APPENDIX H AIRCRAFT NOISE ANALYSIS

This appendix presents the noise exposure analysis of aircraft operations at LAX. This includes the baseline year and forecast year for the proposed restriction and alternatives. The existing FAA Air Traffic Control Tower (ATCT) and Southern California Terminal Radar Approach Control (SOCAL TRACON or SCT) procedures and LAX noise abatement or operational procedures are assumed to remain in effect with the only changes made in reference to the proposed restriction.

Noise Analysis Methodology

§Part 161.9 requires airports to conduct noise analyses in accordance with Part 150 "specifications, methods, and criteria." Consistent with that requirement, all noise modeling conducted for this study followed Part 150 "best practices." Part 150 requires use of the FAA's Integrated Noise Model (INM) to prepare Community Noise Equivalent Level (CNEL) contours for civilian airports. Part 150 Appendix A provides standards to be followed in applying the INM. Those standards were followed in preparing contours for this analysis, using the most recent release of the INM available at the time (version 7.0b).

The INM contains the necessary algorithms to compute the necessary aircraft flight profiles and noise metrics; however, there are various airport-specific details that must be determined to make the model results specific to the desired airport. Therefore, various INM input parameters were researched, collected, and derived through close communications with the FAA and airport staffs. The following sections describe the required inputs to the INM, except for details on the aircraft fleet mix and operations, which are described in Section 6 of the report.

LAX Physical Parameters
LAX Runway Utilization
LAX Flight Track Geometry and Utilization
LAX Meteorological Data
Aircraft Noise and Performance Characteristics

LAX Physical Parameters

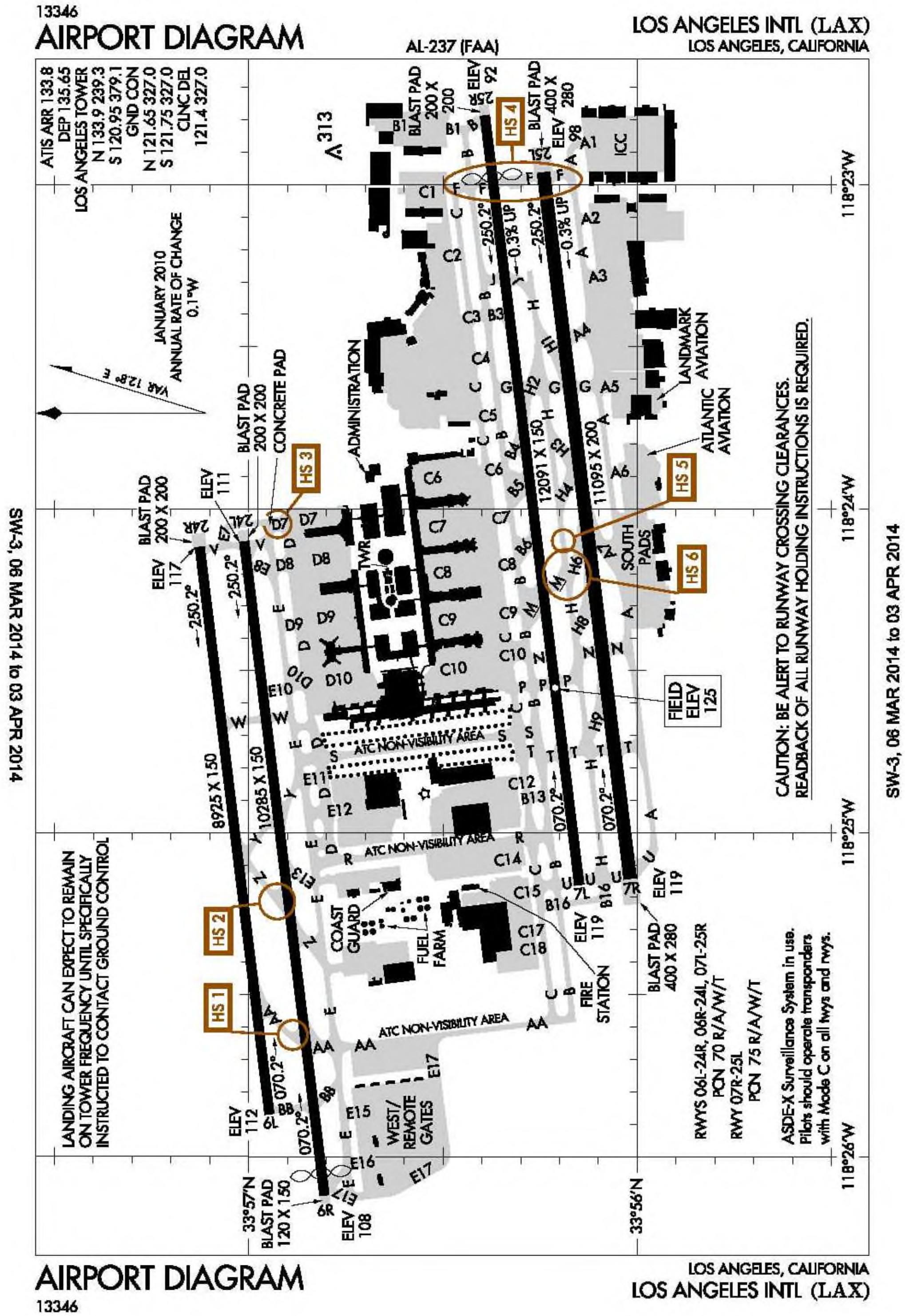
LAX is located in west Los Angeles next to the Pacific Ocean approximately fifteen miles southwest of Downtown Los Angles. The airport is contained within the jurisdictional boundaries of the City of Los Angeles and is surrounded by heavily populated areas to the north, south, and east, with the Pacific Ocean to the west. Table H-1 presents the LAX airport layout. The INM includes an internal database on the airport layout, including runway locations, orientation, runway end elevations, landing thresholds, approach angles, etc. These data were verified with LAX sources and the FAA-approved LAX September 2010 Airport Layout Plan. The airport has four parallel runways grouped in pairs. The parallel runways are distinguished from each other with letter endings "L", meaning left, and "R", meaning right, as seen by the pilot. Each end of the runways is designated by a different number that, with the addition of a trailing "0," reflects the magnetic heading of the runway to the nearest 10 degrees, as seen by the pilot. Thus, the runway, 7L/25R, has the designation "7" at the west end of the pavement looking eastward, indicating that it is aligned on a magnetic heading of approximately 70 degrees, while the opposite end of the same piece of pavement has the designation "25" indicating its orientation on a heading of approximately 250 degrees.

Table H-1 Runway/Helipad Details
Source: FAA-approved LAX ALP, 2010

Runway	Latitude Longitude	Elev. (feet MSL)	Width (feet)	Length (feet)	Displaced Threshold (feet)	Descent Angle (degrees)	Effective Runway Gradient
6L	N33.949108 W118.431153	112.0	150	8,925	0	3.0	0.100%
24R	N33.952097 W118.401942	117.2	150	8,925	0	3.0	-0.100%
6R	N33.946742 W118.435319	107.3	150	10,285	331	3.0	0.119%
24L	N33.950189 W118.401661	111.1	150	10,285	0	3.0	-0.119%
7L	N33.935822 W118.419375	118.5	150	12,091	0	3.0	-0.278%
25R	N33.939872 W118.379769	91.9	150	12,091	957	3.0	0.278%
7R	N33.933644 W118.419014	121.8	200	11,095	0	3.0	-0.269%
25L	N33.937358 W118.382711	97.9	200	11,095	0	3.0	0.269%
Pad 1	N33.943998 W118.418709	112.0	-	-	-	-	-
Pad 2	N33.933926 W118.393979	102.0	-	-	-	-	-

Figure H-1 LAX Airport Diagram

Source: FAA SW-3, 06 Mar 2014 to 03 Apr 2014



LAX Runway Utilization

Twelve months of LAX ANOMS data, April 1, 2010 through March 31, 2011, were used to define the baseline runway use, flight track geometry, and the aircraft fleet distribution. Slight variations in the runway use were made for the proposed restriction scenario for both 2013 and 2018.

Table H-2 presents the modeled runway use for arrival and departure operations for 2013 status quo and 2013 with the proposed restriction split into day (7:00 a.m.–7:00 p.m.), evening (7:00 p.m.–10:00 p.m.), and night (10:00 p.m.–7:00 a.m.).

Table H-2 Runway Utilization for 2013 Status Quo and with Proposed Restriction
Source: LAWA ANOMS, HMMH

	Arrivals			Departures		
Runway	**Day**	**Evening**	**Night**	**Day**	**Evening**	**Night**
06L	0.8%	0.7%	1.8%	0.0%	0.0%	0.0%
06R	0.1%	0.0%	8.7%	0.8%	0.8%	0.5%
07L	0.0%	0.0%	11.0%	1.0%	1.0%	1.3%
07R	0.9%	0.8%	2.5%	0.1%	0.0%	0.1%
24L	0.9%	1.7%	0.8%	42.7%	50.3%	24.3%
24R	47.5%	46.2%	28.8%	1.0%	0.5%	1.1%
25L	48.3%	47.7%	44.6%	3.2%	3.5%	3.0%
25R	1.4%	2.9%	1.7%	51.2%	43.9%	69.8%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
PAD1	68.0%	36.0%	100.0%	64.0%	100.0%	100.0%
PAD2	32.0%	64.0%	0.0%	36.0%	0.0%	0.0%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

These runway utilization rates were then applied to the aircraft flight operations detailed in Section 5 and assumed to apply to both 2013 scenarios. The runway utilization for 2018 status quo differed very slightly from that in 2013 due to a forecast change in aircraft types and operations as detailed in Appendix I. These runway utilization rates are shown in Table H-3 and Table H-4.

Table H-3 Runway Utilization for 2018 Status Quo
Source: LAWA ANOMS, HMMH

Runway	Arrivals			Departures		
	Day	Evening	Night	Day	Evening	Night
06L	0.8%	0.7%	1.8%	0.0%	0.0%	0.0%
06R	0.1%	0.0%	8.7%	0.8%	0.8%	0.5%
07L	0.0%	0.0%	11.0%	1.0%	1.0%	1.3%
07R	0.9%	0.8%	2.5%	0.1%	0.0%	0.1%
24L	1.0%	1.7%	0.8%	44.6%	50.4%	24.5%
24R	48.5%	47.0%	29.2%	1.0%	0.5%	1.1%
25L	47.3%	46.9%	44.2%	3.0%	3.6%	2.9%
25R	1.4%	2.8%	1.7%	49.5%	43.6%	69.7%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
PAD1	68.0%	41.0%	100.0%	68.0%	56.0%	100.0%
PAD2	32.0%	59.0%	0.0%	32.0%	44.0%	0.0%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Table H-4 Runway Utilization for 2018 with Proposed Restriction
Source: LAWA ANOMS, HMMH

Runway	Arrivals			Departures		
	Day	Evening	Night	Day	Evening	Night
06L	0.8%	0.7%	1.8%	0.0%	0.0%	0.0%
06R	0.1%	0.0%	8.7%	0.8%	0.8%	0.5%
07L	0.0%	0.0%	11.0%	1.0%	1.0%	1.2%
07R	0.9%	0.8%	2.5%	0.1%	0.0%	0.1%
24L	1.0%	1.7%	0.8%	44.6%	50.4%	24.5%
24R	48.5%	47.0%	29.2%	1.0%	0.5%	1.1%
25L	47.3%	46.9%	44.2%	3.0%	3.6%	3.0%
25R	1.4%	2.8%	1.7%	49.5%	43.6%	69.8%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
PAD1	68.0%	41.0%	100.0%	68.0%	56.0%	100.0%
PAD2	32.0%	59.0%	0.0%	32.0%	44.0%	0.0%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

LAX Flight Track Geometry

ANOMS data from April 10, 2010 through March 31, 2011 were used to develop aircraft flight tracks for use in developing model flight tracks. The flight tracks and operations were input into a modeling preprocessor known as RealContours^{TM} that provides greater detail to the modeling process by improving the precision of modeling each individual aircraft flight track. This provides the advantage of modeling each aircraft operation on the specific runway it actually used and at the actual time of day of arrival or departure.

Figure H-2 and Figure H-3 show a sample of the fixed-wing aircraft arrival and departure flight tracks from the ANOMS data and Figure H-4 shows the modeled helicopter flight tracks.

The 12-month period from April 2010 through March 2011 was then used to determine the allocation of annual-average non-conforming operations to include appropriate flight tracks and fleet mix. **Table H-5** below provides the non-conforming nighttime departures by aircraft type, stage length, and flight track assigned to the non-conforming operations in 2013. The annual average of 65 non-conforming operations was derived from the 56 non-conforming operations contained in the 12-month period. Table H-6 provides similar information for the 2018 forecast. Figure H-5 and Figure H-6 provide the flight track reference nomenclature for the status quo scenario and proposed restriction scenarios, respectively.

Table H-7 and Table H-8 present a consolidated summary for 2013 and 2018, respectively, of the aircraft type, departure stage length, and average number of nighttime departures by runway for both status quo and proposed restriction scenarios.

Table H-5 2013 Non-Conforming Nighttime Departures by Flight Track and Stage Length

Source: HMMH

2013						
INM Aircraft Type		Status Quo		Proposed Restriction		Nighttime Departures
	Profile or Stage Length	Runway	Track Name	Runway	Track Name	
747400	7	07R	NC01	25L	LWWSN	0.00343
747400	7	07R	NC02	25L	LWWSN	0.00343
747400	9	07L	NC03	25R	LWWWS	0.00315
777M	M	07L	NC04	25R	LWWWP	0.00320
747400	7	07L	NC05	25R	LWWSN	0.00315
777200	7	07L	NC06	25R	LWWWN	0.00320
777200	8	07L	NC07	25R	LWWWN	0.00320
747400	8	07L	NC08	25R	LWWWN	0.00315
747400	7	07R	NC09	25L	LWWSN	0.00343
767300	4	07L	NC10	25R	SWSSH	0.00274
777M	M	07R	NC11	25L	LWWWP	0.00274
747400	8	07R	NC12	25L	LWWSP	0.00343
747400	7	07R	NC13	25L	LWWSN	0.00343
747400	7	07L	NC14	25R	LWWSN	0.00315
747400	8	07L	NC15	25R	LWWWN	0.00315
747400	8	07L	NC16	25R	LWWWP	0.00315
777200	7	07L	NC17	25R	LWWWN	0.00320
747400	9	07L	NC18	25R	LWWSS	0.00315
747400	8	07L	NC19	25R	LWWWS	0.00315
767CF6	3	07L	NC20	25R	SWSSH	0.00274
747400	7	07L	NC21	25R	LWWWN	0.00315

2013						
INM Aircraft Type		Status Quo		Proposed Restriction		Nighttime Departures
	Profile or Stage Length	Runway	Track Name	Runway	Track Name	
747400	9	07L	NC22	25R	LWWWS	0.00315
747400	8	07L	NC23	25R	LWWWP	0.00315
777200	7	07L	NC24	25R	LWWWN	0.00320
777200	8	07L	NC25	25R	LWWWN	0.00320
777M	M	07L	NC26	25R	LWWWN	0.00320
747400	7	07L	NC27	25R	LWWSN	0.00315
747400	7	07R	NC28	25L	LWWSN	0.00343
747400	8	07L	NC29	25R	LWWWP	0.00315
747400	8	07L	NC30	25R	LWWWN	0.00315
747400	9	07L	NC31	25R	LWWWS	0.00315
747400	8	07L	NC32	25R	LWWWP	0.00315
777M	M	07L	NC33	25R	LWWSS	0.00320
747400	8	07L	NC34	25R	LWWWN	0.00315
777200	7	07L	NC35	25R	LWWWN	0.00320
777M	M	07L	NC36	25R	LWWWN	0.00320
777200	7	07L	NC37	25R	LWWWN	0.00320
777M	M	07L	NC38	25R	LWWWN	0.00320
747400	7	07L	NC39	25R	LWWWN	0.00315
747400	7	07R	NC40	25L	LWWSN	0.00343
747400	7	07R	NC41	25L	LWWSN	0.00343
747400	8	07L	NC42	25R	LWWWN	0.00315
747400	9	07L	NC43	25R	LWWWS	0.00315
777200	7	07L	NC44	25R	LWWWN	0.00320
777200	7	07L	NC45	25R	LWWSN	0.00320
777200	7	07L	NC46	25R	LWWSN	0.00320
747400	9	07L	NC47	25R	LWWSS	0.00315
777200	7	07L	NC48	25R	LWWSN	0.00320
747400	9	07L	NC49	25R	LWWSS	0.00315
747400	8	07L	NC50	25R	LWWWP	0.00315
747400	8	07L	NC51	25R	LWWWP	0.00315
747400	9	07L	NC52	25R	LWWSS	0.00315
777M	M	07L	NC53	25R	LWWWN	0.00320
747400	7	07L	NC54	25R	LWWWN	0.00315
747400	7	07L	NC55	25R	LWWWN	0.00315
777200	7	07L	NC56	25R	LWWWN	0.00320

Table H-6 2018 Non-Conforming Nighttime Departures by Flight Track and Stage Length

Source: HMMH

2018						
INM Aircraft Type		Status Quo		Proposed Restriction		Nighttime Departures
	Profile or Stage Length	Runway	Track Name	Runway	Track Name	
A340-642	7	07R	NC01	25L	LWWSN	0.0027
747400	7	07R	NC02	25L	LWWSN	0.0027
A380-841	8	07L	NC03	25R	LWWWS	0.0018
777M	M	07L	NC04	25R	LWWWP	0.0046
747400	8	07L	NC05	25R	LWWSN	0.0019
777200	7	07L	NC06	25R	LWWWN	0.0035
777200	7	07L	NC07	25R	LWWWN	0.0035
747400	8	07L	NC08	25R	LWWWN	0.0019
A340-642	7	07R	NC09	25L	LWWSN	0.0027
767300	3	07L	NC10	25R	SWSSH	0.0014
777M	M	07R	NC11	25L	LWWWP	0.0082
747400	7	07R	NC12	25L	LWWSP	0.0027
747400	7	07R	NC13	25L	LWWSN	0.0027
747400	7	07L	NC14	25R	LWWSN	0.0027
747400	8	07L	NC15	25R	LWWWN	0.0019
747400	9	07L	NC16	25R	LWWWP	0.0021
777200	7	07L	NC17	25R	LWWWN	0.0035
A380-841	8	07L	NC18	25R	LWWSS	0.0018
747400	9	07L	NC19	25R	LWWWS	0.0021
767300	3	07L	NC20	25R	SWSSH	0.0014
747400	7	07L	NC21	25R	LWWWN	0.0027
A380-841	8	07L	NC22	25R	LWWWS	0.0018
747400	9	07L	NC23	25R	LWWWP	0.0021
777200	7	07L	NC24	25R	LWWWN	0.0035
777200	7	07L	NC25	25R	LWWWN	0.0035
777M	M	07L	NC26	25R	LWWWN	0.0046
747400	8	07L	NC27	25R	LWWSN	0.0019
A340-642	7	07R	NC28	25L	LWWSN	0.0027
747400	9	07L	NC29	25R	LWWWP	0.0021
747400	8	07L	NC30	25R	LWWWN	0.0019
747400	9	07L	NC31	25R	LWWWS	0.0021
747400	8	07L	NC32	25R	LWWWP	0.0019

2018						
INM Aircraft Type		Status Quo		Proposed Restriction		Nighttime Departures
	Profile or Stage Length	Runway	Track Name	Runway	Track Name	
777M	M	07L	NC33	25R	LWWSS	0.0046
747400	8	07L	NC34	25R	LWWWN	0.0019
777200	7	07L	NC35	25R	LWWWN	0.0046
777M	M	07L	NC36	25R	LWWWN	0.0091
777200	8	07L	NC37	25R	LWWWN	0.0041
777M	M	07L	NC38	25R	LWWWN	0.0091
A340-642	7	07L	NC39	25R	LWWWN	0.0027
747400	7	07R	NC40	25L	LWWSN	0.0027
A340-642	7	07R	NC41	25L	LWWSN	0.0027
747400	8	07L	NC42	25R	LWWWN	0.0019
747400	9	07L	NC43	25R	LWWWS	0.0021
777200	7	07L	NC44	25R	LWWWN	0.0035
777200	7	07L	NC45	25R	LWWSN	0.0035
777200	7	07L	NC46	25R	LWWSN	0.0046
747400	9	07L	NC47	25R	LWWSS	0.0021
777200	7	07L	NC48	25R	LWWSN	0.0046
747400	9	07L	NC49	25R	LWWSS	0.0021
747400	8	07L	NC50	25R	LWWWP	0.0019
747400	8	07L	NC51	25R	LWWWP	0.0019
747400	9	07L	NC52	25R	LWWSS	0.0021
777M	M	07L	NC53	25R	LWWWN	0.0091
747400	7	07L	NC54	25R	LWWWN	0.0027
A340-642	7	07L	NC55	25R	LWWWN	0.0027
777200	8	07L	NC56	25R	LWWWN	0.0041

Table H-7 2013 Non-Conforming Nighttime Departures by Aircraft, Stage Length, and Runway

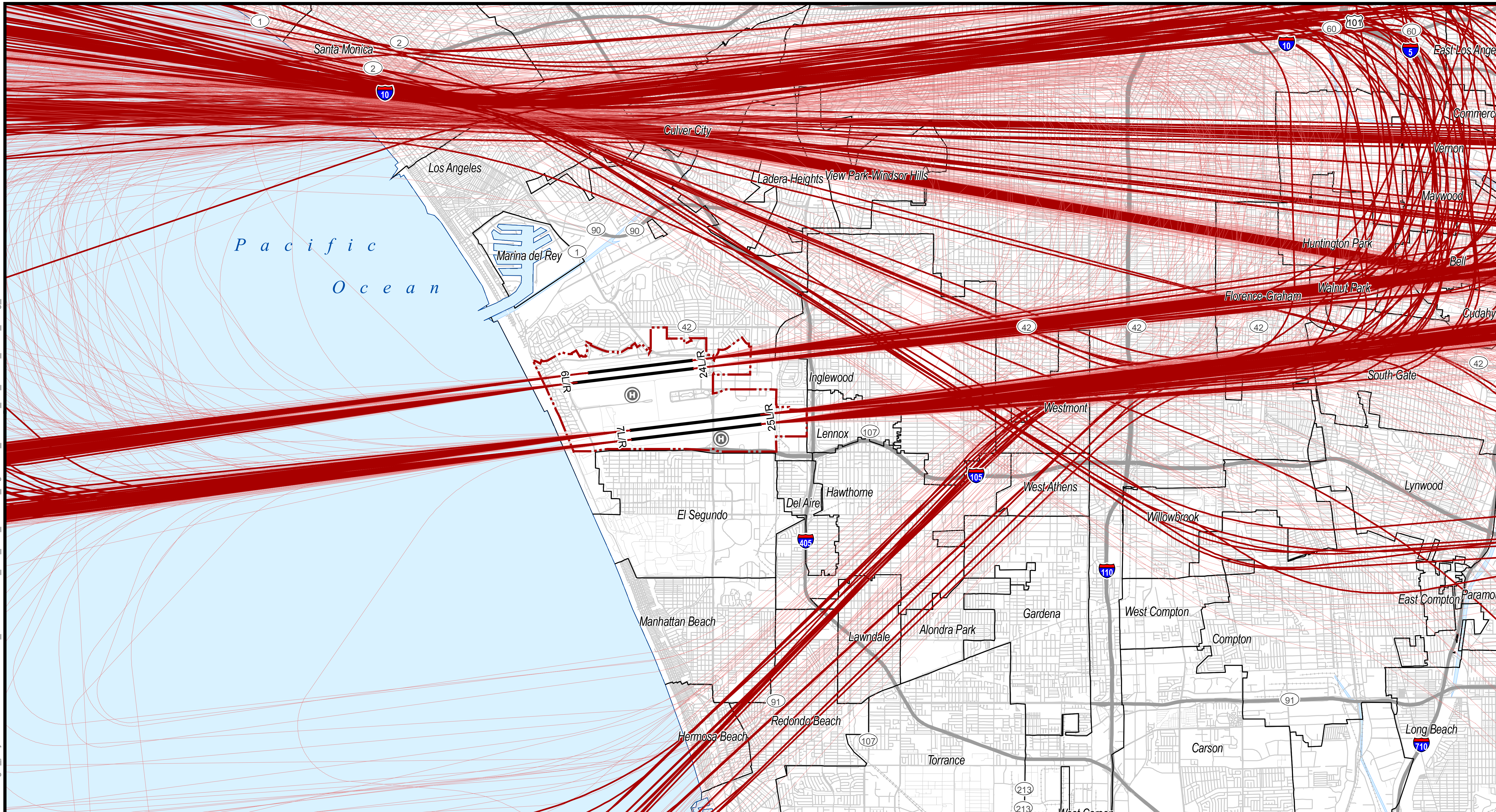
Source: HMMH

2013				
INM Aircraft Type	Profile or Stage Length	Status Quo	Proposed Restriction	Nighttime Departures
		Runway	Runway	
747400	7	07R	25L	0.0240
747400	9	07L	25R	0.0252
777M	M	07L	25R	0.0192
747400	7	07L	25R	0.0220
777200	7	07L	25R	0.0320
777200	8	07L	25R	0.0064
747400	8	07L	25R	0.0378
767300	4	07L	25R	0.0027
777M	M	07R	25L	0.0027
747400	8	07R	25L	0.0034
767CF6	3	07L	25R	0.0027

Table H-8 2018 Non-Conforming Nighttime Departures by Aircraft, Stage Length, and Runway

Source: HMMH

2018				
INM Aircraft Type	Profile or Stage Length	Status Quo	Proposed Restriction	Nighttime Departures
		Runway	Runway	
A340-642	7	07R	25L	0.011
747400	7	07R	25L	0.011
A380-841	8	07L	25R	0.005
777M	M	07L	25R	0.041
747400	8	07L	25R	0.019
777200	7	07L	25R	0.038
767300	3	07L	25R	0.003
777M	M	07R	25L	0.008
747400	7	07L	25R	0.008
747400	9	07L	25R	0.019
777200	8	07L	25R	0.008
A340-642	7	07L	25R	0.005



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Note: All area shown on this figure is within the jurisdictional boundaries of both the City of Los Angeles and Los Angeles County.

