



# (●) CASPER

## CITY OF SUNNYVALE Q4 – FLIGHT OPERATIONS AND NOISE REPORT

## DISCLAIMER

Casper Airport Solutions, Inc. provides the data in this report on behalf of the City of Sunnyvale for informational purposes only. It has no legal standing and is not recognized as an official source by either the State of California or the Federal Aviation Administration (FAA).

The City of Sunnyvale is not an airport authority. It has no statutory reporting obligation under Title 21 of the California Department of Transportation.

The sound level meters installed by Casper are certified by the manufacturer Larson Davis to meet all ANSI performance requirements for a Type 1 sound level meter.

The FAA System Wide Information Management (SWIM) flight track position data has a stated minimum accuracy of  $\pm 150$  feet and temporal accuracy of approximately 1 second.

# INTRODUCTION

The City of Sunnyvale's primary goal in procuring a Noise and Operations Monitoring System (NOMS) is to monitor flight activity and the aircraft noise associated with overflights that affect residents living within the city limits. Secondly, to provide this data to interested parties in a transparent and unfiltered way.

The data contained in this report is presented with that goal in mind. On each page, you will find an explanation of how to read the various charts and definitions of the different metrics and data types. What you will not find is any interpretation by the "City" about the data in this report.

For a more detailed explanation of the various noise metrics, general aircraft operations, or ATC procedures discussed in this report, please refer to the Education section of the City of Sunnyvale's NoiseLab website (<https://syv.noiselab.casper.aero>). The website also contains interactive data browsers that allow interested parties to view detailed noise and flight operations statistics concerning areas around the City of Sunnyvale.

When reading this report, it is essential to consider the following factors:

- This report's data may vary from San Jose International Airport's (SJC) information as this report does not include South Flow arrivals to SJC that did not overfly the "City".
- Not every aircraft overflight is captured by one of the four NMTs due to spikes in ambient noise levels, which may obscure the aircraft event or environmental factors such as wind speed and direction.
- The maximum noise level of a specific flight may vary based on the point of closest approach (PCA) slant distance and altitude of the aircraft in relation to the NMT. In addition, aircraft engine power settings, flap position, and landing gear state also influence the maximum noise level and event duration.
- The City's noise monitors capture noise events from all sources such as people, vehicles, animals, trains, and planes. The NOMS system analyzes every noise event captured by each NMT to determine if it meets the parameters to identify it as an aircraft noise event. Once the system identifies the source of a noise event as an aircraft, the NOMS system then attempts to match the noise event based on the time stamp, altitude, and lateral distance from the noise monitor to a specific flight.

## 24 HOUR VIEW OF AIRCRAFT NOISE

Most aircraft overfly the City during daytime hours between 7:00 AM and 7:00 PM when ambient noise levels tend to be higher due to increased community activity. Aircraft overflight volumes during the evening (7:00 PM to 10:00 PM) and nighttime (10:00 PM to 7:00 AM) periods are significantly reduced. However, individual events during these periods can be more disturbing to residents due to the lower ambient noise levels in the City. Below is the breakdown of flights by time of day in Q4-2022.

### SUNNYVALE OVERFLIGHTS BY TIME OF DAY



# SJC AIRPORT SOUTH FLOW DATA FOR Q4 – 2022

One of the City of Sunnyvale's primary objectives in installing a Noise and Operations Monitoring System (NOMS) was to monitor and report on South Flow arrivals that overfly the City on their approach to land to Norman Y. Mineta San Jose International Airport (SJC).

There are two types of approaches flown by airplanes landing in South Flow at SJC Airport. The widely dispersed ILS/Visual approach is shown in yellow. The highly concentrated RNP approach is shown in blue on the facing page.

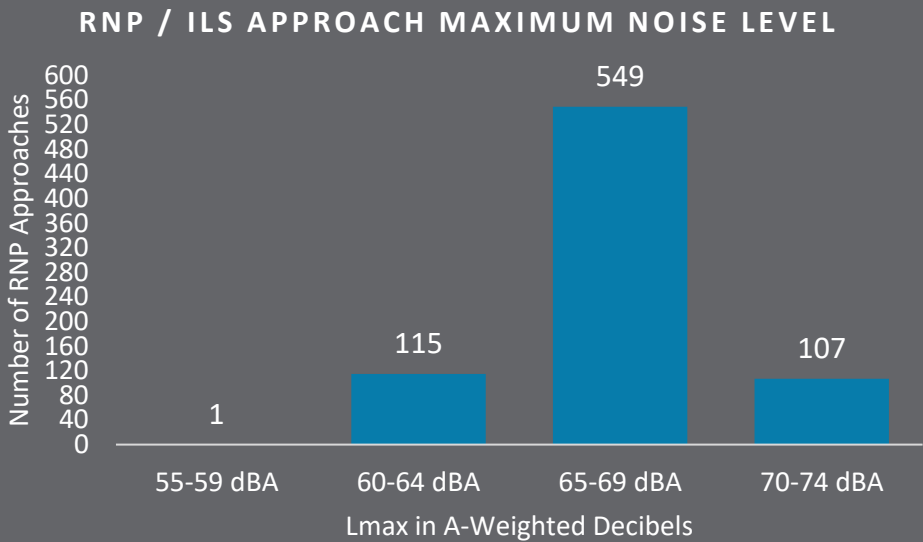
The ILS/Visual approach has a wide lateral footprint because the pilots are flying vectors (headings) under ATC's direction. The controller determines their turn onto the final approach. By contrast, the RNP approach is a precision instrument procedure that utilizes fixed GPS waypoints that must be precisely overflown and have very small lateral error tolerances.

Because of the wide dispersion caused by the ILS/Visual approach, a single noise monitoring terminal (NMT) cannot capture a noise event for each flight. However, the concentrated flight path of the RNP approach makes it possible to capture noise events at SYV-2 Dona Ave. for the vast majority of aircraft flying this approach.

In the 4th Quarter of 2022, the Casper system successfully captured noise events for 87% of the total South Flow RNP approaches flown to SJC Airport, the distribution of which is shown in the chart below.

The chart at right illustrates the maximum noise level (Lmax) recorded at the Dona Ave (SYV-2) permanent noise monitor for aircraft that flew the RNP Approach to Runway 12L or 12R at SJC Airport and passed over the City of Sunnyvale.

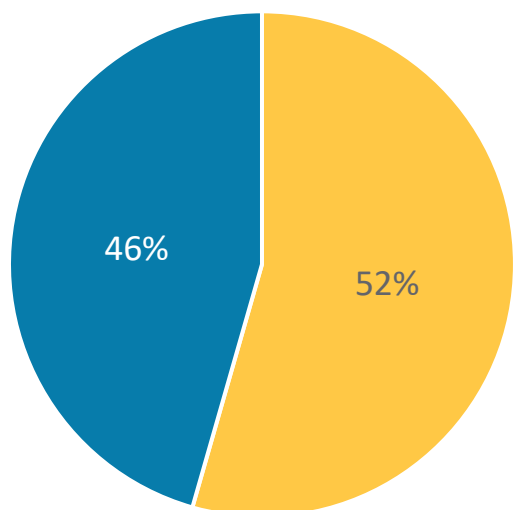
The number above each bar represents the total number of aircraft noise events in which the Lmax fell within the specific five decibel bucket identified on the chart.







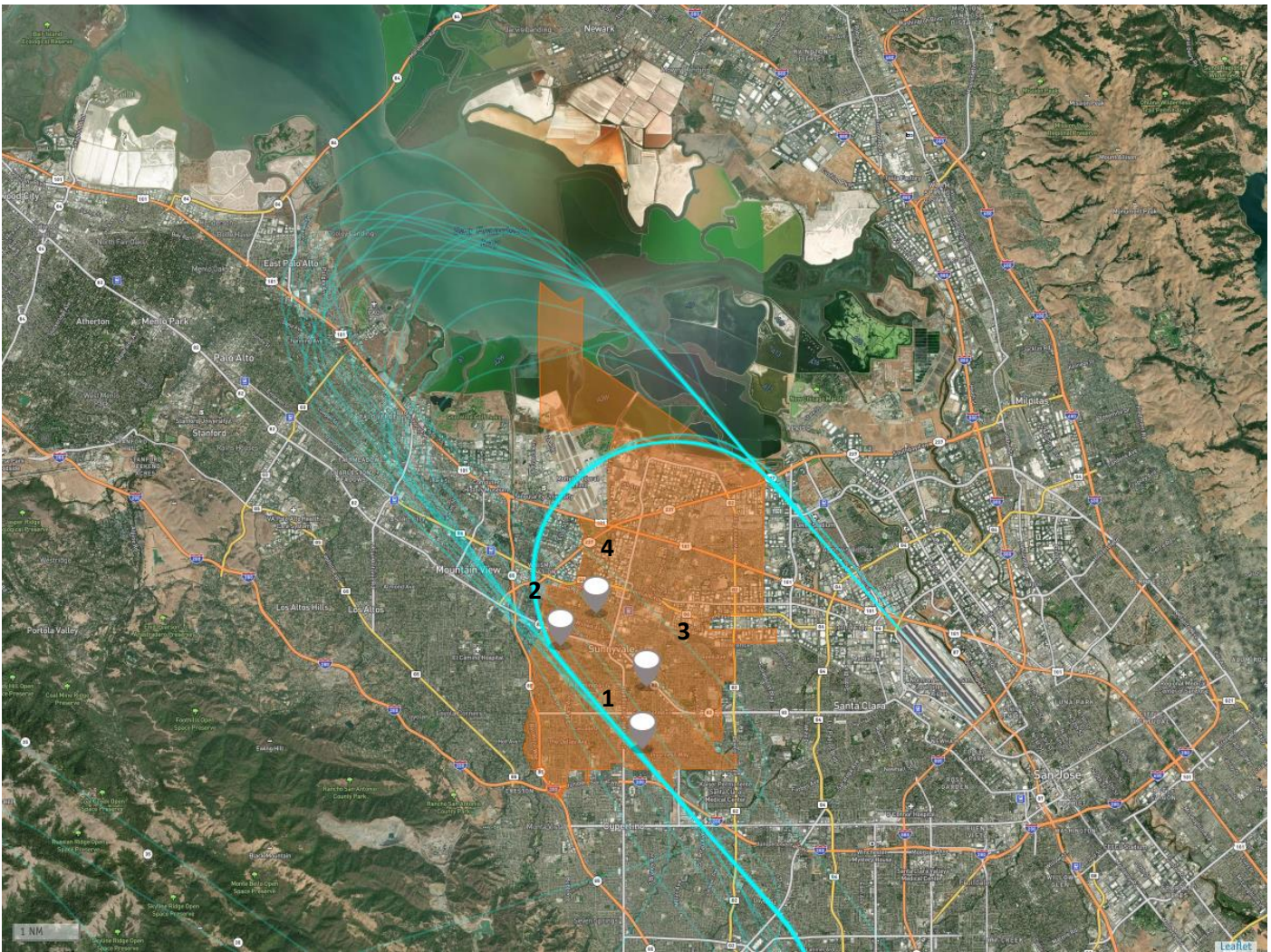
## SOUTH FLOW APPROACHES IN Q4-2022 October 1 – December 31



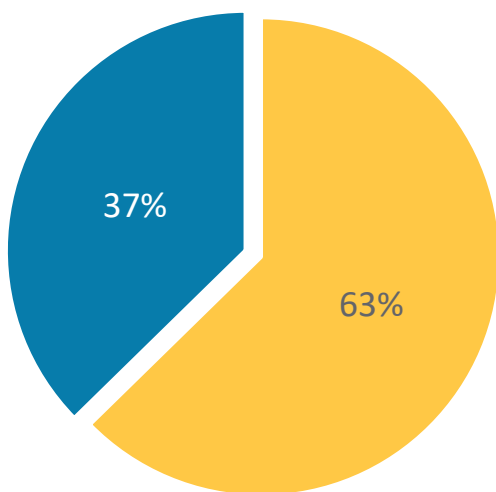
■ ILS/Visual Approach
 ■ RNP Approach

	ILS/Visual vs RNP	
Average Altitude ft.	3,192	3,165
Runway 12L App.	71	75
Runway 12R App.	996	818
Total Approaches	1,067	893





