Noise Levels for Aircraft on Alaska's North Slope for Polar Bear and Walrus Impacts Analysis

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Revised Final Report — May 2021

DOT-VNTSC-FWS-21-01

Prepared for:
U.S. Fish and Wildlife Service
Marine Mammal Management
Anchorage, AK

50 YEARS 1970 – 2020
U.S. Department of Transportation
Volpe Center

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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	May 2021	Revised Final Report

4. TITLE AND SUBTITLE
Noise Levels for Aircraft on Alaska's North Slope for Polar Bear and Walrus Impacts Analysis

5a. FUNDING NUMBERS
F21PG00018
F21PG00018/P00002

6. AUTHOR(S)
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5b. CONTRACT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
U.S. Department of Transportation
John A Volpe National Transportation Systems Center
55 Broadway
Cambridge, MA 02142-1093

8. PERFORMING ORGANIZATION REPORT NUMBER
DOT-VNTSC-FWS-21-01

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U.S. Department of Interior
U.S. Fish and Wildlife Service
Marine Mammals Management
1011 East Tudor Road, MS 341
Anchorage, AK 99503-6199

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

Volpe, The National Transportation Systems Center, computed noise levels for a list of aircraft on behalf of the United States Fish and Wildlife Service. The purpose of the analysis was to inform noise impact analyses for polar bears and walruses on Alaska's North Shore. Volpe utilized the Federal Aviation Administration's Aviation Environmental Design Tool (AEDT) to compute noise levels for fixed wing aircraft and rotorcraft performing various operations at a range of altitudes.

14. SUBJECT TERMS
Aircraft noise, noise modeling, polar bear, walrus, Alaska

15. NUMBER OF PAGES
12

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	Unlimited

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. 239-18
298-102

1. Introduction

This report presents the results of an analysis of aircraft noise levels conducted on behalf of the United States Fish and Wildlife Service (FWS) by Volpe, The National Transportation Systems Center. Volpe computed noise levels for a list of aircraft selected by FWS conducting various operations over a range of altitudes. The sections below present the methodology and results of the analysis. In addition to this report, the deliverables transmittal includes a spreadsheet that summarizes the noise results, text grid files of the computed noise values, and shapefiles of the noise contours.

2. Methodology

FWS provided Volpe with a list of 18 fixed-wing aircraft and 7 rotorcraft. For each aircraft FWS required the calculation of noise levels for arrivals, departures, and level overflights. Calculation of noise levels for hovering flight were required for rotorcraft only. Calculations for level and hovering flight were required for seven altitudes ranging from 500 ft. to 3,500 ft. above ground level in 500 ft. increments. The requirements included a total of 265 discrete aircraft/operation combinations.

Volpe computed the Maximum A-weighted Sound Level (L_{MAX}) for each of the operations using the latest, publicly released version of the Federal Aviation Administration (FAA) Aviation Environmental Design Tool (AEDT) at the start of the analysis, version 3c. AEDT is the FAA's official tool for the calculation of aviation noise, emissions, and fuel burn. In order to compute aircraft noise in AEDT, the user must specify the aircraft type, select or create the flight profile, and input the flight path.

AEDT computed the noise levels over level soft ground. Hard ground or other reflective surfaces such as cliffs or water can increase sound levels relative to environments with only soft ground.

2.1 AEDT Aircraft

The AEDT database contains noise and performance data for over 300 aircraft. It also maps over 3,700 aircraft to the best matching noise and performance data within the database. Volpe matched the list of project aircraft to the equipment in AEDT. This report and the other project deliverables list the results using AEDT's Aircraft Noise and Performance (ANP) identifier (e.g. the ANP identifier for the Cessna 208 Caravan is CNA208). Table 1 shows the required aircraft and their classifications as provided by FWS and the modeled AEDT equipment for each of the required aircraft. In some cases, multiple pieces of AEDT equipment map to the same ANP aircraft (e.g. the Cessna 208 and the Pilatus PC-12). All project aircraft apart from the Bell 412 have matching equipment in AEDT (note the AEDT Airframe column). A similar helicopter, the Sikorsky S76, was selected to represent the Bell 212.

