

APPENDIX E
NASL NOISE INFORMATION
NAS LEMOORE JOINT LAND USE STUDY (JLUS)

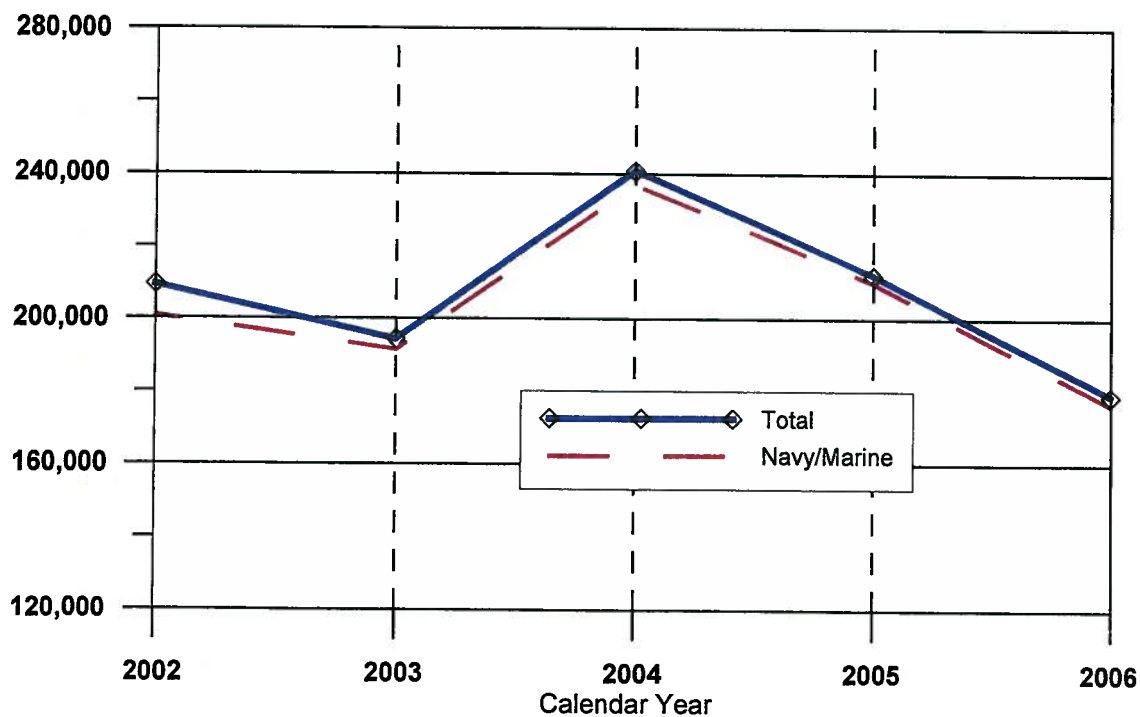


Annual Flight Operations at NAS Lemoore

Calendar Year	Military		Civil		Total
	Navy / Marine	Other	Air Carrier	General Aviation	
2006	176,263	1,186	7	1,448	178,904
2005	209,904	828	13	1,257	212,002
2004	236,805	2,314	47	1,610	240,776
2003	191,626	1,278	17	1,459	194,380
2002	201,083	2,226	537	5,615	209,461

TYPE OF OPERATION	Was Counted As:	
	One Operation	Two Operations
A Touch and Go	NO	YES
An Overhead Break	YES	NO
A Low Approach and Go Around	NO	YES

