O’Hare Modernization
Environmental Impact Statement

Attachment F-7

Airspace Noise Analysis

HMMH Report No. 298930.064
October 2004

Prepared for:

Crawford, Murphy & Tilly, Inc.
Chicago, IL 60602

O'Hare Modernization
Environmental Impact Statement

Airspace Noise Analysis

HMMH Report No. 298930.064
October 2004

Prepared for:

Crawford, Murphy & Tilly, Inc.
70 West Madison St., Ste 460
Chicago, IL 60602

Prepared by:

Robert Mentzer Jr.
David Crandall
Marc NewmarK

HARRIS MILLER MILLER & HANSON INC.
15 New England Executive Park
Burlington, MA 01803

EXECUTIVE SUMMARY

The Build Alternatives would result in changes to aircraft operations in five geographical areas as follows:

- General Mitchell International Airport (MKE) Eastbound Departure Corridor from Milwaukee, Wisconsin
- Midway Airport (MDW) arrivals Southeast from the Brickyard VORTAC (VHP) between 6,000 and 24,000 feet MSL
- South Bend Airport (SBN) flight tracks while O'Hare (ORD) is in west flow
- Rockford Airport (RFD) flight tracks while ORD is in east flow
- DuPage Airport (DPA) westbound departures while ORD is in east flow

The airspace noise analysis evaluated Build Out + 5 (2018) Alternative A (No Action) and Build Out + 5 (2018) for the Build Alternatives.

The changes listed above would not cause noise levels in Build Out + 5 (2018) for the Build Alternatives to exceed FAA's criteria for significant noise impact anywhere. The effect of the changes on total noise exposure is expected to be minimal because the number of affected aircraft operations is small and the most of the changes occur where aircraft are at altitudes above 3000 feet.

In addition to there being no significant noise impact, the airspace analysis indicates that no noise impact is expected with respect to DNL 5 dB increases at DNL values above 45 dBA or DNL 3 dB increases at DNL values above 60 dBA.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

Harris Miller Miller & Hanson Inc. (HMMH) conducted an evaluation of potential noise impact resulting from changes to aircraft operations at surrounding airports caused by the Build Alternatives. This report summarizes HMMH's evaluation including applicable noise criteria, study methods and potential noise impact.

OMP implementation would result in changes to aircraft operations in five geographical areas as follows:[1]

- General Mitchell International Airport (MKE) Eastbound Departure Corridor from Milwaukee, Wisconsin
- Midway Airport (MDW) arrivals Southeast from the Brickyard VORTAC (VHP) between 6,000 and 24,000 feet MSL
- South Bend Airport (SBN) flight tracks while O'Hare (ORD) is in west flow
- Rockford Airport (RFD) flight tracks while ORD is in east flow
- DuPage Airport (DPA) westbound departures while ORD is in east flow

The airspace noise analysis evaluated Build Out + 5 (2018) Alternative A (No Action) and Build Out + 5 (2018) Build Alternative C (With Project). For this EIS, Alternative C was analyzed to represent the Build Alternatives (Alternatives C, D, and G), as the same airspace changes would be required for all Build Alternatives.

FAA Order 1050.1E indicates that

> for air traffic airspace actions where the study area is larger than the immediate vicinity of an airport, incorporates more than one airport, or includes actions above 3,000 feet AGL, noise modeling will be conducted using NIRS… Noise contours will not be prepared for the NIRS, however, NIRS will be used to produce change-of-exposure tables and maps at population centroids using the following criteria:
>
> - DNL 60-65 dB ±3 dB
> - DNL 45-60 dB ±5 dB

The changes listed above would not cause noise levels in Alternative C to exceed FAA's criteria for significant noise impact. The effect of the changes on total noise exposure is expected to be minimal because the number of affected aircraft operations is small, and most of the changes occur where aircraft are at altitudes above 3,000 feet.

In addition to there being no significant noise impact, the airspace analysis indicates that no noise impact is expected with respect to a DNL 5 dB increases at values above DNL 45 dB or 3 dB increases at values above DNL 60 dB.

For MKE, there are potential changes to air traffic below 3000 feet in Alternative C, so the Integrated Noise Model (INM) is used for the analysis. For the other four airports, a simple NIRS modeling procedure provided an estimate of the noise levels and the change in noise levels

[1] October 22, 2003 and May 26, 2004 meetings with FAA at Great Lakes Region.

associated with operations affected by Alternative C. Since this analysis will not be developed as a full airspace analysis, various simplifying assumptions that are comparable to the Air Traffic Noise Screening (ATNS) modeling procedure were used, including:

- No lateral dispersion,
- Little vertical dispersion – aircraft will be modeled at the lowest altitude associated with the respective alternative or the level that they would file in their flight plans,
- Point-to-point flight tracks, and
- Noise values will be computed *at* discrete points directly under the flight path.

The following sections present the analysis of changes at other airports in the region in Alternative C or to changes to their flight procedures in Alternative C.

2 TECHNICAL APPROACH

This section of the report discusses the noise criteria and technical approach. Results are given in the next section. Attachment A to this report provides detailed descriptions and graphical illustrations of the various noise descriptors and metrics that are referred to throughout this report.

2.1 Noise Criteria

2.1.1 Regulatory Context

The analysis of aviation noise impacts generally falls under the responsibility of the FAA. A list of Federal statutes and FAA regulations related to the consideration of noise impacts follows:

- 49 U.S.C. 47501-47507; The Aviation Safety and Noise Abatement Act of 1979, as amended
- 49 U.S.C. 40101 et seq., as amended by PL 103-305 (Aug. 23, 1994); The Federal Aviation Act of 1958
- The Control and Abatement of Aircraft Noise and Sonic Boom Act of 1968
- 49 U.S.C. 47101 et seq., as amended by PL 103-305 (Aug. 23, 1994); The Airport and Airway Improvement Act
- 49 U.S.C. 2101 et seq.; The Airport Noise and Capacity Act of 1990
- 49 U.S.C. 44715; The Noise Control Act of 1972
- 14 CFR Part 150; Noise Control and Compatibility Planning for Airports Advisory Circular, 150/5020
- 14 CFR Part 161; Notice and Approval of Airport Noise and Access Restrictions

2.1.2 Thresholds of Significance

Day Night Noise Level (DNL) is a cumulative measure of total sound energy generally compiled on an annual basis. The DNL represents a logarithmic average of the sound levels at a location over a 24 hour period, with a 10 decibel (dB) weighting penalty added to all sounds occurring during nighttime hours (between 10:00 p.m. and 7:00 a.m.). The 10 dB penalty represents the added intrusiveness of noise at nighttime because ambient sound levels during nighttime hours are typically about 10 dB lower than during daytime hours, and because of the annoyance associated with sleep disruption.

The threshold of significance for aircraft noise is incorporated into FAA Order 1050.1E, Appendix A, Paragraph 14.3, which reads as follows:

> If the above comparisons show a DNL 1.5 dB or greater increase over a noise sensitive area exposed to DNL 65 dB or greater as a result of the proposed project or any of its reasonable alternatives (except no action), a level of significant noise impact has been reached.

This level of significance was subsequently re-examined and confirmed by the Federal Interagency Committee on Noise (FICON) in 1992. In accordance with this Federal policy, FAA Order 1050.1E states the following:

> A significant noise impact would occur if analysis shows that a project will cause noise sensitive areas to experience an increase in noise of DNL 1.5 dB or more at or above DNL 65 dB noise exposure when compared to the alternative for the same timeframe. For example, an increase from 63.5 dB to 65 dB is considered a significant impact. Special consideration needs to be given to the evaluation of the significance of noise impacts on noise sensitive areas within national parks, national wildlife refuges and historic sites, including traditional cultural properties. For example, the DNL 65 dB threshold does not adequately address the effects of noise on visitors to areas within a national park or national wildlife refuge where other noise is very low and a quiet setting is a generally recognized purpose and attribute.

Aircraft noise exposure is customarily evaluated relative to the probable effect on human activities characteristic of specific land uses. Federal guidelines (14 CFR Part 150 Table A) and thresholds for evaluating such effects on land use are outlined in Section 5.2.2 of the Environmental Impact Statement. All land uses are considered to be compatible with noise less than DNL 65, but only certain activities are compatible at levels greater than DNL 65. As discussed above, changes in DNL of 1.5 dB or more in noise sensitive areas exceeding DNL 65 are considered to be significant.

In addition to the threshold of significance discussed above, the 1992 FICON recommended that examination of noise levels between DNL 65 and 60 dB be conducted if analysis shows that noise sensitive areas at or above DNL 65 dB will have an increase of DNL 1.5 dB or more. This analysis should identify noise-sensitive areas between DNL 60-65 dB having an increase of DNL 3 dB or more due to the proposed action. The FICON recommendations also state that the potential for mitigating noise in those areas should be considered, including consideration of the same range of mitigation options available at DNL 65 dB and higher and eligibility for federal funding. As noted in FAA Order 1050.1E, the consideration of mitigation for noise impacts between DNL 60 and 65 "…is not to be interpreted as a commitment to fund or otherwise implement mitigation measures in any particular area."

2.1.3 Impact Threshold at Low Noise Levels

Since many of the changes to aircraft routes that would occur with Alternative C are where the aircraft are above 10,000 feet MSL, most of the DNL values from aircraft operations in these areas would be quite low. As implied in the last paragraph of the section above, if future noise levels with the proposed action are less than 45 dBA, then no noise impact occurs with respect to FAA Order 1050.1E. To streamline the airspace noise analysis for areas where little or no impact is expected, the DNL value of 43.3 dBA was identified as a threshold for the Alternative C DNL, below which no impact can occur, independent of any other ambient noise sources and the DNL from Alternative A in the same year.[2] Therefore, in many of the areas where low levels of DNL were expected, the airspace modeling first evaluated only Alternative C to determine where DNL values were less than 43.3 dBA. Then, in those areas, Alternative A was not evaluated since impact could not occur.

[2] No combination of Alternative C (proposed action) DNL values less than 43.3 dBA and any Alternative A (no action) DNL or ambient DNL that remains constant between Alternatives A and C can result in an Alternative C DNL that equals or exceeds 45 dBA <u>and</u> is also 5 dB or more higher than the Alternative A DNL.

Additional analysis is warranted in areas where DNL values from Alternative C are 43.3 dBA or higher.

2.2 Methodology

2.2.1 General Mitchell International Airport (MKE)

General Mitchell International Airport (MKE) is a medium hub airport situated approximately 70 miles north of Chicago's O'Hare International Airport (ORD), close enough that its flights must be coordinated with O'Hare operations under certain flow conditions. Specifically, under Alternative C, during high traffic hours from 6:30 AM to 10:00 PM, existing departures out of MKE on easterly headings would, in the future, need to be rerouted to the southeast shortly after takeoff to join with eastbound departure streams leaving ORD. No other changes to MKE departure of arrival procedures are anticipated at this time.[3]

Because the Alternative C affects some aircraft routings during climbout from MKE, the FAA's INM was used rather than NIRS to evaluate changes in noise exposure in the vicinity of this airport. For consistency with other on-going noise evaluations at MKE, noise model inputs used for both the No Action Alternative (Alternative A) and Alternative C came largely from a current FAR Part 150 Noise Compatibility Study, which was provided to the EIS study team by staff at Mitchell International Airport. Relevant data included information on runway use, flight tracks and track usage, and climb profiles. The number and mix of operations by aircraft type were also derived from information collected for the Part 150 Study, but were modified to represent Build Out + 5 year operation levels by (a) scaling the traffic counts to match FAA's Fiscal Year 2003 Terminal Area Forecast (TAF), published in early calendar year 2004, and (b) substituting several new aircraft types to reflect the retirement of older, noisier aircraft that are not expected to remain in the fleet. The only differences in model inputs between the No Action and Alternative C are the locations and usage of the eastbound flight tracks that are anticipated to change with the Build Alternative.

The Integrated Noise Model (INM) study for MKE for the basecase conditions of the MKE Part 150 study[4] was used to identify five jet departure flight paths from MKE, which turn to a 90-degree heading and proceed east towards the SQUIB fix. Using these flight paths as a guide, new flight paths were developed to follow the current initial turns but then turn to a 130-degree heading and proceed southeast toward the new fix SLAKR. It is important to note that the noise abatement procedures in place for MKE would not change as a result of the Alternative C.

Using the TAF as a guide, the operating fleet mix for MKE was developed for the Build Out + 5 study year. A Build Out + 5 No Action case was set up for MKE to run contours and a uniform grid covering the area to be affected by the route change.

The expected level of operations to be shifted to the new route was identified from data provided by the FAA. Operations are shifted from the existing eastbound route to the new southeast-bound route, and contours and the uniform grid covering the area were calculated for this case also. These results were compared with the Build Out + 5 No Action case to determine the potential noise impact to the surrounding communities. These results are given in Section 3.1.

[3] Email from FAA to HMMH on 8/3/2004

[4] Provided by General Mitchell Airport officer to FAA

2.2.2 Midway (MDW)

Midway Airport (MDW) is situated approximately 10 miles south of O'Hare, and is O'Hare's primary reliever airport. In some circumstances, the Build Alternatives would cause MDW arrivals approaching from the southeast on the BOILER TWO Standard Terminal Arrival Route (STAR) between BRICKYARD VORTAC (VHP) and Chicago Heights VORTAC (CGT) to be rerouted to the east. This procedure would affect arrivals between 6,000 feet and 24,000 feet MSL. Arrivals on the Goshen Three STAR and the Motif Two STAR are unaffected by Alternative C.

The MDW arrivals are expected to change in ground track and in altitudes. Table 1 and Figure1 summarize the affected route as expected by the FAA. Currently aircraft are vectored from VHP northwest to BVT and then onto CGT. Under the proposed procedure, the aircraft would be vectored from VHP northeast to the Kokomo VORTAC (OKK), then north to the CLEFT fix, then west to the BOONE fix and then northwest to CGT. The aircraft would turn west at CLEFT to avoid the northeast corner of Twelve Mile West Military Operations Area (MOA). The base map in Figure1 is color-coded to show estimated ambient DNL values based on U.S. Census 2000 data, as calculated using the EPA equation for estimating DNL based on population density.

Table 1 Alternatives A and C Routes for MDW Arrivals from Southeast

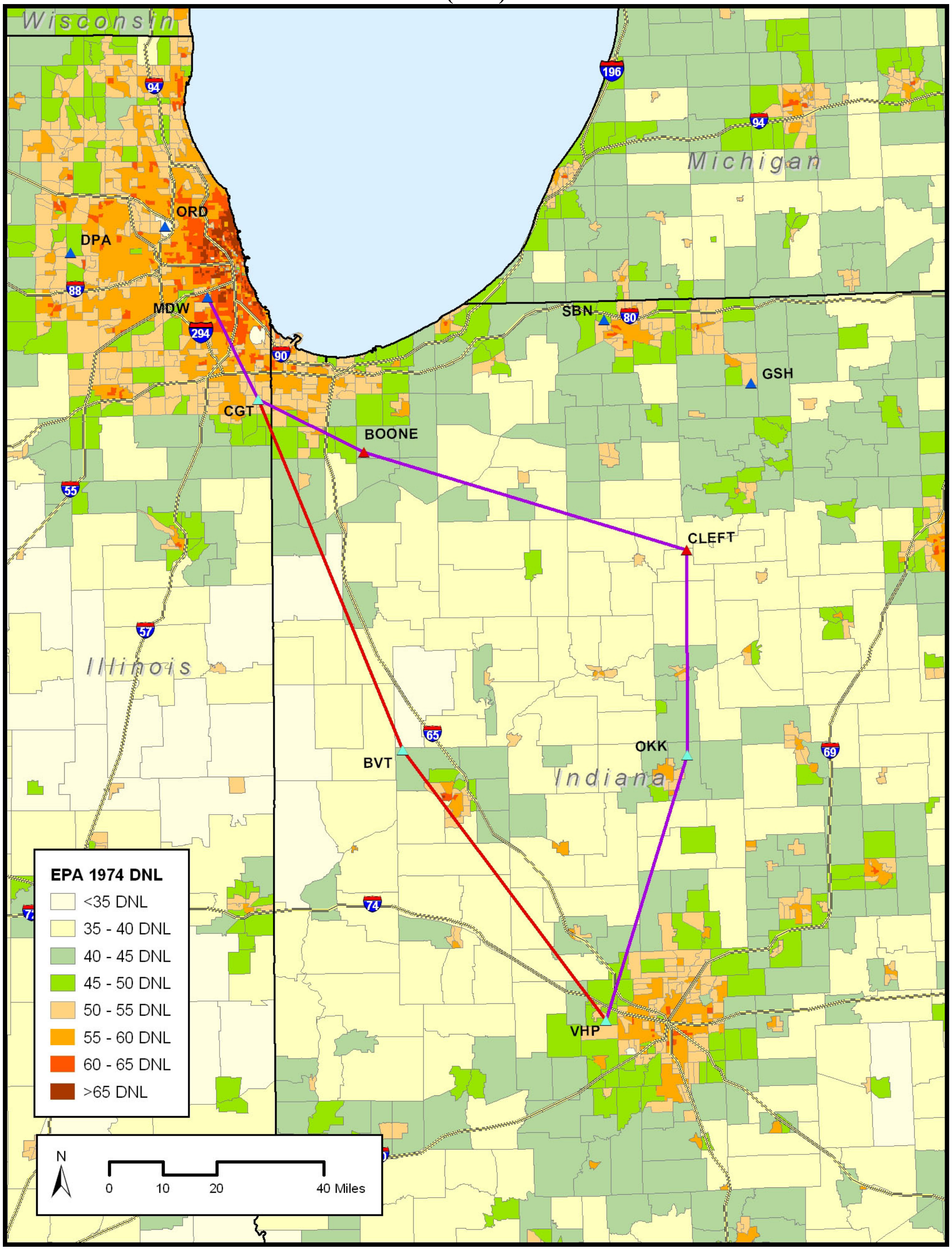
Alternative A		Alternative C	
Location	**Altitude (MSL)**	**Location**	**Altitude (MSL)**
VHP	13,000 feet or lower	VHP	13,000 feet or lower
BVT	13,000 feet or lower	OKK	13,000 feet or lower
		CLEFT	~18,000 feet and descending
		BOONE	6,000 feet or filed altitude
CGT	6,000 feet or filed altitude	CGT	6,000 feet or filed altitude
MDW	Land	MDW	Land

Source: FAA October 22, 2003 Meeting

Because of the large distances and high altitudes over which Alternative C affects Midway traffic, the FAA's NIRS (rather than the INM) was used to evaluate changes in noise exposure from the new routes described above. Calculations of noise were made at individual points conservatively located directly under the current and modified routes to identify the maximum degree of change that could expected from Alternative C. A total of 138 points were modeled for noise computations, spaced approximately 3 miles apart along each of the routes. Figure1 shows the No Action and Proposed routes. Using the FAA's 2003 Terminal Area Forecast (TAF) and the FAA's POET data as a guide, the operating fleet mix along these routes was determined for MDW arrivals for 2018.

Using data provided from the FAA, the expected level of operations to be shifted to the new route were estimated including only operations requesting 13,000 feet and below. Specific points along both routes were computed and compared with Alternative A (2018) to determine noise changes to the underlying communities.

