SFO COMMUNITY ROUNDTABLE

Meeting Announcement

Technical Working Group

Wednesday, March 24, 2021
12:00 p.m. – 1:30 p.m.

BY VIDEO CONFERENCE ONLY
Please click the link below to join the webinar:
https://smcgov.zoom.us/j/99846389039
Or Dial-in:
US: +1(669)900-6833 Webinar ID: 998 4638 9039

**Please see instructions for written and spoken comments at the end of this agenda.

AGENDA

Call to Order

Public Comment on Items NOT on the Agenda

AGENDA ITEMS

1. **Work Plan: Goal 1: Review and Comment on Aircraft Procedures**
   Discussion, Direction to Staff / Consultants on Next Steps, and Priorities
   a. **FAA NIITE and HUSSH Departures**
   b. **Nighttime Arrivals on Runways 28R and 28L**
   c. **Redirect Southern Arrivals (SERFR) and PIRAT STAR Airspace arrival**
   Attachments: Roundtable Annual Work Plan

2. **Update on Ground-Based Augmentation System (GBAS): Timeline Update, Status, and NEPA/CEQA**
   Bert Ganoung, SFO Noise Office Manager and Paul Hannah, Consultant
   Attachments: November 19, 2020 Presentation on GBAS to Technical Working Group

3. **Status of Title 21 Reports, Threshold Waiver Request, and Aircraft Detection Methods other non-Title 21 sites.**
   Bert Ganoung, SFO Noise Office
   Attachments: Remote Monitoring Terminal Threshold Report Dec 30, 2020 and Appendix dated August 17, 2020 BridgeNet

4. **Adjourn**

****Instructions for Public Comment during Videoconference Meeting**

San Francisco International Airport/Community Roundtable
455 County Center – 2nd Floor, Redwood City, CA 94063
T (650) 363-4220 sforoundtable.org

During videoconference of the Technical Working Group subcommittee meeting, members of the public may address the Roundtable as follows:

Written Comments:
Written public comments may be emailed in advance of the meeting. Please read the following instructions carefully:

1. Your written comment should be emailed to amontescardenas@smcgov.org.
2. Your email should include the specific agenda item on which you are commenting.
3. Members of the public are limited to one comment per agenda item.
4. The length of the emailed comment should be commensurate with two minutes customarily allowed for verbal comments, which is approximately 250-300 words.
5. If your emailed comment is received by 3:00 pm on the day before the meeting, it will be provided to the Roundtable and made publicly available on the agenda website under the specific item to which comment pertains. The Roundtable will make every effort to read emails received after that time but cannot guarantee such emails will be read during the meeting, although such emails will still be included in the administrative record.

Spoken Comments:
Spoken public comments will be accepted during the meeting on Items NOT on the Agenda, and at the end of each Agenda Item. It is up to the Chairperson to increase the frequency of public comments, such as after each Agenda Item. Please read the following instructions carefully:

1. The March 24, 2021 Subcommittee meeting may be accessed through Zoom online at https://smcgov.zoom.us/j/99846389039 . The meeting ID: 998 4638 9039. The meeting may also be accessed via telephone by dialing in +1-669-900-6833, entering meeting ID: 998 4638 9039, then press #.
2. You may download the Zoom client or connect to the meeting using the internet browser. If you are using your browser, make sure you are using current, up-to-date browser: Chrome 30+, Firefox 27+, Microsoft Edge 12+, Safari 7+. Certain functionality may be disabled in older browsers including Internet Explorer.
3. You will be asked to enter an email address and name. We request that you identify yourself by name as this will be visible online and will be used to notify you that it is your turn to speak.
4. When the Roundtable Chairperson calls for the item on which you wish you speak click on “raise-hand” icon. You will then be called on and unmuted to speak.
5. When called, please limit your remarks to the time limit allotted.

Note: To arrange an accommodation under the Americans with Disabilities Act to participate in this public meeting, please call (650) 363-4220 at least 2 days before the meeting date.

ROUNDTABLE ANNUAL WORK PLAN

July 1, 2020 through June 30, 2021

Adopted by the Membership on December 2, 2020

Organization of the Work Program

The Work Program is organized as follows: Strategic Plan goal and action, and work plan task to be accomplished this fiscal year 2020-2021.

Introduction

The Work Program is part of the Roundtable's overall approach to planning efforts; it is guided by the Roundtable's Strategic Plan. The Strategic Plan has a three-year planning horizon and the Work Program has a one-year planning horizon. The Work Program items are distilled from the overall Strategic Plan goals; each of the Work Program items are associated with a Strategic Plan goal.

While the Work Program is a one-year document, many items will be rolled over through multiple planning cycles. This is due to the longer-term nature of some items, including standing updates and future technologies. These longer-term items remain on the Work Program in order for the Roundtable to maintain their understanding of the issue. The Roundtable appointed a Work Program Subcommittee to carry out the work program planning process and to bring a recommended Work Program back to the full Roundtable for its consideration and adoption.

The following are the approved Strategic Plan (2020-2024) Goals, and Action Items, along with the Work Plan tasks to be accomplished during the fiscal year 2020-2021:

Goal 1: Review and Comment on Aircraft Procedures: Focus on all aircraft procedures including arrival, departure, and ground based procedures.

Action item: The Roundtable will focus, advocate, and respond on procedural changes that limit the noise impacts on our communities.

Work Plan Item(s):

- The Roundtable Technical Working Group will evaluate the FAA NIITE and HUSSH Departures modified proposal for nighttime noise abatement regarding location, level of flight paths, night time hours, and environmental review process. The Roundtable Technical Working Group will recommend next steps to the full Roundtable, as appropriate.

- Working with the technical consultant, the Roundtable will evaluate options for nighttime arrivals on Runways 28R and 28L.

- Working with the technical consultant, the Roundtable will evaluate options for Redirect Southern Arrivals (SERFR) and PIRAT STAR Airspace arrival procedures.

Goal 2: Address Airport Operation Noise: Abate noise impacts to surrounding communities from airport and airline operations.

Action item: The Roundtable will identify noise impacts and provide recommendations to SFO Airport Noise Abatement Office for outreach to airlines and FAA as well as to the Airport Director to address in the Airport Development and Noise Action Plans.

Work Plan Item(s):

-Review and provide feedback on the SFO Strategic Plan, Development Plan, and Noise Action Plan. Include Environmental Justice in the feedback.

-The Roundtable Technical Working Group will actively work with SFO on Ground Based Augmentation System to provide feedback on the GLS (global navigation satellite landing) approach, the associated noise evaluation, and the Community Flight Procedure Package (CFPP) and plan for community evaluation of innovative GLS approaches.

-The Roundtable Ground Based Noise Subcommittee will complete the Ground Based Noise Study and make a recommendation to the Membership on next steps.

Plan Goal 3: Lobby for Aircraft Noise Reduction. Lobby for aircraft noise reduction by sponsoring legislation and research.

Action item: Actively monitor, review, and oppose or support legislation, research, and/or aircraft noise reduction programs to achieve measurable noise reduction in our communities.

Work Plan Task(s):

- Receive regular reports from N.O.I.S.E., a national organization to insure a sound controlled environment, regarding federal legislation and action.

- Actively monitor activities from the congressional Quiet Skies Caucus.

- Lobby/advocate as needed.

- Work with Congressional delegation to help develop and pass noise-related legislation.

Goal 4: Airline Award Program: The Roundtable will partner with SFO to modify the *Fly Quiet Program* to obtain compliance and measurable improvement year over year.

Action item: The Roundtable will report to its community's *Fly Quiet Program* compliance and measurable improvement in compliance year over year.

Work Plan Task(s):

- Receive Noise Office presentation on new plan, provide feedback, and recommend needed revisions.

Goal 5: Address Community Concerns*:* Focusing on San Mateo, and San Francisco Counties continue to actively respond to community concerns regarding aircraft and airport noise issues.

Action item: Provide the forum for communities to voice their concerns and give their input. Educate community members about FAA, SFO International Airport, Airlines, and SFORT roles and responsibilities and authority.

Work Plan Task(s):

- Revamp the Roundtable website to include accessible meeting information, useful documents, and archived history so that it can be used as an education tool for the community. The website can also be used to communicate

Roundtable successes.

- Conduct an Annual Report of Accomplishments and celebrate the Roundtable 40th Anniversary.

- Analyze noise monitor methodology and make recommendations at the local, state, and federal levels.

Goal 6: Improve Roundtable Effectiveness*:* Increase Roundtable effectiveness with inward focused Member education, support and mentorship.

Action item: The Roundtable will make an ongoing effort at strengthening our membership, by developing a mentorship program, creating a new member packet, and translating technical jargon.

Work Plan Task(s):

- Conduct Noise 101 training.

- Create a member packet for onboarding and supporting new members including mentorship.