Table 1. Project Aircraft List

FWS Project Requirements		AEDT Equipment		
Aircraft Classification	**Aircraft**	**Airframe**	**ANP Aircraft**	**ANP Description**
Fixed-wing (Airplane)	Beechcraft 1900	Raytheon Beech 1900-D	1900D	BEECH 1900D / PT6A67
	Piper Navajo	Piper PA-31 Navajo	BEC58P	BARON 58P/TS10-520-L
	Lockheed C-130 Hercules	Lockheed C-130 Hercules	C130	C-130H/T56-A-15
	Cessna 206	Cessna 206	CNA206	CESSNA 206H / LYCOMING IO-540-AC
	Cessna 208B Caravan	Cessna 208 Caravan	CNA208	Cessna 208 / PT6A-114
	Pilatus PC-12	Pilatus PC-12		
	Cessna Conquest II	Cessna 441 Conquest II	CNA441	CONQUEST II/TPE331-8
	Douglas DC-6	Boeing DC-6	DC6	DC6/R2800-CB17
	De Havilland Beaver	DeHavilland DHC-2 Mk III Beaver Float	DHC-2FLT	DHC-2 Beaver Floatplane
	de Havilland Canada DHC-6 Twin Otter	DeHavilland DHC-6-100 Twin Otter	DHC6	DASH 6/PT6A-27
	CASA C-212 Aviocar	CASA 212-100 Series		
	Beechcraft King Air	Raytheon King Air 100		
	De Havilland Canada Dash 8	DeHavilland DHC-8-100	DHC8	DASH 8-100/PW121
	Super Cub	Piper PA-18-150 (FAS)	GASEPF	1985 1-ENG FP PROP
	Cessna 180	Cessna 180 (FAS)	GASEPV	1985 1-ENG VP PROP
	Patenavia P.68	Vulcanair P.68	PA30	PIPER TWIN COMANCHE PA-30 / IO-320-B1A
Fixed-wing (Jet)	Boeing 737	Boeing 737-800 Series	737800	BOEING 737-800/CFM56-7B26
Rotor-winged (Helicopter)	Bell 206L-4 LongRanger	Bell 206L-4T Long Ranger	B206L	Bell 206L Long Ranger
	Bell 212	Bell UH-1 Iroquois	B212	Bell 212 Huey (UH-1N) (CH-135)
	Bell 407	Bell 407 / Rolls-Royce 250-C47B	B407	Bell 407
	Robinson R-44	Robinson R44 Raven / Lycoming O-540-F1B5	R44	Robinson R44 Raven / Lycoming O-540-F1B5
	Jay Hawk - USCG helicopter	Sikorsky SH-60 Sea Hawk	S70	Sikorsky S-70 Blackhawk (UH-60A)
	Bell 412	Sikorsky S-76 Spirit	S76	Sikorsky S-76 Spirit
	Eurocopter AS350 B2 (A-star)	Aerospatiale SA-350D Astar (AS-350)	SA350D	Aerospatiale SA-350D Astar (AS-350)

2.2 Flight Profiles

The AEDT performance database contains a standard arrival profile and one or more standard departure profiles for a range of weights for each of the project aircraft. The noise modeling utilized the standard arrival profile and the highest weight standard departure profile. Though AEDT does not contain standard level flight profiles, the touch and go profiles for fixed wing aircraft do contain level flight segments. The modeled level flight profiles for fixed wing aircraft utilized the aircraft performance parameters (e.g. speed, thrust) from these segments. Likewise, the departure profiles for rotorcraft end with a long level segment and the modeled level flight profiles for rotorcraft utilized the performance parameters from these segments. The modeling used newly created hovering flight profiles for rotorcraft at each of the specified altitudes.

2.3 Flight Tracks

The flight path for each of the modeled operations had a heading of due east and was referenced to an arbitrary runway end located at 61.4 degrees latitude, -151.2 degrees longitude, as per discussions with FWS. Fixed wing departures started their takeoff roll at the runway end and flew to the east. Fixed wing arrivals overflew the runway end from the west at a standard threshold crossing height of 50 ft. Rotorcraft began their departures and ended their arrivals at a helipad located at the runway end. Aircraft in level flight maintained a constant altitude and heading and overflew the runway end, flying eastward. Hovering rotorcraft maintained a constant altitude and an eastward heading over the runway end. Figure 1 shows example departure (blue) and arrival (red) L_{MAX} contours. The runway end is marked with a blue "R" placemark, labeled 09, which indicates a heading of 090 degrees. The helipad, "H1", is visible at the same location.