Figure 1 Alternative A (red) and Alternative C (magenta) Routes for MDW Arrivals from Southeast (VHP)



2.2.3 South Bend Regional Airport (SBN)

South Bend Regional Airport (SBN) is situated approximately 74 miles east of O'Hare Airport. SBN is a small regional airport with three runways and the longest is 8412 feet. Due to Alternative C, SBN departures with westerly headings may be affected.

Departures from SBN do not follow any Standard Instrument Departure (SID) procedures but do have published departure procedures that require aircraft to depart and follow the runway heading until reaching 2000 feet and then they can turn and be vectored to the appropriate route. This procedure is expected to remain the same in the future.

Using the FAA's Terminal Area Forecast (TAF) and POET analysis, the affected operations and fleet mix for SBN departures were estimated for Alternative C in 2018. These operations were modeled departing a single runway and on a single route in NIRS, which calculated DNL values directly under the flight path at specific points, spaced approximately 3 miles apart. This conservative approach tends to over-estimate the future DNL, since in practice, the operations will be using multiple runways and the flight tracks will be more dispersed. Only Alternative C was modeled with NIRS for SBN, since operational changes would be above 10,000 feet and low DNL values were expected (see Section 2.1.3 for details on this rationale).

2.2.4 DuPage Airport (DPA)

DuPage Airport (DPA) is situated approximately 16 miles west of O'Hare Airport. DPA is a small regional airport with four runways and the longest is 7570 feet long. Due to Alternative C, DPA departures with westerly headings may be affected.

Departures from DPA do not follow any Standard Instrument Departure (SID) procedures but for this analysis the departures will follow the runway heading until reaching 3000 feet and then they can turn and be vectored to the appropriate route. This same procedure is expected in the future.

Using the FAA's Terminal Area Forecast and POET data, the affected operations and fleet mix for SBN departures were estimated for Alternative C in 2018. These operations were modeled departing a single runway and on a single route in NIRS, which calculated DNL values directly under the flight path at specific points, spaced approximately 3 miles apart. This conservative approach tends to over-estimate the future DNL, since in practice, the operations will be using multiple runways and the flight tracks will be more dispersed. Only Alternative C was modeled with NIRS for DPA, since operational changes would be above 10,000 feet and low DNL values were expected (see Section 2.1.3 for details on this rationale).

2.2.5 Greater Rockford Airport (RFD)

Greater Rockford Airport (RFD) is situated approximately 54 miles northwest of Chicago's O'Hare International Airport (ORD). RFD is a regional airport with two runways and the longest is 10,000 feet long. Due to Alternative C, RFD departures with easterly headings may be affected.

Departures from RFD do not follow any Standard Instrument Departure (SID) procedures but for this analysis the departures will follow the runway heading until reaching 3,000 feet and then they can turn and be vectored to the appropriate route. This same procedure is expected in the future.

Using the FAA's Terminal Area Forecast and POET analysis, the affected operations and fleet mix for SBN departures were estimated for Alternative C in 2018. These operations were modeled departing a single runway and on a single route in NIRS, which calculated DNL values directly under the flight path at specific points, spaced approximately 3 miles apart. This conservative approach tends to over-estimate the future DNL, since in practice, the operations will be using multiple runways and the flight tracks will be more dispersed. Only Alternative C was modeled with NIRS for RFD, since operational changes would be above 10,000 feet and low DNL values were expected (see Section 2.1.3 for details on this rationale).

2.3 Milwaukee Analysis

2.3.1 Existing Operational Environment

The Part 150 study obtained for MKE from the FAA contained all of the data necessary to run the base case except for the terrain files. The area that may be affected by the route change is near Lake Michigan, however, and does not contain any terrain features that would affect the results of this analysis. Table 2 and Table 3 present the operations for the MKE 2003 base case.

The MKE 2003 Part 150 study contours also contain taxiway modeling, which affect the noise contours on the northwest side of the airport. However, the taxiway modeling is not in the area affected by the traffic shift, so that information was not included in the 2018 modeling.

Day operations occur between 7:00 AM and 10:00 PM. Night operations occur between 10:00 PM and 7:00 AM, and carry a nighttime "penalty" of 10 dBA in the calculation of DNL. In terms of how operations contribute to DNL, one nighttime operation is equivalent to 10 identical daytime operations.

Table 2 Milwaukee 2003 Air Carrier and Air Taxi Average Day Operations

INM A/C Type	Day	Night	Total	Percent
Air Carrier				
717200	24.39	1.51	25.90	13.71%
727EM1	0.44	0.32	0.76	0.40%
727EM2	1.29	2.52	3.81	2.02%
7373B2	9.12	0.92	10.04	5.31%
737400	0.35	0.03	0.38	0.20%
737800	3.19	0.30	3.49	1.84%
737N17	5.10	0.65	5.75	3.04%
74720B	0.06	0.01	0.08	0.04%
757PW	8.12	1.30	9.42	4.99%
757RR	1.29	0.28	1.57	0.83%
A30062	1.89	2.34	4.24	2.24%
A310	0.07	0.06	0.12	0.07%
A319	4.71	1.39	6.10	3.23%
A320	6.27	1.39	7.66	4.05%
A32123	0.67	0.37	1.04	0.55%
BAE146	5.16	0.01	5.17	2.74%
BAE300	4.27	0.00	4.27	2.26%
DC1030	0.02	0.01	0.03	0.02%
DC870	0.76	1.89	2.65	1.40%
DC95HW	45.67	5.11	50.78	26.87%
F10065	0.02	0.00	0.02	0.01%
MD83	42.32	3.36	45.68	24.17%
Total	**165.19**	**23.77**	**188.96**	**100.00%**
Air Taxi				
BEC190	80.96	9.76	90.73	30.83%
BEC9F	0.54	0.07	0.61	0.21%
CL600	2.63	0.34	2.98	1.01%
CNA441	9.37	5.97	15.33	5.21%
DHC6	2.59	0.17	2.76	0.94%
DHC8	2.39	1.36	3.75	1.28%
EMB120	0.52	0.97	1.48	0.50%
EMB14L	83.25	11.14	94.40	32.08%
J328	59.79	5.88	65.67	22.32%
SF340	14.04	2.50	16.54	5.62%
Total	**256.08**	**38.17**	**294.25**	**100.00%**

Table 3 Milwaukee 2003 General Aviation and Military Average Day Operations

INM A/C Type	Day	Night	Total	Percent
General Aviation				
BEC58P	6.54	4.97	11.51	13.96%
CIT3	4.30	0.58	4.87	5.91%
CNA208	9.49	6.85	16.34	19.82%
CNA55B	11.38	0.81	12.19	14.78%
CNA750	1.96	0.11	2.07	2.51%
FAL20	0.59	0.03	0.62	0.75%
GASEPF	3.43	0.31	3.74	4.53%
GASEPV	14.01	1.35	15.36	18.62%
GIIB	0.69	0.03	0.72	0.88%
GIV	2.63	0.26	2.89	3.50%
IA1125	0.65	0.03	0.68	0.83%
LEAR25	0.33	0.04	0.37	0.45%
LEAR35	3.57	0.39	3.96	4.80%
SABR80	6.50	0.63	7.13	8.65%
Total	**66.08**	**16.38**	**82.46**	**100.00%**
Military				
C130	7.50	0.24	7.74	58.73%
F16GE	0.50	0.00	0.50	3.79%
KC135R	4.60	0.34	4.94	37.48%
Total	**12.60**	**0.58**	**13.18**	**100.00%**
Patterns (2 Operations)				
BEC58P	0.00	0.00	0.00	0.20%
CNA441	0.01	0.00	0.01	0.35%
GASEPF	0.20	0.00	0.20	12.64%
GASEPV	1.39	0.00	1.39	86.81%
Total	**1.60**	**0.00**	**1.60**	**100.00%**

2.3.2 Build Out + 5 (2018) Conditions

The FAA's February 2004 Terminal Area Forecast (TAF) of operations was used to develop the 2018 fleet mix for MKE. Operations are forecast for four (4) groups of traffic: air carrier, air taxi, general aviation, and military. Table 4 presents the 2003 tower counts and the TAF operations for 2018, and shows a moderate increase (15.3%) in air carrier and a small increase in general aviation and military. A large increase (38.4%) in air taxi operations is forecast, driven by expected increases in regional jet activity.

Table 4 Milwaukee Terminal Area Forecast Data

Year	Source	Air Carrier	Air Taxi	General Aviation	Military	Total
2003	Tower count	50355	127346	29290	4305	211296
2018	TAF	58038	176196	30103	4509	268846
Percent Change		15.3%	38.4%	2.8%	4.7%	27.2%

The TAF data does not forecast the types or day-night split of aircraft activity. For this airspace analysis, the 2018 operations were assumed to contain the same day-night breakdown as the 2003 Part 150 fleet. For aircraft types, the fleet mix was assumed to remain the same except for the following adjustments.

- The 727-hushkitted operations were replaced with 757 aircraft
- The 737-hushkitted operations were replaced with 737-800 aircraft[5]
- The DC9-hushkitted operations were replaced with A319 aircraft[6]
- The F100 operations were replaced with A319 aircraft
- For the air taxi operations, the turboprops were held at current levels and the regional jet activity was increased.

Regional jets are 55.4% of the existing 2003 air taxi fleet. By holding the turboprops constant and only increasing the regional jets for 2018, the regional jet mix increased to 72.8% of the air taxi fleet.

Table 5 presents details of the future 2018 operations modeled for MKE.

[5] Based on the current Delta fleet

[6] Based on airlines at MKE, the DC9 is being replaced by the B717 and the A319, the A319 is louder and is being used as the DC9 replacement.

Table 5 Milwaukee 2018 Air Carrier and Air Taxi Average Day Operations

INM A/C Type	Day	Night	Total	Percent
Air Carrier				
717200	20.52	1.27	21.79	13.71%
727EM1*	0.00	0.00	0.00	0.00%
727EM2*	0.00	0.00	0.00	0.00%
7373B2	7.67	0.78	8.45	5.31%
737400	0.29	0.03	0.32	0.20%
737800	6.98	0.80	7.77	4.89%
737N17*	0.00	0.00	0.00	0.00%
74720B	0.05	0.01	0.06	0.04%
757PW	6.83	1.09	7.93	4.99%
757RR	2.55	2.62	5.17	3.25%
A30062	1.59	1.97	3.57	2.24%
A310	0.05	0.05	0.10	0.07%
A319	42.41	5.47	47.88	30.11%
A320	5.28	1.17	6.45	4.05%
A32123	0.57	0.31	0.88	0.55%
BAE146	4.34	0.01	4.35	2.74%
BAE300	3.59	0.00	3.59	2.26%
DC1030	0.02	0.01	0.03	0.02%
DC870	0.64	1.59	2.23	1.40%
DC95HW*	0.00	0.00	0.00	0.00%
F10065*	0.00	0.00	0.00	0.00%
MD83	35.61	2.82	38.44	24.17%
Total	**139.01**	**20.00**	**159.01**	**100.00%**
Air Taxi				
BEC190	80.96	9.76	90.73	18.79%
BEC9F	0.54	0.07	0.61	0.13%
CL600	49.80	4.97	54.76	11.34%
CNA441	9.37	5.97	15.33	3.18%
DHC6	2.59	0.17	2.76	0.57%
DHC8	2.39	1.36	3.75	0.78%
EMB120	0.52	0.97	1.48	0.31%
EMB14L	179.50	24.02	203.52	42.16%
J328	84.79	8.45	93.24	19.32%
SF340	14.04	2.50	16.54	3.43%
Total	**424.49**	**58.24**	**482.73**	**100.00%**
* Aircraft no longer operating in 2018				

Table 6 Milwaukee 2018 General Aviation and Military Average Day Operations

INM A/C Type	Day	Night	Total	Percent
General Aviation				
BEC58P	6.48	4.92	11.40	13.96%
CIT3	4.26	0.57	4.83	5.91%
CNA208	9.40	6.79	16.19	19.82%
CNA55B	11.27	0.80	12.08	14.78%
CNA750	1.94	0.11	2.05	2.51%
FAL20	0.59	0.03	0.62	0.75%
GASEPF	3.39	0.31	3.70	4.53%
GASEPV	13.88	1.33	15.21	18.62%
GIIB	0.69	0.03	0.72	0.88%
GIV	2.60	0.26	2.86	3.50%
IA1125	0.64	0.03	0.68	0.83%
LEAR25	0.33	0.04	0.37	0.45%
LEAR35	3.54	0.39	3.92	4.80%
SABR80	6.44	0.62	7.07	8.65%
Total	**65.46**	**16.23**	**81.68**	**100.00%**
Military				
C130	7.03	0.23	7.26	58.73%
F16GE	0.47	0.00	0.47	3.79%
KC135R	4.31	0.32	4.63	37.48%
Total	**11.81**	**0.54**	**12.35**	**100.00%**
Patterns (2 Operations)				
BEC58P	0.00	0.00	0.00	0.20%
CNA441	0.00	0.00	0.00	0.35%
GASEPF	0.10	0.00	0.10	12.64%
GASEPV	0.69	0.00	0.69	86.81%
Total	**0.79**	**0.00**	**0.79**	**100.00%**

There were no adjustments to the runway use for 2018 in either Alternative A or C. In Alternative A, there were no changes to flight tracks or track use. The flight tracks and track use were adjusted for eastbound jets in Alternative C as described in the following section.

2.3.3 Post Operation Evaluation Tool (POET) data

Post Operation Evaluation Tool (POET) [7] data was collected by the FAA for the period of September 4, 2003 through October 22, 2003, representing 49 days of traffic. The data included only eastbound departures from MKE (i.e. flights using the SQUIB fix), and contained both jet and non-jet traffic. The FAA identified the existing operations that would be affected; those operations were then separated from the original data, and into day and night operations.

Currently, jets depart MKE and turn to a 90 deg magnetic heading to proceed to the SQUIB fix, as shown in Figure 2. Alternative C would reroute traffic to a 130 deg magnetic heading and proceed southeast toward a new fix called SLAKR[8], shown in Figure 3. After reaching SLAKR, the aircraft would head south to the eastbound ORD departure stream. Figure 4 presents both sets of tracks, and shows that the proposed rerouting would be occurring primarily over the water except for the area from Oak Creek south to Wind Point.

---

[7] POET is a tool that analyzes recent aircraft operations archived from the Enhanced Traffic Management System (ETMS). Data included departure airport, arrival airport, aircraft type, arrival time, filed route, and requested altitude.

[8] GRAIL runs from August and September 2003 were used to estimate the location of the SLAKR fix. The coordinates used are 42.5625N and 87.4357W. (GRAIL is a real-time simulation model developed by the MITRE Corporation to evaluate proposed changes in airspace routes and sectorization.)