San Francisco International Airport GBAS Procedure Review

SFO Roundtable Technical Working Group

November 19, 2020

Agenda

1. Status of overlay GLS approaches
2. Status of innovative GLS approaches for evaluation
3. Noise evaluation of innovative GLS approaches
4. Community Flight Procedure Package Contents
5. Request for TWG feedback on CFPP and plan for community evaluation of innovative GLS approaches

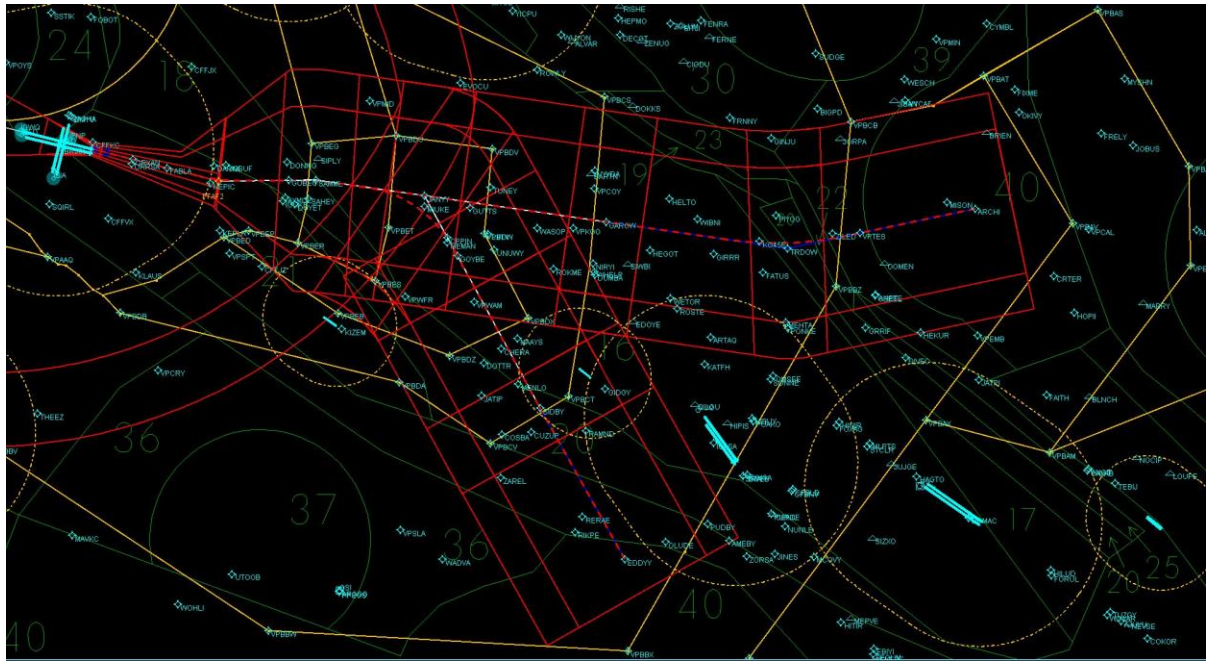


Image from TARGETS for FMS Bridge Visual Conversion to a GLS Approach to 28R

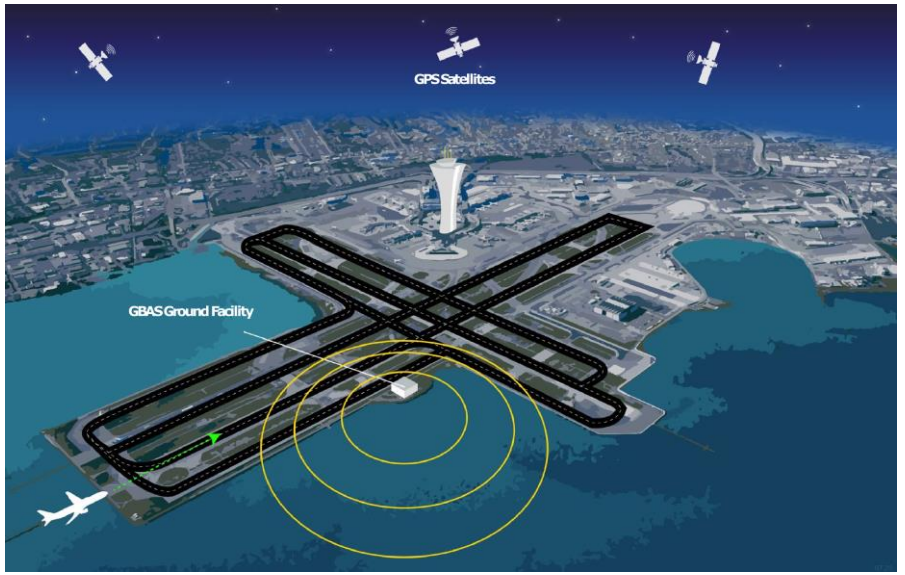
Ground Based Augmentation System (GBAS) at SFO

1. GBAS support up to 48 unique GBAS Landing System (GLS) approach procedures to SFO runways

2. SFO GBAS receives information from Global Positioning System (GPS), and Wide Area Augmentation System (WAAS), to create precision approach paths for aircraft to follow

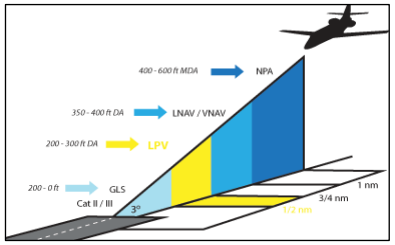
3. Equipped aircraft, and trained flight crews, request GLS approach and tune into the GBAS data broadcast specific to the runway and procedures

4. The GLS precision approach path is currently limited to the final approach segment, which is approximately 5 – 10 Nautical Miles from the end of the runway



https://www.flysfo.com/community/noise/making-sfo-quieter/sfos-initiatives-tackle-noise

GBAS Project Goals



1. **Reduce Noise Impact to the Community**
   - GLS, and RNP to GLS, allows innovative procedure design resulting in unique flight tracks and increased operational altitudes.
2. **Create Redundant ILS Capabilities**
   - Allows continued ILS like operations during runway/taxiway rehabilitation and equipment outages.
3. **Enhance Efficiency**
   - Single GBAS can support multiple runway ends steeper approaches and reduced track miles via RNP to GLS leading to reduced fuel burn and GHG
4. **Reduce Delays**
   - Closely Spaced Parallel Runway Operations (CSPR) and CAT I/II/III Capabilities to runways that do not currently have ILS.

GBAS Project Commitments are Unchanged

SFO Commitment
Purchase, Commission and Operation of GBAS

- Commissioning and Operations are performed in accordance with FAA Non-Federal NAVAID Program

Review GLS Procedures with Community

- Evaluate and communicate any proposed GBAS procedures thoroughly, with active and ongoing input from the Round Table and our communities.

- If a proposed GBAS procedure appears to have a negative community impact, *that procedure will not be pursued.*

GBAS Overlay Approach Status

SFO Requested Overlay Approaches for 28L, 28R, 19L and 19R

- Approaches were requested in Q2 of 2018
- All overlay approaches are being developed from RNAV (GPS) approaches using LPV profiles and waypoints
- Existing waypoints, altitudes and speed restrictions (no changes from current procedures)
- FAA Environmental Screening resulted in a CATEX for these four overlay approaches in Q3 2019
- Procedures are “hard dated” for publication to coincide with commissioning of the SFO GBAS on 07OCT21

Aeronautical Information Services

Alerts/Notices
NOTAMs
Catalog of Products
Digital Products
Order FAA Products
Aeronautical Data
Obstacle Data
Critical DME List
Instrument Flight Procedures Information Gateway
IFP Request Form
IFP Announcements & Reports
PBN Implementation Plan
IFP Initiation
IFP Inventory Summary
Aeronautical Charting Meeting
Air Transportation Information Exchange Conference (ATIEC)
FAQs
Chart Discrepancies

SFO SAN FRANCISCO/SAN FRANCISCO INTL

Notify me of changes to SFO

Charts (58) | IFP Production Plan (12) | IFP Coordination (0) | IFP Documents (NDBR) (53)

IFP Production Plan - Current IFPs under Development or Amendments with Tentative Publication Date and Status.

