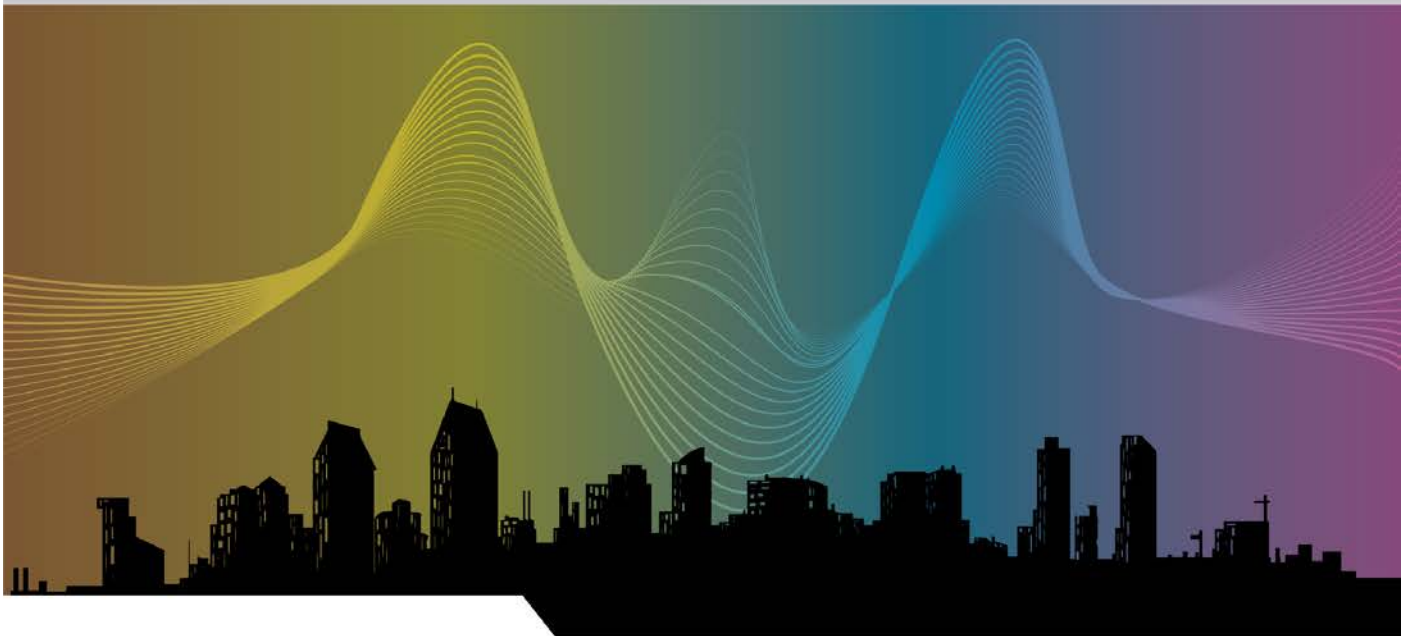


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# Point Loma and Ground Based Aircraft Portable Noise Monitoring

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## Executive Summary

BridgeNet International was contracted by the San Diego International Airport (SAN) Noise Mitigation Office for two tasks involving portable noise monitoring. The purpose of the noise monitoring of Task 1 (Point Loma Portable Noise Monitoring) was to determine the overall average daily noise level from SAN aircraft only, the overall average daily noise level from all other noise and the overall total average noise level at noise monitoring Locations 1 and 2. All other noise refers to non SAN aircraft and any other noise sources occurring throughout the community.

The purpose of the noise monitoring for Task 2 (Ground Based Aircraft Portable Noise Monitoring) was to determine if low frequency noise from aircraft on the ground of the airfield is creating higher low frequency noise levels at noise monitoring Locations 1 and 2. For the purpose of this worst-case analysis, noise from aircraft on the ground means either aircraft arriving and using their reverse thrust or aircraft departing before wheels up.

Three noise monitoring locations were selected with assistance from the Airport Noise Mitigation Office; Location 1 was at Point Loma Nazarene University on the roof of the Rohr Science Building, Location 2 was in the Sunset Cliffs area on Adair Street between Santa Barbara Street and Guizot Street and Location 3 was adjacent to the airfield in between the new rental car facility and near the end of Runway 27.

### Summary of Results for Task 1 – Point Loma Portable Noise Monitoring

The overall average daily noise level from SAN aircraft only for Location 1 ranged between 47 and 51 dB CNEL. The overall average daily noise level from all other noise for Location 1 ranged between 52 and 60 dB CNEL. All other noise refers to non SAN aircraft and any other noise sources occurring throughout the community. The overall total average daily noise level for Location 1 ranged from 54 to 61 dB CNEL.

The overall average daily noise level from SAN aircraft only for Location 2 ranged between 48 and 53 dB CNEL. The overall average daily noise level from all other noise for Location 2 ranged between 50 and 61 dB CNEL. All other noise refers to non SAN aircraft and any other noise sources occurring throughout the community. The overall total average daily noise level for Location 2 ranged from 53 to 61 dB CNEL.

Noise from SAN aircraft did not increase the overall total average daily noise level (58 dB CNEL) at Location 1. Noise from SAN aircraft increased the overall total average daily noise level (57 dB CNEL) at Location 2 by 1 dB.

### Summary of Results for Task 2 – Ground Based Aircraft Portable Noise Monitoring

The data collected for the ground based aircraft portable noise monitoring task did not provide consistent enough results that would indicate that there is a correlation between low frequency ground based aircraft noise at Location 3 from Locations 1 and 2. The majority of the worst-case arrival frequencies are less than the equivalent ambient frequencies at Locations 1 and 2. Some of the worst-case departure frequencies are greater than the equivalent ambient frequencies at Locations 1 and 2 and some are less.

During the two days of monitoring for this task, staff attended each site and it was noted that noise from ground based aircraft events was not audible at Location 1. It was not audible at Location 2 except for between 6 a.m. and 7 a.m. when it was sometimes audible because of a lower ambient noise level.

Reasoning factors for it not being audible could include distance reduction, other community noise, terrain, weather and other shielding effects.

## Background Information

### Characteristics of Sound

Sound can be described technically in terms of amplitude (loudness), frequency (pitch), or duration (time). The standard unit of measurement of the loudness of sound is the decibel (dB). Decibels are based on the logarithmic scale. The logarithmic scale compresses the wide range in sound pressure levels to a more usable range of numbers in a manner similar to the Richter scale used to measure earthquakes.

The human hearing system is not equally sensitive to sound at all frequencies. Sound waves below 16 Hz are not heard at all and are “felt” more as a vibration. Similarly, while people with extremely sensitive hearing can hear sounds as high as 20,000 Hz, most people cannot hear above 15,000 Hz. In all cases, hearing acuity falls off rapidly above about 10,000 Hz and below about 200 Hz. Since the human ear is not equally sensitive to sound at all frequencies, a special frequency-dependent rating scale has been devised to relate noise to human sensitivity. The A-weighted decibel scale (dBA) performs this compensation by discriminating against frequencies in a manner approximating the sensitivity of the human ear. Community noise levels are measured in terms of the A-weighted decibel abbreviated dBA.

### Propagation of Noise

Outdoor sound levels decrease as a result of several factors, including increasing the distance from the sound source, atmospheric absorption (characteristics in the atmosphere that actually absorb sound), and ground attenuation (characteristics on the ground that absorb sound). If sound is radiated from a source in a homogeneous and undisturbed manner, the sound travels in spherical waves. As the sound wave travels away from the source, the sound energy is spread over a greater area dispersing the sound power of the wave.

Temperature and humidity of the atmosphere also influence the sound levels received by the observer. The influence of the atmosphere and the resultant fluctuations increase with distance and become particularly important at distances greater than 1,000 feet. The degree of absorption depends on frequency of the sound as well as the humidity and air temperature. For example, when the air is cold and humid, and therefore denser, atmospheric absorption is lowest. Higher frequencies are more readily absorbed than the lower frequencies. Over large distances, lower frequency sounds become dominant as the higher frequencies are attenuated.