Figure 2 Existing Milwaukee Eastbound Jet Departure Tracks

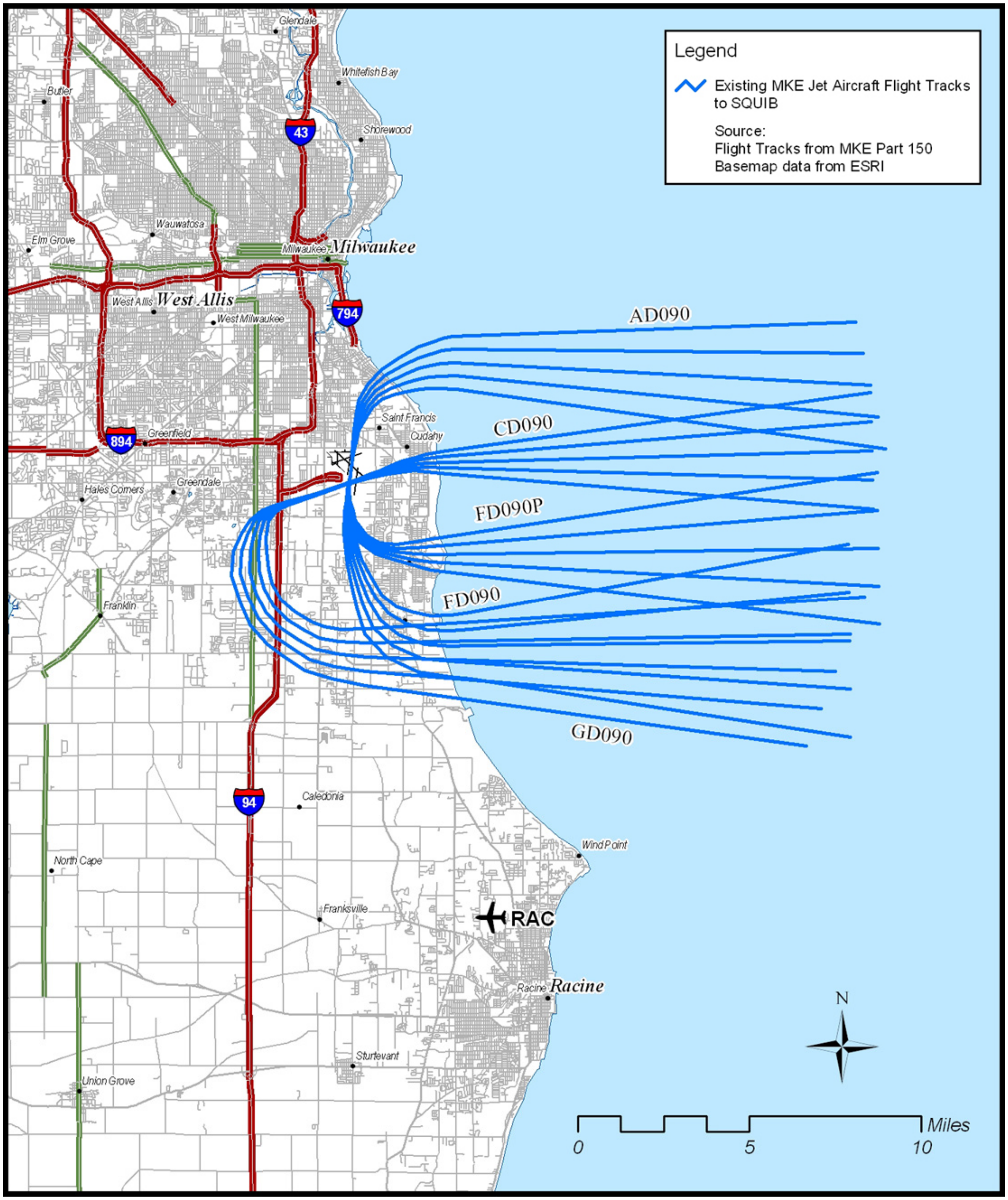


Figure 3 Alternative C (2018) Milwaukee Eastbound Jet Departures Tracks

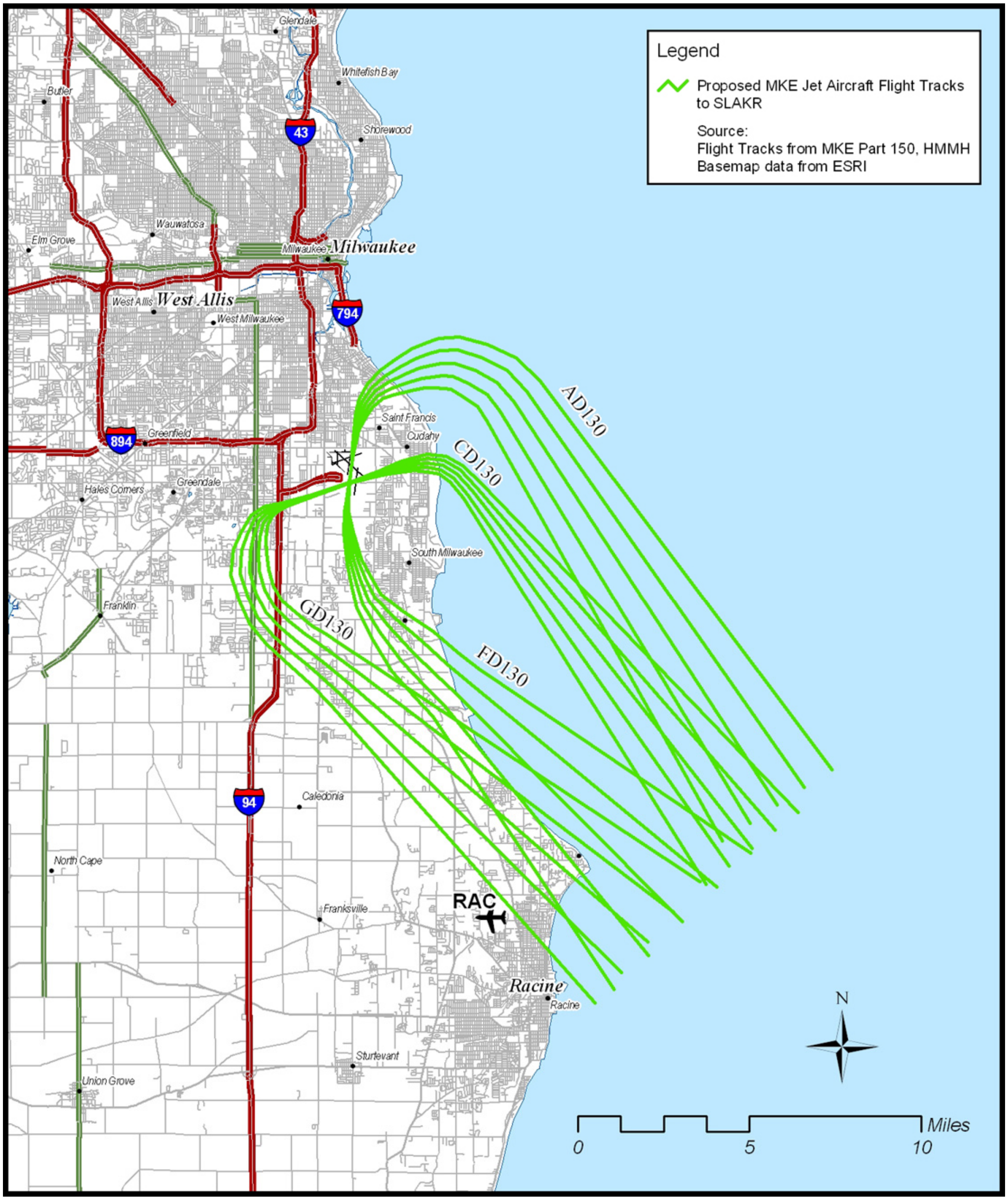
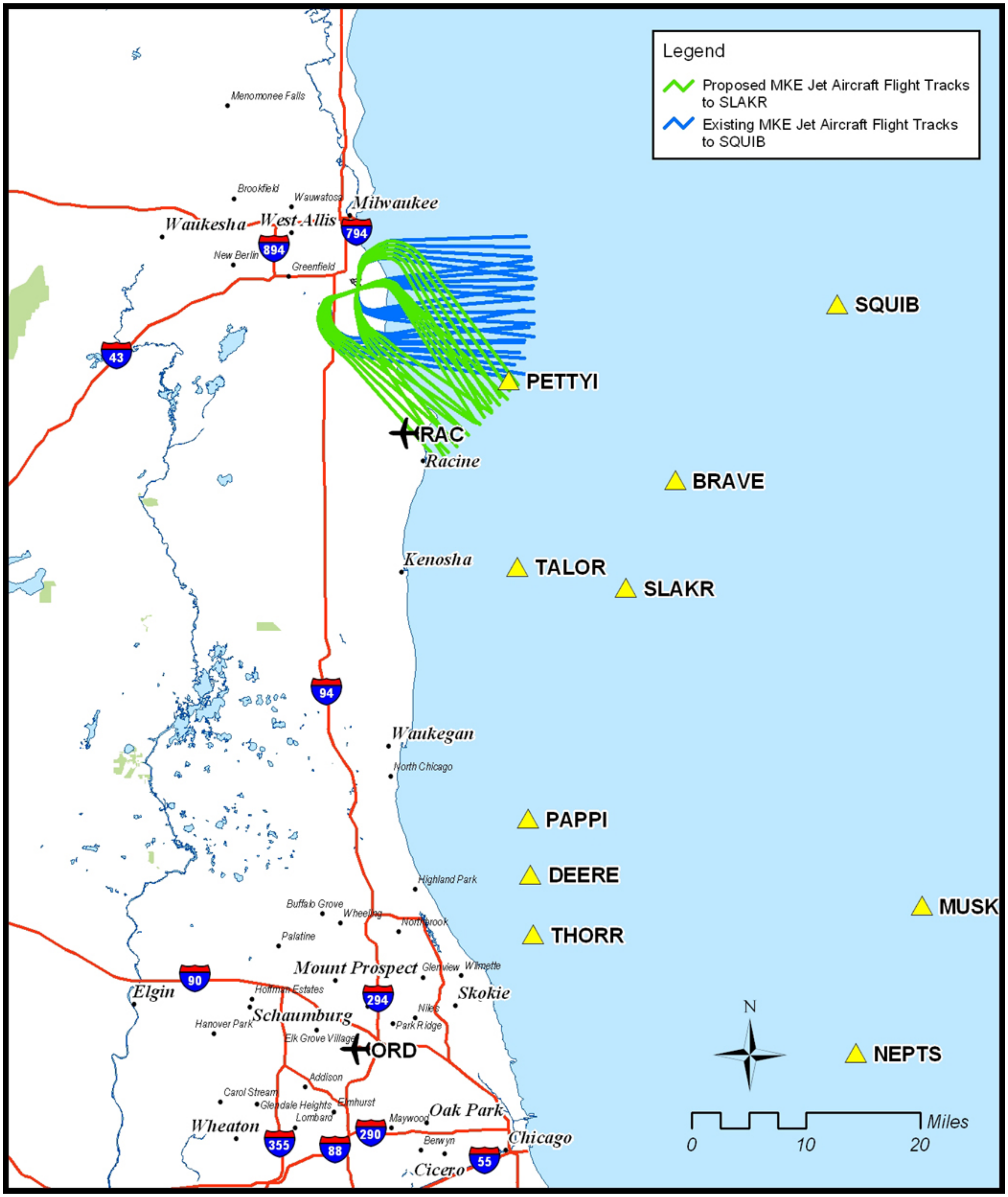


Figure 4 Milwaukee Flight tracks – Existing and Alternative C (2018)



Currently, an average of 96.4 daily operations proceed towards the SQUIB fix, nearly half of the 196.5 daily jet departures from MKE. Analysis of the POET data showed that on an average day, 26.5 operations, due to Alternative C, would be rerouted to the SLAKR fix; the majority of those operations would be air carrier and regional jets. Table 7 provides a breakdown of the current day, night and total operations that would be rerouted, by aircraft category.

Table 7 Milwaukee Average Day Operations Affected by Rerouted Procedure from POET Analysis for 2003

Category	Day	Night	Total
Air Carrier	11.51	0.20	11.71
Air Taxi (Regional Jet)	10.82	0.41	11.22
G/A (Corporate Jet)	3.37	0.02	3.39
Military	0.22	0.00	0.22
Total	**25.92**	**0.63**	**26.55**

Percentages of rerouted aircraft by day and night were applied to the 2018 future fleet mix expected to fly the eastbound routes to SQUIB. Table 8 presents the number of jet departures that would head towards SQUIB in 2018 Alternative A, and how many would be re-routed to SLAKR in Alternative C.

Table 8 Milwaukee Eastbound Jet Departures for the Future Year 2018

East Jet Departures	Procedure	Day		Night		Total	
		No. Ops.	Percent	No. Ops.	Percent	No. Ops.	Percent
Alternative A	SQUIB	100.08	100.0%	11.02	100.0%	112.10	100.0%
Alternative C	SQUIB	54.87	54.8%	9.55	86.7%	64.97	58.0%
	SLAKR	45.21	45.2%	1.47	13.3%	47.12	42.0%

The new tracks and the operations shifted to those tracks were modeled in the INM. Results of the modeling are presented in Section 3.

2.4 Midway Analysis

2.4.1 Existing Operational Environment

Post Operation Evaluation Tool (POET) data was collected by the FAA for a 49-day period in September and October 2003. The data contained both jet and non-jet departures. The FAA identified the existing routes that would be affected; those routes were then separated from the original data, and into day and night operations.

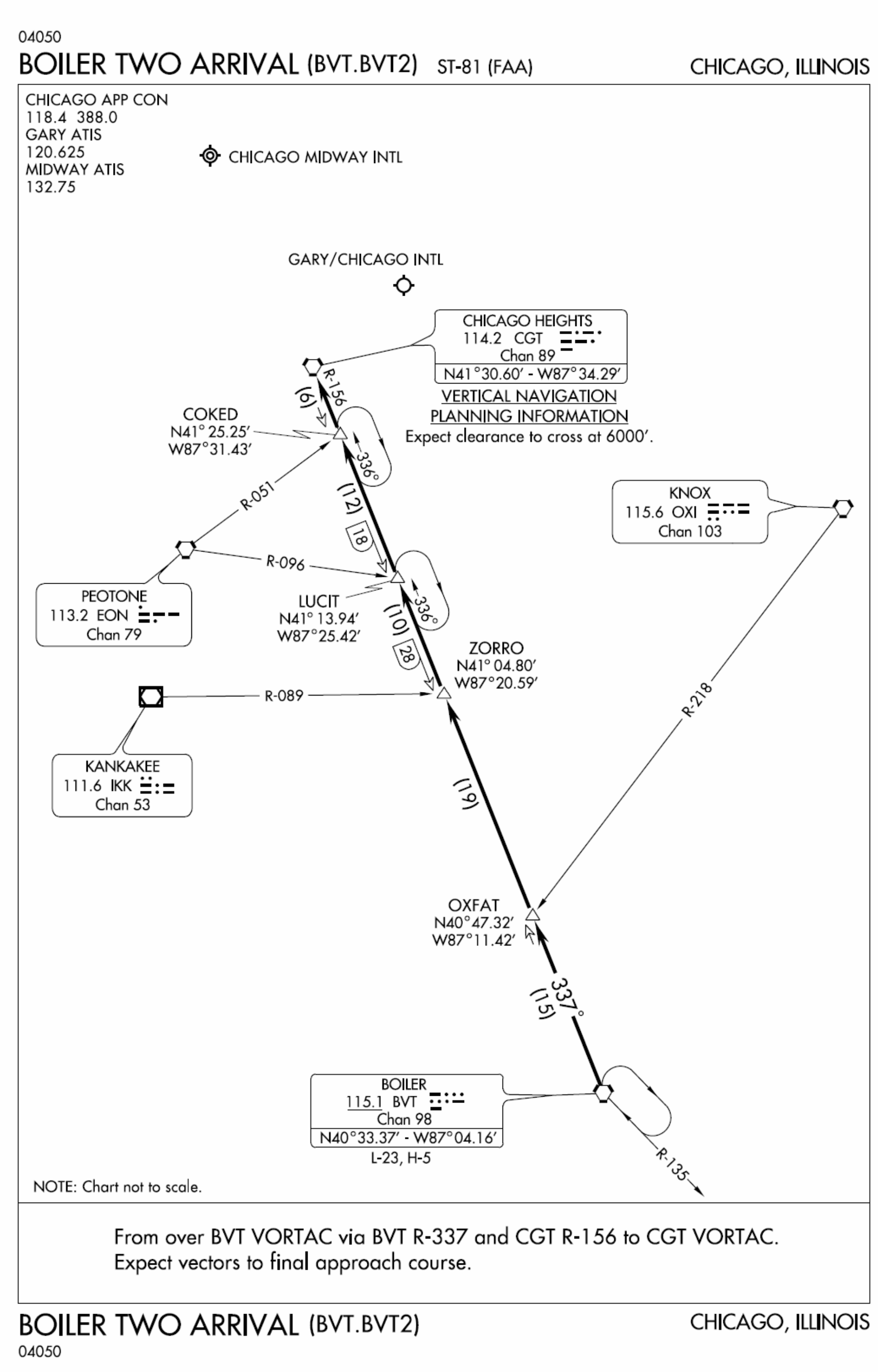
Approximately 52% of the Midway arrivals from the southeast use the Boiler Two STAR and 48% use the Goshen Three STAR. In Alternative C, there would be no changes in the Goshen Three STAR routing. However, some aircraft that currently fly the Boiler Two STAR (see Figure 5) would be rerouted in Alternative C, and are examined in this analysis. The current Boiler Two route takes aircraft from VHP (see Table 1) to BVT and then onto CGT. Approximately 102 arrivals per day followed this route in 2003. Table 9 presents the breakdown of the 2003 operations from the POET data sample. The data is broken down by NIRS aircraft type and split into day and night operations and requesting altitude. These operations form the basis of the Build Out + 5 fleet mix.

Table 9 Average Daily Arrival Operations on Boiler Two STAR for 2003

INM A/C Type	Day	Night	Total
Flights above 13,000 feet			
717200	6.41	1.66	8.07
737300	12.06	4.90	16.96
737400	0.13	0.53	0.66
737500	0.66	0.57	1.23
737700	22.11	5.49	27.60
757PW	4.55	0.22	4.77
757RR	4.02	1.29	5.31
BEC58P	0.06	0.00	0.06
CIT3	0.44	0.09	0.53
CL600	0.60	0.03	0.63
CL601	4.02	1.44	5.46
CNA441	0.22	0.09	0.31
CNA500	0.47	0.09	0.56
CNA750	0.28	0.13	0.41
DHC6	0.79	0.75	1.54
EMB145	0.03	0.00	0.03
FAL20	0.25	0.00	0.25
GASEPV	0.00	0.03	0.03
GII	0.19	0.03	0.22
GIIB	0.09	0.06	0.15
GIV	0.60	0.13	0.73
GV	0.13	0.09	0.22
IA1125	0.22	0.09	0.31
LEAR25	0.35	0.13	0.48
LEAR35	3.27	1.76	5.03
MD81	0.03	0.00	0.03
MU3001	3.05	0.69	3.74
SD330	0.00	0.03	0.03
SF340	2.86	1.04	3.90
Total	**67.89**	**21.36**	**89.25**
Flights at 13,000 feet and below			
BEC58P	0.72	1.51	2.23
CNA172	0.06	0.00	0.06
CNA441	0.09	0.06	0.15
CNA500	0.00	0.03	0.03
DHC6	0.03	0.35	0.38
FAL20	0.06	0.00	0.06
GASEPF	0.13	0.00	0.13
GASEPV	0.47	0.66	1.13

INM A/C Type	Day	Night	Total
GV	0.03	0.00	0.03
SD330	0.03	0.03	0.06
SF340	6.81	1.57	8.38
Total	**8.43**	**4.21**	**12.64**
Total All Flights	**76.32**	**25.57**	**101.89**

Figure 5 Boiler Two STAR



2.4.2 Build Out + 5 (2018) Conditions

The FAA's February 2004 Terminal Area Forecast (TAF) of operations was used to develop the 2018 fleet mix for MDW. The level of operations is forecasted for four (4) groups of traffic: air carrier, air taxi, general aviation, and military. Table 10 presents the 2003 tower counts and the TAF operations for 2018. The forecast indicates a large increase (60.9%) in air carrier and significant decrease (33.5%) in air taxi operations. There is also a large decrease in general aviation and military operations expected at MDW by 2018. The large reduction in operations of smaller aircraft would lessen the effects of the new procedure.

Table 10 Midway Terminal Area Forecast data

Year	Source	Air Carrier	Air Taxi	General Aviation	Military	Total
2003	Tower count	174050	94919	57680	1322	327971
2018	TAF	280045	63117	10807	604	354573
Percent Change		60.9%	-33.5%	-81.3%	-54.3%	8.1%

The TAF data does not forecast the types or day-night split of aircraft activity. For this analysis the 2018 operations were assumed to have the same day-night split as the 2003 POET data.

Table 11 presents the Alternative A fleet mix that would arrive using the Boiler Two STAR in 2018.

Table 11 Average Daily Arrivals on Boiler Two STAR for 2018, Alternative A

INM A/C Type	Day	Night	Total
Flights above 13,000 feet			
717200	11.63	1.37	12.99
737300	23.51	3.79	27.30
737400	0.20	0.86	1.06
737500	1.92	0.05	1.97
737700	43.17	1.26	44.44
757PW	7.53	0.15	7.68
757RR	8.44	0.10	8.54
BEC58P	0.01		0.01
CIT3	0.10		0.10
CL600	0.12		0.12
CL601	3.58	0.04	3.62
CNA441	0.06		0.06
CNA500	0.10	0.01	0.11
CNA750	0.07	0.01	0.08
DHC6	0.22	0.38	0.60
EMB145	0.02		0.02
FAL20	0.05		0.05
GASEPV	0.01		0.01
GII	0.04		0.04
GIIB	0.02	0.01	0.03
GIV	0.12	0.01	0.14

INM A/C Type	Day	Night	Total
Flights above 13,000 feet			
GV	0.04	0.01	0.04
IA1125	0.10	0.01	0.10
LEAR25	0.09		0.09
LEAR35	0.78	0.16	0.94
MD81	0.05		0.05
MU3001	0.66	0.04	0.70
SD330	0.01		0.01
SF340	2.55	0.04	2.59
Total	**105.18**	**8.30**	**113.48**
Flights at 13,000 feet and below			
BEC58P	0.16	0.25	0.42
CNA172	0.01		0.01
CNA441	0.03		0.03
CNA500	0.01		0.01
DHC6	0.01	0.23	0.24
FAL20	0.01		0.01
GASEPF	0.02		0.02
GASEPV	0.09	0.12	0.21
GV	0.01		0.01
SD330	0.04		0.04
SF340	5.12	0.46	5.58
Total	**5.50**	**1.07**	**6.57**
Total All Flights	**110.68**	**9.37**	**120.05**

For Alternative C in 2018, the operations in Table 11 that are above 13,000 feet would remain on the Boiler Two STAR. The operations in Table 11 at or below 13,000 feet would be rerouted onto the new route as described in Section 2.2.2 and shown in Figure 1. As Table 11 shows, only 6.6 operations per day in 2018 would be rerouted in Alternative C, and the mix of aircraft is mainly small pistons, turboprops and a small number of corporate jets.

