Quarterly Noise Monitoring Report
Metropolitan Oakland International Airport
October – December 2007

HMMH Report No. 302550.004
October 2008

Prepared for:

Port of Oakland
Oakland, California

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Prepared for:

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EXECUTIVE SUMMARY

The California Airport Noise Regulation (California Code of Regulations, Title 21, Section 50025, County Report) requires the quarterly report include use of a standard information format provided by the California Department of Transportation "Department" (form DOA 617, dated 10/89). The information below fulfills this requirement.

CALIFORNIA FORM DOA 617

Summary of Statistical Information

For

California Department of Transportation

Oakland International Airport

Calendar Year 2007: Fourth Quarter 2007

1. Size of Noise Impact Area as defined in the Noise Standards (California Code of Regulations, Title 21, Chapter 2.5, Subchapter 6): 0 sq. miles
2. Estimated number of dwelling units included in the Noise Impact Area as defined by the Noise Standards: 0 dwelling units
3. Estimated number of people residing within the Noise Impact Area as defined by the Noise Standards: 0 people
4. Identification of aircraft type having highest takeoff noise level operating at this airport together with estimated number of operations by this aircraft type during the calendar quarter reporting period: Boeing 727 aircraft; SEL 112 dB; Estimated Operations: 1,804.
5. Total number of aircraft operations during the calendar quarter: 67,830 aircraft operations
6. Number of Air Carrier operations during the calendar quarter (not mandatory): 41,692 air carrier operations
7. Percentage of Air Carrier operations by aircraft certified under Federal Aviation Regulation (FAR) Part 36, Stage III (not mandatory): 100% of air carrier/air cargo operations Stage III
8. Estimated number of operations by General Aviation aircraft during the calendar quarter (not mandatory): 32,593 General Aviation aircraft operations estimated from FAA tower counts
9. Estimated number of operations by Military aircraft during the calendar quarter (not mandatory): 63 Military aircraft operations

In addition to the above form, the report must include a map illustrating the location of the noise impact boundary, as validated by measurement, and the location of the measurement points, in the four preceding calendar quarters. Figure 1 satisfies this requirement.

Figure 1 Noise Impact Boundary: 12-Month CNEL Contours for January 2007 – December 2007

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

Harris Miller Miller and Hanson, Inc (HMMH) and PK Consultants, Inc. (PK) prepared the Fourth Quarter of 2007 (4Q2007) Noise Monitoring Report. This quarterly noise monitoring report provides the aircraft noise levels and airport operations at Metropolitan Oakland International Airport (OAK) for the periods from January 1, 2007 to December 31, 2007 and satisfies the California Division of Aeronautics Noise Standards[1], Section 5025 requirements. California's Division of Aeronautics and Alameda County received copies of this report.

According to the California Noise Standards, hereinafter Title 21, a county may declare an airport within its boundaries to have a noise problem and shall enforce Title 21 requirements. Alameda County has declared OAK a "noise problem" airport. In as such, the County must provide quarterly to the California Department of Transportation "the department" a report containing at least the following information:

- A map illustrating the noise impact boundary for the preceding four quarters; see Figure 1 in the Executive Summary
- The annual noise impact area and the estimated number of dwelling units and people residing with the noise impact area; see Form DOA 617 in the Executive Summary
- Daily CNEL measurements, number of aircraft operations, and estimated number of operations of the highest noise level aircraft type during the calendar quarter; see Form DOA 617 in the Executive Summary and Appendix A for the daily CNEL measurements
- Form DOA 617; see the Executive Summary

This report meets and exceeds Title 21's reporting requirements for 4Q 2007. The following sections provide the methodology used to obtain the information reported and further details illustrating the aircraft operations and noise exposure from those operations in the OAK environs. This report is organized as follows:

Section 2: Aircraft Noise and Operations Measurements

Section 3: Airport Operations

Section 4: Measured Community Noise Equivalent Levels

Section 5: Preparation of Annual CNEL Contours

Section 6: Single Event Aircraft Noise Levels

Appendix: Fourth Quarter 2007 Monthly CNEL Summaries

[1] State of California Department of Transportation Division of Aeronautics, Title 21, Subchapter 6, Noise Standards, Register 90, No. 10--3-10-90.

2 AIRCRAFT NOISE AND OPERATIONS MEASUREMENTS

On September 14, 1990 the Port of Oakland (Port), as the airport proprietor, installed a state-of-the-art noise and operations monitoring system (NOMS)[2], which automatically collects flight track data and flight identification data for a majority of all operations at the airport as well as measure and report noise levels at specific locations. In 2006, the Port received an upgrade to their NOMS with ANOMS8 software in order to maintain the most up-to-date technologically advanced NOMS.

OAK's NOMS is currently configured with fifteen (15) Remote Monitoring Terminals (RMTs) dispersed in the communities surrounding OAK to assist in evaluating compliance with OAK's established flight pattern and aircraft noise abatement procedures, and to assess the noise impact in residential areas from OAK aircraft operations. ANOMS™ correlates recorded noise events at each RMT with aircraft flight track records obtained from the Automated Radar Terminal System (ARTS) Gateway System located at the Northern California TRACON[3] (NCT) in Sacramento, California.

The ARTS data is used to separate aircraft and non-aircraft noise events recorded at the RMT's. ANOMS™ also excludes noise events due to aircraft overflights from other airports (such as San Francisco International) using the aircraft identification information included in the ARTS data. Figure 1 shows the RMT locations.