### Noise Metrics

The description, analysis and reporting of community noise levels around communities is made difficult by the complexity of human response to noise and the variety of noise metrics that have been developed for describing noise impacts. Each of these metrics attempts to quantify noise levels with respect to community response.

Noise metrics can be divided into two categories: single event and cumulative. Single event metrics describe the noise levels from an individual event such as an aircraft flyover. Cumulative metrics average the total noise over a specific time period, which is typically from one to 24-hours for community noise levels.

## Single Event Metrics

**Maximum Noise Level or LMax** is the maximum or peak sound level during an aircraft noise event. The metric only accounts for the instantaneous peak intensity of the sound, and not for the duration of the event. As an aircraft passes by an observer, the sound level increases to a maximum level and then decreases.

**Single Event Noise Exposure Level (SEL)** - The duration of a noise event, or an aircraft flyover, is an important factor in assessing annoyance and is measured most typically as SEL. The effective duration of a sound starts when a sound rises above the background sound level and ends when it drops back below the background level. An SEL is calculated by summing the dB level at each second during a noise event and compressing that noise into one second. It is the level the noise would be if it all occurred in one second. The SEL value is the integration of all the acoustic energy contained within the event. This metric takes into account the maximum noise level of the event and the duration of the event. For aircraft flyovers, the SEL value is numerically about 10 dBA higher than the maximum noise level.

## Cumulative Metrics

**Leq** is the sound level corresponding to a steady-state sound level containing the same total energy as a time-varying signal over a given sample period. Leq is the "energy" average noise level during the time period of the sample. Leq can be measured for any time period, but is typically measured for 15 minutes, 1 hour or 24-hours.

**Community Noise Equivalent Level (CNEL)** is similar to Leq but is for twenty-four hours, and applies a weighting factor which places greater significance on noise events occurring during the evening and night hours (when sleep disturbance is a concern). CNEL is a 24-hour, time-weighted average noise level based on the "A-weighted" decibel. Time-weighted refers to the fact that noise which occurs during certain sensitive time periods is penalized for occurring at these times. The evening time period is penalized by 5 dB (7 p.m. to 10 p.m.) while night time period (10 p.m. to 7 a.m.) noises are penalized by 10 dB. This penalty and these time periods were selected to attempt to account for increased human sensitivity to noise during the quieter period of a day, where sleep is the most probable activity.

## Task 1 - Point Loma Portable Noise Monitoring

For this task, portable noise monitoring was conducted from November 23, 2015 to December 7, 2015 by BridgeNet International. The purpose of the noise monitoring was to determine the overall average daily noise level from SAN aircraft only, the overall average daily noise level from all other noise and the overall total average noise level at each of the noise monitoring locations. All other noise refers to non SAN aircraft and any other noise sources occurring throughout the community.

During the entire duration of the noise measurements, the sound level meters were mounted on tripods five feet above the ground and equipped with windscreens. For the Point Loma portable noise monitoring task, noise measurements were made at 2 locations: Location 1 was at Point Loma Nazarene University on the roof of the Rohr Science Building and Location 2 was in the Sunset Cliffs area on Adair Street between Santa Barbara Street and Guizot Street. During the initial two days of monitoring, staff from BridgeNet International attended each site from approximately 6 a.m. to 6 p.m. to log aircraft noise events, note general acoustic observations and ensure that the noise monitoring equipment was fully operational so that it could be left out to record for the remainder of the measurement period.

The state-of-the-art sound level meters<sup>1</sup> used to measure the one second and one-third octave spectral noise levels were two 01dB DUOs. The equipment used meets the International Standard IEC 61672 specification for Type 1 precision sound level meters. The microphones were calibrated before the tests with a Brüel & Kjær Type 4231 sound level calibrator that meets the International Standard IEC 60942. Calibration is traceable to the National Institute of Standards and Technology (NIST).

Table 1 below shows the number of SAN correlated aircraft events by noise monitoring location. The number of SAN correlated aircraft events were less on December 7, 2015 because the equipment was collected around 10 a.m. There were also less on November 23-24, 2015 at Location 1 because staff was not able to properly secure the equipment that evening.

Rather than have an automated event correlation process by establishing thresholds at each noise monitoring location, BridgeNet International manually correlated all of the aircraft events at each of the noise monitoring locations by using flight track data from the Airport's Noise Monitoring and Management System. This was done so that the correlation could be as accurate as possible.

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<sup>1</sup> <http://01db.acoemgroup.com/catalog/Environnemental-solutions-catalog-1-0-1>

**Table 1** –Number of SAN Correlated Aircraft Events by Noise Monitoring Location

<i>Date</i>	Location 1 - Point Loma Nazarene University	Location 2 - Sunset Cliffs
11/23/2015	157	219
11/24/2015	157	249
11/25/2015	202	197
11/26/2015	159	161
11/27/2015	215	215
11/28/2015	250	242
11/29/2015	286	283
11/30/2015	276	273
12/1/2015	253	213
12/2/2015	250	233
12/3/2015	252	253
12/4/2015	265	253
12/5/2015	199	201
12/6/2015	245	235
12/7/2015	76*	67*
<b>Totals</b>	<b>3,166</b>	<b>3,227</b>

Tables 2 through 5 below contain the noise monitoring results for Location 1 - Point Loma Nazarene University. Tables 6 through 9 contain the noise monitoring results for Location 2 - Sunset Cliffs. Tables 5 and 9 show the top 25 loudest SAN aircraft events in terms of the SEL noise metric at both of the noise monitoring locations, respectively.

The overall average daily noise level from SAN aircraft only for Location 1 ranged between 47 and 51 dB CNEL. The overall average daily noise level from all other noise for Location 1 ranged between 52 and 60 dB CNEL. All other noise refers to non SAN aircraft and any other noise sources occurring throughout the community. The overall total average daily noise level for Location 1 ranged from 54 to 61 dB CNEL.

The overall average daily noise level from SAN aircraft only for Location 2 ranged between 48 and 53 dB CNEL. The overall average daily noise level from all other noise for Location 2 ranged between 50 and 61 dB CNEL. All other noise refers to non SAN aircraft and any other noise sources occurring throughout the community. The overall total average daily noise level for Location 2 ranged from 53 to 61 dB CNEL.

Noise from SAN aircraft did not increase the overall total average daily noise level (58 dB CNEL) at Location 1. Noise from SAN aircraft increased the overall total average daily noise level (57 dB CNEL) at Location 2 by 1 dB.

**Table 2** – Location 1 - Point Loma Nazarene University – SAN Aircraft Noise Levels (dBA Leq)

DATE	Hour Of The Day																								CNEL
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
Nov 23	--	--	--	--	--	--	45	46	48	45	46	49	52	50	45	49	49	0	--	--	--	--	--	50	
Nov 24	--	--	--	--	--	--	45	49	48	49	47	47	46	52	48	44	47	46	46	42	40	43	42	36	50
Nov 25	0	0	36	0	0	0	48	48	46	48	49	46	47	50	46	45	46	46	44	44	45	43	41	40	49
Nov 26	0	0	0	0	0	0	48	47	46	44	47	46	45	45	44	42	42	39	38	36	44	35	39	31	47
Nov 27	0	0	0	30	0	0	46	46	46	46	47	46	46	44	46	45	47	44	43	44	44	38	40	0	47
Nov 28	0	0	30	0	0	0	46	45	45	44	45	49	48	50	52	50	51	47	43	42	45	46	41	38	49
Nov 29	0	32	0	0	0	0	47	45	47	44	45	48	50	53	55	52	52	50	44	43	44	46	43	42	50
Nov 30	0	0	0	0	0	0	46	47	48	46	46	49	50	49	48	50	48	50	48	46	44	44	45	39	49
Dec 1	42	0	0	0	0	0	47	47	49	47	47	51	51	49	48	45	48	45	48	46	46	44	45	0	50
Dec 2	0	0	33	0	0	0	46	45	46	46	46	47	48	46	48	48	48	49	45	44	47	48	41	34	49
Dec 3	0	0	0	0	0	24	43	47	47	44	45	46	48	48	47	48	48	50	50	47	45	44	43	34	48
Dec 4	0	32	0	0	0	0	48	49	48	51	50	50	50	49	50	52	48	50	47	49	47	44	40	37	51
Dec 5	36	0	0	0	0	0	48	49	47	48	50	50	50	47	47	46	47	43	43	43	42	40	42	0	49
Dec 6	0	0	0	0	0	0	44	42	47	45	46	46	47	50	47	46	45	44	44	43	44	43	42	34	47
Dec 7	0	0	0	0	0	30	46	53	46	46	47	--	--	--	--	--	--	--	--	--	--	--	--	--	49
Energy Average	32	24	27	19	0	20	47	48	47	47	47	48	49	49	49	48	48	47	46	45	45	44	42	36	48