Basemap: Los Angeles World Airports (LAWA), Southern California Association of Governments (SCAG), Environmental Systems Research Institute (ESRI), United States Geological Survey (USGS)

N

0 8,000 16,000 Feet

- Airport Boundary
- Runway / Taxiway
- Helicopter Pad
- River / Streams
- Roads
- Railroad
- Jurisdictional Boundaries
- Backbone Arrival Tracks
- Dispersed Arrival Tracks

LAX Los Angeles World Airports

Modeled Arrival Flight Tracks for Fixed-Wing Aircraft

Figure H-2

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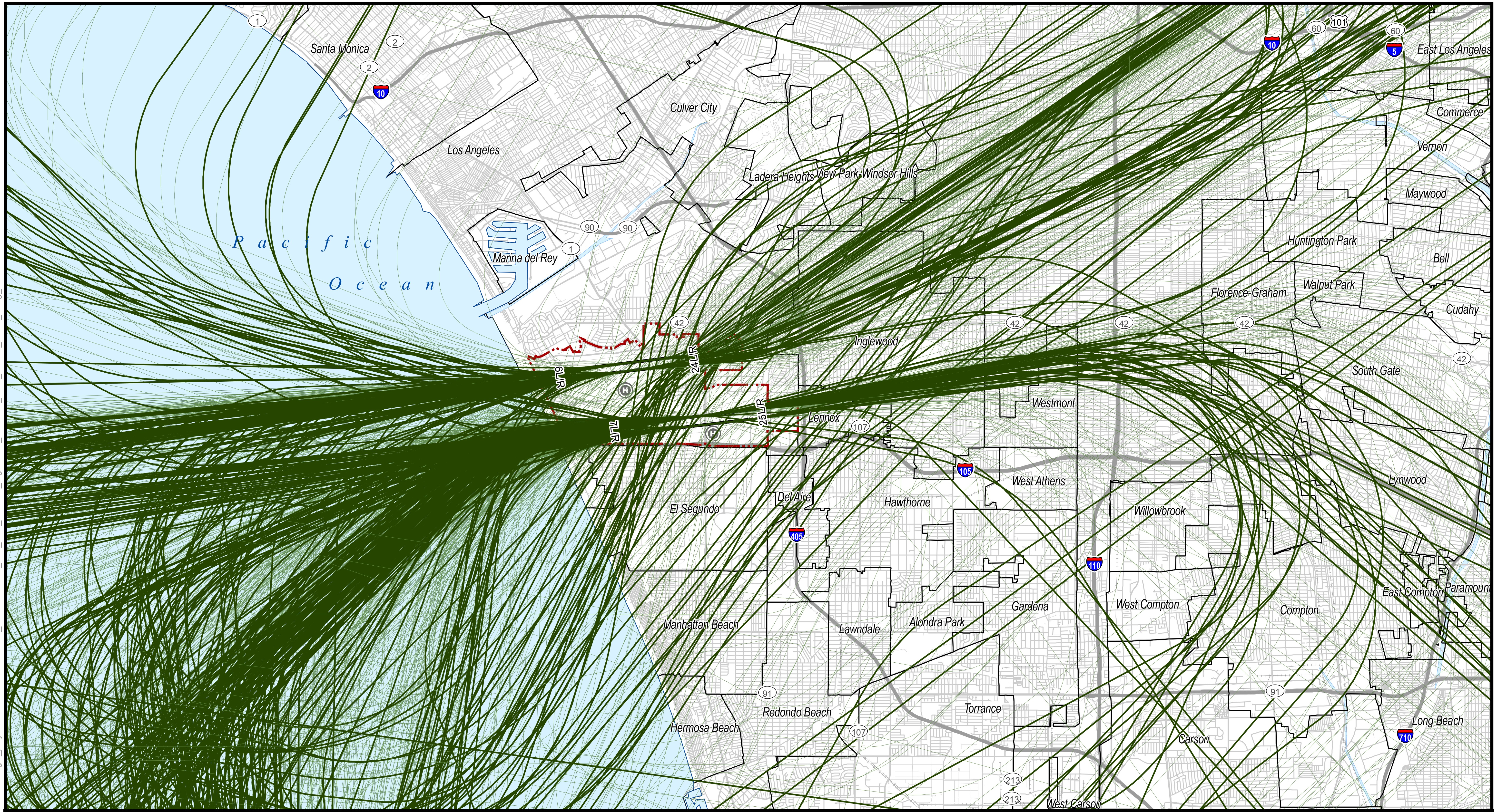

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Note: All area shown on this figure is within the jurisdictional boundaries of both the City of Los Angeles and Los Angeles County.

Basemap: Los Angeles World Airports (LAWA), Southern California Association of Governments (SCAG), Environmental Systems Research Institute (ESRI), United States Geological Survey (USGS)

N

0 8,000 16,000 Feet

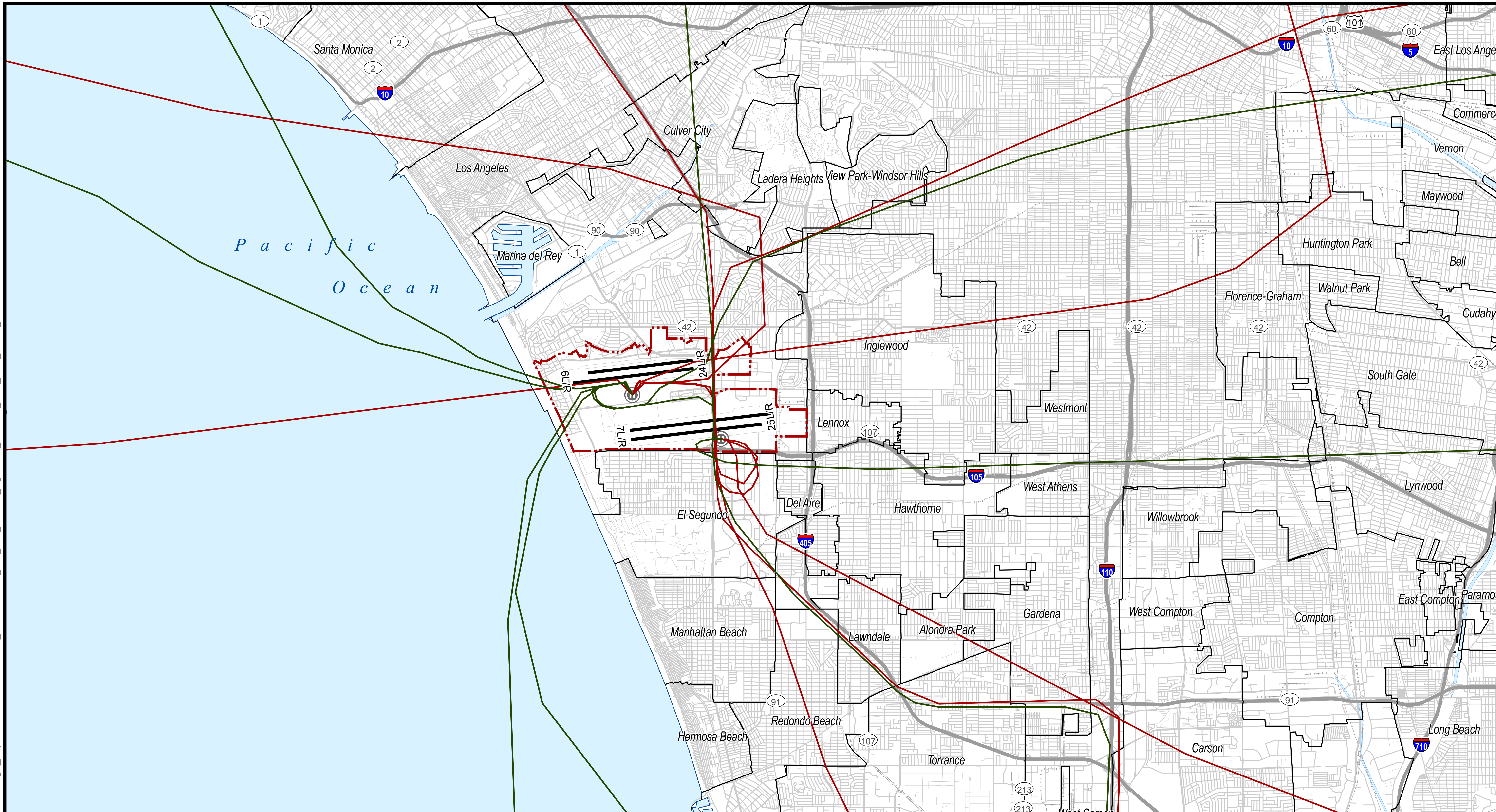
Airport Boundary
Runway / Taxiway
Helicopter Pad
River / Streams
Roads
Railroad
Jurisdictional Boundaries
Backbone Departure Tracks
Dispersed Departure Tracks

LAX
Los Angeles World Airports

Modeled Departure Flight Tracks for Fixed-Wing Aircraft

Figure H-3

HARRIS MILLER MILLER & HANSON INC.



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Note: All area shown on this figure is within the jurisdictional boundaries of both the City of Los Angeles and Los Angeles County.

Basemap: Los Angeles World Airports (LAWA), Southern California Association of Governments (SCAG), Environmental Systems Research Institute (ESRI), United States Geological Survey (USGS)

0 5,000 10,000 Feet

N

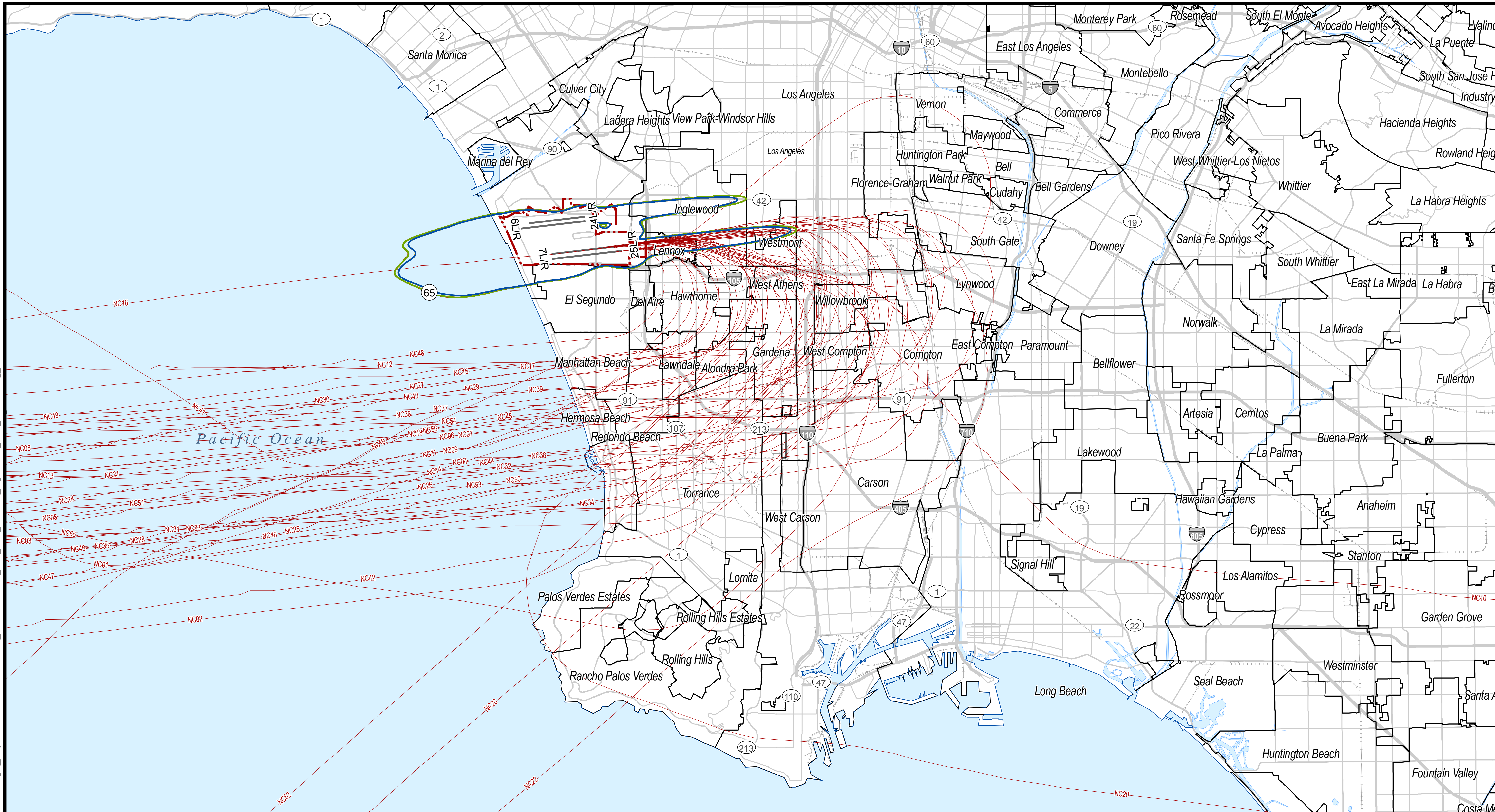
Airport Boundary
Runway / Taxiway
Helicopter Pad
River / Streams
Roads
Railroad
Jurisdictional Boundaries
Helo Arrivals
Helo Departures

LAX
Los Angeles World Airports

Modeled Arrival and Departure Flight Tracks for Helicopters

Figure H-4

HARRIS MILLER MILLER & HANSON INC.



Path: \\fs1\gis_projects\GIS\USA\CA\300700_LAWA\306430_001_LAX_Part161_FigureH-5_Non_Conforming_Tracks.mxd

Basemap: Los Angeles World Airports (LAWA), Southern California Association of Governments (SCAG), Environmental Systems Research Institute (ESRI), United States Geological Survey (USGS)

Airport Boundary
Runway / Taxiway
River / Streams
Roads
Railroad
Jurisdictional Boundaries
Non-Conforming Tracks
Airport Noise Study Area

N

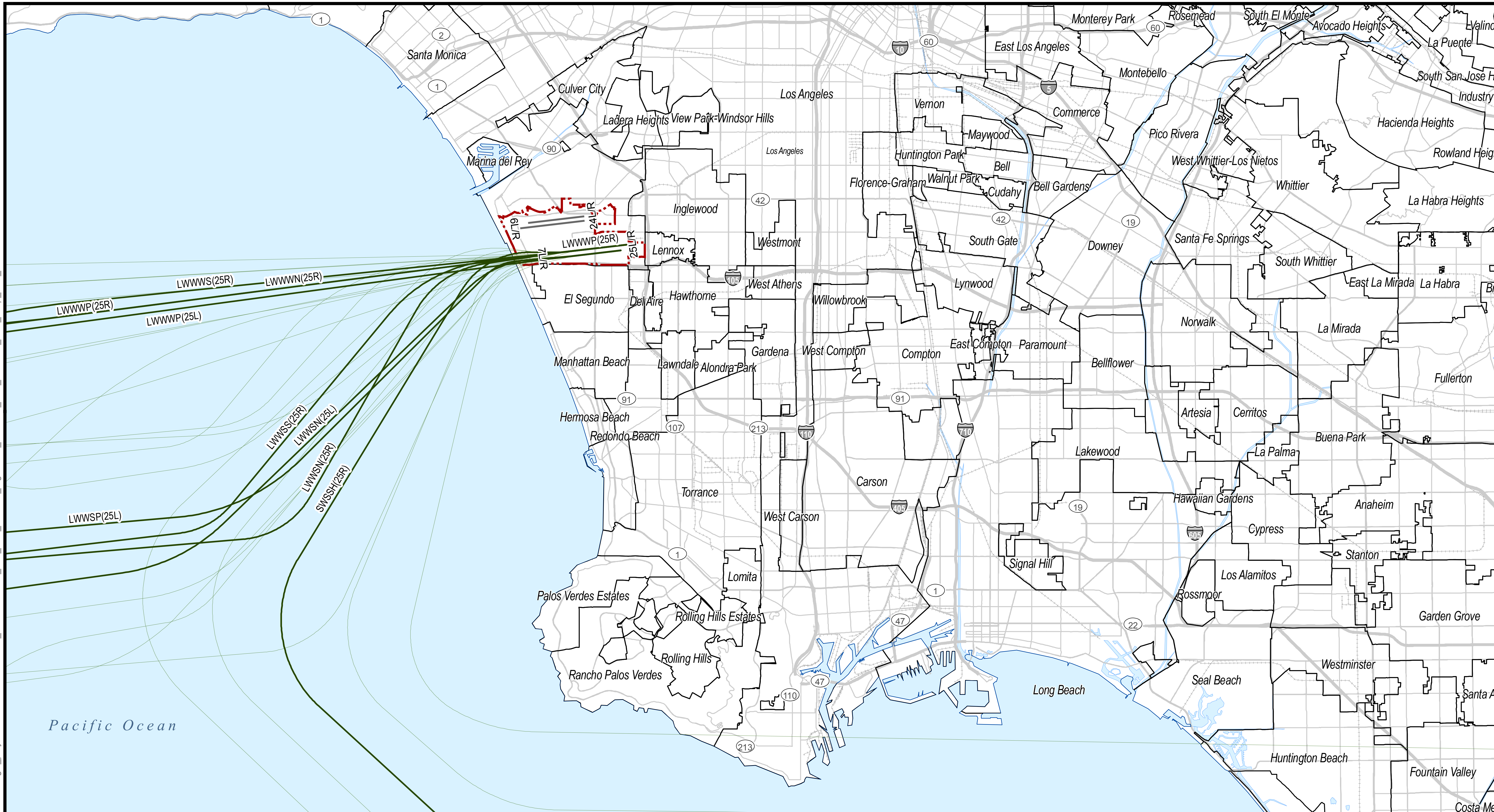
0 15,000 30,000 Feet

LAX Los Angeles World Airports

Modeled Non-Conforming Over-Ocean East Departure Flight Tracks to be affected by the Proposed Restriction

Figure H-5

HARRIS MILLER MILLER & HANSON INC.



Basemap: Los Angeles World Airports (LAWA), Southern California Association of Governments (SCAG), Environmental Systems Research Institute (ESRI), United States Geological Survey (USGS)

Airport Boundary
Runway / Taxiway
River / Streams
Roads
Railroad
Jurisdictional Boundaries
Backbone Departure Tracks
Dispersed Departure Tracks

N

0 15,000 30,000 Feet

LAX
Los Angeles World Airports

Modeled Flight Tracks for the Non-Conforming Flights with the Proposed Runway Use Restriction

Figure H-6

Harris Miller Miller & Hanson Inc.

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Meteorological Data

The INM requires average values of temperature in degrees Fahrenheit, sea level pressure in inches of mercury (Hg), relative humidity in percent, and headwind in knots (kts.). Average daily values of temperature, wet bulb temperature, and pressure for LAX were acquired from the National Climatic Data Center for years 2001 through March 2011. HMMH then developed annual average values for temperature (63.0°F), relative humidity (70.3%), and pressure (29.98 in. Hg) and used the default headwind value of 8 kts. These values were then input into the INM as the meteorological annual averages.

Aircraft Noise and Performance

Specific noise and performance data must be entered for each aircraft type operating at the airport. Noise data are included in the form of sound exposure level (SEL) at a range of distances (from 200 feet to 25,000 feet) with engines at a specific thrust levels. Performance data include thrust, speed, and altitude for takeoffs and landings. The INM database contains standard noise and performance data for over 100 types of fixed-wing aircraft and helicopters. The program automatically accesses the applicable noise and performance data for departure and arrival operations by those aircraft.

To model operations at LAX as accurately as feasible, it was necessary to obtain FAA approval for use of “substitute” aircraft types for aircraft not included in the INM database

To model the effects of sleep disturbance, it was initially intended to develop and use “extended aircraft profiles” for the nighttime departures to the east when in Over-Ocean or Westerly Flow Operations. After initially requesting FAA review, additional technical review determined that the extended profiles were not necessary and therefore were not modeled.

Substitute Aircraft

The INM database does not include data for every aircraft type. The database includes a lookup table that identifies approved “substitutes” for many types. However, that lookup table does not include some aircraft types modeled at LAX. For these aircraft types, recommendations for INM substitute aircraft were forwarded to the FAA for approval or identification of an alternate approved substitution.

Copies of related correspondence from LAWA to the FAA on September 7, 2011 and FAA’s letter of approval to LAWA on December 9, 2011 are presented at the end of this section.

Los Angeles World Airports

September 7, 2011

Mr. Victor Globa
Federal Aviation Administration
Western Pacific Region Airports Division, LAX-600.3
P.O. Box 92007
Los Angeles, CA 90009

Re: INM 7.0b Aircraft Type Substitutions and Aircraft Profile Extensions for both the LAX Part 161 Noise and Access Restriction Study and the LAX Specific Plan Amendment Study

Dear Mr. Globa:

Los Angeles World Airports (LAWA), as owner and operator of Los Angeles International Airport (LAX), has embarked on a 14 CFR Part 161 Noise and Access Restriction Study at LAX to restrict non-conforming late night departures over the City during periods and weather conditions when the airport is operating under our current voluntary Over Ocean Operations noise abatement procedure. Concurrently, LAWA is also undergoing a Specific Plan Amendment Study at LAX, which requires additional noise modeling for our assessment of any environmental impacts that may be associated with those airport improvement projects.

Both of these studies require non-standard inputs to version 7.0b of the Integrated Noise Model, and because they are being conducted in parallel, for credibility it is essential that the two projects maintain fully consistent approaches to their baseline and forecast noise modeling and impact analyses. In that regard, we are requesting that FAA approve INM 7.0b substitutions and extended profiles for each of the aircraft types identified in the attachment to this letter so they may be used on these parallel studies.