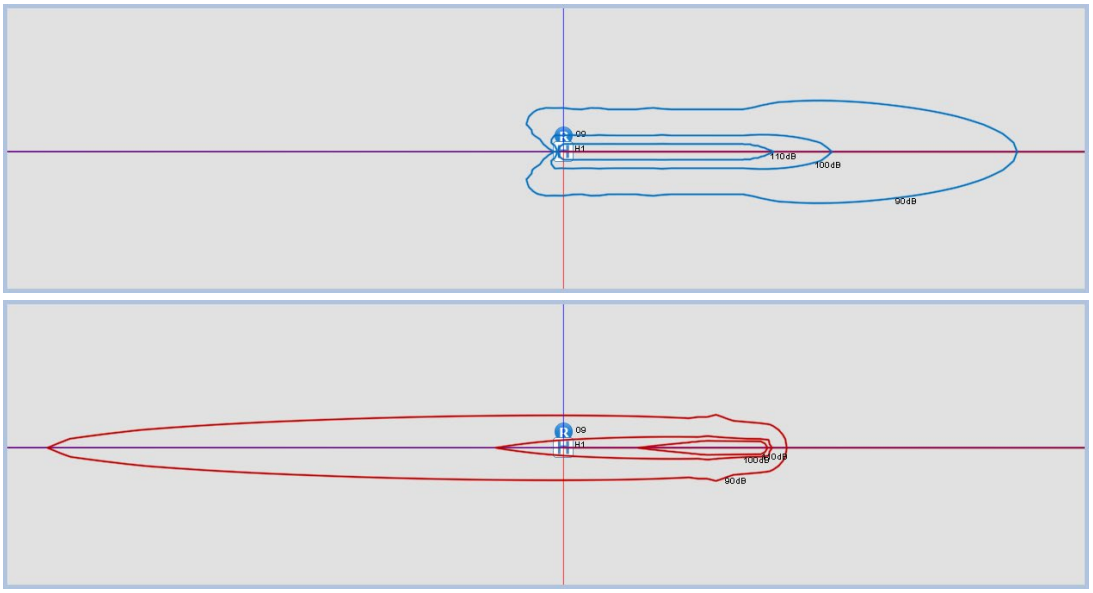

Figure 1. Example Departure (Blue) and Arrival (Red) L_{MAX} Contours for the DHC6

3. Results

The deliverables transmittal includes this report, a spreadsheet with the same tables presented in this report, noise contour shapefiles, and noise grids. The same 64 nmi. by 5 nmi. grid of 129,381 points spaced at 0.05 nmi. was used for each aircraft noise run. FWS specified the levels of 60 dB to 110 dB L_{MAX} in 5 dB increments for the noise contours. In some cases, as noted below, the noise contours stretched beyond the grid.

Table 2 and Table 3 present the 60 dB to 110 dB L_{MAX} contour areas for arrivals and departures for each AEDT ANP aircraft. The contour areas are inclusive, i.e. the full area where noise levels are 60 dB or greater are included in the 60 dB contour area. The 60 dB contour for the 737800 departure is somewhat more rounded than is typical at the east end. This is due to the aircraft reaching the end of the standard profile in AEDT causing the contour to be truncated with the area somewhat reduced. Contours that did not close within the calculation grid are noted as DNC. This is most often the case for rotorcraft arrivals and departures. The profiles for these aircraft start or end with long level segments at 1,000 ft. above ground level. Additionally, the DHC-2FLT aircraft exhibits unusually high modeled noise levels on the higher altitude portion of the arrival with levels of 60 dB – 70 dB stretching to the edge of the grid. The deliverable transmittal includes contour shapefiles and noise grids for each aircraft and operation combination. The shapefile names include the ANP aircraft identifier and the operation type (e.g. Contours_1900D_Arrival_ContourLine_Lines.shp).

Table 4 lists the 60 dB to 95 dB L_{MAX} contour areas for hovering rotorcraft by altitude. Note that no study aircraft produces noise levels on the ground of 95 dB L_{MAX} or greater while hovering at the selected altitudes. The deliverable transmittal includes hover contour shapefiles for all study rotorcraft.

Table 5 presents the level flight L_{MAX} directly under the flight path for each aircraft at each altitude. Note that rotorcraft emit noise asymmetrically and though the L_{MAX} for an aircraft may be below a certain level at the centerline, it may be higher off the centerline. For example, the S70 at 500 ft. altitude is less than 90 dB directly under the aircraft, but noise levels at some locations lateral to the flight path do exceed 90 dB. This also occurs for the S70 flying level at 1,500 ft. at the 80 dB level and the B212 flying level at 1,000 ft. at the 80 dB level.

Table 6 lists the level flight 60 dB to 95 dB L_{MAX} contour widths for each aircraft across the range of altitudes. Note that only the C130, CNA206, and S70 produce noise levels on the ground of 90 dB L_{MAX} or greater at an altitude of 500 ft. No project aircraft produces noise levels of 90 dB L_{MAX} or greater in level flight at altitudes of 1,000 ft. or greater. No project aircraft produces noise levels of 95 dB L_{MAX} or greater in level flight at any of the required altitudes. The deliverable transmittal includes level flight contour shapefiles and noise grids for all project aircraft at each of the seven required altitudes.