2.5 South Bend Analysis

2.5.1 Existing Operational Environment

The POET data supplied by the FAA as described in Section 2.3.3 was used for the SBN analysis. For SBN, Alternative C would affect only westbound departures operations. The data contained both jet and non-jet departures. The FAA identified the existing routes that would be affected; those routes were then separated from the original data, and into day and night operations.

The analysis of the data demonstrates on an average day 6.3 current operations would be affected in Alternative C with the majority of those operations being air taxi and General aviation operations. Table 12 presents the number of operations by aircraft category for an average annual day from the sample, which would be affected. There are 78.5 departures per day from SBN[9] therefore Alternative C would affect six percent of the departures from SBN.

Table 12 South Bend Average Day Operations Affected by Rerouted Procedure from POET Analysis

Category	Day	Night	Total
Air Carrier	0.10	0.04	0.14
Air Taxi / GA	5.63	0.53	6.16
Total	**5.73**	**0.57**	**6.31**

Table 13 presents the breakdown of the operations, which would be affected by Alternative C from the POET data sample. The data is broken down by NIRS aircraft type, day and night operations. These operations form the basis of the Build Out + 5 fleet mix.

Table 13 South Bend 2003 West flow departures

NIRS A/C Type	Day	Night	Total
737N17	0.02	0.00	0.02
757PW	0.04	0.00	0.04
767300	0.02	0.00	0.02
BEC58P	0.02	0.00	0.02
CIT3	0.14	0.00	0.14
CL600	0.22	0.00	0.22
CL601	0.18	0.43	0.61
CNA441	0.43	0.00	0.43
CNA500	0.16	0.00	0.16
CNA750	0.10	0.02	0.12
DC93LW	0.02	0.02	0.04
DC95HW	0.00	0.02	0.02
DHC6	0.61	0.00	0.61
FAL20	0.14	0.02	0.16
GASEPV	0.06	0.00	0.06
GII	0.04	0.00	0.04
GIV	0.16	0.00	0.16
GV	0.02	0.00	0.02
IA1125	0.08	0.00	0.08
LEAR25	0.12	0.00	0.12
LEAR35	1.33	0.02	1.35
MU3001	1.16	0.04	1.20

[9] FAA ATADS Calendar Year 2003

NIRS A/C Type	Day	Night	Total
SF340	0.63	0.00	0.63
Grand Total	5.73	0.57	6.31

2.5.2 Build Out + 5 (2018) Conditions

The FAA's February 2004 Terminal Area Forecast (TAF) of operations and the POET data was used to develop the 2018 fleet mix for SBN. The level of operations is forecasted for four (4) groups of traffic: air carrier, air taxi, general aviation, and military. Table 14 presents the 2003 tower counts and the TAF operations for 2018. The forecast indicates a moderate increase (26.7%) in air carrier and a small increase (11.5%) in air taxi operations. Also, moderate increases are expected in general aviation and military operations at SBN by 2018.

Table 14 South Bend Terminal Area Forecast data

Year	Source	Air Carrier	Air Taxi	General Aviation	Military	Total
2003	Tower count	3014	30420	23754	141	57329
2018	TAF	3820	33919	31194	156	69089
Percent Change		26.7%	11.5%	31.3%	10.6%	20.5%

Table 15 presents the departures, which would be affected by Alternative C from SBN. Less than nine operations per day would be affected. These operations were modeled on one of two flight tracks. Operations to the west and southwest were modeled departing Runway 25, maintaining runway heading for approximately 3 nmi from the start of take-off roll, and then turning to the JOT VORTAC. Operations to the northwest and southwest were modeled departing Runway 25, maintaining runway heading for approximately 3 nmi from the start of take-off roll, and then turning to the BAE VORTAC. The POET data indicated that a large percentage of the affected operations head to these two navigational aides.

Table 15 South Bend 2018 West Flow Departures

NIRS A/C Type	Day	Night	Total
Flights to West and Southwest			
737700	0.03	0.00	0.03
767300	0.03	0.00	0.03
757PW	0.05	0.00	0.05
BEC58P	0.03	0.00	0.03
CIT3	0.11	0.00	0.11
CL600	0.29	0.00	0.29
CL601	0.03	0.00	0.03
CNA441	0.54	0.00	0.54
CNA500	0.21	0.00	0.21

NIRS A/C Type	Day	Night	Total
Flights to West and Southwest			
CNA750	0.08	0.03	0.11
DHC6	0.72	0.00	0.72
FAL20	0.16	0.03	0.19
GASEPV	0.08	0.00	0.08
GII	0.03	0.00	0.03
GIV	0.21	0.00	0.21
GV	0.03	0.00	0.03
IA1125	0.08	0.00	0.08
LEAR25	0.16	0.00	0.16
LEAR35	1.55	0.03	1.58
MU3001	1.45	0.05	1.50
SF340	0.03	0.00	0.03
Total	5.90	0.14	6.04
Flights to Northwest			
A319	0.03	0.05	0.08
CIT3	0.08	0.00	0.08
CL601	0.21	0.56	0.77
CNA441	0.03	0.00	0.03
CNA750	0.05	0.00	0.05
DHC6	0.08	0.00	0.08
FAL20	0.03	0.00	0.03
GII	0.03	0.00	0.03
IA1125	0.03	0.00	0.03
LEAR35	0.19	0.00	0.19
MU3001	0.08	0.00	0.08
SF340	0.80	0.00	0.80
Total	1.64	0.61	2.25
Total All Flights	7.54	0.75	8.29

2.6 DuPage Analysis

2.6.1 Existing Operational Environment

The POET data supplied by the FAA for DPA is a smaller sample than the sample received for the other airports in this analysis. The FAA supplied POET data for 28 days from Sept of 2003. For DPA, Alternative C would affect only westbound departures operations. The data contained both jet and non-jet departures. The FAA identified the existing routes that would be affected; those routes were then separated from the original data, and into day and night operations.

The analysis of the data demonstrates on an average day 26.3 current operations would be affected in Alternative C with the majority of those operations being air taxi and general aviation operations. Table 16 presents the number of operations by aircraft category for an average annual day from the sample, which would be affected. There are 144.7 departures per day from DPA[10] therefore Alternative C would affect 18 percent of the departures from DPA.

Table 16 DuPage Average Day Operations Affected by Rerouted Procedure from POET Analysis

Category	Day	Night	Total
Air Carrier	0.36	0.00	0.36
Air Taxi / GA	25.36	0.57	25.93
Total	**25.71**	**0.57**	**26.29**

Table 17 presents the breakdown of the operations, which would be affected by Alternative C from the POET data sample. The data is broken down by NIRS aircraft type, day and night operations. These operations form the basis of the Build Out + 5 fleet mix.

Table 17 DuPage 2003 West flow departures

NIRS A/C Type	Day	Night	Grand Total
737N17	0.07		0.07
BEC58P	1.04		1.04
CIT3	0.89		0.89
CL600	0.82		0.82
CL601	0.21		0.21
CNA441	1.43		1.43
CNA500	1.21		1.21
CNA750	0.75		0.75
DC93LW	0.18		0.18
DHC6	2.54		2.54
FAL20	0.89		0.89
GASEPV	1.18	0.07	1.25
GII	0.64	0.04	0.68
GIV	0.71		0.71
GV	0.36		0.36
IA1125	1.07	0.04	1.11
LEAR25	0.61		0.61
LEAR35	7.29	0.32	7.61
MU3001	3.39	0.11	3.50
SD330	0.11		0.11

[10] FAA ATADS Calendar Year 2003

NIRS A/C Type	Day	Night	Grand Total
CVR580	0.18		0.18
737700	0.11		0.11
DC3	0.04	0.00	0.04
Grand Total	25.71	0.57	26.29

2.6.2 Build Out + 5 (2018) Conditions

The FAA's February 2004 Terminal Area Forecast (TAF) of operations and the POET data was used to develop the 2018 fleet mix for DPA. The level of operations is forecasted for four (4) groups of traffic: air carrier, air taxi, general aviation, and military. Table 18 presents the 2003 tower counts and the TAF operations for 2018. The forecast indicates almost no change in commercial operations (air carrier and air taxi) and small increase (16.0%) in general aviation operations. Since the level of operations is so small for the air carrier group, the air carrier percent change is not a significant factor.

Table 18 DuPage Terminal Area Forecast Data

Year	Source	Air Carrier	Air Taxi	General Aviation	Military	Total
2003	Tower count	11	5545	99547	531	105634
2018	TAF	5	5470	115469	285	121229
Percent Change		-54.5%	-1.4%	16.0%	-46.3%	14.8%

Table 19 presents the departures, which would be affected by Alternative C from DPA. Approximately 30 operations per day would be affected. These operations were modeled departing Runway 2L, turning left to the Southwest, and continuing towards BDF VOTRAC. The POET data indicated that a large percentage of the affected operations heads to this navigational aide.

Table 19 DuPage 2018 West Flow Departures

NIRS A/C Type	Day	Night	Grand Total
737700	0.09	0.00	0.09
BEC58P	1.20	0.00	1.20
CIT3	1.04	0.00	1.04
CL600	0.95	0.00	0.95
CL601	0.25	0.00	0.25
CNA441	1.66	0.00	1.66
CNA500	1.41	0.00	1.41
CNA750	0.87	0.00	0.87
A319	0.09	0.00	0.09
DHC6	2.94	0.00	2.94
FAL20	1.04	0.00	1.04
GASEPV	1.37	0.08	1.45

NIRS A/C Type	Day	Night	Grand Total
GII	0.75	0.04	0.79
GIV	0.83	0.00	0.83
GV	0.41	0.00	0.41
IA1125	1.24	0.04	1.28
LEAR25	0.70	0.00	0.70
LEAR35	8.45	0.37	8.82
MU3001	3.94	0.12	4.06
SD330	0.12	0.00	0.12
CVR580	0.21	0.00	0.21
DC3	0.04	0.00	0.04
Grand Total	29.59	0.66	30.26

2.7 Rockford Analysis

2.7.1 Existing Operational Environment

The POET data supplied by the FAA, as described in Section 2.3.3, was used for the RFD analysis. For RFD, Alternative C would affect only eastbound departures operations. The data contained both jet and non-jet departures. The FAA identified the existing routes that would be affected; those routes were then separated from the original data, and into day and night operations.

The analysis of the data demonstrates on an average day 4.2 current operations would be affected in Alternative C with the majority of those operations being air taxi and General aviation operations. Table 20 presents the number of operations by aircraft category for an average annual day from the sample, which would be affected. There are 73.8 departures per day from RFD[11] therefore Alternative C would affect six percent of the departures from RFD.

Table 20 Rockford Average Day Operations Affected by Rerouted Procedure from POET Analysis

Category	Day	Night	Total
Air Carrier	0.88	0.00	0.88
Air Taxi / GA	3.16	0.10	3.27
Military	0.02	0.00	0.02
Total	**4.06**	**0.10**	**4.16**

Table 21 presents the breakdown of the operations from the POET data sample that would be affected by Alternative C. The data is broken down by NIRS aircraft type, day and night operations. These operations form the basis of the Build Out + 5 fleet mix.

[11] FAA ATADS Calendar Year 2003

Table 21 Rockford 2003 East Flow Departures

NIRS A/C Type	Day	Night	Grand Total
727EM1	0.04	0.00	0.04
727EM2	0.59	0.00	0.59
737N17	0.02	0.00	0.02
757PW	0.12	0.00	0.12
BEC58P	0.06	0.00	0.06
CIT3	0.06	0.00	0.06
CL600	0.04	0.00	0.04
CL601	0.02	0.00	0.02
CNA441	0.08	0.00	0.08
CNA500	0.02	0.00	0.02
CVR580	0.00	0.02	0.02
DC870	0.04	0.00	0.04
DC93LW	0.06	0.00	0.06
DHC6	0.47	0.02	0.49
FAL20	0.24	0.00	0.24
GASEPV	0.08	0.00	0.08
GII	0.04	0.00	0.04
GV	0.08	0.00	0.08
IA1125	0.04	0.00	0.04
KC135R	0.02	0.00	0.02
LEAR25	0.37	0.00	0.37
LEAR35	1.04	0.06	1.10
MU3001	0.45	0.00	0.45
GASEPF	0.06	0.00	0.06
Total	**4.06**	**0.10**	**4.16**

2.7.2 Build Out + 5 (2018) Conditions

The FAA's February 2004 Terminal Area Forecast (TAF) of operations was used to develop the 2018 fleet mix for RFD. The level of operations is forecasted for four (4) groups of traffic: air carrier, air taxi, general aviation, and military. Table 22 presents the 2003 tower counts and the TAF operations for 2018. The forecast indicates a moderate increase (33.5%) in air carrier and a small increase (5.4%) in air taxi operations. There are also small increases in general aviation and military operations expected at RFD by 2018.

Table 22 Rockford Terminal Area Forecast Data

Year	Source	Air Carrier	Air Taxi	General Aviation	Military	Total
2003	Tower count	11705	3782	36976	1430	53893
2018	TAF	15628	3986	39642	1504	60760
Percent Change		33.5%	5.4%	7.2%	5.2%	12.7%

Table 23 presents the departures that would be affected by Alternative C from RFD. Less than five operations per day would be affected. These operations were modeled departing Runway 7, turning right to the Southeast, and then continuing towards JOT VOTRAC. The POET data indicated that a large percentage of the affected operations head to this navigational aide.

Table 23 Rockford 2018 East flow Departures

NIRS A/C Type	Day	Night	Grand Total
757RR	0.84	0.00	0.84
737700	0.03	0.00	0.03
757PW	0.16	0.00	0.16
BEC58P	0.07	0.00	0.07
CIT3	0.07	0.00	0.07
CL600	0.04	0.00	0.04
CL601	0.02	0.00	0.02
CNA441	0.09	0.00	0.09
CNA500	0.02	0.00	0.02
CVR580	0.00	0.02	0.02
DC870	0.05	0.00	0.05
A319	0.08	0.00	0.08
DHC6	0.50	0.02	0.53
FAL20	0.26	0.00	0.26
GASEPV	0.09	0.00	0.09
GII	0.04	0.00	0.04
GV	0.09	0.00	0.09

IA1125	0.04	0.00	0.04
KC135R	0.02	0.00	0.02
LEAR25	0.39	0.00	0.39
LEAR35	1.12	0.07	1.18
MU3001	0.48	0.00	0.48
GASEPF	0.07	0.00	0.07
Total	**4.57**	**0.11**	**4.68**

3 RESULTS

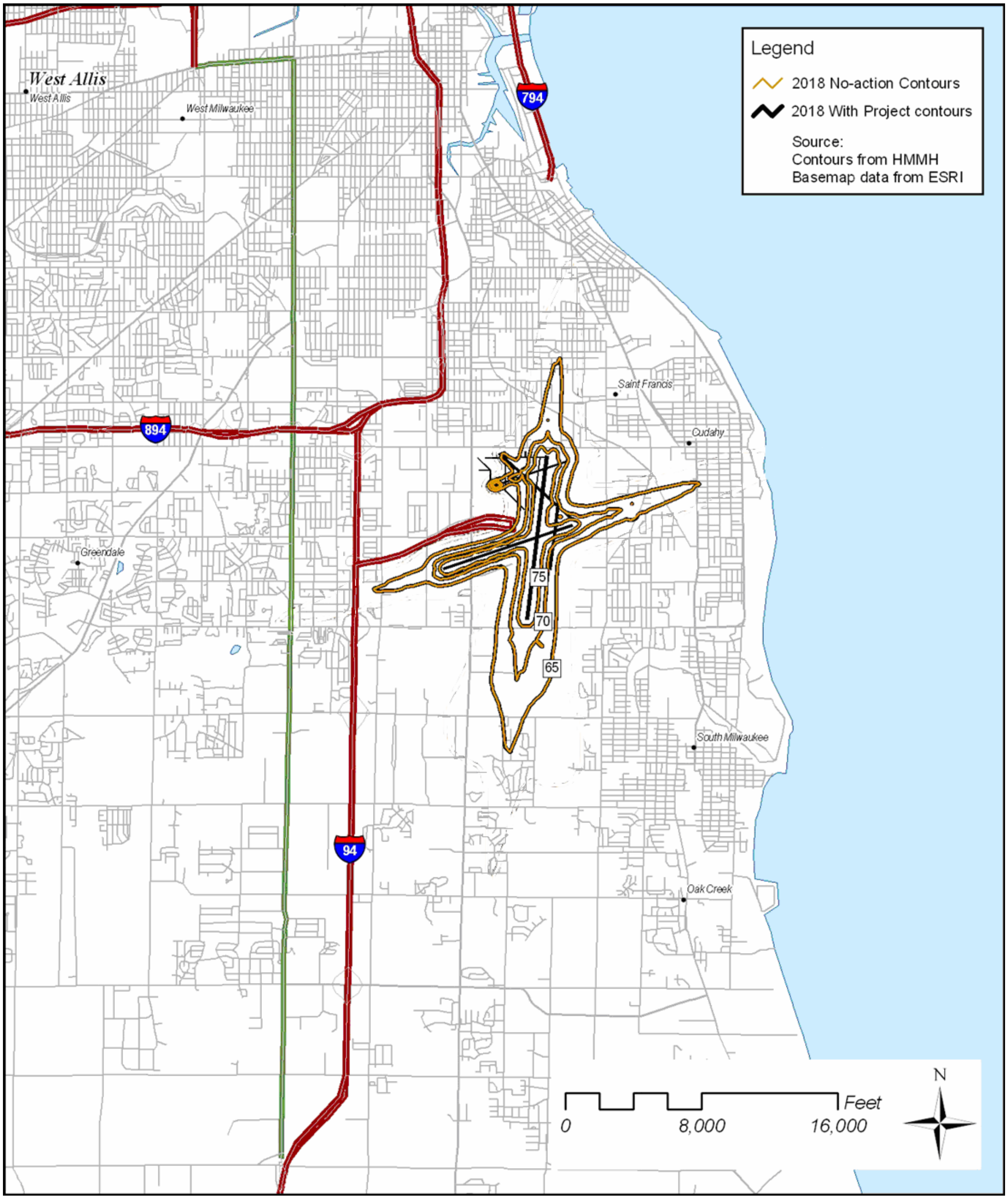
3.1 Milwaukee Results

3.1.1 DNL contours

The changes in DNL values near MKE that result from Alternative C at ORD are considered minimal. As shown in Figure 6, the DNL 65 dBA contours indicate no change due to the proposed route change at MKE. The reasons for this are:

- As the future fleet gets quieter, the noise levels for the Build Out +5 operational levels at MKE are projected to decrease compared to current 2003 noise exposure levels produced for the current Part 150 Study. At low DNL values, a larger change is required before the differences are notable.
- The initial portions of most turns after takeoff would remain unchanged as a result of Alternative C; it is only after aircraft have climbed to relatively high altitudes that the flight tracks diverge between the No Action and Build Alternatives.
- Only a portion of the traffic is expected to be assigned the revised headings, and nearly all of it is occurring during the daytime when its effect on DNL is least.

Figure 6 Milwaukee 2018 Alternatives A and C Noise Contours



3.1.2 Uniform grid results

A uniform grid was setup and run covering an area 14x20 nautical miles with a grid spacing of 0.2 nautical miles (1215.2 feet). This grid was developed to cover the area affected by the route change and to ensure that the area out beyond DNL 45 dBA was covered. There were 7,171 points analyzed. The Alternative C DNL values for 3,302 of the points were greater than 45 dBA. Figure 7 shows the location of the grid relative to MKE. Since the changes in Alternative C involve a shift of headings to the southeast from the east, the grid is not centered on the airport but shifted towards the southeast.