We are always pleased to answer any questions you may have regarding this request. Thank you very much for your prompt assistance on this matter.

Sincerely,

Scott Tatro
Environmental Affairs Officer

SMT:eb

Enclosures

cc: M. Feldman w/o enclosures
R. Miller w/o enclosures

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1 World Way Los Angeles California 90045-5803 Mail P.O. Box 92216 Los Angeles California 90009-2216 Telephone 310 646 5252 Internet www.lawa.aero

Appendix A

INM Aircraft Substitution Requests and Suggestions

Los Angeles World Airports (LAWA) has identified the following aircraft types included in the fleet mixes for the currently on-going LAX 14 CFR Part 161 Noise and Access Restriction Study as well as the LAX Specific Plan Amendment Study (SPAS) for which FAA approved substitutes are required. In each case, we have proposed a substitute from the INM 7.0b database. The bases for our proposed substitutions are discussed following Table 1. The bases for some recommendations refer to recent guidance FAA provided HMMH for the VNY Part 150 Noise Exposure Map Update (VNY NEM)[1]. Our recommendations for other substitutions are based on similar requests approved for other facilities, including Nashville International Airport (BNA)[2], Cleveland Hopkins International Airport (CLE)[3], Louisville International Airport (SDF)[4] Naples Municipal Airport (APF)[5] and Jackson-Evers International Airport (JAN).[6]

Table 1 Aircraft Types and Recommended INM Substitutions

#	Group	Aircraft Code	Represented Aircraft Models	Recommended INM Substitution
1	Commercial Jet	B77L B77W	Boeing 777 Freighter,777-200LR 777-300ER	777300 with addition of maximum takeoff weight profile
2	Commercial Jet	B788/787-8 B789/787-9	Boeing 787-8 and 787-9	A310-304
3	Commercial Jet	A320neo	Airbus A320neo	A320-232
4	Commercial Jet	A350	Airbus 350	A330-343
	Commercial Jet	A350-900		
5	Commercial Jet	B739	Boeing 737-900	737800
6	Commercial Jet	B748	Boeing 747-8 Freighter 747-8 Intercontinental	A340-642
7	Commercial Jet	BOMBC	Bombardier C Series	A319-131
8	Commercial Jet	E190	Embraer 190	A319-131
	Commercial Jet	E90		
	Commercial Jet	EMJ		
9	Jet	C56X	Cessna 560XL Citation Excel	CNA55B
10	Jet	C680	Cessna 680 Citation Sovereign	LEAR35

1 Van Nuys Airport Part 150 Study, HMMH Project No. 304380.000, FAA approval issued March 14, 2011.
2 Nashville International Airport Part 150 Noise Exposure Map Update; HMMH Project No. 304350; FAA approval issued March 7, 2011.
3 Cleveland Hopkins International Airport Part 150 Noise Exposure Map Update; HMMH Project No. 303000; FAA approval issued January 3, 2011.
4 Louisville International Airport Part 150 Noise Exposure Map Update; HMMH Project No. 304060; FAA approval issued July 13, 2010.
5 Naples Municipal Airport Part 150 Noise Exposure Map and Noise Compatibility Program Updates; HMMH Project No. 302720.001.002; FAA approval issued September 12, 2009.
6 Jackson-Evers International Airport Part 150 Noise Exposure Map and Noise Compatibility Program Updates; HMMH Project No. 304140.001(002); FAA approval issued May 13, 2010.

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#	Group	Aircraft Code	Represented Aircraft Models	Recommended INM Substitution
11	Jet	CL30	Bombardier BD-100 Challenger 300	CL600
12	Jet	DA7X	Dassault Falcon 7X	F10062
13	Jet	E50P	Embraer EMP-500 Phenom 100	CNA510
14	Jet	E55P	Embraer EMP505 Phenom 300	IA1125
15	Jet	FA50 / FAL50	Dassault Falcon 50/900	LEAR35 + 1.8 dB
	Jet	F900 / FAL900		
16	Jet	G150	Gulfstream 150	IA1125
17	Jet	GL5T	Bombardier BD-700 Global 5000	GV
	Jet	GLEX	Bombardier Global Express BD-700	
18	Jet	H25C	Raytheon Hawker BAe HS 125-1000	LEAR35
19	Jet	HA4T	Hawker Beechcraft Hawker 4000	CL600
20	Jet	LJ40	Learjet 40	LEAR35
21	Jet	PRIM/PRM1	Hawker Beechcraft Premier 1, 390	CNA500
22	Turbo Prop	P180	Piaggio P-180 Avanti	DHC6
23	Turbo Prop	P46T	Piper Malibu Meridian	SD330
24	Turbo Prop	PC12	Pilatus PC-12, Eagle	CNA208
	Turbo Prop	TBM7	Socata TBM-700	
	Turbo Prop	TBM8	Socata TBM-850	
25	Piston Prop	AA1	AA-1 series (Grumman American)	GASEPF
26	Piston Prop	DA40	DA-40 Katana, Diamond Star	GASEPV
27	Piston Prop	PA32	Piper Saratoga	GASEPV
28	Kit	SR20	Cirrus SR-20	GASEPV
	Kit	SR22	Cirrus SR-22	
29	Propeller	-	Various Propeller Aircraft with relatively few annual operations	See Section 29

1. Boeing 777 Freighter/777-200LR (B77L) and 777-300ER (B77W)

We propose to represent B77L and B77W operations with INM type 777300. We propose to model stage length 8 and 9 destinations (greater than 5,500 nm) with 777300 user-defined profiles (ICAO A, ICAO B and STANDARD) at the INM's 777300 maximum takeoff weight of 660,000 lb.

The Boeing 777 family includes several variants. The INM includes two aircraft, INM type 777200 and 777300, with maximum takeoff weights of 656,000 lb. and 660,000 lb. respectively. The INM lists the maximum static engine thrust of these aircraft as 90,000 lb. and 77,000 lb. respectively.[7]

[7] Boeing's website indicates that the maximum thrust for the 777-300's Rolls-Royce Trent 892 is 90,000 lb. (reference: http://www.boeing.com/commercial/777family/pf/pf_300product.html as viewed July 25, 2011). However INM's aircraft dbf lists the static thrust as 77,000 lb.

Boeing has added three additional variants to the 777 family: the 777-200LR, 777-Frieghter and the 777-300ER. The 777-Frieghter is a dedicated cargo variant of the 777-200LR. All three of these variants have maximum takeoff weights between 766,000 lb. and 775,000 lb. and engine options ranging from 110,100 lb. to 115,300 lb. thrust. ICAO Document 8643, "Aircraft Type Designators" differentiates these variants separately from the 777-200 (designator B772) and 777-300 (B773), using designators B77L for the 777-200LR, 777-Frieghter and B77W for the 777-300ER.[8] Table 2 presents a comparison of the Boeing 777 variants compiled from the Boeing Company's website referenced above.

The noise certification data for the 777 variants that are included in INM and that represent the B77L and B77W variants included in the LAX operations are included in Table 3. The maximum takeoff weights for the B77L and B77W variants are 14 to 17 percent greater than what is offered in INM. The noise certification data for INM type 777300, presented in Table 3 as B-777-300, is closer to B77L and B77W variants, especially for the approach and the full-power sideline certification points. The B77L and B77W variants have takeoff certification levels, which may include a thrust cut-back, in between those associated with INM type 777200 and 777300.[9] INM type 77300 appears to be the better match. Our tests in INM indicate that 777300 is louder than 777200 in most cases.

[8] ICAO Document 8643 corresponds to FAA Order 7340.2B, Change 2 (effective 6/30/2011), Chapter 5. Although FAA Order 7340.2B does not list the B77L or B77W, these aircraft type designators have been used in flight plan data within the United States.
http://www.icao.int/anb/ais/8643/index.cfm
http://www.faa.gov/air_traffic/publications/atpubs/CNT/CNTHME.htm
http://flightaware.com/live/aircrafttype/B77L
http://flightaware.com/live/aircrafttype/B77W

[9] Thrust requirements for the take-off/flyover measurement and the sideline/lateral measurement are described in ICAO Annex 16 Vol. , Chapter 3 and 14 CFR Part 36.

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Table 2 Comparison of 777 Variants

Description	777-200	777-200ER	777-300	777-200LR	777-Freighter (777-F)	777-300ER
Passengers (Cargo)*	305 pax	301 pax	368 pax	301 pax	(112 tons)	365 pax
Engines; Max Thrust	Pratt & Whitney 4077 77,000 lb Rolls-Royce Trent 887 76,000 lb General Electric GE90-77B 77,000 lb	Pratt & Whitney 4090 90,000 lb Rolls-Royce Trent 895 93,400 lb General Electric GE90-94B 93,700 lb	Pratt & Whitney 4098 98,000 lb Rolls-Royce Trent 892 90,000 lb General Electric 90-94B 93,700 lb	General Electric GE90-110B1 110,100 lb General Electric GE90-115BL 115,300 lb	General Electric GE90-110B1L 110,100 lb General Electric GE90-115BL 115,300 lb	General Electric GE90-115B 115,300 lb
Max Range	5,240 nm	7,725 nm	6,005 nm	9,395 nm	4,900 nm**	7,930 nm
Wing Span	199 ft 11in	199 ft 11in	199 ft 11 in	212 ft 7in	212 ft 7 in	212 ft 7 in
Overall Length	209 ft 1in	209 ft 1in	242 ft 4 in	209 ft 1 in	209 ft 1 in	242 ft 4 in

Sources:
http://www.boeing.com/commercial/777family/pf/pf_200product.html
http://www.boeing.com/commercial/777family/pf/pf_300product.html
http://www.boeing.com/commercial/777family/pf/pf_lrproduct.html
http://www.boeing.com/commercial/777family/pf/pf_freighter_product.html
As viewed July 25, 2011
*Does not include cargo for passenger variants.
**This appears to be the maximum range with maximum payload of 112 tons and therefore may not be directly comparable to the other entries.

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Table 3 Noise Certification Data for Boeing 777 Variants

Manufacturer	Type Designation	MTOW (lb)	MLW (lb)	Engine Manufacturer / Type Designator	Effective Perceived Noise Level (EPNdB)		
					Takeoff	Sideline	Approach
Boeing	B-777-200	656,000	470,000	GE90-90B (BLK IV)	91.5	95.7	98.3
Boeing	B-777-300	660,000	524,000	Rolls Royce Trent 892	94.2	96.9	100.4
Boeing Company	777-F	766,000	575,000	GE90-110B1	92.6	97.9	100.3
Boeing Company	777-200LR	750,010	492,070	GE90-110B1	91.9	97.9	99.7
Boeing Company	777-200LR	757,070	492,070	GE90-110B1	92.2	97.9	99.7
Boeing Company	777-200LR	763,020	492,070	GE90-110B1	92.5	97.9	99.7
Boeing Company	777-300ER	750,010	554,000	GE90-115B	91.9	98.9	100.5
Boeing Company	777-300ER	759,600	554,000	GE90-115B	92.3	98.8	100.5
Boeing Company	777-300ER	774,930	554,000	GE90-115B	92.8	98.7	100.5

Sources:
Data for B-777-200 and B-777-300, corresponding to INM types 777200 and 777300, respectively, from FAA AC 36-1H, Appendix 1 (March 2, 2010), at http://www.faa.gov/about/office_org/headquarters_offices/apl/noise_emissions/aircraft_noise_levels/
Data for 777-F, 777-200LR, and 777-300ER from TCDSN database for Jets Issue 12 as posted in "TCDSN Jets.xls" on http://easa.europa.eu/certification/type-certificates/noise.php July 22,2011
777-F from TCDSN record A10078
777-200LR from TCDSN records A4924, A4925 and A4926
777-300ER from TCDSN records A5603, A10649 and A5609
Weights converted from EASA reported units of kg and rounded to tens of lb.
FAA AC-36-1H reported values of Takeoff and Sideline are the same as EASA/ICAO reported values of Flyover and Lateral, respectively.

Approximately 3,000 annual departures of B77Ls and B77Ws at LAX head for destinations greater than 5,500 nautical miles (nm)[10], corresponding to stage length 8 or 9[11]. INM type 777300 includes profile weights representing up to stage length 7 (4,501 to 5,500 nm) at 636,100 lb.[12] This weight represents 96.4% of the 660,000 lb. maximum takeoff weight reported in INM. However, most long-haul aircraft in INM have a profile that represents maximum takeoff weight[13]. In the case of the 747400 and the 777200, there are profiles that represent approximately 96% of maximum takeoff weight in addition to the maximum weight profile.

[10] From an analysis of flight track data from March 2010 through April 2011. Some of the more common destinations included Sydney (~6,500 nm), Hong Kong (~6,250 nm) and Dubai (~7,200 nm)
[11] Stage lengths used by INM are defined in the INM 7.0 User's Guide, Section 9.6.3
[12] INM \sys\data\profile.dbf.
[13] These include, but are not limited to, 747700(Profile 9), 777200(9), A330-343(7) and A380-841(8)

The following sections describe the proposed profile according to the FAA Profile Review Checklist.[14]

1.1 Statement of Benefit

We propose to represent B77L and B77W operations to stage length 8 and 9 destinations (greater than 5,500 nm) with 777300 user-defined profiles (ICAO A, ICAO B and STANDARD) at the INM's 777300 maximum takeoff weight of 660,000 lb. This will provide the option of modeling stage length 8 and 9 777300 operations with the assumptions consistent with other long-haul aircraft in INM.[15] The basis of these profiles are the 777300 ICAO A, ICAO B and STANDARD for stage length/PROF_ID2 =7 at 636,100 lb. We only propose to change the weight and do not propose any changes to flap, speed or altitude settings compared to the respective INM stage length/PROF_ID2 =7 profile. No new coefficient data were developed for these adjusted profiles.

1.2 Analysis Demonstrating Benefit

Table 4, Table 5 and Table 6 compare the Sound Exposure Level (SEL) for the Standard, ICAO A and ICAO B performance profiles for the two different weights. The locations are based on 0.5 nm spacing directly under the flight path. All values are based on a LAX Runway 7L departure with temperature, pressure and humidity set to 63.0 Fahrenheit, 29.98 inches of Mercury and 70.3 % respectively.

Noise values from the three proposed profiles (STD-M, ICAOAA-M and ICAOBB-M) are louder than the respective INM included profile (STANDARD-7, ICAO A-7 and ICAO B-7 respectively) in most areas. The differences range from 0.3 dB to 2.8 dB (across all three profiles) when the aircraft is airborne (1.5 nm and greater). Most of the changes at 3 nm and greater, which represents noise sensitive locations for Runway 7L departures, range from 0.3 to 2.7 dB, with most values on the order of 0.5 to 1.0 dB. Most of the 1.0 dB and greater increases appear to be related to delayed thrust-cut back, because the proposed maximum weight profile takes longer to reach the thrust cut back altitude criteria. These changes are on the order expected for adjacent profile weights.

---

[14] INM 7.0 User's Guide, Appendix B

[15] Since the INM's options of 777 variants are lighter than the B77L and B77W, a comparison with actual or estimated take-off weights would not provide a relevant comparison. Instead we are proposing consistency with modeling assumptions for other INM types.

Table 4 Comparison of Sound Exposure Level (SEL) for 777300 Standard-7 versus Proposed Maximum Weight Profile

Grid Points (nm)	INM Standard Profile STANDARD-7 636,100 lb. (SEL dB)	User Defined Profile STD-M 660,000 lb. (SEL dB)	Difference (dB)
0.5	126.5*	126.4*	-0.1
1.0	123.1*	123.1*	0.0
1.5	109.1	111.9	2.8
2.0	102.7	103.8	1.1
2.5	99.2	100.1	0.9
3.0	94.3	94.8	0.5
3.5	93.3	93.6	0.3
4.0	92.3	92.8	0.5
4.5	91.3	91.6	0.3
5.0	90.6	90.9	0.3
5.5	89.6	90.1	0.5
6.0	88.9	89.3	0.4
6.5	88.2	88.6	0.4
7.0	87.2	88.0	0.8
7.5	86.2	87.0	0.8
8.0	85.4	86.1	0.7
8.5	84.8	85.4	0.6
9.0	84.0	84.8	0.8
9.5	83.3	84.0	0.7
10.0	82.8	83.4	0.6

Sources: INM 7.0b
Notes: *Aircraft is on the runway at this location

Table 5 Comparison of Sound Exposure Level (SEL) for 777300 ICAO A-7 versus Proposed Maximum Weight Profile

Grid Points (nm)	INM Standard Profile ICAO_A-7 636,100 lb. (SEL dB)	User Defined Profile ICAOAA-M 660,000 lb. (SEL dB)	Difference (dB)
0.5	126.5*	126.4*	-0.1
1.0	123.1*	123.1*	0.0
1.5	109.2	112.0	2.8
2.0	102.8	103.9	1.1
2.5	99.3	100.2	0.9
3.0	96.9	97.6	0.7
3.5	92.0	94.0	2.0
4.0	90.6	91.1	0.5
4.5	89.7	90.2	0.5
5.0	88.8	89.3	0.5
5.5	88.0	88.5	0.5
6.0	87.4	87.8	0.4
6.5	86.7	87.2	0.5
7.0	85.9	86.6	0.7
7.5	85.3	85.9	0.6
8.0	84.6	85.3	0.7
8.5	84.1	84.7	0.6
9.0	83.5	84.2	0.7
9.5	83.1	83.6	0.5
10.0	82.5	83.1	0.6

Sources: INM 7.0b
Notes: *Aircraft is on the runway at this location

Table 6 Comparison of Sound Exposure Level (SEL) for 777300 ICAO B-7 versus Proposed Maximum Weight Profile

Grid Points (nm)	INM Standard Profile ICAO_B-7 636,100 lb. (SEL dB)	User Defined Profile ICAOBB-M 660,000 lb. (SEL dB)	Difference (dB)
0.5	126.5*	126.4*	-0.1
1.0	123.1*	123.1*	0.0
1.5	109.1	111.9	2.8
2.0	102.6	103.8	1.2
2.5	99.4	100.1	0.7
3.0	97.5	97.9	0.4
3.5	95.8	96.4	0.6
4.0	94.3	94.8	0.5
4.5	92.9	93.5	0.6
5.0	91.7	92.3	0.6
5.5	88.3	91.0	2.7
6.0	86.2	87.4	1.2
6.5	85.4	85.8	0.4
7.0	84.7	85.1	0.4
7.5	84.0	84.5	0.5
8.0	83.3	83.8	0.5
8.5	82.7	83.2	0.5
9.0	82.2	82.6	0.4
9.5	81.6	82.1	0.5
10.0	81.1	81.6	0.5

Sources: INM 7.0b
Notes: *Aircraft is on the runway at this location

1.3 Concurrence on Aircraft Performance

The proposed performance profiles do not modify the INM 7.0b included 777300 PROF_ID2 =7 profiles, with the exception of weight. As we discussed above, we modified the weight to be consistent with modeling assumptions with other long-haul aircraft in INM.

1.4 Certification of New Parameters

No new parameters were created for these profiles.

1.5 Graphical and Tabular Comparisons

The following figures provide comparisons of the 777300 PROF_ID7 profiles and the proposed maximum weight profiles. Figure 1 shows the altitude versus distance plot for the proposed profiles compared to the INM included profiles. Figure 2 shows the speed versus distance plot and Figure 3 shows the thrust versus distance. All plots were developed from INM 7.0b for a LAX Runway 7L

departure with temperature, pressure and humidity set to 63.0 Fahrenheit, 29.98 inches of Mercury and 70.3 % respectively.[16]

Table 7 through Table 9 present the data used to create Figure 1 through Figure 3. Data for these tables are from the INM calc_prof_pts.dbf file.

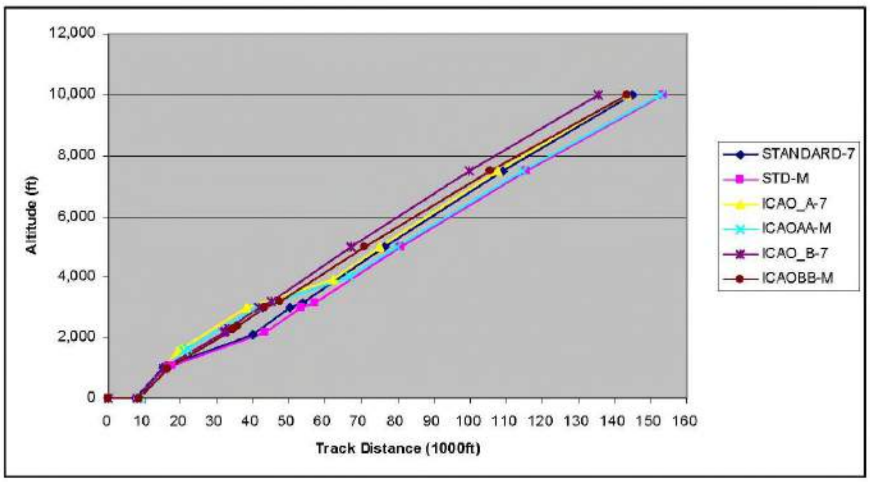

Figure 1 Altitude versus Distance for 777300 Stage Length 7 and Proposed Maximum Weight Profiles

[16] Historic conditions for LAX from National Climatic Data Center (NCDC)

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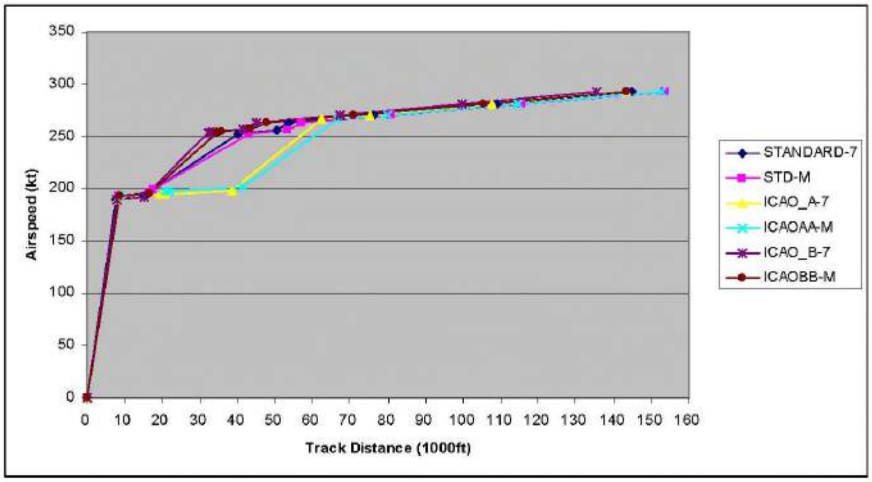

Figure 2 Airspeed versus Distance for 777300 Stage Length 7 and Proposed Maximum Weight Profiles

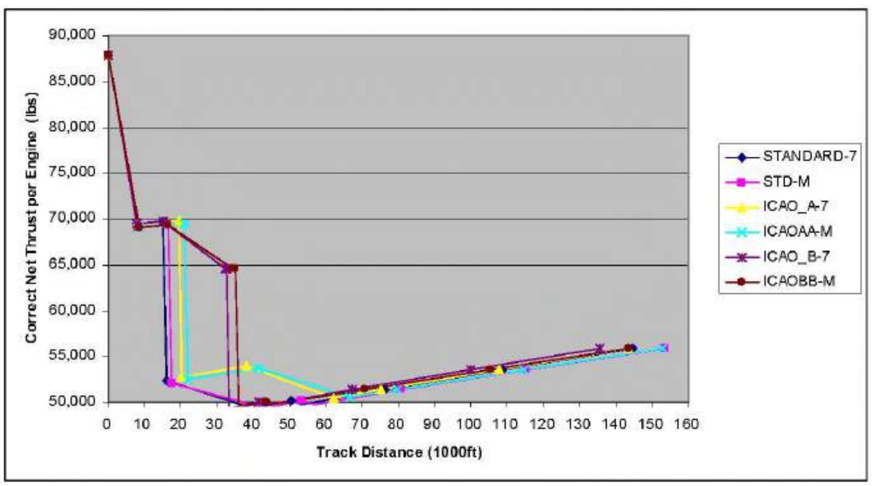

Figure 3 Thrust versus Distance for 777300 Stage Length 7 and Proposed Maximum Weight Profiles

