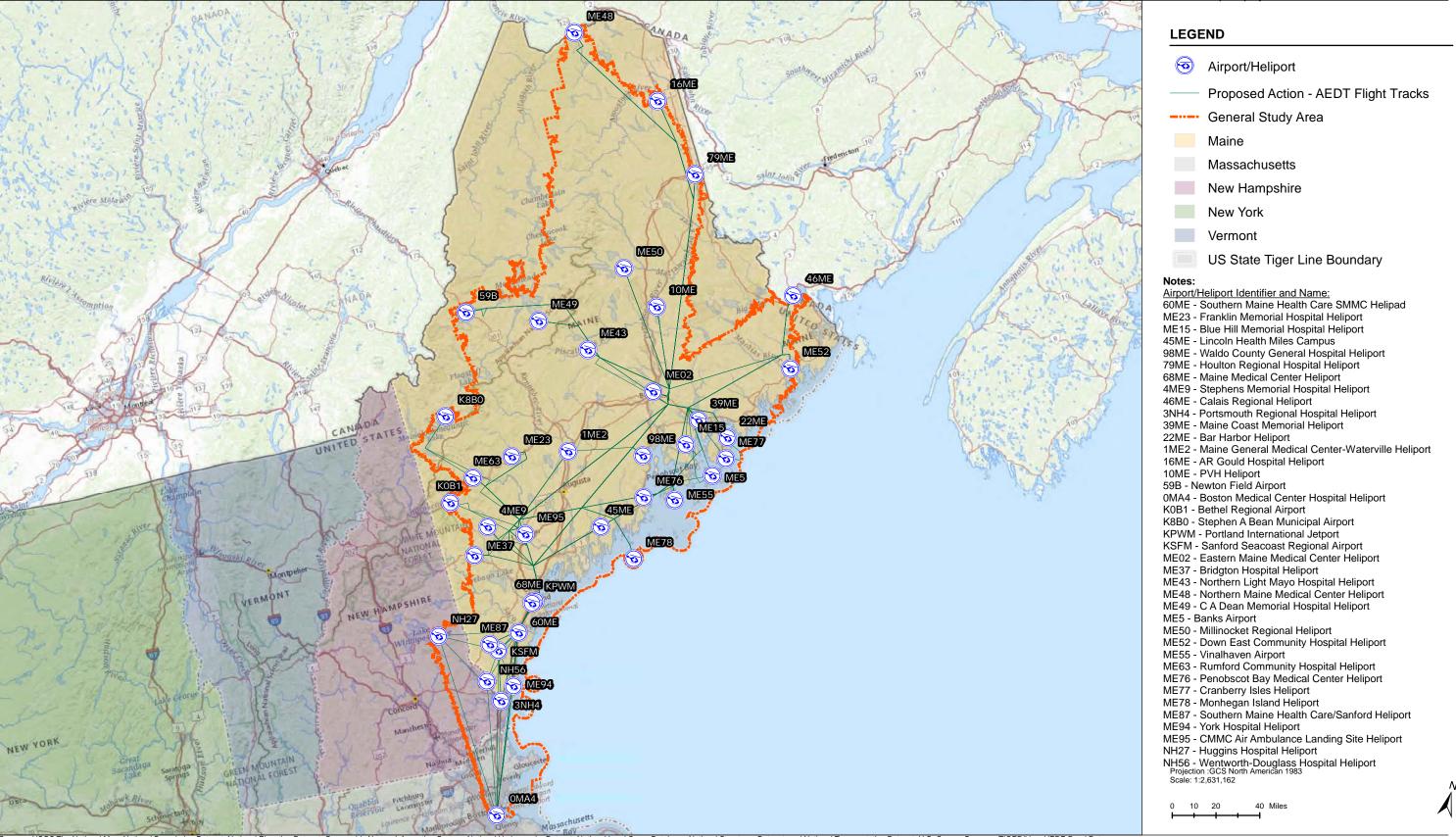
Exhibit 12

## **No Action - AEDT Flight Tracks**

Proposed Action Alternative flight tracks are modeled to follow the departure IFP associated with the origin heliport (as applicable), continuing on a straight-line path to the nearest reasonable procedure waypoint, following the proposed "ZK" procedure(s), then exiting at a reasonable waypoint to enter the arrival IFP (as applicable) represented at the destination. For airports that do not have IFPs, a straight-line path was assumed. In cases where this assumption created an unreasonable track (e.g., unnecessarily and significantly increasing track distance), the No Action scenario flight track was used. Proposed Action Alternative scenarios are presented in **Exhibit 13** below.

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Instrument Flight Procedures Low-level Helicopter System (ILHS) to support Helicopter Air Ambulance (HAA) Operations Environmental Assessment



Sources: USGS The National Map: National Boundaries Dataset, National Elevation Dataset, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset: U.S. Census Bureau \_ TIGER/Line; HERE Road Data. Federal Aviation Administration, FFD.

Exhibit 13

# **ILHS-HAA Environmental Assessment**

## **Proposed Action - AEDT Flight Tracks**

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Exhibit 14 contains three images displaying how a track is created in the Proposed Action Alternative scenarios using the proposed "ZK" procedures. The exhibit shows an example track from ME48 to ME95. The flight track starts at ME48, departing on the IDATE1 procedure (OMNEW→IDATE), then joins the ZK411 procedure at the EDGUE waypoint. The track then follows the ZK411 procedure south to CORAC to CIYEP to TELCO to MARSY. The track then transitions to the ZK415 procedure at MARSY, then south to CEPKO, where it exits the procedure and enters the ME95 approach procedure.

The left-hand image emphasizes how tracks were created using multiple procedures (e.g., ZK411 and ZK415 procedures). The middle image is a zoomed-in version displaying how the flight track departs ME48 on the IDATE1 procedure and joins the ZK411 procedure at the most reasonable waypoint. The right image is a zoomed-in version displaying how the flight track arrives using the ME95 approach procedure. The decision of how Proposed Action Alternative tracks enter and exit procedures was done reasonably and conservatively.

Exhibit 14 Example Flight Track for 16ME to ME95

Source: SkyView/GRADE, October 2022 Prepared by: ATAC, October 2022

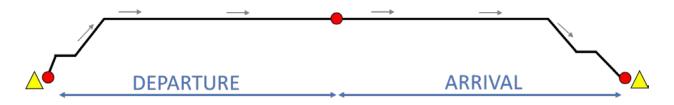
#### 3.4.1 Track Partition

A flight track can be partitioned as a departure from an origin and an arrival to a destination. Partitioning a flight in this manner makes modeling helicopter operations in AEDT simpler, as rules exist governing the definition of operation types and sequencing of procedure steps. As a result, each flight track is partitioned into two tracks based on operation type: (1) departure and (2) arrival.

Flight tracks are partitioned into two by splitting the track at a calculated location. The location of the split is calculated by dividing cumulative track ground distance by 2 and placing an interpolated track point at the resulting location. The departure flight track begins at the origin heliport and terminates at this calculated point. The arrival flight track begins at the calculated point and terminates at the destination heliport. **Exhibit 15** depicts the partitioning of flight track from a profile view. The yellow triangles represent origin and destination airports. The red circles represent flight track end points. Grey arrows indicate direction of travel.

#### **Exhibit 15 Flight Track Partitioning**

#### PROFILE VIEW



Source: ATAC, December 2021 Prepared by: ATAC, December 2021

#### 3.5 Profile Creation

In AEDT, helicopter profiles are defined as a set of pre-determined, static procedure steps that compose a flight profile. Helicopter profiles exist for combinations of different helicopter and operations types (e.g., "A109" helicopter type, "Arrival" operation type). It was determined that the existing set of helicopter profiles do not adequately represent profiles on the designed helicopter procedures. In general, existing AEDT helicopter profiles do not reach the typical cruising altitude and distance of the new procedures.

The specific nature and aircraft type in this study required a User Defined Profile (UDP) to be submitted and reviewed by the FAA Office of Environment and Energy (AEE). This UDP request was first submitted on December 14, 2021. The UDP has since been updated and resubmitted twice: on May 26, 2022, and again on June 7, 2022. These updates were related to expanding the range of cruising altitudes and speeds at which the proposed methodology could be applied in order to capture the cruising speeds/altitudes that are included in the proposed procedures. These UDP submissions were all approved, with the latest version being approved on June 21, 2022. The latest UDP submission and approval is included in the Section **0** of this document.

In general, existing helicopter procedure steps are copied and edited to reflect the SME-provided performance values of a cruising altitude of 2,000 ft MSL. For cases where flights follow a SID or approach procedure, the highest altitude restriction in the SID or instrument approach procedure along the flight's path was used as the cruising altitude. One exception to this methodology was done for routes to K8B0, where the cruising altitude was set to 3,000 ft MSL for the Baseline Scenario (see Section 2.3). A cruising speed of 145 knots was used for all flights.

For the Proposed Action procedures, SMEs provided minimum en route altitudes (MEA) per leg of the "ZK" procedures. In the Proposed Action Alternative scenarios, the greatest MEA of all the legs of origin/destination pair was used as the cruising altitude, with the cruising speed remaining at 145 knots.

Additionally, distances covered by profiles are matched to track distances between origin and destination. In almost all cases, distance matching is achieved by increasing cruise segment distances. In rare cases, reducing cruise segment distances was required as origin and destination study landing sites were within a close proximity to one another. If needed, cruise segment distances were set to 0, and all other profile procedure step distances remain unchanged.

For details about how user-defined profiles were created, see Section 0.

## 3.6 Receptor Set Creation

In order to capture the noise impact of the proposed procedures (discussed in Section 2), three sets of receptor points were created, which are described in the proceeding subsections. Receptor points are locations where AEDT reports noise for a given scenario. The methodology described in the following

sections (3.6.1 - 3.6.3) resulted in 353,829 total receptor points. The same receptor sets were used in all scenarios in order to compare results.

#### 3.6.1 Census Block

In this study area there were 48,261 population points evaluated, representing a total population of 3,379,346 people. These points are called population centroids, which represent a specific number of people. The centroids each represent a census block, which is the geographical unit for population data. The smallest centroid has a population of one, and the largest centroid has a population of 2,488. This centroid data is based on the 2020 U.S. Census data. The DNL values were calculated at all population centroids in this study area. **Exhibit 16** displays the census block receptor set.

### 3.6.2 Section 4(f): Historic and Cultural Resources

#### 3.6.2.1 Receptor Set Description

There are specific sites and land that are protected under the Section 4(f) of the Department of Transportation Act of 1966, in which noise levels need to be evaluated. Section 4(f) resources include historic sites, state and national parks, National Wildlife Refuges, and National Wilderness Areas. The Section 4(f) receptor points can be represented by one point, however, there are some areas where a property covers a large area, which may be outside the study area, and is represented by a grid of points. **Table 5** displays the sources of the Section 4(f) resources.

Table 5 Section 4(f) and 106 Sources

Source	Spatial Data	URL Download or Data Files Received
ESRI	USA Federal Lands	https://www.arcgis.com/home/item.html?id=26c2a38f94c54ad880ff877f88 4ff931
		Accessed 03/05/2022
ESRI	USA Parks	https://www.arcgis.com/home/item.html?id=578968f975774d3fab79fe56c8c90941
		Accessed 03/03/2022
Maine	Conserved Lands	https://www.maine.gov/geolib/catalog.html
Geolibrary		Accessed 03/01/2022
Maine	E911 Features	https://www.maine.gov/geolib/catalog.html
Geolibrary	Schools	Accessed 03/01/2022
Maine	Endangered,	https://www.maine.gov/geolib/catalog.html
Geolibrary	Threatened, and	Accessed 03/01/2022
	Special Concern	
	Wildlife Habitat	
Maine	Lighthouses	https://www.maine.gov/geolib/catalog.html
Geolibrary		Accessed 03/01/2022
Maine		https://www.maine.gov/geolib/catalog.html
Geolibrary	Resource Waters	Accessed 03/01/2022
Maine	Wildlife Management	https://www.maine.gov/geolib/catalog.html
Geolibrary	Areas	Accessed 03/01/2022
MassGIS	Areas of Critical	https://www.mass.gov/info-details/massgis-data-areas-of-critical-
	Environmental	environmental-concern
	Concern	Accessed 03/02/2022
MassGIS	Community	https://www.mass.gov/info-details/massgis-data-community-preservation-
	Preservation Act	act-projects
	(CPA) Projects	Accessed 03/02/2022
MassGIS	Lighthouses	http://www.mass.gov/mgis/lighthouses.htm
		Accessed 03/02/2022
MassGIS	Massachusetts	https://www.mass.gov/info-details/massgis-data-mhc-historic-inventory
	Historical	Accessed 03/02/2022

Source	Spatial Data	URL Download or Data Files Received
	Commission (MHC) Historic Inventory	
MassGIS	NHESP Certified Vernal Pools	https://www.mass.gov/info-details/massgis-data-nhesp-certified-vernal-pools Accessed 03/08/2022
MassGIS	NHESP Estimated Habitats of Rare Wildlife	https://www.mass.gov/info-details/massgis-data-nhesp-estimated-habitats-of-rare-wildlife Accessed 03/08/2022
MassGIS	NHESP Natural Communities	https://www.mass.gov/info-details/massgis-data-nhesp-natural-communities Accessed 03/02/2022
MassGIS	NHESP Priority Habitats of Rare Species	https://www.mass.gov/info-details/massgis-data-nhesp-priority-habitats-of-rare-species Accessed 03/02/2022
MassGIS	Protected and Recreational OpenSpace	https://www.mass.gov/info-details/massgis-data-protected-and- recreational-openspace Accessed 03/02/2022
MassGIS	Schools K-12 and Colleges and Universities	https://www.mass.gov/info-details/massgis-data-massachusetts-schools-pre-k-through-high-school https://www.mass.gov/info-details/massgis-data-colleges-and-universities Accessed 03/08/2022
National Park Service Integrated Resource Management Data Store	File geodatabase of unrestricted National Register of Historic Places properties	https://irma.nps.gov/DataStore/Reference/Profile/2210280 Accessed 03/01/2022
National Register of Historic Places	Historic Buildings, Districts, Objects, Points, Polygons, and Structures	https://www.nps.gov/subjects/nationalregister/data-downloads.htm Accessed 03/15/2022
NH Enhanced Mapping & Management Information Tool (EMMIT)	Historic and Archaeological Records	www.nh.gov/nhdhr/emmit/index.htm Accessed 04/21/2022
NH GRANIT	Coastal Conservation Focus Areas	https://www.granit.unh.edu/data/downloadfreedata/category/databycategory.html3 Accessed 03/04/2022
NH GRANIT	Connect the Coast (CTC) Prioritized Habitat Blocks	https://www.granit.unh.edu/data/downloadfreedata/category/databycategory.html3 Accessed 03/04/2022
NH GRANIT	Conservation Focus Areas	https://www.granit.unh.edu/data/downloadfreedata/category/databycategory.html3 Accessed 03/04/2022
NH GRANIT	Geographic Names Information System (GNIS)	https://www.granit.unh.edu/data/downloadfreedata/category/databy category.html3 Accessed 03/04/2022
NH GRANIT	Great Bay Estuary Assessment Zone	https://www.granit.unh.edu/data/downloadfreedata/category/databy category.html3 Accessed 03/04/2022

Source	Spatial Data	URL Download or Data Files Received
NH GRANIT	Historic and Cultural Resources	https://www.granit.unh.edu/data/downloadfreedata/category/databy category.html3 Accessed 03/04/2022
NH GRANIT	OEP Recreation Inventory	https://www.granit.unh.edu/data/downloadfreedata/category/databycategory.html3 Accessed 03/04/2022
US Census Bureau	American Indian/Alaska Native Areas/Hawaiian Home Lands	https://www.census.gov/geographies/mapping-files/time-series/geo/carto-boundary-file.html Accessed 03/01/2022
US Geological Survey ScienceBase Catalog	Protected Areas Database of the United States (PAD-US) 2.1, DOI Region 1 Shapefile	https://www.sciencebase.gov/catalog/item/602597cad34eb12031138e12 Accessed 03/01/2022
US Geological Survey ScienceBase Catalog	Wild and Scenic Rivers	https://www.sciencebase.gov/catalog/item/602597cad34eb12031138e12 Accessed 03/01/2022

Source: ATAC, August 2022 Prepared by: ATAC, August 2022

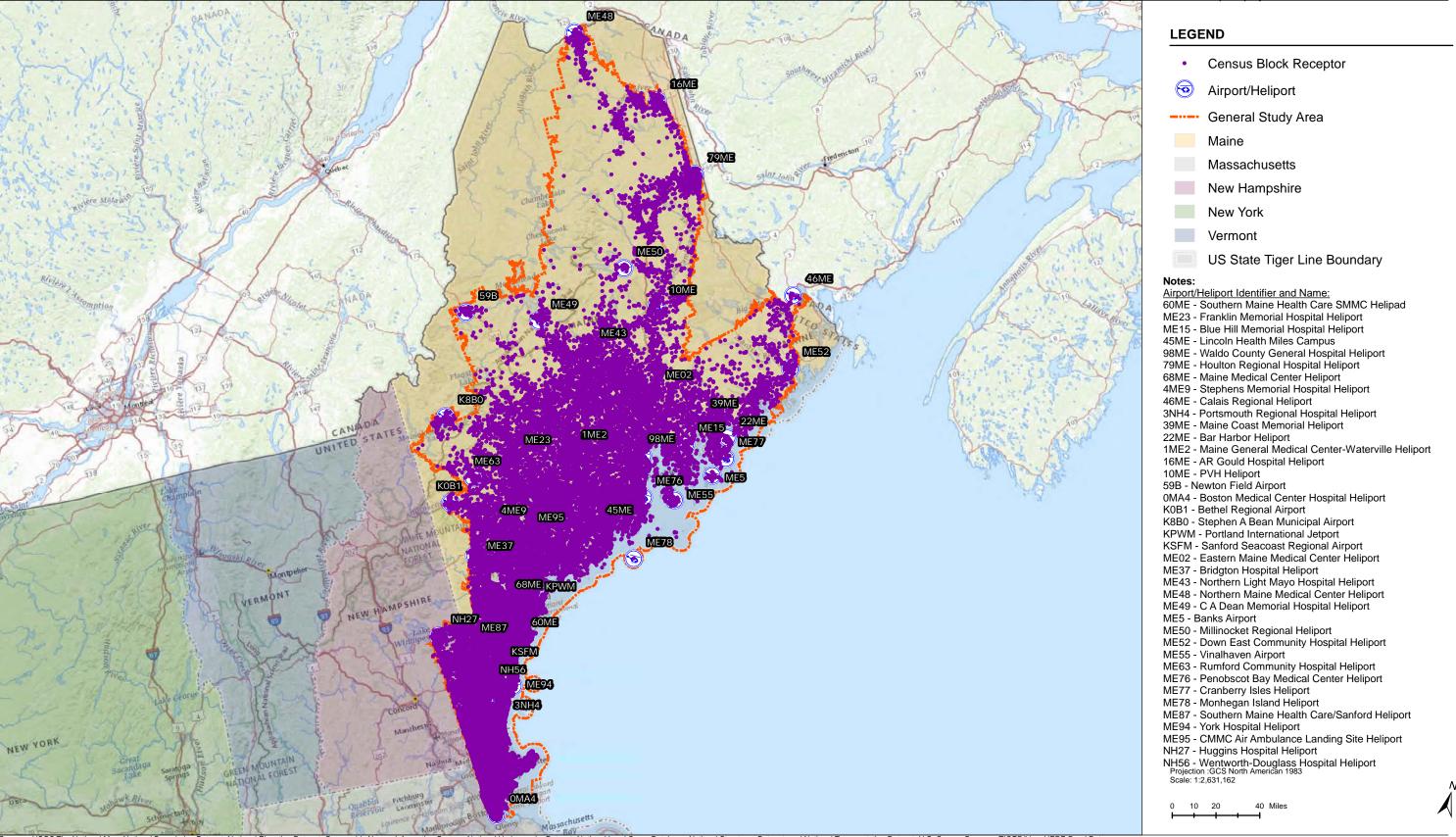
#### 3.6.2.2 Receptor Set Count and Trimming

Initially, 228,692 4(f) receptor points were created to cover all of the identified 4(f) resources. However, when viewing the 4f receptor set with the terrain regions for the study, it was found there is no terrain data to exist over portions of the 4f receptor set (over large area of the ocean). AEDT cannot run without terrain files covering all receptor points, therefore the receptor set was trimmed based on the availability of terrain data. There were 4,079 receptor points identified to be trimmed, resulting in 224,613 receptor points where noise was calculated. Exhibit 17 displays the Section 4(f) receptor set used in this study.