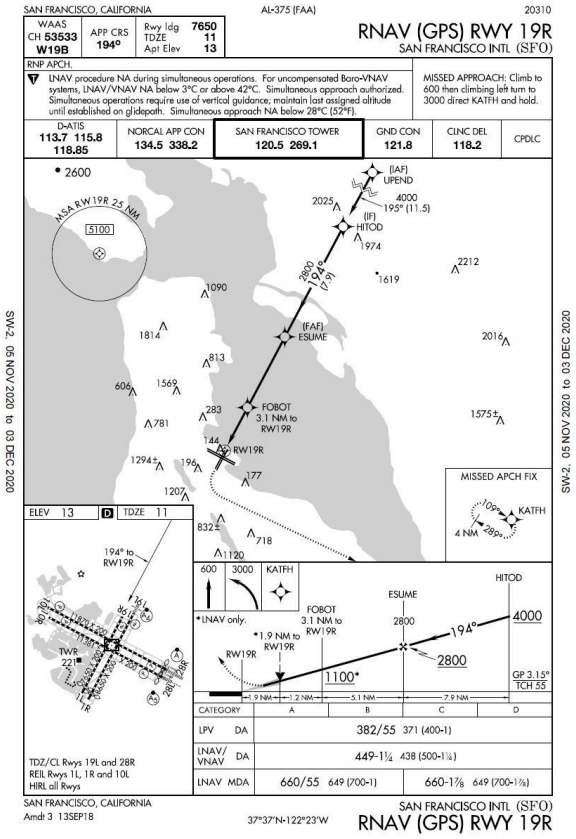
Filter Options

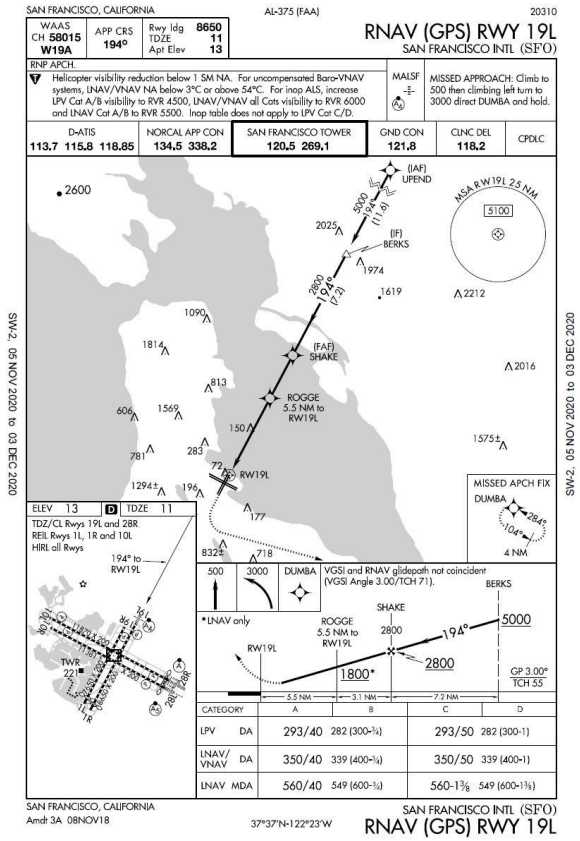
Showing results 1 - 12 of 12

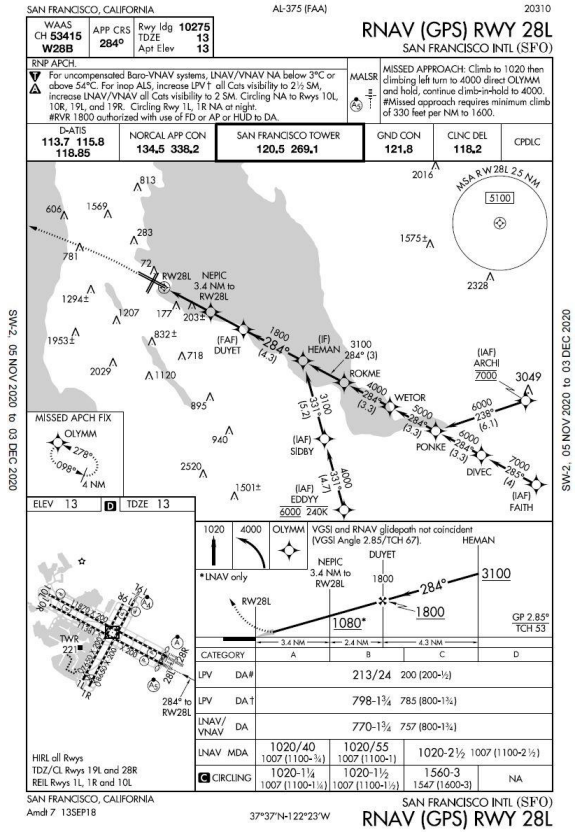
Procedure	Airport Name	Airport ID	City/State	Scheduled Pub Date	Status	Actual Pub Date	
TIPP TOE VISUAL RWY 28L/R, AMDT 3	SAN FRANCISCO INTL	SFO (KSFO)	SAN FRANCISCO, CA	12/2/2021	Pending		Email FAA
GLS OVERLAY RNAV (GPS) RWY 19L, AMDT 3	SAN FRANCISCO INTL	SFO (KSFO)	SAN FRANCISCO, CA	10/7/2021	Pending		Email FAA
GLS OVERLAY RNAV (GPS) RWY 19R, AMDT 2	SAN FRANCISCO INTL	SFO (KSFO)	SAN FRANCISCO, CA	10/7/2021	Pending		Email FAA
GLS OVERLAY RNAV (GPS) RWY 28L, AMDT 6	SAN FRANCISCO INTL	SFO (KSFO)	SAN FRANCISCO, CA	10/7/2021	Pending		Email FAA
GLS OVERLAY RNAV (GPS) Z RWY 28R, AMDT 6	SAN FRANCISCO INTL	SFO (KSFO)	SAN FRANCISCO, CA	10/7/2021	Pending		Email FAA

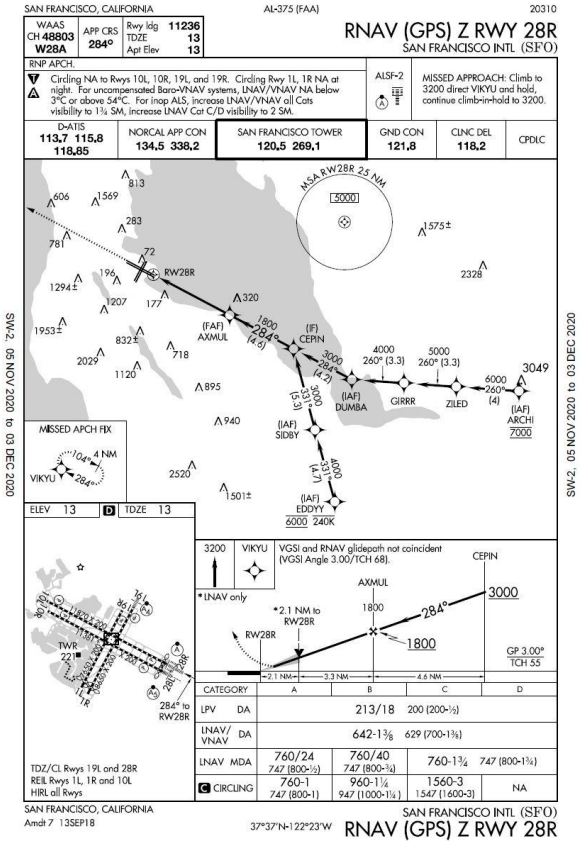
https://www.faa.gov/air_traffic/flight_info/aeronav/procedures/application/?event=procedure.results&tab=productionPlan&nasrId=SFO#searchResultsTop

SFO GLS Overlay Approaches









RNAV (GPS) RWY 19R

- GPA: 3.15°
- Opportunity: 5%
- CSPR: TBD

RNAV (GPS) RWY 19L

- GPA: 3.00°
- Opportunity: 5%
- CSPR: TBD

RNAV (GPS) RWY 28L

- GPA: 2.85°
- Opportunity: 95%
- CSPR: Yes

RNAV (GPS) Z RWY 28R

- GPA: 3.00°
- Opportunity: 95%
- CSPR: Yes

GBAS Overlay Approach Status

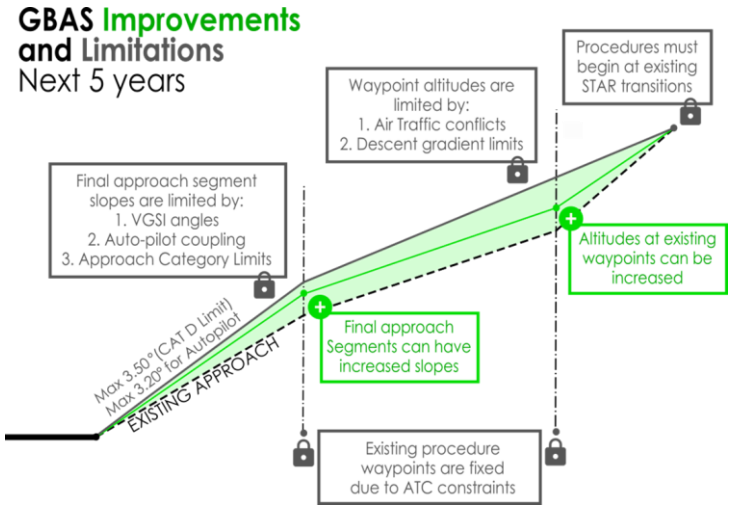
Additional Overlay Changes Since 2018

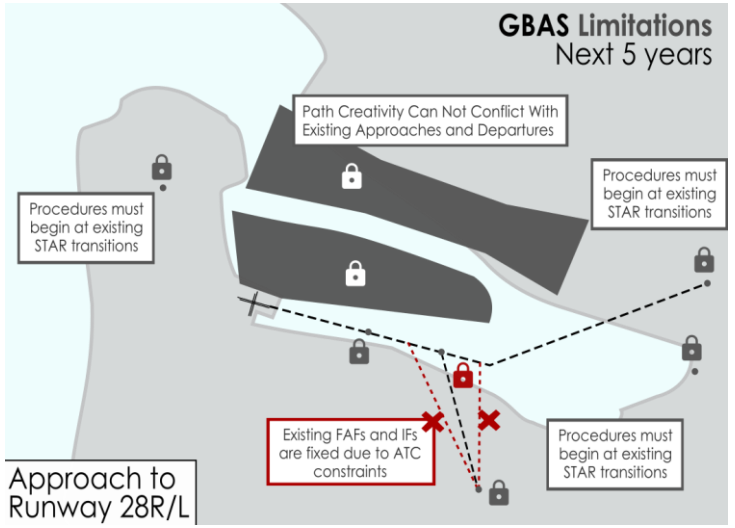
- GBAS Project Team is tracking possible changes to SERFR
  - Currently using the existing EDDYY location
  - All GLS outreach materials that use EDDYY will be updated if/when SERFR 5 reaches the IFP Gateway
- GLS version of LDA approaches to 28R are no longer being pursued
  - No current FAA criteria for “offset” GLS approaches that terminate in a long visual segment
  - LDA approach is being decommissioned
- Potential change to missed approaches to 19L and 19R are being studied to enhance safety during CSPR in southeast flow