The 15 RMTs located in the community are Larson Davis Laboratories Model 870 (LD870) Precision Integrating Sound Level Meters fitted with LDL Model 2100 outdoor microphone assemblies. The meters are housed in weatherproof cabinets, and the microphones are placed on booms at least 20 feet above the ground surface or at least 10 feet above neighboring roof tops, whichever is higher and has a clear line of sight to the path of aircraft in flight. The meters report the maximum A-weighted sound level (L_{max}), the duration of a noise event at a pre-programmed measurement threshold level, and the Single Event Noise Exposure Level (SENEL) for single noise events. The RMT's pre-programmed parameters were determined from previous field observations of aircraft and background noise levels at each measurement site. ANOMS™ also reports the Hourly Noise Level (HNL) and Community Noise Equivalent Level (CNEL) based on both overall noise levels and single noise events exceeding the selected measurement threshold levels.

The sound level meters' internal calibration system performs daily checks using an acoustic actuator. The meters are externally calibrated periodically using an acoustical calibrator certified to be consistent with National Bureau of Standards (NBS) reference levels. The measurement systems meet all pertinent specifications of the American National Standards Institute (ANSI) and the International Electrotechnical commission (IEC) for Type 1 Precision sound level meters and microphones, and comply with all applicable requirements of Title 21.

[2] The OAK system utilizes ANOMS™, which is a product of the Lochard Corporation.

[3] TRACON or Terminal Radar Approach Control Facility's main function is to control airspace around airports for which it serves. The NCT handles flight operations for a 21,000-square mile area that stretches from Santa Rosa in the north to Big Sur in the south and is bordered by the Pacific Ocean to the west and the Sierra Nevada mountains to the east. The 95,000-square foot facility is home to more than 350 air traffic controllers and technicians and provides flight approach control services to 19 airports in the northern California area.

3 AIRPORT OPERATIONS

Title 21 requires the reporting of the total number of airport operations during the calendar quarter. Table 1 provides a summary of the monthly activity for October through December 2007 as captured in ANOMS™, along with the previous quarter totals. Table 1 indicates a substantial increase in regional jet and military activity while other aircraft categories showed decreases for a total slight decrease in operations of 2% during the fourth quarter of 2007 compared to the third quarter of 2007.

Table 1 Monthly Aircraft Operational Activity – Fourth Quarter 2007

Aircraft Category	Monthly Arrivals and Departures					Percent Change
	October	November	December	Total	3Q2007	
Carrier Jets	14,048	13,798	13,846	41,692	43,143	-3%
Regional Jets	1,062	1,118	1,100	3,280	2,131	35%
Corporate Jets	1,607	1,550	1,375	4,532	5,256	-16%
Turboprops	1,428	1,379	1,346	4,153	3,841	8%
Propeller	2,587	2,683	2,123	7,393	7,823	-6%
Military	18	30	15	63	7	89%
Unknown	2,575	2,318	1,824	6,717	6,744	0%
Total	23,325	22,876	21, 296	67,830	68,945	-2%

Note: "Unknown" aircraft category implies ANOMS™ did not have aircraft type associated with flight track.

Source: Port of Oakland ANOMS™ October 1, 2007 through December 31, 2007.

Airport operations determine noise exposure in the OAK environs as described by the CNEL metric, which by definition is a daily noise exposure. To determine the average daily noise exposure from OAK operations, additional information is required for determining aircraft fleet mix, runway use, and time of day of the operations as CNEL weights evening (7pm to 10pm) and night (10pm to 7am) noise levels.

For accurate determination of daily noise exposure using actual aircraft operations for modeling purposes, the ANOMS™ database provided complete and accurate information for approximately 253,823 operations on 365 days[4]. These operations represent the majority of all aircraft operations at OAK and are a large "sample" with an extremely high statistical reliability.

Aircraft operating at OAK are arranged in one of seven categories; carrier jets, regional jets, corporate jets, turbo-propeller (turboprops), propeller, military, and unknown. Carrier jets are primarily large jets consisting of both commercial carriers and freight operators as defined in FAA Order 7210.3. Regional jets are primarily small commercial jets while corporate jets have fewer seats and passengers are typically flown as charter operations. Commuter and charter operators use turboprops for air taxi services but, may also use regional or corporate jets for these services. The military category contains both propeller and jet aircraft. The general aviation category contains the remaining operations. General aviation operations include jets, single- and twin-engine propeller driven aircraft.

[4] RealContours™, an Integrated Noise Model (INM) preprocessor, successfully processed 365 days of complete and accurate flight track data to determine the average daily noise exposure. Traditional modeling techniques determine daily noise exposure from a single day of "annual-average" activity.

Table 2 summarizes the arrival and departure activity during October through December 2007. Table 3 provides the total daily arrivals and departures for commercial jets at OAK during each of the last four quarters. Carrier jets accounted for approximately 85% of all commercial jet operations during each of the four quarters.

Table 4 and Table 5 summarize runway usage from each quarter during January 2007 through December 2007 for South Field and North Field, respectively. South Field runways, 11 and 29, were utilized approximately 70% of all aircraft operations. North Field runways 9 R/L and 27 R/L were utilized approximately 18% and runways 15 and 33 were utilized approximately 12% during the four quarters.

Table 2 Aircraft Operational Activity – Fourth Quarter 2007

Aircraft Category	RWY 29	RWY 11	South Field Total	RWY 27R/L	RWY 33	RWY 09R/L	RWY 15	North Field Total	Grand Total
Aircraft Landings									
Carrier Jets	18,879	1,757	**20,636**	143	2	6	0	**151**	**20,787**
Regional Jets	1,460	124	**1,584**	56	0	1	0	**57**	**1,641**
Corporate Jets	98	123	**221**	1,965	0	63	0	**2,028**	**2,248**
Turboprops	130	16	**146**	1,781	10	115	24	**1,930**	**2,076**
Propeller	23	5	**28**	3,364	122	152	131	**3,769**	**3,778**
Military	4	2	**6**	27	0	0	0	**27**	**33**
Unknown	68	9	**77**	1,761	402	65	362	**2,590**	**2,667**
Total	**20,662**	**2,036**	**22,698**	**9,097**	**536**	**402**	**517**	**10,552**	**33,250**
Aircraft Departures									
Carrier Jets	19,237	1,630	**20,867**	20	1	17	0	**38**	**20,905**
Regional Jets	1,507	123	**1,630**	1	0	8	0	**9**	**1,639**
Corporate Jets	1,887	23	**1,910**	162	14	197	0	**373**	**2,283**
Turboprops	231	25	**256**	1,292	117	411	1	**1,821**	**2,077**
Propeller	83	7	**90**	2,121	1,066	314	5	**3,506**	**3,596**
Military	21	0	**21**	4	2	3	0	**9**	**30**
Unknown	303	46	**349**	1168	1,962	476	95	**3,701**	**4,050**
Total	23,269	1,854	**25,123**	4,768	3,162	1426	101	**9,457**	**34,580**
Total Operations	**43,931**	**3,890**	**47,821**	**13,865**	**3,698**	**1,828**	**618**	**20,009**	**67,830**