#### 3.6.3 Grid Points

A set of grid points were evenly placed 0.5 NM apart within the study area, resulting in 80,956 receptor points. These receptors are placed within the entire study area to capture the noise levels in areas that were not covered by the census block set nor the Section 4(f) set. However, this can result in duplicate noise impact areas. **Exhibit 18** displays the grid point receptor set.

Instrument Flight Procedures Low-level Helicopter System (ILHS) to support Helicopter Air Ambulance (HAA) Operations Environmental Assessment



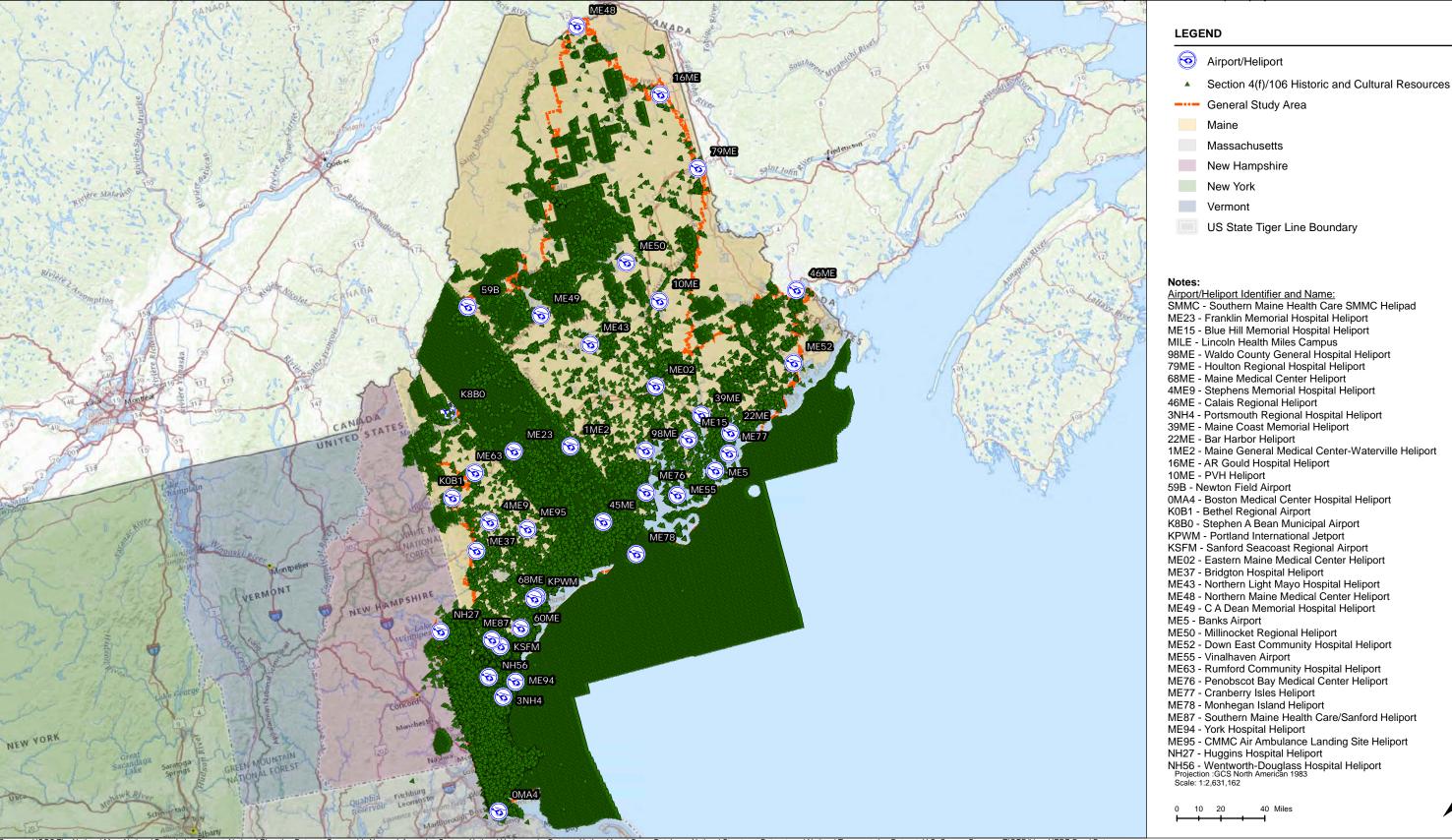
Sources: USGS The National Map: National Boundaries Dataset, National Elevation Dataset, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset: U.S. Census Bureau \_ TIGER/Line; HERE Road D

Exhibit 16



## **General Study Area - Census Block Receptors**

Instrument Flight Procedures Low-level Helicopter System (ILHS) to support Helicopter Air Ambulance (HAA) Operations Environmental Assessment



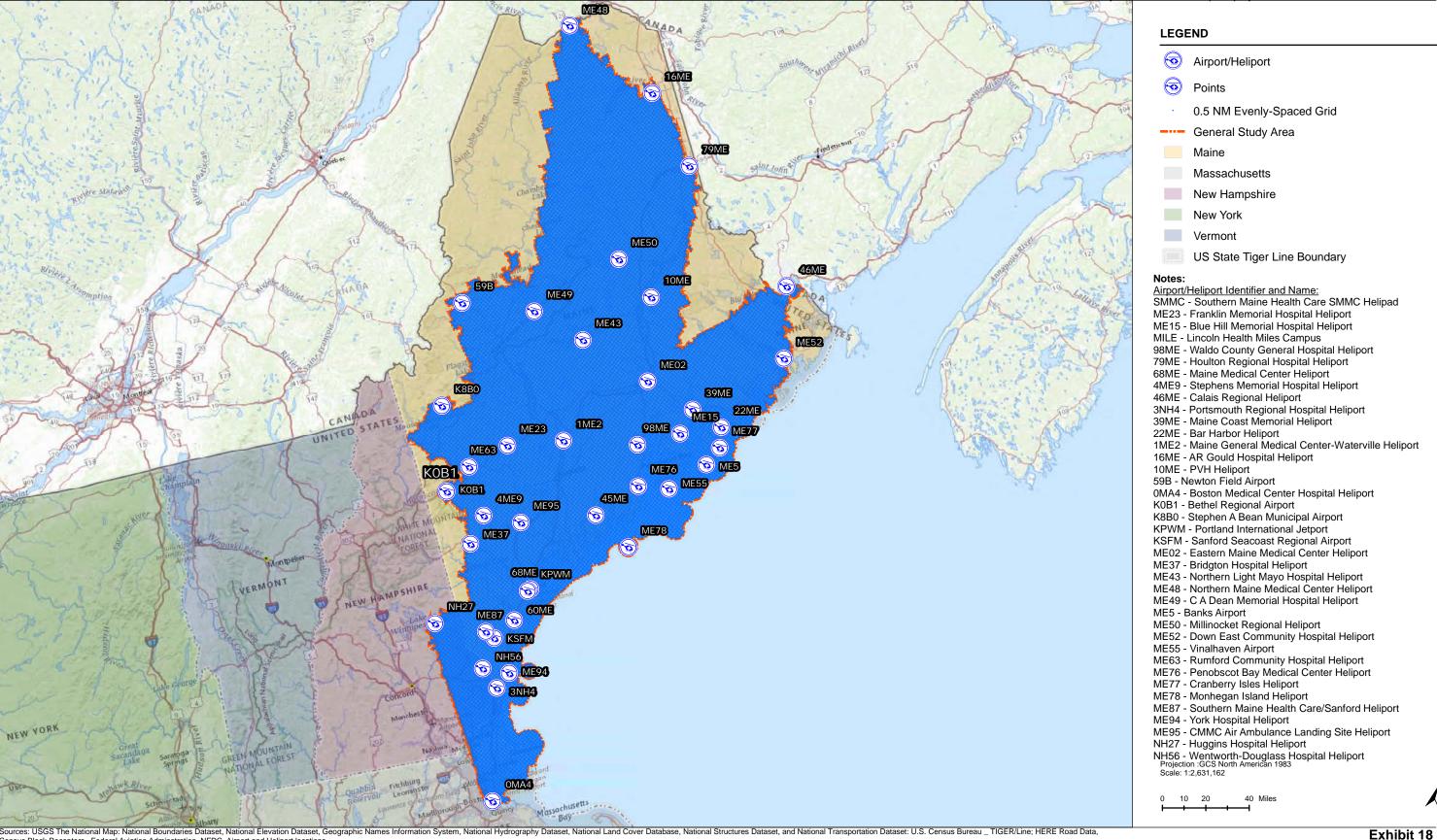
Sources: USGS The National Map: National Boundaries Dataset, National Elevation Dataset: U.S. Census Bureau \_ TIGER/Line; HERE Road Data, Census Block Receptors. Federal Aviation Adminstration, NFDC, Airport and Heliport locations. Prepared by: ATAC Corporation, Februrary 2023.

Exhibit 17

# **ILHS-HAA Environmental Assessment**

## Section 4(f)/106 Historic and Cultural Resources

Instrument Flight Procedures Low-level Helicopter System (ILHS) to support Helicopter Air Ambulance (HAA) Operations Environmental Assessment



Sources: USGS The National Map: National Boundaries Dataset, National Elevation Dataset, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; U.S. Census Bureau \_\_TIGER/Line; HERE Road Data, Census Block Receptors. Federal Aviation Adminstration, NFDC, Airport and Heliport locations Prepared by: ATAC Corporation, February 2023.

0.5 NM Evenly-Spaced Grid

### 4 Results

This section presents noise results for the four scenarios modeled in AEDT.

**Exhibit 19** to **Exhibit 21**, depict a side-by-side comparison of the AEDT noise level results for the NA2023 and the PA2023 scenarios. The NA2023 scenario is presented on the left, and the PA2023 scenario is presented on the right.

The noise levels from the NA2023 scenario and the PA2023 scenario for the Census Block Receptor set are presented in **Exhibit 19**. The noise levels from the NA2023 scenario and the PA2023 scenario for the Section 4(f) Receptor set are presented in **Exhibit 20**.

The noise levels from the NA2023 scenario and the PA2023 scenario for the Grid Points Receptor set are presented in **Exhibit 21.** The noise levels, measured in DNL dB, are colored according to the legend based on magnitude. Receptor locations are plotted on the map in the exhibit with United States state boundaries.

dB dB X < 20 X < 2020 ≤ X < 25 20 ≤ X < 25 25 ≤ X < 30 25 ≤ X < 30 30 ≤ X < 35  $30 \le X < 35$ 35 ≤ X < 40  $35 \le X < 40$ 40 ≤ X < 45 40 ≤ X < 45 45 ≤ X < 50  $45 \le X < 50$ 50 ≤ X < 55 50 ≤ X < 55 55 < X ≤ 60 55 < X ≤ 60

Exhibit 19 NA2023 (left) and PA2023 (right) Scenarios Census Block Noise Results

Source: Prepared by: ATAC, March 2023 ATAC, March 2023

dB dB X < 20 X < 20 20 ≤ X < 25 20 ≤ X < 25 25 ≤ X < 30 25 ≤ X < 30 30 ≤ X < 35 30 ≤ X < 35 35 ≤ X < 40 35 ≤ X < 40 40 ≤ X < 45 40 ≤ X < 45 45 ≤ X < 50 45 ≤ X < 50 50 ≤ X < 55 50 ≤ X < 55 55 < X ≤ 60 55 < X ≤ 60

Exhibit 20 NA2023 (left) and PA2023 (right) Scenarios Section 4(f) Noise Results

Source: Prepared by: ATAC, March 2023 ATAC, March 2023

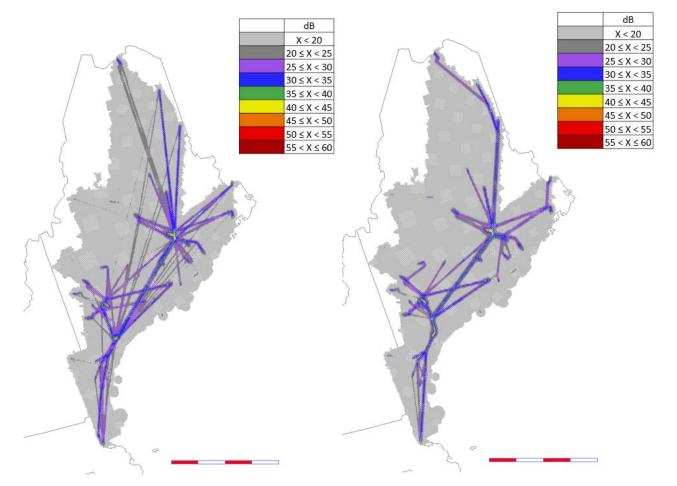


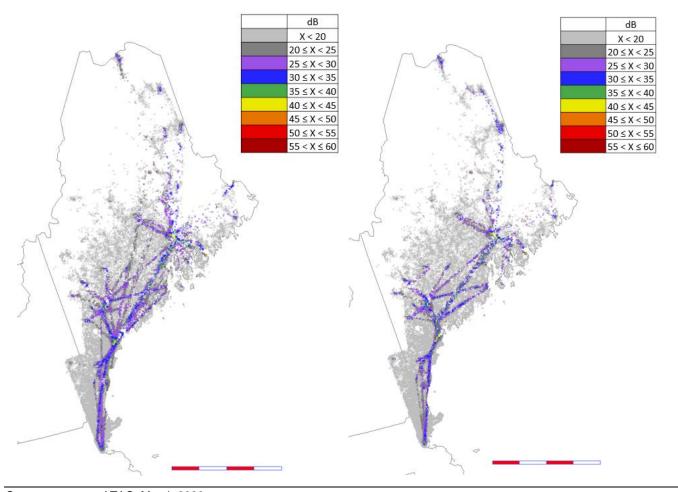
Exhibit 21 NA2023 (left) and PA2023 (right) Scenarios Grid Points Noise Results

Source: ATAC, March 2023 Prepared by: ATAC, March 2023

**Exhibit 22** to **Exhibit 24**, depict a side-by-side comparison of the noise levels for the NA2028 and the PA2028 scenarios. The NA2028 scenario is presented on the left and the PA2028 scenario is presented on the right.

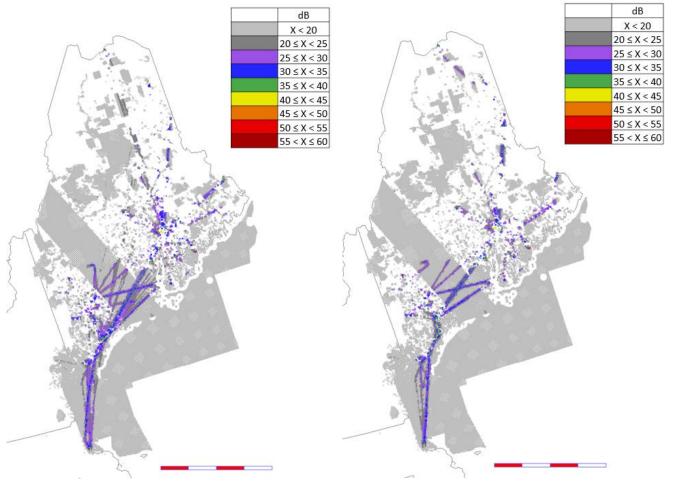
The noise levels from the NA2028 scenario and the PA2028 scenario for the Census Block Receptor set are presented in **Exhibit 22**. The noise levels from the NA2028 scenario and the PA2028 scenario for the Section 4(f) Receptor set are presented in **Exhibit 23**. The noise levels from the NA2028 scenario and the PA2028 scenario for the Grid Points Receptor set are presented in **Exhibit 24**. The noise levels, measured in DNL dB, are colored according to the legend based on magnitude. Receptor locations are plotted on the map in the exhibit with United States state boundaries.