GBAS Innovative Approach Evaluation Status

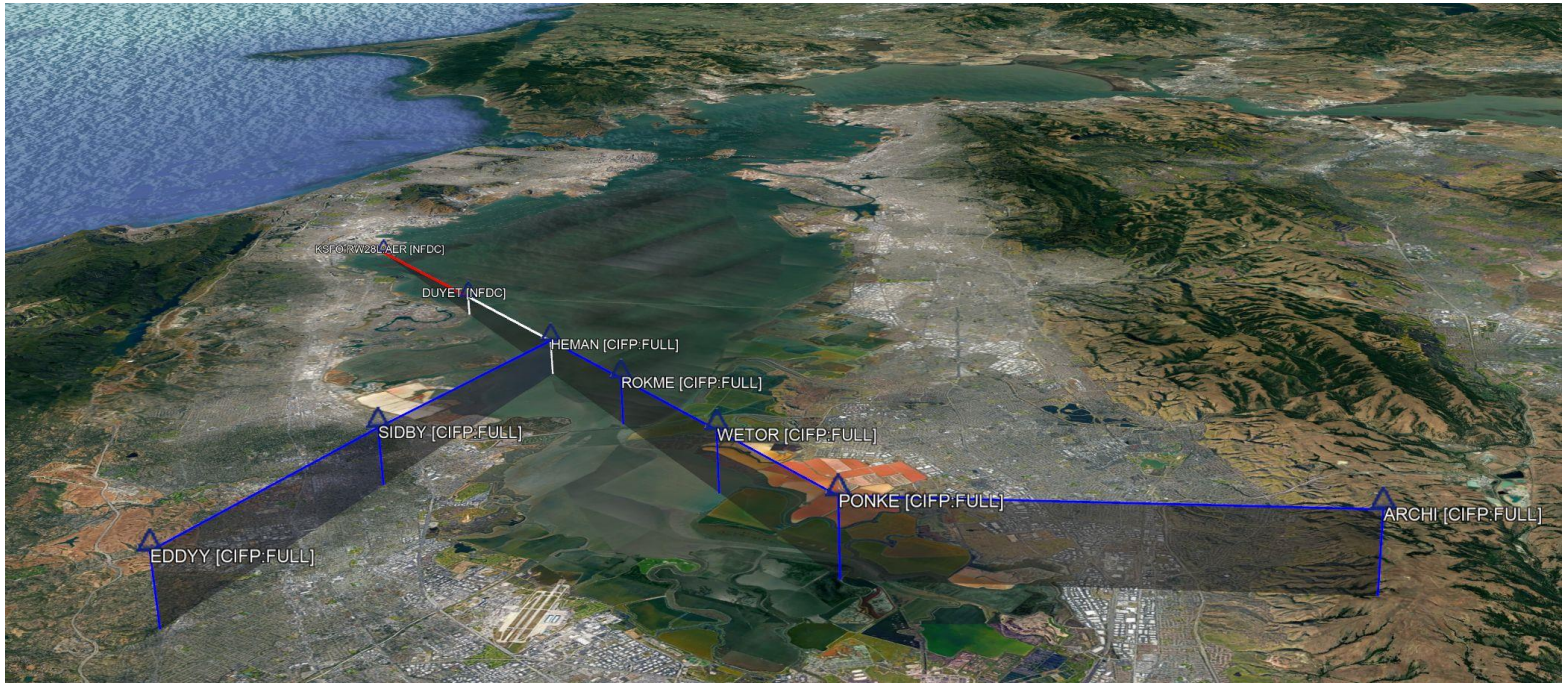
SFO GBAS Project Team Has 8 Innovative GLS Concepts For Evaluation

- Developed through a flight procedures subcommittee to identify criteria, ATC and flyability challenges
- 23 initial concepts were reduced to 8
- Resulted in two “groups” of concept approaches to pursue
- Group 1 focusses on what can be published and flown within the next 5 years
    - 28R – 4 Concepts
    - 28L – 1 Concept
    - 10R – 1 Concept
    - 10L – 1 Concept