## PEAK SOUTH FLOW DAY IN Q4-2022 December 11

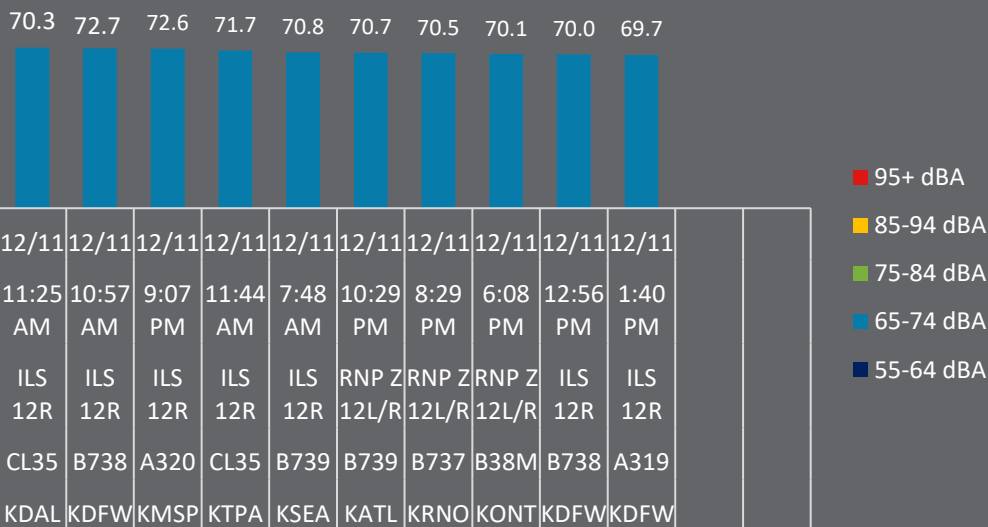


■ ILS/Visual Approach ■ RNP Approach

	ILS/Visual	RNP
Average Altitude ft.	3,168	3,150
Runway 12L App.	4	5
Runway 12R App.	132	76
Total Approaches	136	81

The following charts detail the Peak South Flow Approach Day Top 10 loudest (by Lmax) noise events measured at SYV-1 and SYV-2 noise monitoring terminals (NMTs) during the 4th Quarter. Keep in mind that these events only pertain to aircraft that overflowed the City of Sunnyvale on a South Flow Approach to SJC Airport and were not necessarily the loudest overall for the Quarter. For information on the loudest overall aircraft noise events, see the individual NMT summaries starting on page 10.

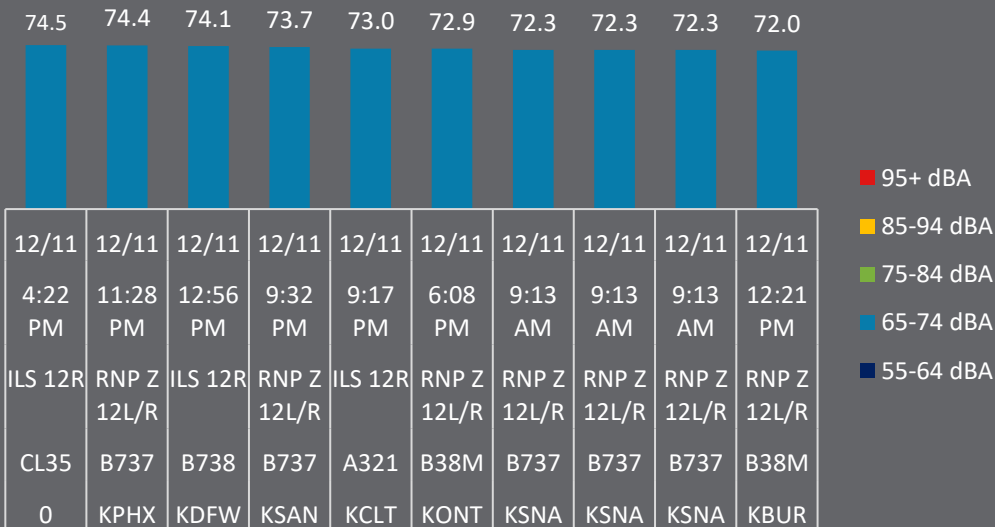
#### SYV-1 PEAK SOUTH FLOW DAY A/C NOISE EVENTS IN Q4-2022



The chart at left illustrates the Top 10 SJC South Flow Peak Day aircraft noise events ranked by maximum noise level (Lmax) as measured at SYV-1 in the 4th Quarter of 2022. Below each bar is the date of the event and the four-letter ICAO aircraft code of the aircraft type involved.

Events with no aircraft type denote that an aircraft type was not identified in the FAA data.

#### SYV-2 PEAK SOUTH FLOW DAY A/C NOISE EVENTS IN Q4-2022

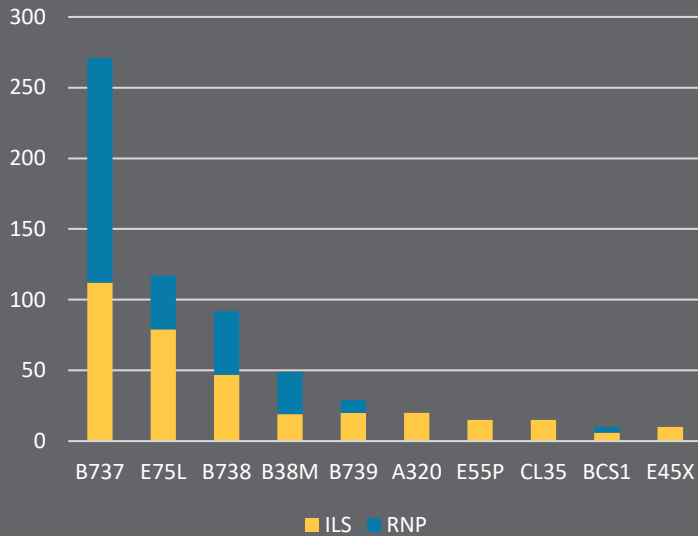


The chart at left illustrates the Top 10 SJC South Flow Peak Day aircraft noise events ranked by maximum noise level (Lmax) as measured at SYV-2 in the 4th Quarter of 2022. Below each bar is the date of the event and the four-letter ICAO aircraft code of the aircraft type involved.

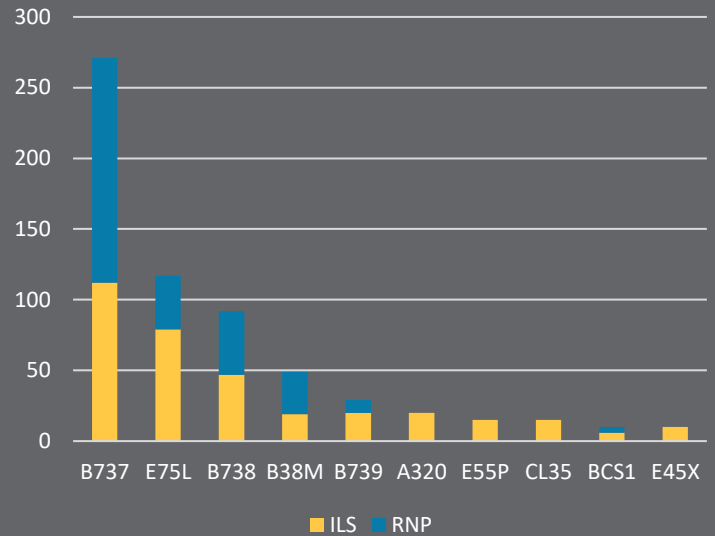
Events with no aircraft type denote that an aircraft type was not identified in the FAA data.

The following charts show the most frequent aircraft types and operators to fly the South Flow approach to SJC for the 4th Quarter and the Peak South Flow Approach Day. The total for each column is derived by adding the number of ILS/Visual, and RNP approaches flown. Keep in mind that this data only pertains to aircraft that overflowed the City of Sunnyvale on a South Flow Approach to land at SJC Airport.