Exhibit 22 NA2028 (left) and PA2028 (right) Scenarios Census Block Noise Results



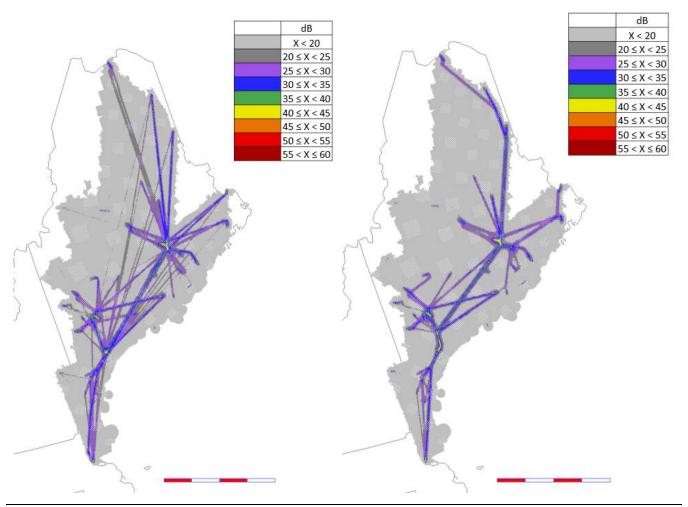
Source: Prepared by: ATAC, March 2023 ATAC, March 2023

Exhibit 23 NA2028 (left) and PA2028 (right) Scenarios Section 4(f) Noise Results



Source: Prepared by: ATAC, March 2023 ATAC, March 2023

Exhibit 24 NA2028 (left) and PA2028 (right) Scenarios Grid Points Noise Results



Source: Prepared by: ATAC, March 2023 ATAC, March 2023

### 5 Analysis

This section presents analysis of the results presented in Section 4. The criteria for determining the impact of changes in aircraft noise between scenarios are presented, followed by the results using said criteria.

#### 5.1 Criteria

As discussed in Section 1.2, DNL is the FAA's primary noise metric. **Table 6** provides the criteria used to assess the changes in aircraft noise exposure attributable to the alternative compared with the baseline. FAA Order 1050.1F defines a significant impact as an increase of DNL 1.5 dB at noise-sensitive land-use locations (e.g., residences, schools, etc.) exposed to aircraft noise of DNL 65 dB or higher under the alternative. For example, an increase from 63.5 dB to 65 dB is considered a significant impact.

FAA Order 1050.1F also recommends that when there are DNL increases of 1.5 dB or more at noise-sensitive locations in areas exposed to aircraft noise of DNL 65 dB and higher, DNL increases of 3 dB or more in areas exposed to aircraft noise between DNL 60 dB and 65 dB should also be evaluated and disclosed. It is important to note that DNL increases of 3 dB in areas exposed to aircraft noise below DNL 65 dB are not considered "significant impacts," but are to be considered in the environmental evaluation of a proposed project.

FAA Order 1050.1F stipulates that changes in exposure of DNL 5 dB or greater in areas exposed to aircraft noise between DNL 45 dB and 60 dB should be considered for airspace actions, such as changes to air traffic routes. This threshold was established in 1990, following issuance of an FAA noise screening ATC procedure to evaluate whether certain airspace actions above 3,000 feet AGL might increase DNL levels by 5 dB or more. The FAA prepared this noise-screening ATC procedure because experience indicated that DNL increases 5 dB or more at cumulative levels well below DNL 65 dB could be disturbing to people and become a source of public concern. As shown in **Table 6**, a 3 dB increase in areas exposed to DNL 60 to 65 dB and a 5 dB increase in areas exposed to DNL 45 to 60 dB are considered reportable noise increases.

Table 6 Criteria for Determining Impact of Changes in Aircraft Noise

DNL Noise Exposure Level Under the Proposed Action Alternative	Increase in DNL with Alternative	Aircraft Noise Exposure Change Consideration
DNL 65 and higher	DNL 1.5 dB or greater <sup>1</sup>	Exceeds Threshold of Significance
DNL 60 to 65	DNL 3.0 dB or greater <sup>2</sup>	Reportable Noise Increase (Considered When Evaluating Air Traffic Actions)
DNL 45 to 60	DNL 5.0 dB or greater <sup>3</sup>	Reportable Noise Increase (Information Disclosed When Evaluating Air Traffic Actions)

#### Notes:

Source: FAA Order 1050.1F Desk Reference, Ch. 11, Noise and Noise-Compatible Land Use, July 2015.

Prepared by: ATAC, December 2021

#### 5.2 Results

**Table 7** summarizes the results of the noise analysis between the four modeled scenarios.

<sup>1/</sup> Source FAA Order 1050.1F Desk Reference, Pg. 11-9; Title 14 C.F.R. Part 150.21 (2) (d); and Federal Interagency Committee on Noise, Federal Agency Review of Selected Airport Noise Issues, August 1992.

<sup>2/</sup> Source FAA Order 1050.1F Desk Reference, Pg. 11-9; and Federal Interagency Committee on Noise, Federal Agency Review of Selected Airport Noise Issues, August 1992.

<sup>3/</sup> Source FAA, Order 1050.1F Desk Reference, Pg. 11-9.

Table 7 Potential Change in Receptors Exposed to Aircraft Noise

DNL Noise Exposure Level Under the Proposed Action Alternative		Receptors Exposed to Noise that Exceeds the Threshold
DNL 65 and higher	DNL 1.5 dB or greater	0
DNL 60 to 65	DNL 3.0 dB or greater	0
DNL 45 to 60	DNL 5.0 dB or greater	0

Sources: ATAC, January 2023 (AEDT modeling results).

Prepared by: ATAC, January 2023

The results indicate that the Proposed Action Alternative scenarios, when compared to the No Action scenarios, would not result in a DNL 1.5 dB or higher increase in noise at any receptor exposed to DNL 65 dB or higher. Furthermore, no receptors experience a reportable noise increase in areas exposed to DNL between 60 dB and 65 dB. Similarly, no receptors would experience a DNL 5 dB increase in areas exposed to DNL between 45 dB and 60 dB.

#### 5.3 Environmental Justice

This section presents a summary of the analysis of the environmental justice impacts under the Proposed Action Alternative scenarios.

#### 5.3.1 Summary of Impacts

The Proposed Action Alternative scenarios would not displace people or businesses; therefore, there is no direct impact to the low-income or minority populations. Although there are areas exposed to reportable noise increases of DNL 5dB within areas exposed to DNL 45 to 60 dB, these do not constitute a significant impact related to a change in DNL exposure to people, including members of minority and/or low-income populations.

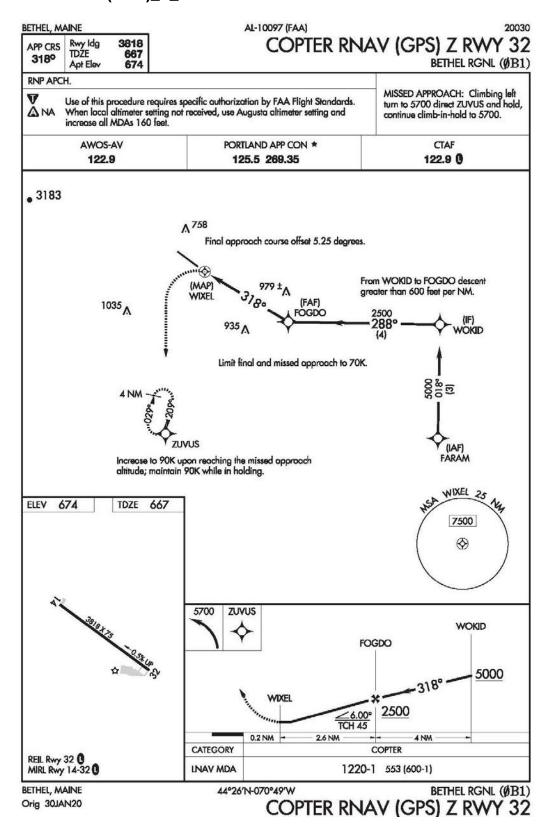
## 6 Supplements

## 6.1 List of Third-Party Special Instrument Flight Procedures

Table 8 Arrival IAPs						
Airport/Heliport Served	Gate Served	Procedure Name	Procedure Type	Transitions		
0B1	NW	COPTER RNAV (GPS) Z RWY 32	RNAV	1		
4ME9	SE	COPTER RNAV (GPS) 353°	RNAV	3		
22ME	N	COPTER RNAV (GPS) 182°	RNAV	1		
39ME	NW	COPTER RNAV (GPS) 170°	RNAV	1		
59B	NE, SE	COPTER RNAV (GPS) Z RWY 31	RNAV	2		
98ME	NW	COPTER RNAV (GPS) 160°	RNAV	1		
ME02	NE, SE	COPTER RNAV (GPS) 317°	RNAV	2		
ME15	SE, SW	COPTER RNAV (GPS) 352°	RNAV	2		
ME23	NE, SE	COPTER RNAV (GPS) 288°	RNAV	2		
ME37	NE, SE	COPTER RNAV (GPS) 299°	RNAV	2		
ME43	SE, SW	COPTER RNAV (GPS) 335°	RNAV	2		
ME48	SE, SW	COPTER RNAV (GPS) 002°	RNAV	2		
ME49	SE	COPTER RNAV (GPS) 198°	RNAV	1		
ME52	NE, NW	COPTER RNAV (GPS) 210°	RNAV	2		
ME55	N	COPTER RNAV (GPS) 202°	RNAV	1		
ME63	NE, SE	COPTER RNAV (GPS) 341°	RNAV	2		
ME76	Е	COPTER RNAV (GPS) 287°	RNAV	1		
ME77	NE, SE	COPTER RNAV (GPS) 309°	RNAV	2		
ME78	NE, NW	COPTER RNAV (GPS) 196°	RNAV	2		
ME87	Е	COPTER RNAV (GPS) 275°	RNAV	1		
ME95	NE, NW	COPTER RNAV (GPS) 163°	RNAV	2		

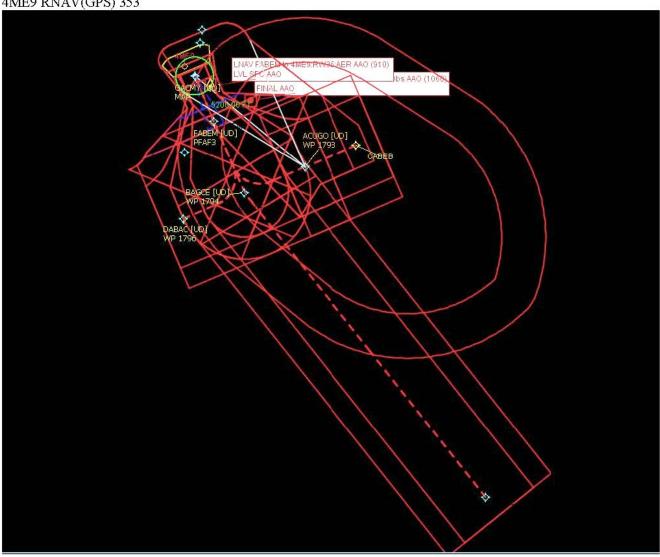
Table 9 Departure IFPs					
Airport/Heliport Served	Gate Served	Procedure Name	Procedure Type	Transitions	
22ME	N	HURLA ONE DEPARTURE (COPTER) (RNAV)	RNAV	1	
ME02	S	DUFFE ONE DEPARTURE (COPTER) (RNAV)	RNAV	1	
ME15	S	(RNAV)	RNAV	1	
ME23	NE. SE	FEMIG ONE DEPARTURE (RNAV)	RNAV	2	
ME37	Е	WASAL ONE DEPARTURE (RNAV)	RNAV	1	
ME43	SE	CAPUK ONE DEPARTURE (RNAV)	RNAV	1	
ME48	S	IDATE ONE DEPATURE (RNAV)	RNAV	1	
ME52	N	FODAG ONE DEPARTURE (RNAV)	RNAV	1	
ME55	N	MASST ONE DEPARTURE (RNAV)	RNAV	1	
ME63	SE	FEPUV ONE DEPARTURE (RNAV)	RNAV	1	
ME76	E	HUVIR ONE DEPARTURE (RNAV)	RNAV	1	
ME78	NW	IGILE ONE DEPARTURE (COPTER) (RNAV)	RNAV	3	
ME95	SW	ZATIS ONE DEPARTURE (RNAV)	RNAV	1	

# 6.2 Arrival IAPs 0B1 - RNAV(GPS) Z RWY32

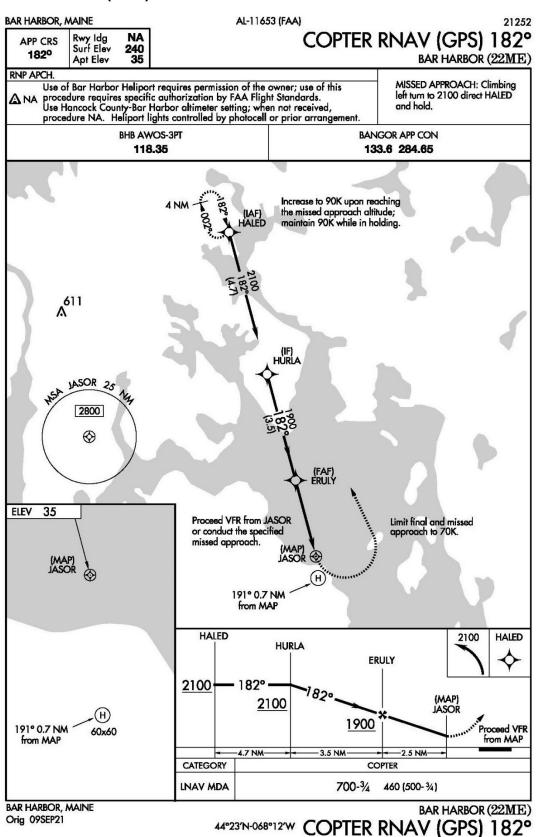


## 4ME9 - RNAV(GPS)\_353

4ME9 RNAV(GPS) 353

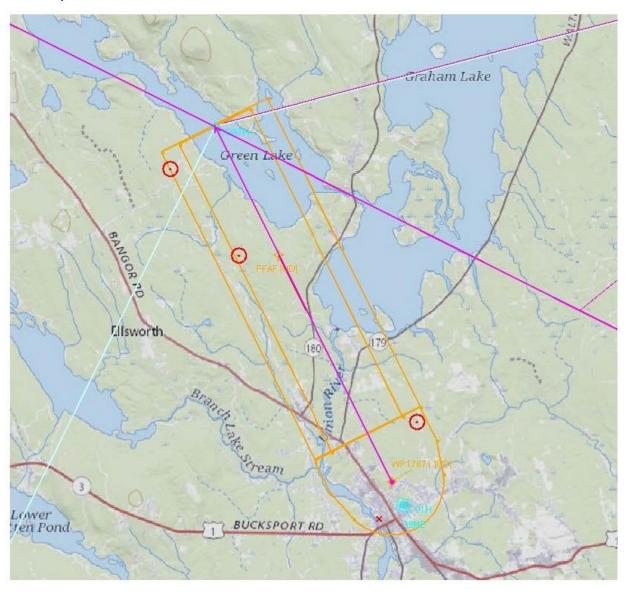


#### 22ME - RNAV(GPS)\_182

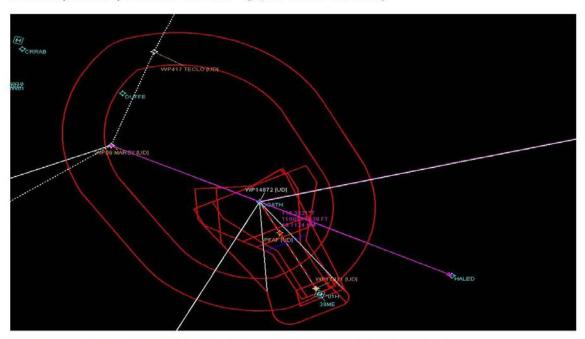


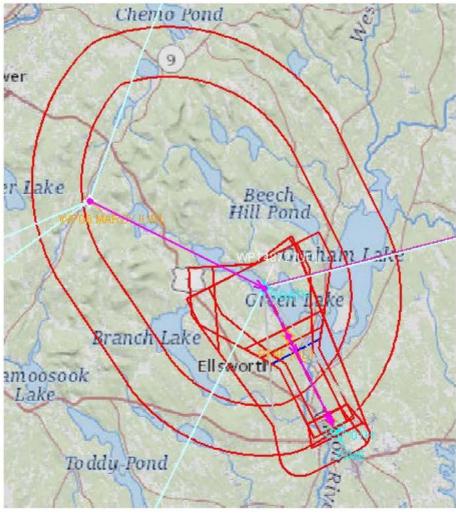
## 39ME - RNAV(GPS)\_170

K39ME Special OGATH RNAV DEP

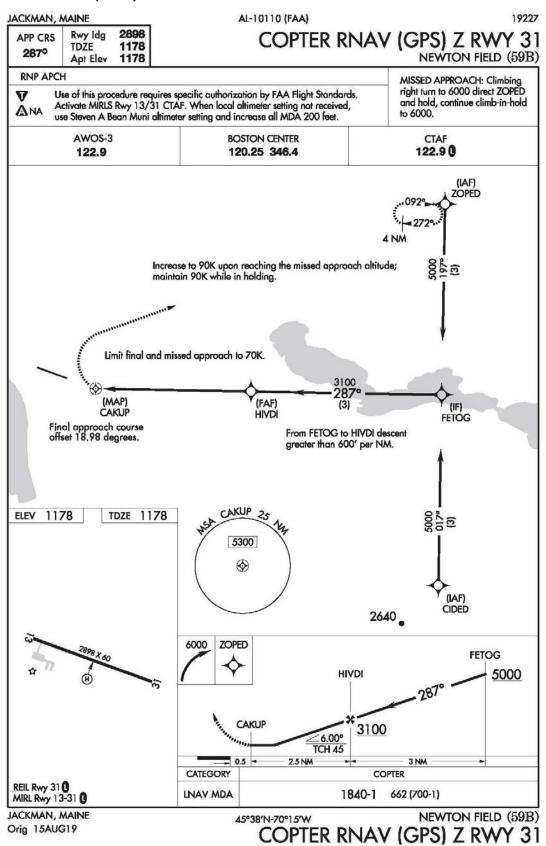


K39ME Special Copter RNAV GPS 170° (IF/IAF at OGATH 2100)