Source: NAS Lemoore, 2007



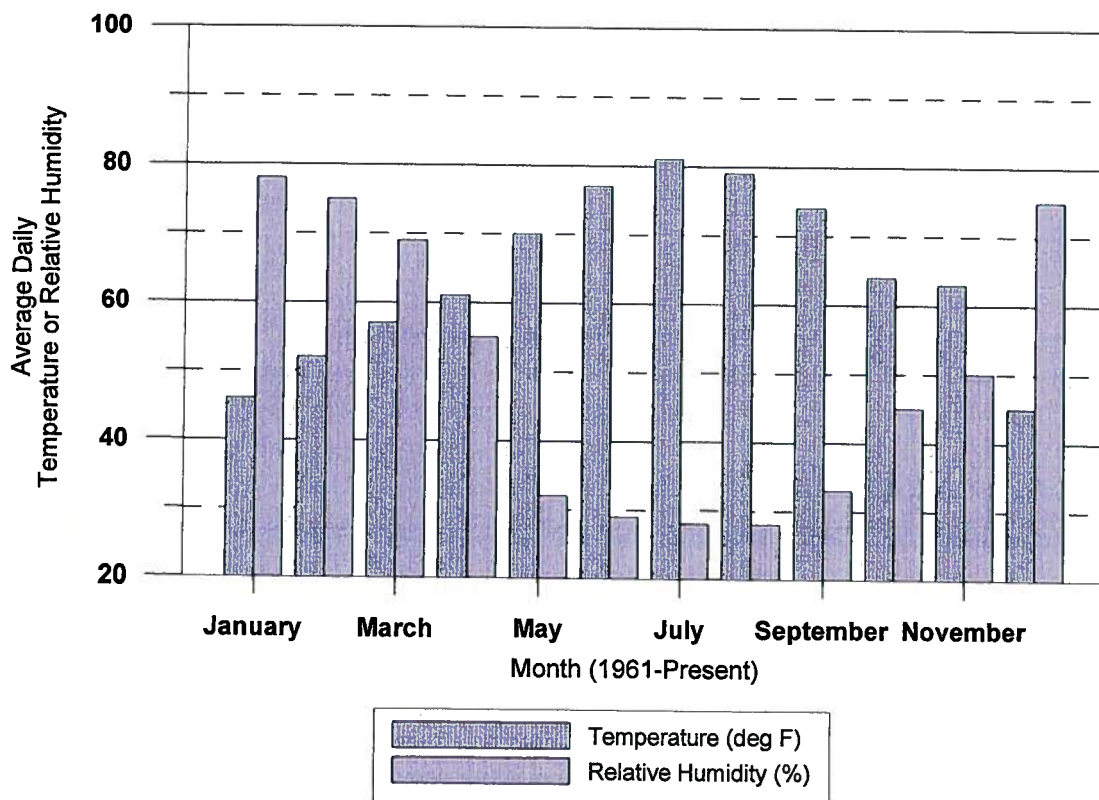
Source: NAS Lemoore ATC (tower counts +primary radar ops)

Figure 3-4. Annual Flight Operations at NAS Lemoore

Climatic Data

Because weather is an important factor in the propagation of noise, the computer models require input of the average daily temperatures in degrees Fahrenheit (degrees F), percent relative humidity (% RH) and station pressure in inches of mercury (in Hg) for each month of a year. Climatic information was provided by the NAS Lemoore weather department and from Navy and public websites.

Figure 3-3 shows the monthly average temperature and relative humidity (RH) from 1961 to the present. In the summer months, Lemoore is warm and dry with cloudless skies. With summer temperatures ranging from 72 degrees F to 114 degrees F, average monthly temperatures are between 60 and 80 degrees F and most average monthly humidity values are below 40%RH. Heavy ground fog occurs for about six to eight weeks every winter creating extremely hazardous driving and flying conditions. Average monthly temperatures fall between 40 and 60 degrees F and most humidity is between 60 and 80%RH during the winter months. NASL receives about nine inches of rain per year (globalsecurity.org). The station pressure averages 29.91 inHg. Prevailing winds are from the northwest with an average speed of six miles per hour. NOISEMAP's BaseOps program computes sound absorption coefficients for each month and selects the sixth highest coefficient for the purposes of noise exposure modeling (US Air Force, 1992). The modeled conditions computed by the BaseOps program correspond to November with values of 63 degrees F and 50%RH.



Source: NAS Lemoore, 2007.