Table 2. Aircraft Arrival L_{MAX} Contour Area (km^2)

ANP Aircraft	60 dB	65 dB	70 dB	75 dB	80 dB	85 dB	90 dB	95 dB	100 dB	105 dB	110 dB
1900D	30.4870	12.8930	5.3737	2.1306	0.7945	0.2859	0.1292	0.0695	0.0434	0.0298	0.0215
BEC58P	18.3730	7.4195	2.9120	1.0599	0.3980	0.1974	0.1237	0.0886	0.0676	0.0524	0.0400
C130	67.6290	32.2340	15.2560	6.9644	3.1111	1.3238	0.5598	0.3034	0.2085	0.1605	0.1295
CNA206	12.4020	4.4910	1.6075	0.5647	0.2067	0.0974	0.0544	0.0344	0.0233	0.0163	0.0108
CNA208	47.3080	19.1090	7.4931	2.8354	1.0400	0.3667	0.1651	0.0921	0.0600	0.0429	0.0319
CNA441	15.4080	6.1494	2.3544	0.8514	0.2981	0.1322	0.0698	0.0438	0.0301	0.0216	0.0157
DC6	75.9990	36.0580	17.6200	8.3995	3.9235	1.5585	0.5996	0.2560	0.1435	0.0949	0.0688
DHC-2FLT	DNC	DNC	DNC	20.4630	1.5291	0.4300	0.1707	0.0848	0.0486	0.0297	0.0178
DHC6	48.5080	20.8260	8.8187	3.6203	1.3129	0.4532	0.1644	0.0751	0.0400	0.0240	0.0155
DHC8	7.7522	3.3307	1.3732	0.5693	0.2576	0.1450	0.0950	0.0681	0.0510	0.0386	0.0278
GASEPF	2.4810	0.8739	0.2927	0.1184	0.0576	0.0322	0.0198	0.0127	0.0084	0.0049	0.0020
GASEPV	12.8980	5.2045	1.8429	0.6596	0.2573	0.1193	0.0588	0.0327	0.0200	0.0129	0.0086
PA30	6.4606	2.5066	0.9269	0.3230	0.1364	0.0677	0.0379	0.0229	0.0150	0.0102	0.0063
737800	53.5030	20.8920	9.2931	4.0420	1.7933	0.8303	0.4208	0.2798	0.2170	0.1773	0.1465
B206L	DNC	DNC	DNC	0.9950	0.2012	0.0808	0.0421	0.0203	0.0095	0.0048	0.0024
B212	DNC	DNC	DNC	DNC	0.7548	0.2175	0.0934	0.0483	0.0238	0.0117	0.0066
B407	DNC	DNC	DNC	1.2439	0.2916	0.0999	0.0362	0.0162	0.0086	0.0059	0.0037
R44	DNC	DNC	7.7431	0.3025	0.0975	0.0321	0.0157	0.0102	0.0077	0.0056	0.0038
S70	DNC	DNC	DNC	DNC	DNC	0.3676	0.1363	0.0641	0.0319	0.0152	0.0080
S76	DNC	DNC	DNC	DNC	0.7323	0.2052	0.0892	0.0451	0.0210	0.0094	0.0043
SA350D	DNC	DNC	DNC	1.3308	0.2894	0.1084	0.0567	0.0285	0.0130	0.0060	0.0030

Notes: DNC indicates that the contour did not close within the calculation grid.

Table 3. Aircraft Departure L_{MAX} Contour Area (km^2)