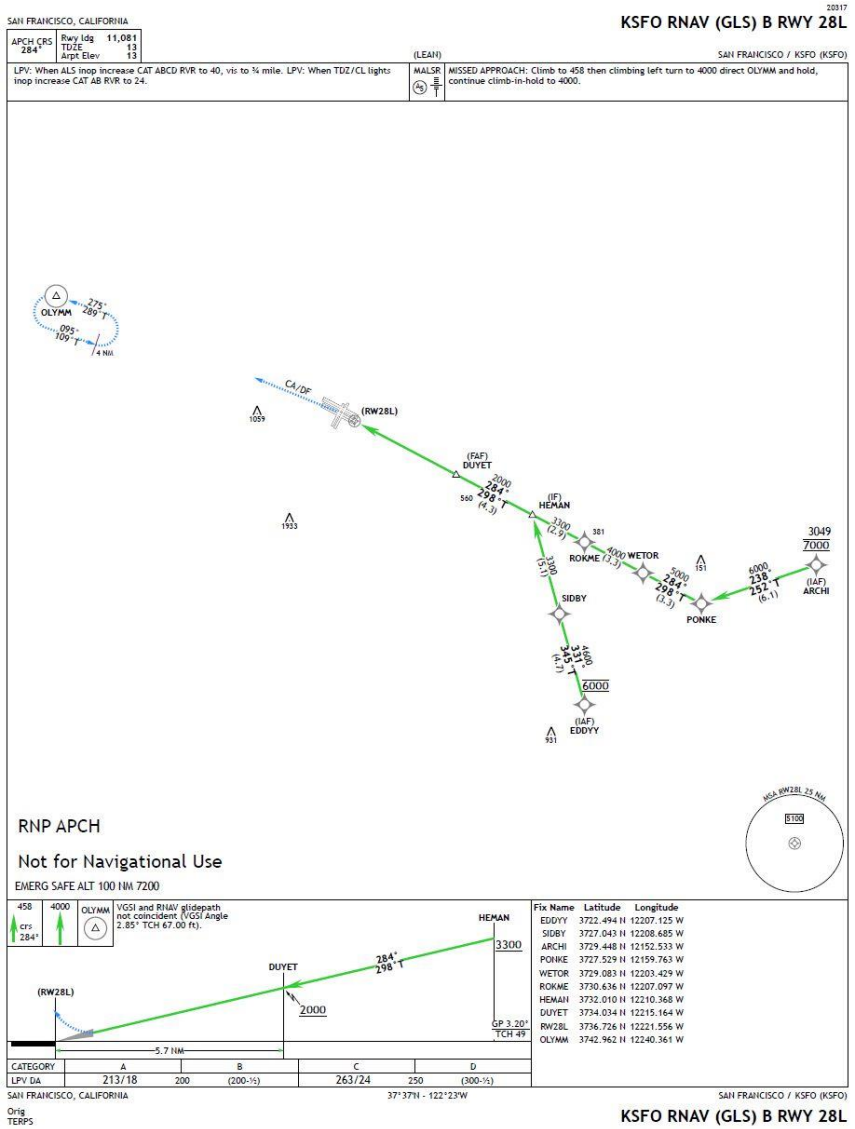
SFO GLS Concept: 28L



28L GLS Procedure Image TARGETS, Background Image Google Earth

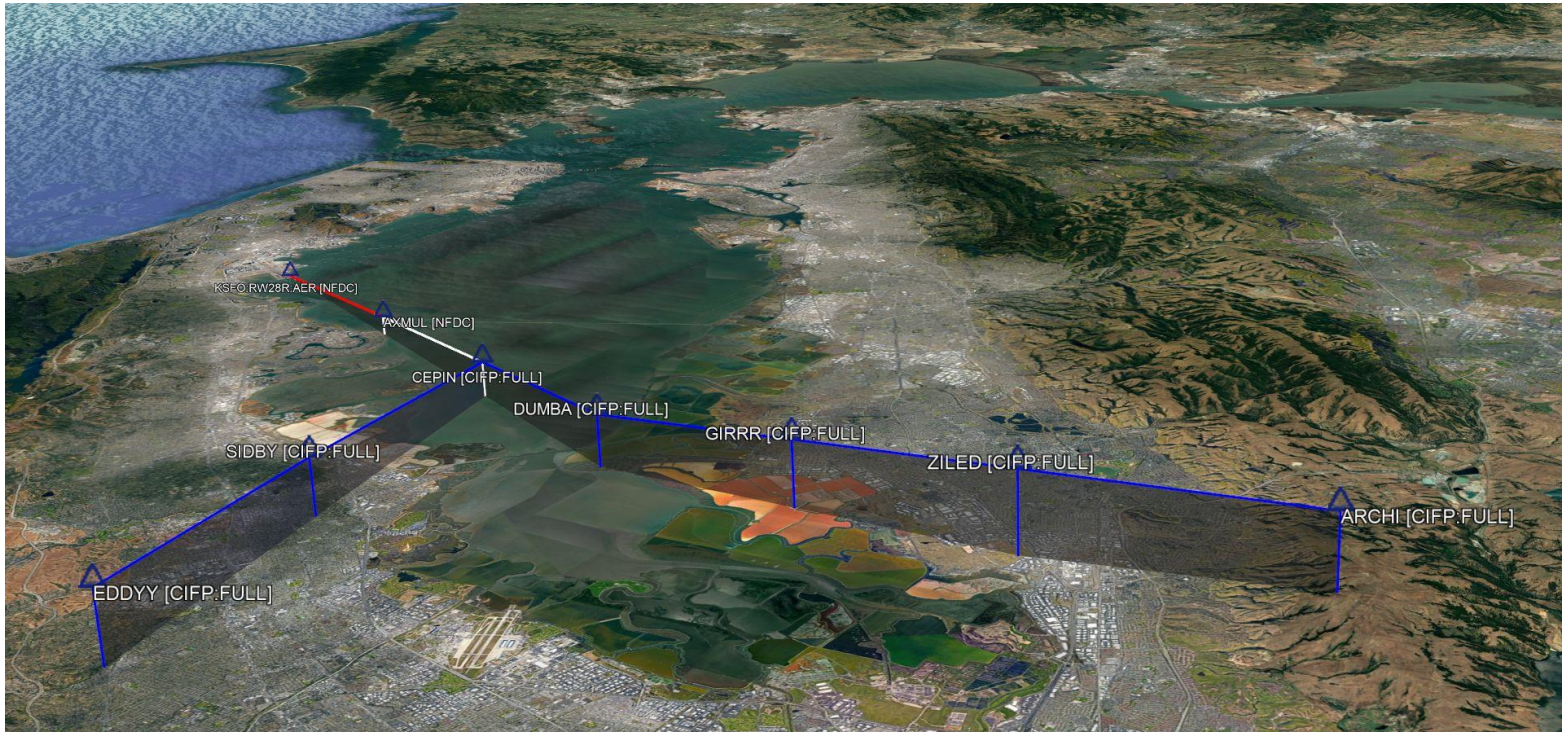
GLS B RWY 28L

- GPA: 3.20º
- Opportunity: 95%
- CSPR: TBD
- Final approach, and preceding altitudes are increased
- Can not change location or altitude at EDDYY or ARCHI
- Can not change location of any other waypoints

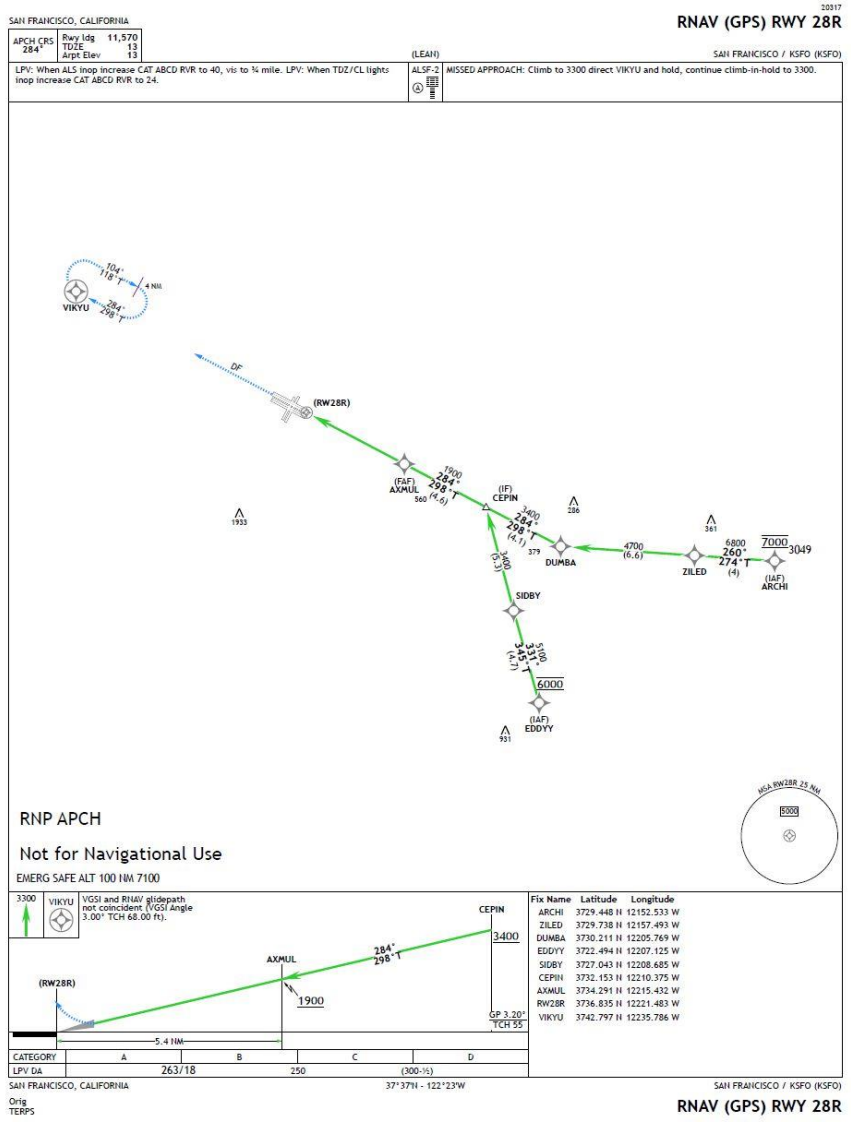


28L GLS Flight Inspection Graphic from GPD

SFO GLS Concept: 28R



28R GLS Procedure Image TARGETS, Background Image Google Earth

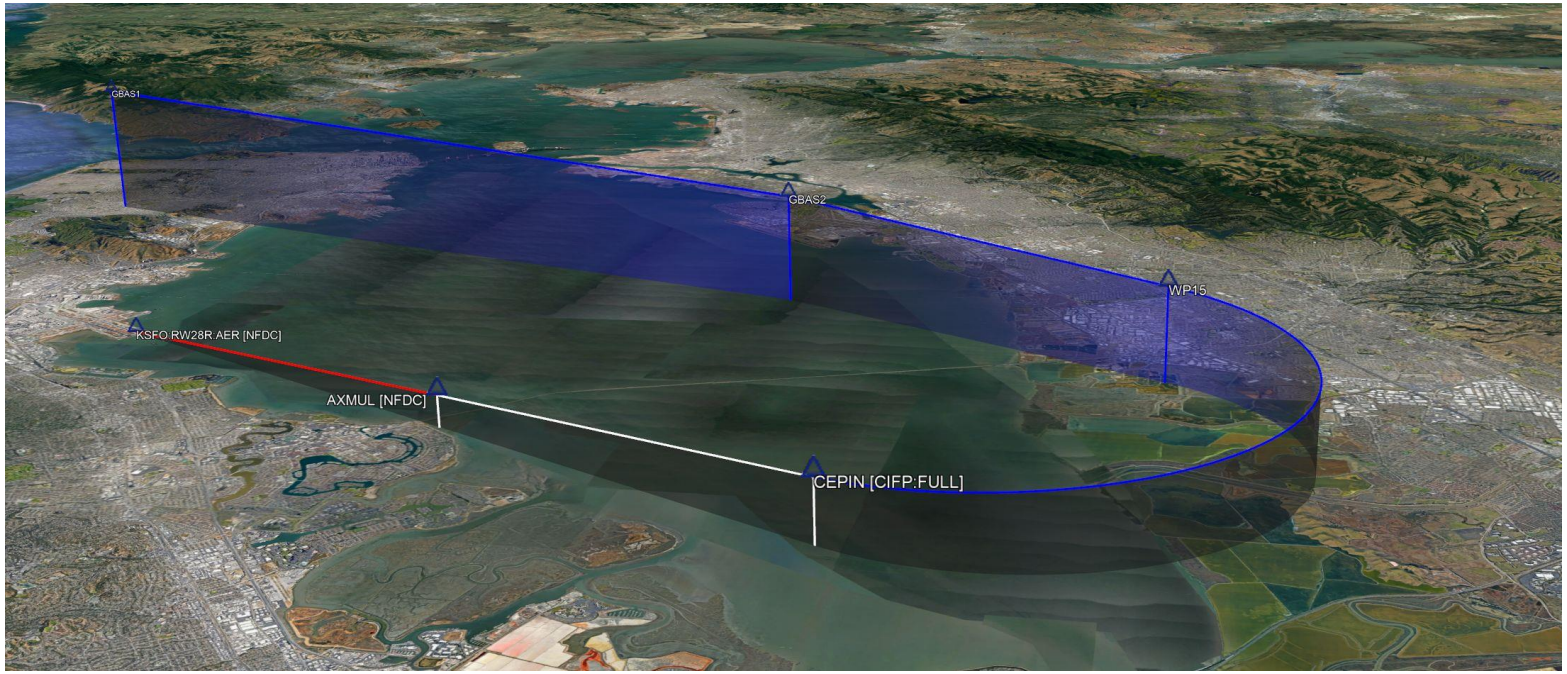


28R GLS Flight Inspection Graphic from GPD

GLS B RWY 28R

- GPA: 3.20º
- Opportunity: 95%
- CSPR: TBD
- Final approach, and preceding altitudes are increased
- Can not change location or altitude at EDDYY or ARCHI
- Can not change location of any other waypoints