Note: "Unknown" aircraft category implies ANOMS™ did not have aircraft type associated with the flight track
Source: Port of Oakland ANOMS™ October 1, 2007 through December 31, 2007

Table 3 Quarterly Commercial Jet Aircraft Operational Activity

Aircraft Category	1Q 2007		2Q 2007		3Q 2007		4Q 2007	
	Total	Percent	Total	Percent	Total	Percent	Total	Percent
Carrier Jets	40,195	84%	41,710	85%	43,143	86%	41,692	84%
Regional Jets	2,880	6%	2,616	5%	2,131	4%	3,280	7%
Corporate Jets	4,844	10%	4,699	10%	5,256	10%	4,532	9%
Total	47,919	100%	49,025	100%	50,530	100%	49,504	100%

Source: Port of Oakland ANOMS™ January 1, 2007 through December 31, 2007

Table 4 Runway Use Factors – South Field

Operation	Runway			
	Runway 29		Runway 11	
	Total	Percent	Total	Percent
First Quarter 2007				
Landings	20,135	91.3%	1,931	8.8%
Departures	22,180	92.6%	1,771	7.4%
Second Quarter 2007				
Landings	22,055	98.3%	384	1.7%
Departures	24,302	98.4%	386	1.6%
Third Quarter 2007				
Landings	23,238	99.7%	70	0.3%
Departures	25,424	99.5%	125	0.5%
Fourth Quarter 2007				
Landings	20,662	91.0%	2,036	9.0%
Departures	23,269	92.6%	1,854	7.4%
Total Four Quarters				
Landings	86,090	95.1%	4,421	4.9%
Departures	95,175	95.8%	4,136	4.2%
Source: Port of Oakland ANOMS™ January 1, 2007 through December 31, 2007				

Table 5 Runway Use Factors – North Field

Operation	Runway							
	27L/R		33		9R/L		15	
	Total	Percent	Total	Percent	Total	Percent	Total	Percent
First Quarter 2007								
Landings	7,810	80.1%	995	10.2%	463	4.8%	479	4.9%
Departures	4,136	20.4%	4,280	21.1%	2,001	9.9%	84	0.4%
Second Quarter 2007								
Landings	126	1.2%	617	5.7%	63	0.6%	10,067	92.6%
Departures	9	0.1%	2,517	28.1%	832	9.3%	5,611	62.6%
Third Quarter 2007								
Landings	10,355	92.7%	683	6.1%	36	0.3%	101	0.9%
Departures	5,484	61.5%	2,710	30.4%	702	7.9%	17	0.2%
Fourth Quarter 2007								
Landings	9,097	86.2%	536	5.1%	402	3.8%	517	4.9%
Departures	4.768	50.4%	3,162	33.4%	1,426	15.1%	101	1.1%
Total Four Quarters								
Landings	27,388	65.4%	2,831	6.8%	501	1.2%	11,164	26.7%
Departures	14,397	38.1%	12,669	33.5%	4,691	13.1%	5,813	15.4%
Source: Port of Oakland ANOMS™ January 1, 2007 through December 31, 2007								

4 MEASURED COMMUNITY NOISE EQUIVALENT LEVELS

Title 21 requires the noise impact boundary be validated by measurements. For airports with 1,000 or more homes within the 70 dB CNEL contour, continuous monitoring (measurements for at least 48 weeks in a year) is required at monitoring positions that fall within residential areas. OAK has no homes within the 70 dB CNEL contour. Therefore, intermittent monitoring is all that is required at OAK, which, at a minimum, is continuous 24-hour monitoring during four 7-day samples throughout the year, chosen such that each of the four seasons are represented. Regardless, OAK continues to operate their continuous monitoring protocol with their NOMS.

The average daily CNEL at each RMT calculated by ANOMS is presented in Table 6. The measured aircraft CNEL values attributed to aircraft operations for this quarter show reasonable consistency with previously measured values. Daily CNEL values due to OAK aircraft operations for each RMT during the fourth quarter of 2007 are captured in Appendix A.

Table 6 Average Measured Aircraft CNEL Values

RMT No.	RMT Name	First Quarter 2007	Second Quarter 2007	Third Quarter 2007	Fourth Quarter 2007	Four-Quarter Average
1	Oro Loma San. Dist	65	66	66	65	66
2	San Leandro Marina	61	57	55	59	58
3	Fernside	50	51	51	51	51
4	Godfrey Park	59	59	58	59	59
5	Garden Isle	61	61	61	60	61
6	Wake Lane	61	63	61	61	62
7	Fire Station	61	61	61	61	61
8	Earhart School	59	58	57	59	58
9	Doolittle Drive	61	61	62	60	61
10	Tudor Court	53	52	52	53	53
11	John Muir School	54	55	53	54	54
12	Garfield School	54	53	53	55	54
13	SLUSD Admin Office	45	43	42	44	44
14	Washington School	46	46	45	45	45
15	Beach Road	59	60	59	60	59
Source: Port of Oakland ANOMS™ January 1, 2007 through December 30, 2007						

5 PREPARATION OF ANNUAL CNEL CONTOURS

CNEL can be measured or estimated through modeling. Most airport noise studies use computer-generated CNEL estimates, in terms of equal-exposure noise contours (much as topographic maps present equal-elevation contours). Title 21, Section 5012, Airport Noise Standard, indicates that the "noise impact area" is "based on the standard of 65 dB CNEL".