Figure 3-3. Average Daily Temperature and Relative Humidity at NAS Lemoore

Table 4-2 Annual Flight Operations for Baseline Scenario

Operation Type	Day	Evening	Night	Total	Day	Evening	Night	Total
Departure	684	73	6	763	214	43	15	272
Straight-In Arrival	138	18	2	158	236	35	2	273
Overhead Break Arrival	597	7	0	604	0	0	0	0
Touch and Go*	651	77	15	743	385	53	5	443
FCLP*	0	0	0	0	0	0	0	0
GCA Box*	1,219	136	7	1,362	305	38	0	343
Total	3,289	311	30	3,630	1,140	169	22	1,331

Operation Type	Transient/Based Prop ^{1,2}				Transient/Based GA ^{1,2}			
	Day	Evening	Night	Total	Day	Evening	Night	Total
Departure	398	35	4	437	579	38	8	625
Straight-In Arrival	357	57	11	425	536	75	15	626
Overhead Break Arrival	11	0	0	11	0	0	0	0
Touch and Go*	646	107	33	786	1,853	316	70	2,239
FCLP*	0	0	0	0	0	0	0	0
GCA Box*	107	18	5	130	202	54	7	263
Total	1,519	217	53	1,789	3,170	483	100	3,753

Operation Type	All Aircraft			
	Day	Evening	Night	Total
Departure	43,601	4,877	501	48,979
Straight-In Arrival	7,117	1,461	406	8,984
Overhead Break Arrival	34,476	3,945	1,576	39,997
Touch and Go*	31,357	3,465	1,741	36,563
FCLP*	27,184	28,510	10,608	66,302
GCA Box*	4,877	3,220	1,081	9,178
Total	148,612	45,478	15,913	210,003

Source: TEC

* Patterns counted as 2 operations

** Twr counts yield CY02-06 avg of 98% W/M;

¹ Not Modeled.

² per WR 97-16, Scenario 1 (211,000 ops total) factored by 90% for transient sum to be 5% of Grand Total

Day = 0700-1900 Local

Eve = 1900-2200 Local

Night = 2200-0700 Local

Table 5-4 Sound Exposure Levels and Maximum Sound Levels for Representative Flight Conditions at NAS Lemoore

**Table 5-4
Sound Exposure Levels and Maximum Sound Levels for Representative Flight Conditions at NAS Lemoore**

Condition ⁽²⁾	F/A-18C/D				F/A-18E/F				F-35C ⁽¹⁾			
	Power %NC	Speed (knots)	SEL (dBA)	L _{max} (dBA)	Power %NC	Speed (knots)	SEL (dBA)	L _{max} (dBA)	Power %ETR	Speed (knots)	SEL (dBA)	L _{max} (dBA)
Departure through 1000 ft AGL ^(4, 5)	97	300	117	108	97	250	118	113	100	300	117	114
Departure through 10,000 ft MSL (prior to Hwy 41) near CNEL Contour Differences ⁽⁴⁾	97	310	92	77	97	350	92	83	100	350	92	84
Non-Break Arrival through 1800 ft MSL (near Initial Points) ⁽⁶⁾	88	135	105	98	85	135	110	103	35 ⁽³⁾	170	96	91
FCLP on Downwind (600 ft AGL) ⁽⁶⁾	88	135	113	108	85	135	118	113	57	145	113	108
GCA Box mid-downwind (1800 ft MSL; average downwind speed)	83	200	91	85	83	200	102	93	33	200	89	83

Notes:

1) modeled with F-35A (Edwards AFB data 2008)

2) 63 deg F, 50%RH, 29.86 inHg; 234 ft MSL field elevation with relatively flat terrain

3) limited to 38%ETR by noise model

4) No afterburner

6.0 Supplemental Noise Metrics and Analysis

Section 6.1 provides an introduction to the topic and a brief summary of the results. Section 6.2 discusses single-event metrics. Section 6.3 provides general information common to the analyses and the overall methodology. Sections 6.4 and 6.5 discuss the residential speech interference and sleep disturbance analyses and results, respectively. Section 6.6 presents the results of the classroom speech analysis.