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Table 7 777300 Standard Graphical Comparison Data

ACFT ID	OP TYPE	RWY ID	PROF ID1	PROF ID2	PT NUM	DISTANCE	ALTITUDE	SPEED	THR_SET
777300	D	7L	STANDARD	7	1	0.0	0.0	0.0	87852.96
777300	D	7L	STANDARD	7	2	7726.3	0.0	189.4	69423.25
777300	D	7L	STANDARD	7	3	15251.5	1042.0	192.4	69710.25
777300	D	7L	STANDARD	7	4	16251.5	1084.6	195.1	52265.03
777300	D	7L	STANDARD	7	5	39929.4	2093.7	252.3	49299.23
777300	D	7L	STANDARD	7	6	50300.7	3000.0	255.8	50096.87
777300	D	7L	STANDARD	7	7	53623.9	3141.2	263.3	49753.63
777300	D	7L	STANDARD	7	8	76243.1	5000.0	270.7	51389.52
777300	D	7L	STANDARD	7	9	108931.2	7500.0	281.3	53589.71
777300	D	7L	STANDARD	7	10	144710.0	10000.0	292.5	55789.89
777300	D	7L	STD	M	1	0.0	0.0	0.0	87852.96
777300	D	7L	STD	M	2	8348.2	0.0	193.0	69080.22
777300	D	7L	STD	M	3	16402.6	1042.0	195.9	69367.22
777300	D	7L	STD	M	4	17402.6	1084.2	198.3	52016.56
777300	D	7L	STD	M	5	43219.5	2174.9	252.6	49370.70
777300	D	7L	STD	M	6	53239.5	3000.0	255.8	50096.87
777300	D	7L	STD	M	7	56980.9	3158.9	263.3	49769.24
777300	D	7L	STD	M	8	80763.7	5000.0	270.7	51389.52
777300	D	7L	STD	M	9	115511.0	7500.0	281.3	53589.71
777300	D	7L	STD	M	10	153628.6	10000.0	292.5	55789.89

Note: All OP_MODE set to D
Sources: INM 7.0b

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Table 8 777300 ICAO A Graphical Comparison Data

ACFT ID	OP TYPE	R WY ID	PROF ID1	PRO F ID2	PT NUM	DISTANCE	ALTITUDE	SPEED	THR_SET	OP MODE
777300	D	7L	ICAO_A	7	1	0.0	0.0	0.0	87852.96	D
777300	D	7L	ICAO_A	7	2	8035.8	0.0	189.4	69423.25	D
777300	D	7L	ICAO_A	7	3	19401.7	1553.0	193.8	69851.00	D
777300	D	7L	ICAO_A	7	4	20401.7	1629.7	194.0	52714.75	D
777300	D	7L	ICAO_A	7	5	38271.0	3000.0	198.0	53988.22	D
777300	D	7L	ICAO_A	7	6	62130.4	3949.3	266.5	50464.80	D
777300	D	7L	ICAO_A	7	7	75081.9	5000.0	270.7	51389.52	D
777300	D	7L	ICAO_A	7	8	107769.9	7500.0	281.3	53589.71	D
777300	D	7L	ICAO_A	7	9	143548.7	10000.0	292.5	55789.89	D
777300	D	7L	ICAOAA	M	1	0.0	0.0	0.0	87852.96	D
777300	D	7L	ICAOAA	M	2	8697.1	0.0	193.0	69080.22	D
777300	D	7L	ICAOAA	M	3	20865.9	1553.0	197.4	69507.96	D
777300	D	7L	ICAOAA	M	4	21865.9	1623.3	197.6	52466.28	D
777300	D	7L	ICAOAA	M	5	41448.1	3000.0	201.7	53739.74	D
777300	D	7L	ICAOAA	M	6	66661.8	3994.8	266.7	50504.91	D
777300	D	7L	ICAOAA	M	7	79824.1	5000.0	270.7	51389.52	D
777300	D	7L	ICAOAA	M	8	114571.4	7500.0	281.3	53589.71	D
777300	D	7L	ICAOAA	M	9	152689.0	10000.0	292.5	55789.89	D
Sources: INM 7.0b										

Table 9 777300 ICAO B Graphical Comparison Data

ACFT ID	OP TYPE	RWY ID	PROF ID1	PROF ID2	PT NUM	DISTANCE	ALTITUDE	SPEED	THR_SET	OP MODE
777300	D	7L	ICAO_B	7	1	0.0	0.0	0.0	87852.96	D
777300	D	7L	ICAO_B	7	2	8035.8	0.0	189.4	69423.25	D
777300	D	7L	ICAO_B	7	3	15249.8	1000.0	192.2	69698.68	D
777300	D	7L	ICAO_B	7	4	32150.2	2174.8	253.7	64552.22	D
777300	D	7L	ICAO_B	7	5	32465.4	2216.0	253.8	64563.57	D
777300	D	7L	ICAO_B	7	6	33465.4	2303.0	254.2	49336.06	D
777300	D	7L	ICAO_B	7	7	41473.2	3000.0	256.8	50026.04	D
777300	D	7L	ICAO_B	7	8	44976.8	3178.1	263.4	49786.14	D
777300	D	7L	ICAO_B	7	9	67159.3	5000.0	270.7	51389.52	D
777300	D	7L	ICAO_B	7	10	99847.4	7500.0	281.3	53589.71	D
777300	D	7L	ICAO_B	7	11	135626.2	10000.0	292.5	55789.89	D
777300	D	7L	ICAOBB	M	1	0.0	0.0	0.0	87852.96	D
777300	D	7L	ICAOBB	M	2	8697.1	0.0	193.0	69080.22	D
777300	D	7L	ICAOBB	M	3	16418.2	1000.0	195.8	69355.65	D
777300	D	7L	ICAOBB	M	4	34491.4	2245.5	253.9	64571.71	D
777300	D	7L	ICAOBB	M	5	34895.4	2295.5	254.1	64585.48	D
777300	D	7L	ICAOBB	M	6	35895.4	2377.6	254.4	49406.07	D
777300	D	7L	ICAOBB	M	7	43485.2	3000.0	256.8	50026.04	D
777300	D	7L	ICAOBB	M	8	47553.0	3206.7	263.5	49811.32	D
777300	D	7L	ICAOBB	M	9	70736.1	5000.0	270.7	51389.52	D
777300	D	7L	ICAOBB	M	10	105483.3	7500.0	281.3	53589.71	D
777300	D	7L	ICAOBB	M	11	143601.0	10000.0	292.5	55789.89	D
Sources: INM 7.0b										

2. **Boeing 787-8 (B788) Boeing 787-9 (B789)**

We propose to model B788 and B789 operations with INM type A310-304.

The Boeing 787 is a new twin-engine, wide-body aircraft. The 787-8 is the first variant and was recently certified.[17] Recently released noise certification data indicates that this aircraft has noise levels comparable on approach to many twin-engine, wide-body aircraft in INM 7.0b. However the 787-8 take-off and sideline noise values are quieter than aircraft currently available in INM. The 787-9 will be a heavier variant of the 787-8.[18]

[17] http://boeing.mediaroom.com/index.php?s=43&item=1903
[18] http://www.boeing.com/commercial/787family/787-9prod.html

Table 10 presents the certification data for the 787-8 and various twin-engine wide-body aircraft represented in INM. The Airbus A310-304 appears to be the best match overall, over predicting takeoff and sideline noise by 3 to 6 dB and approach noise by 1.5 dB.

Table 10 Noise Certification Data for Boeing 787-8 and Various Wide-body Aircraft

Manufacturer	Type Designation	MTOW (lb)	MLW (lb)	Engine Manufacturer / Type Designator	Effective Perceived Noise Level (EPNdB)		
					Takeoff	Sideline	Approach
Boeing Company	787-8	484,000	370,000	Rolls Royce Trent 1000-A	86.5	89.9	96.9
Boeing Company	787-8	467,500	370,000	Rolls Royce Trent 1000-A	85.5	90.0	96.9
Boeing Company	787-8	462,900	355,000	Rolls Royce Trent 1000-A	85.2	90.0	96.9
Boeing Company	787-8	440,000	345,000	Rolls Royce Trent 1000-A	84.0	90.1	96.8
Boeing Company	777-200	656,010	470,000	GE90-90B	91.7	95.7	98.8
Boeing	B-777-200	656,000	470,000	GE90-90B (BLK IV)	91.5	95.7	98.3
Boeing	B-777-300	660,000	524,000	Rolls Royce Trent 892	94.2	96.9	100.4
Airbus	A330-343	513,680	412,260	Trent 772B-60	90.7	97.4	97.0
Airbus	A330-301	467,380	383,600	CF6-80E1A2	91.0	97.7	98.8
Boeing Company	767-400ER	450,000	350,000	CF6-80C2B8F	91.2	96.8	98.7
Boeing Company	767-300	407,000	320,000	PW4060	93.2	97.0	100.2
Airbus	A300-B4-622R	378,530	308,650	PW4158	92.4	97.7	101.7
Airbus	A300-B4-203	363,760	295,420	CF6-50C2	93.9	97.9	102.9
Airbus	A310-304	346,130	273,370	CF6-80C2A2	89.4	94.5	98.4

Sources:
Data for all 787-8 entries from http://easa.europa.eu/certification/type-certificates/noise.php file EASA-TCDS-A.115_(IM)_Boeing_787-01-26082011.pdf, EASA Record Numbers A16692, A16618, A16619 and A16620.
Weights converted from EASA reported units of kg and rounded to tens of lb.
FAA AC-36-1H reported values of Takeoff and Sideline are the same as EASA/ICAO reported values of Flyover and Lateral, respectively.
Data for B-777-200 and B-777-300, corresponding to INM types 777200 and 777300, respectively, from FAA AC 36-1H, Appendix 1 (March 2, 2010), at
http://www.faa.gov/about/office_org/headquarters_offices/apl/noise_emissions/aircraft_noise_levels/
Data for all aircraft from entries from TCDSN database for Jets Issue 12 as posted in "TCDSN Jets.xls" on
http://easa.europa.eu/certification/type-certificates/noise.php July 22,2011
A330-343 from Record Number A15071, which corresponds to INM 7.0b type "A330-343"
A330-301 from Record Number A2894, which corresponds to INM 7.0b type "A330-301"
767-400ER from Record Number A1852, which corresponds to INM 7.0b type "767400"
767-300 from Record Number A3578, which corresponds to INM 7.0b type "767300"
A300-B4-622R from Record Number A216, which corresponds to INM 7.0b type "A300-622R"
A300-B4-203 from Record Number A124, which corresponds to INM 7.0b type "A300B4-203"
A310-304 from Record Number A283, which corresponds to INM 7.0b type "A310-304"

3. **Airbus 320 New Engine Option -A320neo**

We propose to mode A320neo operation with INM type A320-232.

Airbus describes the A320neo has an "…efficiency improvement package which Airbus is offering as options for the A319, A320, and A321 models of the A320 Family." The Airbus A320 new engine option will be offered with two engines: Pratt & Whitney's PurePower PW1100G geared turbofan or CFM International's LEAP-X. Airbus expects that the A320neo will be 15 dB below Chapter 4. The Airbus A320 variant is expected to start service in October 2015.[19]

We assume that the reported "15 dB below Chapter 4" translates to 25 dB cumulatively below ICAO Annex 16 Chapter 3 with the EPNdB metric (Chapter 4 is defined as 10 dB cumulatively, at the three certification points, below Chapter 3) and applies to both engine choices. Since the A320neo is a variant of the existing A320, we believe using an existing INM A320 type would be appropriate.

Table 11 presents the noise certification data and cumulative below Chapter 3 as reported by European Aviation Safety Agency (EASA)[20] for the A320 variants in INM. INM type A320-211 is 12.1 dB below Chapter 3 limits while INM type A320-232 is 19.0 dB below Chapter 3 limits. Therefore, INM type A320-232 should be closer (in terms of noise) to the A320neo than INM type A320-211, based on available certification data and the statements made by Airbus.

Table 11 Noise Certification Data from A320 Variants in INM

Manufacturer	Type Designation	MTOW (lb)	MLW (lb)	Engine Manufacturer / Type Designator	Effective Perceived Noise Level (EPNdB)			
					Fly Over	Lateral	Approach	Cumulative below Chapter 3
Airbus	A320-211	169,760	142,200	CFM56-5A1	87.4	93.7	96.1	12.1
Airbus	A320-232	169,760	145,510	V2527-A5	86.4	91.3	94.4	19.0

Source: TCDSN database for Jets Issue 12 as posted in "TCDSN Jets.xls" on http://easa.europa.eu/certification/type-certificates/noise.php July 22,2011
A320-211 from Record Number A2458, which corresponds to INM 7.0b type "A320-211"
A320-211 from Record Number A616, which corresponds to INM 7.0b type "A320-232"
Weights converted from EASA reported units of kg and rounded to tens of lb.
FAA AC-36-1H reported values of Takeoff and Sideline are the same as EASA/ICAO reported values of Flyover and Lateral, respectively.

4. **Airbus 350 -A350/A350-900**

We propose to model the A350 operations with INM type A330-343.

[19] http://www.airbus.com/aircraftfamilies/passengeraircraft/a320family/spotlight-on-a320neo/ July_2011_A320neo_Facts___Figures.pdf
[20] EASA data is used because it reports Chapter 3 noise limits and for Chapter 4 aircraft, the cumulative below.

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The two wing-mounted engines are either Genx or Trent 1700 engines with rated thrusts in the 63,000-75,000 lb. range. The maximum takeoff weight is approximately 540,000 lb. This puts the A350 in nearly the same class as the A330-300.

5. Boeing 737-900 -737900

We propose to model 737900 operations with INM type 737800 as approved by the FAA for SDF and CLE.

This aircraft is nearly identical to the Boeing 737-800 (INM type 737800) in terms of maximum takeoff weight (174,200 lb.), engines (CFM 56-7B), and dimensions . Certification noise values for these two aircraft, as reported by Advisory Circular AC36-1 H, are within 1.0 dB for similar weight, flap and engine configurations. The primary difference is that the 737-900 is designed to carry more passengers in a two-class configuration and the operating empty weight is greater for the 737-900.

Table 12 presents a comparison of the 737-800 and 737-900 certification levels.

Table 12 Comparison of 737-800 and 737-900

Manufacturer	Type Designation	MTOW (lb)	MLW (lb)	Engine Manufacturer / Type Designator	Effective Perceived Noise Level (EPNdB)		
					Takeoff	Sideline	Approach
BOEING	B-737-800/BBJ 2	174,200	146,300	CFM56-7B26; -7B26/B1	87.4	93.8	96.5
BOEING	B-737-900	174,200	147,300	CFM56-7B26	87.2	93.5	96.4

Source: FAA AC 36-1H, Appendix 1 (March 2, 2010), at http://www.faa.gov/about/office_org/headquarters_offices/apl/noise_emissions/aircraft_noise_levels/

6. Boeing 747-8 Freighter and 747-8 Intercontinental - B748

We propose to model B748 operations with INM type 747400.

The Boeing 747-8 is a new variant of the Being 747 family that is heavier and larger than prior iterations. The aircraft is available in freighter and passenger (Boeing's name "Intercontinental") configurations. Both configurations are expected to have a maximum takeoff weight of 975,000 lb. and GE GEnx-2B67 engines with 66,500 lb. thrust.[21] The aircraft recently completed certification and the first delivery expected this September.[22]

Table 13 presents the noise certification data for the 747-8 along aircraft types747400 and Airbus A380 and A340-642 which are represented in the INM. INM type A340-642 appears to be a reasonable match based on certification data. The A340-642 approach certification is within the

[21] http://www.boeing.com/commercial/747family/747-8_facts.html
[22] http://boeing.mediaroom.com/index.php?s=43&item=1867
http://boeing.mediaroom.com/index.php?s=43&item=1889

range of the 747-8 entries while the A340-642 takeoff certification levels and sideline values are slightly higher than the 747-8 entries. The 747-400 is several decibels louder than 747-8 while the A380 entries are quieter on approach and louder on takeoff.

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Table 13 Noise Certification Data for Boeing 747-8, 747-400, Airbus A340-642 and A380

Manufacturer	Type Designation	MTOW (lb)	MLW (lb)	Engine Manufacturer / Type Designator	Effective Perceived Noise Level (EPNdB)		
					Takeoff	Sideline	Approach
Boeing	747-8F	700,000	600,000	GEnx-2B67	85.3	94.8	99.6
Boeing	747-8F	750,000	630,000	GEnx-2B67	86.9	94.6	99.9
Boeing	747-8F	800,000	651,000	GEnx-2B67	88.5	94.4	100.1
Boeing	747-8F	850,000	682,000	GEnx-2B67	90.0	94.3	100.4
Boeing	747-8F	875,000	700,000	GEnx-2B67	90.8	94.2	100.5
Boeing	747-8F	910,000	749,000	GEnx-2B67	91.9	94.1	100.9
Boeing	747-8F	950,000	759,000	GEnx-2B67	93.2	94.0	100.9
Boeing	747-8F	975,000	761,000	GEnx-2B67	94.0	94.0	100.9
BOEING	B-747-400	875,000	652,000	PW4056	101.6	99.7	104.7
BOEING	B-747-400	875,000	652,000	PW4056 PH3 (FB2B)	99.7	98.6	103.6
BOEING	B-747-400	875,000	652,000	PW4056 PH3 (FB2C)	98.6	98.4	103.0
BOEING	B-747-400	875,000	652,000	PW4056 PH3 (FB2C) NR	97.4	98.1	102.1
BOEING	B-747-400	875,000	652,000	PW4056 PKG B/PHASE I	99.3	98.5	103.4
Airbus	A340-642	804,690	564,380	Trent 556-61	94.2	95.9	99.9
Airbus	A380-841	1,254,430	862,010	Rolls-Royce Trent 970	95.6	94.2	98.0
Airbus	A380-861	1,254,430	862,010	Engine Alliance GP7270	95.4	94.4	97.2

Sources:
Data for all 747-8F entries from http://easa.europa.eu/certification/type-certificates/noise.php file EASA-TCDS-A.196_(IM)_Boeing_747-06-19082011.pdf, EASA Record Numbers A16591 through A16598, respectively
Weights converted from EASA reported units of kg and rounded to tens of lb.
FAA AC-36-1H reported values of Takeoff and Sideline are the same as EASA/ICAO reported values of Flyover and Lateral, respectively.
Data for all B-747-400 entries, corresponding to INM type 747400, from FAA AC 36-1H, Appendix 1 (March 2, 2010), at http://www.faa.gov/about/office_org/headquarters_offices/apl/noise_emissions/aircraft_noise_levels/
Data for all A340s and A380s from entries from TCDSN database for Jets Issue 12 as posted in "TCDSN Jets.xls" on http://easa.europa.eu/certification/type-certificates/noise.php July 22,2011
A340-642 from Record Number A5242, which corresponds to INM 7.0b type "A340-642"
A380-841 from Record Number A10955, which corresponds to INM 7.0b type "A380-841"
A380-861 from Record Number A6642, which corresponds to INM 7.0b type "A380-861"

7. Bombardier CSeries - BOMBC

We propose to model BOMBC operations with INM type A319-131.

The Bombardier C Series is a new passenger aircraft that is expected to enter service with Republic airlines in 2015.[23] These aircraft are passenger aircraft with seating for 100 to 145 passengers and maximum takeoff weights in the range of 128,200.lb to 139,600 lb. The C Series will be powered by Pratt & Whitney's new PW1500 geared turbofan with a thrust range of 18,900 l. to 23,200 lb.[24] Engines of this type have recently started flight testing and therefore are yet in service with any aircraft type.[25] The aircraft configuration is with engines under the wing, similar to the Boeing 737 and Airbus A319. Bombardier's website indicates that the C Series will be "4-times quieter" than current production 110 to 130 seat aircraft.[26] INM type A319-131 appears to be a reasonable match. Although the A319-131 is heavier than other current production aircraft in the INM such as the 737-700, the A319-131 is quieter.[27]

8. Embraer 190 - E190/E190/E90/EMJ

We propose to model Embraer 190 operations with INM type A319-131 as approved by the FAA for BNA.

The Embraer 190 is similar to the Embraer 170, although slightly larger and heavier and is listed as INM 7.0b standard EMB190, mapped to the GV.

Table 14presents noise certification data for the Embraer 190, Airbus A319-131 and several other aircraft. Although the A319-131 is almost 40% heavier than the Embraer 190, the certification noise levels are close, especially for Takeoff/Fly Over and Sideline/Lateral. The Bombardier CRJ-900 (INM type CRJ9-LR) and Gulfstream V (INM type GV) are at least 2 EPNdB quieter at the same two locations.

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[23] http://www.flightglobal.com/articles/2010/02/25/338823/republic-orders-40-cseries-and-options-40-more.html
[24] http://cseries.com/en/medias/gallery/literature/factsheetcs100_en.pdf
http://cseries.com/en/medias/gallery/literature/factsheetcs300_en.pdf

[25] http://www.pratt-whitney.com/media_center/press_releases/2011/06_jun/6-21-2011_00002.asp
[26]
http://cseries.com/en/#/cseries/environment/noisereduction/noisereductioncs100/
http://cseries.com/en/#/cseries/environment/noisereduction/noisereductioncs300/
[27] Single point comparison of an aircraft flying directly overhead with SEL metric. Departure grid point set to 15,000 ft from the start-of-take-off roll using profile STANDARD-1 and an arrivals point 5,000 ft from the landing threshold. INM standard weather conditions at sea level, 0 gradient runway. The A319-131 SEL values for are 87.8 dB for departure and 90.8 for arrival. The 737700 SEL values for are 88.7 dB for departure and 95.7 for arrival.

Table 14 Noise Certification Data from Embraer 190, Airbus A319 and Gulfstream GV

Manufacturer	Type Designation	MTOW (lb)	MLW (lb)	Engine Manufacturer / Type Designator	Effective Perceived Noise Level (EPNdB)		
					Fly Over	Lateral	Approach
EMBRAER	ERJ-190-100 IGW	114,200	97,000	CF34-10E6	86.9	91.9	92.8
EMBRAER	ERJ 170-100 (SE)	82,012	73,414	CF34-8E5	83.2	92.0	94.9
EMBRAER	ERJ 170-100 (SE)	82,012	72,312	CF34-8E5	84.1	92.3	94.9
EMBRAER	ERJ 170-200 (LR)	85,517	74,957	CF34-8E5	84.4	91.9	95.0
BOMBARDIER	CL-600-2D24 (CRJ-900)	84,500	73,500	CF34-8C5 & CF34-8C5A1	84.6	89.1	93.2
AIRBUS	A319-131	158,730	149,910	V2522-A5	85.3	91.4	94.5
GULFSTREAM	G-V	90,500	75,300	BR700-710A1-10	80.3	89.1	90.8

Source: FAA AC 36-1H, Appendix 1 (March 2, 2010), at
http://www.faa.gov/about/office_org/headquarters_offices/apl/noise_emissions/aircraft_noise_levels/
Source for the Embraer 170: file "TCDSN Jets (080711).xls", as posted on
http://easa.europa.eu/ws_prod/c/c_tc_noise.php on November 12, 2008
Note:
The certification data for the Airbus A319-131 with V2522-A5 engines indicate weights that do not match INM exactly. However the maximum takeoff weight in INM does correspond to another A319 variant.
Weights converted from EASA reported units of kg and rounded to tens of lb.
FAA AC-36-1H reported values of Takeoff and Sideline are the same as EASA/ICAO reported values of Flyover and Lateral, respectively.

9. Cessna 560XL Citation Excel C56X

We propose to model the C56X operations with INM type CNA55B as recommended for JAN.

In the JAN Part 150 the FAA approved the Cessna Citation Bravo (CNA55B) as the substitution aircraft for the Cessna Citation Excel (Cessna model 560XL). Both aircraft have the PW500 series power plants with similar certification noise levels shown in Table 15.