The FAA Integrated Noise Model (INM) incorporates a comprehensive set of computer routines for calculating noise exposure contours around airports. Consistent with FAA policy, HMMH used the most current release of the model, INM Version 7.0, to prepare the full rolling year ending with the fourth quarter 2007 contours (January 1, 2007 through December 31, 2007). The INM requires data in three principal categories: (1) aircraft noise and performance data, (2) airport layout, and (3) aircraft operational data.

HMMH used the Port of Oakland's LT6 radar files and noise level measurement data collected by ANOMS™ as the basis for predicting aircraft noise at OAK using Version 7.0 of the FAA's INM. Data for aircraft activity, aircraft fleet mix including helicopters, and airport configuration used in the noise modeling process were obtained from ANOMS™ for the time period of January 1, 2007 through December 31, 2007. The following sections provide the summary of the data, methods and assumptions used to prepare the Annual CNEL noise exposure map.

5.1 INM-Required Data

5.1.1 Aircraft Noise and Performance Data

The INM includes a database of noise and performance data for a broad range of representative aircraft types. Noise data cover a range of distances (from 200 feet to 25,000 feet) for specific thrust levels. Performance data include thrust, speed, and altitude profiles for takeoff and landing operations. The INM database contains standard noise and performance data for more than one hundred different fixed-wing civilian aircraft types. The program automatically accesses the applicable noise and performance data for departure and approach operations by those aircraft. For aircraft not included in the database, the FAA maintains a list of acceptable "substitutes".

Airfield elevation and average temperature have an effect on aircraft performance; these are accounted for in INM 7.0. Aircraft departing an airport with a high temperature and/or a high elevation must use more thrust than at lower temperatures and elevations. The performance data used by the INM define the length of the takeoff roll (based on aircraft takeoff weight), the climb rate, and speeds for each flight segment.

5.1.2 Airport Layout Data

The INM requires the following airfield layout related inputs:

- Runway orientations
- Runway lengths
- Runway end elevations
- Start-of-takeoff-roll points on each runway
- Landing touchdown points on each runway

- Runway threshold crossing heights
- Runway approach slopes
- Annual average temperature, pressure, relative humidity, and runway-specific headwinds

5.1.3 Aircraft Operational Data

The INM requires the following aircraft operational inputs:

- Number of aircraft operations
- Aircraft fleet mix
- Day-night split of operations
- Runway utilization
- Flight track geometry and utilization

5.2 Preparation of INM-input Files

To simplify the task of manually collecting, refining, and entering the enormous amount of data related to a full year of activity at an airport, the standard method of applying the INM involves development of operational inputs for activity on the average annual day and calculating the CNEL for that prototypical day, which is mathematically the same as the CNEL for the total year. This approach, which has been used to produce all the previous quarterly report contours, meets accepted professional standards, but requires a certain amount of consolidation and simplification. It also does not take advantage of the investment that the Port of Oakland has made in installing and maintaining a state-of-the-art ANOMS™, which automatically collects flight track data and flight identification data for a majority of all operations at the airport.

As directed by the Port, HMMH prepared the INM input files through the use of our proprietary INM pre-processor, "RealContours™", which takes maximum possible advantage of both the INM's capabilities and the investment that the Port has made in operations monitoring. RealContours™ automates the process of preparing the INM inputs directly from the flight operations monitoring results, to permit airports to model the full diversity of activity as precisely as possible. Rather than modeling a single annual-average day, RealContours allowed the determination of daily noise exposure from actual OAK flight operations for a total of 365 days[5].

RealContours™ improved the precision of modeling by utilizing operations monitoring results in four key areas:

1. It directly converts the flight track for every identified aircraft operation to an INM track, rather than assigning all operations to a limited number of prototypical tracks.
2. It models each operation on the specific runway that it actually used, rather than applying a generalized distribution to broad ranges of aircraft types.
3. It uses each aircraft's actual climb performance on departure to select the "best-fitting" standard profile for that aircraft type in the INM database.

[5] RealContours found a total of 365 days of complete and accurate flight track data from ANOMS™ to develop 365 daily CNEL contour sets using actual flight tracks and operations to compile and derive the annual contour. This compares to modeling a single annual-average day using modeled flight tracks and operations.

4. It selects the specific airframe and engine combination to model, on an operation-by-operation basis, based on the published composition of the fleets of the specific airlines operating at OAK, resulting in a far more detailed and truly representative fleet mix.

RealContours™ did not modify any of the noise and performance data in the INM, nor did it modify the computational algorithms. The FAA has reviewed RealContours™ and has stated that the FAA does not require any special approvals for applying the INM.

The following subsections summarize the noise modeling inputs for January 1, 2007 through December 31, 2007 operations at OAK.

5.2.1 Annual-average airport operations, aircraft fleet mix and time of day

RealContours™ assigned INM types based on the FAA code associated with each flight. For commercial operations, selection of the specific INM aircraft type was accomplished by using the fleet mix of each airline. This information permits a rational and representative selection of INM aircraft types. In cases where multiple INM types are available for a single FAA code, RealContours™ chooses the INM type using a random process, with weightings corresponding to the number of each aircraft type operated by that particular airline.

A comprehensive list of all aircraft types and annual-average daily operations by aircraft type in each aircraft category is provided in Table 7: Air Carrier, Regional/Corporate Jets, General Aviation, Helicopters, and Military.