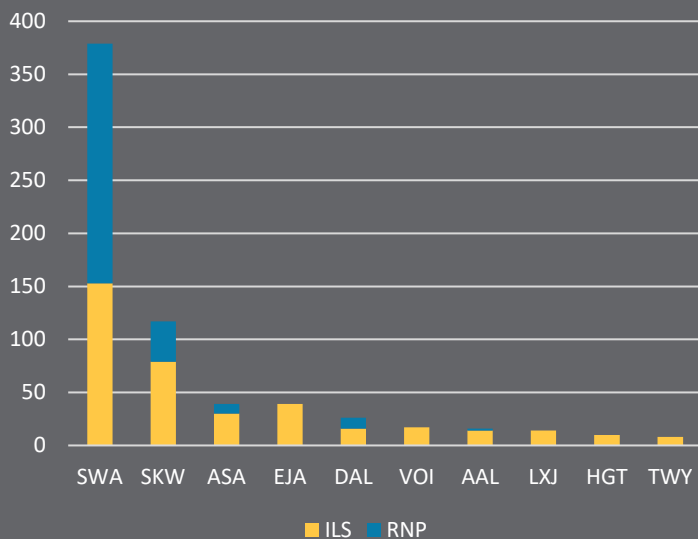
**SOUTH FLOW APPROACH BY AIRCRAFT TYPE IN Q4-2022**



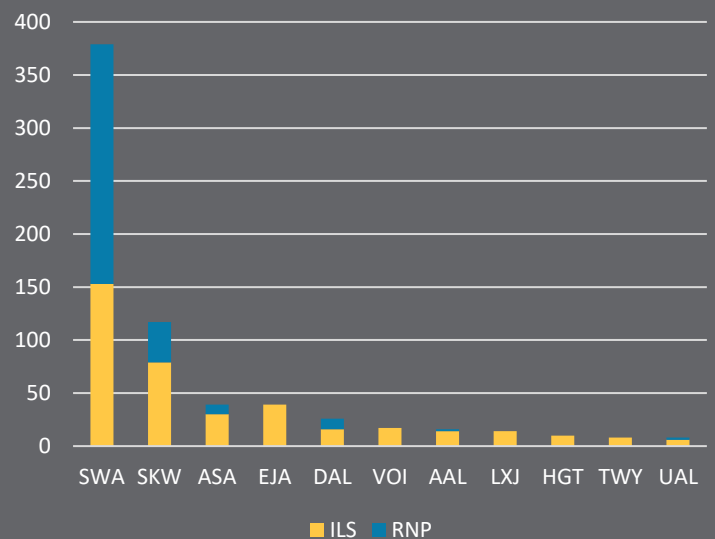
**PEAK SOUTH FLOW DAY APPROACH BY AIRCRAFT TYPE IN Q4-2022**



**SOUTH FLOW APPROACH BY OPERATOR IN Q4-2022**

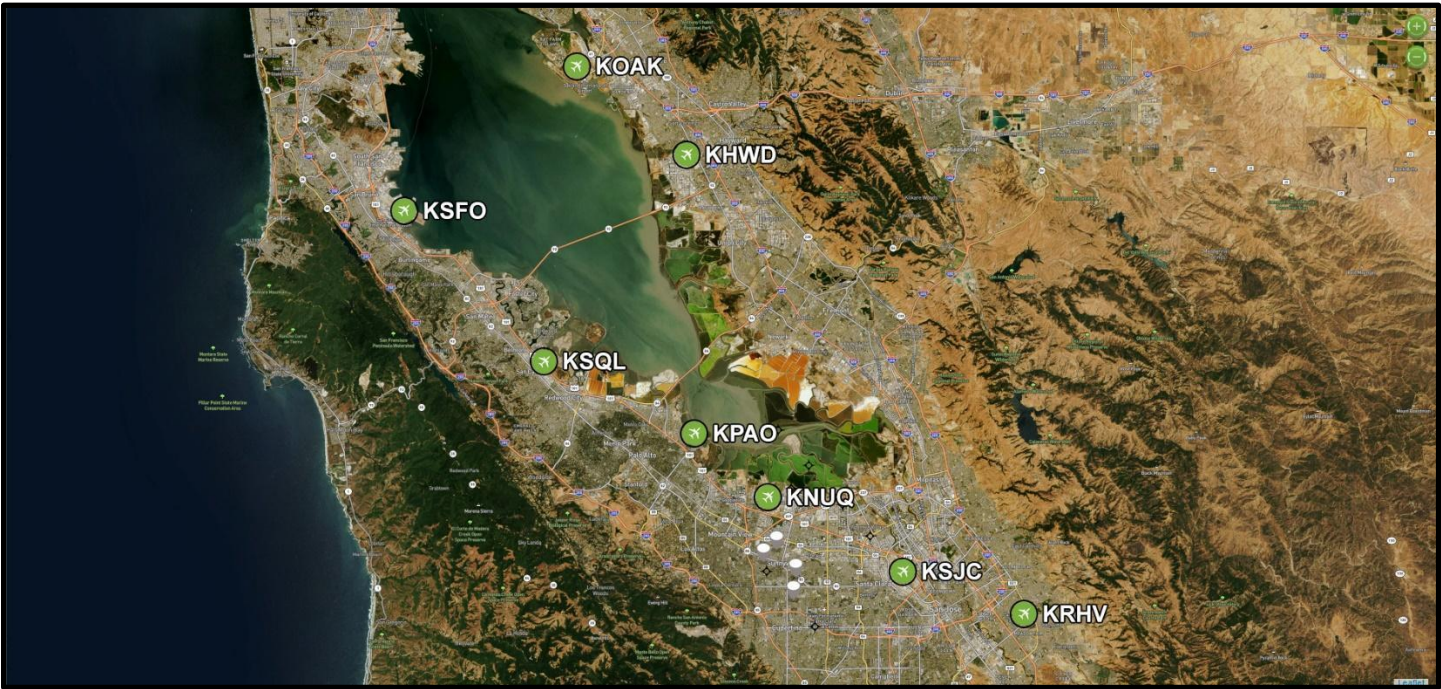


**PEAK SOUTH FLOW DAY APPROACH BY OPERATOR IN Q4-2022**





# CITY OF SUNNYVALE OVERFLIGHT DATA FOR Q4 – 2022

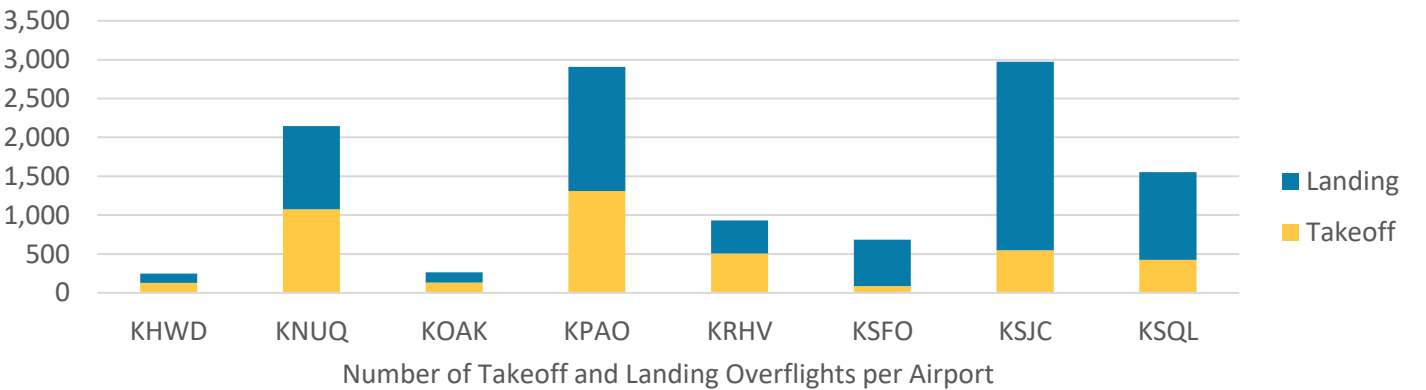


While SJC Airport is the closest major airport to the City of Sunnyvale, residents are overflown by aircraft arriving and departing from many different airports in the region. The data in this section quantifies overflights associated with each of the eight primary airports of interest listed below and helps explain the distribution of flights across the four zip codes that fall within the City limits.

## AIRPORTS OF INTEREST

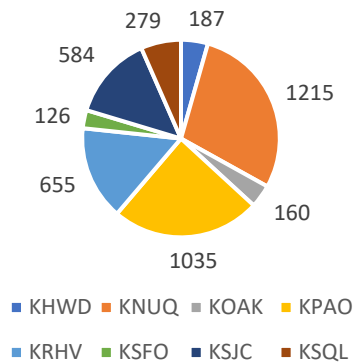
- KHWd – Hayward Executive Airport
- KNUQ – Moffett Federal Airfield
- KOAK – Metro Oakland Int’l Airport
- KPAO – Palo Alto Airport
- KRHV – Reid-Hillview Airport of Santa Clara County
- KSFO – San Francisco Int’l Airport
- KSJC – Norman Y Mineta San Jose Int’l Airport
- KSQL – San Carlos Airport

## CITY OF SUNNYVALE OVERFLIGHTS BY AIRPORT

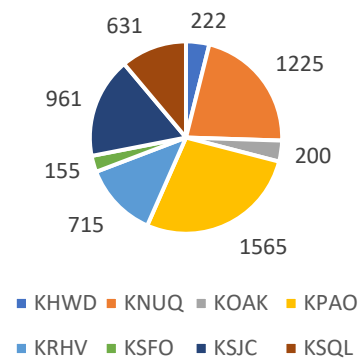


The City of Sunnyvale is comprised of four primary zip codes (94085, 94086, 94087, 94089), which bisect the City forming four unique zones from North to South. The volume of overflights on any given day can vary significantly across the City. Seasonal wind patterns play the most significant role in dictating the arrival and departure patterns into a specific airport. The current wind direction largely determines which Sunnyvale neighborhoods are overflowed by aircraft during their arrival or departure to that airport. The charts below illustrate the pattern of overflights for each of the four zip codes for the 4th Quarter of 2022.

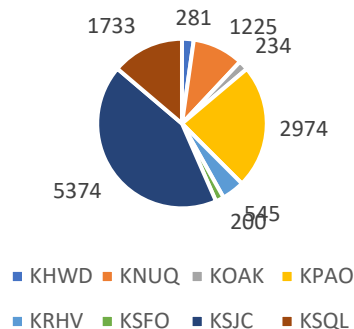
Overflights by Airport in Zip Code 94085



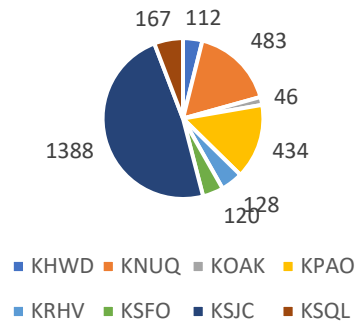
Overflights by Airport in Zip Code 94086



Overflights by Airport in Zip Code 94087



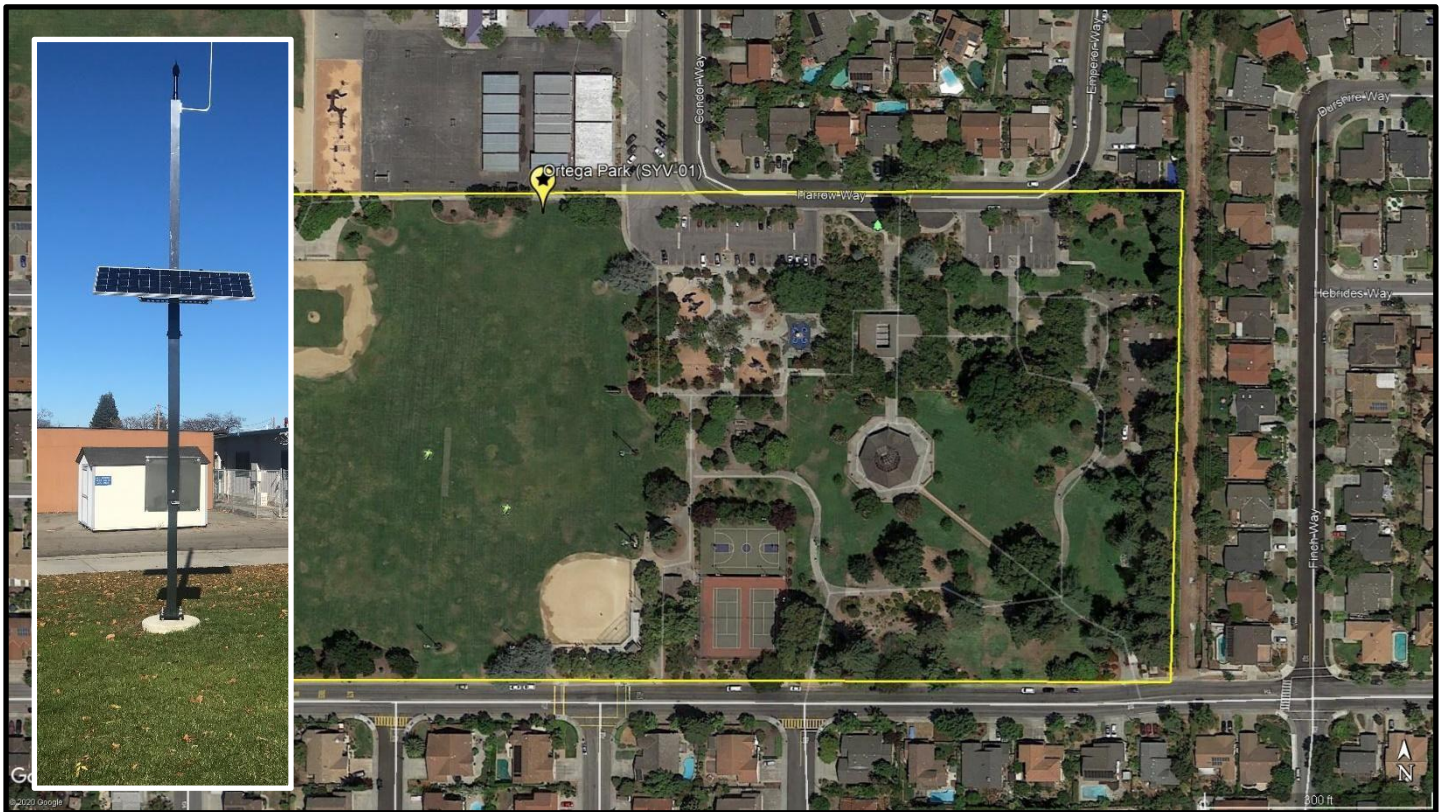
Overflights by Airport in Zip Code 94089



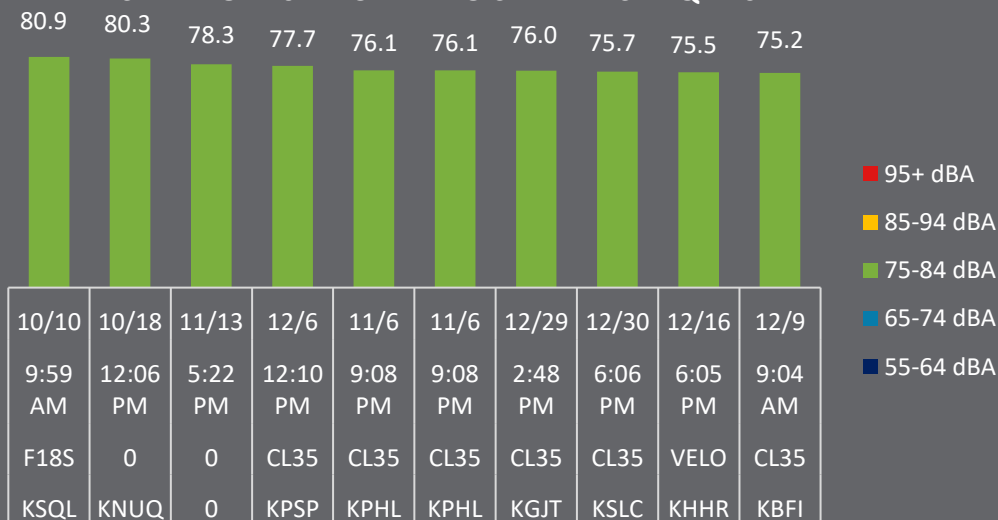


# SYV-1 ORTEGA PARK NMT DATA Q4 – 2022

Noise Monitoring Terminal SYV-1 is in Ortega Park. Its primary purpose is to capture RNP arrivals to SJC Airport in South Flow and secondarily flight activity associated with Moffett Field, Palo Alto, Reid-Hillview, and San Carlos Airports. The image below is an aerial depicting the location of the NMT in the park and a photo of the installed equipment.