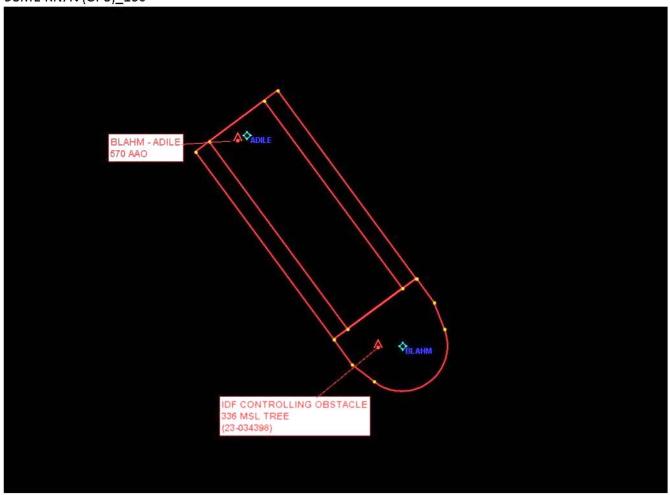


#### 59B - RNAV(GPS)\_Z\_RWY 31

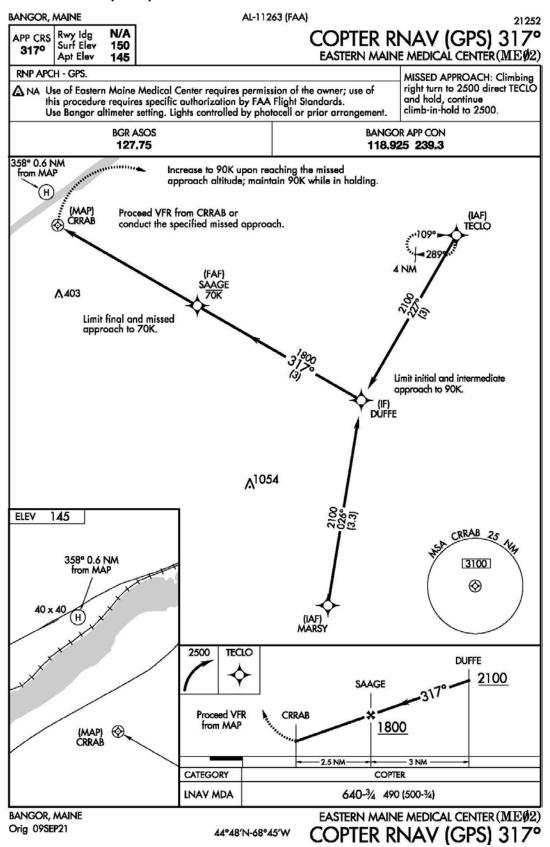


## 98ME - RNAV(GPS)\_160

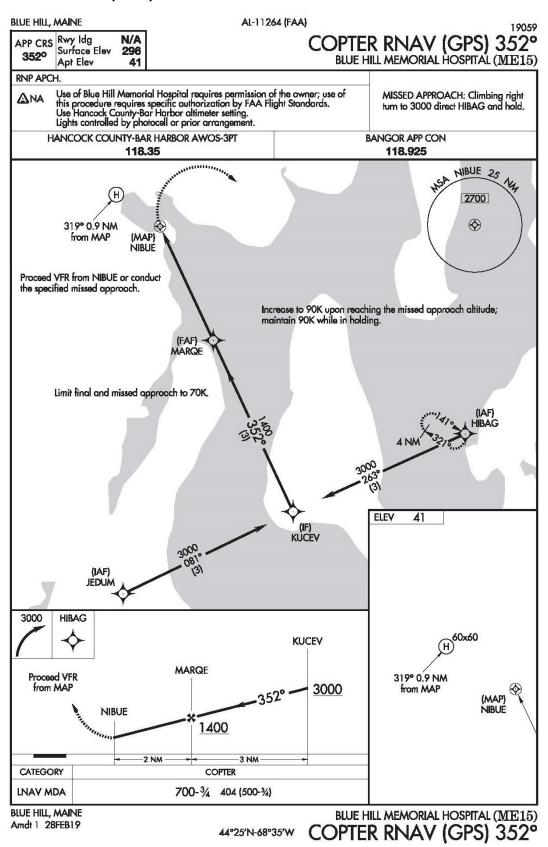
98ME RNAV(GPS)\_160

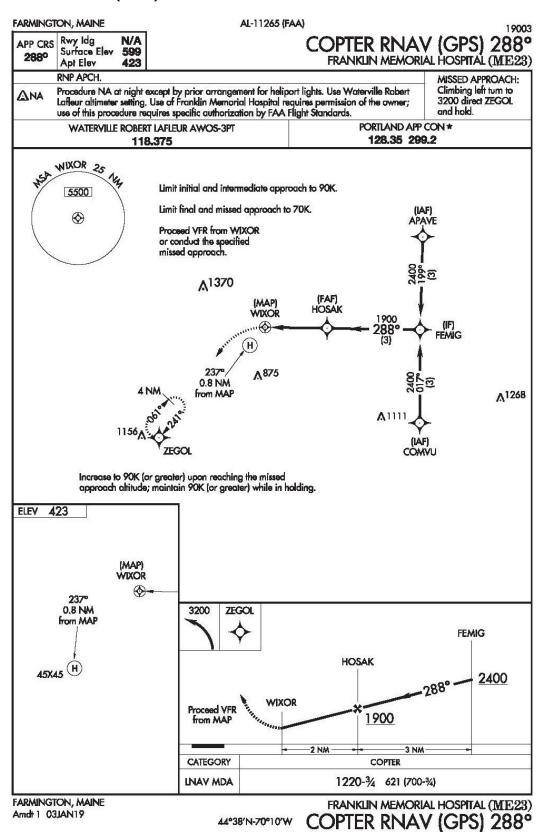


#### **ME02 - RNAV(GPS)\_317**

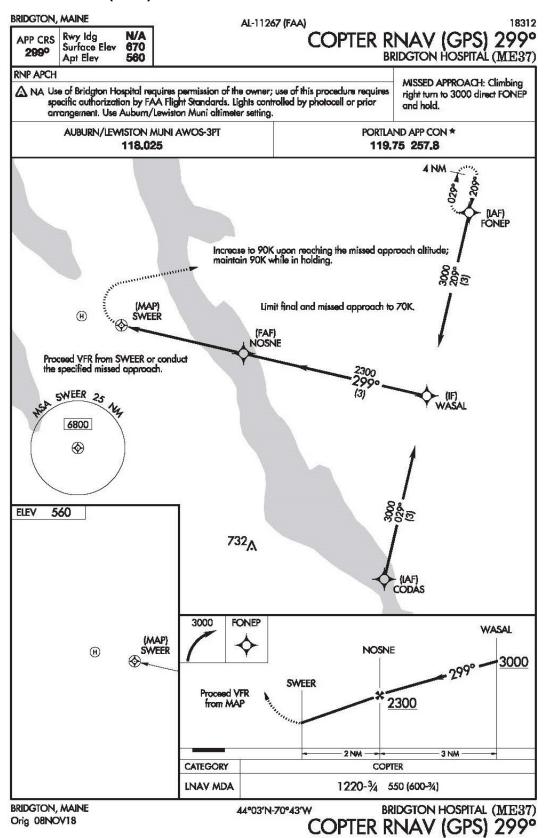


#### **ME15 - RNAV(GPS)\_352**

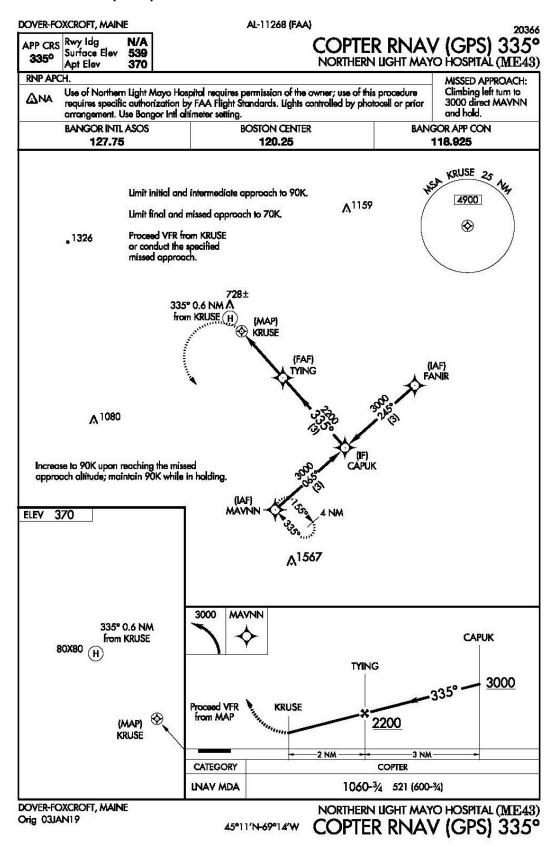


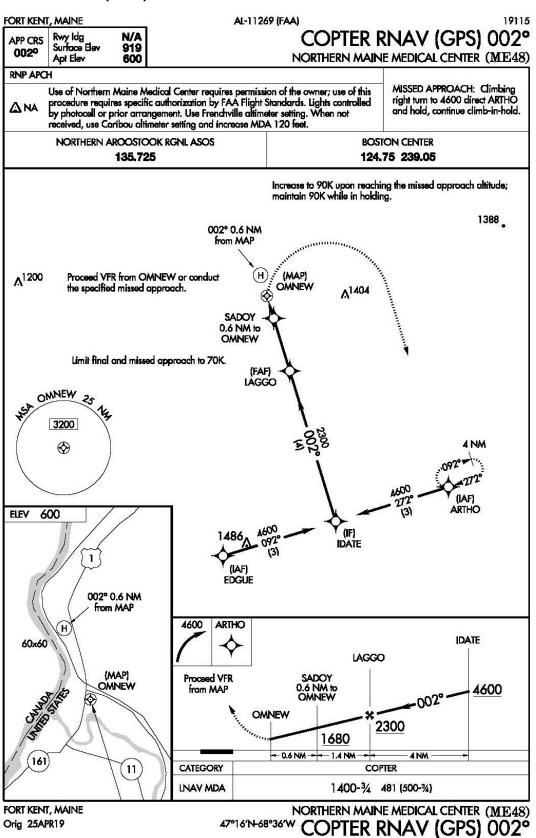


#### **ME37 - RNAV(GPS)\_299**

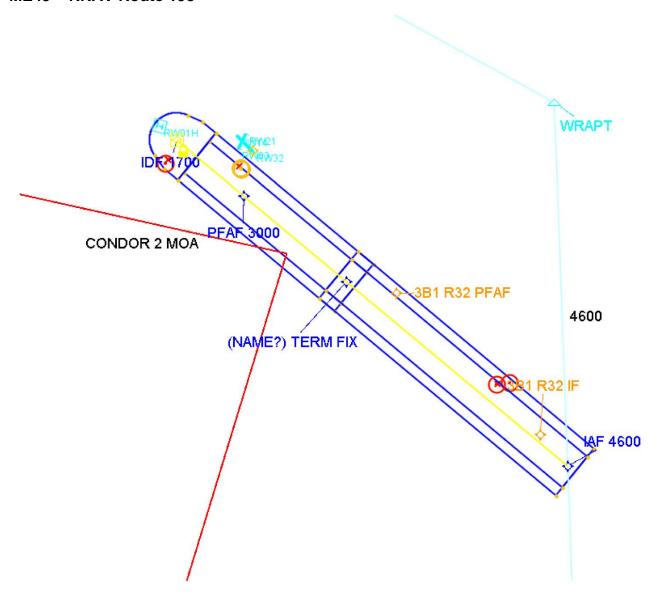


#### **ME43 - RNAV(GPS)\_335**

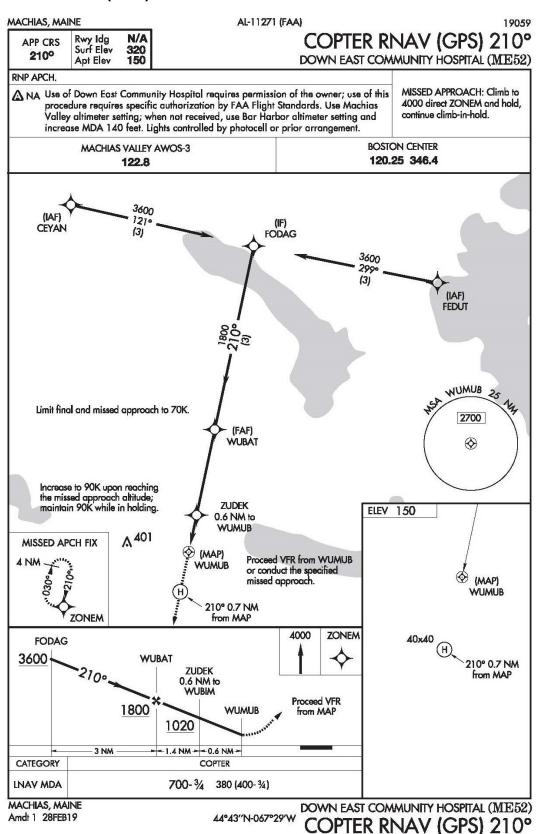


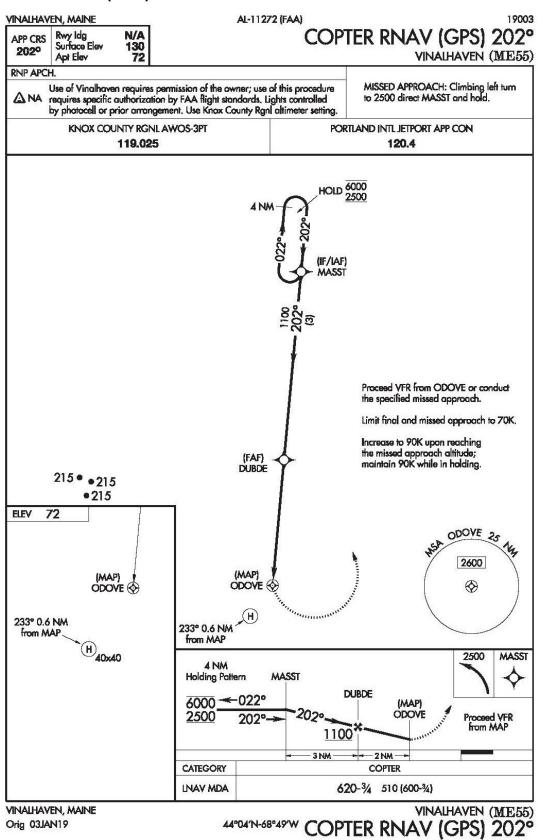


#### ME49 - RNAV Route 198

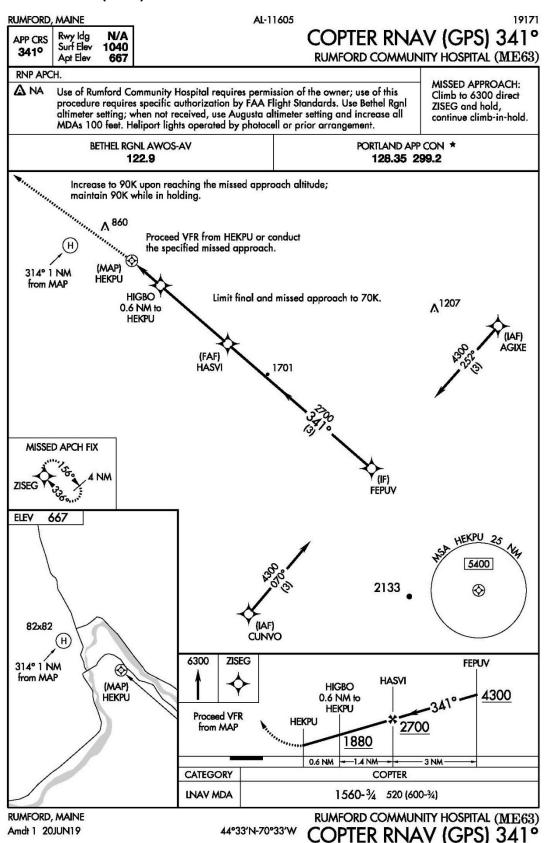


#### ME52 - RNAV(GPS)\_210

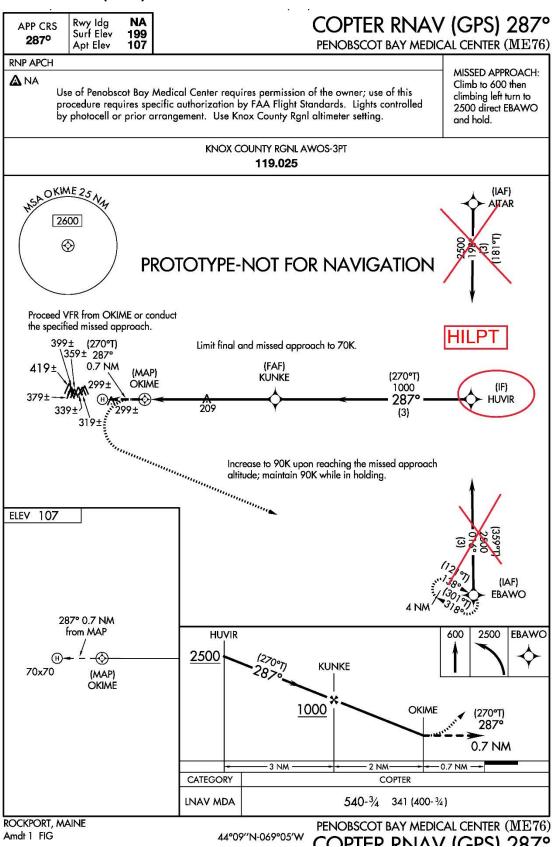




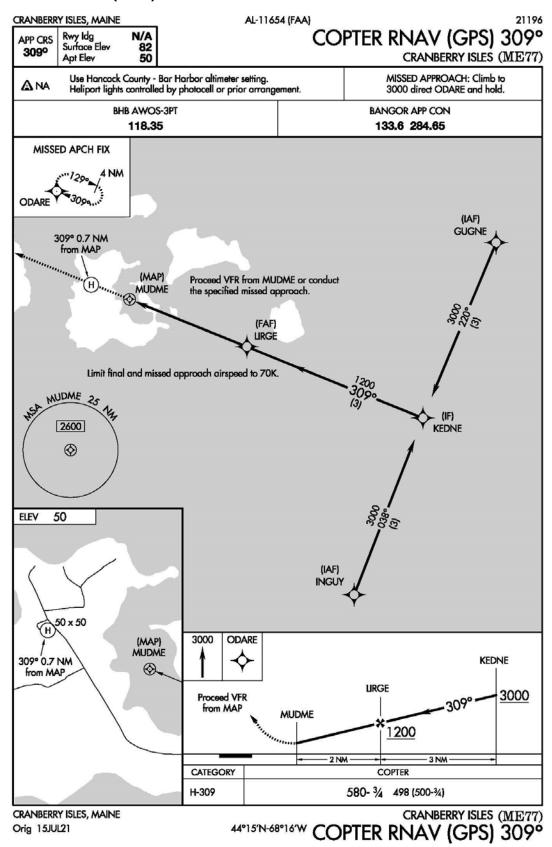
#### ME63 - RNAV(GPS)\_341



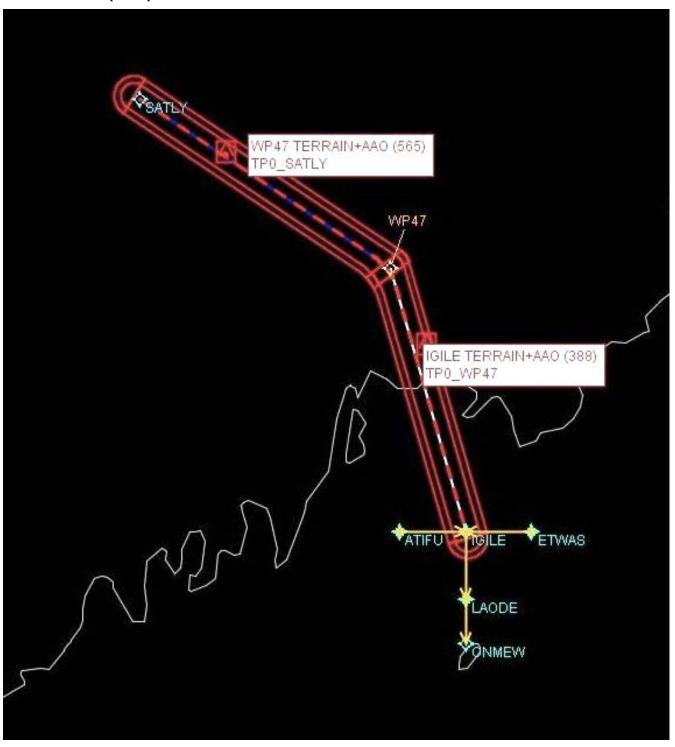
#### **ME76 - RNAV(GPS)\_287**



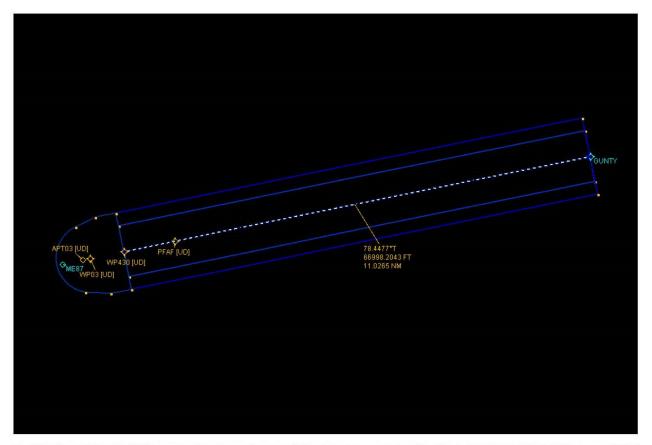
#### **ME77 - RNAV(GPS)\_309**

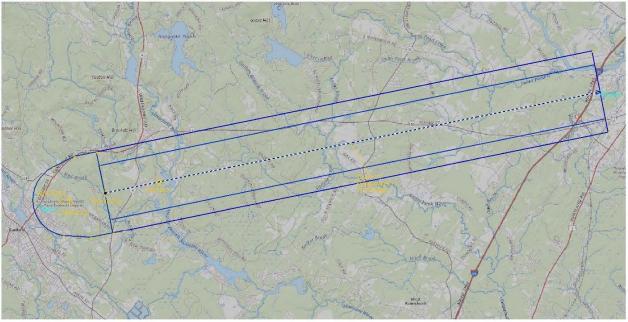


**ME78 - RNAV(GPS)\_196** 

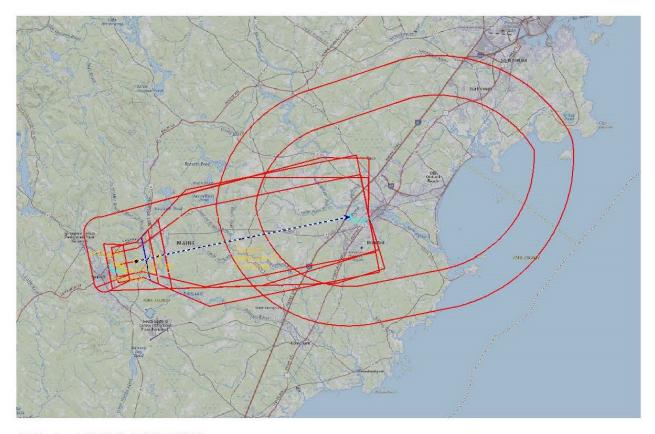


## ME87 - RNAV(GPS)\_275

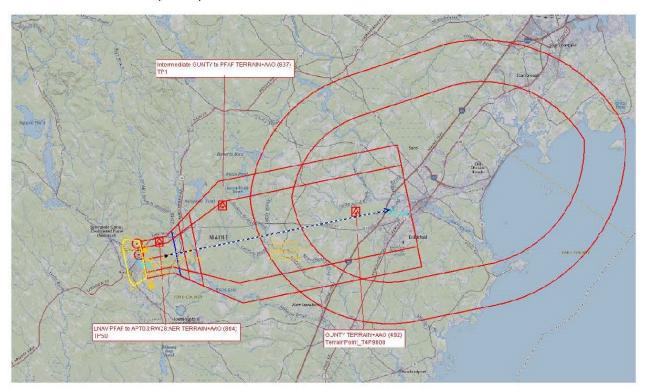




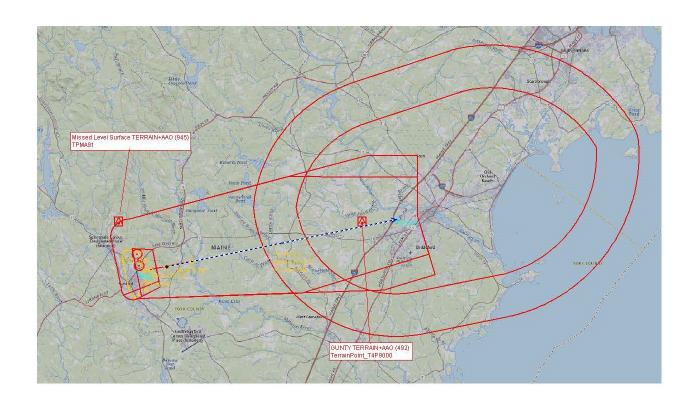
RNAV SID GUNTY DP

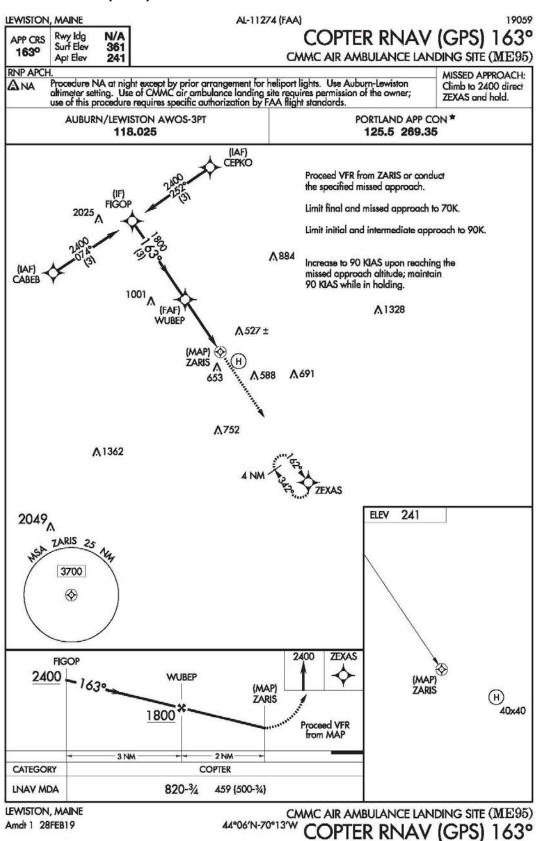


Altitude at GUNTY 1800 (ZK411)



PFAF at 1800





# 6.3 Departure IFPs 22ME – HURLA1

(HURLA1.HURLA) 21252

AL-11653 (FAA)

HURLA ONE DEPARTURE (COPTER) (RNAV)

BAR HARBOR (22ME) BAR HARBOR, MAINE

**TOP ALTITUDE:** 

**ASSIGNED BY ATC** 

BHB AWOS 3PT 118.35 BANGOR DEP CON 133.6 284.65

HALED

2100

HURLA
2100

(5)

JASOR

H

660

NOTE: Use Hancock County-Bar Harbor altimeter setting.

NOTE: GPS required. NOTE: RNAV 1.

NOTE: Pilot must ensure CDI sensitivity is set to 0.3 NM. CDI may be reset to 1.0 NM after HURLA.

NOTE: Maintain CDI sensitivity of 0.3 NM when assigned HALED transition.

NOTE: Use of Bar Harbor Heliport requires permission of the owner; use of this procedure requires specific authorization by FAA Flight Standards.

NOTE: Chart not to scale.

#### DEPARTURE ROUTE DESCRIPTION

VFR SEGMENT: VFR climb to JASOR, cross JASOR at or above 660.

IFR SEGMENT: From JASOR, track 002° to cross HURLA at or above 2100, thence . . . .

. . . . (transition) maintain ATC assigned altitude for RADAR vectors or assigned transition.

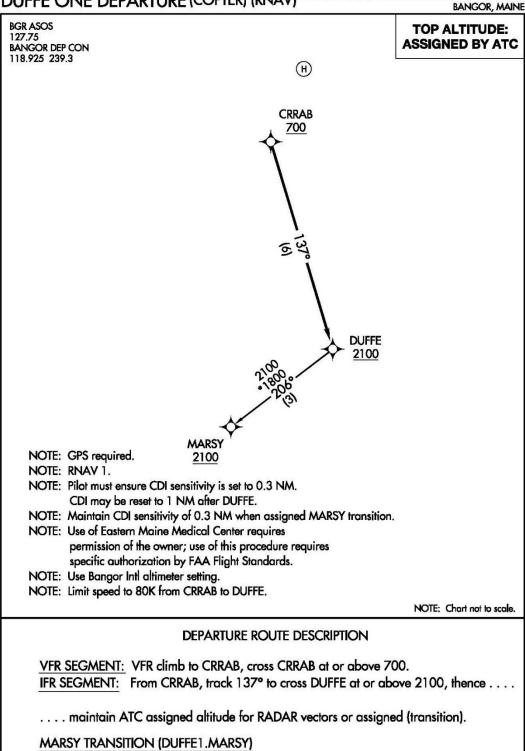
HALED TRANSITION (HURLA1.HALED)

HURLA ONE DEPARTURE (COPTER) (RNAV) (HURLA1.HURLA) 095EP21

BAR HARBOR, MAINE BAR HARBOR (22ME) (DUFFE1.DUFFE) 21252 AL-11263 (FAA)

DUFFE ONE DEPARTURE (COPTER) (RNAV) EASTERN MAINE MEDICAL CENTER (ME \$\( \text{M2} \))

BANGOR, MAINE



DUFFE ONE DEPARTURE (COPTER) (RNAV) EASTERN MAINE MEDICAL CENTER (ME \$\varrho 2) (DUFFE 1 .DUFFE) 095EP21

#### ME15 - KUCEV1

(KUCEV1.KUCEV) 19059

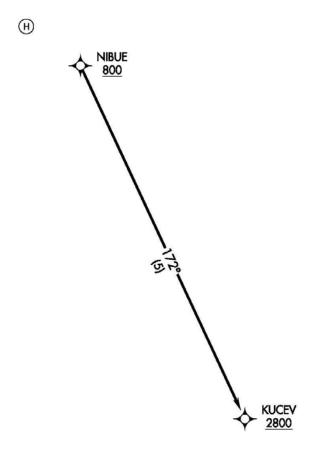
AL-11264 (FAA)

KUCEV ONE DEPARTURE (RNAV)

BLUE HILL MEMORIAL HOSPITAL (ME15) BLUE HILL, MAINE