6.1 Introduction and Summary

In California, the DoD has long relied on traditional methods of analyzing aircraft noise using the CNEL. As a single-number measure, CNEL does not represent the sound level heard at any particular time and is often misunderstood by the public. DoD land use compatibility for AICUZ and environmental impact documents typically analyze and only show CNEL at levels greater than or equal to 65 dB. Aircraft noise continues beyond the 65 dB CNEL contour line where 12 percent of the population may be 'highly annoyed' by the aircraft noise. At 60 dB CNEL, 6 percent of the population may be 'highly annoyed' with the aircraft noise. Thus it is important to supplement the traditional CNEL analysis with other metrics.

CNEL contours provide broad based land use planning guidance. To provide a more thorough noise analysis for local government leaders and the community to consider in development of the Joint Land Use Plan, purpose of this chapter is to provide supplemental noise analysis with regard to overall average daily noise exposure beyond what it is typically presented in an AICUZ study. This chapter examines the potential for speech interference and sleep disturbance based on the single-event noise metrics such as SEL, L_{max} and NA.

The results of the analysis indicates speech interference and sleep disturbance effects are present in both the Baseline and Prospective operational scenarios but there would be an increase in potential speech interference and sleep disturbance effects in the areas to the east of NAS exposed to noise levels less than 65 dB CNEL for the Prospective scenario. This change is due, in part, to an increase in F/A-18E/F Super Hornet operations. As a result, development to the east in this area is a concern to the Navy and could result in significant noise complaints from those areas. The following analysis provides amplifying information.

6.2 Single-Event Metrics

Table 5-4 lists SEL and L_{max} for representative flight conditions at NAS Lemoore. The legacy Hornet is comparable (within 1-2 dB) in SEL to the F-35C for all of the chosen flight modes except for arrivals where the F-35C is approximately 9 dB SEL less than the legacy Hornet. The Super Hornet is 1 to 14 dB greater in SEL than the F-35C for all of the chosen flight modes except for departures through 10,000 ft MSL where the F-35C is identical in SEL.

6.3 Methodology and Common Parameters

Ten Points of Interest (POI) in the vicinity of NAS Lemoore were identified by the NAS for the purposes of the supplemental analyses of annual average daily aircraft operations at the NAS (Benitez 2010). These are communities nearby NAS Lemoore and could be potential development sites and are

listed in Table 6-1 and shown in Figure 6-1. For the potential residential sites, noise effects included CNEL daytime/evening speech interference and nighttime sleep disturbance.

Table 6-1 List of Points of Interest for NAS Lemoore

Number	Point of Interest		Longitude (West)			Latitude (North)		
	Description	Type	degrees	minutes	seconds	degrees	minutes	seconds
1	Community of Burrel	School and Non-School	36	29	16.40	119	59	39.66
2	Community of Caruthers	School and Non-School	36	32	22.26	119	50	19.60
3	Central Union School	School	36	14	35.65	119	46	50.00
4	College Park Apartments	Non-School	36	18	32.77	119	48	22.76
5	Community of Conejo	School and Non-School	36	31	5.09	119	43	12.54
6	Fairway Homes at Lemoore Golf Course	Non-School	36	16	51.27	119	47	3.43
7	Community of Helm	School and Non-School	36	31	59.46	120	5	58.06
8	Huron Middle School	School	36	11	55.99	120	6	2.48
9	Island Elementary School	School	36	21	41.80	119	50	0.60
10	Community of Lanare	Non-School	36	25	49.91	119	55	55.70
11	Neutra Elementary School	School	36	15	38.20	119	52	59.34
12	Community of Riverdale	School and Non-School	36	25	54.32	119	51	18.77
13	Santa Rosa Racheria homes near Tachi Casino	Non-School	36	14	18.09	119	45	23.38
14	Community of Stratford	School and Non-School	36	11	31.41	119	49	16.22
15	West Hills College	School	36	17	44.13	119	49	1.85

Source: NAS Lemoore except sites number 4, 6, 8, and 13 obtained from aerial photography

The analyses contained herein are consistent with the recent DoD guidelines for the use of supplemental noise metrics (Wyle 2009b). For speech interference, the DoD guidelines recommend the use of the NA metric. NA for outdoor sound levels was computed with a version of NOISEMAP modified to compute NA, the same version used by the DoD guidelines document.