ANP Aircraft	60 dB	65 dB	70 dB	75 dB	80 dB	85 dB	90 dB	95 dB	100 dB	105 dB	110 dB
1900D	17.9300	4.9476	2.0094	0.8929	0.4260	0.2551	0.2011	0.1685	0.1427	0.1197	0.0982
BEC58P	56.0700	20.1820	7.7515	3.6227	1.6617	0.7216	0.3473	0.1754	0.1209	0.0910	0.0723
C130	235.4200	100.9800	45.0480	20.1430	9.6929	4.8700	2.2811	1.1252	0.5642	0.4088	0.3318
CNA206	57.2740	25.4800	13.2050	6.3780	2.6051	0.8818	0.3534	0.1404	0.0761	0.0483	0.0349
CNA208	29.2200	11.2370	4.3796	1.6811	0.6690	0.2583	0.1240	0.0789	0.0572	0.0443	0.0346
CNA441	14.6610	5.7000	2.3125	1.0031	0.4780	0.2262	0.1477	0.1113	0.0895	0.0732	0.0591
DC6	531.8800	312.1200	116.4100	43.9400	16.9710	7.5873	3.1559	1.3515	0.5944	0.3767	0.2865
DHC-2FLT	222.0100	66.6580	26.3710	11.5820	4.2525	1.6296	0.6229	0.2672	0.1463	0.1046	0.0821
DHC6	43.2380	17.0790	6.5547	2.5663	1.0248	0.4101	0.1655	0.0989	0.0722	0.0578	0.0482
DHC8	6.4302	3.0244	1.3824	0.5295	0.2182	0.1255	0.0994	0.0833	0.0695	0.0567	0.0447
GASEPF	9.1079	3.5945	1.6237	0.6231	0.2376	0.1203	0.0774	0.0543	0.0395	0.0293	0.0217
GASEPV	39.2460	14.4720	5.6589	2.5545	1.1498	0.5177	0.2480	0.1251	0.0717	0.0508	0.0383
PA30	39.4810	19.2820	10.1520	5.5875	3.2468	1.8487	0.9903	0.5016	0.2372	0.1371	0.0906
737800	160.6400*	74.7980	33.7190	14.8350	7.8531	3.7553	1.6358	0.8628	0.4874	0.3776	0.3202
B206L	DNC	DNC	49.0880	0.2280	0.0941	0.0582	0.0364	0.0233	0.0143	0.0070	0.0029
B212	DNC	DNC	DNC	DNC	0.2767	0.1298	0.0699	0.0435	0.0274	0.0174	0.0093
B407	DNC	DNC	28.8280	0.2617	0.1026	0.0511	0.0316	0.0206	0.0117	0.0065	0.0042
R44	DNC	56.7520	17.0850	0.1949	0.0770	0.0423	0.0277	0.0176	0.0097	0.0065	0.0045
S70	DNC	DNC	DNC	DNC	DNC	0.1001	0.0604	0.0380	0.0246	0.0153	0.0078
S76	DNC	DNC	DNC	63.3450	0.2802	0.1328	0.0693	0.0419	0.0259	0.0155	0.0071
SA350D	DNC	DNC	52.7360	0.4653	0.2048	0.1003	0.0583	0.0351	0.0215	0.0117	0.0042

Note: DNC indicates that the contour did not close within the calculation grid.

*The area of the 60 dB contour for the 737800 departure is somewhat reduced due to the aircraft reaching the end of it modeled profile.

Table 4. Rotorcraft Hover L_{MAX} Contour Area (km^2)

ANP Aircraft	Altitude	60 dB	65 dB	70 dB	75 dB	80 dB	85 dB	90 dB	95 dB
B206L	500	2.1738	1.0881	0.4073	0.0919	0.0000	0.0000	0.0000	0.0000
	1000	2.6880	1.1386	0.2592	0.0000	0.0000	0.0000	0.0000	0.0000
	1500	2.7008	0.8922	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	2000	2.4141	0.3781	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	2500	1.9293	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	3000	1.1189	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	3500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
B212	500	5.7515	3.0193	1.5162	0.6515	0.1992	0.0192	0.0000	0.0000
	1000	7.4871	3.9767	1.7491	0.5850	0.0000	0.0000	0.0000	0.0000
	1500	8.3734	4.2242	1.5981	0.3215	0.0000	0.0000	0.0000	0.0000
	2000	8.6785	4.0524	1.2445	0.0000	0.0000	0.0000	0.0000	0.0000
	2500	8.5709	3.6162	0.7689	0.0000	0.0000	0.0000	0.0000	0.0000
	3000	8.1640	3.0041	0.1679	0.0000	0.0000	0.0000	0.0000	0.0000
	3500	7.5263	2.3529	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
B407	500	2.2594	1.1356	0.5103	0.1785	0.0258	0.0000	0.0000	0.0000
	1000	2.8151	1.2117	0.3889	0.0349	0.0000	0.0000	0.0000	0.0000
	1500	2.8593	1.0033	0.1616	0.0000	0.0000	0.0000	0.0000	0.0000
	2000	2.6110	0.6493	0.0060	0.0000	0.0000	0.0000	0.0000	0.0000
	2500	2.1698	0.3084	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	3000	1.6199	0.0643	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	3500	1.1001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
R44	500	1.3358	0.6230	0.2371	0.0523	0.0000	0.0000	0.0000	0.0000
	1000	1.4559	0.5210	0.0730	0.0000	0.0000	0.0000	0.0000	0.0000
	1500	1.2433	0.2564	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	2000	0.8851	0.0017	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	2500	0.3904	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	3000	0.0158	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	3500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
S70	500	10.4370	5.9373	3.1808	1.6181	0.7303	0.2417	0.0111	0.0000
	1000	13.7740	7.6943	4.1690	1.8859	0.6848	0.0000	0.0000	0.0000
	1500	16.0140	8.5975	4.4249	1.7539	0.2343	0.0000	0.0000	0.0000
	2000	17.4320	8.9166	4.2569	1.3793	0.0000	0.0000	0.0000	0.0000
	2500	18.2160	8.8210	3.8238	0.3627	0.0000	0.0000	0.0000	0.0000
	3000	18.4980	8.4262	3.1974	0.0000	0.0000	0.0000	0.0000	0.0000
	3500	18.3790	7.7947	2.0321	0.0000	0.0000	0.0000	0.0000	0.0000
S76	500	5.1474	2.6379	1.3131	0.5231	0.1412	0.0000	0.0000	0.0000
	1000	6.6373	3.4313	1.4597	0.4119	0.0000	0.0000	0.0000	0.0000
	1500	7.3278	3.6196	1.2636	0.0000	0.0000	0.0000	0.0000	0.0000
	2000	7.4848	3.4135	0.5932	0.0000	0.0000	0.0000	0.0000	0.0000
	2500	7.2682	2.9610	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	3000	6.7808	2.1058	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	3500	6.0855	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SA350D	500	2.3716	1.1869	0.4675	0.1263	0.0000	0.0000	0.0000	0.0000
	1000	3.0004	1.2774	0.3341	0.0000	0.0000	0.0000	0.0000	0.0000
	1500	3.0858	1.0522	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	2000	2.8389	0.4950	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	2500	2.3714	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	3000	1.5399	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	3500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table 5. Aircraft Level Flight L_{MAX} Under Flight Path by Altitude