HANCOCK COUNTY-BAR HARBOR AWOS-3PT
118.35
BANGOR DEP CON
118.925 239.3

TOP ALTITUDE:
3000



NOTE: GPS required. NOTE: RNAV 1.

NOTE: Pilot must ensure CDI sensitivity is set to 0.3 NM. CDI may be reset to 1 NM after KUCEV. NOTE: Use of Blue Hill Memorial Hospital requires permission of the owner; use of this procedure

requires specific authorization by FAA flight standards.

NOTE: Use Hancock County-Bar Harbor altimeter setting.

NOTE: Chart not to scale.

#### DEPARTURE ROUTE DESCRIPTION

VFR SEGMENT: VFR climb to NIBUE, cross NIBUE at or above 800.

IFR SEGMENT: From NIBUE on track 172° to cross KUCEV at or above 2800.

KUCEV ONE DEPARTURE (RNAV) (KUCEV1.KUCEV) 28FEB19

BLUE HILL MEMORIAL HOSPITAL (ME15)

(FEMIG1.FEMIG) 19003

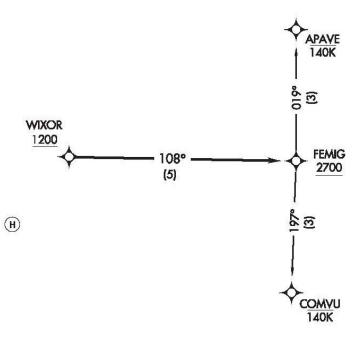
AL-11265 (FAA)

FEMIG ONE DEPARTURE (RNAV)

FRANKLIN MEMORIAL HOSPITAL (ME23) FARMINGTON, MAINE

> **TOP ALTITUDE:** 2700

WATERVILLE ROBERT LAFLEUR AWOS-3PT PORTLAND DEP CON \* 128.35 299.2



NOTE: RNAV 1 NOTE: GPS required.

NOTE: Pilot must ensure CDI sensitivity is set to 0.3 NM. CDI may be reset to 1.0 NM after FEMIG.

NOTE: Use Waterville Robert Lafleur altimeter setting.
NOTE: Use of Franklin Memorial Hospital requires permission of the owner.

use of this procedure requires specific authorization by FAA flight standards;

NOTE: Chart not to scale.

#### DEPARTURE ROUTE DESCRIPTION

VFR SEGMENT: VFR climb to WIXOR, cross WIXOR at or above 1200. IFR SEGMENT: From WIXOR, track 108° to cross FEMIG at or above 2700.

APAVE TRANSMON (FEMIG1.APAVE) COMVU TRANSMON (FEMIG1.COMVU)

FEMIG ONE DEPARTURE (RNAV) (FEMIG1.FEMIG) 03JAN19

FARMINGTON, MAINE FRANKLIN MEMORIAL HOSPITAL (ME23)

#### ME37 - WASAL1

(WASAL1.WASAL) 18312

AL-11267 (FAA)

BRIDGTON HOSPITAL (ME37) BRIDGTON, MAINE

WASAL ONE DEPARTURE (RNAV)

118.025 PORTLAND DEP CON \*

**TOP ALTITUDE:** 3000

119.75 257.8 BOSTON CENTER (when tower closed)

AUBURN/LEWISTON MUNI AWOS-3PT

128.2 263.05

(H)

**SWEER** 1300 1190 WASAL (5) 3000

NOTE: GPS required. NOTE: RNAV 1.

NOTE: Pilot must ensure CDI sensitivity is set to 0.3 NM. CDI may be reset to 1.0 NM after WASAL. NOTE: Use of Bridgton Hospital requires permission of the owner; use of this procedure requires specific authorization by FAA Flight Standards.

NOTE: Use Aubum/Lewiston Muni altimeter setting.

NOTE: Chart not to scale.

#### DEPARTURE ROUTE DESCRIPTION

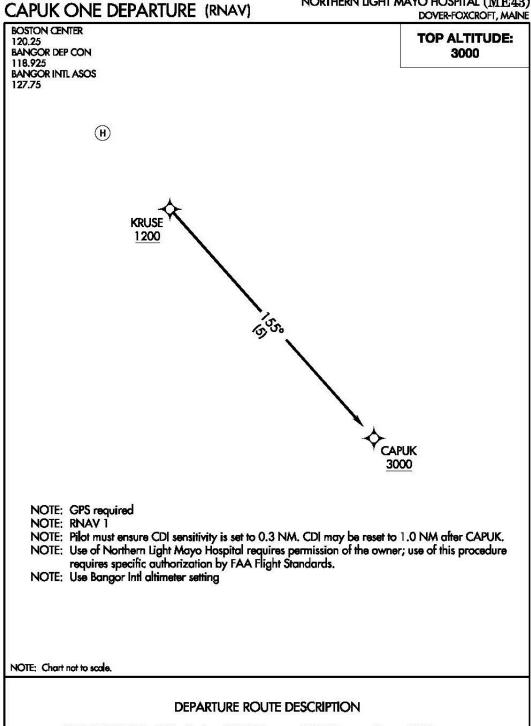
VFR SEGMENT: VFR climb to SWEER, cross SWEER at or above 1300. IFR SEGMENT: From SWEER on track 119° to cross WASAL at or above 3000.

WASAL ONE DEPARTURE (RNAV) (WASAL1.WASAL) 08NOV18

BRIDGTON, MAINE BRIDGTON HOSPITAL (ME37)

#### ME43 - CAPUK1

(CAPUK1.CAPUK) 20366 AL-11268 (FAA) NORTHERN LIGHT MAYO HOSPITAL (ME43)
CAPUK ONE DEPARTURE (RNAV) DOVER-FOXCROFT, MAINE



VFR SEGMENT: VFR climb to KRUSE, cross KRUSE at or above 1200.

IFR SEGMENT: From KRUSE, track 155° to cross CAPUK at or above 3000.