**SYV-1 TOP 10 AIRCRAFT NOISE EVENTS IN Q4-2022**



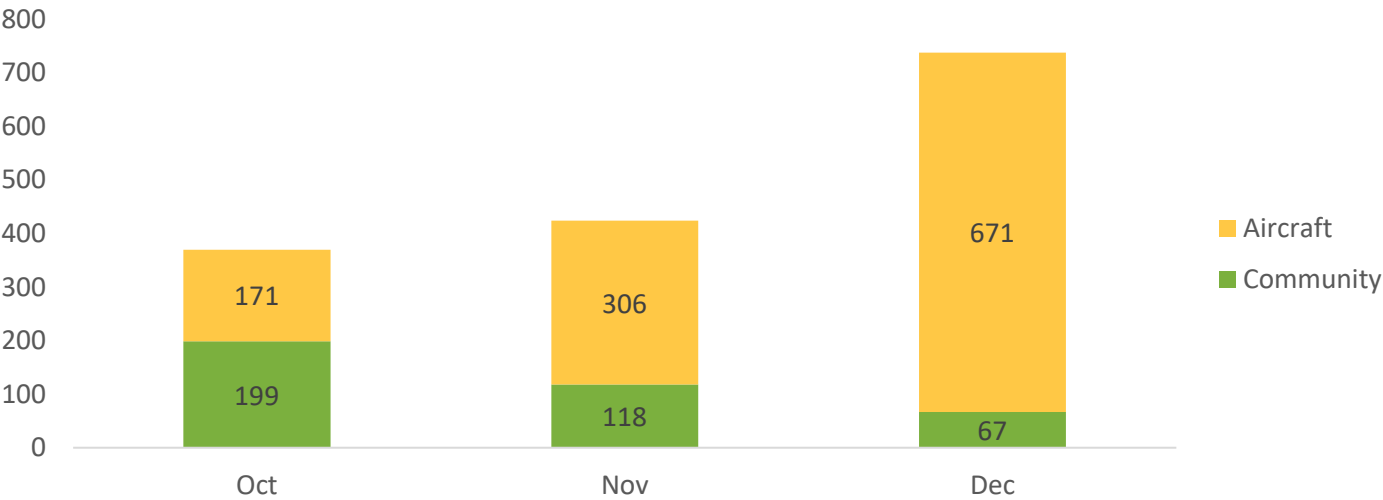
The chart at left illustrates the Top 10 aircraft noise events ranked by maximum noise level (Lmax) as measured at SYV-1 in the 4th Quarter of 2022. Below each bar is the date of the event and the four-letter ICAO aircraft code of the aircraft type involved.

Events with no aircraft type denote that an aircraft type was not identified in the FAA data.



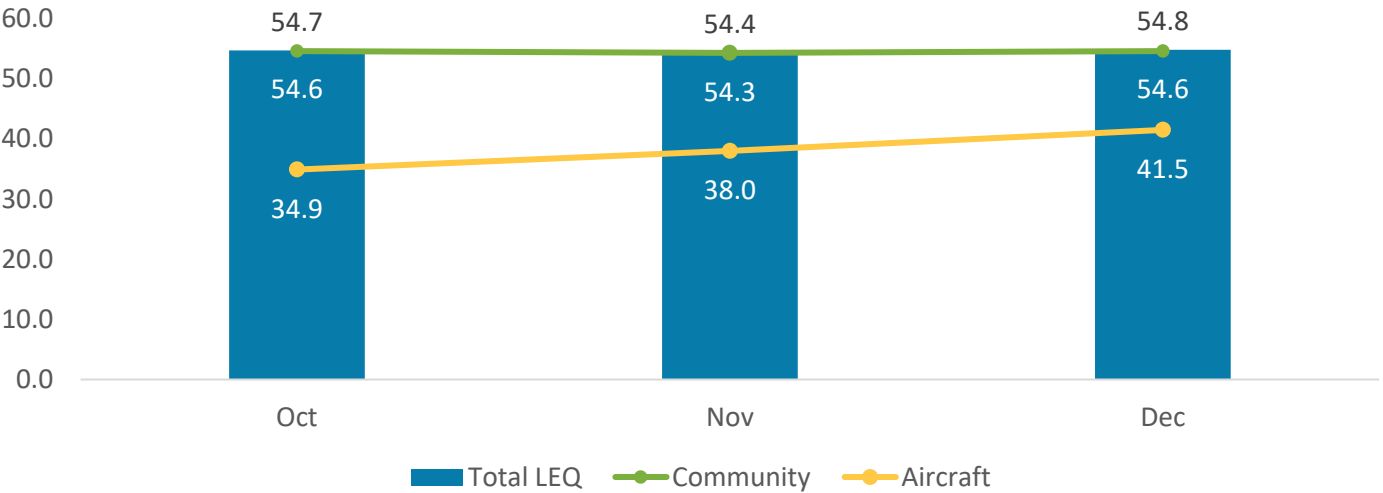
The charts below illustrate the relationship between aircraft and community noise and their contribution to the total noise environment measured by the noise monitoring terminal SYV-1 in Ortega Park.

SYV-1 TOTAL RECORDED NOISE EVENTS IN Q4-2022



Noise events captured by the NMTs are analyzed on the fly as they happen. Based on their categorization as community or aircraft noise, the system automatically calculates an hourly Aircraft, Community, and Total LEQ (equivalent continuous sound level). Equivalent signifies that the total acoustical energy associated with the continually fluctuating noise level (during the specified period); in this case, a month is equal to the total acoustic energy associated with the steady noise level. Hourly LEQs are averaged to derive a Daily LEQs, which is averaged to derive a monthly LEQ. The Total LEQ considers both the aircraft and community contributions to the noise environment.

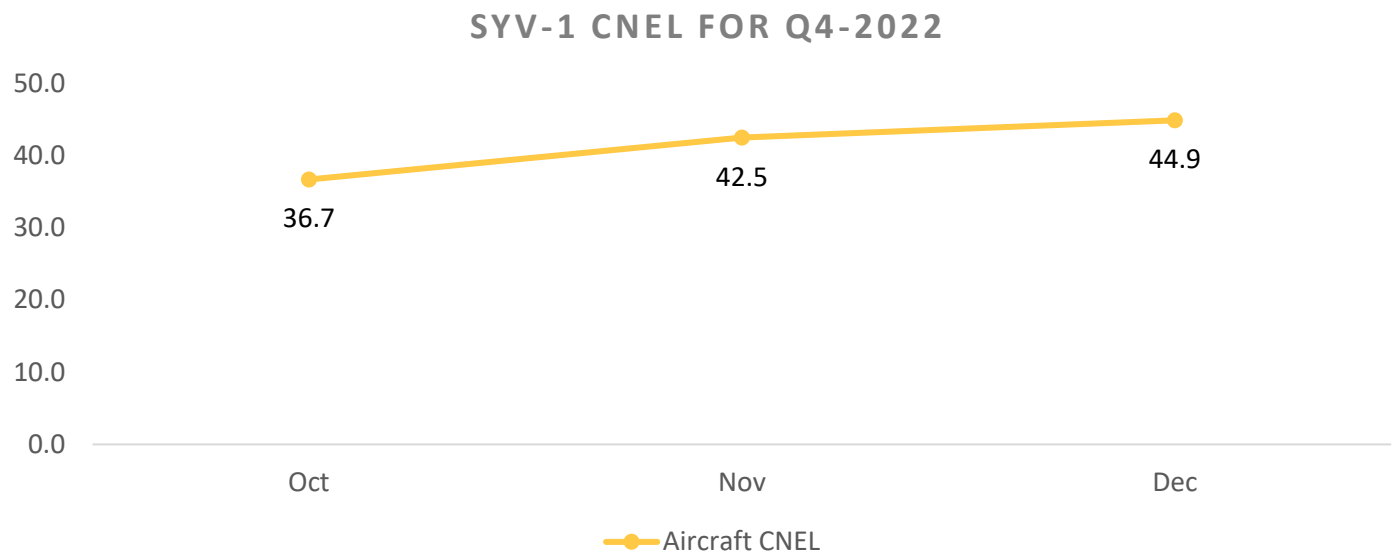
SYV-1 LEQ NOISE LEVEL FOR Q4-2022



While most singular noise events are expressed in Lmax or LEQ dB(A), cumulative noise exposure originating from aircraft expressed over longer periods of time are typically done in DNL, or day-night average sound level. This adds more “weight” to aircraft noise levels during more sensitive times of the day, typically during night hours. However, the State of California uses a slightly modified version of DNL called CNEL, or Community Noise Equivalent Level. Taken from the FAA’s website on guidance for managing community noise,