ANP Aircraft	L_{MAX} at Centerline (dB)						
	500 ft.	1,000 ft.	1,500 ft.	2,000 ft.	2,500 ft.	3,000 ft.	3,500 ft.
1900D	80.4	73.8	69.8	67.1	64.7	62.7	61.1
BEC58P	78.5	72.2	68.5	65.9	63.8	62.1	60.6
C130	90.2	83.4	79.2	76.3	73.8	71.7	70.1
CNA206	90.7	84.1	80.0	77.1	74.6	72.6	70.9
CNA208	85.4	77.5	73.6	70.8	68.5	66.7	65.1
CNA441	75.9	69.5	65.6	62.8	60.6	58.7	57.1
DC6	89.3	82.7	78.7	75.9	73.6	71.7	70.1
DHC-2FLT	88.5	82.9	79.6	77.5	75.7	74.5	73.6
DHC6	83.0	76.6	72.7	70.0	67.7	65.8	64.3
DHC8	73.5	66.4	61.9	58.9	56.6	54.8	53.4
GASEPF	69.7	63.4	59.7	57.2	55.1	53.5	52.1
GASEPV	75.3	69.0	65.2	62.6	60.5	58.8	57.4
PA30	73.9	67.3	62.6	59.2	55.9	53.1	50.8
737800	83.8	76.7	72.2	69.1	66.5	64.4	62.6
B206L	79.2	72.4	68.8	66.2	63.7	61.6	59.9
B212	86.2	79.9	76.7	74.5	72.3	70.5	69.0
B407	79.3	72.6	68.3	65.2	62.6	60.4	58.5
R44	78.0	71.5	67.5	64.6	62.2	60.2	58.5
S70	89.3	82.6	79.0	76.5	74.0	71.9	70.2
S76	83.0	76.2	72.4	69.8	67.1	64.9	63.1
SA350D	78.2	71.4	67.8	65.3	62.8	60.8	59.0

Table 6. Aircraft Level Flight L_{MAX} Contour Width (km)