To take into account the penalties applied to evening and nighttime operations, all INM input must be coded as occurring either in the day, evening or at night. RealContours™ used the time recorded in the operations data for calculating sound exposure. Operations between 7 a.m. and 7 p.m. are un-weighted. When the time of the operation is between 7 p.m. and 10p.m., the operation is considered to be an evening operation and a weighting factor of 3 times the noise energy is added in the computation of CNEL by the INM. When the time of the operation is between 10 p.m. and 7 a.m., the operation is considered to be a nighttime operation and a weighting factor of 10 is added in the computation of CNEL by the INM. RealContours™ provides a highly accurate basis for determining the day-night split, because it is based on the actual times of operation as recorded in the ARTS data, rather than airline schedules.

Table 7 Annual-Average Daily Airport Operations by Aircraft Type

Air Carrier		Regional/ Corporate Jets		Propellers/ Non-Jets		Helicopters		Military	
A/C Type	Daily Ops	A/C Type	Daily Ops	A/C Type	Daily Ops	A/C Type	Daily Ops	A/C Type	Daily Ops
727EM1	0.175	CIT3	0.611	1900D	0.038	A109	0.025	C130	0.038
727EM2	9.263	CL600	2.986	BEC58P	8.499	B206L	4.192	C17	0.011
727Q7	0.003	CL601	20.523	CNA172	24.060	B212	1.910	F5E	0.005
727Q9	0.008	CNA500	3.981	CNA206	7.296	B222	0.003	F16GE	0.011
727Q15	0.003	CNA55B	0.003	CNA20T	2.058	BO105	0.871	F-18	0.030
727QF	0.047	CNA750	2.299	CNA441	8.816	CH47D	0.003		
737300	114.033	EMB145	1.425	COMSEP	0.079	EC130	0.003		
7373B2	17.279	EMB14L	3.770	CVR580	0.016	H500D	0.203		
737400	11.189	FAL20	0.153	DC3	0.038	S76	3.611		
737500	6.603	FAL50	1.326	DC6	0.058	SA365N	0.022		
737700	155.310	FAL900	2.282	DHC6	17.984				
737800	15.189	GII	0.405	DHC8	2.995				
737900	1.584	GIIB	1.740	DHC830	0.748				
737N17	0.142	GIV	3.696	EMB120	0.038				
737N9	0.132	GV	11.688	GASEPF	20.578				
74710Q	0.058	IA1125	2.562	GASEPV	31.340				
747200	0.005	J328	0.279	HS748A	0.981				
74720A	0.003	LEAR25	0.384	PA28	6.893				
74720B	0.315	LEAR35	11.392	PA31	14.921				
757300	0.244	MU3001	12.353	SD330	5.751				
757PW	6.068								
757RR	1.655								
767300	6.104								
767400	0.014								
767CF6	1.216								
767JT9	0.175								
777200	0.003								
A300-622R	11.307								
A310-304	3.123								
A319-131	7.348								
A320-211	0.860								
A320-232	36.540								
A330-301	0.003								
A330-343	0.003								
A340-211	0.005								
DC1010	12.707								
DC1030	4.142								
DC86HK	0.068								
DC870	0.011								
DC93LW	0.159								
DC95HW	0.025								
DC9Q9	0.003								
L10115	0.005								
MD11GE	5.071								
MD11PW	2.518								
MD81	0.148								
MD82	4.614								
MD83	10.921								
MD9025	1.025								
Air Carriers	447.425	Regional/ Corp Jets	83.858	Propellers / Non-Jets	153.186	Helos	10.841	Military	0.096
Source: RealContours™ January 1, 2007 through December 31, 2007									

5.2.2 Annual runway utilization

Runway utilization depends on several factors, including:

1. In general, pilots take off and land into the wind. Lighter aircraft are particularly sensitive to wind. The stronger the wind is, the more it has to be taken into account.
2. Flight origins and destinations can affect runway selection to the extent that one runway end offers a shorter flight and/or ground taxi time. Flight purpose can be an issue if the tower segregates one or more types of activity, such as touch-and-go training operations.
3. OAK, like many airports, has a noise abatement program that establishes recommended runway use priorities.
4. The pilot has ultimate decision authority over which operational runway, he or she will use.

As discussed in Section 5.1 the standard application of the INM involves application of runway use and track use percentages for three or four categories of aircraft types with similar performance characteristics. Few airports collect detailed runway use data. Prior to incorporating RealContours™ into the quarterly reporting process, the INM users (under contract to the Port) based runway use percentages on relatively small samples of radar data, reviews of wind data, interviews with airport staff, pilots, FAA ATCT staff, and other appropriate personnel, and other relatively limited sources. Another advantage of RealContours™ is that it bases the runway use on a very large, accurate, and objective data sample. In addition, it is highly sensitive to differences in runway use related to day and night, aircraft type, and arrival and departure.

Table 2 summarizes the observed runway utilization rates, collapsed into major aircraft type categories: (1) air carrier/ large jet, (2) regional jet, (3) corporate jet, (4) turbo-propeller, (5) piston propeller aircraft, and (6) military, respectively. RealContours™ modeled each aircraft operation on the individual flight track found in the ANOMS™ sample, thus each aircraft type has unique runway utilization.

5.2.3 Flight track geometry and utilization

Prior to incorporating RealContours™, the standard application of the INM involved the use of a relatively limited number of prototypical flight tracks (on the order of 50 to 100 is common for an airport like OAK). Operations are assigned to these tracks on a percentage basis, based on factors such as origin and destination, aircraft performance, and any available flight track samples or other records.

The RealContours™ approach used every available flight track in the radar sample. As discussed in Section 3, the OAK ANOMS database includes flight tracks with associated flight identification data for 253,823 operations from a total of 365 days modeled. RealContours™ permitted HMMH to model operations on every one of these tracks.

The use of such a large number of tracks from actual operations spread over the entire year ensures that the modeling is extraordinarily objective and sensitive to dispersion of tracks associated with such factors as weather conditions, air traffic conditions, air traffic controller preferences, aircraft performance, pilot technique, etc.