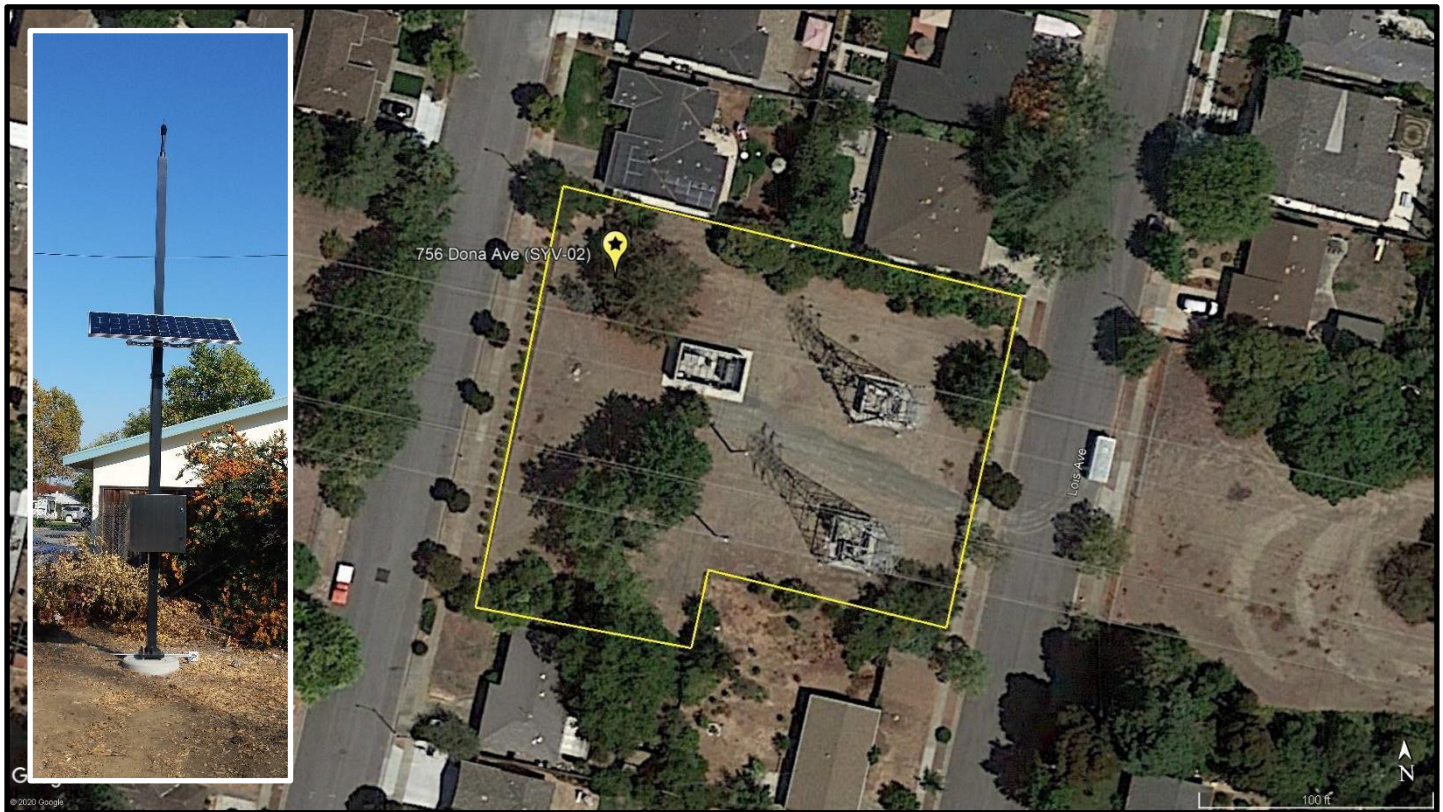
“While DNL is the primary metric FAA uses to determine noise impacts, FAA accepts the Community Noise Equivalent Level (CNEL) in California as California adopted the use of CNEL prior to FAA adopting DNL. While CNEL, like DNL, adds a ten times weighting (equivalent to a 10 dBA "penalty") to each aircraft operation between 10:00 p.m. and 7:00 a.m., CNEL also adds a three times weighting (equivalent to a 4.77 dBA penalty) for each aircraft operation during evening hours (7:00 p.m. to 10:00 p.m.)”

DNL and CNEL are most effective when calculating for only aircraft noise events, or acne. The below chart displays the trend in CNEL over the course of the last quarter

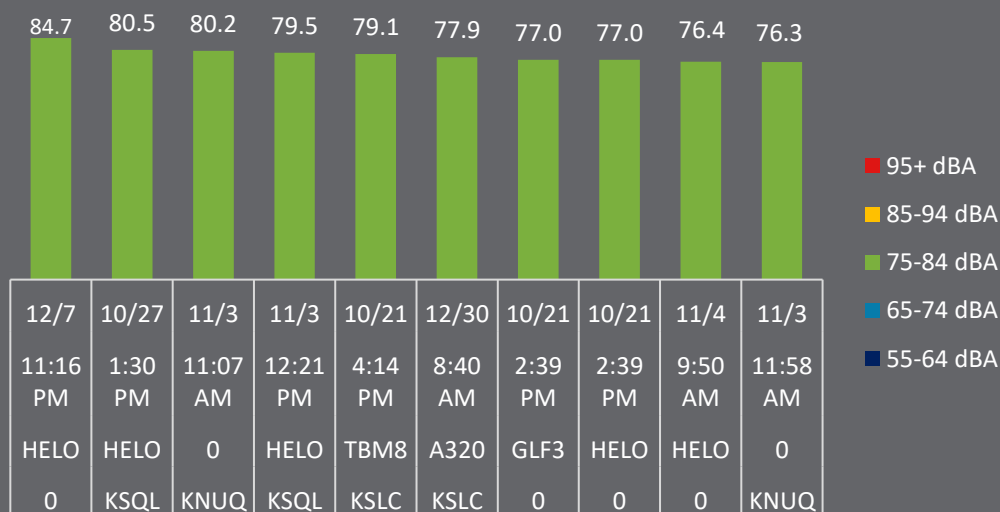


# SYV-2 DONA AVE NMT DATA Q4 – 2022

Noise Monitoring Terminal SYV-2 is on Dona Ave. Its primary purpose is to capture RNP arrivals to SJC Airport in South Flow and secondarily flight activity associated with Moffett Field, Palo Alto, Reid-Hillview, and San Carlos Airports. The image below is an aerial depicting the location of the NMT and a photo of the installed equipment.



## SYV-2 TOP 10 AIRCRAFT NOISE EVENTS IN Q4-2022



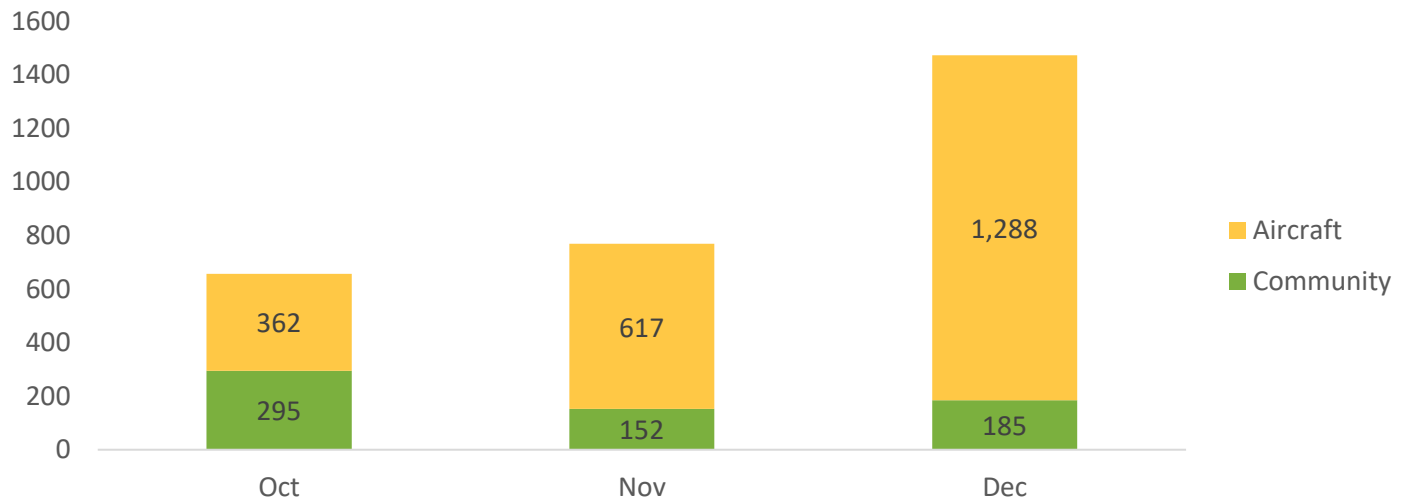
The chart at left illustrates the Top 10 aircraft noise events ranked by maximum noise level (Lmax) as measured at SYV-2 in the 4th Quarter of 2022. Below each bar is the date of the event and the four-letter ICAO aircraft code of the aircraft type involved.

Events with no aircraft type denote that an aircraft type was not identified in the FAA data.



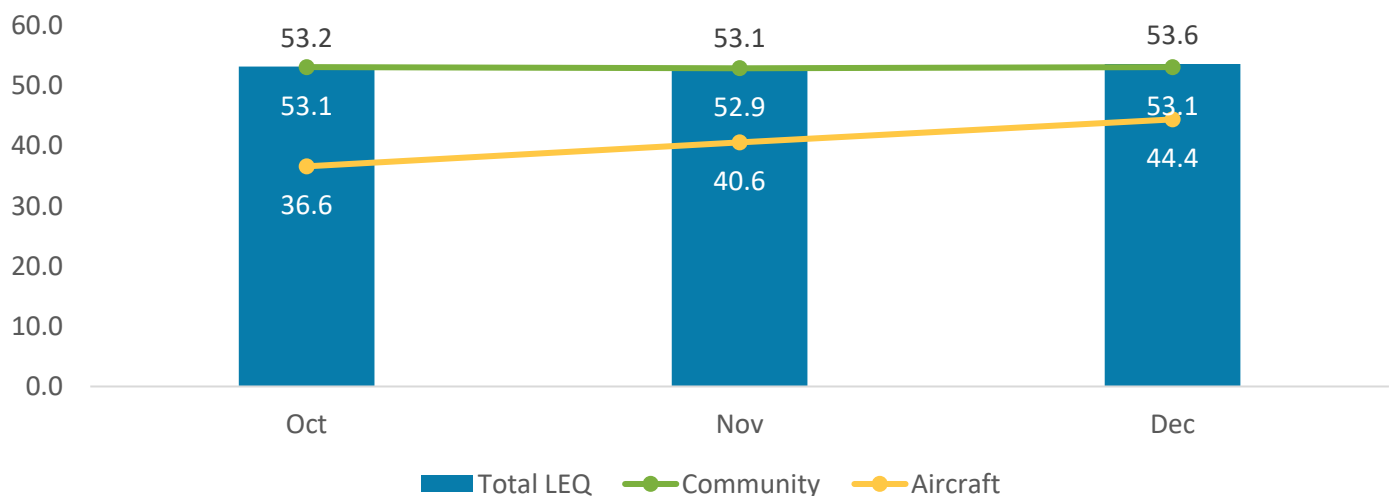
The charts below illustrate the relationship between aircraft and community noise and their contribution to the total noise environment measured by the noise monitoring terminal SYV-2 on Dona Avenue.

### SYV-2 TOTAL RECORDED NOISE EVENTS IN Q4-2022



Noise events captured by the NMTs are analyzed on the fly as they happen. Based on their categorization as community or aircraft noise, the system automatically calculates an hourly Aircraft, Community, and Total LEQ (equivalent continuous sound level). Equivalent signifies that the total acoustical energy associated with the continually fluctuating noise level (during the specified period); in this case, a month is equal to the total acoustic energy associated with the steady noise level. Hourly LEQs are averaged to derive a Daily LEQs, which is averaged to derive a monthly LEQ. The Total LEQ considers both the aircraft and community contributions to the noise environment.

### SYV-2 LEQ NOISE LEVEL FOR Q4-2022

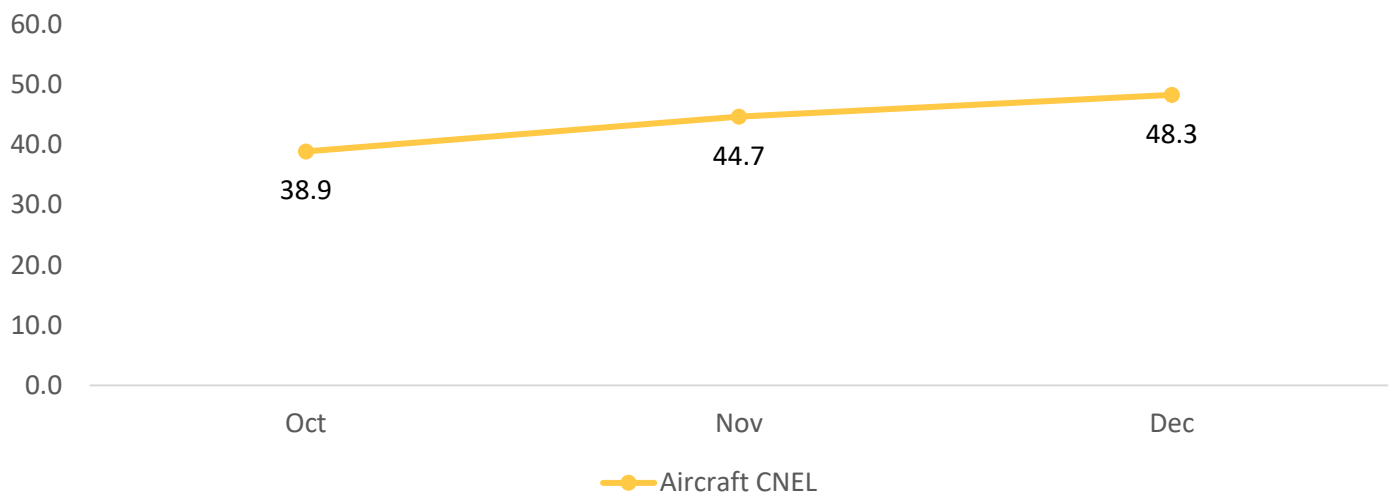


While most singular noise events are expressed in Lmax or LEQ dB(A), cumulative noise exposure originating from aircraft expressed over longer periods of time are typically done in DNL, or day-night average sound level. This adds more “weight” to aircraft noise levels during more sensitive times of the day, typically during night hours. However, the State of California uses a slightly modified version of DNL called CNEL, or Community Noise Equivalent Level. Taken from the FAA’s website on guidance for managing community noise,

“While DNL is the primary metric FAA uses to determine noise impacts, FAA accepts the Community Noise Equivalent Level (CNEL) in California as California adopted the use of CNEL prior to FAA adopting DNL. While CNEL, like DNL, adds a ten times weighting (equivalent to a 10 dBA "penalty") to each aircraft operation between 10:00 p.m. and 7:00 a.m., CNEL also adds a three times weighting (equivalent to a 4.77 dBA penalty) for each aircraft operation during evening hours (7:00 p.m. to 10:00 p.m.)”