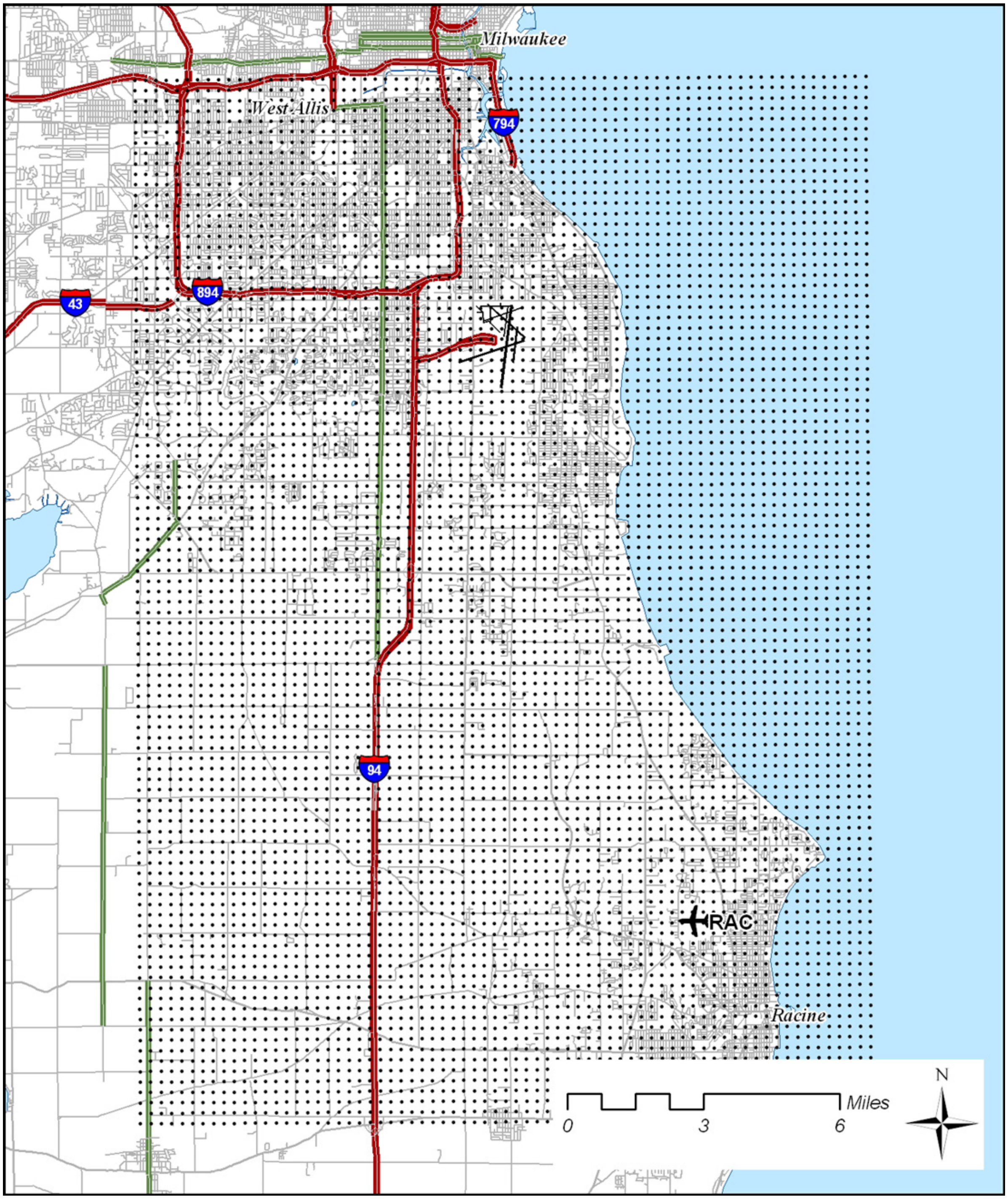
Alternative C caused no changes to the DNL values greater than 65 dBA. Between DNL 60 dBA and 65 dBA, the maximum increase in noise was less than 0.5 dB and the minimum reduction in noise was less than 0.5 dB. Between DNL values of 45 dBA and 60 dBA, the maximum increase in noise was less than 2 dB and the minimum reduction in noise was less than 2 dBA.

3.1.3 Conclusion

These results indicate that the proposed re-routing of jet departures from MKE to a new fix called SLAKR due to the Build Alternatives at ORD would have no significant effects on the noise environment near Milwaukee, Wisconsin.

The contour analysis demonstrates that Alternative C would not cause any changes in the DNL 65 dBA contour at MKE. Also, the largest increase found at grid points having DNL values between 45 dBA and 60 dBA was less than 2 dB, which is well below the FAA criteria for impact (5 dB) as defined by FAA Order 1050.1E.

Figure 7 Milwaukee Uniform Grid location



3.2 Midway, South Bend, DuPage, and Rockford Results

The airspace noise calculations were performed using NIRS at 297 points for the potentially rerouted aircraft at Midway, South Bend, DuPage, and Rockford airports, as well as a simplified representation of the O'Hare arrivals from the southeast and southwest. The modeled routes are all associated with the Alternative C improvements for the Build Out + 5 year. Each of these modeled points was located directly under one, or under the intersection of two, of the modeled flight paths, and the DNL values computed from all of the rerouted aircraft were logarithmically added together at each point.

The 2018 No Action Alternative (Alternative A) conditions were modeled at all 297 points for the affected Midway operations and the Alternative A ORD arrivals[12] from the southeast and southwest. The Build Out + 5 Alternative C conditions were modeled at all 297 points for the affected Midway operations and the Build Out + 5 Alternative C ORD arrivals from the southeast and southwest (including the high-and-wide),[13] Rockford, South Bend and DuPage. As mentioned previously, Rockford, South Bend and DuPage airports were not modeled for Alternative A, so increases in DNL caused by Alternative C are exaggerated, and the analysis represents a worst-case assessment.

Only 12 points had Alternative C DNL values equal to or above 43.3 dB DNL. Of these, only seven (7) points had Alternative C DNL values equal to or above 43.3 dB DNL and a DNL 5 dB or greater increase compared to Alternative A. Each of the seven points was a result of aircraft associated with DPA, RFD, or SBN at an altitude below 10,000 ft MSL. Since operations associated with these airports below 10,000 feet MSL would not affected, these points are not representative of the noise change associated with the Alternative C improvements, and additional analysis is not warranted. The increase in DNL associated with these points occurs because Alternative C alone was modeled, and its DNL is not being compared to the Alternative A DNL. These points were modeled to assist with the analysis, determine where aircraft reach 10,000 ft MSL and to indicate a minimum altitude in which the operations could be affected without additional analysis being required.

The remaining five points with Alternative C DNL values equal to or above 43.3 dB DNL had increases of 1 dB or less, or decreases, compared to the respective Alternative A DNL, and therefore additional analysis was not warranted. Three of these points were associated with the changes of the MDW operations near CGT where the Alternative C and Alternative A tracks are the nearly identical, one point was associated with simplified modeling of the O'Hare arrivals from the southwest, and one point was associated with modeling a location where SBN departures could potentially cross over the MDW arrivals between CGT and MDW.

---

12 Alternative A O'Hare arrivals from the Southwest were modeled on a simple track representing the Bradford Three Arrival STAR. Alternative A O'Hare arrivals from the Southeast were modeled on a simple track representing the Kokomo One STAR. Operations for both tracks were from the 2018 NA INM study.

13 Alternative C O'Hare arrivals from the Southwest were modeled on one of two simple tracks representing the Bradford Three Arrival STAR using either the "high-and-wide" procedure or not using the "high-and-wide" procedure. Alternative C O'Hare arrivals from the Southeast were modeled on one of two simple tracks representing the Kokomo One STAR using either the "high-and-wide" procedure or not using the "high-and-wide" procedure. Operations for all four tracks were from the 2018 WP INM study.

Furthermore, the analysis suggests this rerouting of the MDW arrivals between VHP and CGT to OKK-CLEFT-BOONE, could handle at least 10 times the operations expected without exceeding FAA noise criteria.[14]

The analysis for these airports included a simplified, assumption that had all operations associated with one airport flying on the same track. This simplification does not represent the variability in flight tracks that occurs because of difference in aircraft performance, weather conditions, runway use or Air Traffic Control instructions to the aircraft in flight. However, even with all of the aircraft flying the same flight track, an assumption that over-estimates the noise and the increase in noise compared to Alternative A directly under the modeled flight path, FAA criteria were not exceeded in this analysis. Therefore FAA criteria would not be exceeded in a detailed analysis that accounted for these factors.

[14] For this statement, Alternative C DNL values were recalculated by adding 10 dB to the affected MDW results, which is equivalent to a ten-fold increase in the number of affected MDW operations. The comparison of the recalculated Alternative C DNL values to Alternative A did not exceed FAA criteria or exceed levels that would indicate additional analysis is warranted. The recalculated Alternative C DNL values analysis assumes that the affected MDW operations' altitudes, aircraft types, and day/night split are still representative. If the affected MDW operations exceed ten times what is modeled, the aircraft types, day/night splits, and/or proposed action altitudes vary, additional analysis may be warranted.

ATTACHMENT A DESCRIPTION OF NOISE METRICS

To assist reviewers in interpreting the complex noise metrics used in evaluating airport noise, we present below an introduction to relevant fundamentals of acoustics and noise terminology.

A.1 Introduction to Acoustics and Noise Terminology

Five acoustical descriptors of noise are introduced here in increasing degree of complexity:

- Decibel, dB;
- A-weighted decibel, dBA;
- Sound Exposure Level, SEL;
- Equivalent Sound Level, Leq; and
- Day-Night Average Sound Level, DNL.

These noise metrics form the basis for the majority of noise analysis conducted at most airports throughout the U.S.

A.1.1 Decibel, dB

All sounds come from a sound source -- a musical instrument, a voice speaking, an airplane passing overhead. It takes energy to produce sound. The sound energy produced by any sound source is transmitted through the air in sound waves -- tiny, quick oscillations of pressure just above and just below atmospheric pressure. These oscillations, or sound pressures, impinge on the ear, creating the sound we hear.

Our ears are sensitive to a wide range of sound pressures. Although the loudest sounds that we hear without pain have about one million times more energy than the quietest sounds we hear, our ears are incapable of detecting small differences in these pressures. Thus, to better match how we hear this sound energy, we compress the total range of sound pressures to a more meaningful range by introducing the concept of sound pressure level.

Sound pressure levels are measured in decibels (or dB). Decibels are logarithmic quantities reflecting the ratio of the two pressures, the numerator being the pressure of the sound source of interest, and the denominator being a reference pressure (the quietest sound we can hear).

The logarithmic conversion of sound pressure to sound pressure *level* (SPL) means that the quietest sound that we can hear (the reference pressure) has a sound pressure level of about 0 dB, while the loudest sounds that we hear without pain have sound pressure levels of about 120 dB. Most sounds in our day-to-day environment have sound pressure levels on the order of 30 to 100 dB.

Because decibels are logarithmic quantities, combining decibels is unlike common arithmetic. For example, if two sound sources each produce 100 dB operating individually and they are then operated together, they produce 103 dB -- not the 200 decibels we might expect. Four equal sources operating simultaneously produce another three decibels of noise, resulting in a total sound pressure level of 106 dB. For every doubling of the number of equal sources, the sound pressure level goes up another three decibels. A tenfold increase in the number of sources makes the sound pressure level go up 10 dB. A hundredfold increase makes the level go up 20 dB, and it takes a thousand equal sources to increase the level 30 dB.

If one noise source is much louder than another, the two sources operating together will produce virtually the same sound pressure level (and sound to our ears) that the louder source would produce alone. For example, a 100 dB source plus an 80 dB source produce approximately 100 dB of noise when operating together (actually, 100.04 dB). The louder source "masks" the quieter one. But if the quieter source gets louder, it will have an increasing effect on the total sound pressure level such that, when the two sources are equal, as described above, they produce a level three decibels above the sound of either one by itself.

Conveniently, people also hear in a logarithmic fashion. Two useful rules of thumb to remember when comparing sound levels are: (1) a 6 to 10 dB increase in the sound pressure level is perceived by individuals as being a doubling of loudness, and (2) changes in sound pressure level of less than about three decibels are not readily detectable outside of a laboratory environment.

A.1.2 A-Weighted Decibel, dBA

Another important characteristic of sound is its frequency, or "pitch." This is the rate of repetition of the sound pressure oscillations as they reach our ear. When analyzing the total noise of any source, acousticians often break the noise into frequency components (or bands) to determine how much is low-frequency noise, how much is middle-frequency noise, and how much is high-frequency noise. This breakdown is important for two reasons:

(1) People react differently to low-, mid-, and high-frequency noise levels. This is because our ear is better equipped to hear mid and high frequencies but is quite insensitive to lower frequencies. Thus, we find mid- and high-frequency noise to be more annoying.

(2) Engineering solutions to a noise problem are different for different frequency ranges. Low-frequency noise is generally harder to control.

The normal frequency range of hearing for most people extends from a low frequency of about 20 Hz to a high frequency of about 10,000 to 15,000 Hz. People respond to sound most readily when the predominant frequency is in the range of normal conversation, typically around 1,000 to 2,000 Hz. Acousticians have developed several filters which roughly match this sensitivity of our ear and thus help us to judge the relative loudness of various sounds made up of many different frequencies. The so-called A-weighting network, does this best for most environmental noise sources. Sound pressure levels measured through this filter are referred to as A-weighted sound levels (measured in A-weighted decibels, or dBA).

The A-weighting network significantly discounts those parts of the total noise that occur at lower frequencies (those below about 500 Hz) and also at very high frequencies (above 10,000 Hz) where we do not hear as well. The network has very little effect, or is nearly "flat," in the middle range of frequencies between 500 and 10,000 Hz where our hearing is most sensitive. Because this network generally matches our ears' sensitivity, sounds having higher A-weighted sound levels are judged to be louder than those with lower A-weighted sound levels, a relationship which otherwise might not be true. It is for this reason that A-weighted sound levels are normally used to evaluate environmental noise sources. Figure A.1 presents typical A-weighted sound levels of several common environmental sources.

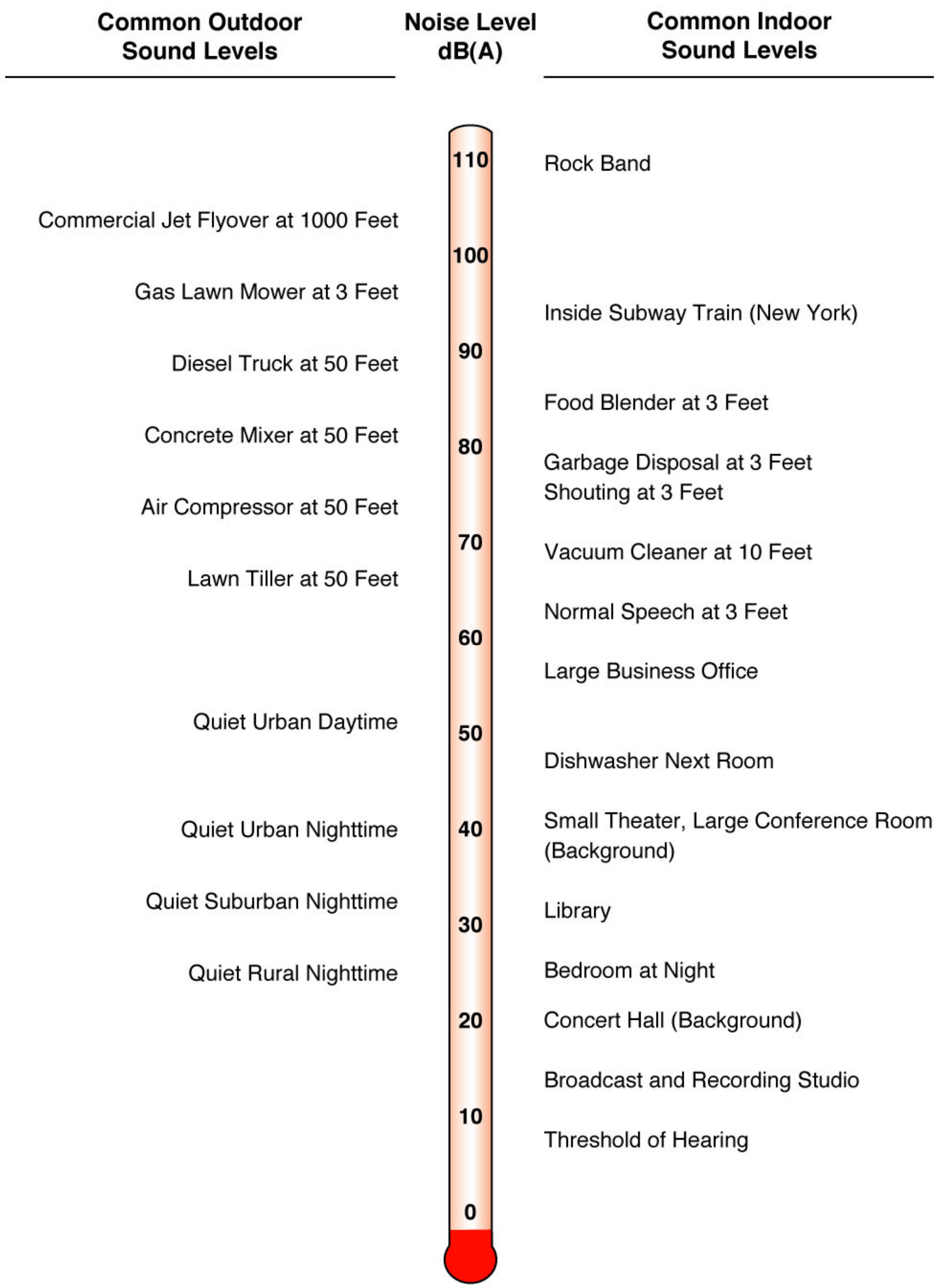


Figure A.1 Common environmental sound levels, in dBA

An additional dimension to environmental noise is that A-weighted levels vary with time. For example, the sound level increases as an aircraft approaches, then falls and blends into the background as the aircraft recedes into the distance (though even the background varies as birds chirp, the wind blows, or a vehicle passes by). This is illustrated in Figure A.2.