5.2.4 Annual-average weather conditions

Weather data were obtained from the National Oceanic and Atmospheric Administration; National Climatic Data Center for a 1-year period for OAK and these values were used in the INM for computing the annual noise exposure map.

5.3 Annual Noise Exposure Map

The Integrated Noise Model (INM), Version 7.0, was used to prepare the OAK Annual CNEL noise exposure map shown in Figure 1 based on the aircraft noise level and airport operational factors described in the previous sections. The FAA Integrated Noise Model (INM) incorporates a comprehensive set of computer routines for calculating noise exposure contours around airports. Consistent with FAA policy, HMMH used the most current release of the model, INM Version 7.0, to prepare the full rolling year ending with the fourth quarter 2007 contours.

RealContours™ developed INM input files for each day of radar data, 365 total modeled days. These input files were run through the INM and then the results are stored for use by the system. The input and output files are saved in a compressed file which provides complete documentation of each run.

Stored in the file are:

- Track names and geometry files
- Runway names and geometry files
- Operation data for that run
- Case file which contains all options selected and weather conditions used
- INM error files (if any are generated)
- Aircraft and related files (in case there are used defined aircraft)
- Output files (contour and specific points)

These files were reviewed for accuracy. RealContours™ also stores an audit control database in its system which keeps a record of all of the cases run, their selected options and weather conditions used. The resulting Annual CNEL Noise Exposure Map is displayed in Figure 3.

The predicted 65 dB CNEL contour was plotted on an ArcView map of the area surrounding the airport, as shown by Figure 1. The CNEL contours prepared for current annual average operations at OAK describe the airport noise environment within the requirements of the California Airport Noise Regulations.

The contour map was used to determine the number of dwelling units included within the Noise Impact Boundary defined by the California Airport Noise Regulations. For this analysis, it was assumed that a parcel was affected if it included an incompatible land use, and if any portion of the parcel was included in the 65 dB CNEL contour. Land use was determined from the AutoCAD parcel map prepared by the Port of Oakland, which was imported into ArcView. Based upon these data and in congruence with the previous reports, no incompatible residences exist within the current Noise Impact Boundary.

5.4 Validation of Noise Exposure Map

The INM calculated the predicted CNEL values at each of the current noise monitoring sites. Table 8 compares the measured and predicted CNEL values at each RMT location.

Table 8 Measured and Predicted Aircraft Annual CNEL Values

RMT No.	RMT Name	Measured CNEL (A)	Modeled[1] CNEL (B)	Difference (B-A)
1	Oro Loma San. Dist[2]	66	66	0.1
2	San Leandro Marina[3]	58	57	-0.6
3	Fernside	51	52	0.9
4	Godfrey Park	59	59	0.4
5	Garden Isle[3]	61	60	-0.4
6	Wake Lane[3]	62	61	-1.1
7	Fire Station[3]	61	61	-0.1
8	Earhart School	58	55	-3.1
9	Doolittle Drive[3]	61	63	2.0
10	Tudor Court	53	56	2.8
11	John Muir School	54	58	4.2
12	Garfield School	54	54	-0.2
13	SLUSD Admin Office	44	49	5.2
14	Washington School	45	47	1.3
15	Beach Road[3]	59	60	0.8

Notes: 1 Modeled using INM 7.0
2 Location within 65 dB CNEL contour
3 Location within 60 dB CNEL contour

Source: Port of Oakland ANOMS™ January 1, 2007 through December 31, 2007 and RealContours™ 4Q2007 Model.

Since only one location is within the 65 dB CNEL contour (RMT 1), it is difficult to determine the validity of the noise impact boundary with only the RMTs measuring an annual CNEL of 65 dB. Therefore, we also reviewed results at RMT 2, 5, 6, 7, 9, and 15 to assist with the assessment of the noise impact boundary as modeled using INM 7.0. Regardless, RMT 1 provided validation of the maximum extent of the noise impact boundary to the east of the South Field as the measured and modeled levels agreed to within less than 0.5 dB.

5.4.1 South Field Contour Validation

RMT 1 measured an annual CNEL that was only 0.1 dB less than the modeled CNEL at that location. Therefore, the lobe extending to the east southeast (predominant south runway arrival lobe) is extremely accurate as modeled.

RMT 2 measured an annual CNEL 0.6 dB above the modeled CNEL at that location. Previous reports commented that this difference is likely due to over water sound propagation. Sound propagates more efficiently over water than grass, which is the ground cover assumed in the INM. Therefore, the INM would under predict noise levels from ground operations at a receiver location on the other side of a body of water from the aircraft. This anomaly would affect the lobes on either side of Runway End 29 extending behind the start-of-takeoff roll. However, even with a 0.6 dB

correction, the 65 dB CNEL impact boundary does not extend beyond the water body. As a result, no adjustment is required to the lobes behind the start-of-takeoff roll on Runway 29 to account for the over water sound propagation effect.

Since no RMT's exist within the 65 dB CNEL contour on the opposite side of the airport (the predominant departure end of the south runway), we used the 60 dB contour to compare to measured levels at RMT 5, 6, and 7 to validate the shape and size of the predominant departure lobe. As noted in Table 8 above, the measured noise level was within 1 dB of the modeled levels at each of these RMT locations. Therefore, no adjustment to the 65 dB CNEL noise impact boundary is required on Runway End 11.

5.4.2 North Field Contour Validation

Due to the relatively small noise impact boundary associated with North Field operations, only RMT locations 9 and 15 were used to validate the 65 dB contour for North Field. RMT 9 and 15 are to the east and west, respectively, of North Field and have measured annual noise levels of around 60 dB. The modeled annual noise level at RMT 15 was less than 1 dB over the measured level, which implies that the operations are accurately modeled. The modeled annual noise level at RMT 9 was actually over 2 dB higher than the measured level for which there is no understanding at this time. Since the modeling produces a noise impact boundary that is slightly larger than the measurement would dictate in this area and since the larger boundary still includes no noise sensitive properties, OAK opts to report the larger boundary.