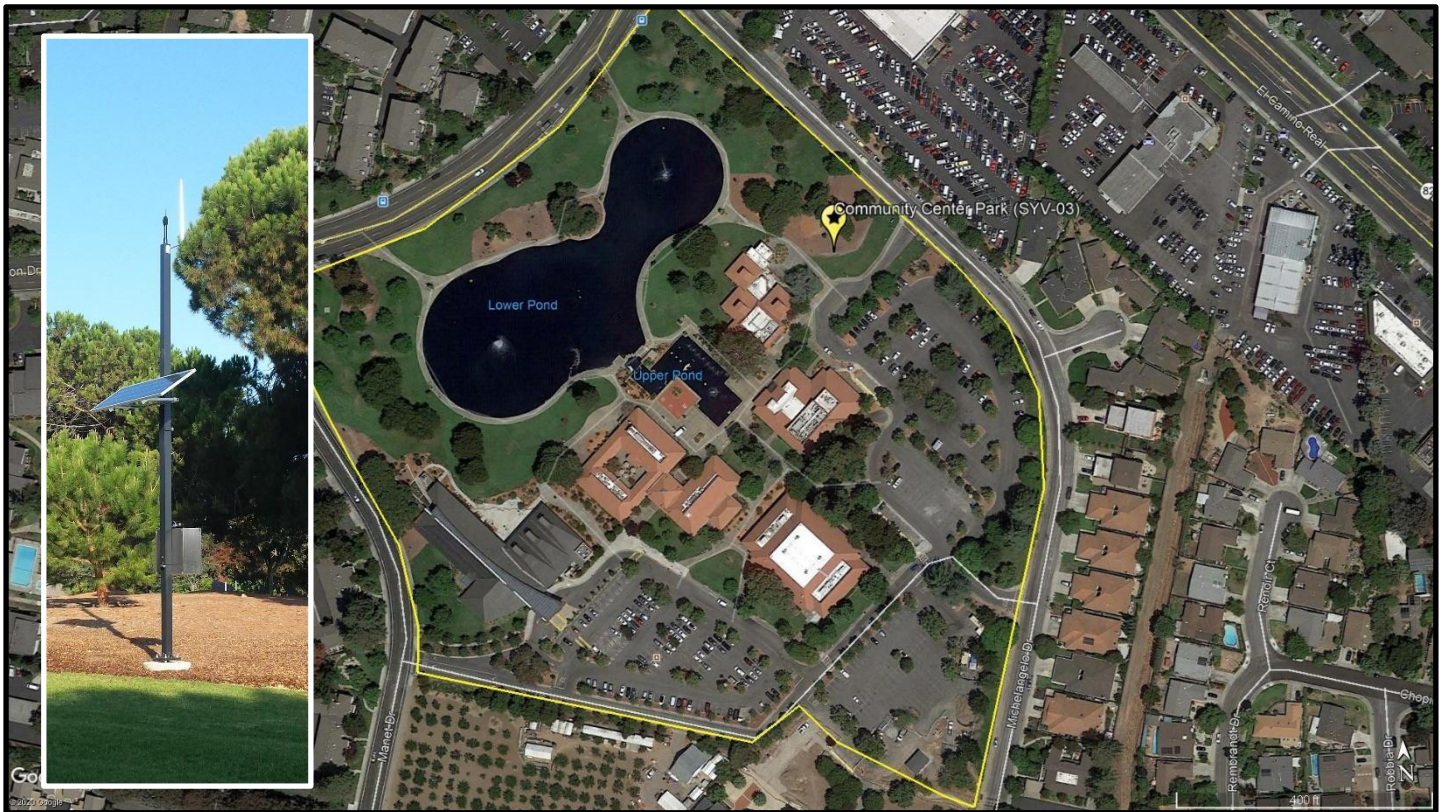
DNL and CNEL are most effective when calculating for only aircraft noise events, or acne. The below chart displays the trend in CNEL over the course of the last quarter

### SYV-2 CNEL FOR Q4-2022

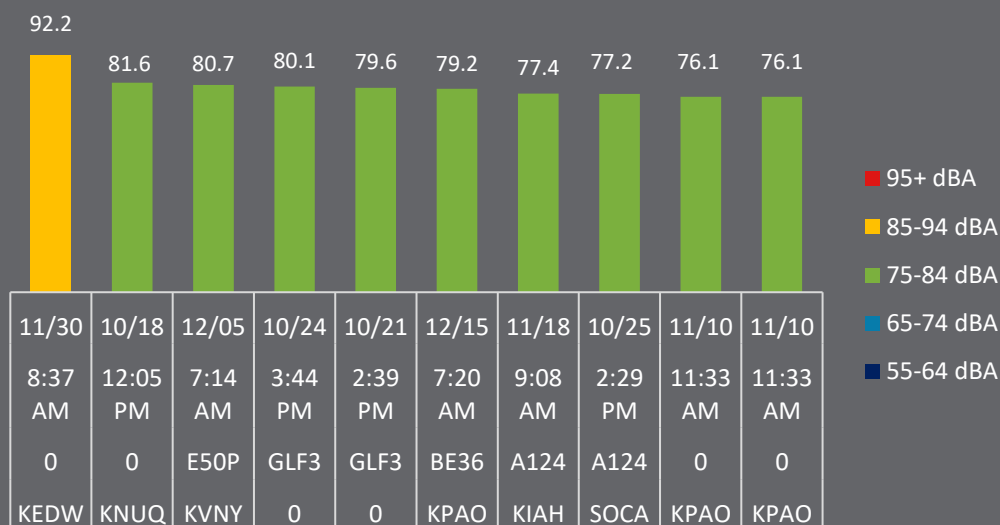


# SYV-3 COMMUNITY CENTER PARK NMT DATA Q4 – 2022

Noise Monitoring Terminal SYV-3 is in Community Center Park. Its primary purpose is to capture RNP arrivals to SJCAirport in South Flow and secondarily flight activity associated with Moffett Field, Palo Alto, Reid-Hillview, and San Carlos Airports. The image below is an aerial depicting the location of the NMT and a photo of the installed equipment.



SYV-3 TOP 10 AIRCRAFT NOISE EVENTS IN Q4-2022



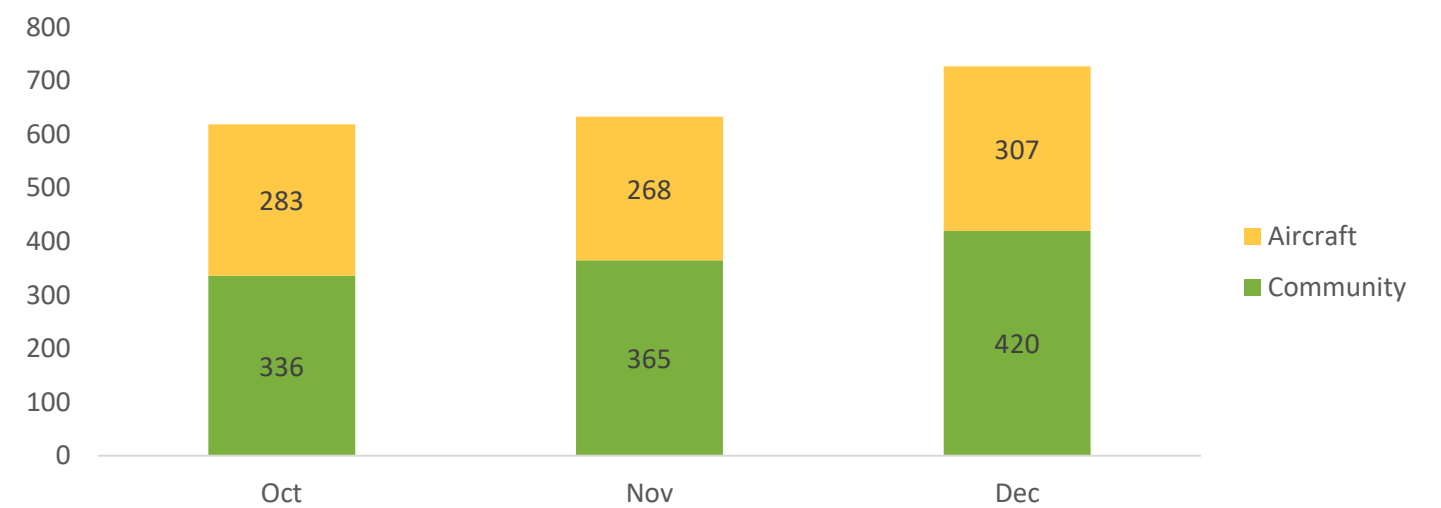
The chart at left illustrates the Top 10 aircraft noise events ranked by maximum noise level (Lmax) as measured at SYV-3 in the 4th Quarter of 2022. Below each bar is the date of the event and the four-letter ICAO aircraft code of the aircraft type involved.

Events with no aircraft type denote that an aircraft type was not identified in the FAA data.



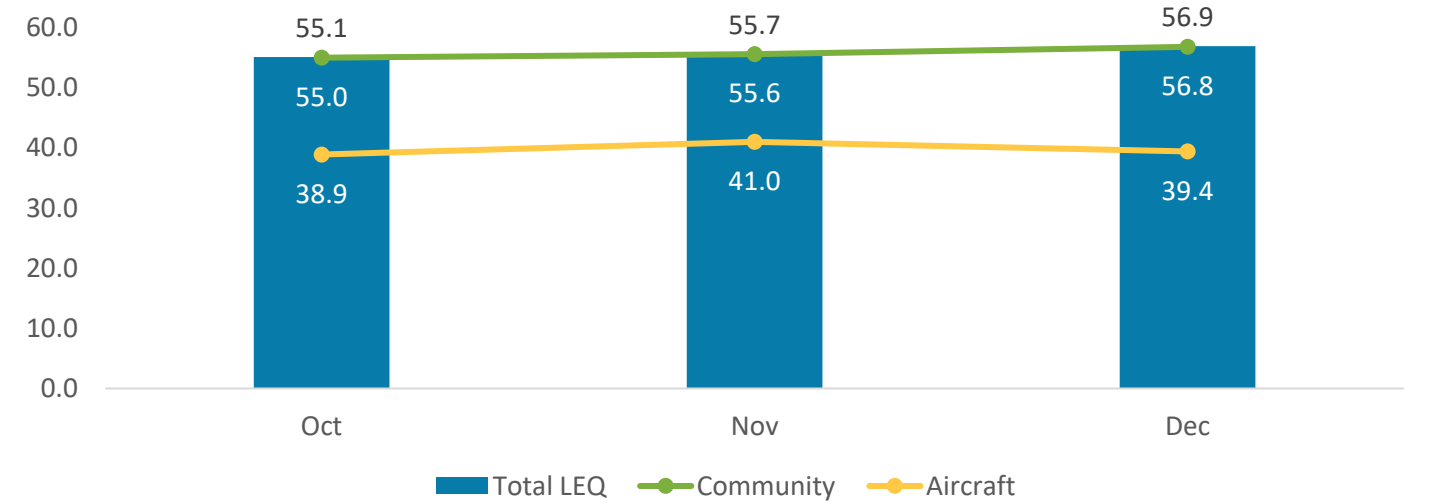
The charts below illustrate the relationship between aircraft and community noise and their contribution to the total noise environment measured by the noise monitoring terminal SYV-3 in Community Center Park.