Table 15 Noise Certification Data from Cessna 560XL and Cessna 550 Bravo

Manufacturer	Type Designation	MTOW (lb)	MLW (lb)	Engine Manufacturer / Type Designator	Effective Perceived Noise Level (EPNdB)		
					Takeoff	Sideline	Approach
Cessna	Cessna 560XL	20,000	18,700	PW545A	72.4	85.3	93.1
Cessna	Cessna 550 Bravo	14,800	13,500	PW530A	73.7	85.2	91.2

Source: FAA AC 36-1H, Appendix 1 (March 2, 2010), at
http://www.faa.gov/about/office_org/headquarters_offices/apl/noise_emissions/aircraft_noise_levels/

10. Cessna Citation Sovereign - C680

We propose to model C680 operations with INM type LEAR35 as approved for BNA.

For BNA, the FAA approved the LEAR35 as the substitution aircraft for the Cessna Citation Sovereign (Cessna model 680). This aircraft is relatively new (certification completed in 2004) with a maximum takeoff weight (MTOW) of 30,300 lb., maximum landing weight (MLW) of 27,100 lb. and is powered by two Pratt & Whitney Canada PW306C turbofans rated at 5,770 pounds (lb.) These weights are similar to INM types CL600 and CL601. Table 16 provides certification values for these three aircraft and the LEAR35.

Table 16 Noise Certification Data from Cessna 680, Bombardier CL-601, Bombardier CL-600 and Learjet LEAR35

Manufacturer	Type Designation	MTOW (lb)	MLW (lb)	Engine Manufacturer / Type Designator	Effective Perceived Noise Level (EPNdB)		
					Fly Over	Lateral	Approach
Cessna	Cessna 680	30,298	27,099	PW 306C	71.8	87.5	91.3
Bombardier	CL-601-3R	45,100	36,000	CF-34-3A1	79.8	85.7	90.1
Bombardier	Cl-600	36,000	33,000	ALF-502	81.6	89.3	91.2
Learjet	LEAR 35 A	18,000	14,300	TFE731-2-2B	83.6	87.4	91.3

Source for Cessna 680: EASA Record No. A2489, file "TCDSN Jets (080711).xls", as posted on http://easa.europa.eu/ws_prod/c/c_tc_noise.php on November 12, 2008
Source for Bombardier CL-601, CL-600 and LEAR35: FAA AC 36-1H, Appendix 1 (March 2, 2010), at http://www.faa.gov/about/office_org/headquarters_offices/apl/noise_emissions/aircraft_noise_levels/
Weights converted from EASA reported units of kg and rounded to tens of lb.
FAA AC-36-1H reported values of Takeoff and Sideline are the same as EASA/ICAO reported values of Flyover and Lateral, respectively.

11. Bombardier Challenger 300 - CL30

We propose to model CL30 operations with INM type CL600 as approved for BNA.

The CL30 (Bombardier engineering designation BD-100-1A10) is a relatively new twin-engine corporate jet with a MTOW of 38,500 lb. and MLW of 33,750 lb. The aircraft's Honeywell HTF700 (formerly AS907) engines are thrust rated between 6,500 lb. to 8,050 lb. This is comparable to the INM type CL600 (MTOW 36,000 lb., MLW of 33,000 lb. and max. static thrust 7,500 lb. according to INM 7.0b). Table 17 presents the noise certification data from the CL30 and CL600.

Table 17 Noise Certification Data from Bombardier Challenger 300 and Bombardier CL-600

Manufacturer	Type Designation	MTOW (lb)	MLW (lb)	Engine Manufacturer / Type Designator	Effective Perceived Noise Level (EPNdB)		
					Takeoff	Sideline	Approach
Bombardier	BD-100-1A10 (CL300)	38,500	33,750	AS907-1-1A	75.3	87.6	89.6
Bombardier	CL-600	36,000	33,000	ALF-502	81.6	89.3	91.2
Source: FAA AC 36-1H, Appendix 1 (March 2, 2010), at http://www.faa.gov/about/office_org/headquarters_offices/apl/noise_emissions/aircraft_noise_levels/							

12. Dassault Falcon 7X - FA7X

We propose to model FA7X operations with INM type F10062 as recommended by FAA for SDF.

The Dassault Falcon 7X is a relatively new three-engine (two are fuselage mounted, one tail mounted) corporate jet and does not have an FAA-approved INM substitution. The FA7X is powered by three Pratt & Whitney Canada PW 307A engines and is heavier than previous three-engine Dassault corporate aircraft that are powered by Allied Signal/Garrett TFE731 series engines (i.e. Falcon 50 and Falcon 900). Certification from EASA indicates that the INM F10062 would be an appropriate substitution. The Dassault Falcon 7X has a certified MTOW of 31,298 kg (69,000 lb.) and a certified MLW of 28,304 kg (62,400 lb.). For comparison, the Fokker 100 has a MTOW of 43,090 kg and a MLW of 38,780 kg. Since the FA7X has three-engines and the Fokker 100 has two engines (along with most other candidate INM 7.0b types), thrust to weight comparisons would not be effective because three-engine and two-engine aircraft have different certification requirements regarding available thrust for engine-out conditions. Table 18 presents a comparison of the Dassault Falcon 7X and Fokker 100 certification data.

Table 18 Noise Certification Data from Dassault Falcon 7X and Fokker 100

Manufacturer	Type Designation	MTOW (lb)	MLW (lb)	Engine Manufacturer / Type Designator	Effective Perceived Noise Level (EPNdB)		
					Fly Over	Lateral	Approach
Dassault Aviation	Falcon 7X	31,298	28,304	Pratt & Whitney Canada PW 307 A	83.7	90.4	92.6
Fokker Services	F28 Mark 0100	43,090	38,780	Rolls-Royce Tay 620-15	83.4	89.3	93.1
Source: EASA file "TCDSN Jets (080711).xls", as posted on http://easa.europa.eu/ws_prod/c/c_tc_noise.php on November 12, 2008 Notes Weights converted from EASA reported units of kg and rounded to tens of lb.							

13. Embraer EMB-500 Phenom 100 – E50P

We propose to model EMB-500 Phenom 100 operations with INM type CNA510 as approved for BNA.

Table 19 presents certification data for the EMB-500 and similar types that are available in INM. The Cessna Mustang, identified in INM 7.0b as CNA510, has the same series of engines as the EMB-500 and provides the closest match in certification levels.

Table 19 Noise Certification Data for Embraer EMB 500 Phenom 100, Cessna Citation Mustang, Eclipse 500 and Cessna Bravo

Manufacturer	Type Designation	MTOW (lb)	MLW (lb)	Engine Manufacturer / Type Designator	Effective Perceived Noise Level (EPNdB)		
					Fly Over	Lateral	Approach
Embraer	EMB 500	10,472	9,766	Pratt & Whitney Canada / PW617F-E	70.4	81.4	86.1
Cessna Aircraft Company	Cessna 510 / Citation Mustang	8,644	8,001	Pratt & Whitney Canada / PW615F-A	73.9	85.0	86.0
Eclipse Aerospace, Inc.	EA500	6,001	5,600	Pratt & Whitney Canada / PW610F-A	69.2	78.9	81.9
Cessna Aircraft Company	Model 550 / Bravo	14,800	13,499	Pratt & Whitney Canada / PW530A	73.7	85.2	91.2

Source:
"TCDSN Jets (080711).xls", at http://easa.europa.eu/ws_prod/c/c_tc_noise.php on January 4, 2010.
Notes:
Weights converted from EASA reported units of kg and rounded to tens of lb.
FAA AC-36-1H reported values of Takeoff and Sideline are the same as EASA/ICAO reported values of Flyover and Lateral, respectively.

14. Embraer EMB-505 Phenom 300 – E55P

We propose to model EMB-505 Phenom 300 operations with INM type IA1125.

Table 20 presents certification data for the EMB-505 and similar types that are available in INM. The Israel Aircraft 1125 ASTRA, identified in INM 7.0b as IA1125, could arguably have the best match, especially in the lateral and approach levels.

Table 20 Noise Certification Data for Embraer EMB 505 Phenom 300, Learjet 35, Israel Aircraft 1125, Cessna 650 Citation III and Cessna Bravo

Manufacturer	Type Designation	MTOW (lb)	MLW (lb)	Engine Manufacturer / Type Designator	Effective Perceived Noise Level (EPNdB)		
					Fly Over	Lateral	Approach
Embraer	EMB 505 / Phenom 300	17,968	16,865	Pratt & Whitney Canada / PW535E	69.9	88.8	88.5
Learjet	LEAR 35 A	18,000	14,300	TFE731-2-2B	83.6	87.4	91.3
Israel Aircraft	1125 ASTRA	23,500	20,700	TFE731-3A-200G	82.3	89.8	89.8
Cessna	650 Citation III	21,000	17,000	TFE731-3B-100S	84.9	92.5	92.4
Cessna Aircraft Company	Model 550 / Bravo	14,800	13,499	Pratt & Whitney Canada / PW530A	73.7	85.2	91.2

Source for Embraer EMB 505 and Cessna Model 550 Bravo (CNA55B): http://easa.europa.eu/ws_prod/c/c_tc_noise.php on January 4, 2010.
Source for Learjet 35 (LEAR35), 1125 ASTRA (IA1125) and Citation III (CIT3): FAA AC 36-1H, Appendix 1 (March 2, 2010), at http://www.faa.gov/about/office_org/headquarters_offices/apl/noise_emissions/aircraft_noise_levels/
Notes:
Weights converted from EASA reported units of kg and rounded to tens of lb.
FAA AC-36-1H reported values of Takeoff and Sideline are the same as EASA/ICAO reported values of Flyover and Lateral, respectively.

15. Dassault Falcon 50 and Falcon 900 – FAL50, FAL900

We propose to model the FAL50 and FAL900 with a USER Defined type, which is a copy of the LEAR35 aircraft and associated noise-power-distance (NPD) curves and adds 1.8 dB to the NPD curves as described in the INM 5.1 User Guide, pg. 8-9.

The FAL50 and FAL900 are similar to the LEAR35 model in the INM except they have a third TFE731 engine. The aircraft type designator's for these aircraft include FA50 for the Falcon 50 and F900 and FA90 for the Falcon 900.

16. Gulfstream 150 - G150

We propose to model G150 operations with INM type IA1125 as approved for BNA.

The Gulfstream 150 is a relatively new aircraft and is sometimes described as a wide body variant of the Galaxy Aerospace Astra (INM Type IA1125 with TFE731-3A engines). However the wing and engine have changed. The G150 has a MTOW of 26,100 lb., a MLW of 21,700 lb. and Honeywell TFE731-40 AR-200G rated at 4,420 lb.

Table 21 presents the certification data for the aforementioned aircraft types based on certification levels. The IA1125 is similar to the G150 in terms of both weight and certification data points.

Table 21 Noise Certification Data from Gulfstream G150, Hawker 800 and Israel Aircraft 1125 Astra

Manufacturer	Type Designation	MTOW (lb)	MLW (lb)	Engine Manufacturer / Type Designator	Effective Perceived Noise Level (EPNdB)		
					Fly Over	Lateral	Approach
Gulfstream Aerospace	Gulfstream G150	26,101	21,700	Honeywell TFE731-40AR-200G	80.7	91.2	91.9
ISRAEL AIRCRAFT	1125 ASTRA	23,500	20,700	TFE731-3A-200G	82.3	89.8	89.8

Notes: Source for Gulfstream G150: file "TCDSN Jets (080711).xls", at http://easa.europa.eu/ws_prod/c/c_tc_noise.php on November 12, 2008. Source for 1125 ASTRA: FAA AC 36-1H, Appendix 1 (March 2, 2010), at http://www.faa.gov/about/office_org/headquarters_offices/apl/noise_emissions/aircraft_noise_levels/
Notes:
Weights converted from EASA reported units of kg and rounded to tens of lb.
FAA AC-36-1H reported values of Takeoff and Sideline are the same as EASA/ICAO reported values of Flyover and Lateral, respectively.

17. Bombardier BD-700 Global Express/Global 5000 – GL5T and GLEX

We propose to model GL5T and GLEX operations with INM type GV as approved for BNA.

The GLEX, Bombardier BD-700 Global Express, is similar to the Gulfstream V (INM 7.0b type GV). Both aircraft use variants of the Rolls-Royce BR710 engine and both have similar maximum takeoff weights, landing weights and noise levels. Table 22 provides a comparison of the noise certification data for these aircraft.

Table 22 Noise Certification Data from Bombardier Global Express and Gulfstream GV

Manufacturer	Type Designation	MTOW (lb)	MLW (lb)	Engine Manufacturer / Type Designator	Effective Perceived Noise Level (EPNdB)		
					Fly Over	Lateral	Approach
Bombardier	BD-700-1A10 (Global Express)	96,000	78,500	BR700-710-A2-20	82.7	88.6	89.8
Bombardier	BD-700-1A10 (Global Express)	93,500	78,500	BR700-710-A2-20	82.1	88.7	89.8
Bombardier	BD-700-1A10 (Global Express) (Learjet STC: SA8184nm-D)	75,000	75,000	Rolls Royce/ BR700-710-A2-20	75.6	89.3	89.7
Bombardier	BD700-1A11 (Global 5000)	92,500	78,600	Rolls Royce/ BR700-710A2-20	81.3	88.9	89.7
Gulfstream	G-V	90,500	75,300	BR700-710-A1-10	80.3	89.1	90.8

Source: FAA AC 36-1H, Appendix 1 (March 2, 2010), at
http://www.faa.gov/about/office_org/headquarters_offices/apl/noise_emissions/aircraft_noise_levels/
Source for Global 5000 from EASA TCDSN database for Jets Issue 12 as posted in "TCDSN Jets.xls" on
http://easa.europa.eu/certification/type-certificates/noise.php July 22,2011
Notes:
Weights converted from EASA reported units of kg and rounded to tens of lb.
FAA AC-36-1H reported values of Takeoff and Sideline are the same as EASA/ICAO reported values of Flyover and Lateral, respectively.

18. **Raytheon Hawker-125-1000 – H25C**

We propose to model H25C operations with INM type LEAR35 as approved for VNY.

We compared the Hawker 125-1000 with the Hawker 800 and LEAR35 aircraft shown in Table 23. Based on the comparison, the LEAR35 appears to be a good match.

Table 23 Noise Certification Data from BAe-125-1000 and -800 and LEAR35

Manufacturer	Type Designation	MTOW (lb)	MLW (lb)	Engine Manufacturer / Type Designator	Effective Perceived Noise Level (EPNdB)		
					Takeoff	Sideline	Approach
Raytheon	Hawker 125-1000	31,000	25,000	PW305	81.8	85.9	91.6
Raytheon	Hawker 125-800	27,400	23,350	TFE731-5R-1H	80.9	87.2	96.5
Learjet	LEAR 35 A	18,000	14,300	TFE731-2-2B	83.6	87.4	91.3

Source: FAA AC 36-1H, Appendix 1 (March 2, 2010), at http://www.faa.gov/about/office_org/headquarters_offices/apl/noise_emissions/aircraft_noise_levels/

19. Hawker Beechcraft Hawker 4000 - HA4T

We propose to model Hawker 4000 operations with INM type CL600 as approved for BNA

The Hawker 4000 is a relatively new aircraft in operational service, although the aircraft was certified in 2006 when the program was then owned by Raytheon. Previously this aircraft had been marketed as the Horizon 1000 (note – this aircraft is different than the Hawker 125-1000). This aircraft has Pratt & Whitney Canada PW308A engines, which are not used by any standard INM aircraft. However, the PW308C engines are used by the newer Falcon 2000EX variants. Both of these aircraft have relatively high Lateral/Sideline certification levels compared to other aircraft with similar weights. The Falcon 2000 is an INM standard substitution (FAL20A) and maps to the CL600.

Table 24 Noise Certification Data for Hawker 4000 and Various Similar Aircraft

Manufacturer	Type Designation	MTOW (lb)	MLW (lb)	Engine Manufacturer / Type Designator	Effective Perceived Noise Level (EPNdB)		
					Fly Over	Lateral	Approach
Hawker Beechcraft Corporation	Model 4000	39,498	33,499	Pratt & Whitney Canada / PW308A	75.1	91.6	91.6
Dassault	Falcon 2000EX	40,999	39300	Pratt & Whitney Canada / PW308C	76.7	91.7	91.0
Dassault	Falcon 2000	36,500	33,000	CFE738-1-1B	79.4	86.4	93.1
Bombardier	CL-600	36,000	33,000	ALF-502	81.6	89.3	91.2

Notes:
Source for Hawker 4000: http://easa.europa.eu/ws_prod/c/c_tc_noise.php on January 4, 2010.
Source for Dassault Falcon 2000 (INM Substitution FAL20A), Gulfstream (G-IV): FAA AC 36-1H, Appendix 1 (March 2, 2010), at http://www.faa.gov/about/office_org/headquarters_offices/apl/noise_emissions/aircraft_noise_levels/
Weights converted from EASA reported units of kg and rounded to tens of lb.
FAA AC-36-1H reported values of Takeoff and Sideline are the same as EASA/ICAO reported values of Flyover and Lateral, respectively.

20. Learjet 40 – LJ40

We propose to model LJ40 operations with INM type LEAR35 as approved for BNA.

The LJ40 is a derivative of the Learjet 45 (LJ45) with a shorter fuselage. The LJ40 and LJ45 engines are both versions of the Honeywell TFE731-20AR. In INM 7.0b the LJ45 is mapped to the substitution aircraft, LEAR35.

21. Hawker Beechcraft Premier 1 390 - PRM1

We propose to model PRM1 operations with INM type CNA500 as approved for BNA.

The PRM1 is a relatively new light twin-engine corporate jet. The maximum takeoff weight is 12,500 lb. and maximum landing weight is 11,600 lb. The aircraft is powered by two William FJ44-2A turbo fans, each rated at 2,300 lb. The PRM1 is similar in weight and engines as the Cessna 525A (max takeoff weight of 12,375 lb., max landing weight of 11,500 lb., powered by William FJ44-2C turbofans with max thrust of 2,400 lb.) , which has an INM standard substitution of CNA525 and is mapped to the CNA500. In addition, the Cessna 525A and the PRM1 have similar noise certification data as summarized in Table 25.

Table 25 Noise Certification Data from Cessna 525A and Bombardier Beechcraft 390 Premier I

Manufacturer	Type Designation	MTOW (lb)	MLW (lb)	Engine Manufacturer / Type Designator	Effective Perceived Noise Level (EPNdB)		
					Takeoff	Sideline	Approach
Cessna	525A Citation Jet II (CJ-2)	12,370	11,500	FJ44-2C	74.5	88.8	91.4
Raytheon	390 Premier	12,500	11,600	FJ44-2A	76.6	87.9	92.0
Source: FAA AC 36-1H, Appendix 1 (March 2, 2010), at http://www.faa.gov/about/office_org/headquarters_offices/apl/noise_emissions/aircraft_noise_levels/							

22. Piaggio P-180 Avanti – P180

We propose to model the P180 as INM type DHC6 as approved by the FAA for VNY.

The Piaggio P-180 Avanti has two PT6A-66 turboprops which appear to be similar to the DHC6 turboprops, PT6A-27.

23. Piper Malibu Meridian – P46T

We propose to model the P46T as INM type SD330 as approved by the FAA for VNY.

The SD330 INM type was recommended by the FAA for the Piper Malibu Meridian for the Van Nuys Airport Part 161 study and approved for the VNY NEM and the APF Part 150 study.

24. Pilatus PC-12 – PC12, Socata TBM-700 – TBM7 and Socata TBM-850 – TBM8

We propose to model PC12 and TBM7 operations with INM type CNA208 as approved by FAA for VNY. We also propose to model TBM8 operations with INM type CNA208.

The FAA recommended the INM aircraft type CNA208 for the PC12 and TBM7 turboprop aircraft in prior studies. The TBM8 is an updated version of the TBM7 (Socata's engineering designation for the TBM8 is "TBM 700N).

25. Grumman AA-1 – AA1

We propose to model AA1 operations with INM type GASEPF as approved for APF.

This aircraft is a small single-engine aircraft that would probably be best modeled as GASEPF.

26. Diamond Aircraft Katana, Diamond Star - DA40

We propose to model DA-40 operations with INM type GASEPV as approved for BNA.

These aircraft are all small single-engine aircraft with either a two or three-blade, constant-speed, variable pitch propeller that would probably be best modeled as GASEPV.[28]

[28] Information on the options for the DA40 can be found on the Diamond Aircraft Industries Inc.'s website.
http://www.diamondaircraft.com/aircraft/da40_xls/specs.php
http://www.diamondaircraft.com/aircraft/da40_cs/specs.php

27. Piper Saratoga – PA32

We propose to model PA32 operations with INM type GASEPV as approved for SDF.

This aircraft has single-engine piston power plants with constant-speed variable pitch propeller that would probably be best modeled as GASEPV.

28. Kit Aircraft -Cirrus SR-22 and SR-20 - SR22, SR20

We propose to model the kit aircraft operations with INM type GASEPV as approved for BNA.

These aircraft types have a variety of different engine options and, as such, are difficult to characterize without having detailed specifications of the actual aircraft flying into LAX. Therefore, a conservative grouping of these types with the GASEPV INM aircraft type is made.

29. Various Propeller Aircraft

We propose to model the following aircraft operations, which account for less than 365 annual ops each, with INM type as listed in Table 26 below.

These aircraft types have a variety of different engine options and, as such, are difficult to characterize without having detailed specifications of the actual aircraft flying into LAX.

Table 26 Non-Standard Propeller Aircraft

Aircraft Code	Represented Aircraft Models	Recommended INM Substitution	Project Last Approved
B350	Beechcraft King Air 350	DHC6	VNY P150 NEM
B36T	Turboprop Bonanza 36	CNA206	BNA NEM
BE36	36 Bonanza	CNA206	BNA NEM
C10T	Cessna P210 (turbine)	CNA208	VNY P150 NEM
COL4	Lancair 400, Columbia 300/350/400	GASEPV	BNA NEM
P28A	Piper Cherokee Archer	GASEPF	SDF NEM
DA42	Diamond Twinstar	BEC58P	CLE NEM

Appendix B

INM Profile Extension Request

1. Statement of Benefit

The study area for this project has not yet been formally defined. However, the analysis will include sleep disturbance, which requires analysis to levels of 50 dB SEL indoors. At 50 dB SEL, most sleep disturbance methods predict approximately two percent of the population will be awakened,[1] while other methods indicate that values below 50 dB SEL should be ignored.[2] The proposed profile extensions are designed to prevent aircraft profiles ending (and associated noise) within the likely study area and thus affecting the sleep disturbance calculation. It should be noted that at LAX, many aircraft fly abeam the airport on the downwind leg, then 30 to 50 nautical miles (nm) total track distance before landing, while most INM standard arrival profiles are approximately 20 nm or less.

A similar profile extension for INM 6.1, for the Philadelphia International Airport (PHL) Runway 17-35 Extension EIS and PHL Capacity Enhancement Program was approved.

1.1 Methodology

We propose to extend profiles for aircraft using both procedure steps and fixed point profiles. Profiles will be extended in 1,000 ft. altitude increments for arrivals and 2,000 ft. altitude increments for departures. By extending in these increments, INM is able to compute aircraft performance data in a manner consistent with the standard profiles. The proposed extensions will only be developed for fixed-wing aircraft; standard INM profiles are used for helicopters.