CAPUK ONE DEPARTURE (RNAV) (CAPUK1.CAPUK) 03JAN19

dover-foxcroft, maine Northern light mayo hospital (ME43)

# ME48 - IDATE1 AL-11269 (FAA) (IDATE1.IDATE) 19115 NORTHERN MAINE MEDICAL CENTER (ME48) IDATE ONE DEPARTURE (RNAV) FORT KENT, MAINE NORTHERN AROOSTOOK RGNL ASOS 135.725 BOSTON DEP CON 124.75 239.05 **TOP ALTITUDE:** 4600 (H) **OMNEW** 1600 IDATE 4600 NOTE: GPS required. NOTE: RNAV 1. NOTE: Pilot must ensure CDI sensitivity is set to 0.3 NM. CDI may be reset to 1.0 NM after IDATE. NOTE: Use of Northern Maine Medical Center requires permission of the owner; use of this procedure requires specific authorization by FAA Flight Standards. NOTE: Use Frenchville altimeter setting. When not received, use Caribou altimeter setting and cross IDATE at or above 1700. NOTE: Chart not to scale.

# DEPARTURE ROUTE DESCRIPTION

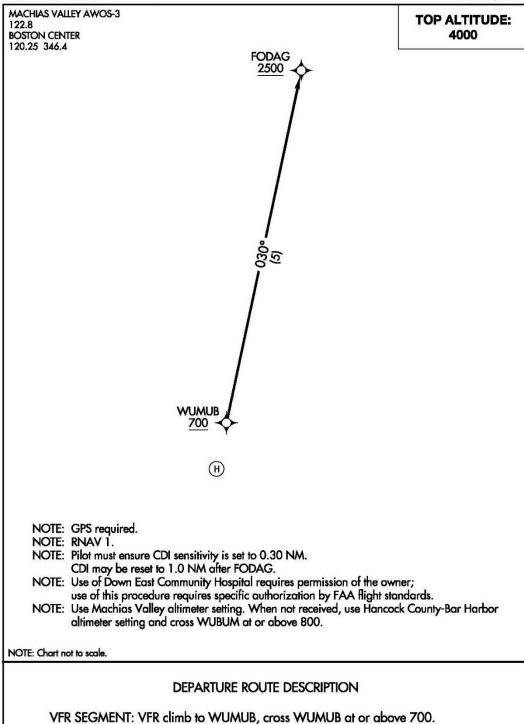
<u>VFR SEGMENT:</u> VFR climb to OMNEW, cross OMNEW at or above 1600. IFR SEGMENT: From OMNEW, track 182° to cross IDATE at or above 4600.

IDATE ONE DEPARTURE (RNAV) (IDATE) JOATE) 25APR19

FORT KENT, MAINE NORTHERN MAINE MEDICAL CENTER (ME48)

(FODAG1.FODAG) 19059 FODAG ONE (RNAV) AL-11271 (FAA)

DOWN EAST COMMUNITY HOSPITAL (ME52) MACHIAS, MAINE



IFR SEGMENT: From WUMUB on track 030° to cross FODAG at or above 2500.

FODAG ONE (RNAV) (FODAG1.FODAG) 28FEB19 MACHIAS, MAINE DOWN EAST COMMUNITY HOSPITAL (ME52)

(MASST1.MASST) 19003

AL-11272 (FAA)

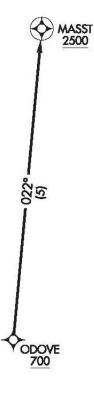
## MASST ONE DEPARTURE (RNAV)

VINALHAVEN (ME55) VINALHAVEN, MAINE

KNOX COUNTY RGNL AWOS-3PT

BANGOR DEP CON 118.925

**TOP ALTITUDE:** 2500



(H)

NOTE: GPS required. NOTE: RNAV 1.

NOTE: Pilot must ensure CDI sensitivity is set to 0.3 NM. CDI may be reset to 1,0 NM after MASST.

NOTE: Use of Vinalhaven requires permission of the owner;

use of this procedure requires specific authorization by FAA flight standards.

NOTE: Use Knox County Rgnl altimeter setting.

NOTE: Chart not to scale.

#### DEPARTURE ROUTE DESCRIPTION

VFR SEGMENT: VFR climb to ODOVE, cross ODOVE at or above 700. IFR SEGMENT: From ODOVE, track 022° to cross MASST at or above 2500.

MASST ONE DEPARTURE (RNAV) (MASSTI .MASST) 03JAN19

VINALHAVEN, MAINE VINALHAVEN (ME55)

#### ME63 - FEPUV1

(FEPUV1.FEPUV) 19171

AL-11605 (FAA)

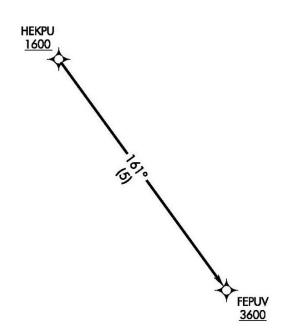
FEPUV ONE DEPARTURE (RNAV)

RUMFORD COMMUNITY HOSPITAL (ME63) RUMFORD, MAINE

BETHEL RGNL AWOS-AV 122.9 PORTLAND DEP CON \* 128.35 299.2 BOSTON CENTER 128.2 263.05

**TOP ALTITUDE:** 5700

 $\oplus$ 



NOTE: GPS required. NOTE: RNAV 1.

NOTE: Pilot must ensure CDI sensitivity is set to 0.3 NM.

CDI may be reset to 1 NM after FEPUV.

NOTE: Use of Rumford Community Hospital requires permission of the owner; use of this procedure requires specific authorization by FAA flight standards.

NOTE: Use Bethel altimeter setting. When not received, use Augusta altimeter setting

and cross HEKPU at or above 1700.

NOTE: Chart not to scale.

#### DEPARTURE ROUTE DESCRIPTION

VFR SEGMENT: VFR climb to HEKPU, cross HEKPU at or above 1600. IFR SEGMENT: From HEKPU, track 161° to cross FEPUV at or above 3600.

FEPUV ONE DEPARTURE (RNAV) (FEPUV1.FEPUV) 20JUN19

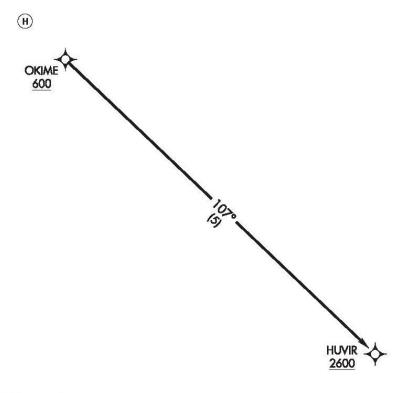
RUMFORD, MAINE RUMFORD COMMUNITY HOSPITAL (ME63)

#### ME76 - HUVIR1

(HUVIR1.HUVIR) 19003 HUVIR ONE DEPARTURE (RNAV)

PENOBSCOT BAY MEDICAL CENTER (ME76) ROCKPORT, MAINE

KNOX COUNTY RGNL AWOS-3PT **TOP ALTITUDE:** 119.025 PORTLAND DEP CON \* 3000 120.4 299.2 BOSTON CENTER 120.25 346.4



NOTE: GPS required.

NOTE: RNAV 1.

NOTE: Pilot must ensure CDI sensitivity is set to 0.3 NM. CDI may be reset to 1.0 NM after HUVIR. NOTE: Use of Penobscot Bay Medical Center requires permission of the owner;

use of this procedure requires specific authorization by FAA flight standards.

NOTE: Use Knox County Rgnl altimeter setting.

NOTE: Chart not to scale.

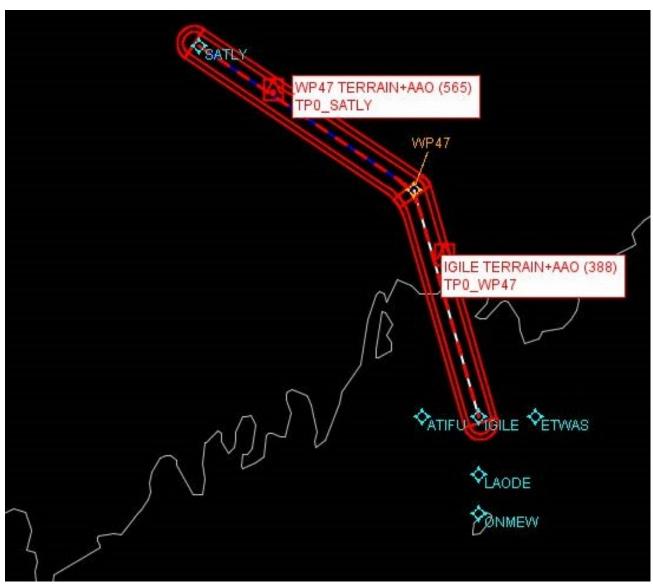
#### DEPARTURE ROUTE DESCRIPTION

VFR SEGMENT: VFR climb to OKIME, cross OKIME at or above 600. IFR SEGMENT: From OKIME, track 107° to cross HUVIR at or above 2600.

HUVIR ONE DEPARTURE (RNAV) (HUVIR1.HUVIR) 03JAN19

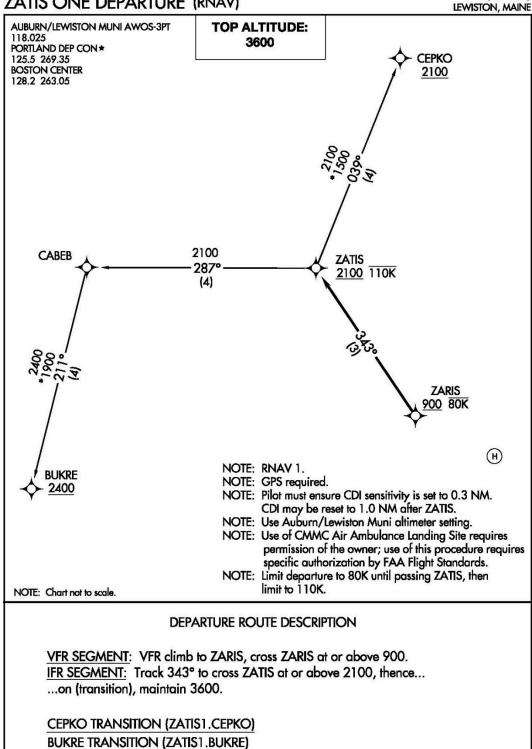
ROCKPORT, MAINE PENOBSCOT BAY MEDICAL CENTER (ME76)

### **ME78 – IGILE1**



#### ME95 - ZATIS1

# (ZATIS1.ZATIS) 19059 AL-11274 (FAA) ZATIS ONE DEPARTURE (RNAV) CMMC AIR AMBULANCE LANDING SITE (ME95)



ZATIS ONE DEPARTURE (RNAV)

LEWISTON, MAINE CMMC AIR AMBULANCE LANDING SITE (ME95)

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# Instrument Flight Procedures Low-level Helicopter System (ILHS) to support Helicopter Air Ambulance (HAA)

# AEDT User-Defined Profile Submission – User-Defined Profiles August 5, 2022

# **Prepared for:**



Prepared by: ATAC Corporation



2770 De La Cruz Boulevard Santa Clara, CA 94050



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### 1 Introduction

## 1.1 Background & Purpose

This submittal contains data and information describing the use and implementation of user-defined profiles in the Federal Aviation Administration (FAA)'s Aviation Environmental Design Tool (AEDT). AEDT is a comprehensive software tool that provides aircraft noise, fuel burn, and emissions information to the FAA and its stakeholders. AEDT facilitates environmental review activities required under the National Environmental Policy Act (NEPA) by consolidating the modeling of these environmental impacts in a single tool. Use of non-default methods or data for environmental analysis of FAA actions generally requires written approval from the FAA's Office of Environment and Energy (AEE). AEDT provides prepackaged default profiles that are appropriate for most studies. In certain situations, user-defined profiles are required.

The purpose of this submittal is to seek approval of a methodology of creating user-defined helicopter profiles to model environmental consequences for a project attempting to establish formal airspace procedures for commonly flown helicopter routes for Instrument Flight Procedures Low-level Helicopter System (ILHS) to support Helicopter Air Ambulance (HAA) operations. The request for approval is limited to the methodology for creating helicopter profiles mentioned in this submittal in support of this project. A previous request for this effort was submitted December 14, 2021 and approved on January 31, 2022. However, the previous submission and subsequent approval specified a cruising altitude of 2,000 feet Mean Sea Level (MSL) and cruising speed of 145 knots. Due to changing project scope and needs, this request seeks approval for a methodology to develop helicopter user-defined profiles for a range of cruising altitudes (1500 to 5200 feet MSL) and speeds (130 to 170 knots ground speed) as defined by Subject Matter Experts (SMEs). The overall methodology would remain the same as it was defined from the previous request.

LifeFlight of Maine is a nonprofit service that is jointly operated by Northern Light Health and Central Maine Healthcare. LifeFlight of Maine brings lifesaving equipment and critical care nurses and paramedics to emergency scenes and small, rural hospitals throughout the state.<sup>1</sup>

This submittal follows the guidance that was put forth in the FAA document titled *Guidance on Using the Aviation Environmental Design Tool (AEDT) to Conduct Environmental Modeling for FAA Actions Subject to NEPA*<sup>2</sup>. Section 5.3.2 from the AEDT guidance document outlines the additional information to include in the submittal package when requesting the use of user-defined profiles.

This submittal includes a statement of the problem, the proposed solution, an explanation of the methodology, and then follows the outline of additional information to include specified in Section 5.3.2 of the FAA guidance document. This submittal does not include some or all information for the following items because they are not applicable under the conditions of this request:

- #1 Analysis Demonstrating Change: This section is included, but lacks receptors representing noise sensitive areas. Existing receptors should adequately represent noise impacts; however, additional receptors can be considered if appropriate.
- #2 Concurrence on Aircraft Performance
- #4 Graphical and Tabular Comparison, subsection C regarding thrust: There are no thrust
  calculations for helicopter flight paths and therefore graphs and tables for thrust data is not
  included in this submittal.

<sup>&</sup>lt;sup>1</sup> https://www.lifeflightmaine.org/About-Us/Mission.aspx. Accessed on December 1, 2021.

<sup>&</sup>lt;sup>2</sup> Federal Aviation Administration. *Guidance on Using the Aviation Environmental Design Tool (AEDT) to Conduct Environmental Modeling for FAA Actions Subject to NEPA*, Retrieved from https://aedt.faa.gov/2d\_information.aspx on May 30, 2018.



#### 1.2 Problem Statement

In AEDT, helicopter profiles are defined as a set of pre-determined, static procedure steps that compose a flight profile. Helicopter profiles exist for combinations of different helicopter and operation types (e.g., 'A109' helicopter type, 'Arrival' operation type). In AEDT 3d, helicopter profiles exist for the intended helicopter type to be modeled, AgustaWestland A-109.

The existing set of helicopter profiles do not adequately represent profiles on the designed helicopter procedures. In general, existing AEDT helicopter profiles do not reach the typical cruising altitude and distance of the new procedures. When standard profiles are deemed inappropriate for a study, AEE requires users to submit a request to use user-defined profiles. As the existing helicopter profiles are inappropriate, a solution to accurately model these operations must be explored.

### 1.3 Proposed Solution

ATAC proposes to construct profiles for A109 operations by adjusting existing departure and arrival profiles (and procedure steps) such that cruise segments are modeled at subject matter expert (SME) approved altitudes and speeds. ATAC works with SMEs to confirm that all targeted cruising altitudes and speeds are realistic for each route.

Depending on the origin and destination pair of the route, profile cruise distance is calculated to partition the route at the halfway point. Additionally, climb and descent angles of existing profiles are maintained. Section **2.3** details a step-by-step explanation of the proposed solution methodology that solves the problem identified in Section **1.2**.

To model A109 operations, ATAC proposes to use non-default AEDT data in the form of user-defined helicopter procedure steps. All other data (including NPD data) necessary for AEDT to model helicopter performance, emissions, and noise will come from HELO\_ID "A109."

#### 1.4 Statement of Benefit

Implementing the proposed solution in Section **1.3** allows for A109 operations to be modeled to a more satisfactory level in order to better measure the noise levels of the proposed procedures.

# 2 Methodology

This section presents the methodology used to create user-defined profiles for A109 operations supporting the ILHS HAA project.

# 2.1 Flight Trajectory Partition

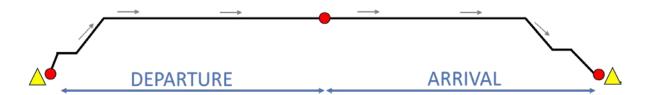
A flight can be partitioned as a departure from an origin and an arrival to a destination. Partitioning a flight in this manner makes modeling helicopter operations in AEDT simpler as rules exist governing the definition of operation types and sequencing of procedure steps. As a result, each flight is partitioned into two trajectories based on operation type: (1) departure and (2) arrival.

Flight trajectories are partitioned into two by splitting the track at a calculated location. The location of the split is calculated by dividing cumulative trajectory ground distance by 2 and placing an interpolated track point at the resulting location. The departure flight trajectory begins at the origin heliport and terminates at this calculated point. The arrival flight trajectory begins at the calculated point and terminates at the destination heliport. **Figure 1** depicts the partitioning of flight trajectories from a profile view. The yellow triangles represent origin and destination airports. The red circles represent flight trajectory end points. Grey arrows indicate direction of travel.



Figure 1 Flight Trajectory Partitioning

#### PROFILE VIEW



### 2.2 Default Profiles and Procedure Steps

After flight trajectories are partitioned, a profile for each is created. Creating profiles begins with the default helicopter procedure steps contained within AEDT for an A109 departure and an A109 arrival. This data can be found in the [FLT\_ANP\_HELICOPTER\_PROCEDURES] table in the FLEET database. The fields in this table are:

- STEP\_NUM Defines the order of procedure steps
- HELO\_ID Helicopter type
- OP\_TYPE Operation type; 'A' = Arrival, 'D' = Departure
- PROF\_ID1 Primary profile name
- PROF\_ID2 Secondary profile name
- STEP\_TYPE Encoded step definition, see Appendix A AEDT Helicopter Procedure Step Definitions
- DURATION Duration of step in seconds
- DISTANCE 2-D distance of step in feet
- ALTITUDE Elevation of step in feet referenced to the airfield (AFE)
- SPEED Groundspeed of step in knots

**Table 1** contains the procedure steps for the default profile of an A109 arrival. Cells shaded grey indicate values edited when creating user-defined profiles.