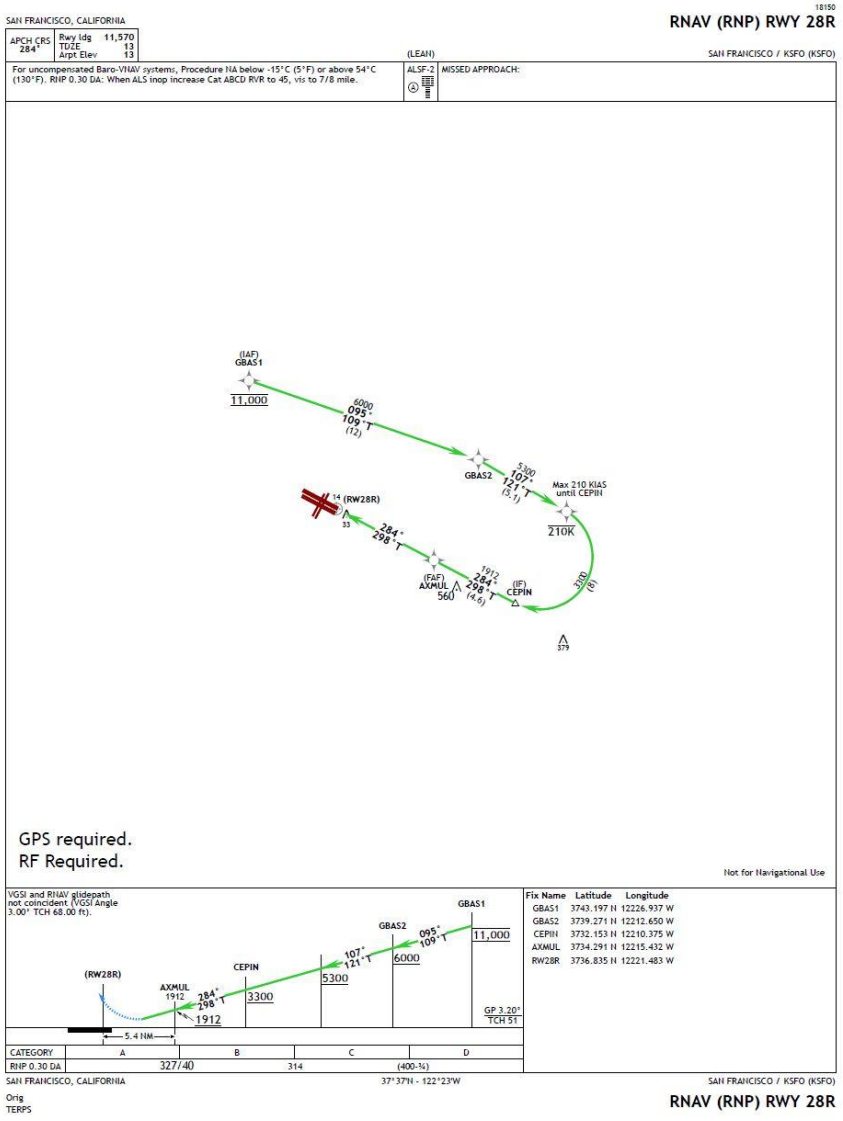
SFO GLS Concept: 28R “Down the Bay”



28R GLS Procedure Image TARGETS, Background Image Google Earth

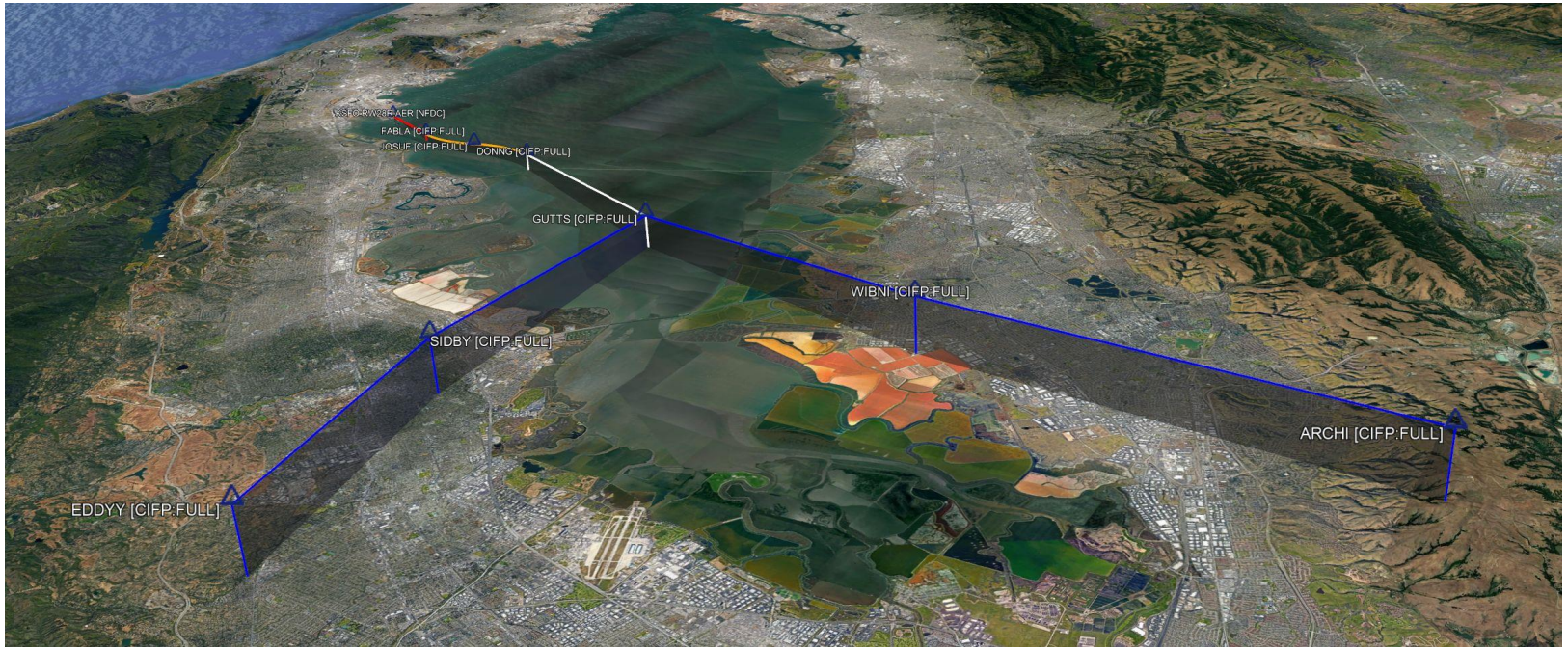
GLS B RWY 28R “Down the Bay”

- GPA: 3.20^{o}
- Opportunity: 95%
- CSPR: No
- Intended to mirror existing vectors from BDEGA Arrival to 28R at CEPIN
- Can not start the approach at CORKK (New Waypoint – GBAS 1)
- Can not change location of CEPIN or AXMUL

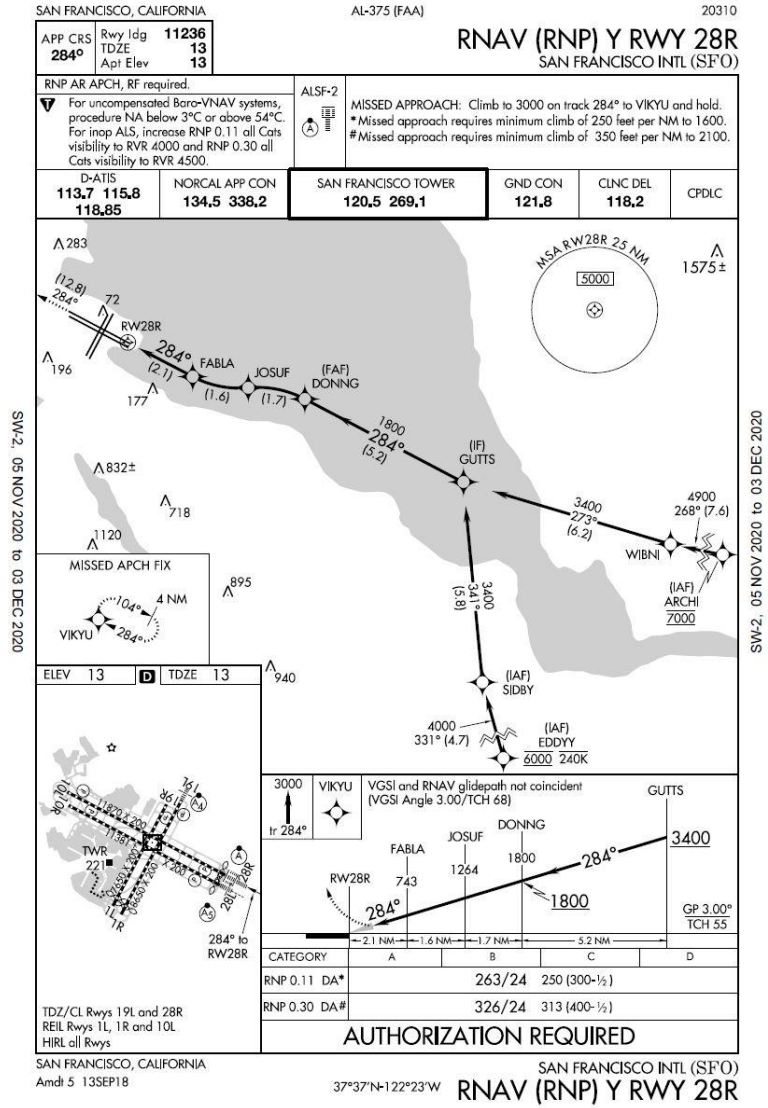


28R GLS Flight Inspection Graphic from GPD

SFO GLS Concept: 28R “RNP-Y to GLS”