**Table 3 – Location 1 - Point Loma Nazarene University – All Other Noise Levels (dBA Leq)**


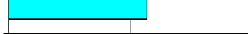

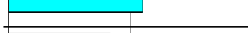



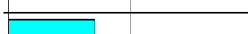

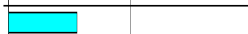





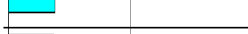

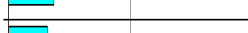

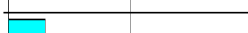

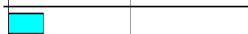





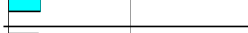

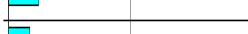

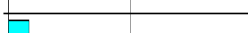

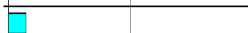





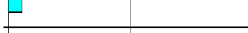

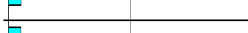

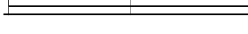






DATE	Hour Of The Day																							CNEL	
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22		23
Nov 23	--	--	--	--	--	--	47	49	50	50	48	51	54	51	50	53	51	34	--	--	--	--	--	52	
Nov 24	--	--	--	--	--	--	46	49	49	51	50	51	51	49	50	50	52	52	52	52	52	52	52	52	56
Nov 25	52	52	52	53	54	56	56	55	54	54	54	54	53	53	54	53	52	52	51	51	52	52	52	60	
Nov 26	52	52	52	52	52	52	51	51	51	52	51	51	52	52	53	52	52	51	51	51	51	51	51	59	
Nov 27	52	53	52	51	51	51	51	51	51	51	51	51	52	52	52	52	52	51	51	51	51	52	51	58	
Nov 28	51	51	51	51	51	51	51	51	52	51	51	54	55	57	59	57	60	57	53	51	51	51	52	59	
Nov 29	51	51	51	52	51	51	51	52	54	51	51	53	56	58	59	59	57	55	52	52	51	52	51	59	
Nov 30	51	51	51	51	51	51	52	53	51	51	53	52	54	52	53	53	52	52	52	52	52	52	52	58	
Dec 1	52	51	52	52	52	52	52	53	51	51	51	52	52	51	52	52	53	51	51	51	51	52	51	58	
Dec 2	50	51	50	50	50	51	50	51	51	50	51	50	52	51	52	52	53	51	51	51	51	51	50	58	
Dec 3	50	50	49	49	49	49	49	50	50	50	50	50	50	51	51	52	52	51	51	51	51	52	52	57	
Dec 4	52	51	51	51	51	52	51	52	52	51	51	52	51	52	52	51	53	52	53	53	54	54	52	59	
Dec 5	53	53	52	51	52	52	52	54	53	52	52	52	52	52	52	52	52	53	52	52	52	52	53	59	
Dec 6	51	51	51	51	50	51	50	51	51	51	51	51	52	52	52	51	51	51	51	51	52	51	51	58	
Dec 7	51	50	51	51	51	51	51	51	51	51	51	--	--	--	--	--	--	--	--	--	--	--	59		
Energy Average	51	51	51	51	51	52	51	52	52	51	51	52	53	53	54	53	54	52	52	52	52	52	52	58	



**Table 4 – Location 1 - Point Loma Nazarene University – Total Noise Levels (dBA Leq)**

DATE	Hour Of The Day																							CNEL	
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22		23
Nov 23	--	--	--	--	--	--	49	51	52	51	51	53	56	54	51	54	53	34	--	--	--	--	--	54	
Nov 24	--	--	--	--	--	--	49	52	51	53	52	53	52	54	52	51	53	53	53	52	52	53	52	52	57
Nov 25	52	52	52	53	54	56	56	56	55	55	56	55	55	55	54	54	54	53	52	52	52	52	53	52	61
Nov 26	52	52	52	52	52	52	53	53	52	52	53	53	53	53	54	52	53	51	51	51	52	51	51	51	59
Nov 27	52	53	52	51	51	51	52	53	52	52	53	53	53	52	53	52	54	52	52	52	52	52	51	52	59
Nov 28	51	51	51	51	51	51	52	52	53	52	52	55	56	57	60	58	60	57	54	51	52	52	52	52	59
Nov 29	51	51	51	52	51	51	52	53	55	52	52	54	57	59	61	60	59	56	52	52	52	53	52	52	60
Nov 30	51	51	51	51	51	51	53	54	53	53	54	53	55	54	54	55	54	54	53	53	53	52	53	52	59
Dec 1	52	51	52	52	52	52	53	54	53	52	52	55	55	53	53	52	54	52	53	52	52	52	52	51	59
Dec 2	50	51	50	50	50	51	52	52	52	51	52	52	54	52	53	54	55	53	52	52	53	53	51	50	58
Dec 3	50	50	49	49	49	49	50	52	52	51	51	51	52	52	52	53	53	53	53	53	52	52	52	52	58
Dec 4	52	51	51	51	51	52	53	54	53	54	53	54	54	54	54	54	54	54	54	55	55	54	53	53	59
Dec 5	53	53	52	51	52	52	53	55	54	53	54	54	54	54	53	53	53	53	52	52	52	52	53	52	59
Dec 6	51	51	51	51	50	51	51	51	53	52	52	52	53	54	53	52	52	52	51	51	52	52	51	51	58
Dec 7	51	50	51	51	51	51	52	55	52	52	53	--	--	--	--	--	--	--	--	--	--	--	--	60	
Energy Average	52	51	51	51	51	52	53	53	53	53	53	53	54	55	55	55	55	53	53	52	52	52	52	52	58

**Table 5 – Location 1 - Point Loma Nazarene University – Top 25 Loudest SAN Aircraft Noise Events**

Aircraft	Airline	Event Time	Aircraft	Ops	Rwy	Lmax	SEL	Graph Of SEL
	AAL	Dec 07, 07:10	A321	D	27	76.0	85.8	
	WJA	Nov 23, 12:07	B738	D	27	74.7	85.6	
	-	Nov 24, 13:39	-	O	-	73.4	84.2	
	-	Nov 25, 13:01	C208	D	27	70.1	83.7	
	SWA	Nov 24, 07:14	B733	D	27	74.8	83.6	
	DAL	Nov 24, 13:22	A320	D	27	71.0	82.9	
	-	Dec 04, 17:57	-	O	-	71.1	82.3	
	-	Dec 04, 14:48	-	O	-	70.9	82.0	
	-	Dec 07, 07:11	-	D	27	70.1	82.0	
	-	Nov 29, 17:42	-	O	-	75.1	81.9	
	SWA	Nov 28, 16:24	B73G	D	27	79.0	81.7	
	-	Nov 25, 10:49	-	O	-	72.4	81.6	
	SWA	Nov 30, 12:56	B73G	D	27	72.1	81.5	
	SWA	Nov 23, 15:44	B738	D	27	70.8	81.5	
	-	Nov 24, 16:19	-	O	-	72.5	81.4	
	JAL	Dec 01, 12:04	B788	D	27	70.3	81.4	
	NKS	Nov 24, 09:46	A319	D	27	68.7	81.3	
	-	Dec 03, 16:42	-	O	-	69.9	80.9	
	-	Nov 29, 14:47	-	O	-	73.0	80.9	
	-	Nov 30, 15:42	-	O	-	70.9	80.8	
	VRD	Nov 25, 09:20	A320	D	27	68.9	80.7	
	SWA	Nov 24, 14:52	B737	D	27	71.2	80.7	
	SWA	Nov 28, 11:53	B738	D	27	70.5	80.6	
	-	Nov 23, 16:12	-	O	-	67.3	80.6	
	-	Nov 30, 17:11	-	O	-	69.1	80.6	