ANP Aircraft	Altitude	60 dB	65 dB	70 dB	75 dB	80 dB	85 dB	90 dB	95 dB
1900D	500	1.683	1.186	0.764	0.427	0.089	0.000	0.000	0.000
	1000	1.894	1.221	0.641	0.000	0.000	0.000	0.000	0.000
	1500	1.922	1.099	0.000	0.000	0.000	0.000	0.000	0.000
	2000	1.850	0.817	0.000	0.000	0.000	0.000	0.000	0.000
	2500	1.699	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	3000	1.461	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	3500	1.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000
BEC58P	500	1.548	1.053	0.648	0.317	0.000	0.000	0.000	0.000
	1000	1.738	1.068	0.470	0.000	0.000	0.000	0.000	0.000
	1500	1.759	0.921	0.000	0.000	0.000	0.000	0.000	0.000
	2000	1.686	0.537	0.000	0.000	0.000	0.000	0.000	0.000
	2500	1.537	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	3000	1.271	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	3500	0.759	0.000	0.000	0.000	0.000	0.000	0.000	0.000
C130	500	2.935	2.160	1.562	1.106	0.719	0.405	0.060	0.000
	1000	3.399	2.488	1.721	1.117	0.574	0.000	0.000	0.000
	1500	3.660	2.605	1.714	0.969	0.000	0.000	0.000	0.000
	2000	3.794	2.615	1.610	0.603	0.000	0.000	0.000	0.000
	2500	3.847	2.558	1.424	0.000	0.000	0.000	0.000	0.000
	3000	3.846	2.445	1.071	0.000	0.000	0.000	0.000	0.000
	3500	3.802	2.281	0.204	0.000	0.000	0.000	0.000	0.000
CNA206	500	3.366	2.419	1.712	1.205	0.785	0.448	0.119	0.000
	1000	3.941	2.809	1.926	1.240	0.663	0.000	0.000	0.000
	1500	4.265	2.982	1.949	1.114	0.000	0.000	0.000	0.000
	2000	4.455	3.032	1.865	0.825	0.000	0.000	0.000	0.000
	2500	4.553	3.000	1.699	0.000	0.000	0.000	0.000	0.000
	3000	4.578	2.904	1.435	0.000	0.000	0.000	0.000	0.000
	3500	4.552	2.758	0.921	0.000	0.000	0.000	0.000	0.000
CNA208	500	2.207	1.553	1.066	0.667	0.373	0.080	0.000	0.000
	1000	2.615	1.729	1.073	0.491	0.000	0.000	0.000	0.000
	1500	2.826	1.732	0.914	0.000	0.000	0.000	0.000	0.000
	2000	2.920	1.632	0.492	0.000	0.000	0.000	0.000	0.000
	2500	2.936	1.452	0.000	0.000	0.000	0.000	0.000	0.000
	3000	2.900	1.108	0.000	0.000	0.000	0.000	0.000	0.000
	3500	2.823	0.315	0.000	0.000	0.000	0.000	0.000	0.000
CNA441	500	1.265	0.823	0.469	0.138	0.000	0.000	0.000	0.000
	1000	1.335	0.727	0.000	0.000	0.000	0.000	0.000	0.000
	1500	1.243	0.324	0.000	0.000	0.000	0.000	0.000	0.000
	2000	1.032	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	2500	0.508	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	3000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	3500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
DC6	500	2.969	2.148	1.532	1.065	0.677	0.360	0.000	0.000
	1000	3.482	2.498	1.697	1.072	0.511	0.000	0.000	0.000
	1500	3.781	2.636	1.694	0.916	0.000	0.000	0.000	0.000
	2000	3.958	2.667	1.597	0.509	0.000	0.000	0.000	0.000
	2500	4.053	2.627	1.417	0.000	0.000	0.000	0.000	0.000
	3000	4.091	2.536	1.074	0.000	0.000	0.000	0.000	0.000
	3500	4.089	2.398	0.259	0.000	0.000	0.000	0.000	0.000

Table 6. Aircraft Level Flight L_{MAX} Contour Width (Continued)

ANP Aircraft	Altitude	60 dB	65 dB	70 dB	75 dB	80 dB	85 dB	90 dB	95 dB
DHC-2FLT	500	2.614	1.921	1.400	0.976	0.620	0.318	0.000	0.000
	1000	3.124	2.322	1.607	1.042	0.512	0.000	0.000	0.000
	1500	3.482	2.539	1.705	0.993	0.000	0.000	0.000	0.000
	2000	3.755	2.688	1.756	0.848	0.000	0.000	0.000	0.000
	2500	3.971	2.806	1.784	0.533	0.000	0.000	0.000	0.000
	3000	4.164	2.909	1.776	0.000	0.000	0.000	0.000	0.000
	3500	4.345	3.003	1.721	0.000	0.000	0.000	0.000	0.000
DHC6	500	2.111	1.481	1.002	0.611	0.290	0.000	0.000	0.000
	1000	2.461	1.630	0.982	0.383	0.000	0.000	0.000	0.000
	1500	2.583	1.605	0.791	0.000	0.000	0.000	0.000	0.000
	2000	2.588	1.478	0.000	0.000	0.000	0.000	0.000	0.000
	2500	2.521	1.251	0.000	0.000	0.000	0.000	0.000	0.000
	3000	2.393	0.762	0.000	0.000	0.000	0.000	0.000	0.000
	3500	2.210	0.000	0.000	0.000	0.000	0.000	0.000	0.000
DHC8	500	0.901	0.572	0.286	0.000	0.000	0.000	0.000	0.000
	1000	0.829	0.316	0.000	0.000	0.000	0.000	0.000	0.000
	1500	0.556	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	2000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	2500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	3000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	3500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GASEPF	500	0.732	0.392	0.000	0.000	0.000	0.000	0.000	0.000
	1000	0.611	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	1500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	2000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	2500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	3000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	3500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GASEPV	500	1.213	0.777	0.430	0.076	0.000	0.000	0.000	0.000
	1000	1.282	0.675	0.000	0.000	0.000	0.000	0.000	0.000
	1500	1.198	0.202	0.000	0.000	0.000	0.000	0.000	0.000
	2000	0.998	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	2500	0.492	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	3000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	3500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
PA30	500	0.966	0.636	0.336	0.000	0.000	0.000	0.000	0.000
	1000	0.912	0.420	0.000	0.000	0.000	0.000	0.000	0.000
	1500	0.670	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	2000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	2500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	3000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	3500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
737800	500	1.794	1.314	0.920	0.602	0.333	0.000	0.000	0.000
	1000	2.076	1.435	0.915	0.407	0.000	0.000	0.000	0.000
	1500	2.178	1.406	0.719	0.000	0.000	0.000	0.000	0.000
	2000	2.176	1.268	0.000	0.000	0.000	0.000	0.000	0.000
	2500	2.095	0.926	0.000	0.000	0.000	0.000	0.000	0.000
	3000	1.943	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	3500	1.690	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 6. Aircraft Level Flight L_{MAX} Contour Width (Continued)