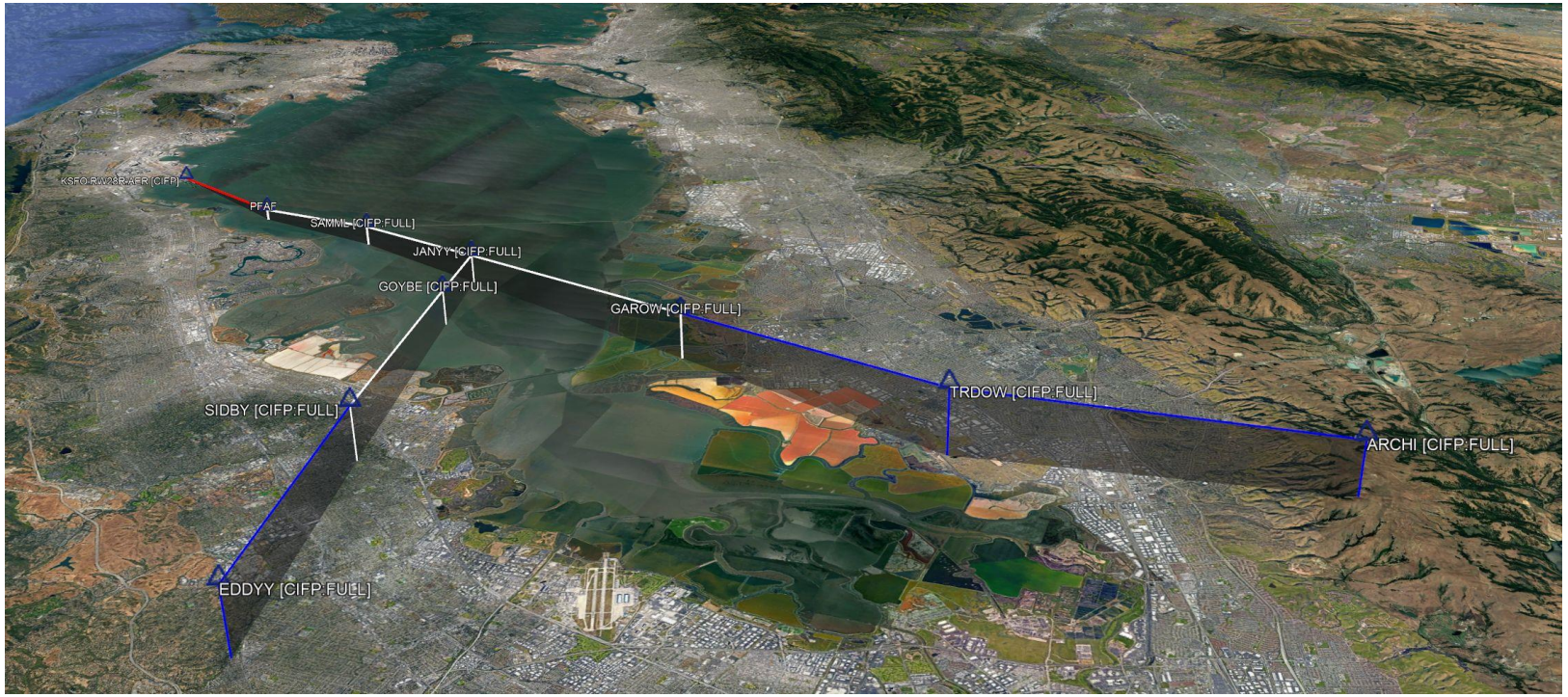
28R GLS Procedure Image TARGETS, Background Image Google Earth



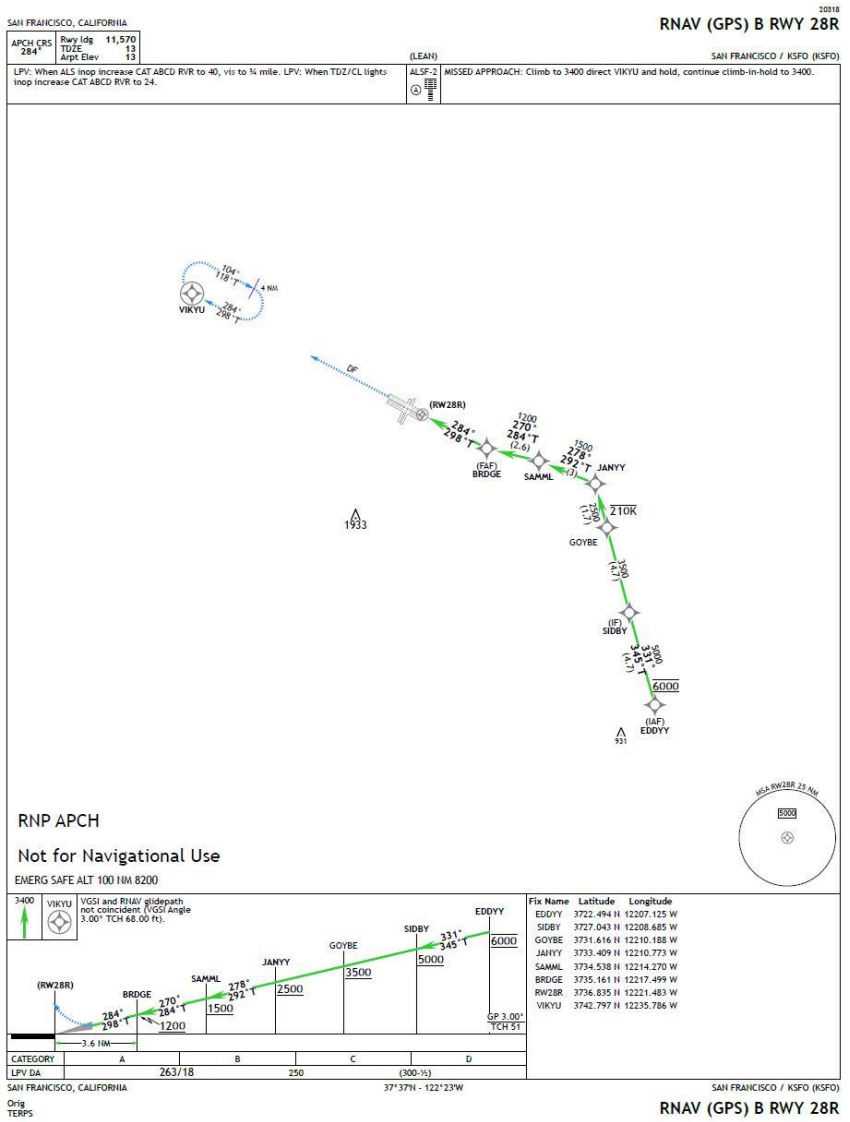
GLS B RWY 28R “RNP-Y to GLS”

- GPA: 3.00º
- Opportunity: 95%
- CSPR: No
- GLS Conversion of RNAV (RNP) Y RWY 28R
- Short FROP will prevent increase in GPA
- FAA Criteria for this is in development