**Table 6 – Location 2 - Sunset Cliffs – SAN Aircraft Noise Levels (dBA Leq)**

DATE	Hour Of The Day																								CNEL
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
Nov 23	--	--	--	--	--	--	47	47	48	44	48	50	49	48	47	49	49	45	48	48	40	31	41	30	50
Nov 24	0	0	0	0	0	0	49	47	49	49	47	51	52	52	51	51	50	48	49	48	46	48	45	41	51
Nov 25	0	0	0	0	0	0	52	54	52	50	51	52	52	51	50	50	50	49	48	48	48	45	42	40	53
Nov 26	0	0	32	0	0	0	52	50	49	48	50	49	49	48	46	44	46	41	40	38	45	39	39	37	51
Nov 27	0	0	0	33	0	0	51	51	51	49	50	51	50	50	51	47	49	48	49	48	46	43	44	0	51
Nov 28	0	0	0	0	0	0	52	51	50	46	49	51	50	51	48	48	47	46	47	46	47	49	43	41	52
Nov 29	0	35	0	0	0	0	52	50	51	47	50	51	50	50	52	51	50	50	48	47	47	48	45	44	52
Nov 30	0	0	0	0	0	0	51	52	52	49	47	51	50	49	51	50	49	50	50	49	46	47	44	39	52
Dec 1	39	0	0	0	0	0	51	50	50	46	48	48	50	49	48	46	48	43	50	48	46	45	44	0	51
Dec 2	0	0	0	0	0	0	50	49	48	45	46	51	48	47	53	48	45	48	47	45	46	45	39	30	50
Dec 3	0	0	0	0	0	27	45	47	47	45	47	46	48	48	46	48	46	47	49	49	47	46	43	0	49
Dec 4	0	0	0	0	0	0	52	51	49	49	51	50	52	50	49	52	48	49	49	49	48	48	39	40	52
Dec 5	0	0	0	0	0	0	51	51	50	48	49	49	50	49	48	48	50	43	43	44	43	39	41	0	51
Dec 6	0	0	0	0	0	0	44	45	48	44	47	45	45	48	47	47	47	46	43	45	44	46	43	34	48
Dec 7	39	0	0	0	0	31	49	48	49	48	--	--	--	--	--	--	--	--	--	--	--	--	--	--	50
Energy Average	30	24	21	22	0	21	51	50	50	48	49	50	50	49	50	49	48	47	48	47	46	46	43	38	50
















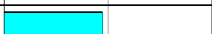








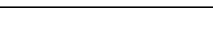
**Table 7 – Location 2 - Sunset Cliffs – All Other Noise Levels (dBA Leq)**

DATE	Hour Of The Day																								CNEL
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
Nov 23	--	--	--	--	--	--	45	45	46	47	44	45	44	38	43	42	48	44	41	42	45	46	45	44	50
Nov 24	44	44	45	45	43	43	44	64	46	44	47	43	46	46	44	43	45	45	43	46	44	45	45	44	54
Nov 25	44	45	46	48	52	55	54	52	51	51	51	51	50	49	48	48	49	48	47	46	46	47	46	46	57
Nov 26	47	46	46	46	45	46	45	44	44	46	46	47	46	47	47	49	46	44	44	43	44	43	44	45	52
Nov 27	50	50	52	52	51	51	51	52	51	49	46	49	46	48	47	48	45	47	43	44	46	48	51	51	57
Nov 28	52	52	52	52	52	52	51	51	52	46	50	45	50	47	47	46	48	46	43	43	44	45	47	49	58
Nov 29	51	51	51	51	52	52	49	49	51	45	44	43	45	44	54	49	46	46	44	43	43	44	47	49	57
Nov 30	51	52	52	50	51	52	52	51	50	48	49	47	43	49	46	47	48	46	46	48	46	46	47	48	57
Dec 1	49	51	51	52	53	52	49	50	72	49	50	50	48	46	47	46	49	47	47	46	49	47	47	48	61
Dec 2	49	50	51	50	50	51	52	52	48	44	43	44	46	42	40	43	49	47	46	46	46	45	43	43	56
Dec 3	43	44	45	45	45	46	45	45	46	43	44	44	41	42	44	39	47	47	45	45	45	46	43	49	52
Dec 4	48	45	46	47	48	49	50	49	51	46	45	45	44	43	41	45	48	47	48	49	50	51	49	52	56
Dec 5	50	48	48	50	51	51	51	53	48	46	50	47	49	48	47	50	49	46	48	47	47	48	50	47	56
Dec 6	45	48	49	47	46	48	46	47	48	45	45	45	42	44	51	42	43	45	46	45	45	45	45	45	53
Dec 7	44	45	45	46	47	47	46	47	50	49	--	--	--	--	--	--	--	--	--	--	--	--	--	--	55
Energy Average	49	49	49	49	50	51	50	54	61	47	48	47	46	46	48	46	47	46	46	46	46	47	47	48	56

**Table 8 – Location 2 - Sunset Cliffs – Total Noise Levels (dBA Leq)**

DATE	Hour Of The Day																								CNEL
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
Nov 23	--	--	--	--	--	--	49	49	50	49	50	51	50	48	49	49	51	47	49	49	46	46	46	45	53
Nov 24	44	44	45	45	43	43	51	65	51	50	50	51	53	53	52	51	51	50	50	50	48	50	48	46	56
Nov 25	44	45	46	48	52	55	56	56	55	54	54	55	54	53	52	52	53	51	50	50	50	49	48	47	58
Nov 26	47	46	46	46	45	46	53	51	51	50	51	51	51	50	49	50	49	46	46	44	47	45	45	45	55
Nov 27	50	50	52	53	51	51	54	55	54	52	52	53	52	52	52	51	50	51	50	50	49	49	52	51	58
Nov 28	52	52	52	52	52	52	54	54	54	49	53	52	53	52	51	50	50	49	48	48	49	50	48	49	59
Nov 29	51	51	51	51	52	52	54	53	54	49	51	51	51	51	56	53	52	52	49	48	48	49	49	50	58
Nov 30	51	52	52	50	51	52	54	55	54	52	51	52	51	52	53	52	52	51	52	52	49	49	49	48	58
Dec 1	50	51	51	52	53	52	53	53	72	51	53	52	52	51	51	49	52	48	51	50	51	49	49	48	61
Dec 2	49	50	51	50	50	51	54	53	51	47	48	52	50	48	53	49	50	50	50	49	49	48	44	44	57
Dec 3	43	44	45	45	45	46	48	49	50	47	48	48	48	49	48	48	49	50	51	51	49	49	46	49	54
Dec 4	48	45	46	47	48	49	54	53	53	51	52	51	52	51	50	53	51	51	52	52	52	52	49	52	57
Dec 5	50	48	48	50	51	51	54	55	52	50	53	51	53	51	51	52	53	48	49	49	48	48	51	47	57
Dec 6	45	48	49	47	46	48	48	49	51	48	49	48	47	50	52	48	48	49	48	48	47	49	47	46	54
Dec 7	45	45	45	46	47	47	51	51	53	51	--	--	--	--	--	--	--	--	--	--	--	--	--	--	56
Energy Average	49	49	49	50	50	51	53	56	61	50	51	52	52	51	52	51	51	50	50	50	49	49	48	48	57