SYV-3 TOTAL RECORDED NOISE EVENTS IN Q4-2022



Noise events captured by the NMTs are analyzed on the fly as they happen. Based on their categorization as community or aircraft noise, the system automatically calculates an hourly Aircraft, Community, and Total LEQ (equivalent continuous sound level). Equivalent signifies that the total acoustical energy associated with the continually fluctuating noise level (during the specified period); in this case, a month is equal to the total acoustic energy associated with the steady noise level. Hourly LEQs are averaged to derive a Daily LEQs, which is averaged to derive a monthly LEQ. The Total LEQ considers both the aircraft and community contributions to the noise environment.

SYV-3 LEQ NOISE LEVEL FOR Q4-2022

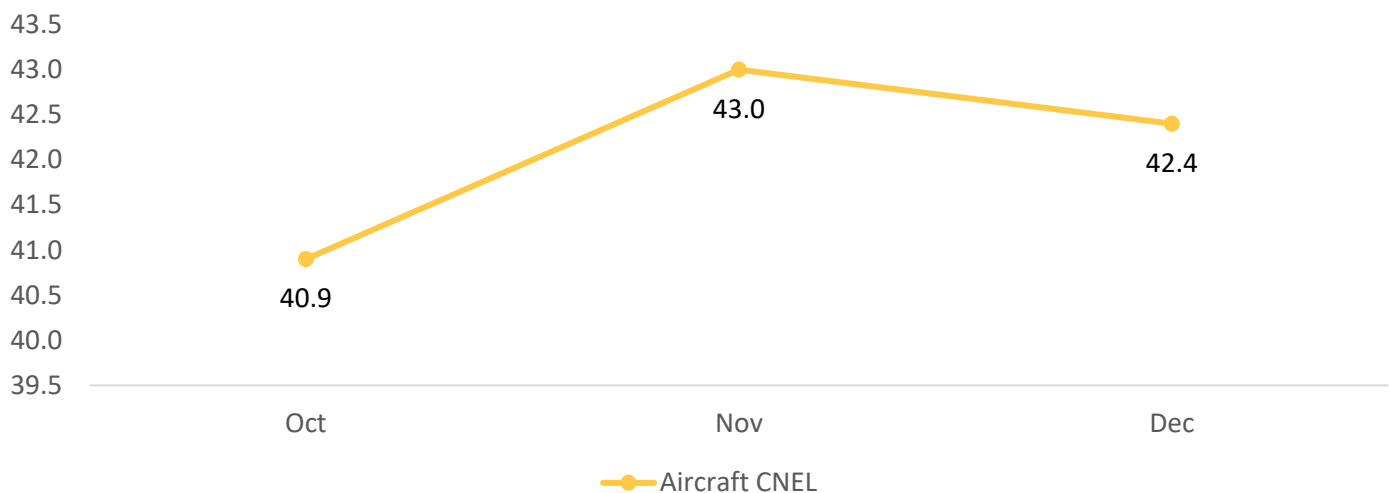


While most singular noise events are expressed in Lmax or LEQ dB(A), cumulative noise exposure originating from aircraft expressed over longer periods of time are typically done in DNL, or day-night average sound level. This adds more “weight” to aircraft noise levels during more sensitive times of the day, typically during night hours. However, the State of California uses a slightly modified version of DNL called CNEL, or Community Noise Equivalent Level. Taken from the FAA’s website on guidance for managing community noise,

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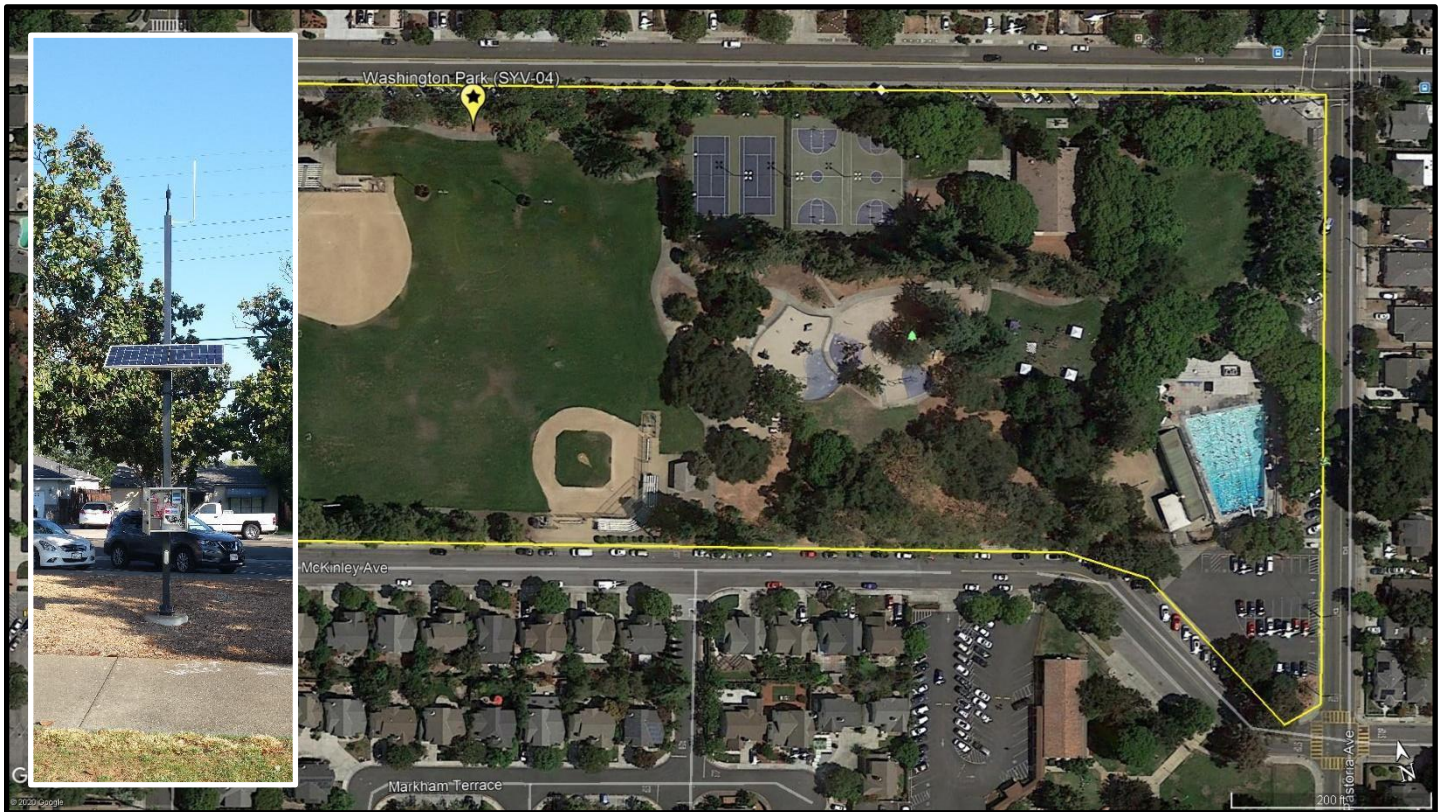
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### SYV-3 CNEL FOR Q4-2022

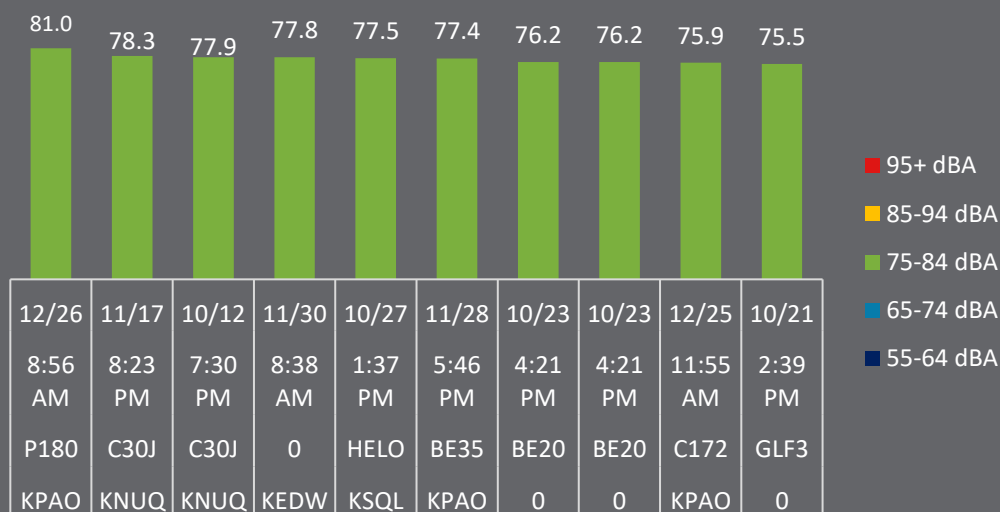


# SYV-4 WASHINGTON PARK NMT DATA Q4 – 2022

Noise Monitoring Terminal SYV-4 is in Washington Park. Its primary purpose is to capture RNP arrivals to SJC Airport in South Flow and secondarily flight activity associated with Moffett Field, Palo Alto, Reid-Hillview, and San Carlos Airports. The image below is an aerial depicting the location of the NMT and a photo of the installed equipment.



**SYV-4 TOP 10 AIRCRAFT NOISE EVENTS IN Q4-2022**



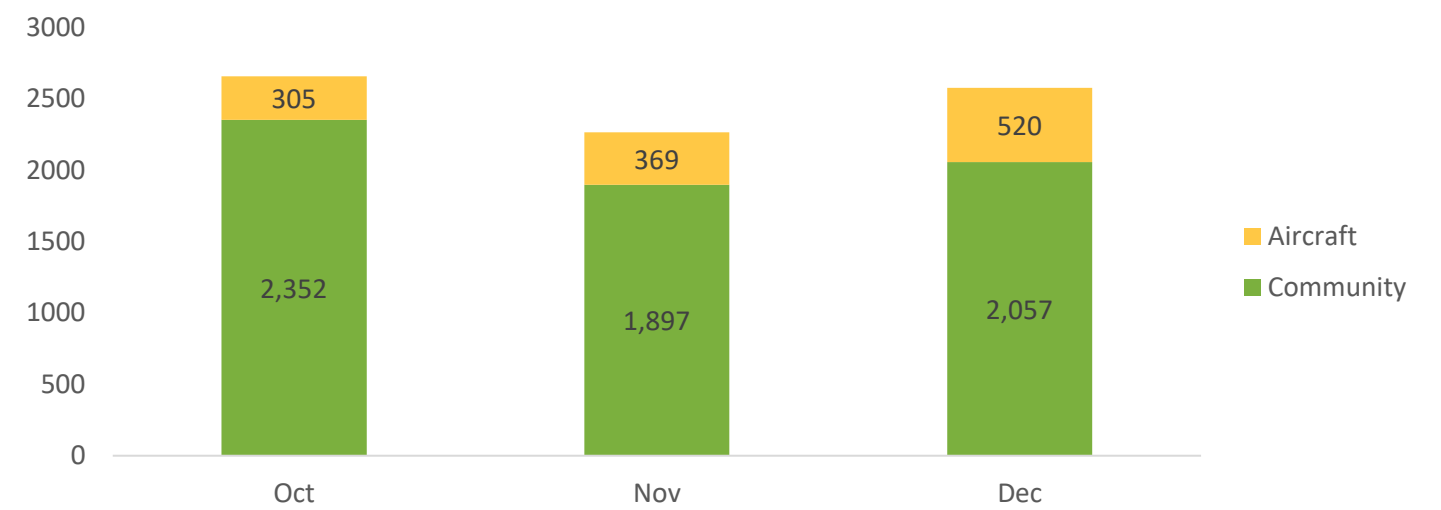
The chart at left illustrates the Top 10 aircraft noise events ranked by maximum noise level (Lmax) as measured at SYV-4 in the 4th Quarter of 2022. Below each bar is the date of the event and the four-letter ICAO aircraft code of the aircraft type involved.