Table 1 Default A109 Arrival Helicopter Procedure Steps

STEP_NUM	HELO_ID	OP_TYPE	PROF_ID1	PROF_ID2	STEP_TYPE	DURATION	DISTANCE	ALTITUDE	SPEED
1	A109	Α	STANDARD	1	S	0	0	1000	116
2	A109	Α	STANDARD	1	L	0	87250	0	0
3	A109	Α	STANDARD	1	В	0	5000	0	60
4	A109	Α	STANDARD	1	Α	0	4800	500	0
5	A109	Α	STANDARD	1	С	0	2850	15	0
6	A109	Α	STANDARD	1	Υ	3	0	0	0
7	A109	Α	STANDARD	1	Н	30	0	0	0
8	A109	Α	STANDARD	1	G	30	0	0	0

Source: AEDT Version 3d, FLEET Database Version 3.40.6, FLT\_ANP\_HELICOPTER\_PROCEDURES table

Prepared by: ATAC, December 2021



**Table 2** contains the procedure steps for the default profile of an A109 departure. Cells shaded grey indicate values edited when creating user-defined profiles.

Table 2 Default A109 Departure Helicopter Procedure Steps

STEP_NUM	HELO_ID	OP_TYPE	PROF_ID1	PROF_ID2	STEP_TYPE	DURATION	DISTANCE	ALTITUDE	SPEED
1	A109	D	STANDARD	1	G	30	0	0	0
2	A109	D	STANDARD	1	Н	30	0	0	0
3	A109	D	STANDARD	1	٧	3	0	15	0
4	A109	D	STANDARD	1	Е	0	100	0	30
5	A109	D	STANDARD	1	F	0	500	30	60
6	A109	D	STANDARD	1	D	0	3500	1000	0
7	A109	D	STANDARD	1	Е	0	2800	0	116
8	A109	D	STANDARD	1	L	0	93100	0	0

Source: AEDT Version 3d, FLEET Database Version 3.40.6, FLT\_ANP\_HELICOPTER\_PROCEDURES table

Prepared by: ATAC, December 2021

## 2.3 User-defined Profiles and Procedure Steps

This section describes how a user-defined profile (and procedure steps) are created to solve the problem identified in Section **1.2**. Although certain procedure steps are common between operation types, the procedure steps for each are different enough that they warrant their own sections. This section uses a cruise altitude of 2,000 feet above mean sea level (MSL) and speed of 145 knots (kn) in this section; however, ATAC will use the appropriate SME-approved cruising altitude and speed for each route. For the purpose of this request, the modeled cruising altitudes for each route will be between a range of 1500 to 5200 feet MSL. Similarly, the modeled cruising speeds for each route will be between a range of 130 to 170 knots ground speed.

#### 2.3.1 Arrival

This section presents the methodology used to create a user-defined arrival A109 profile in support of this project by creating a new set of procedure steps.

- 1. Copy existing values from correct [FLT\_ANP\_HELICOPTER\_PROFILES] record, edit value of PROF\_ID1 field, and insert new record into table.
- 2. Copy existing values from correct [FLT\_ANP\_HELICOPTER\_PROCEDURES] records and insert new records into table.
- 3. Edit values of newly inserted records into [FLT\_ANP\_HELICOPTER\_PROCEDURES] table:
  - a. Identify elevation of operating runway end/helipad
  - b. Calculate cruise altitude, in feet, referenced to operating runway end/helipad elevation to achieve a cruise altitude of 2,000 ft MSL using equation:

$$Elevation_{ARE} = Elevation_{MSL} - Elevation_{RE}$$

where

Elevation<sub>ARE</sub> elevation in feet above operating runway end/helipad

 $Elevation_{MSL}$  elevation in feet above mean sea level

Elevation<sub>RF</sub> elevation in feet of operating runway end/helipad



Store calculated  $Elevation_{ARE}$  value in ALTITUDE field of STEP\_NUM '1'. Set SPEED field value to '145' of STEP\_NUM '1'.

- c. Calculate DISTANCE value of STEP\_NUM '4'. Value is calculated keeping descent rate equal to that of default profile. Descent rate of default step of 0.10416667 vertical feet per horizontal foot ((1000 500) / 4800) (see **Table 1**).
  - i. Calculate vertical distance to descend by subtracting ALTITUDE value in STEP\_NUM '1' by ALTITUDE in STEP\_NUM '4'.
  - ii. Solve for DISTANCE in STEP\_NUM '4' by dividing calculated vertical distance value by descent rate.
  - iii. Store solved for value in DISTANCE field of STEP\_NUM '4'.
- d. Calculate DISTANCE value level cruise step (STEP\_TYPE 'L') of STEP\_NUM '2'.
  - i. Calculate cumulative flight trajectory distance. Divide by 2.
  - ii. Subtract from it, the cumulative distance from all subsequent steps.
  - iii. Store solved for value in DISTANCE field of STEP\_NUM '2'.

### 2.3.2 Departure

This section presents the methodology used to create a user-defined departure A109 profile in support of this project by creating a new set of procedure steps.

- 1. Copy existing values from correct [FLT\_ANP\_HELICOPTER\_PROFILES] record, edit value pf PROF\_ID1 field, and insert new record into table.
- 2. Copy existing values from correct [FLT\_ANP\_HELICOPTER\_PROCEDURES] records and insert new records into table.
- 3. Edit values of newly inserted records into [FLT\_ANP\_HELICOPTER\_PROCEDURES] table:
  - a. Identify elevation of operating runway end/helipad
  - b. Calculate cruise altitude, in feet, referenced to operating runway end/helipad elevation to achieve a cruise altitude of 2,000 ft MSL using equation:

$$Elevation_{ARE} = Elevation_{MSL} - Elevation_{RE}$$

#### where

Elevation in feet above operating runway end/helipad

 $Elevation_{MSL}$  elevation in feet above mean sea level

Elevation elevation in feet of operating runway end/helipad

Store *Elevation*<sub>ARE</sub> value in ALTITUDE field of STEP\_NUM '6'.

- c. Calculate DISTANCE value of STEP\_NUM '6'. Value is calculated keeping ascent rate of this step equal to that of default profile for the given step. Ascent rate of default step is 0.277143 vertical feet per horizontal foot ((1000 30) / 3500) (see **Table 2**).
  - i. Calculate vertical distance to ascend by subtracting ALTITUDE value in STEP\_NUM '6' by ALTITUDE in STEP\_NUM '5'
  - ii. Solve for DISTANCE in STEP\_NUM '6' by dividing calculated vertical distance value by ascent rate.



- iii. Store solved for value in DISTANCE field of STEP\_NUM '6'.
- d. Set value of SPEED field to '145' for STEP NUM '7'.
- e. Calculate DISTANCE value level cruise step (STEP\_TYPE 'L') of STEP\_NUM '8'.
  - i. Calculate cumulative flight trajectory distance. Divide by 2.
  - ii. Subtract from it, the cumulative distance from all previous steps.
  - iii. Store solved for value in DISTANCE field of STEP\_NUM '8'.

# 3 Analysis Demonstrating Change

As outlined in Section 5.3.2 of the "Guidance on Using the Aviation Environmental Design Tool (AEDT) to Conduct Environmental Modeling for FAA Actions Subject to NEPA" document, noise results user-defined profiles should be reported by placing noise receptors 0.5 nautical miles (NM) apart underneath the flight path. This section presents an example scenario of implementing the methodology defined in Section 2.3 followed by the noise results comparing the default and user-defined profiles applied to the example scenario. Similar to previous sections, data presented in this section uses a cruise altitude of 2,000 ft MSL and speed of 145 kn; however, ATAC will use the appropriate SME-approved cruising altitude and speed for each route. For the purpose of this request, the modeled cruising altitudes for each route will be between a range of 1500 to 5200 feet MSL. Similarly, the modeled cruising speeds for each route will be between a range of 130 to 170 knots ground speed.

### 3.1 Example Scenario Definition

A flight track departing Eastern Maine Medical Center Heliport (ME02) and arriving to Northern Maine Medical Center Heliport (ME48) is created. This flight is partitioned into 2 trajectories according to the methodology in Section **2.1**. Each partitioned trajectory is assigned an AgustaWestland A-109 (HELO\_ID "A109") aircraft type with an operation count of "1.0". Annualizations for all scenarios and cases were set to "1.0".

Figure 2 is a map displaying both ME02 and ME48 as orange triangles as well as the trajectory as a yellow line.





Figure 2 Scenario Trajectory Image

Source: OpenStreetMap; ATAC, December 2021

Prepared by: ATAC, December 2021

All data presented from this point forward was generated from this example trajectory.

## 3.2 Comparative Noise Results

As a part of this submittal, noise results are reported by placing noise receptors 0.5 NM apart underneath the flight path beginning from the helipad until 10 NM was reached. Noise results for each of the profiles are presented in tabular and graphical format. It is noted that noise results were not computed with terrain effects.

**Table 3** presents the noise levels, using the Sound Exposure Level (SEL) metric measured in decibels (dB), of the arrival default (see **Table 1**) and user-defined (see **Table 5**) profiles. Additionally, the starting weight of the aircraft in pounds (lbs) is presented.

**AEDT Helicopter Model: A109** Profile Weight: 5,730 lbs **User-Defined Profile** Receptors **AEDT Default Profile Difference** (NM) (SEL dB) (SEL dB) (SEL dB) 0.0 104.96 104.96 0.00 0.5 94.32 94.32 0.00 1.0 91.90 92.12 0.22 1.5 89.67 90.36 0.69 87.43 87.87 0.44 2.0 2.5 85.11 85.51 0.40 3.0 84.99 85.94 0.95 3.5 84.98 85.78 0.80 4.0 84.98 85.77 0.79 0.79 4.5 84.97 85.76 85.76 84.97 0.79 5.0

**Table 3 Example Scenario Comparative Arrival Noise Results** 



AEDT Helicopter Model: A109		Profile Weight: 5,730 lbs	
Receptors	AEDT Default Profile	User-Defined Profile	Difference
5.5	84.97	85.76	0.79
6.0	84.97	85.76	0.79
6.5	84.97	85.76	0.79
7.0	84.97	85.76	0.79
7.5	84.97	85.76	0.79
8.0	84.97	85.76	0.79
8.5	84.97	85.76	0.79
9.0	84.97	85.76	0.79
9.5	84.97	85.76	0.79
10.0	84.97	85.76	0.79

It can be observed from **Table 3** that small differences in noise levels do exist between arrival default and user-defined profiles.

**Table 4** presents the noise levels, using SEL metric measured dB, of the departure default (see **Table 2**) and user-defined (see **Table 6**) profiles. Additionally, the starting weight of the aircraft in pounds is presented.

**Table 4 Example Scenario Comparative Departure Noise Results** 

AEDT Helicopter Model: A109		Profile Weigh	nt: 5,730 lbs
Receptors	AEDT Default Profile	User-Defined Profile	Difference
(NM)	(SEL dB)	(SEL dB)	(SEL dB)
0.0	108.86	108.86	0.00
0.5	87.30	87.29	-0.01
1.0	83.02	82.81	-0.21
1.5	84.66	80.24	-4.42
2.0	84.53	83.68	-0.85
2.5	84.52	83.61	-0.91
3.0	84.52	83.59	-0.93
3.5	84.52	83.59	-0.93
4.0	84.51	83.59	-0.92
4.5	84.51	83.58	-0.93
5.0	84.51	83.58	-0.93
5.5	84.51	83.58	-0.93
6.0	84.51	83.58	-0.93
6.5	84.51	83.58	-0.93
7.0	84.51	83.58	-0.93
7.5	84.51	83.58	-0.93
8.0	84.51	83.58	-0.93
8.5	84.51	83.58	-0.93
9.0	84.51	83.58	-0.93
9.5	84.51	83.58	-0.93
10.0	84.51	83.58	-0.93

Source: ATAC, December 2021 Prepared by: ATAC, December 2021



It can be observed from **Table 4** that small differences in noise levels do exist between departure default and user-defined profiles.

### 4 Performance Characteristics

As outlined in Section 5.3.2 of the "Guidance on Using the Aviation Environmental Design Tool (AEDT) to Conduct Environmental Modeling for FAA Actions Subject to NEPA" document, aircraft performance characteristics must be correctly translated into the AEDT formatted profile. This section combines the example scenario defined in Section 3.1 with the methodology to create user-defined profiles in Section 2.3 to produce the user-defined profiles and procedure steps for the example scenario. This section contains sub-sections for each operation type and walks through the methodology in Section 2.3 step-by-step and presents the resulting user-defined profile and procedure steps. Similar to previous sections, data presented in this section uses a cruise altitude of 2,000 ft MSL and speed of 145 kn; however, ATAC will use the appropriate SME-approved cruising altitude and speed for each route. For the purpose of this request, the modeled cruising altitudes for each route will be between a range of 1500 to 5200 feet MSL. Similarly, the modeled cruising speeds for each route will be between a range of 130 to 170 knots ground speed.

#### 4.1 Arrival

This section applies the methodology of creating an arrival user-defined profile (see Section 2.3.1) for the example scenario and presents the resulting procedure steps.

### 4.1.1 Example

This section walks through creating of a user-defined arrival profile and procedure steps for the example scenario.

- 1. Copy existing values from [FLT\_ANP\_HELICOPTER\_PROFILES] where HELO\_ID = 'A109' and OP\_TYPE = 'A'. Set PROF\_ID1 to unique value based on route and insert record into table.
- 2. Copy existing values from [FLT\_ANP\_HELICOPTER\_PROCEDURES] where HELO\_ID = 'A109' and OP\_TYPE = 'A'. For all records, set PROF\_ID1 equal to unique value and insert into table.
- 3. Edit values in [FLT\_ANP\_HELICOPTER\_PROCEDURES] table:
  - a. Elevation of 'H1' helipad at ME48 = 600
  - b. Cruise Elevation = 1400 (1400 = 2000 600)
    - Store '1400' in ALTITUDE field of STEP\_NUM '1'. Set SPEED field value to '145' of STEP\_NUM '1'.
  - c. DISTANCE value of STEP NUM '4' = '8,907.2165'
    - i. Vertical distance to descend = 900 (900 = 1400 500)
    - ii. Distance = 8,640 (8,640= 900 / 0.10416667)
    - iii. Store '8,640' in DISTANCE field of STEP NUM '4'.
  - d. DISTANCE value level cruise step (STEP TYPE 'L') of STEP NUM '2' = '431,805.93'
    - i. Cumulative flight trajectory distance (ft) = 897,126.3. Divide by 2 = 448,563.15 (448,563.15 = 897,126.3 / 2).
    - ii. Cumulative distance of all subsequent steps = 16,490 (16,490 = 5000 + 8640 + 2850). Subtract it from 448,563.15 = 431,805.93 (432,073.15 = 448,563.15 16,490)



iii. Store '432,073.15' in DISTANCE field of STEP\_NUM '2'.

### 4.1.2 Result

**Table 5** contains the result of applying the methodology from Section **2.3.1** on the example scenario in AEDT format. Additionally, values for the PROF\_ID1 field are edited to provide a unique name. The origin airport/heliport code and destination airport/heliport code are concatenated with an underscore to populate these fields. Cells shaded grey indicate values edited when creating user-defined profiles and procedure steps.

STEP NUM HELO ID OP TYPE PROF ID1 PROF ID2 STEP TYPE DURATION DISTANCE ALTITUDE SPEED A109 Α 1 ME02 ME48 1 S 0 1400 145 2 A109 Α ME02 ME48 1 L 0 432073.15 0 0 3 A109 Α ME02\_ME48 В 0 5000 0 60 Α Α 0 0 A109 ME02\_ME48 8640 500 Α ME02\_ME48 С 0 2850 0 5 A109 15 Υ 3 0 0 0 6 A109 Α ME02\_ME48 7 Α Н 30 0 0 0 A109 ME02 ME48 0 8 ME02\_ME48 G 0 0 A109 Α 1 30

Table 5 User-Defined A109 Arrival Helicopter Procedure Steps

Source: ATAC, December 2021 Prepared by: ATAC, December 2021

### 4.2 Departure

This section applies the methodology of creating a departure user-defined profile (see Section 2.3.2) for the example scenario and presents the resulting procedure steps.

## 4.2.1 Example

This section walks through creating of a user-defined departure profile and procedure steps for the example scenario.

- 1. Copy existing values from [FLT\_ANP\_HELICOPTER\_PROFILES] where HELO\_ID = 'A109' and OP\_TYPE = 'D'. Set PROF\_ID1 to unique value based on route and insert record into table.
- 2. Copy existing values from [FLT\_ANP\_HELICOPTER\_PROCEDURES] where HELO\_ID = 'A109' and OP\_TYPE = 'D'. For all records, set PROF\_ID1 equal to unique value and insert into table.
- 3. Edit values in [FLT\_ANP\_HELICOPTER\_PROCEDURES] table:
  - a. Elevation of 'H1' helipad at ME02 = 145
  - b. Cruise Elevation = 1855 (1855 = 2000 145)Store '1855' in ALTITUDE field of STEP\_NUM '6'
  - c. DISTANCE value of STEP\_NUM '6' = '6,585.052'
    - i. Vertical distance to descend = 1825 (1825 = 1855 30)
    - ii. Distance = 6,585.052 (6,585.052 = 1825 / 0.277143)
    - iii. Store '6,585.052' in DISTANCE field of STEP NUM '6'
  - d. Set SPEED field value to '145' of STEP NUM '7'.



- e. DISTANCE value level cruise step (STEP\_TYPE 'L') of STEP\_NUM '8' = '438,578.1'
  - i. Cumulative flight trajectory distance (ft) = 897,126.3. Divide by 2 = 448,563.15 (448,563.15 = 897,126.3 / 2).
  - ii. Cumulative distance of all previous steps = 10,291.75 (10,291.75 = 2800 + 6891.753 + 500 + 100). Subtract it from 448,563.15 = 438,271.40 (438,271.40 = 448,563.15 10,291.75)
  - iii. Store '438,271.40' in DISTANCE field of STEP\_NUM '8'.

#### 4.2.2 Result

**Table 6** contains the result of applying the methodology from Section **2.3.2** on the example scenario in AEDT format. The origin airport/heliport code and destination airport/heliport code are concatenated with an underscore to populate these fields. Cells shaded grey indicate values edited when creating user-defined profiles and procedure steps.