**Table 9 – Location 2 - Sunset Cliffs – Top 25 Loudest SAN Aircraft Noise Events**

Aircraft	Airline	Event Time	Aircraft	Ops	Rwy	Lmax	SEL	Graph Of SEL
	-	Dec 02, 14:24	SBR1	D	27	77.3	87.8	
	SWA	Nov 29, 14:28	B73G	D	27	76.3	83.1	
	-	Dec 02, 11:31	SBR1	D	27	76.3	83.0	
	DAL	Nov 24, 13:21	A320	D	27	70.1	82.3	
	UAL	Dec 01, 08:14	B739	D	27	71.0	81.3	
	FDX	Nov 27, 07:34	DC10	D	27	68.7	80.8	
	-	Nov 24, 13:39	-	O	-	69.7	80.8	
	AAL	Dec 04, 17:58	B752	D	27	69.7	80.3	
	GTI	Nov 24, 18:58	B762	D	27	68.6	79.9	
	-	Dec 04, 12:37	SBR1	D	27	73.8	79.9	
	GTI	Nov 27, 18:45	B762	D	27	67.3	79.9	
	-	Nov 30, 17:11	-	O	-	70.7	79.8	
	SWA	Nov 28, 06:54	B73G	D	27	66.8	79.7	
	-	Nov 23, 16:31	-	O	-	69.8	79.6	
	-	Nov 29, 15:46	GLF4	D	27	69.0	79.6	
	-	Nov 24, 17:29	-	O	-	63.7	79.5	
	-	Nov 29, 17:28	C650	D	27	69.2	79.5	
	-	Dec 04, 14:47	-	O	-	69.5	79.4	
	JBL	Dec 01, 12:04	A320	D	27	68.2	79.3	
	GTI	Dec 04, 18:42	B762	D	27	67.0	79.3	
	-	Nov 24, 15:48	-	O	-	67.5	79.2	
	UAL	Nov 27, 08:11	B739	D	27	68.6	79.2	
	GTI	Nov 30, 18:40	B762	D	27	68.6	79.2	
	SWA	Nov 25, 11:01	B733	D	27	68.2	79.0	
	SCX	Nov 24, 13:05	B738	D	27	67.5	79.0	

## Task 2 - Ground Based Aircraft Portable Noise Monitoring

For this task, portable noise monitoring was conducted from November 23, 2015 to November 24, 2015 by BridgeNet International. The purpose of the noise monitoring was to determine if low frequency noise from aircraft on the ground of the airfield is creating higher low frequency noise levels at noise monitoring Locations 1 and 2. For this analysis and report, noise from aircraft on the ground means either aircraft arriving and using their reverse thrust or aircraft departing before wheels up.

During the entire duration of the noise measurements, the sound level meters were mounted on tripods five feet above the ground and equipped with windscreens. Noise measurements were made at 3 locations for the ground based aircraft portable noise monitoring task: Location 1 was at Point Loma Nazarene University on the roof of the Rohr Science Building, Location 2 was in the Sunset Cliffs area on Adair Street between Santa Barbara Street and Guizot Street and Location 3 was adjacent to the airfield in between the new rental car facility near the end of Runway 27. During the two days of monitoring, staff from BridgeNet International attended each site from approximately 6 a.m. to 6 p.m. to log aircraft noise events, note general acoustic observations and ensure that the noise monitoring equipment was fully operational.

The state-of-the-art sound level meters<sup>2</sup> used to measure the one second and one-third octave spectral noise levels were two 01dB DUOs and one 01dB FUSION. The equipment used meets the International Standard IEC 61672 specification for Type 1 precision sound level meters. The microphones were calibrated before the tests with a Brüel & Kjær Type 4231 sound level calibrator that meets the International Standard IEC 60942. Calibration is traceable to the National Institute of Standards and Technology (NIST).

For the two days of monitoring, different aircraft types from different time periods were selected for further analysis. Aircraft arrival and departure ground based events were selected when other airborne aircraft events would have little to no impact on noise monitoring Locations 1 and 2. Ground based aircraft events were then correlated between Locations 1, 2 and 3.

The one-third octave spectral noise level data collected at Location 3 was compared to the one-third octave spectral noise level data at Locations 1 and 2 to determine if there was any low frequency noise correlation.

Table 10 shows a comparison of aircraft arrival event noise levels at Location 3 to Locations 1 and 2. The worst-case aircraft event frequencies are bolded. The negative differences are depicted in blue and the positive differences are depicted in green. All but two of the worst-case aircraft event frequencies in bold at Location 3 were not the same as the bold at Locations 1 and 2.

Table 11 shows a comparison of aircraft departure event noise levels at Location 3 to Locations 1 and 2. The worst-case aircraft event frequencies are bolded. The negative differences are depicted in blue and the positive differences are depicted in green. The worst-case aircraft event frequencies in bold at Location 3 were never the same as the bold at Locations 1 and 2.

Table 12 shows a comparison of aircraft arrival event noise levels and ambient noise levels at Locations 1 and 2. The ambient noise level is the average noise level without any SAN aircraft events. The negative differences are depicted in blue and the positive differences are depicted in green. Table 13 shows a

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<sup>2</sup> <http://01db.acoemgroup.com/catalog/Environnemental-solutions-catalog-1-0-1>

comparison of aircraft departure event noise levels and ambient noise levels at Locations 1 and 2. The ambient noise level is the average noise level without any SAN aircraft events. The negative differences are depicted in blue and the positive differences are depicted in green.

The data in Tables 12 and 13 did not provide consistent enough results that would indicate that there is a correlation between low frequency ground based aircraft noise at Location 3 from Locations 1 and 2. The majority of the worst-case arrival frequencies are less than the equivalent ambient frequencies at Locations 1 and 2. Some of the worst-case departure frequencies are greater than the equivalent ambient frequencies at Locations 1 and 2 and some are less.

During the two days of monitoring for this task, staff attended each site and it was noted that noise from ground based aircraft events was not audible at Location 1. It was not audible at Location 2 except for between 6 a.m. and 7 a.m. when it was sometimes audible because of a lower ambient noise level. Reasoning factors for it not being audible could include distance reduction, other community noise, terrain, weather and other shielding effects.



**Table 10** – Comparison of Arrival Aircraft Event Noise Levels at Location 1 – Point Loma Nazarene University and Location 3 – Near Airfield