For sleep disturbance, the DoD guidelines recommend the methodology and standard developed by American National Standards Institute (ANSI) and the Acoustical Society of America (ASA) in 2008 to compute the probability of awakening associated with outdoor noise events heard in homes and is a function of indoor SEL. SEL only pertains to flight events. Only CNEL nighttime (10 p.m. to 7 a.m.) events were considered.

NOISEMAP only computes outdoor aircraft noise levels. To convert the outdoor noise levels to indoor values, the outdoor noise levels are adjusted to account for the noise level reduction (NLR) provided by the structure. Structure-specific NLR values are mentioned below.

Consistent with guidance promulgated by the Federal Interagency Committee on Noise (FICON), the NLR for windows open was assumed to be 15 dB and the NLR for windows closed was assumed to be 25 dB (FICON 1992). These values are typical of national averages for potential residential structures.

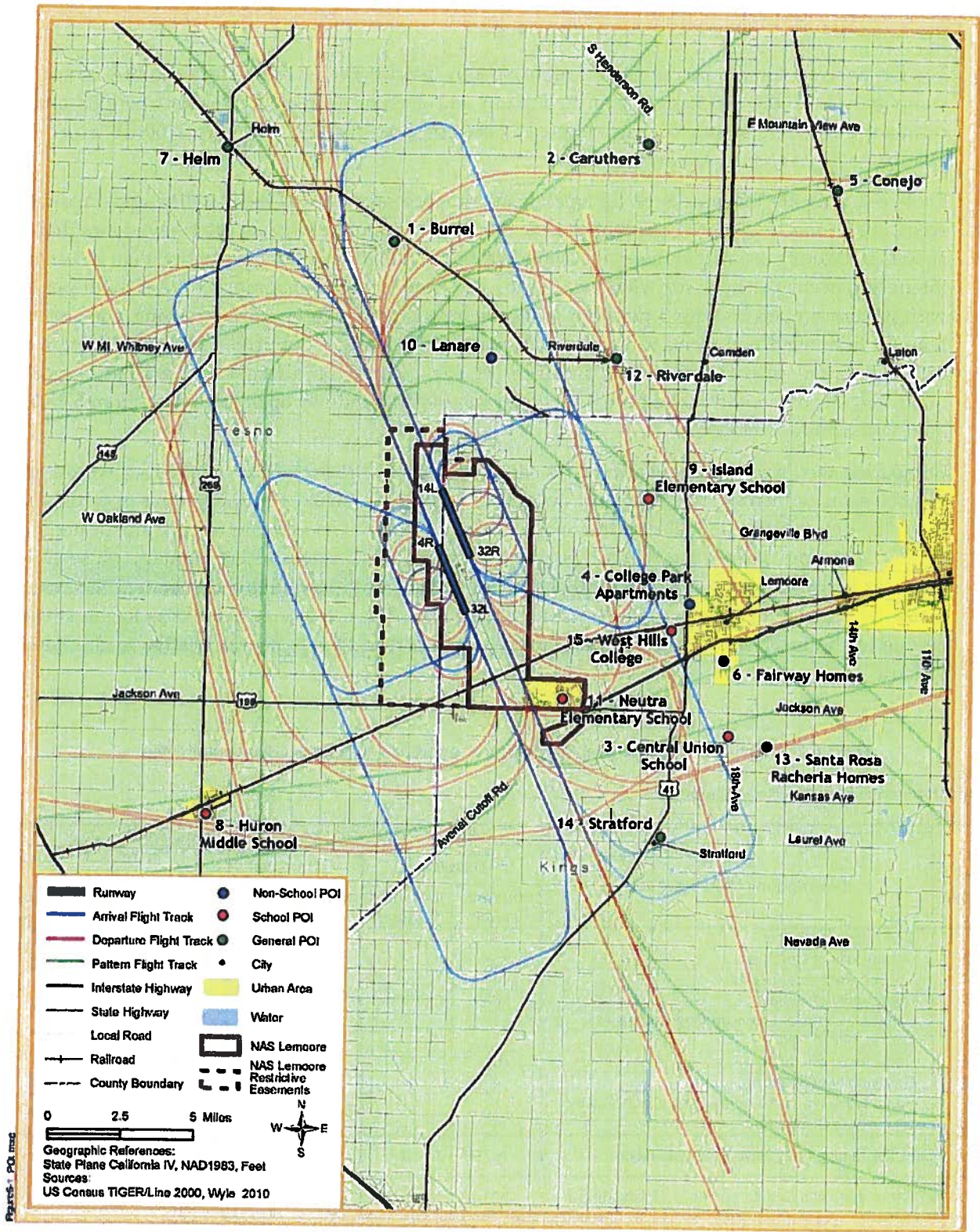


Figure 6-1. Points of Interest

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6.4 Potential for Speech Interference

For the analysis for the potential for indoor speech interference at these sites, the NA metric was computed for CNEL daytime (7 a.m. to 7 p.m.) and evening (7 p.m. to 10 p.m.) periods and the resultant NAs were summed. The selected noise threshold for NA was indoor 50 dB L_{max} . L_{max} pertains to flight and run-up events.

Table 6-2 presents the results of the speech interference analysis for the Baseline and Prospective scenarios for the 10 potential residential sites. For the Baseline scenario, six sites have more than one speech interfering event per hour for windows open and three sites have more than one speech interfering event per hour for windows closed. The interfering events range from 2 to 10 per hour with windows open and are 3 per hour with windows closed. Three sites exceeding one event per hour for both windows open and windows closed are communities of Burrel, Conejo and Lanare. For the Prospective scenario, the same numbers of sites would be affected as Baseline except the interfering events would range from 4 to 10 per hour with windows open and range from 5 to 7 per hour with windows closed.