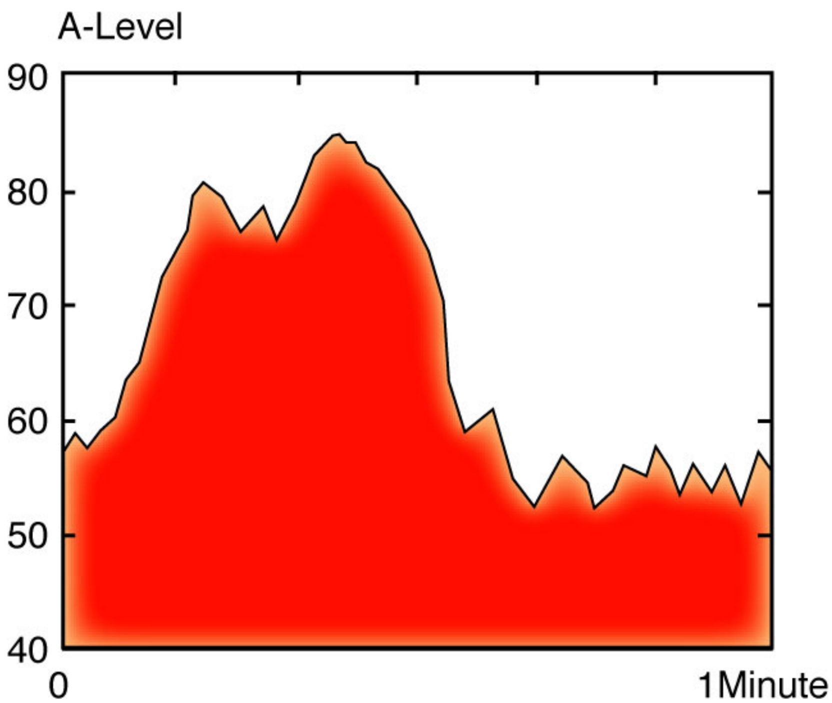


Figure A.2 Variation in the A-weighted sound level over time

Because of this variation, it is often convenient to describe a particular noise "event" by its maximum sound level, abbreviated as L_{max}. In Figure A.2, the L_{max} is approximately 85 dBA. However, the maximum level describes only one dimension of an event; it provides no information on the cumulative noise exposure generated by a sound source. In fact, two events with identical maximum levels may produce very different total exposures. One may be of very short duration, while the other may continue for an extended period and be judged much more annoying. The next section introduces a measure that accounts for this concept of a noise "dose."

A.1.3 Sound Exposure Level, SEL

The most common measure of cumulative noise exposure for a single aircraft fly-over is the Sound Exposure Level, or SEL. SEL is an accumulation of the sound energy over the duration of a noise event. The lightly shaded area in Figure A.3 illustrates the portion of the sound energy included in this dose. To account for the variety of durations that occur among different noise events, the noise dose is normalized (standardized) to a one-second duration. This normalized dose is the SEL; it is shown as the darkly shaded area in Figure A.3. Mathematically, the SEL is the summation of all the noise energy compressed into one second.

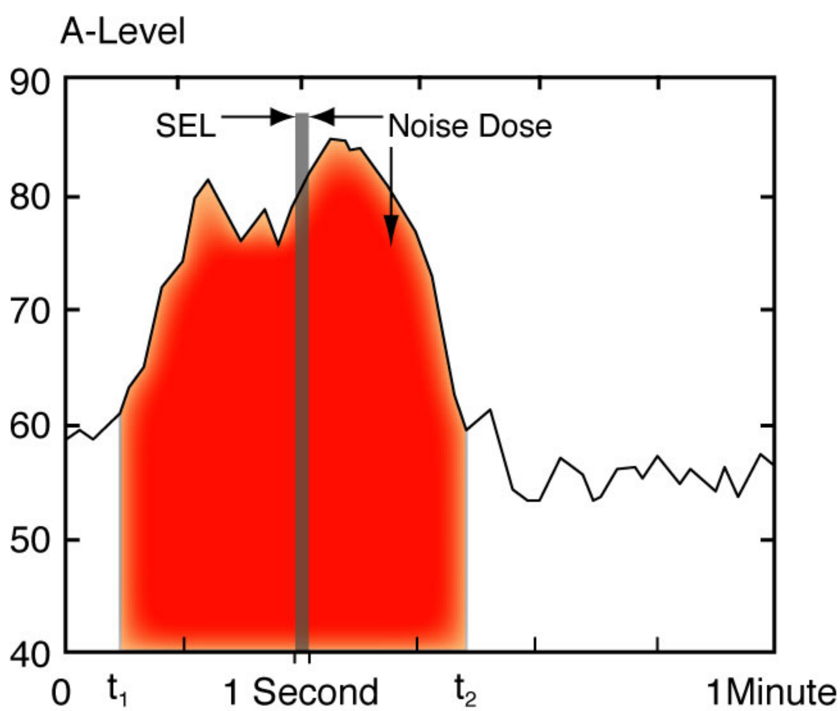


Figure A.3 Sound exposure level

Note that because the SEL is normalized to one second, it will almost always be larger in magnitude than the maximum A-weighted level for the event. In fact, for most aircraft overflights, the SEL is on the order of 7 to 12 dBA higher than the L_{max}. Also, the fact that it is a cumulative measure means that not only do louder fly-overs have higher SEL than do quieter ones, but also fly-overs with longer durations have greater SEL than do shorter ones.

With this metric, we now have a basis for comparing noise events that generally matches our impression of the sound -- the higher the SEL, the more annoying it is likely to be. In addition, SEL provides a comprehensive way to describe a noise event for use in modeling noise exposure. Computer noise models base their computations on these SELs.

A.1.4 Equivalent Sound Level, Leq

The Equivalent Sound Level, abbreviated L_{eq}, is a measure of the exposure resulting from the accumulation of A-weighted sound levels over a particular period of interest -- for example, an hour, an eight-hour school day, nighttime, or a full 24-hour day. However, because the length of the period can be different depending on the time frame of interest, the applicable period should always be identified or clearly understood when discussing the metric.

L_{eq} may be thought of as a constant sound level over the period of interest that contains as much sound energy as the actual time-varying sound level. This is illustrated in Figure A.4. The equivalent level is, in a sense, the total sound energy that occurred during the time in question, but spread evenly over the time period. It is a way of assigning a single number to a time-varying sound level. Since L_{eq} includes all sound energy, it is strongly influenced by the louder events.

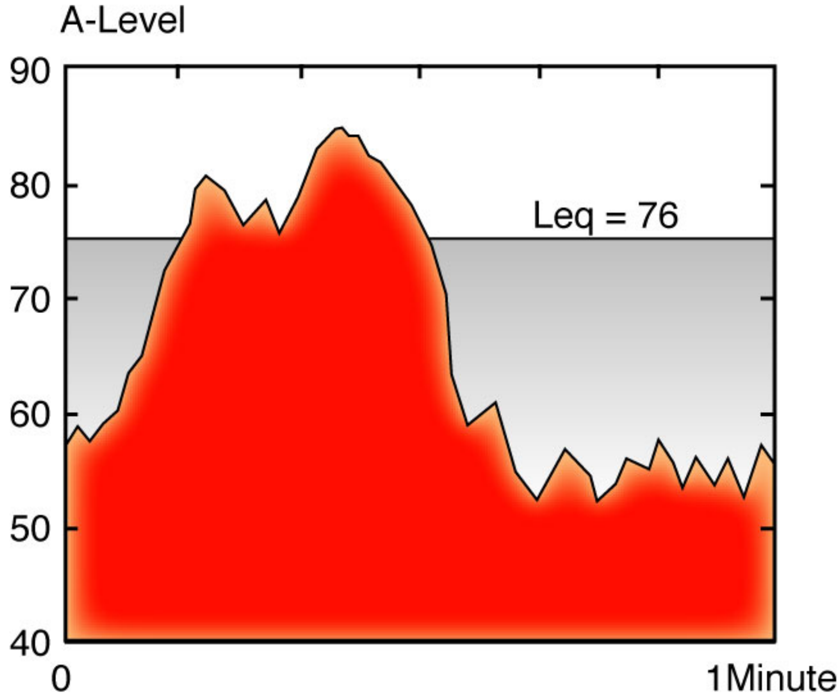


Figure A.4 Example of a 1-minute equivalent sound level

As for its application to airport noise issues, L_{eq} is often presented for consecutive one-hour periods to illustrate how the hourly noise dose rises and falls throughout a 24-hour period as well as how certain hours are significantly affected by a few loud aircraft.

A.1.5 Day-Night Average Sound Level, DNL

In the previous sections, we have been addressing noise measures that account for the moment-to-moment or short-term fluctuations in A-weighted levels as sound sources come and go affecting our overall noise environment. The Day-Night Average Sound Level (DNL) represents a concept of noise dose as it occurs over a 24-hour period. It is the same as a 24-hour L_{eq}, with one important exception; DNL treats nighttime noise differently from daytime noise. In determining DNL, it is assumed that the A-weighted levels occurring at night (10 p.m. to 7 a.m.) are 10 dB louder than they really are. This 10 dB penalty is applied to account for greater sensitivity to nighttime noise, and the fact that events at night are often perceived to be more intrusive because nighttime ambient noise is less than daytime ambient noise.

Earlier, we illustrated the A-weighted level due to an aircraft event. The example is repeated in the top frame of Figure A.5. The level increases as the aircraft approaches, reaching a maximum of 85 dBA, and then decreases as the aircraft passes by. The ambient A-weighted level around 55 dBA is due to the background sounds that dominate after the aircraft passes. The shaded area reflects the noise dose that a listener receives during the one-minute period of the sample.

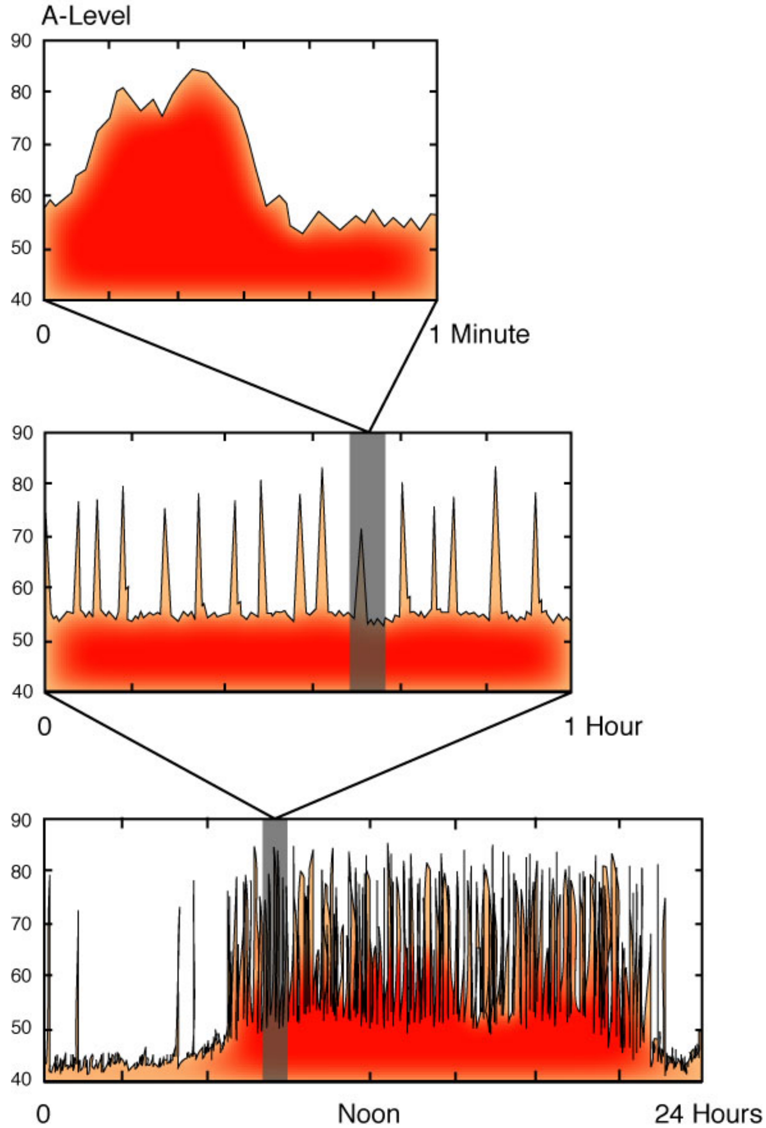


Figure A.5 A-weighted level fluctuations and noise dose

The center frame of Figure A.5 includes this one-minute interval within a full hour. Now the shaded area represents the noise dose during that hour when sixteen aircraft pass nearby, each producing a single event dose represented by an SEL. Similarly, the bottom frame includes the one-hour interval within a full 24 hours. Here the shaded area represents the noise dose over a complete day. Note that several overflights occur at night, when the background noise drops some 10 decibels, to approximately 45 dBA.

Values of DNL are normally measured with standard monitoring equipment or are predicted with computer models. Measurements are practical for obtaining DNL values for only relatively limited numbers of locations, and, in the absence of a permanently installed monitoring system, only for relatively short time periods. Thus, most airport noise studies utilize computer-generated estimates of

DNL, determined by accounting for all of the SEL from individual aircraft operations that comprise the total noise dose at a given location on the ground. This principle is used in all airport noise modeling.

Computed values of DNL are usually depicted as noise contours that are lines of equal exposure around an airport (much as topographic maps have contour lines of equal elevation). The contours usually reflect long-term (annual average) operating conditions, taking into account the average flights per day, how often each runway is used throughout the year, and where over the surrounding communities the aircraft normally fly.

Figure A.6 presents a representative sample of DNL (denoted L_{dn} in the figure) measured at various locations in the U.S.

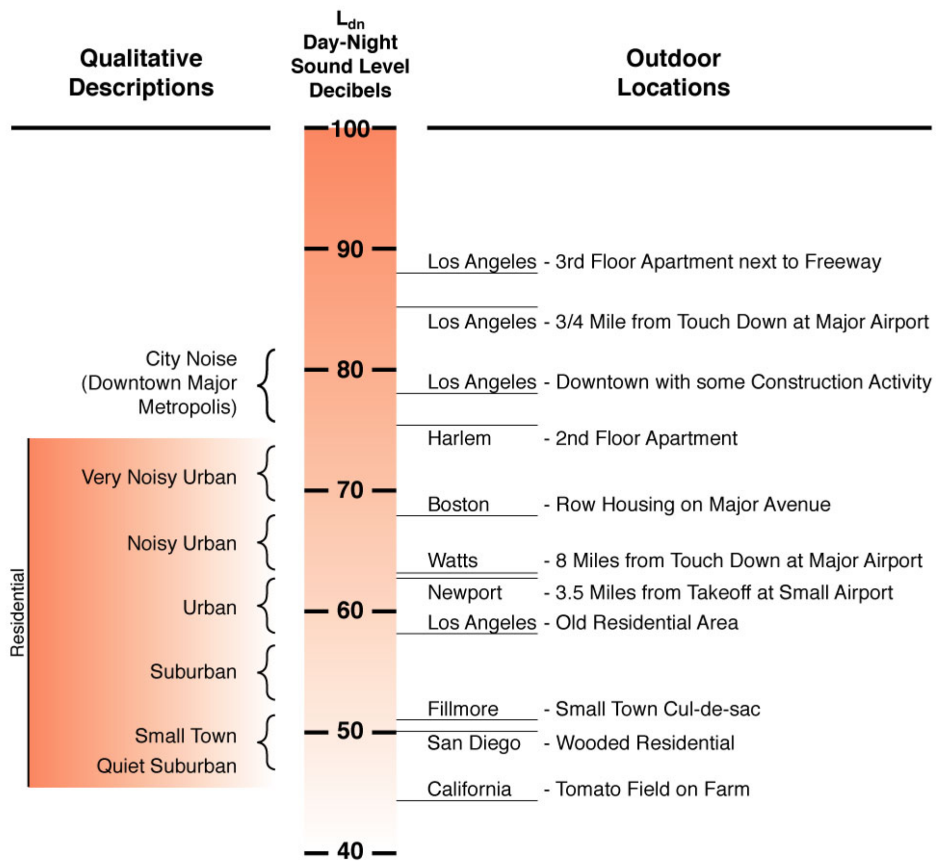


Figure A.6 Representative examples of Day-Night Average Sound Levels

Source: UNightd States Environmental Protection Agency, Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, March 1974, p.14

ATTACHMENT B NIRS RESULTS FOR MIDWAY, SOUTH BEND, GREATER ROCKFORD, AND DUPAGE AIRPORTS

This Attachment provides the noise levels and the contributing noise sources for all of the locations modeled in the Noise Integrated Routing System (NIRS) analysis in Table 25.

Each location is listed with its position in geographical coordinates, latitude and longitude referenced to the North American Datum of 1983 (NAD 83). For each location, the table reports the contributions to DNL from each of the various aircraft operations modeled, and the total DNL. The first set of columns shows the DNL values for Alternative A, the second set is for Alternative C. The contributing sources are abbreviated in the column headings as follows:

ORD SW Arr – DNL values for O'Hare arrivals from the southwest. These aircraft were modeled on simplified tracks. Operations are from the INM study prepared by LFA

ORD SE Arr – DNL values for O'Hare arrivals from the southeast. These aircraft were modeled on simplified tracks. Operations are from the INM study prepared by LFA

MDW OKK – DNL values from operations on the proposed Midway route

MDW BVT – DNL values from operations on the current Midway route. In Alternative A, this includes all operations between VHP and CGT. In Alternative C, this includes only those operations (above 13,000 ft MSL) that will continue to use this route.

RFD – DNL values from Greater Rockford departures

DPA – DNL values from Dupage departures

SBN – DNL values from South Bend departures.

Since noise impact would not occur where Alternative C DNL values are expected to be 43.2 dBA or less (see Section 2.1.3), the table only presents results for locations where the total DNL values for either Alternative A or Alternative C equal or exceed 43.2 dBA. Contributions from other sources are given where the computed DNL values are 25 dBA or higher. Table 24 provides comments about each of the locations where either the computed Alternative A or Alternative C DNL value equals or exceeds 43.2 dBA.

Table 24 Comments about Modeled Points with DNL Values 43.2 dBA or Greater

Pt. No.	Point Name	Comment
44	BVTCGT22	2018 Alternative C DNL values are approximately the same or slightly less than those for Alternative A
45	BVTCGT23	2018 Alternative C DNL values are approximately the same or slightly less than those for Alternative A
46	CGT	2018 Alternative C DNL values are approximately the same or slightly less than those for Alternative A
107	RFD_0725_30k1	RFD departures are completing initial turn. Air traffic is below 10,000 ft (about 3,700 ft MSL) at this point. Alternative C and Alternative A are the same here.
127	SBN_2709_20k1	SBN departures are above 2,000 ft MSL and just starting initial turn. Alternative C and Alternative A are the same here. (This point is the same as SBN_20k_BAE1)
210	NEWRK_to_ORD1	This point is under a representation of the ORD SW arrivals
239	DPA_turn_7_1	Air traffic is below 10,000 ft (about 4,200 ft MSL) at this point. Alternative C and Alternative A are the same here.
240	DPA_turn_7_2	Air traffic is below 10,000 ft (between about 4,200 ft and 7,200 ft MSL) at this point. Alternative C and Alternative A are the same here.
241	DPA_turn_7_3	Air traffic is below 10,000 ft (between about 5,200 ft and 8,200 ft MSL) at this point. Alternative C and Alternative A are the same here.
273	OXI_HALIE8	2018 Alternative C DNL values are approximately the same or slightly less than those for Alternative A
274	OXI_HALIE9	2018 Alternative C DNL values are approximately the same or slightly less than those for Alternative A
275	HALIE1	2018 Alternative C DNL values are approximately the same or slightly less than those for Alternative A
282	CGT_X_SBN	This point is at a potential intersection of SBN departures flying over MDW arrivals for Alternative C. MDW arrivals here are between MDW and CGT. Neither the SBN nor MDW modeled operations included dispersion or vectoring, therefore DNL values are overestimates.
283	SBN_20k_BAE1	SBN departures are above 2,000 ft MSL and just starting initial turn. Alternative C and Alternative A are the same here. (This point is the same as SBN_2709_20k1)
293	RFD_turn3	At initial turn, where traffic is below 10,000 ft (about 3,700 ft MSL). Alternative C and Alternative A are the same here.