Date of Event	Aircraft Event	Location	Lmax Noise Level (dBA)	One-Third Octave Noise Levels (dBA)									
				31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	16000 Hz
11/24/2015	SWA B737-700 at 8:00:05 a.m.	1 - Point Loma Nazarene University	50.5	<b>50.7</b>	47.6	49.8	47.0	42.1	39.6	34.7	31.6	31.6	26.9
		3 - Near Airfield	83.4	74.7	78.3	<b>80.0</b>	78.4	77.5	73.7	67.9	55.2	24.0	9.4
		Difference	-32.9	-24.0	-30.7	-30.2	-31.4	-35.4	-34.1	-33.2	-23.6	7.6	17.5
11/23/2015	ASA B737-800 at 9:23:40 a.m.	1 - Point Loma Nazarene University	49.0	<b>51.2</b>	47.5	48.9	45.7	41.3	38.8	33.4	24.2	13.2	13.1
		3 - Near Airfield	83.1	72.5	<b>78.9</b>	<b>78.9</b>	78.3	76.9	74.4	64.9	42.3	12.4	9.9
		Difference	-34.1	-21.3	-31.4	-30.0	-32.6	-35.6	-35.6	-31.5	-18.1	0.8	3.2
11/24/2015	AAL A320 at 10:27:29 a.m.	1 - Point Loma Nazarene University	47.9	<b>49.1</b>	46.7	48.5	44.3	41.3	37.5	30.0	25.7	18.5	16.9
		3 - Near Airfield	73.4	58.9	<b>63.2</b>	59.0	55.7	57.0	61.4	53.9	46.6	24.9	10.9
		Difference	-25.5	-9.8	-16.5	-10.5	-11.4	-15.7	-23.9	-23.9	-20.9	-6.4	6.0
11/23/2015	SWA B737-700 at 10:51:44 a.m.	1 - Point Loma Nazarene University	50.9	<b>52.4</b>	52.2	51.6	46.7	42.8	41.1	36.4	27.4	15.4	15.8
		3 - Near Airfield	81.8	69.5	76.9	<b>77.4</b>	76.9	75.8	72.8	62.6	47.4	36.1	17.9
		Difference	-30.9	-17.1	-24.7	-25.8	-30.2	-33.0	-31.7	-26.2	-20.0	-20.7	-2.1
11/24/2015	SWA B737-300 at 3:04:42 p.m.	1 - Point Loma Nazarene University	51.6	<b>55.1</b>	52.0	48.5	47.0	44.3	42.7	36.1	28.7	18.7	12.1
		3 - Near Airfield	74.0	71.1	76.3	<b>77.1</b>	72.0	66.5	61.5	58.3	51.0	50.2	24.4
		Difference	-22.4	-16.0	-24.3	-28.6	-25.0	-22.2	-18.8	-22.2	-22.3	-31.5	-12.3
11/23/2015	SWA B737-800 at 3:40:49 p.m.)	1 - Point Loma Nazarene University	48.7	<b>56.1</b>	50.6	50.2	44.5	40.1	38.2	35.2	29.7	19.4	11.0
		3 - Near Airfield	81.0	74.0	81.8	<b>84.7</b>	78.3	72.1	70.4	65.6	54.9	23.6	9.8
		Difference	-32.3	-17.9	-31.2	-34.5	-33.8	-32.0	-32.2	-30.4	-25.2	-4.2	1.2
11/24/2015	SWA B737-700 at 8:00:05 a.m.	2 - Sunset Cliffs	46.2	40.8	<b>44.3</b>	42.7	37.1	33.9	33.8	30.5	32.6	28.9	42.4
		3 - Near Airfield	83.4	74.7	78.3	<b>80.0</b>	78.4	77.5	73.7	67.9	55.2	24.0	9.4
		Difference	-37.2	-33.9	-34.0	-37.3	-41.3	-43.6	-39.9	-37.4	-22.6	4.9	33.0
11/23/2015	ASA B737-800 at 9:23:40 a.m.	2 - Sunset Cliffs	48.2	51.2	<b>56.7</b>	48.6	39.1	38.7	38.1	34.5	26.7	22.4	38.0
		3 - Near Airfield	83.1	72.5	<b>78.9</b>	<b>78.9</b>	78.3	76.9	74.4	64.9	42.3	12.4	9.9
		Difference	-34.9	-21.3	-22.2	-30.3	-39.2	-38.2	-36.3	-30.4	-15.6	10.0	28.1
11/24/2015	AAL A320 at 10:27:29 a.m.	2 - Sunset Cliffs	45.3	42.5	39.7	35.5	31.8	30.4	32.2	33.4	32.8	28.0	<b>43.3</b>
		3 - Near Airfield	73.4	58.9	<b>63.2</b>	59.0	55.7	57.0	61.4	53.9	46.6	24.9	10.9
		Difference	-28.1	-16.4	-23.5	-23.5	-23.9	-26.6	-29.2	-20.5	-13.8	3.1	32.4
11/23/2015	SWA B737-700 at 10:51:44 a.m.	2 - Sunset Cliffs	47.7	48.0	49.3	<b>52.2</b>	46.4	37.2	29.6	26.5	16.1	8.0	21.4
		3 - Near Airfield	81.8	69.5	76.9	<b>77.4</b>	76.9	75.8	72.8	62.6	47.4	36.1	17.9
		Difference	-34.1	-21.5	-27.6	-25.2	-30.5	-38.6	-43.2	-36.1	-31.3	-28.1	3.5
11/24/2015	SWA B737-300 at 3:04:42 p.m.	2 - Sunset Cliffs	44.5	42.2	<b>47.2</b>	36.5	32.8	31.6	32.9	32.4	33.9	26.6	25.2
		3 - Near Airfield	74.0	71.1	76.3	<b>77.1</b>	72.0	66.5	61.5	58.3	51.0	50.2	24.4
		Difference	-29.5	-28.9	-29.1	-40.6	-39.2	-34.9	-28.6	-25.9	-17.1	-23.6	0.8
11/23/2015	SWA B737-800 at 3:40:49 p.m.)	2 - Sunset Cliffs	43.2	<b>45.1</b>	42.8	39.6	37.1	32.0	30.9	28.2	26.1	13.7	22.1
		3 - Near Airfield	81.0	74.0	81.8	<b>84.7</b>	78.3	72.1	70.4	65.6	54.9	23.6	9.8
		Difference	-37.8	-28.9	-39.0	-45.1	-41.2	-40.1	-39.5	-37.4	-28.8	-9.9	12.3

 Note: Worst-Case Aircraft Event Frequency in **Bold**

**Table 11** – Comparison of Departure Aircraft Event Noise Levels at Location 1 – Point Loma Nazarene University and Location 3 – Near Airfield

Date of Event	Aircraft Event	Location	Lmax Noise Level (dBA)	One-Third Octave Noise Levels (dBA)									
				31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	16000 Hz
11/23/2015	ASA B737-800 at 6:35:37 a.m.	1 - Point Loma Nazarene University	52.3	<b>55.0</b>	52.8	54.4	51.9	45.3	39.5	31.8	22.3	9.5	8.4
		3 - Near Airfield	91.5	78.0	85.2	<b>89.8</b>	89.2	87.4	76.1	70.7	56.0	21.8	9.3
		Difference	-39.2	-23.0	-32.4	-35.4	-37.3	-42.1	-36.6	-38.9	-33.7	-12.3	-0.9
11/24/2015	UPS B767-300 at 6:41:35 a.m.	1 - Point Loma Nazarene University	51.4	<b>53.2</b>	50.5	53.0	48.1	43.1	40.9	33.3	25.0	10.0	7.9
		3 - Near Airfield	92.8	83.0	87.6	<b>90.8</b>	90.6	87.4	81.2	72.7	65.5	43.3	28.5
		Difference	-41.4	-29.8	-37.1	-37.8	-42.5	-44.3	-40.3	-39.4	-40.5	-33.3	-20.6
11/23/2015	UAL B737-900 at 7:01:30 a.m.	1 - Point Loma Nazarene University	51.6	50.4	<b>53.2</b>	52.6	48.5	45.1	40.8	32.3	24.0	13.0	8.8
		3 - Near Airfield	92.3	79.6	84.6	89.6	<b>89.9</b>	88.4	75.5	67.9	53.0	23.2	9.1
		Difference	-40.7	-29.2	-31.4	-37.0	-41.4	-43.3	-34.7	-35.6	-29.0	-10.2	-0.3
11/24/2015	SWA B737-800 at 11:13:39 a.m.	1 - Point Loma Nazarene University	49.2	<b>52.3</b>	48.8	47.7	46.1	42.8	38.0	34.3	26.7	17.1	14.5
		3 - Near Airfield	88.6	78.0	84.9	<b>88.1</b>	86.5	82.9	76.1	71.4	65.9	50.2	14.4
		Difference	-39.4	-25.7	-36.1	-40.4	-40.4	-40.1	-38.1	-37.1	-39.2	-33.1	0.1
11/24/2015	JBU A320 at 2:13:31 p.m.	1 - Point Loma Nazarene University	51.0	<b>54.1</b>	51.6	52.2	52.0	42.8	36.7	31.0	22.4	18.8	23.5
		3 - Near Airfield	89.9	74.7	80.7	84.6	<b>85.9</b>	82.6	79.9	76.2	69.6	55.6	16.2
		Difference	-38.9	-20.6	-29.1	-32.4	-33.9	-39.8	-43.2	-45.2	-47.2	-36.8	7.3
11/24/2015	DAL A320 at 4:45:53 p.m.	1 - Point Loma Nazarene University	54.0	<b>58.0</b>	54.7	51.4	48.2	46.4	40.1	33.4	38.7	16.8	10.4
		3 - Near Airfield	85.5	75.1	80.0	80.8	<b>81.6</b>	80.3	74.6	67.5	63.1	51.3	13.3
		Difference	-31.5	-17.1	-25.3	-29.4	-33.4	-33.9	-34.5	-34.1	-24.4	-34.5	-2.9
11/23/2015	ASA B737-800 at 6:35:37 a.m.	2 - Sunset Cliffs	48.1	54.7	<b>57.3</b>	51.9	48.9	35.3	28.4	27.4	27.9	22.7	36.5
		3 - Near Airfield	91.5	78.0	85.2	<b>89.8</b>	89.2	87.4	76.1	70.7	56.0	21.8	9.3
		Difference	-43.4	-23.3	-27.9	-37.9	-40.3	-52.1	-47.7	-43.3	-28.1	0.9	27.2
11/24/2015	UPS B767-300 at 6:41:35 a.m.	2 - Sunset Cliffs	49.7	55.5	<b>60.1</b>	53.8	49.3	35.2	27.2	28.0	31.1	27.2	42.2
		3 - Near Airfield	92.8	83.0	87.6	<b>90.8</b>	90.6	87.4	81.2	72.7	65.5	43.3	28.5
		Difference	-43.1	-27.5	-27.5	-37.0	-41.3	-52.2	-54.0	-44.7	-34.4	-16.1	13.7
11/23/2015	UAL B737-900 at 7:01:30 a.m.	2 - Sunset Cliffs	48.9	44.6	<b>45.9</b>	41.4	38.9	34.4	38.3	37.7	29.4	26.5	42.0
		3 - Near Airfield	92.3	79.6	84.6	89.6	<b>89.9</b>	88.4	75.5	67.9	53.0	23.2	9.1
		Difference	-43.4	-35.0	-38.7	-48.2	-51.0	-54.0	-37.2	-30.2	-23.6	3.3	32.9
11/24/2015	SWA B737-800 at 11:13:39 a.m.	2 - Sunset Cliffs	46.2	40.3	42.0	32.3	29.7	32.3	36.3	35.2	31.3	28.7	<b>42.3</b>
		3 - Near Airfield	88.6	78.0	84.9	<b>88.1</b>	86.5	82.9	76.1	71.4	65.9	50.2	14.4
		Difference	-42.4	-37.7	-42.9	-55.8	-56.8	-50.6	-39.8	-36.2	-34.6	-21.5	27.9
11/24/2015	JBU A320 at 2:13:31 p.m.	2 - Sunset Cliffs	49.6	<b>55.7</b>	52.3	43.7	40.4	35.4	39.1	38.0	37.7	30.0	27.6
		3 - Near Airfield	89.9	74.7	80.7	84.6	<b>85.9</b>	82.6	79.9	76.2	69.6	55.6	16.2
		Difference	-40.3	-19.0	-28.4	-40.9	-45.5	-47.2	-40.8	-38.2	-31.9	-25.6	11.4
11/24/2015	DAL A320 at 4:45:53 p.m.	2 - Sunset Cliffs	44.8	40.4	<b>43.2</b>	37.9	36.5	33.8	31.1	32.5	30.3	28.2	42.1
		3 - Near Airfield	85.5	75.1	80.0	80.8	<b>81.6</b>	80.3	74.6	67.5	63.1	51.3	13.3
		Difference	-40.7	-34.7	-36.8	-42.9	-45.1	-46.5	-43.5	-35.0	-32.8	-23.1	28.8