ANP Aircraft	Altitude	60 dB	65 dB	70 dB	75 dB	80 dB	85 dB	90 dB	95 dB
B206L	500	1.674	1.189	0.727	0.355	0.000	0.000	0.000	0.000
	1000	1.863	1.213	0.587	0.000	0.000	0.000	0.000	0.000
	1500	1.869	1.058	0.000	0.000	0.000	0.000	0.000	0.000
	2000	1.769	0.712	0.000	0.000	0.000	0.000	0.000	0.000
	2500	1.586	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	3000	1.219	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	3500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B212	500	2.700	1.955	1.388	0.909	0.506	0.180	0.000	0.000
	1000	3.079	2.244	1.487	0.857	0.069	0.000	0.000	0.000
	1500	3.254	2.291	1.417	0.627	0.000	0.000	0.000	0.000
	2000	3.311	2.261	1.245	0.000	0.000	0.000	0.000	0.000
	2500	3.287	2.131	0.969	0.000	0.000	0.000	0.000	0.000
	3000	3.205	1.919	0.425	0.000	0.000	0.000	0.000	0.000
	3500	3.073	1.710	0.000	0.000	0.000	0.000	0.000	0.000
B407	500	1.266	0.880	0.562	0.291	0.000	0.000	0.000	0.000
	1000	1.297	0.789	0.344	0.000	0.000	0.000	0.000	0.000
	1500	1.171	0.567	0.000	0.000	0.000	0.000	0.000	0.000
	2000	0.973	0.078	0.000	0.000	0.000	0.000	0.000	0.000
	2500	0.679	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	3000	0.163	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	3500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
R44	500	1.199	0.786	0.453	0.188	0.000	0.000	0.000	0.000
	1000	1.228	0.664	0.203	0.000	0.000	0.000	0.000	0.000
	1500	1.096	0.438	0.000	0.000	0.000	0.000	0.000	0.000
	2000	0.909	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	2500	0.619	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	3000	0.086	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	3500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
S70	500	3.670	2.763	2.020	1.440	0.967	0.559	0.111	0.000
	1000	4.221	3.149	2.314	1.555	0.937	0.000	0.000	0.000
	1500	4.573	3.331	2.387	1.499	0.387	0.000	0.000	0.000
	2000	4.735	3.393	2.341	1.329	0.000	0.000	0.000	0.000
	2500	4.881	3.396	2.219	0.049	0.000	0.000	0.000	0.000
	3000	4.902	3.303	2.032	0.000	0.000	0.000	0.000	0.000
	3500	4.890	3.160	1.626	0.000	0.000	0.000	0.000	0.000
S76	500	2.625	1.871	1.321	0.838	0.461	0.000	0.000	0.000
	1000	2.960	2.142	1.400	0.758	0.000	0.000	0.000	0.000
	1500	3.113	2.207	1.312	0.000	0.000	0.000	0.000	0.000
	2000	3.133	2.148	0.458	0.000	0.000	0.000	0.000	0.000
	2500	3.111	2.007	0.000	0.000	0.000	0.000	0.000	0.000
	3000	3.011	0.873	0.000	0.000	0.000	0.000	0.000	0.000
	3500	2.861	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SA350D	500	1.701	1.206	0.757	0.399	0.000	0.000	0.000	0.000
	1000	1.900	1.240	0.622	0.000	0.000	0.000	0.000	0.000
	1500	1.914	1.110	0.000	0.000	0.000	0.000	0.000	0.000
	2000	1.819	0.641	0.000	0.000	0.000	0.000	0.000	0.000
	2500	1.640	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	3000	1.213	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	3500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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DOT-VNTSC-FWS-21-01