The following is a list of the assumptions proposed for the extensions:

- Only INM standard profiles are to be extended.[3] To the greatest extent possible, the extended profiles should not modify aircraft performance and noise calculations or results in the region of the standard profiles (i.e. the departures below 10,000 ft. Above Field Elevation (AFE) and arrivals below 6,000 ft. AFE). Therefore we expect that the extensions will have no effect on the 65 dB Community Noise Equivalent Level (CNEL).
- Extended profiles will be developed only for aircraft with nighttime operations.
- All extended profiles will start/end at a cardinal Mean Sea Level (MSL) altitude.[4] There will be one extended segment with an altitude increment less than noted above to convert from AFE to MSL.[5]

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[1] Effects of Aviation Noise on Awakenings from Sleep, Federal Interagency Committee on Aviation Noise (FICAN), June 1997. That documented recommended the relationship: Awakenings = 0.0087 x (SEL-30)^1.79
[2] Quantities and Procedures for Description and Measurement of Environmental Sound — Part 6: Methods for Estimation of Awakenings Associated with Outdoor Noise Events Heard in Homes, ANSI S12.9-2008/Part 6. Section 4.1.
[3] In this section, "INM standard profile" refers to all INM-provided profiles such as STANDARD, ICAO A, and ICAO B.
[4] Even 1,000 ft. levels such as 12,000 ft. MSL instead of 12,100 ft. MSL.
[5] LAX as an airfield elevation of 125 ft. MSL. Therefore one departure extension segment will be 1,875 ft. instead of 2,000 ft. and one arrival extension segment will be 875 ft. instead of 1,000 ft.

- The departure profiles will be extended by adding a new segment at the end of the standard profile to reflect a climb to 24,000 feet (ft.) Mean Sea Level (MSL) using MaxClimb Thrust and zero flaps.
- The arrival profiles will be extended by adding a new segment at the beginning of the standard profile to reflect a descent from level flight and using extrapolated speed and thrust values. All level flight segments are above 6,000 ft. AFE and therefore are an extension of the INM standard profile and not a modification.
- Level flight altitudes for arrivals have been derived through radar data analysis and associated to respective ground tracks (which has been compared to published procedures). Hold downs below 6,000 ft. AFE that are already included in the INM standard profile will not be modified. Level flight altitudes that we propose to model are listed below
  - 6,125 ft. MSL / 6,000 ft. AFE (to represent aircraft at 6,000 ft. MSL)
  - 7,000 ft. MSL / 6,875 ft. AFE
  - 8,000 ft. MSL / 7,875 ft. AFE
  - 9,000 ft. MSL / 8,875 ft. AFE
  - 10,000 ft. MSL / 9,875 ft. AFE
  - 11,000 ft. MSL / 10,875 ft. AFE
  - 12,000 ft. MSL / 11,875 ft. AFE

INM aircraft profiles are available in the model in two formats: procedure steps and profile points. Procedure steps use the INM modules to compute the aircraft performance based on manufacturers' supplied data for different states of flight and conditions. Profile points are fixed profiles with supplied data for each location that are static and not modified by INM modules based on changes to INM study or case conditions. The following sections describe the development of departure and arrival extended profiles for aircraft with either type of INM standard profile.

1.2 Departures

We propose to extend all INM standard departure profiles to 24,000 ft. MSL altitude.[6] Our testing indicates that this should be sufficient given resulting ground track profiles to cover the likely study area extents. The following steps will be followed:

- Begin with the INM standard (STANDARD, ICAO A, ICAO B) profiles.
- Aircraft will climb from 10,000 ft. AFE to 24,000 ft. MSL altitude in 2,000 ft., or less, increments. The first extension segment is at a reduced altitude increment to put all future extensions at cardinal MSL increments.

[6] INM does not allow adequate thrust for certain aircraft-profile-stage length combinations to reach 24,000ft. MSL. Therefore, departure profiles maximum altitudes for such aircraft have been set to the following MSL elevations:
1900D-STANDARD-1: 12,000ft; 777200-ICAOAA-9: 22,000ft; 777200-ICAOBB-9: 22,000ft; CNA208-STANDARD-1: 18,000ft; CNA510-FLAPS_0-1: 22,000ft; CNA55B-FLAPS_0-1: 18,000ft; CNA750-FLAP_15-1: 20,000ft; GASEPF-STANDARD-1: 22,000ft; IA1125-STANDARD-1: 20,000ft

- Procedure steps aircraft will repeat the last climb profile step found in the standard profile in the noted increments. Table 1 provides an example of the 747400 extension. The 747400 is one of the most common INM types modeled for nighttime departures at LAX.
- The three fixed-point profile aircraft (CNA206, PA28, PA31) will climb at the same rate as the last INM standard climb segment (i.e. linear extrapolation distance based on altitude). The true airspeed above 10,000 ft. AFE will be computed for each point using a constant calibrated airspeed equal to the calibrated speed in the final INM standard point.[7] The thrust (THR_SET) will be computed using an analogous equation from the INM 7.0 Technical Manual.[8]

Table 1 747400 Extended Departure Profile

Procedure Profile Departure for 747400 (PROF_ID1 =STANDARD, PROF_ID2 = 7)							
STEP_NUM	**STEP_TYPE**	**FLAP_ID**	**THR_TYPE**	**PARAM1**	**PARAM2**	**PARAM3**	**TYPE**
1	T	10	T	0.0	0.0	0.0	INM STD
2	C	T_10H	T	1000.0	0.0	0.0	INM STD
3	A	10	C	963.6	216.4	0.0	INM STD
4	A	5	C	1114.2	259.6	0.0	INM STD
5	C	T_01	C	2544.0	0.0	0.0	INM STD
6	A	T_05	C	1329.4	270.0	0.0	INM STD
7	C	T_00H	C	5500.0	0.0	0.0	INM STD
8	C	T_00H	C	7500.0	0.0	0.0	INM STD
9	C	T_00H	C	10000.0	0.0	0.0	INM STD
10	C	T_00H	C	11875.0	0.0	0.0	LAX EXT
11	C	T_00H	C	13875.0	0.0	0.0	LAX EXT
12	C	T_00H	C	15875.0	0.0	0.0	LAX EXT
13	C	T_00H	C	17875.0	0.0	0.0	LAX EXT
14	C	T_00H	C	19875.0	0.0	0.0	LAX EXT
15	C	T_00H	C	21875.0	0.0	0.0	LAX EXT
16	C	T_00H	C	23875.0	0.0	0.0	LAX EXT

1.3 Arrivals

We propose to extend all INM standard arrival profiles up to the desired level flight altitude. The profile will be extended such that the aircraft will be modeled throughout the study area without ending prematurely within the study area.

The following steps will be followed:

[7] INM 7.0 Technical Manual, FAA-AEE_08-01, January 2008, Equation 2-42. The final true airspeed in the INM standard departure profile is converted to calibrated airspeed solving Equation 2-42 and using the density ratio at 10,000 ft. Mean Sea Level (assumption based on the development of INM standard profiles). For each altitude extension, the true airspeed is calculated using the extension altitude's density ratio and calibrated airspeed at the final point of the INM standard profile.

[8] INM 7.0 Technical Manual, FAA-AEE_08-01, January 2008, Equation 2-6, correct net thrust definition on page 5. The new corrected net thrust is computed by multiplying the ratio of the pressure ratio at the last point of the INM standard profile to the pressure ratio at the desired altitude.

- Start with INM standard profiles and extrapolate from 6,000 ft. in 1,000 ft. increments to the desired altitude. The last extension segment is at a reduced altitude increment to put all prior extensions at cardinal MSL increments. Hold downs below 6,000 ft. AFE that are already included in the INM standard profile will not be modified.
  - For aircraft with procedure steps, the first INM standard procedure step will be repeated in the noted increments from the desired altitude. A level flight segment will be added at the desired altitude. Small transition steps will be used to control the thrust transition from the level flight segment to the descent. Table 2 provides an example of the 747400 extension with a level flight segment at 10,000 ft. MSL. The 747400 is one of the most common INM types modeled for nighttime arrivals at LAX.
  - For profile-points aircraft,[9] the profile will be extended to the desired level flight altitude in the noted increments, by extrapolating the first two (i.e. highest points) in the INM standard profile and maintaining the descent angle of the first segment in the INM standard profile.[10] The true airspeed above 6,000 ft. AFE will be computed for each point using a constant calibrated airspeed equal to the calibrated speed in the initial INM standard arrival point.[11] The thrust (THR_SET) will be computed using an analogous equation from the INM 7.0 Technical Manual.[12] The level flight segment is developed with one of the two methodologies
    - For aircraft with procedure departure profiles. The level flight segment thrust is developed by creating a test departure with the appropriate standard arrival profile weight, level flight altitude and calibrated airspeed as explained in the departure section. This will be modeled to obtain profile points for the level flight segment from the flight.txt output file. Small transition steps will be used to control the thrust transition from the level flight segment to the descent.[13] Table 3 provides an example of the 777300 arrival extension with a level flight segment at 10,000 ft. MSL. The 777300 is one of the most common INM types modeled for nighttime arrivals at LAX.
    - For aircraft without procedure departure profiles. There are only three INM aircraft types in the LAX night time fleet mix that fit this description: CNA206; PA28; and PA31). The operations for all three aircraft types combined are less than .03 operations or less than twelve annual operations, across all three aircraft types. Since we do not have an efficient way to develop the level flight thrust for these types and these types represent so few operations, we propose to extend the profiles to higher altitudes, as discussed above, but will not place the aircraft in level flight.

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[9] Aircraft defined with INM standard profile-point arrival profiles include 737800, 757300, 777200, 777300, CNA206, MD11GE, MD11PW, PA28, PA31
[10] We found several aircraft profiles defined with arrival profile-points have descent angles that differ from the standard 3-degree.
[11] See footnote7. This process is the same as for the departures except that the calibrated airspeed is computed from the initial INM standard arrival point at 6,000 ft. Mean Sea Level (assumption based on the development of INM standard profiles).
[12] See footnote8.
[13] The transition steps may also be used to make small adjustments in the true airspeed from the level flight segment to the descents segments. However, since the level flight segments are developed using the speeds in the arrival profile, this should be unlikely.

Table 2 747400 Extended Arrival Profile with Level Flight Segment at 10,000 ft. MSL

Procedure Profile Arrival for 747400 to 10,000 ft.							
STEP_NUM	**STEP_TYPE**	**FLAP_ID**	**THR_TYPE**	**PARAM1**	**PARAM2**	**PARAM3**	**TYPE**
1	V	5		9875.0	250.0	250000.0	LAX EXT
2	V	5		9875.0	250.0	500.0	LAX EXT
3	D	5		9875.0	250.0	3.0	LAX EXT
4	D	5		8875.0	250.0	3.0	LAX EXT
5	D	5		7875.0	250.0	3.0	LAX EXT
6	D	5		6875.0	250.0	3.0	LAX EXT
7	D	5		6000.0	250.0	3.0	INM STD
8	D	10		3000.0	175.4	3.0	INM STD
9	D	D-25		1500.0	161.4	3.0	INM STD
10	D	D-30		1000.0	155.4	3.0	INM STD
11	L	D-30		533.6	0.0	0.0	INM STD
12	B		V	4802.4	147.5	10.0	INM STD
13	B		L	0.0	30.0	10.0	INM STD

Table 3 777300 Extended Arrival Profile with Level Flight Segment at 10,000 ft. MSL

Profile Point Profile Arrival for 777300 to 10,000 ft.						
PT_NUM	DISTANCE	ALTITUDE	SPEED	THR_SET	OP_MODE	TYPE
1	-477221.2	9750.0	298.7	17243.90	A	LAX EXT
2	-227221.2	9750.0	298.7	17243.90	A	LAX EXT
3	-226721.2	9875.0	289.4	1.20	A	LAX EXT
4	-206309.5	8875.0	284.9	1.10	A	LAX EXT
5	-185897.9	7875.0	280.5	1.10	A	LAX EXT
6	-165486.2	6875.0	276.2	1.00	A	LAX EXT
7	-147626.0	6000.0	272.0	1.00	A	INM STD
8	-86391.0	3000.0	261.0	1.00	A	INM STD
9	-70159.0	3000.0	220.0	42.50	A	INM STD
10	-61102.0	3000.0	192.0	2231.00	A	INM STD
11	-56765.0	3000.0	179.0	5883.50	A	INM STD
12	-54191.0	3000.0	169.0	6413.00	A	INM STD
13	-54091.0	3000.0	169.0	2151.00	A	INM STD
14	-52237.0	2892.0	165.0	2077.50	A	INM STD
15	-48787.0	2702.0	150.0	2203.50	A	INM STD
16	-48454.0	2683.0	148.0	2224.50	A	INM STD
17	-48354.0	2683.0	148.0	20314.00	A	INM STD
18	-47301.0	2620.0	148.0	20266.00	A	INM STD
19	-42598.0	2359.0	147.0	20073.50	A	INM STD
20	-37914.0	2099.0	147.0	19883.50	A	INM STD
21	-33249.0	1841.0	146.0	19696.00	A	INM STD
22	-28603.0	1583.0	146.0	19512.00	A	INM STD
23	-23974.0	1326.0	145.0	19330.00	A	INM STD
24	-19364.0	1071.0	145.0	19151.00	A	INM STD
25	-14772.0	816.0	144.0	18974.50	A	INM STD
26	-10198.0	562.0	143.0	18800.00	A	INM STD
27	-5642.0	309.0	143.0	18629.00	A	INM STD
28	-1103.0	57.0	142.0	18460.00	A	INM STD
29	-979.0	50.0	142.0	18460.00	A	INM STD
30	0	0	141	18455	A	INM STD
31	445.7	0	134	7700	D	INM STD
32	4456.8	0	30	7700	A	INM STD

2. Analysis Demonstrating Benefit

Since we are making these modifications to all of the aircraft profiles and all profiles are developed using the same method, two representative aircraft types were selected to demonstrate the results. The selected types are discussed above and summarized below.

- 747400 representing departure procedure profiles
- 747400 representing arrival procedure profiles starting with a level flight segment at 10,000 ft. MSL
- 777300 representing arrival profile point profiles starting with a level flight segment at 10,000 ft. MSL

A grid point analysis is presented below in addition to SEL contour comparisons.

Table 4 presents a comparison of the noise modeling results for a 747400 aircraft using a STANDARD departure profile (up to 10,000 ft. AFE) and an extended departure profile (to 24,000 ft. MSL). Grid points under the flight path were modeled at every 0.5 nm from the start of takeoff out to 50 nm.

Figure 4 demonstrates the additional noise levels produced by extending the departure profiles for the 747400. The SEL contours for the INM standard profile are in thin black from 60 dB SEL to 75 dB SEL. The bold black contour lines are the SEL contours produced from the extended profiles from 60 dB SEL to 75 dB SEL. As seen in the figures the standard profiles end well before the end of the flight paths.

Table 4 Comparison of Sound Exposure Level (SEL) for 747400 STANDARD-7 Profile versus Proposed Extended Profile

Grid Points (nm)	INM Standard Profile STANDARD-7 776,600 lb. (SEL dB)	User Defined Profile STD_XT24 776,600 lb. (SEL dB)	Difference (dB)
0.0	146.4	146.4	0.0
0.5	136.4	136.4	0.0
1.0	132.3	132.3	0.0
1.5	109.2	109.2	0.0
2.0	103.6	103.6	0.0
2.5	100.8	100.8	0.0
3.0	96.4	96.4	0.0
3.5	95.3	95.3	0.0
4.0	94.2	94.2	0.0
4.5	93.3	93.3	0.0
5.0	92.4	92.4	0.0
5.5	91.6	91.6	0.0
6.0	90.9	90.9	0.0
6.5	90.1	90.1	0.0
7.0	89.4	89.4	0.0
7.5	88.7	88.7	0.0
8.0	87.9	87.9	0.0
8.5	87.3	87.3	0.0
9.0	86.7	86.7	0.0
9.5	86.0	86.0	0.0
10.0	85.4	85.4	0.0
10.5	84.8	84.8	0.0
11.0	84.3	84.3	0.0
11.5	83.7	83.7	0.0
12.0	83.3	83.3	0.0
12.5	82.8	82.8	0.0
13.0	82.4	82.4	0.0
13.5	82.0	82.0	0.0
14.0	81.6	81.6	0.0
14.5	81.3	81.3	0.0
15.0	80.9	80.9	0.0
15.5	80.6	80.6	0.0
16.0	80.3	80.3	0.0
16.5	80.0	80.0	0.0
17.0	79.7	79.7	0.0

Grid Points (nm)	INM Standard Profile STANDARD-7 776,600 lb. (SEL dB)	User Defined Profile STD_XT24 776,600 lb. (SEL dB)	Difference (dB)
17.5	79.4	79.4	0.0
18.0	79.1	79.2	0.1
18.5	78.9	78.9	0.0
19.0	78.6	78.7	0.1
19.5	78.4	78.5	0.1
20.0	78.0	78.3	0.3
20.5	77.6	78.1	0.5
21.0	76.7	77.9	1.2
21.5	75.3	77.8	2.5
22.0	73.0	77.6	4.6
22.5	70.2	77.4	7.2
23.0	67.2	77.3	10.1
23.5	64.3	77.2	12.9
24.0	61.6	77.0	15.4
24.5	59.2	76.9	17.7
25.0	57.0	76.8	19.8
25.5	55.1	76.7	21.6
26.0	53.3	76.5	23.2
26.5	51.7	76.4	24.7
27.0	50.2	76.3	26.1
27.5	48.8	76.2	27.4
28.0	47.5	76.1	28.6
28.5	46.3	76.0	29.7
29.0	45.2	75.9	30.7
29.5	44.1	75.8	31.7
30.0	43.1	75.8	32.7
30.5	42.2	75.7	33.5
31.0	41.3	75.6	34.3
31.5	40.4	75.5	35.1
32.0	39.6	75.4	35.8
32.5	38.8	75.4	36.6
33.0	38.1	75.3	37.2
33.5	37.4	75.2	37.8
34.0	36.7	75.2	38.5
34.5	36.1	75.1	39.0
35.0	35.4	75.0	39.6
35.5	34.8	75.0	40.2

Grid Points (nm)	INM Standard Profile STANDARD-7 776,600 lb. (SEL dB)	User Defined Profile STD_XT24 776,600 lb. (SEL dB)	Difference (dB)
36.0	34.2	74.9	40.7
36.5	33.7	74.9	41.2
37.0	33.1	74.8	41.7
37.5	32.6	74.7	42.1
38.0	32.1	74.7	42.6
38.5	31.6	74.7	43.1
39.0	31.2	74.6	43.4
39.5	30.7	74.6	43.9
40.0	30.3	74.5	44.2
40.5	29.8	74.5	44.7
41.0	29.4	74.5	45.1
41.5	29.0	74.4	45.4
42.0	28.6	74.4	45.8
42.5	28.3	74.4	46.1
43.0	27.9	74.4	46.5
43.5	27.5	74.4	46.9
44.0	27.2	74.4	47.2
44.5	26.8	74.4	47.6
45.0	26.5	74.3	47.8
45.5	26.2	74.3	48.1
46.0	25.8	74.3	48.5
46.5	25.5	74.3	48.8
47.0	25.2	74.3	49.1
47.5	24.9	74.3	49.4
48.0	24.6	74.3	49.7
48.5	24.4	74.3	49.9
49.0	24.1	74.3	50.2
49.5	23.8	74.3	50.5
50.0	23.5	74.3	50.8

Sources: INM 7.0b

Figure 4 747400 Stage length 7 Departure, Standard vs. Proposed Extended Profile SEL contours

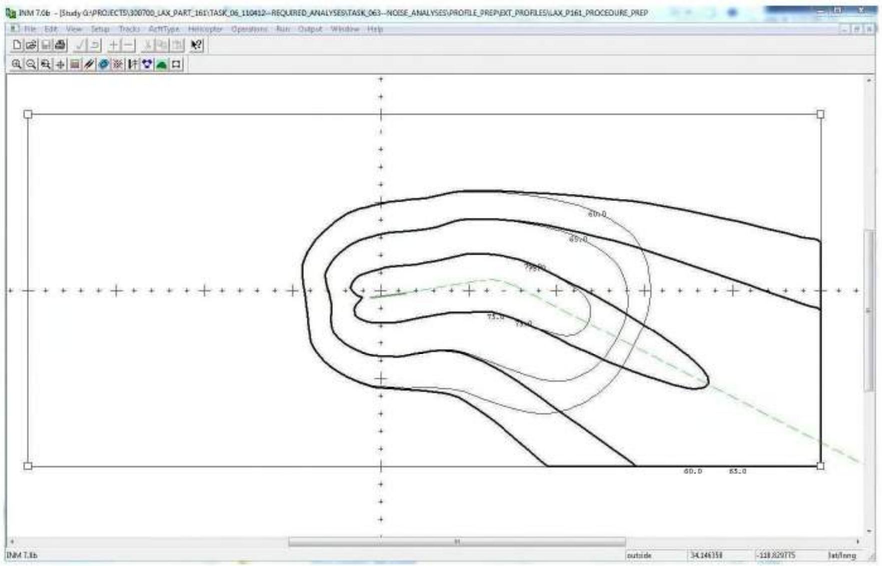

Table 5 compares the noise modeling results for a 747400 arrival using a STANDARD arrival profile (from 6,000 ft. AFE) and an extended arrival profile. The extended profile begins in level flight at 10,000 ft. MSL and then descends to the airport runway. Grid points under the flight path were modeled every 0.5 nm from 50 nm to landing on the runway.

Figure 5 demonstrates the additional noise levels produced by extending the 757PW arrival profiles. The SEL contours for the INM standard profile are in thin black from 60 dB SEL to 75 dB SEL. The bold black contour lines are the SEL contours produced from the extended profiles from 60 dB SEL to 75 dB SEL. As seen in the figures the standard profiles end well before the end of the flight paths.