 Note: Worst-Case Aircraft Event Frequency in **Bold**

**Table 12** – Comparison of Arrival Aircraft Events and Ambient Noise Levels at Location 1 – Point Loma Nazarene University and Location 2 – Sunset Cliffs

Location	Date of Event	Type	Lmax Noise Level (dBA)	One-Third Octave Noise Levels (dBA)									
				31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	16000 Hz
1 - Point Loma Nazarene University	11/24/2015	Aircraft Event (SWA B737-700 at 8:00:05 a.m.)	50.5	<b>50.7</b>	47.6	49.8	47.0	42.1	39.6	34.7	31.6	31.6	26.9
		Ambient	51.6	<b>53.4</b>	51.8	52.9	49.3	44.6	40.1	36.3	30.5	21.1	15.4
		Difference	-1.1	-2.7	-4.2	-3.1	-2.3	-2.5	-0.5	-1.6	1.1	10.5	11.5
	11/23/2015	Aircraft Event (ASA B737-800 at 9:23:44 a.m.)	49.0	<b>51.2</b>	47.5	48.9	45.7	41.3	38.8	33.4	24.2	13.2	13.1
		Ambient	51.6	<b>53.4</b>	51.8	52.9	49.3	44.6	40.1	36.3	30.5	21.1	15.4
		Difference	-2.6	-2.2	-4.3	-4.0	-3.6	-3.3	-1.3	-2.9	-6.3	-7.9	-2.3
	11/24/2015	Aircraft Event (AAL A320 at 10:27:30 a.m.)	47.9	<b>49.1</b>	46.7	48.5	44.3	41.3	37.5	30.0	25.7	18.5	16.9
		Ambient	55.1	<b>56.0</b>	54.5	52.2	48.4	45.8	45.1	39.3	32.2	25.7	27.8
		Difference	-7.2	-6.9	-7.8	-3.7	-4.1	-4.5	-7.6	-9.3	-6.5	-7.2	-10.9
	11/23/2015	Aircraft Event (SWA B737-700 at 10:51:54 a.m.)	50.9	<b>52.4</b>	52.2	51.6	46.7	42.8	41.1	36.4	27.4	15.4	15.8
		Ambient	55.1	<b>56.0</b>	54.5	52.2	48.4	45.8	45.1	39.3	32.2	25.7	27.8
		Difference	-4.2	-3.6	-2.3	-0.6	-1.7	-3.0	-4.0	-2.9	-4.8	-10.3	-12.0
	11/24/2015	Aircraft Event (SWA B737-300 at 3:04:51 p.m.)	51.6	<b>55.1</b>	52.0	48.5	47.0	44.3	42.7	36.1	28.7	18.7	12.1
		Ambient	51.0	53.8	51.0	<b>54.1</b>	48.7	43.2	39.0	36.5	29.4	22.8	24.9
		Difference	0.6	1.3	1.0	-5.6	-1.7	1.1	3.7	-0.4	-0.7	-4.1	-12.8
	11/23/2015	Aircraft Event (SWA B737-800 at 3:40:50 p.m.)	48.7	<b>56.1</b>	50.6	50.2	44.5	40.1	38.2	35.2	29.7	19.4	11.0
		Ambient	51.0	53.8	51.0	<b>54.1</b>	48.7	43.2	39.0	36.5	29.4	22.8	24.9
		Difference	-2.3	2.3	-0.4	-3.9	-4.2	-3.1	-0.8	-1.3	0.3	-3.4	-13.9
2 - Sunset Cliffs	11/24/2015	Aircraft Event (SWA B737-700 at 8:00:14 a.m.)	46.2	40.8	<b>44.3</b>	42.7	37.1	33.9	33.8	30.5	32.6	28.9	42.4
		Ambient	47.4	49.1	<b>51.8</b>	47.6	41.6	36.7	34.9	35.7	29.9	26.7	41.9
		Difference	-1.2	-8.3	-7.5	-4.9	-4.5	-2.8	-1.1	-5.2	2.7	2.2	0.5
	11/23/2015	Aircraft Event (ASA B737-800 at 9:23:40 a.m.)	48.2	51.2	<b>56.7</b>	48.6	39.1	38.7	38.1	34.5	26.7	22.4	38.0
		Ambient	47.4	49.1	<b>51.8</b>	47.6	41.6	36.7	34.9	35.7	29.9	26.7	41.9
		Difference	0.8	2.1	4.9	1.0	-2.5	2.0	3.2	-1.2	-3.2	-4.3	-3.9
	11/24/2015	Aircraft Event (AAL A320 at 10:27:34 a.m.)	45.3	42.5	39.7	35.5	31.8	30.4	32.2	33.4	32.8	28.0	<b>43.3</b>
		Ambient	45.6	49.0	<b>51.1</b>	48.0	43.1	35.9	34.1	30.9	26.6	21.2	31.5
		Difference	-0.3	-6.5	-11.4	-12.5	-11.3	-5.5	-1.9	2.5	6.2	6.8	11.8
	11/23/2015	Aircraft Event (SWA B737-700 at 10:51:45 a.m.)	47.7	48.0	49.3	<b>52.2</b>	46.4	37.2	29.6	26.5	16.1	8.0	21.4
		Ambient	45.6	49.0	<b>51.1</b>	48.0	43.1	35.9	34.1	30.9	26.6	21.2	31.5
		Difference	2.1	-1.0	-1.8	4.2	3.3	1.3	-4.5	-4.4	-10.5	-13.2	-10.1
	11/24/2015	Aircraft Event (SWA B737-300 at 3:04:50 p.m.)	44.5	42.2	<b>47.2</b>	36.5	32.8	31.6	32.9	32.4	33.9	26.6	25.2
		Ambient	45.6	48.3	<b>50.1</b>	43.8	39.7	38.2	33.3	32.9	28.0	28.0	36.8
		Difference	-1.1	-6.1	-2.9	-7.3	-6.9	-6.6	-0.4	-0.5	5.9	-1.4	-11.6
	11/23/2015	Aircraft Event (SWA B737-800 at 3:40:55 p.m.)	43.2	<b>45.1</b>	42.8	39.6	37.1	32.0	30.9	28.2	26.1	13.7	22.1
		Ambient	45.6	48.3	<b>50.1</b>	43.8	39.7	38.2	33.3	32.9	28.0	28.0	36.8
		Difference	-2.4	-3.2	-7.3	-4.2	-2.6	-6.2	-2.4	-4.7	-1.9	-14.3	-14.7