Comparing the Prospective scenario to the Baseline scenario, the overall NA 50 dB L_{max} would either stay the same or increase by one to four events per hour across all sites with windows open or closed. All of the potential residential sites that would see an increase in speech interference are located north of NAS Lemoore near some of the primary departure flight tracks. The primary cause for the increases between the Prospective and Baseline scenarios would be due to the increased L_{max} created by the F-35C relative to the legacy Hornet for departures. The increase at Santa Rosa Rancheria would be due to the increase in Super Hornet events for the Prospective scenario relative to the Baseline scenario.

Table 6-2 Potential for Daytime/Evening Speech Interference at Potential Residential Sites

Table 2
Speech Interference Results - Non-School Sites

Point Number	Description (All Residential)	Indoor Number of Events per Daytime/Evening Hour*					
		Baseline		Prospective		Increase relative to Baseline	
		Windows Open	Windows Closed	Windows Open	Windows Closed	Windows Open	Windows Closed
1	Community of Burrel	8	3	9	7	1	4
2	Community of Caruthers	6	-	6	1	-	1
4	College Park Apartments	1	-	1	-	-	-
5	Community of Conejo	6	3	6	5	-	2
6	Fairway Homes at Lemoore Golf Course	1	-	1	-	-	-
7	Community of Helm	1	-	1	1	-	1
10	Community of Lanare	10	3	10	6	-	3
12	Community of Riverdale	4	-	6	-	2	-
13	Santa Rosa Rancheria homes near Tachi Casino	2	-	4	-	2	-
14	Community of Stratford	1	-	1	-	-	-
Number of Sites Exceeding 1 Intrusive Event per Hour		6	3	6	3		
Minimum Number of Intrusive Events per Hour if Exceeding 1		2	3	4	5		

6.5 Potential for Sleep Disturbance

Table 6-3 presents the results of the sleep disturbance analysis for the potential residential sites. For Baseline, the probability of awakening ranges from less than 0.5 percent to 10 percent with windows open and ranges from less than 0.5 percent to 5 percent with windows closed. For the Prospective scenario the probability of awakening would range from less than 0.5 percent to 10 percent with windows open and would range from less than 0.5 percent to 6 percent with windows closed.