Table 5 Comparison of Sound Exposure Level (SEL) for 747400 Standard Arrival versus Proposed Extended Profile with 10,000 ft. MSL Level Flight Segment

Grid Points (nm)	INM Standard Profile STANDARD 567,000 lb. (SEL dB)	User Defined Profile STD_VX10 567,000 lb. (SEL dB)	Difference (dB)
50.0	14.4	70.1	55.7
49.5	14.7	70.1	55.4
49.0	14.9	70.2	55.3
48.5	15.1	70.2	55.1
48.0	15.4	70.1	54.7
47.5	15.6	70.1	54.5
47.0	15.9	70.1	54.2
46.5	16.1	70.1	54.0
46.0	16.4	70.1	53.7
45.5	16.6	70.1	53.5
45.0	16.9	70.1	53.2
44.5	17.2	70.1	52.9
44.0	17.4	70.1	52.7
43.5	17.7	70.1	52.4
43.0	18.0	70.1	52.1
42.5	18.3	70.1	51.8
42.0	18.6	70.1	51.5
41.5	18.9	70.1	51.2
41.0	19.2	70.1	50.9
40.5	19.5	70.1	50.6
40.0	19.9	70.1	50.2
39.5	20.2	70.1	49.9
39.0	20.6	70.1	49.5
38.5	20.9	70.1	49.2
38.0	21.3	70.1	48.8
37.5	21.7	70.1	48.4
37.0	22.0	70.1	48.1
36.5	22.4	70.1	47.7
36.0	22.9	70.1	47.2
35.5	23.3	70.1	46.8
35.0	23.7	70.1	46.4
34.5	24.2	70.1	45.9
34.0	24.7	70.1	45.4
33.5	25.2	70.1	44.9
33.0	25.7	70.1	44.4

Grid Points (nm)	INM Standard Profile STANDARD 567,000 lb. (SEL dB)	User Defined Profile STD_VX10 567,000 lb. (SEL dB)	Difference (dB)
32.5	26.2	70.0	43.8
32.0	26.7	70.0	43.3
31.5	27.3	70.0	42.7
31.0	27.9	69.9	42.0
30.5	28.6	69.9	41.3
30.0	29.2	69.9	40.7
29.5	29.9	70.0	40.1
29.0	30.7	70.1	39.4
28.5	31.5	70.2	38.7
28.0	32.3	70.4	38.1
27.5	33.2	70.6	37.4
27.0	34.1	70.8	36.7
26.5	35.1	71.0	35.9
26.0	36.2	71.2	35.0
25.5	37.3	71.4	34.1
25.0	38.6	71.6	33.0
24.5	39.9	71.8	31.9
24.0	41.4	72.0	30.6
23.5	42.9	72.2	29.3
23.0	44.7	72.4	27.7
22.5	46.6	72.7	26.1
22.0	48.8	72.9	24.1
21.5	51.2	73.2	22.0
21.0	53.9	73.4	19.5
20.5	57.0	73.7	16.7
20.0	60.6	73.9	13.3
19.5	64.8	74.2	9.4
19.0	68.9	74.4	5.5
18.5	72.1	74.7	2.6
18.0	74.1	75.0	0.9
17.5	75.0	75.4	0.4
17.0	75.6	75.7	0.1
16.5	76.0	76.1	0.1
16.0	76.4	76.5	0.1
15.5	76.8	76.8	0.0
15.0	77.2	77.2	0.0
14.5	77.6	77.6	0.0

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Grid Points (nm)	INM Standard Profile STANDARD 567,000 lb. (SEL dB)	User Defined Profile STD_VX10 567,000 lb. (SEL dB)	Difference (dB)
14.0	78.1	78.1	0.0
13.5	78.5	78.5	0.0
13.0	79.0	79.0	0.0
12.5	79.4	79.4	0.0
12.0	79.9	79.9	0.0
11.5	80.4	80.4	0.0
11.0	80.9	80.9	0.0
10.5	81.4	81.4	0.0
10.0	82.0	82.0	0.0
9.5	82.6	82.6	0.0
9.0	83.1	83.1	0.0
8.5	83.7	83.7	0.0
8.0	84.3	84.3	0.0
7.5	84.9	84.9	0.0
7.0	85.6	85.6	0.0
6.5	86.3	86.3	0.0
6.0	87.1	87.1	0.0
5.5	87.8	87.8	0.0
5.0	88.6	88.6	0.0
4.5	89.5	89.5	0.0
4.0	90.4	90.4	0.0
3.5	91.6	91.6	0.0
3.0	93.0	93.0	0.0
2.5	94.2	94.2	0.0
2.0	95.7	95.7	0.0
1.5	97.5	97.5	0.0
1.0	99.7	99.7	0.0
0.5	102.9	102.9	0.0
0.0	107.6	107.6	0.0

Sources: INM 7.0b

Figure 5 747400 Arrival, Standard vs. Proposed Extended Profile with 10,000 ft. MSL Level Flight Segment SEL contours

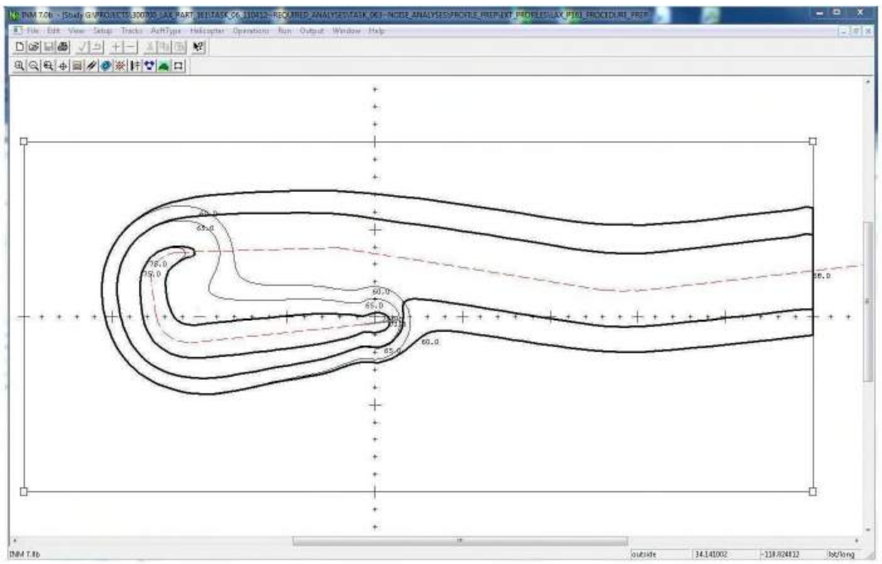

Table 6 compares the noise modeling results for a 777300 arrival using a Standard Arrival profile (from 6,000 ft. AFE) and an extended arrival profile. The extended profile begins in level flight at 10,000 ft. MSL and then descends to the airport runway. Under the flight path, Grid points under the flight path were modeled every 0.5 nm from 50 nm to landing on the runway.

Figure 6 demonstrates the additional noise levels produced by extending the 777300 arrival profiles. The SEL contours for the INM standard profile are in thin black from 60 dB SEL to 75 dB SEL. The bold black contour lines are the SEL contours produced from the extended profiles from 60 dB SEL to 75 dB SEL. As seen in the figures the standard profiles end well before the end of the flight paths.

Table 6 Comparison of Sound Exposure Level (SEL) for 777300 Standard Arrival versus Proposed Extended Profile with 10,000 ft. MSL Level Flight Segment

Grid Points (nm)	INM Standard Profile STANDARD 471,600 lb. (SEL dB)	User Defined Profile STD_VX10 471,600 lb. (SEL dB)	Difference (dB)
50.0	11.7	65.6	53.9
49.5	11.9	65.6	53.7
49.0	12.2	65.7	53.5
48.5	12.5	65.6	53.1
48.0	12.8	65.6	52.8
47.5	13.0	65.6	52.6
47.0	13.3	65.6	52.3
46.5	13.6	65.6	52.0
46.0	13.9	65.6	51.7
45.5	14.3	65.6	51.3
45.0	14.6	65.6	51.0
44.5	14.9	65.6	50.7
44.0	15.3	65.6	50.3
43.5	15.6	65.6	50.0
43.0	16.0	65.6	49.6
42.5	16.3	65.6	49.3
42.0	16.7	65.6	48.9
41.5	17.1	65.6	48.5
41.0	17.5	65.6	48.1
40.5	18.0	65.6	47.6
40.0	18.4	65.5	47.1
39.5	18.9	65.5	46.6
39.0	19.3	65.5	46.2
38.5	19.8	65.4	45.6
38.0	20.3	65.2	44.9
37.5	20.9	64.8	43.9
37.0	21.4	64.3	42.9
36.5	22.0	63.7	41.7
36.0	22.6	63.3	40.7
35.5	23.3	63.1	39.8
35.0	24.0	63.1	39.1
34.5	24.7	63.1	38.4
34.0	25.4	63.2	37.8
33.5	26.3	63.4	37.1
33.0	27.1	63.5	36.4

Grid Points (nm)	INM Standard Profile STANDARD 471,600 lb. (SEL dB)	User Defined Profile STD_VX10 471,600 lb. (SEL dB)	Difference (dB)
32.5	28.0	63.7	35.7
32.0	29.0	63.9	34.9
31.5	30.0	64.0	34.0
31.0	31.1	64.2	33.1
30.5	32.4	64.4	32.0
30.0	33.7	64.6	30.9
29.5	35.1	64.8	29.7
29.0	36.6	65.0	28.4
28.5	38.3	65.2	26.9
28.0	40.2	65.4	25.2
27.5	42.3	65.6	23.3
27.0	44.6	65.8	21.2
26.5	47.2	66.0	18.8
26.0	50.2	66.2	16.0
25.5	53.6	66.5	12.9
25.0	57.4	66.7	9.3
24.5	61.2	66.9	5.7
24.0	64.2	67.1	2.9
23.5	66.2	67.4	1.2
23.0	67.2	67.6	0.4
22.5	67.7	67.8	0.1
22.0	68.0	68.1	0.1
21.5	68.3	68.3	0.0
21.0	68.6	68.6	0.0
20.5	68.9	68.9	0.0
20.0	69.2	69.2	0.0
19.5	69.4	69.4	0.0
19.0	69.7	69.7	0.0
18.5	70.0	70.0	0.0
18.0	70.4	70.4	0.0
17.5	70.7	70.7	0.0
17.0	71.0	71.0	0.0
16.5	71.3	71.3	0.0
16.0	71.7	71.7	0.0
15.5	72.0	72.0	0.0
15.0	72.4	72.4	0.0
14.5	72.8	72.8	0.0

Grid Points (nm)	INM Standard Profile STANDARD 471,600 lb. (SEL dB)	User Defined Profile STD_VX10 471,600 lb. (SEL dB)	Difference (dB)
14.0	73.2	73.2	0.0
13.5	73.4	73.4	0.0
13.0	73.5	73.5	0.0
12.5	73.6	73.6	0.0
12.0	73.8	73.8	0.0
11.5	74.0	74.0	0.0
11.0	74.4	74.4	0.0
10.5	74.7	74.7	0.0
10.0	75.2	75.2	0.0
9.5	75.8	75.8	0.0
9.0	76.4	76.4	0.0
8.5	76.8	76.8	0.0
8.0	78.3	78.3	0.0
7.5	81.2	81.2	0.0
7.0	82.7	82.7	0.0
6.5	83.5	83.5	0.0
6.0	84.2	84.2	0.0
5.5	84.9	84.9	0.0
5.0	85.7	85.7	0.0
4.5	86.5	86.5	0.0
4.0	87.3	87.3	0.0
3.5	88.4	88.4	0.0
3.0	89.5	89.5	0.0
2.5	90.7	90.7	0.0
2.0	92.3	92.3	0.0
1.5	94.0	94.0	0.0
1.0	96.2	96.2	0.0
0.5	99.5	99.5	0.0
0.0	104.5	104.5	0.0

Sources: INM 7.0b

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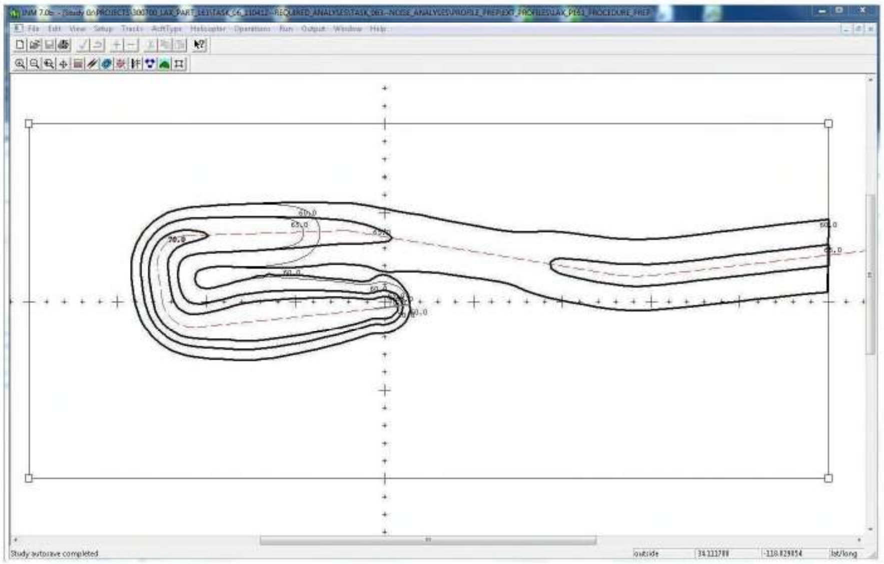
Figure 6 777300 Arrival, Standard vs. Proposed Extended Profile with 10,000 ft. MSL Level Flight Segment SEL contours



3. Concurrence on Aircraft Performance

This project began with the existing INM standard performance profiles and extended them to various cruise altitudes provided by the simulation model. Existing profiles were not modified (i.e. below 6,000 ft. AFE for arrivals and 10,000 ft. AFE for departures). Wherever possible, INM itself was used to aide in the generation of the extended profiles.

Actual input from airlines and or the manufacturer were not obtained to verify these procedures.

4. Certification of New Parameters

There were no new parameters developed. All profiles were copied and extended from existing profiles. For profiles using fixed-point profiles:

- Altitude is above field elevation in feet
- Speed is true airspeed in knots
- The thrust setting used match the units of the thrust setting parameter used in the aircraft's associated NPD curves.

For profiles using procedure steps:

- No new performance coefficient data were developed. Existing coefficients were used.

- The added steps conform to the rules given in the INM User's Guide.
- The thrust setting used match the units of the thrust setting parameter used in the aircraft's associated NPD curves.

5. Graphical and Tabular Comparison

The figures shown below provide comparisons of the standard vs. proposed modified profiles by altitude, speed and thrust All plots were developed from INM 7.0b for a LAX Runway 7L departure or arrival with temperature, pressure and humidity set to 63.0 Fahrenheit, 29.98 inches of Mercury and 70.3 % respectively.

Figures 7 through 9 show the altitude, speed and thrust plots respectively, for 747400 Stage Length 7 Departures. Table 7 and Table 8 present the same data in tabular from for the proposed extended profile and the INM standard profile. Note that all data for the proposed modified profile departures are identical below the 10,000 ft. AFE standard profile maximum altitude.

Figures 10 through 12 show the altitude, speed and thrust plots respectively, for 747400 Arrivals where the proposed modified profile descends from a 10,000 ft. MSL level flight segment. Table 9 and Table 10 present the same data in tabular from for the proposed extended profile and the INM standard profile. Note that all data for the proposed modified profile arrivals is identical below the 6,000 ft. AFE standard profile maximum altitude.

Figures 13 through 15 show the altitude, speed and thrust plots, respectively, for 777300 Arrivals where the proposed modified profile descends from a 10,000 ft. MSL level flight segment. Table 11 and Table 12 present the same data in tabular from for the proposed extended profile and the INM standard profile. Note that all data for the proposed modified profile arrivals is identical below the 6,000 ft. AFE standard profile maximum altitude.

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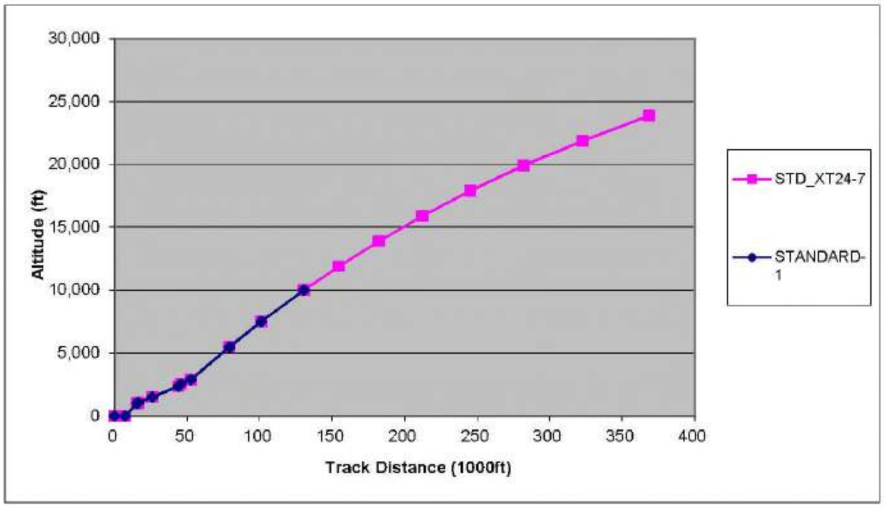

Figure 7 Altitude vs. Distance for 747400 Stage length 7 Departure, Standard vs. Modified profiles

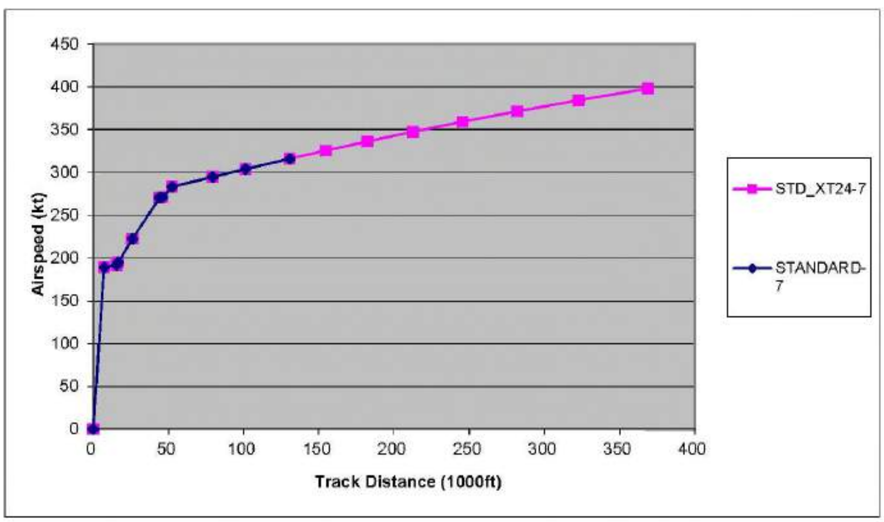

Figure 8 Airspeed vs. Distance for 747400 Stage length 7 Departure, Standard vs. Modified profiles

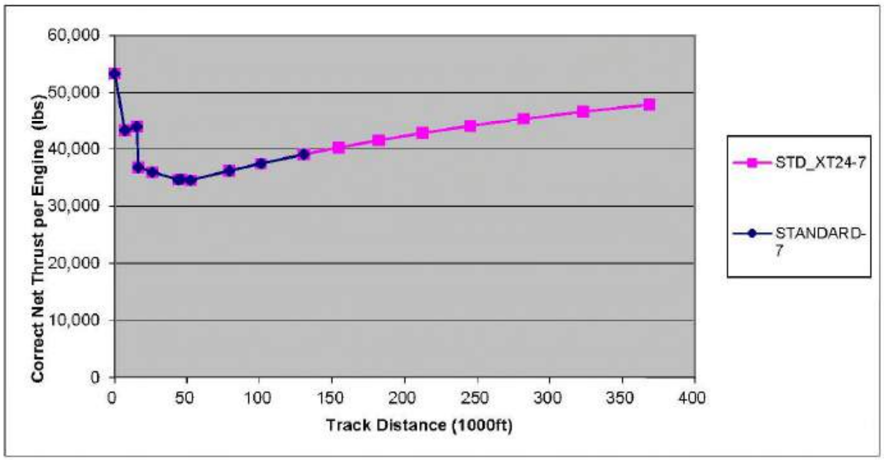

Figure 9 Thrust vs. Distance for 747400 Stage length 7 Departure, Standard vs. Modified profiles

Table 7 747400 Departure State length 7 Proposed Extended Profile Altitude, Speed and Thrust Data

ACFT ID	OP TYPE	RWY ID	PROF ID1	PROF ID2	PT NUM	DISTANCE	ALTITUDE	SPEED	THR_SET
747400	D	07L	STD_XT24	7	1	0.0	0.0	0.0	53332.67
747400	D	07L	STD_XT24	7	2	7210.9	0.0	189.0	43284.88
747400	D	07L	STD_XT24	7	3	15406.1	1000.0	191.8	43891.17
747400	D	07L	STD_XT24	7	4	16406.1	1048.4	194.9	36824.19
747400	D	07L	STD_XT24	7	5	25997.1	1512.1	222.4	35941.28
747400	D	07L	STD_XT24	7	6	43885.3	2353.3	270.2	34635.13
747400	D	07L	STD_XT24	7	7	45781.6	2544.0	270.9	34756.39
747400	D	07L	STD_XT24	7	8	52452.4	2876.7	283.2	34524.71
747400	D	07L	STD_XT24	7	9	79188.5	5500.0	294.6	36192.54
747400	D	07L	STD_XT24	7	10	101077.8	7500.0	303.8	37464.09
747400	D	07L	STD_XT24	7	11	130592.7	10000.0	315.9	39053.52
747400	D	07L	STD_XT24	7	12	154576.3	11875.0	325.5	40245.59
747400	D	07L	STD_XT24	7	13	182201.2	13875.0	336.1	41517.13
747400	D	07L	STD_XT24	7	14	212294.9	15875.0	347.3	42788.68
747400	D	07L	STD_XT24	7	15	245313.1	17875.0	359.0	44060.22
747400	D	07L	STD_XT24	7	16	281834.7	19875.0	371.3	45331.77
747400	D	07L	STD_XT24	7	17	322611.0	21875.0	384.2	46603.31
747400	D	07L	STD_XT24	7	18	368642.7	23875.0	397.8	47874.85
Sources: INM 7.0b									

Table 8 747400 Departure Standard-7 Profile Altitude, Speed and Thrust Altitude, Speed and Thrust Data

ACFT ID	OP TYPE	RWY ID	PROF ID1	PROF ID2	PT NUM	DISTANCE	ALTITUDE	SPEED	THR_SET
747400	D	07L	STANDARD	7	1	0.0	0.0	0.0	53332.67
747400	D	07L	STANDARD	7	2	7210.9	0.0	189.0	43284.88
747400	D	07L	STANDARD	7	3	15406.1	1000.0	191.8	43891.17
747400	D	07L	STANDARD	7	4	16406.1	1048.4	194.9	36824.19
747400	D	07L	STANDARD	7	5	25997.1	1512.1	222.4	35941.28
747400	D	07L	STANDARD	7	6	43885.3	2353.3	270.2	34635.13
747400	D	07L	STANDARD	7	7	45781.6	2544.0	270.9	34756.39
747400	D	07L	STANDARD	7	8	52452.4	2876.7	283.2	34524.71
747400	D	07L	STANDARD	7	9	79188.5	5500.0	294.6	36192.54
747400	D	07L	STANDARD	7	10	101077.8	7500.0	303.8	37464.09
747400	D	07L	STANDARD	7	11	130592.7	10000.0	315.9	39053.52
Sources: INM 7.0b									

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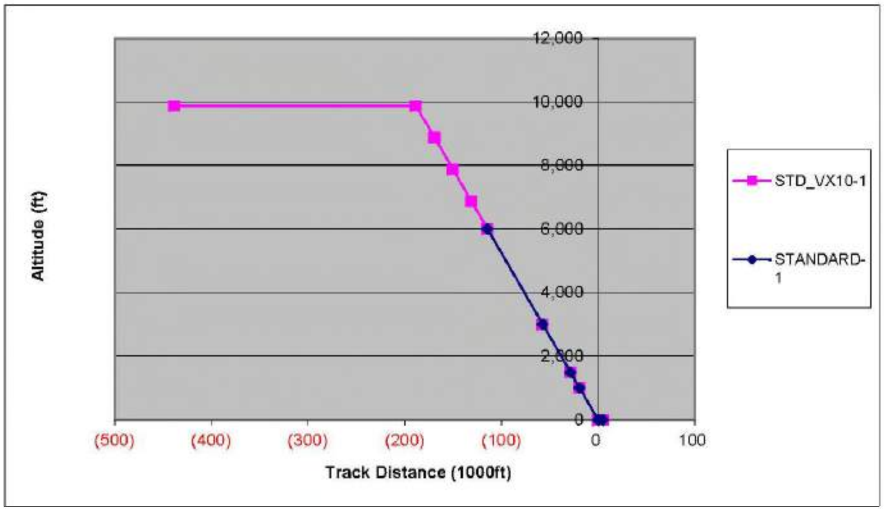

Figure 10 Altitude vs. Distance for 747400 Arrival Standard and Proposed Extended Profile with 10,000 ft. MSL Level Flight Segment

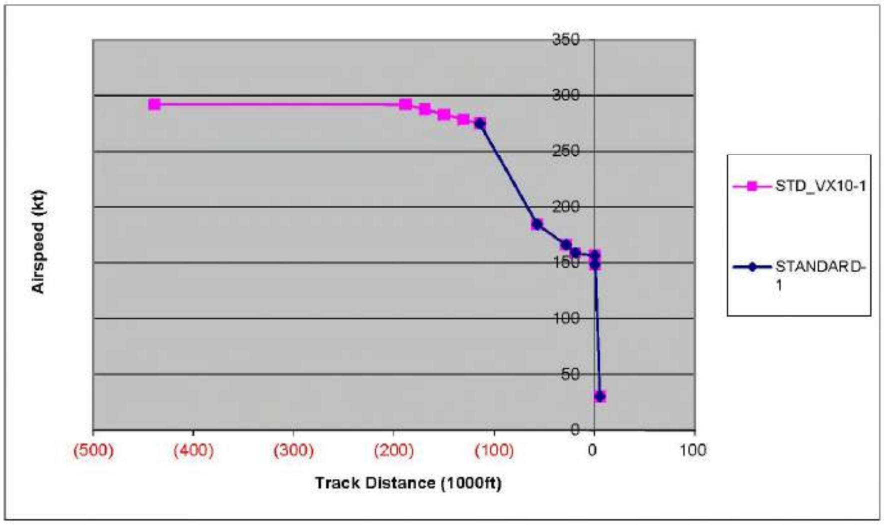

Figure 11 Airspeed vs. Distance for 747400 Arrival Standard and Proposed Extended Profile with 10,000 ft. MSL Level Flight Segment