Table 25 Computed DNL Values for 2018 Alternatives C and A at Analysis Points

				2018 Alternative C								2018 Alternative A				
Pt. No.	Point Name	Latitude	Longitude	ORD SW Arr	ORD SE Arr	MDW OKK	MDW BVT	RFD	DPA	SBN	Total	ORD SW Arr	ORD SE Arr	MDW	Total	Alt C minus Alt A
1	VHP	39.814722	-86.367577	-	-	-	-	-	-	-	-	-	-	-	-	-
2	VHPBVT1	39.850009	-86.400520	-	-	-	-	-	-	-	-	-	-	-	-	-
3	VHPBVT2	39.885285	-86.433499	-	-	-	-	-	-	-	-	-	-	-	-	-
4	VHPBVT3	39.920551	-86.466513	-	-	-	-	-	-	-	-	-	-	-	-	-
5	VHPBVT4	39.955807	-86.499562	-	-	-	-	-	-	-	-	-	-	-	-	-
6	VHPBVT5	39.991052	-86.532647	-	-	-	-	-	-	-	-	-	-	-	-	-
7	VHPBVT6	40.026286	-86.565767	-	-	-	-	-	-	-	-	-	-	-	-	-
8	VHPBVT7	40.061511	-86.598922	-	-	-	-	-	-	-	-	-	-	-	-	-
9	VHPBVT8	40.096724	-86.632114	-	-	-	-	-	-	-	-	-	-	-	-	-
10	VHPBVT9	40.131927	-86.665340	-	-	-	-	-	-	-	-	-	-	-	-	-
11	VHPBVT10	40.167120	-86.698603	-	-	-	-	-	-	-	-	-	-	-	-	-
12	VHPBVT11	40.202302	-86.731901	-	-	-	-	-	-	-	-	-	-	-	-	-
13	VHPBVT12	40.237474	-86.765234	-	-	-	-	-	-	-	-	-	-	-	-	-
14	VHPBVT13	40.272635	-86.798604	-	-	-	-	-	-	-	-	-	-	-	-	-
15	VHPBVT14	40.307786	-86.832009	-	-	-	-	-	-	-	-	-	-	-	-	-
16	VHPBVT15	40.342926	-86.865450	-	-	-	-	-	-	-	-	-	-	-	-	-
17	VHPBVT16	40.378056	-86.898927	-	-	-	-	-	-	-	-	-	-	-	-	-
18	VHPBVT17	40.413176	-86.932440	-	-	-	-	-	-	-	-	-	-	-	-	-
19	VHPBVT18	40.448284	-86.965989	-	-	-	-	-	-	-	-	-	-	-	-	-
20	VHPBVT19	40.483383	-86.999574	-	-	-	-	-	-	-	-	-	-	-	-	-
21	VHPBVT20	40.518471	-87.033195	-	-	-	-	-	-	-	-	-	-	-	-	-
22	BVT	40.556119	-87.069320	-	-	-	-	-	-	-	-	-	-	-	-	-
23	BVTCGT1	40.596545	-87.090283	-	-	-	-	-	-	-	-	-	-	-	-	-
24	BVTCGT2	40.636968	-87.111273	-	-	-	-	-	-	-	-	-	-	-	-	-
25	BVTCGT3	40.677386	-87.132288	-	-	-	-	-	-	-	-	-	-	-	-	-
26	BVTCGT4	40.717800	-87.153329	-	-	-	-	-	-	-	-	-	-	-	-	-
27	BVTCGT5	40.758210	-87.174396	-	-	-	-	-	-	-	-	-	-	-	-	-
28	BVTCGT6	40.798616	-87.195490	-	-	-	-	-	-	-	-	-	-	-	-	-

				2018 Alternative C								2018 Alternative A				
Pt. No.	Point Name	Latitude	Longitude	ORD SW Arr	ORD SE Arr	MDW OKK	MDW BVT	RFD	DPA	SBN	Total	ORD SW Arr	ORD SE Arr	MDW	Total	Alt C minus Alt A
29	BVTCGT7	40.839018	-87.216609	-	-	-	-	-	-	-	-	-	-	-	-	-
30	BVTCGT8	40.879415	-87.237755	-	-	-	-	-	-	-	-	-	-	-	-	-
31	BVTCGT9	40.919809	-87.258927	-	-	-	-	-	-	-	-	-	-	-	-	-
32	BVTCGT10	40.960198	-87.280125	-	-	-	-	-	-	-	-	-	-	-	-	-
33	BVTCGT11	41.000583	-87.301349	-	-	-	-	-	-	-	-	-	-	-	-	-
34	BVTCGT12	41.040964	-87.322600	-	-	-	-	-	-	-	-	-	-	-	-	-
35	BVTCGT13	41.081341	-87.343877	-	-	-	-	-	-	-	-	-	-	-	-	-
36	BVTCGT14	41.121714	-87.365181	-	-	-	-	-	-	-	-	-	-	-	-	-
37	BVTCGT15	41.162083	-87.386511	-	-	-	-	-	-	-	-	-	-	-	-	-
38	BVTCGT16	41.202447	-87.407868	-	-	-	-	-	-	-	-	-	-	-	-	-
39	BVTCGT17	41.242808	-87.429251	-	-	-	-	-	-	-	-	-	-	-	-	-
40	BVTCGT18	41.283164	-87.450661	-	-	-	-	-	-	-	-	-	-	-	-	-
41	BVTCGT19	41.323516	-87.472098	-	-	-	-	-	-	-	-	-	-	-	-	-
42	BVTCGT20	41.363864	-87.493561	-	-	-	-	-	-	-	-	-	-	-	-	-
43	BVTCGT21	41.404208	-87.515051	-	-	-	-	-	-	-	-	-	-	-	-	-
44	BVTCGT22	41.444548	-87.536568	-	-	-	43.8	-	-	-	43.8	-	-	44.1	44.1	-0.3
45	BVTCGT23	41.484884	-87.558112	-	-	26.6	44.7	-	-	-	44.8	-	-	44.9	44.9	-0.1
46	CGT	41.510005	-87.571544	-	-	32.2	44.8	-	-	-	45.0	-	-	45.0	45.0	0.0
47	CGTMDW1	41.549213	-87.596521	-	-	-	-	-	-	-	-	-	-	-	-	-
48	VHPOKK1	39.855985	-86.349854	-	-	-	-	-	-	-	-	-	-	-	-	-
49	VHPOKK2	39.897245	-86.332109	-	-	-	-	-	-	-	-	-	-	-	-	-
50	VHPOKK3	39.938503	-86.314342	-	-	-	-	-	-	-	-	-	-	-	-	-
51	VHPOKK4	39.979758	-86.296553	-	-	-	-	-	-	-	-	-	-	-	-	-
52	VHPOKK5	40.021011	-86.278742	-	-	-	-	-	-	-	-	-	-	-	-	-
53	VHPOKK6	40.062261	-86.260908	-	-	-	-	-	-	-	-	-	-	-	-	-
54	VHPOKK7	40.103508	-86.243053	-	-	-	-	-	-	-	-	-	-	-	-	-
55	VHPOKK8	40.144752	-86.225175	-	-	-	-	-	-	-	-	-	-	-	-	-
56	VHPOKK9	40.185994	-86.207274	-	-	-	-	-	-	-	-	-	-	-	-	-
57	VHPOKK10	40.227234	-86.189352	-	-	-	-	-	-	-	-	-	-	-	-	-
58	VHPOKK11	40.268470	-86.171407	-	-	-	-	-	-	-	-	-	-	-	-	-

Pt. No.	Point Name	Latitude	Longitude	2018 Alternative C								2018 Alternative A				Alt C minus Alt A
				ORD SW Arr	ORD SE Arr	MDW OKK	MDW BVT	RFD	DPA	SBN	Total	ORD SW Arr	ORD SE Arr	MDW	Total	
59	VHPOKK12	40.309705	-86.153440	-	-	-	-	-	-	-	-	-	-	-	-	-
60	VHPOKK13	40.350936	-86.135450	-	-	-	-	-	-	-	-	-	-	-	-	-
61	VHPOKK14	40.392165	-86.117438	-	-	-	-	-	-	-	-	-	-	-	-	-
62	VHPOKK15	40.433391	-86.099403	-	-	-	-	-	-	-	-	-	-	-	-	-
63	VHPOKK16	40.474615	-86.081345	-	-	-	-	-	-	-	-	-	-	-	-	-
64	VHPOKK17	40.515836	-86.063265	-	-	-	-	-	-	-	-	-	-	-	-	-
65	OKK	40.527789	-86.058018	-	-	-	-	-	-	-	-	-	-	-	-	-
66	OKKCLEFT1	40.571255	-86.056728	-	-	-	-	-	-	-	-	-	-	-	-	-
67	OKKCLEFT2	40.614721	-86.055436	-	-	-	-	-	-	-	-	-	-	-	-	-
68	OKKCLEFT3	40.658187	-86.054143	-	-	-	-	-	-	-	-	-	-	-	-	-
69	OKKCLEFT4	40.701653	-86.052847	-	-	-	-	-	-	-	-	-	-	-	-	-
70	OKKCLEFT5	40.745119	-86.051550	-	-	-	-	-	-	-	-	-	-	-	-	-
71	OKKCLEFT6	40.788585	-86.050252	-	-	-	-	-	-	-	-	-	-	-	-	-
72	OKKCLEFT7	40.832051	-86.048951	-	-	-	-	-	-	-	-	-	-	-	-	-
73	OKKCLEFT8	40.875516	-86.047649	-	-	-	-	-	-	-	-	-	-	-	-	-
74	OKKCLEFT9	40.918982	-86.046345	-	-	-	-	-	-	-	-	-	-	-	-	-
75	OKKCLEFT10	40.962448	-86.045040	-	-	-	-	-	-	-	-	-	-	-	-	-
76	OKKCLEFT11	41.005914	-86.043732	-	-	-	-	-	-	-	-	-	-	-	-	-
77	OKKCLEFT12	41.049380	-86.042423	-	-	-	-	-	-	-	-	-	-	-	-	-
78	CLEFT	41.081097	-86.041467	-	-	-	-	-	-	-	-	-	-	-	-	-
79	CLEFTBOONE1	41.094814	-86.095982	-	-	-	-	-	-	-	-	-	-	-	-	-
80	CLEFTBOONE2	41.108504	-86.150521	-	-	-	-	-	-	-	-	-	-	-	-	-
81	CLEFTBOONE3	41.122167	-86.205083	-	-	-	-	-	-	-	-	-	-	-	-	-
82	CLEFTBOONE4	41.135803	-86.259669	-	-	-	-	-	-	-	-	-	-	-	-	-
83	CLEFTBOONE5	41.149413	-86.314279	-	-	-	-	-	-	-	-	-	-	-	-	-
84	CLEFTBOONE6	41.162996	-86.368911	-	-	-	-	-	-	-	-	-	-	-	-	-
85	CLEFTBOONE7	41.176552	-86.423568	-	-	-	-	-	-	-	-	-	-	-	-	-
86	CLEFTBOONE8	41.190081	-86.478247	-	-	-	-	-	-	-	-	-	-	-	-	-
87	CLEFTBOONE9	41.203584	-86.532950	-	-	-	-	-	-	-	-	-	-	-	-	-
88	CLEFTBOONE10	41.217060	-86.587676	-	-	-	-	-	-	-	-	-	-	-	-	-

Pt. No.	Point Name	Latitude	Longitude	2018 Alternative C								2018 Alternative A				Alt C minus Alt A
				ORD SW Arr	ORD SE Arr	MDW OKK	MDW BVT	RFD	DPA	SBN	Total	ORD SW Arr	ORD SE Arr	MDW	Total	
89	CLEFTBOONE11	41.230509	-86.642426	-	-	-	-	-	-	-	-	-	-	-	-	-
90	CLEFTBOONE12	41.243931	-86.697198	-	-	-	-	-	-	-	-	-	-	-	-	-
91	CLEFTBOONE13	41.257327	-86.751994	-	-	-	-	-	-	-	-	-	-	-	-	-
92	CLEFTBOONE14	41.270695	-86.806812	-	-	-	-	-	-	-	-	-	-	-	-	-
93	CLEFTBOONE15	41.284037	-86.861654	-	-	-	-	-	-	-	-	-	-	-	-	-
94	CLEFTBOONE16	41.297352	-86.916518	-	-	-	-	-	-	-	-	-	-	-	-	-
95	CLEFTBOONE17	41.310641	-86.971405	-	-	-	-	-	-	-	-	-	-	-	-	-
96	CLEFTBOONE18	41.323902	-87.026315	-	-	-	-	-	-	-	-	-	-	-	-	-
97	CLEFTBOONE19	41.337137	-87.081248	-	-	-	-	-	-	-	-	-	-	-	-	-
98	CLEFTBOONE20	41.350345	-87.136203	-	-	-	-	-	-	-	-	-	-	-	-	-
99	BOONE	41.363758	-87.192147	-	-	-	-	-	-	-	-	-	-	-	-	-
100	BOONECGT1	41.383651	-87.243459	-	-	-	-	-	-	-	-	-	-	-	-	-
101	BOONECGT2	41.403521	-87.294804	-	-	-	-	-	-	-	-	-	-	-	-	-
102	BOONECGT3	41.423367	-87.346179	-	-	-	-	-	-	-	-	-	-	-	-	-
103	BOONECGT4	41.443190	-87.397587	-	-	-	-	-	-	-	-	-	-	-	-	-
104	BOONECGT5	41.462989	-87.449026	-	-	-	-	-	-	-	-	-	-	-	-	-
105	BOONECGT6	41.482765	-87.500497	-	-	-	-	-	-	-	-	-	-	-	-	-
106	BOONECGT7	41.502518	-87.551999	-	-	-	-	-	-	-	-	-	-	-	-	-
107	RFD_0725_30k1	42.208043	-89.013922	-	-	-	-	43.8	-	-	43.8	-	-	-	-	-
108	RFD_0725_30k2	42.187084	-88.991657	-	-	-	-	-	-	-	-	-	-	-	-	-
109	RFD_0725_30k3	42.152743	-88.955215	-	-	-	-	-	-	-	-	-	-	-	-	-
110	RFD_0725_30k4	42.118391	-88.918812	-	-	-	-	-	-	-	-	-	-	-	-	-
111	RFD_0725_30k5	42.084028	-88.882448	-	-	-	-	-	-	-	-	-	-	-	-	-
112	RFD_0725_30k6	42.049653	-88.846123	-	-	-	-	-	-	-	-	-	-	-	-	-
113	RFD_0725_30k7	42.015267	-88.809837	-	-	-	-	-	-	-	-	-	-	-	-	-
114	RFD_hold1	41.980871	-88.773590	-	-	-	-	-	-	-	-	-	-	-	-	-
115	RFD_hold2	41.944732	-88.735424	-	-	-	-	-	-	-	-	-	-	-	-	-
116	RFD_hold3	41.908581	-88.697302	-	-	-	-	-	-	-	-	-	-	-	-	-
117	RFD_hold4	41.872418	-88.659222	-	-	-	-	-	-	-	-	-	-	-	-	-
118	RFD_hold5	41.836242	-88.621186	-	-	-	-	-	-	-	-	-	-	-	-	-

				2018 Alternative C								2018 Alternative A				
Pt. No.	Point Name	Latitude	Longitude	ORD SW Arr	ORD SE Arr	MDW OKK	MDW BVT	RFD	DPA	SBN	Total	ORD SW Arr	ORD SE Arr	MDW	Total	Alt C minus Alt A
119	RFD_hold6	41.800054	-88.583192	-	-	-	-	-	-	-	-	-	-	-	-	-
120	RFD_hold7	41.763854	-88.545241	-	-	-	-	-	-	-	-	-	-	-	-	-
121	RFD_hold8	41.727641	-88.507332	-	-	-	-	-	-	-	-	-	-	-	-	-
122	RFD_hold9	41.691416	-88.469466	-	-	-	-	-	-	-	-	-	-	-	-	-
123	RFD_hold10	41.655179	-88.431643	-	-	-	-	-	-	-	-	-	-	-	-	-
124	RFD_hold11	41.618929	-88.393862	-	-	-	-	-	-	-	-	-	-	-	-	-
125	RFD_hold12	41.582666	-88.356124	-	-	-	-	-	-	-	-	-	-	-	-	-
126	JOT1	41.546392	-88.318429	-	-	-	-	-	-	-	-	-	-	-	-	-
127	SBN_2709_20k1	41.703751	-86.365348	-	-	-	-	-	-	50.7	50.7	-	-	-	-	-
128	SBN_2709_20k2	41.699447	-86.423609	-	-	-	-	-	-	-	-	-	-	-	-	-
129	SBN_2709_20k3	41.695113	-86.481862	-	-	-	-	-	-	-	-	-	-	-	-	-
130	SBN_2709_20k4	41.690750	-86.540109	-	-	-	-	-	-	-	-	-	-	-	-	-
131	SBN_2709_20k5	41.686357	-86.598348	-	-	-	-	-	-	-	-	-	-	-	-	-
132	SBN_2709_20k6	41.681934	-86.656580	-	-	-	-	-	-	-	-	-	-	-	-	-
133	SBN_2709_20k7	41.677482	-86.714804	-	-	-	-	-	-	-	-	-	-	-	-	-
134	SBN_JOT_hold1	41.672999	-86.773021	-	-	-	-	-	-	-	-	-	-	-	-	-
135	SBN_JOT_hold2	41.668144	-86.837528	-	-	-	-	-	-	-	-	-	-	-	-	-
136	SBN_JOT_hold3	41.663252	-86.902025	-	-	-	-	-	-	-	-	-	-	-	-	-
137	SBN_JOT_hold4	41.658323	-86.966513	-	-	-	-	-	-	-	-	-	-	-	-	-
138	SBN_JOT_hold5	41.653358	-87.030992	-	-	-	-	-	-	-	-	-	-	-	-	-
139	SBN_JOT_hold6	41.648357	-87.095461	-	-	-	-	-	-	-	-	-	-	-	-	-
140	SBN_JOT_hold7	41.643319	-87.159921	-	-	-	-	-	-	-	-	-	-	-	-	-
141	SBN_JOT_hold8	41.638244	-87.224371	-	-	-	-	-	-	-	-	-	-	-	-	-
142	SBN_JOT_hold9	41.633133	-87.288811	-	-	-	-	-	-	-	-	-	-	-	-	-
143	SBN_JOT_hold10	41.627985	-87.353241	-	-	-	-	-	-	-	-	-	-	-	-	-
144	SBN_JOT_hold11	41.622801	-87.417661	-	-	-	-	-	-	-	-	-	-	-	-	-
145	SBN_JOT_hold12	41.617581	-87.482071	-	-	-	-	-	-	-	-	-	-	-	-	-
146	SBN_JOT_hold13	41.612324	-87.546471	-	-	-	-	-	-	-	-	-	-	-	-	-
147	SBN_JOT_hold14	41.607030	-87.610860	-	-	-	-	-	-	-	-	-	-	-	-	-
148	SBN_JOT_hold15	41.601700	-87.675239	-	-	-	-	-	-	-	-	-	-	-	-	-