Events with no aircraft type denote that an aircraft type was not identified in the FAA data.



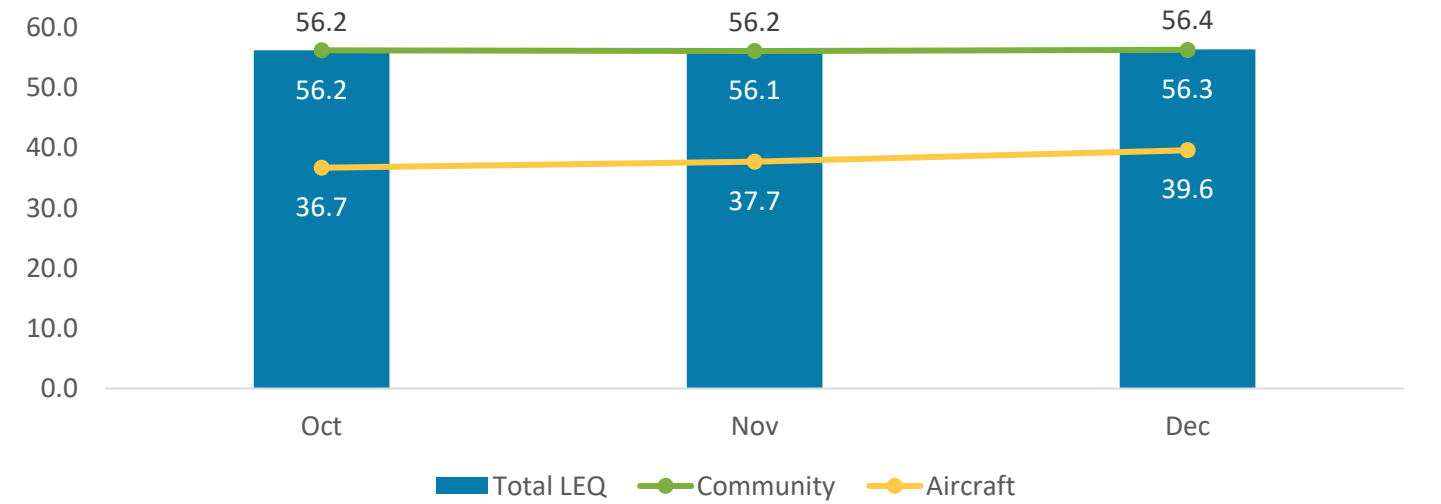
The charts below illustrate the relationship between aircraft and community noise and their contribution to the total noise environment measured by the noise monitoring terminal SYV-4 in Washington Park.

SYV-4 TOTAL RECORDED NOISE EVENTS IN Q4-2022



Noise events captured by the NMTs are analyzed on the fly as they happen. Based on their categorization as community or aircraft noise, the system automatically calculates an hourly Aircraft, Community, and Total LEQ (equivalent continuous sound level). Equivalent signifies that the total acoustical energy associated with the continually fluctuating noise level (during the specified period); in this case, a month is equal to the total acoustic energy associated with the steady noise level. Hourly LEQs are averaged to derive a Daily LEQs, which is averaged to derive a monthly LEQ. The Total LEQ considers both the aircraft and community contributions to the noise environment.

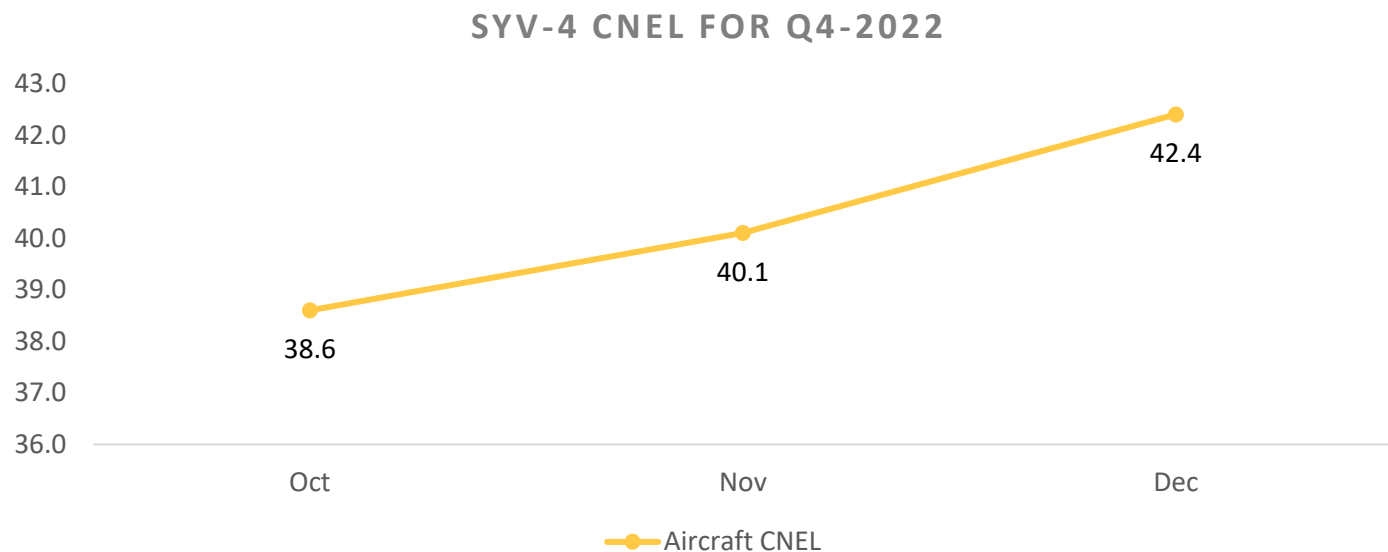
SYV-4 LEQ NOISE LEVELS FOR Q4-2022



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DNL and CNEL are most effective when calculating for only aircraft noise events, or acne. The below chart displays the trend in CNEL over the course of the last quarter



# ICAO AIRCRAFT CODE REFERENCE

Below is a list of the ICAO aircraft codes referenced in the Top-10 Aircraft Noise Event charts.

ICAO Aircraft Code	Common Name	Type
A109	<a href="#">AugustaWestland 109</a>	General Aviation Helicopter
A124	<a href="#">Antonov An-124 Ruslan</a>	Cargo Jet
A306	<a href="#">Airbus A300-600</a>	Commercial Jet
A21N	<a href="#">Airbus A321neo</a>	Commercial Jet
A319	<a href="#">Airbus A319-100</a>	Commercial Jet
A320	<a href="#">Airbus A320-200</a>	Commercial Jet
AC50	<a href="#">Aero Commander 500</a>	General Aviation Piston
AJET	<a href="#">Dassault Alpha Jet</a>	Military Jet Trainer
B38M	<a href="#">Boeing 737 MAX 8</a>	Commercial Jet
B407	<a href="#">Bell Helicopter 407</a>	General Aviation Helicopter
B430	<a href="#">Bell Helicopter 430</a>	General Aviation Helicopter
B733	<a href="#">Boeing 737-300</a>	Commercial Jet
B737	<a href="#">Boeing 737-700</a>	Commercial Jet
B738	<a href="#">Boeing 737-800</a>	Commercial Jet
B763	<a href="#">Boeing 767-300</a>	Commercial Jet
BCS1	<a href="#">Airbus A220-100</a>	Commercial Jet
BCS3	<a href="#">Airbus A220-300</a>	Commercial Jet
BE9L	<a href="#">Beechcraft 90 King Air</a>	General Aviation Turboprop
BE20	<a href="#">Beechcraft 200 Super King Air</a>	General Aviation Turboprop
BE35	<a href="#">Beechcraft 35 Bonanza</a>	General Aviation Piston
BE36	<a href="#">Beechcraft 36 Bonanza</a>	General Aviation Piston
BE60	<a href="#">Beechcraft 60 Duke</a>	General Aviation Piston
C25B	<a href="#">Cessna Citation CJ3</a>	Business Jet
C680	<a href="#">Cessna Citation Sovereign</a>	Business Jet
C68A	<a href="#">Cessna Citation Latitude</a>	Business Jet
C172	<a href="#">Cessna Skyhawk</a>	General Aviation Piston
C180	<a href="#">Cessna 180 Skywagon</a>	General Aviation Piston
C182	<a href="#">Cessna 182 Skylane</a>	General Aviation Piston
C185	<a href="#">Cessna 185 Skywagon</a>	General Aviation Piston
C206	<a href="#">Cessna 206 Stationair</a>	General Aviation Piston
C208	<a href="#">Cessna 208 Caravan</a>	General Aviation Turboprop
C414	<a href="#">Cessna 414 Chancellor</a>	General Aviation Piston
C56X	<a href="#">Cessna Citation Excel</a>	Business Jet
CL30	<a href="#">Bombardier Challenger 300</a>	Business Jet
CL35	<a href="#">Bombardier Challenger 350</a>	Business Jet
CL60	<a href="#">Bombardier Challenger 600</a>	Business Jet
E300	<a href="#">Extra EA-300</a>	General Aviation Piston
E55P	<a href="#">Embraer Phenom 300</a>	Business Jet
E75L	<a href="#">Embraer 175 (Long Winglet)</a>	Commercial Jet
EC45	<a href="#">Airbus Helicopters EC-145</a>	General Aviation Helicopter
FA50	<a href="#">Dassault Falcon 50</a>	Business Jet
F900	<a href="#">Dassault Falcon 900</a>	Business Jet
GL5T	<a href="#">Bombardier Global 5000</a>	Business Jet
GLEX	<a href="#">Bombardier Global Express</a>	Business Jet
GLF3	<a href="#">Gulfstream III</a>	Business Jet
GLF4	<a href="#">Gulfstream IV</a>	Business Jet



GLF5	<a href="#">Gulfstream V</a>	Business Jet
GLF6	<a href="#">Gulfstream G650</a>	Business Jet
H25B	<a href="#">Hawker Beechcraft 800</a>	Business Jet
HELO	Generic Helicopter	General Aviation Helicopter
LJ60	<a href="#">Bombardier Learjet 60</a>	Business Jet
M20P	<a href="#">Mooney M20</a>	General Aviation Piston
MD11	<a href="#">McDonnell Douglas MD-11</a>	Commercial Jet
P180	<a href="#">Piaggio P.180 Avanti</a>	Business Jet
PC12	<a href="#">Pilatus PC-12</a>	General Aviation Turboprop
RV8	<a href="#">Van's Aircraft RV-8</a>	General Aviation Piston
S22T	<a href="#">Cirrus SR22 Turbocharged</a>	General Aviation Piston
SR20	<a href="#">Cirrus SR20</a>	General Aviation Piston
T6	<a href="#">North American T-6 Texan</a>	Military Piston Trainer
TBM7	<a href="#">Socata TBM 7</a>	General Aviation Turboprop