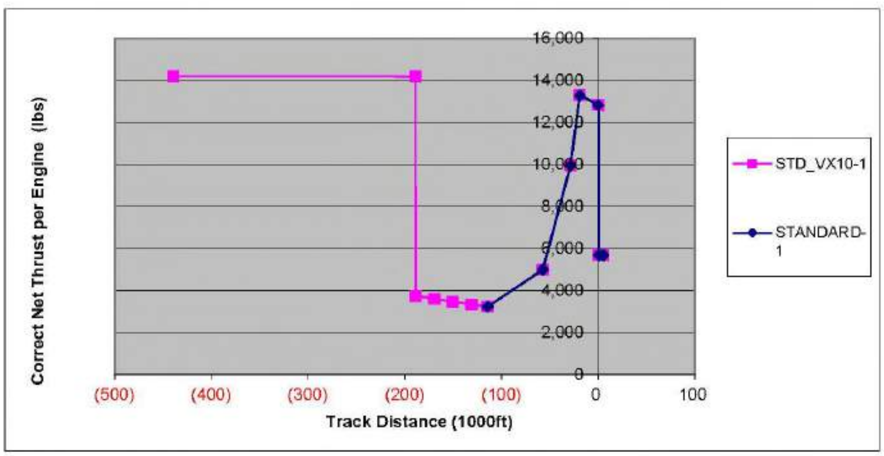

Figure 12 Thrust vs. Distance for 747400 Arrival Standard and Proposed Extended Profile with 10,000 ft. MSL Level Flight Segment

Table 9 747400 Proposed Extended Profile with 10,000 ft. MSL Level Flight Segment Altitude, Speed and Thrust Data

ACFT ID	OP TYPE	RWY ID	PROF ID1	PROF ID2	PT NUM	DISTANCE	ALTITUDE	SPEED	THR_SET
747400	A	07L	STD_VX10	1	1	-438926.2	9875.0	291.9	14191.63
747400	A	07L	STD_VX10	1	2	-188926.2	9875.0	291.9	14191.63
747400	A	07L	STD_VX10	1	3	-188426.2	9875.0	291.9	3740.91
747400	A	07L	STD_VX10	1	4	-169345.1	8875.0	287.4	3599.10
747400	A	07L	STD_VX10	1	5	-150264.0	7875.0	283.0	3463.64
747400	A	07L	STD_VX10	1	6	-131182.8	6875.0	278.6	3334.20
747400	A	07L	STD_VX10	1	7	-114486.8	6000.0	274.9	3225.65
747400	A	07L	STD_VX10	1	8	-57243.4	3000.0	184.3	4993.01
747400	A	07L	STD_VX10	1	9	-28621.7	1500.0	165.9	9947.79
747400	A	07L	STD_VX10	1	10	-19081.1	1000.0	158.5	13289.88
747400	A	07L	STD_VX10	1	11	0.0	0.0	156.2	12816.38
747400	A	07L	STD_VX10	1	12	533.6	0.0	148.3	5680.00
747400	A	07L	STD_VX10	1	13	5336.0	0.0	30.2	5680.00
Sources: INM 7.0b									

Table 10 747400 Arrival Standard Profile Altitude, Speed and Thrust Data

ACFT ID	OP TYPE	RWY ID	PROF ID1	PROF ID2	PT NUM	DISTANCE	ALTITUDE	SPEED	THR_SET
747400	A	07L	STANDARD	1	1	-114486.8	6000.0	274.9	3225.65
747400	A	07L	STANDARD	1	2	-57243.4	3000.0	184.3	4993.01
747400	A	07L	STANDARD	1	3	-28621.7	1500.0	165.9	9947.79
747400	A	07L	STANDARD	1	4	-19081.1	1000.0	158.5	13289.88
747400	A	07L	STANDARD	1	5	0.0	0.0	156.2	12816.38
747400	A	07L	STANDARD	1	6	533.6	0.0	148.3	5680.00
747400	A	07L	STANDARD	1	7	5336.0	0.0	30.2	5680.00
Sources: INM 7.0b									

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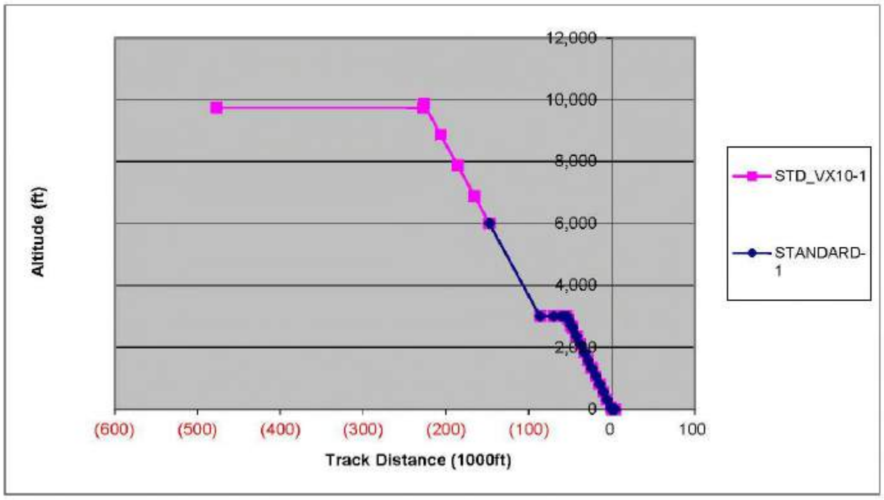

Figure 13 Altitude vs. Distance for 777300 Arrival Standard and Proposed Extended Profile with 10,000 ft. MSL Level Flight Segment

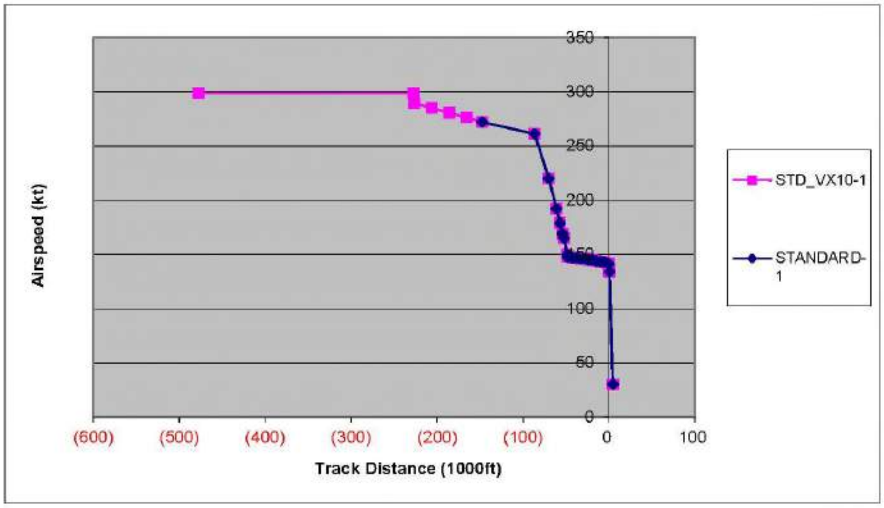

Figure 14 Airspeed vs. Distance for 777300 Arrival Standard and Proposed Extended Profile with 10,000 ft. MSL Level Flight Segment

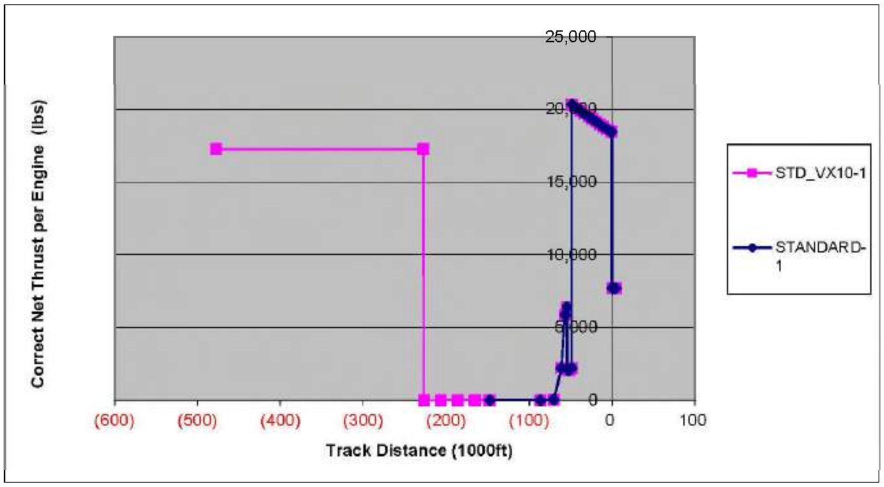

Figure 15 Thrust vs. Distance for 777300 Arrival Standard and Proposed Extended Profile with 10,000 ft. MSL Level Flight Segment

Table 11 777300 Proposed Extended Profile with 10,000 ft. MSL Level Flight Segment Altitude, Speed and Thrust Data

ACFT ID	OP TYPE	RWY ID	PROF ID1	PROF ID2	PT NUM	DISTANCE	ALTITUDE	SPEED	THR_SET
777300	A	07L	STD_VX10	1	1	-477221.2	9750.0	298.7	17243.90
777300	A	07L	STD_VX10	1	2	-227221.2	9750.0	298.7	17243.90
777300	A	07L	STD_VX10	1	3	-226721.2	9875.0	289.4	1.20
777300	A	07L	STD_VX10	1	4	-206309.5	8875.0	284.9	1.10
777300	A	07L	STD_VX10	1	5	-185897.9	7875.0	280.5	1.10
777300	A	07L	STD_VX10	1	6	-165486.2	6875.0	276.2	1.00
777300	A	07L	STD_VX10	1	7	-147626.0	6000.0	272.0	1.00
777300	A	07L	STD_VX10	1	8	-86391.0	3000.0	261.0	1.00
777300	A	07L	STD_VX10	1	9	-70159.0	3000.0	220.0	42.50
777300	A	07L	STD_VX10	1	10	-61102.0	3000.0	192.0	2231.00
777300	A	07L	STD_VX10	1	11	-56765.0	3000.0	179.0	5883.50
777300	A	07L	STD_VX10	1	12	-54191.0	3000.0	169.0	6413.00
777300	A	07L	STD_VX10	1	13	-54091.0	3000.0	169.0	2151.00
777300	A	07L	STD_VX10	1	14	-52237.0	2892.0	165.0	2077.50
777300	A	07L	STD_VX10	1	15	-48787.0	2702.0	150.0	2203.50
777300	A	07L	STD_VX10	1	16	-48454.0	2683.0	148.0	2224.50
777300	A	07L	STD_VX10	1	17	-48354.0	2683.0	148.0	20314.00
777300	A	07L	STD_VX10	1	18	-47301.0	2620.0	148.0	20266.00
777300	A	07L	STD_VX10	1	19	-42598.0	2359.0	147.0	20073.50
777300	A	07L	STD_VX10	1	20	-37914.0	2099.0	147.0	19883.50
777300	A	07L	STD_VX10	1	21	-33249.0	1841.0	146.0	19696.00
777300	A	07L	STD_VX10	1	22	-28603.0	1583.0	146.0	19512.00
777300	A	07L	STD_VX10	1	23	-23974.0	1326.0	145.0	19330.00
777300	A	07L	STD_VX10	1	24	-19364.0	1071.0	145.0	19151.00
777300	A	07L	STD_VX10	1	25	-14772.0	816.0	144.0	18974.50
777300	A	07L	STD_VX10	1	26	-10198.0	562.0	143.0	18800.00
777300	A	07L	STD_VX10	1	27	-5642.0	309.0	143.0	18629.00
777300	A	07L	STD_VX10	1	28	-1103.0	57.0	142.0	18460.00
777300	A	07L	STD_VX10	1	29	-979.0	50.0	142.0	18460.00
777300	A	07L	STD_VX10	1	30	0.0	0.0	141.0	18455.00
777300	A	07L	STD_VX10	1	31	445.7	0.0	134.0	7700.00
777300	A	07L	STD_VX10	1	32	4456.8	0.0	30.0	7700.00

Sources: INM 7.0b

Table 12 777300 Arrival Standard Profile Altitude, Speed and Thrust Data

ACFT ID	OP TYPE	RWY ID	PROF ID1	PROF ID2	PT NUM	DISTANCE	ALTITUDE	SPEED	THR_SET
777300	A	07L	STANDARD	1	1	-147626.0	6000.0	272.0	1.00
777300	A	07L	STANDARD	1	2	-86391.0	3000.0	261.0	1.00
777300	A	07L	STANDARD	1	3	-70159.0	3000.0	220.0	42.50
777300	A	07L	STANDARD	1	4	-61102.0	3000.0	192.0	2231.00
777300	A	07L	STANDARD	1	5	-56765.0	3000.0	179.0	5883.50
777300	A	07L	STANDARD	1	6	-54191.0	3000.0	169.0	6413.00
777300	A	07L	STANDARD	1	7	-54091.0	3000.0	169.0	2151.00
777300	A	07L	STANDARD	1	8	-52237.0	2892.0	165.0	2077.50
777300	A	07L	STANDARD	1	9	-48787.0	2702.0	150.0	2203.50
777300	A	07L	STANDARD	1	10	-48454.0	2683.0	148.0	2224.50
777300	A	07L	STANDARD	1	11	-48354.0	2683.0	148.0	20314.00
777300	A	07L	STANDARD	1	12	-47301.0	2620.0	148.0	20266.00
777300	A	07L	STANDARD	1	13	-42598.0	2359.0	147.0	20073.50
777300	A	07L	STANDARD	1	14	-37914.0	2099.0	147.0	19883.50
777300	A	07L	STANDARD	1	15	-33249.0	1841.0	146.0	19696.00
777300	A	07L	STANDARD	1	16	-28603.0	1583.0	146.0	19512.00
777300	A	07L	STANDARD	1	17	-23974.0	1326.0	145.0	19330.00
777300	A	07L	STANDARD	1	18	-19364.0	1071.0	145.0	19151.00
777300	A	07L	STANDARD	1	19	-14772.0	816.0	144.0	18974.50
777300	A	07L	STANDARD	1	20	-10198.0	562.0	143.0	18800.00
777300	A	07L	STANDARD	1	21	-5642.0	309.0	143.0	18629.00
777300	A	07L	STANDARD	1	22	-1103.0	57.0	142.0	18460.00
777300	A	07L	STANDARD	1	23	-979.0	50.0	142.0	18460.00
777300	A	07L	STANDARD	1	24	0.0	0.0	141.0	18455.00
777300	A	07L	STANDARD	1	25	445.7	0.0	134.0	7700.00
777300	A	07L	STANDARD	1	26	4456.8	0.0	30.0	7700.00

Sources: INM 7.0b

FAA Review and Approval of Aircraft Substitutions

U.S. Department of Transportation
Federal Aviation Administration

Office of Environment and Energy

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

Date: December 9, 2011

Victor Globa
Environmental Protection Specialist
Federal Aviation Administration
15000 Aviation Boulevard
Lawndale, CA 90261
Telephone: 310-725-3637
Fax: 310-725-6849

Dear Mr. Globa,

The Office of Environment and Energy (AEE) received the letter addressed to you from Scott Tatro of Los Angeles World Airports (LAWA) dated September 7, 2011 requesting approval of modeling 29 aircraft types (51 aircraft in total as shown in the Appendix A in the email attachment) that do not have Integrated Noise Model (INM) standard substitutions. This request is to evaluate noise in support of a proposed 14 CFR Part 161 Noise and Access Restriction Study at Los Angeles International Airport (LAX).

Of the proposed 51 aircraft for use in the noise analysis, AEE concurs with 42 of them. The list of those aircraft is displayed in Table 1. AEE does not approve the use of the 9 other proposed aircraft as substitutions, but recommends alternative aircraft. The list of those aircraft is displayed in Table 2 of this letter. The AEE's review is based on comparison of several different candidate aircraft for each matching, in terms of design configuration, aircraft performance, and aircraft noise certification levels. In addition, AEE examined noise contour areas of certain aircraft to support the review.

Please understand that this approval is limited to this particular project for LAX. Any additional projects or non-standard INM input at LAX will require separate approval.

Also, please note that the request for extending INM profiles is still under evaluation and will be addressed under separate cover.

Sincerely,

James Skalecky, Acting Manager
AEE/Noise Division
cc: Jim Byers, APP-400

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Table 1. List of the AEE approved aircraft for use as substitution in the noise analysis. For example, AEE concurs with the proposed use of the INM aircraft Boeing737-800 in modeling the Boeing 737-900 aircraft.

Type	AC code	AC name	AC sub proposed	AEE review
Jet	B77L, B77W	777 -200LR and -300ER (Freighters)	777-300 w. addition of MTOW profile	Concur
Jet	A320neo	Airbus A320neo	A320-232	Concur
Jet	A350 A350-900	Airbus A350	A330-343	Concur
Jet	B739	B737-900	737800	Concur
Jet	B748	B747-8 Freighter 747-8 Intercontinental	A340-642	Concur
Jet	BOMBC	Bombardier C Series	A319-131	Concur
Jet	E190 E90 EMJ	Embraer 190	A319-131	Concur
Jet	C56X	Citation Excel	CNA55B	Concur
Jet	CL30	BD-100 Challenger 300	CL600	Concur
Jet	DA7X	Dassault Falcon 7X	F10062	Concur
Jet	E50P	Embraer EMP-500 Phenom 100	CNA510	Concur
Jet	G150	Gulfstream 150	IA1125	Concur
Jet	GLST GLEX	BD-700	GV	Concur
Jet	H25C	Raytheon Hawker Bae HS125-100	Lear35	Concur
Jet	HA4T	Hawker 4000	CL600	Concur
Jet	LJ40	Learjet 40	Lear35	Concur
Jet	PRIM/PRM1	Hawker Premier1, 390	CNA500	Concur
Turboprop	PC12 TMB7 TBM8	Pilatus PC-12, Eagle Socata TBM-700 Socata TBM-800	CNA208	Concur
Piston Prop	AA1	AA-1 Series (Grumman American)	GASEPF	Concur
Piston Prop	DA40	DA-40 Katana, Diamond Star	GASEPV	Concur
Piston Prop	PA32	Piper Saratoga	GASEPV	Concur
Kit	SR20/22	Cirrus SR-20/22	GASEPV	Concur
Propeller	B36T	B36T Turboprop Bonanza 36 CNA206 BNA NEM	CNA206	Concur
Propeller	BE36 36	Bonanza	CNA206	Concur
Propeller	C10T	Cessna P210 (turbine)	CNA208	Concur
Propeller	COL4	Lancair 400, Columbia 300/350/400	GASEPV	Concur
Propeller	P28A	Piper Cherokee Archer	GASEPF	Concur
Propeller	DA42	Diamond Twinstar	BEC58P	Concur

Table 2. List of the AEE recommended aircraft for substitution instead of the ones proposed. For example, AEE recommends the use of the INM aircraft CNA208 in modeling Piper Malibu Meridian.

Type	AC code	AC name	AC sub proposed	AEE recommendation
Jet	B788/787-8 B789/787-9	B787-8, and -9	A310-304	A330-343
Jet	C680	Citation Sovereign	Lear35	CL600
Jet	E55P	Embraer EMP505 Phenom 300	IA1125	CNA55B
Jet	FAL50 FAL900	Falcon 50/900	Lear35+1.8dB	F10062
Turboprop	P180	Piaggio P-180 Avanti	DHC6	SD330
Turboprop	P46T	Piper Malibu Meridian	SD330	CNA208
Propeller	B350	Beechcraft King Air 350	DHC6	DO228

FAA Review of Aircraft Extended Profiles and Response, 2/29/2012

U.S. Department
of Transportation
Federal Aviation Administration

Office of Environment and Energy

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

Date: February 29, 2012

Dave Cushing
Manager, Los Angeles Airports District Office
Federal Aviation Administration
15000 Aviation Boulevard
Lawndale, CA 90261

Dear Mr. Cushing,

The Office of Environment and Energy (AEE) received the letter addressed to Victor Globa from Scott Tatro of Los Angeles World Airports (LAWA) dated September 7, 2011 requesting approval of modeling extended aircraft flight profiles that go beyond the standard Integrated Noise Model (INM) profiles. This request is to evaluate noise in support of the 14 CFR Part 161 Noise and Access Restriction Study and the Specific Plan Amendment Study (SPAS) at Los Angeles International Airport (LAX).

AEE has reviewed the request and has several concerns regarding the extent and validity of the extended profiles. The request documented in Appendix B of the above referenced letter is to extend INM aircraft departure profiles to an altitude of 24,000 feet. Historically, the FAA has limited the noise study area for air traffic actions above 3000 feet to 18,000 feet Above Ground Level (AGL). Extending departure profiles beyond 18,000 feet AGL would require extrapolation of INM aircraft performance data well beyond the manufacturer-verified aircraft operational envelope and is not recommended.

In addition, the requestor indicated in Appendix B of the request that extended profiles would be developed only for aircraft with nighttime operations; however Appendix B does not include a complete list of aircraft that would have extended profiles in the analysis. There are references to small General Aviation (GA) aircraft, some of which have service ceilings well below the requested profile extension of 24,000 feet. It is not clear in the request whether the departure profiles for these aircraft would be extended to 24,000 feet. When extending aircraft profiles care must be taken to ensure that the user defined profile does not exceed the performance capabilities of the aircraft being modeled. Profile extensions should be validated by the operator or manufacturer of the aircraft to ensure the profile is reasonable. (See INM 7.0 User Guide Appendix B) If operator data is not available, radar data can be used as a guide to modify flight profiles.

The request also includes extension of approach profiles to 10,000 feet altitude with extended level flight segments. Though the requests states an analysis of radar data was completed, no justification on why the 10,000 feet altitude with the extended level flight segments were chosen for the approach profiles was included with the request. In addition, the level flight approach segments require an aircraft flap setting in order for INM to calculate thrust, and then noise level. It is not clear in the request that the proper aircraft flap settings were chosen for level flight on approach. These flap settings must be verified since flap setting is significant in the calculation of approach thrust, and subsequently noise.

Therefore, AEE does not approve the method used to extend the INM aircraft profiles described in Appendix B of the above referenced request. The aircraft departure profile extensions should not exceed 18,000 feet AGL. In addition, the radar analysis of the approach profile extensions mentioned in the request should be provided for review. Verification of aircraft performance data on approach, including flap setting, should also be provided.

Sincerely,

Rebecca Cointin, Acting Manager
AEE/Noise Division

cc: Jim Byers, APP-400
Ralph Thompson, APP-400
Victor Globa, AWP-LAX-ADO

LAWA Response Letter to FAA Letter, 3/28/2012

Los Angeles World Airports

March 28, 2012

Mr. Victor Globa
Federal Aviation Administration (FAA)
Western Pacific Region Airports Division, LAX-600.3
P.O. Box 92007
Los Angeles, CA 90009

Re: FAA Response Letter to LAWA Request for Approval of Aircraft Profile Extensions for the LAX Part 161 Noise and Access Restriction Study

Dear Mr. Globa:

This letter is in response to the attached FAA's letter of February 29, 2012, disapproving our proposed method of extending INM aircraft climb profiles for use in the sleep disturbance analysis of our on-going Part 161 Study. Many months have passed since we submitted the request for extended profiles to be used by LAWA for the Part 161 study, and we are now working toward conclusion of this study within the next few weeks. Therefore, Los Angeles World Airports plans to utilize INM standard profiles for the noise analysis reported in our Part 161 submittal. As a result, we expect the sleep disturbance results in the Part 161 Study to provide a conservative estimate of the potential awakenings. Thank you for your consideration.

Sincerely,

Scott Tatro
Airport Environmental Manager I

Attachment: FAA letter of February 29, 2012

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