6 SINGLE-EVENT AIRCRAFT NOISE LEVELS

A comparison of measured and predicted singe-event noise levels for operations of selected aircraft (those contributing over 0.25% to the total CNEL) at RMT 5 for the 12-month period from January 1, 2007 through December 31, 2007 is presented in Table 9 on the following page. The loudest average measured and predicted single-event noise level (112 dB SEL and 113.2 dB SEL, respectively) was produced by the B727, which is the Boeing 727 series (hushkit). The aircraft that contributed the most to the annual CNEL (due to the number of operations in combination with the associated noise levels) were the B737 and B733, which are the Boeing 737-700 and 737-300 series aircraft.

Table 9 Single-Event Noise Levels by Aircraft Type and Contribution to CNEL

Aircraft Type	Total Modeled Operations[1]	Measured SEL Range (dB)[1]	Predicted SEL Range (dB)[2]	Estimated CNEL Contribution[2]	
				(dB)	(%)
B737	28648	70 - 97	65 - 98	52	12.04%
B733	23755	70 - 98	66 - 99	50	9.29%
B727	**1804**	**71 - 112**	**65 - 113**	**50**	**9.24%**
MD11	1380	71 - 91	67 - 98	50	8.13%
MD83	1964	70 - 106	76 - 107	49	7.16%
DC10	3213	70 - 93	66 - 111	49	7.15%
2Prop	5374	70 - 103	65 - 97	48	5.03%
A320	6847	70 - 98	70 - 97	47	4.55%
B763	1150	71 - 103	67 - 103	47	4.37%
MD82	872	70 - 106	75 - 106	47	4.37%
A306	2142	71 - 98	65 - 104	47	4.36%
MonoPis	13824	70 - 100	65 - 91	46	3.23%
2Pist	4316	71 - 95	65 - 91	45	2.84%
B738	2885	70 - 100	66 - 99	45	2.68%
LRJ	2028	71 - 109	65 - 112	45	2.45%
A310	560	72 - 97	70 - 81	43	1.69%
B752	1426	71 - 96	65 - 94	43	1.68%
B734	2022	71 - 98	70 - 102	41	1.10%
A319	1372	70 - 100	67 - 100	40	0.91%
BE40	2186	71 - 100	65 - 97	40	0.86%
B747	146	72 - 91	65 - 92	39	0.72%
GLF2	387	71 - 105	65 - 101	39	0.69%
DC9	35	74 - 107	71 - 105	39	0.61%
B762	267	71 - 88	66 - 87	38	0.53%
MD81	20	72 - 93	83 - 91	37	0.44%
C500	701	71 - 96	65 - 92	37	0.43%
CL60	4113	71 - 98	65 - 92	37	0.39%
B732	53	82 - 104	82 - 106	36	0.36%
B735	1199	71 - 89	71 - 82	36	0.33%
F900	391	71 - 101	66 - 100	36	0.30%
FA50	236	71 - 102	72 - 100	35	0.28%
HELO	1399	71 - 96	65 - 96	35	0.25%

Note: Bold Text indicates loudest measured single-event

Source: 1. Port of Oakland ANOMS™ January 1, 2007 through December 31, 2007
2. RealContours™ January 1, 2007 through December 31, 2007

APPENDIX A FOURTH QUARTER 2007 MONTHLY CNEL SUMMARIES

A.1 October 2007 Measured CNEL Values

October	RMT Location Number														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	65	55	51	58	58	59	60	58	61	49	54	52	40	45	58
2	66	59	55	59	60	61	61	58	62	54	53	54	40	46	60
3	66	57	51	62	62	62	62	59	61	53	54	53	38	47	60
4	67	58	54	59	61	62	63	59	62	55	55	56	47	42	60
5	66	58	55	59	61	62	61	59	61	55	55	54	46	48	60
6	64	53	51	56	59	60	60	56	57	49	50	51	36	49	58
7	63	52	49	56	59	60	60	55	56	52	49	49	42	42	58
8	64	54	50	56	58	60	60	58	59	52	52	52	40	47	59
9	63	62	53	60	61	60	60	59	60	54	53	57	50	46	60
10	66	58	50	61	63	63	63	60	60	53	55	56	37	49	61
11	67	57	52	60	62	63	62	60	61	56	54	55	47	44	61
12	67	64	53	61	62	61	61	60	63	57	58	59	46	42	60
13	64	57	48	58	60	61	61	56	57	47	46	51	41	42	58
14	63	52	49	57	59	60	61	56	58	50	51	50	25	44	57
15	66	56	53	63	65	63	62	59	61	53	57	52	39	42	65
16	67	60	55	60	61	62	62	60	61	54	55	54	42	42	60
17	66	58	54	62	61	62	63	60	63	56	56	56	34	49	60
18	66	57	53	61	62	63	62	60	60	53	52	55	42	43	61
19	67	59	52	66	62	64	63	60	61	53	53	55	39	42	62
20	65	58	48	57	60	60	60	55	57	50	51	52	40	42	58
21	62	53	49	59	57	58	59	53	59	51	51	50	35	39	58
22	63	53	50	57	57	58	59	58	60	55	56	51	42	44	58
23	65	55	53	58	59	60	61	58	61	55	51	53	35	42	59
24	65	57	53	59	60	61	61	58	60	52	53	54	47	54	60
25	66	57	55	60	61	62	63	60	63	54	57	54	38	46	60
26	66	57	52	60	61	63	63	60	62	54	56	54	40	46	60
27	63	57	51	59	60	61	61	57	58	53	51	53	42	42	59
28	62	51	49	56	57	59	60	55	58	49	51	49	45	42	57
29	63	53	51	56	58	60	60	57	60	50	52	52	28	43	57
30	63	55	52	63	62	63	62	59	61	52	54	54	36	40	61
31	63	54	50	57	58	59	59	59	63	53	54	52	43	45	58
Average	65	57	52	60	61	61	61	58	61	53	54	54	43	46	60
No. Day	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31
Source: ANOMS™ October 1, 2007 through December 31, 2007															