Pt. No.	Point Name	Latitude	Longitude	2018 Alternative C								2018 Alternative A				Alt C minus Alt A
				ORD SW Arr	ORD SE Arr	MDW OKK	MDW BVT	RFD	DPA	SBN	Total	ORD SW Arr	ORD SE Arr	MDW	Total	
149	SBN_JOT_hold16	41.596334	-87.739608	-	-	-	-	-	-	-	-	-	-	-	-	-
150	SBN_JOT_hold17	41.590930	-87.803965	-	-	-	-	-	-	-	-	-	-	-	-	-
151	SBN_JOT_hold18	41.585491	-87.868312	-	-	-	-	-	-	-	-	-	-	-	-	-
152	SBN_JOT_hold19	41.580015	-87.932648	-	-	-	-	-	-	-	-	-	-	-	-	-
153	SBN_JOT_hold20	41.574502	-87.996973	-	-	-	-	-	-	-	-	-	-	-	-	-
154	SBN_JOT_hold21	41.568953	-88.061287	-	-	-	-	-	-	-	-	-	-	-	-	-
155	SBN_JOT_hold22	41.563368	-88.125589	-	-	-	-	-	-	-	-	-	-	-	-	-
156	SBN_JOT_hold23	41.557745	-88.189881	-	-	-	-	-	-	-	-	-	-	-	-	-
157	SBN_JOT_hold24	41.552087	-88.254160	-	-	-	-	-	-	-	-	-	-	-	-	-
158	BDFKELSI1	41.159731	-89.587872	-	-	-	-	-	-	-	-	-	-	-	-	-
159	BDFKELSI2	41.185251	-89.533866	-	-	-	-	-	-	-	-	-	-	-	-	-
160	BDFKELSI3	41.210744	-89.479817	-	-	-	-	-	-	-	-	-	-	-	-	-
161	BDFKELSI4	41.236211	-89.425724	-	-	-	-	-	-	-	-	-	-	-	-	-
162	BDFKELSI5	41.261651	-89.371589	-	-	-	-	-	-	-	-	-	-	-	-	-
163	BDFKELSI6	41.287064	-89.317410	-	-	-	-	-	-	-	-	-	-	-	-	-
164	BDFKELSI7	41.312451	-89.263187	-	-	-	-	-	-	-	-	-	-	-	-	-
165	BDFKELSI8	41.337811	-89.208922	-	-	-	-	-	-	-	-	-	-	-	-	-
166	BDFKELSI9	41.363144	-89.154613	-	-	-	-	-	-	-	-	-	-	-	-	-
167	BDFKELSI10	41.388450	-89.100262	-	-	-	-	-	-	-	-	-	-	-	-	-
168	BDFKELSI11	41.413730	-89.045867	-	-	-	-	-	-	-	-	-	-	-	-	-
169	KELSI1	41.438983	-88.991429	-	-	-	-	-	-	-	-	-	-	-	-	-
170	KELSI2	41.488231	-88.981235	-	-	-	-	-	-	-	-	-	-	-	-	-
171	KELSI3	41.537478	-88.971026	-	-	-	-	-	-	-	-	-	-	-	-	-
172	KELSI4	41.586723	-88.960801	-	-	-	-	-	-	-	-	-	-	-	-	-
173	KELSI5	41.635968	-88.950560	-	-	-	-	-	-	-	-	-	-	-	-	-
174	KELSI6	41.685211	-88.940304	-	-	-	-	-	-	-	-	-	-	-	-	-
175	KELSI7	41.734454	-88.930031	-	-	-	-	-	-	-	-	-	-	-	-	-
176	KELSI8	41.783695	-88.919744	-	-	-	-	-	-	-	-	-	-	-	-	-
177	KELSI9	41.832935	-88.909440	-	-	-	-	-	-	-	-	-	-	-	-	-
178	KELSI10	41.882174	-88.899120	-	-	-	-	-	-	-	-	-	-	-	-	-

				2018 Alternative C								2018 Alternative A				
Pt. No.	Point Name	Latitude	Longitude	ORD SW Arr	ORD SE Arr	MDW OKK	MDW BVT	RFD	DPA	SBN	Total	ORD SW Arr	ORD SE Arr	MDW	Total	Alt C minus Alt A
179	KELSI11	41.931412	-88.888784	-	-	-	-	-	-	-	-	-	-	-	-	-
180	SIMMN1	41.980649	-88.878433	-	-	-	-	-	-	-	-	-	-	-	-	-
181	SIMMN2	41.980772	-88.826012	-	-	-	-	-	-	-	-	-	-	-	-	-
182	RFD_hold1	41.980871	-88.773590	-	-	-	-	-	-	-	-	-	-	-	-	-
183	RFD_hold2	41.981330	-88.707808	-	-	-	-	-	-	-	-	-	-	-	-	-
184	RFD_hold3	41.981751	-88.642025	-	-	-	-	-	-	-	-	-	-	-	-	-
185	RFD_hold4	41.982135	-88.576240	-	-	-	-	-	-	-	-	-	-	-	-	-
186	BDFBENKY2	41.183421	-89.529585	-	-	-	-	-	-	-	-	-	-	-	-	-
187	BDFBENKY3	41.207080	-89.471254	-	-	-	-	-	-	-	-	-	-	-	-	-
188	BDFBENKY4	41.230708	-89.412880	-	-	-	-	-	-	-	-	-	-	-	-	-
189	BDFBENKY5	41.254306	-89.354462	-	-	-	-	-	-	-	-	-	-	-	-	-
190	BDFBENKY6	41.277872	-89.296001	-	-	-	-	-	-	-	-	-	-	-	-	-
191	BDFBENKY7	41.301407	-89.237497	-	-	-	-	-	-	-	-	-	-	-	-	-
192	BDFBENKY8	41.324911	-89.178950	-	-	-	-	-	-	-	-	-	-	-	-	-
193	BDFBENKY9	41.348385	-89.120359	-	-	-	-	-	-	-	-	-	-	-	-	-
194	BDFBENKY10	41.371827	-89.061725	-	-	-	-	-	-	-	-	-	-	-	-	-
195	BDFBENKY11	41.395238	-89.003048	-	-	-	-	-	-	-	-	-	-	-	-	-
196	BDFBENKY12	41.418619	-88.944328	-	-	-	-	-	-	-	-	-	-	-	-	-
197	BDFBENKY13	41.441968	-88.885565	-	-	-	-	-	-	-	-	-	-	-	-	-
198	BDFBENKY14	41.465287	-88.826758	-	-	-	-	-	-	-	-	-	-	-	-	-
199	BDFBENKY15	41.488574	-88.767909	-	-	-	-	-	-	-	-	-	-	-	-	-
200	BENKY1	41.511831	-88.709017	-	-	-	-	-	-	-	-	-	-	-	-	-
201	BENKY2	41.529948	-88.663077	-	-	-	-	-	-	-	-	-	-	-	-	-
202	BENKY3	41.548046	-88.617112	-	-	-	-	-	-	-	-	-	-	-	-	-
203	NEWRK1	41.566125	-88.571120	-	-	-	-	-	-	-	-	-	-	-	-	-
204	NEWRK2	41.603160	-88.526942	-	-	-	-	-	-	-	-	-	-	-	-	-
205	NEWRK3	41.640177	-88.482713	-	-	-	-	-	-	-	-	-	-	-	-	-
206	NEWRK4	41.677177	-88.438433	-	-	-	-	-	-	-	-	-	-	-	-	-
207	NEWRK5	41.714159	-88.394101	-	-	-	-	-	-	-	-	-	-	-	-	-
208	NEWRK6	41.751124	-88.349719	-	-	-	-	-	-	-	-	-	-	-	-	-

				2018 Alternative C								2018 Alternative A				
Pt. No.	Point Name	Latitude	Longitude	ORD SW Arr	ORD SE Arr	MDW OKK	MDW BVT	RFD	DPA	SBN	Total	ORD SW Arr	ORD SE Arr	MDW	Total	Alt C minus Alt A
209	NEWRK7	41.788071	-88.305285	-	-	-	-	-	-	-	-	-	-	-	-	-
210	NEWRK_to_ORD1	41.825001	-88.260799	43.3	-	-	-	-	-	-	43.3	43.2	-	-	43.2	0.1
211	CLEFT2	41.103140	-86.096534	-	-	-	-	-	-	-	-	-	-	-	-	-
212	CLEFT3	41.125156	-86.151638	-	-	-	-	-	-	-	-	-	-	-	-	-
213	CLEFT4	41.147143	-86.206781	-	-	-	-	-	-	-	-	-	-	-	-	-
214	CLEFT5	41.169102	-86.261962	-	-	-	-	-	-	-	-	-	-	-	-	-
215	CLEFT6	41.191034	-86.317181	-	-	-	-	-	-	-	-	-	-	-	-	-
216	CLEFT7	41.212938	-86.372438	-	-	-	-	-	-	-	-	-	-	-	-	-
217	CLEFT8	41.234815	-86.427733	-	-	-	-	-	-	-	-	-	-	-	-	-
218	CLEFT9	41.256663	-86.483066	-	-	-	-	-	-	-	-	-	-	-	-	-
219	CLEFT10	41.278484	-86.538437	-	-	-	-	-	-	-	-	-	-	-	-	-
220	CLEFT11	41.300277	-86.593847	-	-	-	-	-	-	-	-	-	-	-	-	-
221	OXI1	41.322042	-86.649294	-	-	-	-	-	-	-	-	-	-	-	-	-
222	OXI2	41.365920	-86.664686	-	-	-	-	-	-	-	-	-	-	-	-	-
223	OXI3	41.409795	-86.680099	-	-	-	-	-	-	-	-	-	-	-	-	-
224	OXI4	41.453669	-86.695533	-	-	-	-	-	-	-	-	-	-	-	-	-
225	OXI5	41.497539	-86.710988	-	-	-	-	-	-	-	-	-	-	-	-	-
226	OXI6	41.541408	-86.726465	-	-	-	-	-	-	-	-	-	-	-	-	-
227	OXI7	41.585274	-86.741962	-	-	-	-	-	-	-	-	-	-	-	-	-
228	OXI8	41.629138	-86.757481	-	-	-	-	-	-	-	-	-	-	-	-	-
229	SBN_JOT_hold1	41.672999	-86.773021	-	-	-	-	-	-	-	-	-	-	-	-	-
230	SBN_JOT_hold2	41.706653	-86.784798	-	-	-	-	-	-	-	-	-	-	-	-	-
231	SBN_JOT_hold3	41.740306	-86.796587	-	-	-	-	-	-	-	-	-	-	-	-	-
232	STYLE1	41.773957	-86.808389	-	-	-	-	-	-	-	-	-	-	-	-	-
233	STYLE2	41.806251	-86.849057	-	-	-	-	-	-	-	-	-	-	-	-	-
234	STYLE3	41.838530	-86.889765	-	-	-	-	-	-	-	-	-	-	-	-	-
235	STYLE4	41.870794	-86.930515	-	-	-	-	-	-	-	-	-	-	-	-	-
236	STYLE5	41.903043	-86.971306	-	-	-	-	-	-	-	-	-	-	-	-	-
237	STYLE6	41.935278	-87.012138	-	-	-	-	-	-	-	-	-	-	-	-	-
238	NEPTS1	41.967497	-87.053012	-	-	-	-	-	-	-	-	-	-	-	-	-

				2018 Alternative C								2018 Alternative A				
Pt. No.	Point Name	Latitude	Longitude	ORD SW Arr	ORD SE Arr	MDW OKK	MDW BVT	RFD	DPA	SBN	Total	ORD SW Arr	ORD SE Arr	MDW	Total	Alt C minus Alt A
239	DPA_turn_7_1	41.936574	-88.292970	-	-	-	-	-	51.2	-	51.2	-	-	-	-	-
240	DPA_turn_7_2	41.914623	-88.330556	-	-	-	-	-	49.1	-	49.1	-	-	-	-	-
241	DPA_turn_7_3	41.892659	-88.368115	-	-	-	-	-	44.9	-	44.9	-	-	-	-	-
242	DPA_turn_8_1	41.870683	-88.405649	-	-	-	-	-	-	-	-	-	-	-	-	-
243	DPA_turn_8_2	41.845309	-88.448930	-	-	-	-	-	-	-	-	-	-	-	-	-
244	DPA_turn_8_3	41.819919	-88.492176	-	-	-	-	-	-	-	-	-	-	-	-	-
245	DPA_turn_8_4	41.794511	-88.535387	-	-	-	-	-	-	-	-	-	-	-	-	-
246	DPA_turn_9_1	41.769088	-88.578564	-	-	-	-	-	-	-	-	-	-	-	-	-
247	DPA_turn_9_2	41.738839	-88.629487	-	-	-	-	-	-	-	-	-	-	-	-	-
248	DPA_turn_9_3	41.708567	-88.680362	-	-	-	-	-	-	-	-	-	-	-	-	-
249	DPA_turn_9_4	41.678272	-88.731189	-	-	-	-	-	-	-	-	-	-	-	-	-
250	DPA_turn_9_5	41.647954	-88.781968	-	-	-	-	-	-	-	-	-	-	-	-	-
251	DPA_turn_9_6	41.617613	-88.832698	-	-	-	-	-	-	-	-	-	-	-	-	-
252	DPA_turn_9_7	41.587248	-88.883380	-	-	-	-	-	-	-	-	-	-	-	-	-
253	DPA_turn_9_8	41.556861	-88.934014	-	-	-	-	-	-	-	-	-	-	-	-	-
254	DPA_turn_9_9	41.526451	-88.984599	-	-	-	-	-	-	-	-	-	-	-	-	-
255	DPA_turn_9_10	41.496018	-89.035137	-	-	-	-	-	-	-	-	-	-	-	-	-
256	DPA_turn_9_11	41.465561	-89.085626	-	-	-	-	-	-	-	-	-	-	-	-	-
257	DPA_turn_9_12	41.435082	-89.136067	-	-	-	-	-	-	-	-	-	-	-	-	-
258	DPA_turn_9_13	41.404580	-89.186460	-	-	-	-	-	-	-	-	-	-	-	-	-
259	DPA_turn_9_14	41.374054	-89.236805	-	-	-	-	-	-	-	-	-	-	-	-	-
260	DPA_turn_9_15	41.343506	-89.287101	-	-	-	-	-	-	-	-	-	-	-	-	-
261	DPA_turn_9_16	41.312934	-89.337350	-	-	-	-	-	-	-	-	-	-	-	-	-
262	DPA_turn_9_17	41.282339	-89.387551	-	-	-	-	-	-	-	-	-	-	-	-	-
263	DPA_turn_9_18	41.251722	-89.437703	-	-	-	-	-	-	-	-	-	-	-	-	-
264	DPA_turn_9_19	41.221081	-89.487808	-	-	-	-	-	-	-	-	-	-	-	-	-
265	DPA_turn_9_20	41.190417	-89.537864	-	-	-	-	-	-	-	-	-	-	-	-	-
266	OXI_HALIE1	41.322042	-86.649294	-	-	-	-	-	-	-	-	-	-	-	-	-
267	OXI_HALIE2	41.343715	-86.705760	-	-	-	-	-	-	-	-	-	-	-	-	-
268	OXI_HALIE3	41.365360	-86.762266	-	-	-	-	-	-	-	-	-	-	-	-	-

				2018 Alternative C								2018 Alternative A				
Pt. No.	Point Name	Latitude	Longitude	ORD SW Arr	ORD SE Arr	MDW OKK	MDW BVT	RFD	DPA	SBN	Total	ORD SW Arr	ORD SE Arr	MDW	Total	Alt C minus Alt A
269	OXI_HALIE4	41.386976	-86.818809	-	-	-	-	-	-	-	-	-	-	-	-	-
270	OXI_HALIE5	41.408564	-86.875391	-	-	-	-	-	-	-	-	-	-	-	-	-
271	OXI_HALIE6	41.430122	-86.932011	-	-	-	-	-	-	-	-	-	-	-	-	-
272	OXI_HALIE7	41.451652	-86.988670	-	-	-	-	-	-	-	-	-	-	-	-	-
273	OXI_HALIE8	41.473153	-87.045367	-	41.9	-	-	-	-	-	41.9	-	43.5	-	43.5	-1.6
274	OXI_HALIE9	41.494626	-87.102102	-	42.2	-	-	-	-	-	42.2	-	43.9	-	43.9	-1.7
275	HALIE1	41.516069	-87.158875	-	42.5	-	-	-	-	-	42.5	-	44.2	-	44.2	-1.7
276	HALIE2	41.538089	-87.217315	-	-	-	-	-	-	-	-	-	-	-	-	-
277	BEARZ1	41.560078	-87.275795	-	-	-	-	-	-	-	-	-	-	-	-	-
278	BEARZ2	41.593189	-87.325131	-	-	-	-	-	-	-	-	-	-	-	-	-
279	BEARZ_X_SBN1	41.626277	-87.374519	-	-	-	-	-	-	-	-	-	-	-	-	-
280	DPA_X_RFD	41.779228	-88.561351	-	-	-	-	-	-	-	-	-	-	-	-	-
281	NEWRK_X_RFD	41.669965	-88.447069	-	-	-	-	-	-	-	-	-	-	-	-	-
282	CGT_X_SBN	41.605261	-87.632283	-	-	31.6	44.0	-	-	-	44.3	-	-	44.3	44.3	0.0
283	SBN_20k_BAE1	41.703751	-86.365348	-	-	-	-	-	-	50.7	50.7	-	-	-	-	-
284	SBN_20k_BAE2	41.738598	-86.411138	-	-	-	-	-	-	-	-	-	-	-	-	-
285	SBN_20k_BAE3	41.773426	-86.456978	-	-	-	-	-	-	-	-	-	-	-	-	-
286	SBN_20k_BAE4	41.808236	-86.502869	-	-	-	-	-	-	-	-	-	-	-	-	-
287	SBN_20k_BAE5	41.843026	-86.548810	-	-	-	-	-	-	-	-	-	-	-	-	-
288	SBN_20k_BAE6	41.877797	-86.594801	-	-	-	-	-	-	-	-	-	-	-	-	-
289	SBN_20k_BAE7	41.912549	-86.640843	-	-	-	-	-	-	-	-	-	-	-	-	-
290	SBN_20k_BAE8	41.947282	-86.686935	-	-	-	-	-	-	-	-	-	-	-	-	-
291	SBN_20k_BAE9	41.981996	-86.733077	-	-	-	-	-	-	-	-	-	-	-	-	-
292	SBN_20k_BAE10	42.016691	-86.779270	-	-	-	-	-	-	-	-	-	-	-	-	-
293	RFD_turn3	42.215431	-89.024250	-	-	-	-	45.0	-	-	45.0	-	-	-	-	-