Comparing the Prospective scenario to the Baseline scenario, two sites would experience a decrease and two would experience an increase in the probability of awakening. College Park Apartments would experience a decrease by one percent for windows open. The reduction at College Park Apartments would primarily be due to the decreased SEL created by the F-35C relative to the legacy Hornet on the downwind leg of GCA Box operations. Stratford would experience a decrease for windows closed for the Prospective scenario. The decrease at Stratford would be due to the relocation of the GCA Box base leg. In the Baseline scenario this leg was located directly overhead of Stratford and was moved approximately 1.5 miles south for the Prospective scenario. The probability of awakening increases for the Prospective scenario by one percent for either windows open or windows closed at Helm and Lanare. The increase at Helm would be due to rounding and only represents a small fraction of a percent change. The increase at Lanare would be due to the increase in Super Hornet events for the Prospective scenario relative to the Baseline scenario.

Table 6-3 Probability of Nighttime (10 p.m. to 7 a.m.) Awakening for Potential Residential Sites

Point Number	Description (All Residential)	Baseline		Prospective		Increase Relative to Baseline	
		Windows Open	Windows Closed	Windows Open	Windows Closed	Windows Open	Windows Closed
1	Community of Burrel	4%	2%	4%	2%	-	-
2	Community of Caruthers	< 0.5%	< 0.5%	< 0.5%	< 0.5%	-	-
4	College Park Apartments	3%	1%	2%	1%	-1%	-
5	Community of Conejo	1%	< 0.5%	1%	< 0.5%	-	-
6	Fairway Homes at Lemoore Golf Course	2%	1%	2%	1%	-	-
7	Community of Helm	2%	1%	3%	1%	1%	-
10	Community of Lanare	10%	5%	10%	6%	-	1%
12	Community of Riverdale	2%	1%	2%	1%	-	-
13	Santa Rosa Rancheria homes near Tachi Casino	4%	2%	4%	2%	-	-
14	Community of Stratford	6%	3%	6%	2%	-	-1%

*NLRs of 15 dB and 25 dB for windows open and closed, respectively

6.6 Potential for Classroom Disturbance

There are 11 schools considered from Table 6-1. Consistent with the DoD supplemental noise metric guidelines, two noise metrics were computed for each school: Equivalent Sound Level (L_{eq}) and $NA L_{max}$. Per the DoD guidelines, an appropriate set of criteria for speech interference in schools is an indoor L_{eq} of 40 dB (for intermittent noise) and a single-event indoor noise level of 50 dB L_{max} . The school day is assumed to last nine hours and would be entirely contained within the CNEL daytime (7 a.m. to 7 p.m.) period. To adjust the numbers of annual average daily daytime operations to reflect those occurring during only school hours (without further information regarding mission scheduling and an hourly count of flights), the CNEL daytime flight and runup operations were multiplied by 9/12 or 0.75 assuming these operations occur evenly throughout the CNEL daytime period.

Table 6-4 contains the results of the classroom speech disturbance analysis for the applicable school sites. For the Baseline scenario, five of the schools exceed the indoor $L_{eq(9h)}$ threshold of 40 dB. Five of the schools, two of which do not exceed the indoor $L_{eq(9h)}$ criteria, have more than one interfering event per school hour. Two of the latter five schools do not exceed the indoor $L_{eq(9h)}$ criteria. The interfering events range from 4 to 9 per hour with windows open and range from 2 to 4 per hour with windows closed. None of the considered schools exceed both criteria with windows closed. Of the considered schools, schools at which both criteria are exceeded (with windows open) are:

- Burrel Elementary School,
- Conejo School, and
- Neutra Elementary School

For the Prospective scenario, six of the schools would exceed the $L_{eq(9h)}$ threshold of 40 dB. Five of the schools, one of which would not exceed the $L_{eq(9h)}$ criteria (Riverdale High School), would have more than one interfering event per school hour. The interfering events would range from 6 to 10 per hour with windows open and range from 2 to 8 per hour with windows closed. None of the considered schools exceed both criteria with windows closed. Schools at which both criteria would be exceeded (with windows open) are:

- Burrel Elementary School,
- Caruthers High School,
- Conejo School, and
- Neutra Elementary School

Comparing the Prospective scenario to the Baseline scenario, $L_{eq(9h)}$ would decrease by 1 dB for one school (Stratford Elementary School), remain constant for three schools (Burrel Elementary, Neutra Elementary and West Hills College) and increase by 1 dB for the other 10 schools. An increase of at least 3 dB is normally considered as noticeable. None of the 10 schools considered would have noticeable increases in $L_{eq(9h)}$ due to the Prospective scenario. The numbers of classroom/speech interfering events would increase by 1 to 4 events per hour independent of the windows condition due to the Prospective scenario, relative to the Baseline case. The primary cause for the largest increases between the Prospective and Baseline scenarios is due to the F-35 departure events.

Table 6-4 Potential for Indoor Classroom Speech Interference at School Sites

Point of Interest		Baseline						Prospective						Increase relative to Baseline					
		Outdoor			Indoor			Outdoor			Indoor			Outdoor			Indoor		
		L _{eq(9h)} (dB)	Events per Hour ⁽¹⁾	L _{eq(9h)} (dB)	Events per Hour ⁽¹⁾	L _{eq(9h)} (dB)	Events per Hour ⁽¹⁾	L _{eq(9h)} (dB)	Events per Hour ⁽¹⁾	L _{eq(9h)} (dB)	Events per Hour ⁽¹⁾	L _{eq(9h)} (dB)	Events per Hour ⁽¹⁾	L _{eq(9h)} (dB)	Events per Hour ⁽¹⁾	L _{eq(9h)} (dB)	Events per Hour ⁽¹⁾	L _{eq(9h)} (dB)	Events per Hour ⁽¹⁾
1	Burrel Elementary School	61	9	46	36	4	62	47	10	37	8	-	-	-	-	-	-	-	-
2	Caruthers High School	55	7	40	30	-	56	41	7	31	1	+1	+1	+1	+1	+1	+1	+1	+1
3	Central Union School	53	1	38	28	-	54	39	1	29	-	+1	+1	+1	+1	+1	+1	+1	+1
5	Conejo School	59	6	44	34	3	60	45	6	35	6	+1	+1	+1	+1	+1	+1	+1	+3
7	Helm Elementary School	48	1	33	23	-	50	35	1	25	1	+1	+1	+1	+1	+1	+1	+1	+1
8	Huron Middle School	38	-	23	13	-	39	24	-	14	-	+1	+1	+1	+1	+1	+1	+1	-
9	Island Elementary School	51	1	36	26	-	52	37	1	27	1	+1	+1	+1	+1	+1	+1	+1	+1
11	Neutra Elementary School	60	6	45	35	2	60	45	10	35	2	-	-	-	-	-	-	-	-
12	Riverdale High School	51	4	36	26	-	52	37	7	27	-	+1	+1	+1	+1	+1	+1	+1	-
14	Stratford Elementary School	60	1	45	35	-	60	45	1	35	-	-1	-1	-1	-1	-1	-1	-1	-
15	West Hills College	57	1	42	32	-	58	43	1	33	-	-	-	-	-	-	-	-	-
Number of Sites Exceeding 1 Intrusive Event per Hour		5						5						5					
Minimum Number of Intrusive Events per Hour if Exceeding 1		4						6						2					
Maximum Number of Intrusive Events per Hour if Exceeding 1		9						10						8					

Notes:

- (1) Number of Annual Average Daily Events per hour during 9 hour school day (0800-1600) At or Above an Indoor Maximum (single-event) Sound Level (L_{max}) of 50 dB;
- (2) NLRs of 15 dB and 25 dB for windows open and closed, respectively
- (3) Does not account for differences between weekday and weekend activity