A.2 November 2007 Measured CNEL Values

November	RMT Location Number														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	65	55	48	59	58	60	60	59	61	55	53	53	36	44	58
2	63	57	52	62	61	63	61	58	59	53	53	55	41	45	61
3	63	57	50	54	57	58	59	55	57	47	48	51	47	42	57
4	63	58	49	57	58	59	60	54	54	49	46	49	31	33	58
5	64	55	50	61	61	61	61	59	63	56	57	54	43	45	62
6	67	57	50	60	61	61	61	60	60	50	51	52		41	60
7	65	57	47	57	58	60	60	58	59	50	51	55	31	39	58
8	66	58	52	60	61	62	62	60	61	55	57	54	39	47	61
9	66	57	53	60	61	62	63	59	60	52	55	56	43	41	61
10	63	60	48	59	61	61	60	60	57	49	50	56	36	40	59
11	64	56	49	53	57	59	60	56	57	51	53	51	41	41	56
12	65	54	50	55	57	59	60	56	59	51	55	52	41	39	57
13	66	58	52	59	61	62	61	59	62	49	54	54	41	45	60
14	66	57	54	60	61	61	62	59	59	50	54	53	41	41	62
15	66	60	52	60	61	61	62	60	64	54	54	54	42	48	61
16	67	57	51	60	60	60	61	59	62	49	54	54	37	44	59
17	65	54	49	57	59	60	60	57	59	52	51	50	35	43	58
18	63	52	46	54	57	59	60	54	60	51	53	49	29	33	56
19	66	57	51	60	60	60	61	59	58	51	54	53	38	43	59
20	66	58	56	61	62	62	62	60	60	54	55	53	42	40	61
21	65	56	51	58	60	61	61	59	59	55	53	55	25	45	60
22	62	51	42	50	54	56	57	50	58	47	50	50	33	41	54
23	62	56	49	57	56	57	57	54	54	48	46	52	32	43	57
24	62	59	46	55	56	58	58	54	57	54	49	52	26	35	57
25	63	53	49	56	58	59	60	54	59	47	51	51	35	40	58
26	64	56	53	59	59	60	60	58	60	58	55	53	47	44	59
27	66	60	56	60	61	62	62	59	61	52	55	56	36	46	60
28	64	56	51	60	60	60	60	59	61	53	53	55	48	47	59
29	66	60	52	60	60	62	61	60	60	53	55	55	30	46	61
30	66	58	50	60	61	62	61	60	60	53	54	54	44	48	60
Average	65	57	51	59	60	61	61	58	60	52	53	53	41	44	59
No. Day	30	30	30	30	30	30	30	30	30	30	30	30	29	30	30
Source: ANOMS™ October 1, 2007 through December 31, 2007															

A.3 December 2007 Measured CNEL Values

December	RMT Location Number														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	64	57	51	56	60	61	61	56	57	47	51	55	39	44	58
2	61	63	49	60	58	56	56	59	56	55	47	57	46	45	58
3	64	63	48	58	59	59	58	58	59	52	50	58	44	43	58
4	67	64	51	0	61	61	61	59	63	56	55	57	46	44	60
5	67	58	51	61	64	63	62	59	62	53	55	54	45	45	61
6	65	63	49	61	62	61	61	62	60	54	52	61	52	41	60
7	68	62	52	60	62	63	62	66	60	52	56	56	39	45	61
8	64	55	48	55	59	60	59	55	59	52	50	55	44	43	58
9	63	54	52	55	57	59	60	54	62	51	55	52	35	43	56
10	64	55	50	57	58	59	59	58	59	53	54	52	37	49	58
11	64	53	53	61	61	61	60	59	58	52	49	53		44	61
12	65	58	52	60	60	61	61	60	59	50	52	56	27	46	61
13	66	60	51	60	60	62	61	59	58	53	55	54	45	45	60
14	67	60	54	60	61	62	62	61	61	54	55	56	33	47	61
15	65	57	52	60	60	62	61	58	57	51	54	36	42	44	60
16	61	61	50	57	59	59	59	55	57	51	50	55	44	42	57
17	60	61	51	60	59	58	59	60	61	58	54	59	52	45	59
18	67	66	48	60	62	62	62	61	61	56	56	60	52	44	60
19	65	63	53	61	62	62	61	60	59	53	54	57	47	42	61
20	68	62	53	60	63	63	62	60	65	58	58	58	42	48	61
21	67	62	51	60	62	62	62	59	61	52	53	55	55	44	61
22	64	55	48	56	60	60	60	55	57	50	51	53	40	40	59
23	64	58	50	55	59	60	60	55	58	50	52	51		37	57
24	64	53	48	56	57	58	59	55	55	51	46	50	35	41	57
25	62	61	41	51	56	57	58	49	59	49	52	52		26	55
26	66	57	51	59	61	61	60	58	58	52	53	53	35	46	60
27	63	62	52	60	60	59	59	54	59	56	53	56	45	46	60
28	67	63	51	59	61	61	61	60	61	57	58	58	54	48	60
29	65	63	45	59	60	61	60	59	58	49	54	57	43		59
30	63	54	48	56	58	59	59	57	58	48	51	50	37	42	57
31	57	58	51	57	54	54	54	55	55	52	49	51	38	41	55
Average	65	61	51	59	60	61	60	59	60	53	54	56	47	45	59
No. Day	31	31	31	31	31	31	31	31	31	31	31	31	28	30	31
Source: ANOMS™ October 1, 2007 through December 31, 2007															