 Note: Worst-Case Aircraft Event Frequency in **Bold**

**Table 13** – Comparison of Departure Aircraft Events and Ambient Noise Levels at Location 1 – Point Loma Nazarene University and Location 2 – Sunset Cliffs

Location	Date of Event	Type	Lmax Noise Level (dBA)	One-Third Octave Noise Levels (dBA)										
				31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	16000 Hz	
1 - Point Loma Nazarene University	11/23/2015	Aircraft Event (ASA B737-800 at 6:35:27 a.m.)	52.3	<b>55.0</b>	52.8	54.4	51.9	45.3	39.5	31.8	22.3	9.5	8.4	
		Ambient	51.6	<b>53.4</b>	51.8	52.9	49.3	44.6	40.1	36.3	30.5	21.1	15.4	
		Difference	0.7	1.6	1.0	1.5	2.6	0.7	-0.6	-4.5	-8.2	-11.6	-7.0	
	11/24/2015	Aircraft Event (UPS B767-300 at 6:41:43 a.m.)	51.4	<b>53.2</b>	50.5	53.0	48.1	43.1	40.9	33.3	25.0	10.0	7.9	
		Ambient	51.6	<b>53.4</b>	51.8	52.9	49.3	44.6	40.1	36.3	30.5	21.1	15.4	
		Difference	-0.2	-0.2	-1.3	0.1	-1.2	-1.5	0.8	-3.0	-5.5	-11.1	-7.5	
	11/23/2015	Aircraft Event (UAL B737-900 at 7:01:32 a.m.)	51.6	<b>50.4</b>	<b>53.2</b>	52.6	48.5	45.1	40.8	32.3	24.0	13.0	8.8	
		Ambient	55.1	<b>56.0</b>	54.5	52.2	48.4	45.8	45.1	39.3	32.2	25.7	27.8	
		Difference	-3.5	-5.6	-1.3	0.4	0.1	-0.7	-4.3	-7.0	-8.2	-12.7	-19.0	
	11/24/2015	Aircraft Event (SWA B737-800 at 11:13:49 a.m.)	49.2	<b>52.3</b>	48.8	47.7	46.1	42.8	38.0	34.3	26.7	17.1	14.5	
		Ambient	55.1	<b>56.0</b>	54.5	52.2	48.4	45.8	45.1	39.3	32.2	25.7	27.8	
		Difference	-5.9	-3.7	-5.7	-4.5	-2.3	-3.0	-7.1	-5.0	-5.5	-8.6	-13.3	
	11/24/2015	Aircraft Event (JBU A320 at 2:13:28 p.m.)	51.0	<b>54.1</b>	51.6	52.2	52.0	42.8	36.7	31.0	22.4	18.8	23.5	
		Ambient	51.0	53.8	51.0	<b>54.1</b>	48.7	43.2	39.0	36.5	29.4	22.8	24.9	
		Difference	0.0	0.3	0.6	-1.9	3.3	-0.4	-2.3	-5.5	-7.0	-4.0	-1.4	
	11/24/2015	Aircraft Event (DAL A320 at 4:45:57 p.m.)	54.0	<b>58.0</b>	54.7	51.4	48.2	46.4	40.1	33.4	38.7	16.8	10.4	
		Ambient	51.0	53.8	51.0	<b>54.1</b>	48.7	43.2	39.0	36.5	29.4	22.8	24.9	
		Difference	3.0	4.2	3.7	-2.7	-0.5	3.2	1.1	-3.1	9.3	-6.0	-14.5	
	2 - Sunset Cliffs	11/23/2015	Aircraft Event (ASA B737-800 at 6:35:35 a.m.)	48.1	54.7	<b>57.3</b>	51.9	48.9	35.3	28.4	27.4	27.9	22.7	36.5
			Ambient	47.4	49.1	<b>51.8</b>	47.6	41.6	36.7	34.9	35.7	29.9	26.7	41.9
			Difference	0.7	5.6	5.5	4.3	7.3	-1.4	-6.5	-8.3	-2.0	-4.0	-5.4
		11/24/2015	Aircraft Event (UPS B767-300 at 6:41:25 a.m.)	49.7	55.5	<b>60.1</b>	53.8	49.3	35.2	27.2	28.0	31.1	27.2	42.2
			Ambient	47.4	49.1	<b>51.8</b>	47.6	41.6	36.7	34.9	35.7	29.9	26.7	41.9
			Difference	2.3	6.4	8.3	6.2	7.7	-1.5	-7.7	-7.7	1.2	0.5	0.3
11/23/2015		Aircraft Event (UAL B737-900 at 7:01:33 a.m.)	48.9	44.6	<b>45.9</b>	41.4	38.9	34.4	38.3	37.7	29.4	26.5	42.0	
		Ambient	45.6	49.0	<b>51.1</b>	48.0	43.1	35.9	34.1	30.9	26.6	21.2	31.5	
		Difference	3.3	-4.4	-5.2	-6.6	-4.2	-1.5	4.2	6.8	2.8	5.3	10.5	
11/24/2015		Aircraft Event (SWA B737-800 at 11:13:47 a.m.)	46.2	40.3	42.0	32.3	29.7	32.3	36.3	35.2	31.3	28.7	<b>42.3</b>	
		Ambient	45.6	49.0	<b>51.1</b>	48.0	43.1	35.9	34.1	30.9	26.6	21.2	31.5	
		Difference	0.6	-8.7	-9.1	-15.7	-13.4	-3.6	2.2	4.3	4.7	7.5	10.8	
11/24/2015		Aircraft Event (JBU A320 at 2:13:27 p.m.)	49.6	<b>55.7</b>	52.3	43.7	40.4	35.4	39.1	38.0	37.7	30.0	27.6	
		Ambient	45.6	48.3	<b>50.1</b>	43.8	39.7	38.2	33.3	32.9	28.0	28.0	36.8	
		Difference	4.0	7.4	2.2	-0.1	0.7	-2.8	5.8	5.1	9.7	2.0	-9.2	
11/24/2015		Aircraft Event (DAL A320 at 4:45:53 p.m.)	44.8	40.4	<b>43.2</b>	37.9	36.5	33.8	31.1	32.5	30.3	28.2	42.1	
		Ambient	45.6	48.3	<b>50.1</b>	43.8	39.7	38.2	33.3	32.9	28.0	28.0	36.8	
		Difference	-0.8	-7.9	-6.9	-5.9	-3.2	-4.4	-2.2	-0.4	2.3	0.2	5.3	

 Note: Worst-Case Aircraft Event Frequency in **Bold**