HELO\_ID STEP\_NUM OP\_TYPE PROF\_ID1 PROF\_ID2 STEP\_TYPE **DURATION** DISTANCE **ALTITUDE SPEED** 1 A109 D ME02\_ME48 G 30 0 0 0 1 0 2 D Н 0 0 A109 ME02\_ME48 1 30 3 D ٧ 3 0 15 0 A109 ME02\_ME48 1 4 D Е 0 0 A109 ME02 ME48 1 100 30 5 A109 D ME02\_ME48 F 0 30 1 500 60 6 A109 D ME02\_ME48 1 D 0 6585.0515 1855 0 7 D Е A109 ME02\_ME48 1 0 2800 0 145 8 A109 D ME02 ME48 0 438578.1 0

Table 6 User-Defined A109 Departure Helicopter Procedure Steps

Source: ATAC, December 2021 Prepared by: ATAC, December 2021

# 5 Graphical and Tabular Comparison

Section 5.3.2 of the "Guidance on Using the Aviation Environmental Design Tool (AEDT) to Conduct Environmental Modeling for FAA Actions Subject to NEPA" document also describes that graphics and tables depicting each proposed change in profile be provided to display the effect on aircraft performance in altitude vs distance and speed vs distance.

This section provides charts and tables based on the example scenario (see Section **3.1**). As the user-defined profile is longer than the default profile, plots are displayed with data truncated or linearly interpolated to the shorter value such that equitable comparisons are made. Complete data is presented in tables for transparency.

Additionally, this section includes a quantitative comparison comparing user-defined and default profiles is provided. Similar to previous sections, data presented in this section uses a cruise altitude of 2,000 ft MSL and speed of 145 kn; however, ATAC will use the appropriate SME-approved cruising altitude and speed for each route. For the purpose of this request, the modeled cruising altitudes for each route will be between a range of 1500 to 5200 feet MSL. Similarly, the modeled cruising speeds for each route will be between a range of 130 to 170 knots ground speed.



### 5.1 Altitude vs Distance

This section contains tables and graphs of track distance from the helipad (NM) and altitude (MSL ft) of the default and user-defined profiles for each operation type.

### 5.1.1 Arrival

**Table 7** and **Table 8** contain the distance and altitude values of the default and user-defined arrival profiles from the example scenario for the arrival operation type, respectively.

Table 7 Default A109 Arrival Profile – Altitude vs Track Distance Comparison

Track Distance from Helipad (NM)	Altitude MSL (ft)
0.0	600.0
0.0	600.0
0.0	600.0
0.0	615.0
0.1	668.9
0.2	830.6
0.5	1,100.0
1.3	1,600.0
1.5	1,600.0
1.7	1,600.0
2.1	1,600.0
16.4	1,600.0

Source: ATAC, December 2021 Prepared by: ATAC, December 2021

Table 8 User-Defined A109 Arrival Profile – Altitude vs Track Distance Comparison

Track Distance from Helipad (NM)	Altitude MSL (ft)
0.0	600.0
0.0	600.0
0.0	600.0
0.0	615.0
0.1	668.9
0.2	830.6
0.5	1,100.0
1.9	2,000.0
2.0	2,000.0
2.1	2,000.0
2.3	2,000.0
2.5	2,000.0
2.7	2,000.0
73.8	2,000.0



Track Distance from Helipad (NM)	Altitude MSL (ft)
73.8	2,000.0

The data from **Table 7** and **Table 8** is plotted in **Figure 3**. The default altitude profile is represented by the blue line. The user-defined altitude profile is represented by the orange line.

2,500 Default User-defined 2,000 Altitude (feet MSL) 1,500 1,000 500 0 0 2 4 6 8 10 12 14 16 18

Figure 3 A109 Arrival Profile – Altitude vs Track Distance Comparison

Source: ATAC, December 2021 Prepared by: ATAC, December 2021

It is noted from the figure that the default profile's cruise altitude is equal to 1,000 feet above the helipad altitude (600 ft), which is the default behavior of helicopter profiles in AEDT. Note that the user-defined cruise altitude has been adjusted such that the cruise occurs at 2,000 ft MSL. Additionally, note how the rate of descent of the two profiles matches.

Track Distance From Helipad (NM)

# 5.1.2 Departure

**Table 9** and **Table 10** contain the distance and altitude values of the default and user-defined departure profiles from the example scenario for the departure operation type, respectively.



Table 9 Default A109 Departure Profile – Altitude vs Track Distance Comparison

Track Distance from Helipad (NM)	Altitude MSL (ft)
0.0	145.0
0.0	145.0
0.0	145.0
0.0	160.0
0.0	160.0
0.0	160.0
0.0	160.0
0.1	166.3
0.1	175.0
0.7	1,145.0
0.8	1,145.0
0.9	1,145.0
1.1	1,145.0
16.5	1,145.0

Table 10 User-defined A109 Departure Profile – Altitude vs Track Distance Comparison

Track Distance from Helipad (NM)	Altitude MSL (ft)
0.0	145.0
0.0	145.0
0.0	145.0
0.0	160.0
0.0	160.0
0.0	160.0
0.0	160.0
0.1	166.3
0.1	175.0
1.2	2,000.0
1.2	2,000.0
1.3	2,000.0
1.4	2,000.0
1.5	2,000.0
1.6	2,000.0
73.8	2,000.0
73.8	2,000.0

Source: ATAC, December 2021 Prepared by: ATAC, December 2021



The data from **Table 9** and **Table 10** is plotted in **Figure 4**. The default altitude profile is represented by the blue line. The user-defined altitude profile is represented by the orange line.

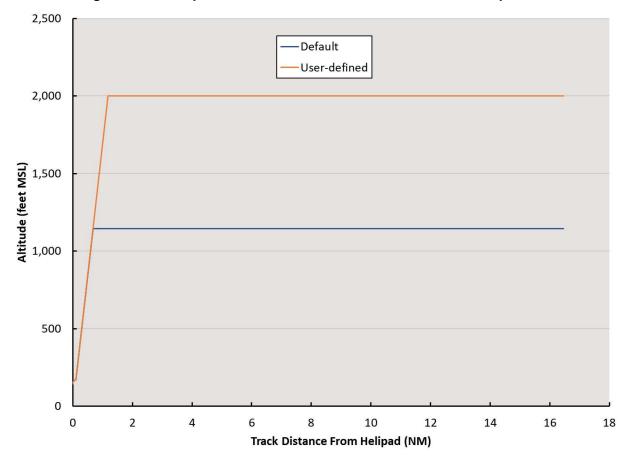


Figure 4 A109 Departure Profile – Altitude vs Track Distance Comparison

Source: ATAC, December 2021 Prepared by: ATAC, December 2021

It is noted from the figure that the default profile's cruise altitude is equal to 1,000 feet above the helipad altitude (145 ft), which is the default behavior of helicopter profiles in AEDT. Note that the user-defined cruise altitude has been adjusted such that the cruise occurs at 2,000 ft MSL. Additionally, note how the rate of ascent of the two profiles matches.

# 5.2 Speed vs Distance

This section contains tables and graphs of track distance from the helipad (NM) and speed (groundspeed in kts) of the default and user-defined profiles for each operation type.

#### 5.2.1 Arrival

**Table 11** and **Table 12** contain the distance and speed values of the default and user-defined arrival profiles from the example scenario for the arrival operation type, respectively.



Table 11 Default A109 Arrival Profile – Speed vs Track Distance Comparison

rack Distance from Helipad (NM) Groundspeed (kt		
0.0	0.0	
0.0	0.0	
0.0	0.0	
0.0	0.0	
0.1	20.0	
0.2	40.0	
0.5	60.0	
1.3	60.0	
1.5	78.7	
1.7	97.3	
2.1	116.0	
16.4	116.0	

Table 12 User-defined A109 Arrival Profile – Speed vs Track Distance Comparison

Track Distance from Helipad (NM)	Groundspeed (kts)	
0.0	0.0	
0.0	0.0	
0.0	0.0	
0.0	0.0	
0.1	20.0	
0.2	40.0	
0.5	60.0	
1.9	60.0	
2.0	77.0	
2.1	94.0	
2.3	111.0	
2.5	128.0	
2.7	145.0	
73.8	145.0	
73.8	145.0	

Source: ATAC, December 2021 Prepared by: ATAC, December 2021

The data from **Table 11** and **Table 12** is plotted in **Figure 5**. The default speed profile is represented by the blue line. The user-defined speed profile is represented by the orange line.



160 140 120 Speed (groundspeed in kts) 100 80 60 Default User-defined 40 20 0 2 4 6 8 10 14 0 12 16 18 Track Distance From Helipad (NM)

Figure 5 A109 Arrival Profile – Speed vs Track Distance Comparison

It is noted from the figure that the default profile's cruise speed is slower than the user-defined profile's cruise speed. Additionally, note the difference in speed values during descent. This may exist as a byproduct of matching the altitude profiles during descent.

# 5.2.2 Departure

**Table 13** and **Table 14** contain the distance and speed values of the default and user-defined departure profiles from the example scenario for the departure operation type, respectively.

Table 13 Default A109 Departure Profile - Speed vs Track Distance Comparison

Track Distance from Helipad (NM) Groundspeed		
0.0	0.0	
0.0	0.0	
0.0	0.0	
0.0	0.0	
0.0	0.0	
0.0	15.0	
0.0	30.0	



Track Distance from Helipad (NM)	Groundspeed (kts)	
0.1	45.0	
0.1	60.0	
0.7	60.0	
0.8	78.7	
0.9	97.3	
1.1	116.0	
16.5	116.0	

Table 14 User-defined A109 Departure Profile – Speed vs Track Distance Comparison

Track Distance from Helipad (NM)	Groundspeed (kts)	
0.0	0.0	
0.0	0.0	
0.0	0.0	
0.0	0.0	
0.0	0.0	
0.0	15.0	
0.0	30.0	
0.1	45.0	
0.1	60.0	
1.2	60.0	
1.2	77.0	
1.3	94.0	
1.4	111.0	
1.5	128.0	
1.6	145.0	
73.8	145.0	
73.8	145.0	

Source: ATAC, December 2021 Prepared by: ATAC, December 2021

The data from **Table 13** and **Table 14** is plotted in **Figure 6**. The default speed profile is represented by the blue line. The user-defined speed profile is represented by the orange line.



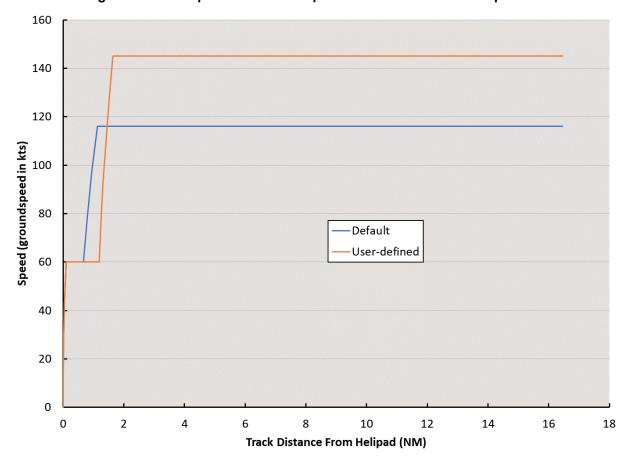


Figure 6 A109 Departure Profile – Speed vs Track Distance Comparison

It is noted from the figure that the default profile's cruise speed is slower than the user-defined profile's cruise speed. Additionally, note the difference in speed values during ascent. This may exist as a byproduct of matching the altitude profiles during ascent.

# 5.3 Quantitative Comparison

The objective of this analysis is to demonstrate the magnitude of differences between default and user-defined profiles with respect to aircraft performance. This section describes the methodology and results of making quantitative comparisons between profiles. Similar to previous sections, data presented in this section uses a cruise altitude of 2,000 ft MSL and speed of 145 kn; however, ATAC will use the appropriate SME-approved cruising altitude and speed for each route. For the purpose of this request, the modeled cruising altitudes for each route will be between a range of 1500 to 5200 feet MSL. Similarly, the modeled cruising speeds for each route will be between a range of 130 to 170 knots ground speed.

# 5.3.1 Methodology

A commonly used measure of the differences between values is the root-mean-square error (RMSE). RMSE is computed by calculating the square root of the average of squared errors. In this application, the error is the difference between the default value and the user-defined value for altitude and speed. These differences were calculated every 0.01 NM along the track. RMSE is defined by the following formula where  $\hat{y}$  is equal to user-defined value and y is the default value:



$$RMSE = \sqrt{\frac{\sum (\hat{y} - y)^2}{n}}$$

A RMSE value of 0 indicates that the default and user-defined values are identical. In general, lower RMSE values indicate the default and user-defined values are similar and higher RMSE values indicate less similarity. It should be noted that comparisons across parameters are invalid because RMSE is dependent on the scale of numbers used. In other words, the RMSE value for altitude cannot be compared to the RMSE value for speed.

#### 5.3.2 Results

This section quantitatively compares the results of the default and user-defined profiles for altitude and speed using the methodology presented in Section **5.3.1**. presents the RMSE values calculated for each aircraft performance parameter.

**Table 15 RMSE Summary Table** 

	RMSE Values		
Operation Type	Altitude Speed		
Arrival	378.6	27.6	
Departure	828.4	28.6	

Source: ATAC, December 2021 Prepared by: ATAC, December 2021

The RMSE values from **Table 15** for altitude indicate that neither the arrival nor departure user-defined profiles are identical to the default altitude profile. Compared to the arrival profile, the larger RMSE altitude value for the departure profile indicates that the departure user-defined profile has a larger error than the arrival user-defined profile when compared to their respective default altitude profiles. Both errors can be largely explained by the different cruising altitudes specified by the profile. It is noted that the difference in operating helipad elevation (Arrival: 600 ft, Departure: 145 ft, see Section **4**) contributes to the differences in these error values.

The RMSE values from **Table 15** for speed indicate that neither the arrival nor departure user-defined profiles are identical to the default speed profile. The arrival and departure user-defined speed profiles have a similar magnitude of error from their respective default profiles.

### 6 Conclusion

ATAC is seeking approval of the presented methodology of creating user-defined helicopter profiles to model environmental consequences of proposed helicopter routes supporting the ILHS HAA project. The proposed solution relies on AEDT-default data as a starting point and edits targeted profile values to accurately model proposed operations on helicopter routes. This is a viable method that stays within reasonable levels of effort with respect to project timeline to model operations while maintaining high levels of modeling fidelity.



# **Appendix A – AEDT Helicopter Procedure Step Definitions**

Step Type	Description	State	Parameters
А	Approach at constant KTAS	Move	Dist Alt
D	Depart at constant KTAS	Move	Dist Alt
L	Level flyover at constant KTAS	Move	Dist
G	Ground idle	Static	Dur
Н	Flight idle	Static	Dur
1	Hover in ground effect	Static	Dur
J	Hover out of ground effect	Static	Dur
V	Vertical ascent in ground effect	Static	Dur Alt
W	Vertical ascent out of ground effect	Static	Dur Alt
Υ	Vertical descent in ground effect	Static	Dur Alt
Z	Vertical descent out of ground effect	Static	Dur Alt
В	Approach with horizontal deceleration	Move	Dist Spd
С	Approach with descending deceleration	Move	Dist Alt Spd
Е	Depart with horizontal acceleration	Move	Dist Spd
F	Depart with climbing acceleration	Move	Dist Alt Spd
Х	Taxi at constant speed	Move	Spd
S	Start altitude (feet AFE) at constant KTAS		Alt Spd

Source:

U.S. Department of Transportation, Federal Aviation Administration, *Aviation Environmental Design Tool (AEDT) Version 3d User Manual*, Appendix L.2.2 Helicopter Procedure Step Types (Pp. 425), March 2021

Prepared by: ATAC, December 2021

#### Office of Environment and Energy

800 Independence Ave., S.W. Washington, D.C. 20591

Administration

8/16/2022

Andrew Pieroni Environmental Protection Specialist Mission Support Services Eastern Service Center Federal Aviation Administration 1701 Columbia Avenue College Park, GA 30337

Dear Andrew,

The Office of Environment and Energy (AEE) has reviewed the proposed non-standard revised noise modeling methodology to develop user-defined helicopter profiles in AEDT 3d to be used for Instrument Flight Procedures Low-level Helicopter System (ILHS) to support Helicopter Air Ambulance (HAA) operations along proposed new routes using the AgustaWestland A-109 (A-109) helicopter throughout the state of Maine. This request is in support of an Environmental Assessment (EA) for the establishment of the proposed routes and airspace in conjunction with the project.

The Proposed Action is for the FAA to establish formal airspace procedures for commonly flown routes by LifeFlight of Maine operating the A-109 helicopter. Multiple routes and procedures are proposed and will be utilized by LifeFlight of Maine to support en route emergency service operations to and from hospitals and medical facilities throughout the state at a range of cruise altitudes from 1,500 to 5,200 feet above Mean Sea Level (MSL), and cruise speeds of 130 to 170 knots Ground Speed (GS).

As the standard helicopter arrival and departure profiles for the A-109 (ANP ID A109) in AEDT 3d do not reach the typical range of cruising altitudes, distance, and cruise speeds to represent profiles on the proposed ILHS HAA helicopter procedures they are currently not suitable for analysis of the Proposed Action. In accordance with FAA guidance as detailed in the document "Guidance on Using the Aviation Environmental Design Tool (AEDT) to Conduct Environmental Modeling for FAA Actions Subject to NEPA"<sup>1</sup>, use of non-default methods or data for environmental analysis of FAA actions within AEDT must be approved by AEE. This letter serves as AEE's response to the revised methodology developed in the ATAC report titled "Instrument Flight Procedures Low-level Helicopter System (ILHS) to support Helicopter Air Ambulance

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<sup>&</sup>lt;sup>1</sup> Federal Aviation Administration, Guidance on Using the Aviation Environmental Design Tool (AEDT) to Conduct Environmental Modeling for FAA Actions Subject to NEPA, Retrieved from <a href="https://aedt.faa.gov/Documents/guidance\_aedt\_nepa.pdf">https://aedt.faa.gov/Documents/guidance\_aedt\_nepa.pdf</a> on August 16, 2022

(HAA) AEDT User-Defined Profile Submission – User-Defined Profiles" dated August 5, 2022.

The proposed revised methodology for developing user-defined helicopter profiles on a route-by-route basis in AEDT 3d over a range of cruise altitudes and speeds 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 EA for the ILHS HAA project for the A-109 using cruise altitudes ranging from 1,500 to 5,200 feet MSL, cruise speeds of 130 to 170 knots GS, and for use with AEDT 3d only. Further non-standard AEDT inputs or methodologies for additional projects at this or any other site will require separate approval.

Sincerely,

Donald Scata Manager AEE-100/Noise Division

cc: ATO-AJV Contacts (James Arrighi AJV-S230, Charles Gibson, AJV-E250)