SFO GLS Concept: 28R “Bridge Visual” EDDYY



28R GLS Procedure Image TARGETS, Background Image Google Earth

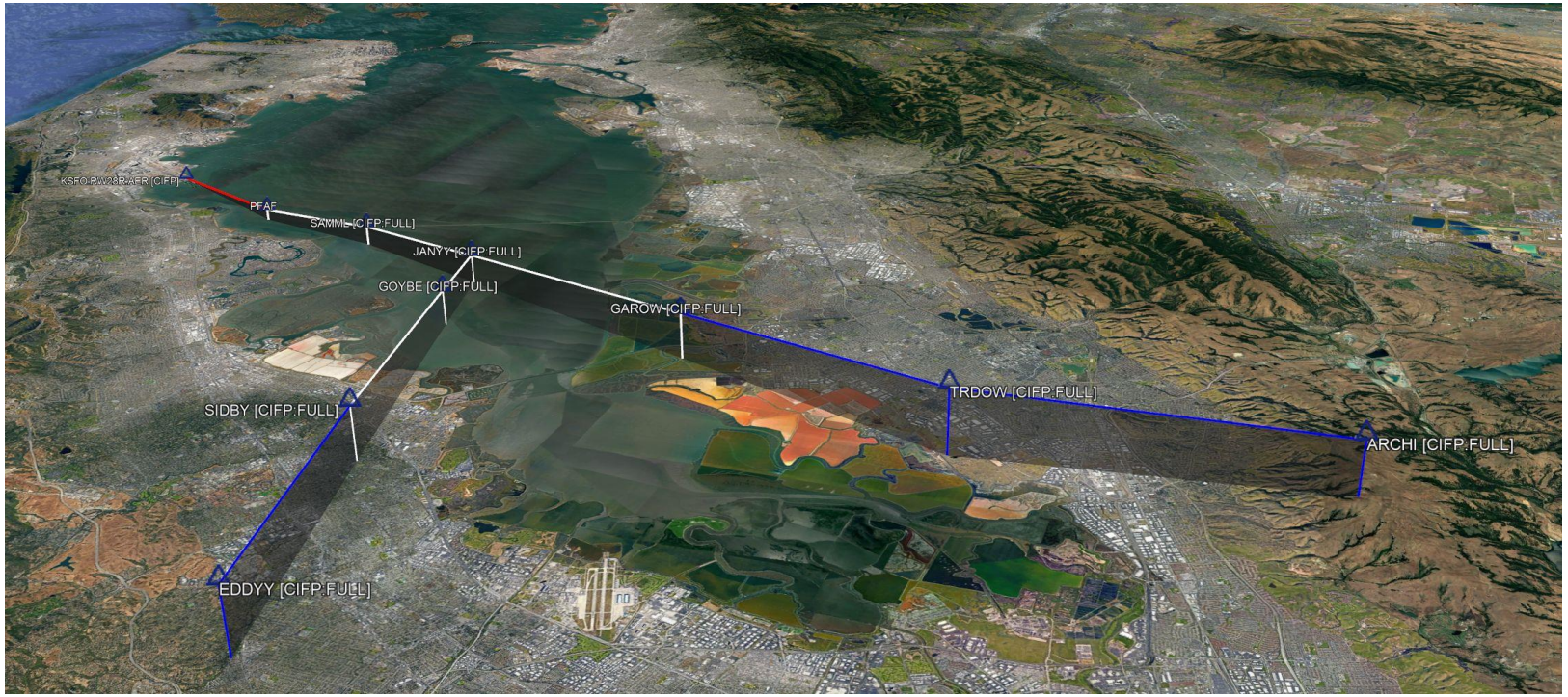


28R GLS Flight Inspection Graphic from GPD

GLS B RWY 28R “Bridge Visual” EDDYY

- GPA: 3.00^{o}
- Opportunity: 95%
- CSPR: No
- GLS Conversion of FMS Bridge Visual
- Use of GOYBE Waypoint considered to reduce “early turns” from SIDBY
- Charts are divided into two for review with community, but will be combined into a single procedure if FAA were to develop

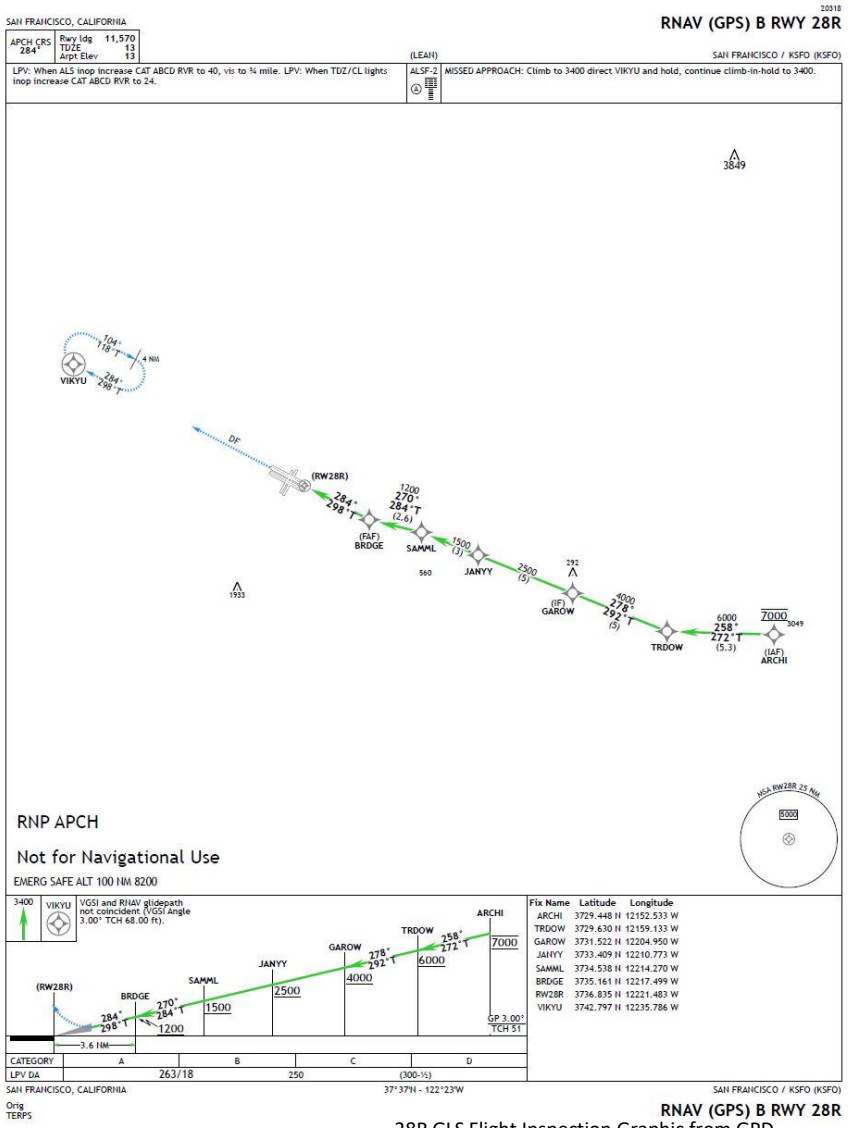
SFO GLS Concept: 28R “Bridge Visual” ARCHI



28R GLS Procedure Image TARGETS, Background Image Google Earth

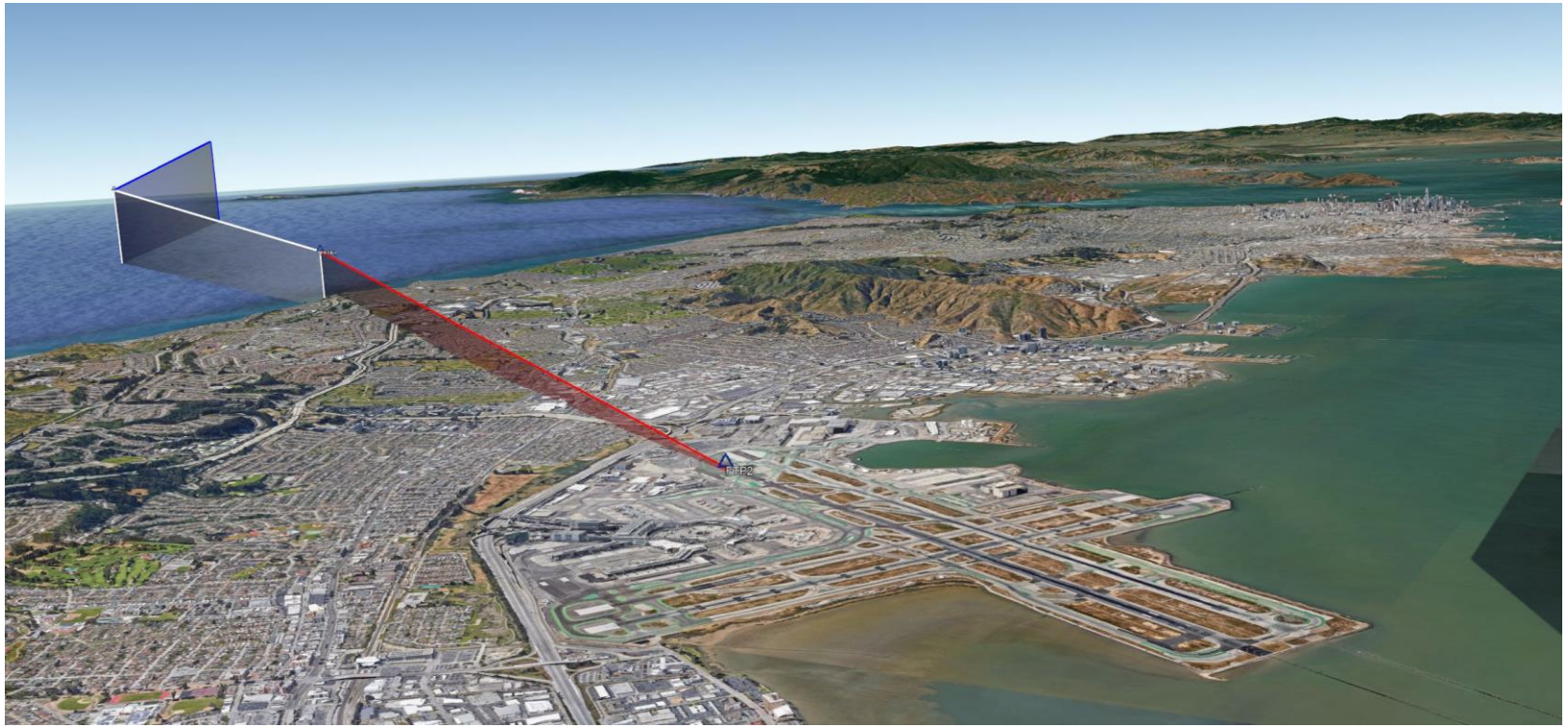
GLS B RWY 28R “Bridge Visual” ARCHI

- GPA: 3.00^{o}
- Opportunity: 95%
- CSPR: No
- GLS Conversion of FMS Bridge Visual
- Charts are divided into two for review with community, but will be combined into a single procedure if FAA were to develop



28R GLS Flight Inspection Graphic from GPD

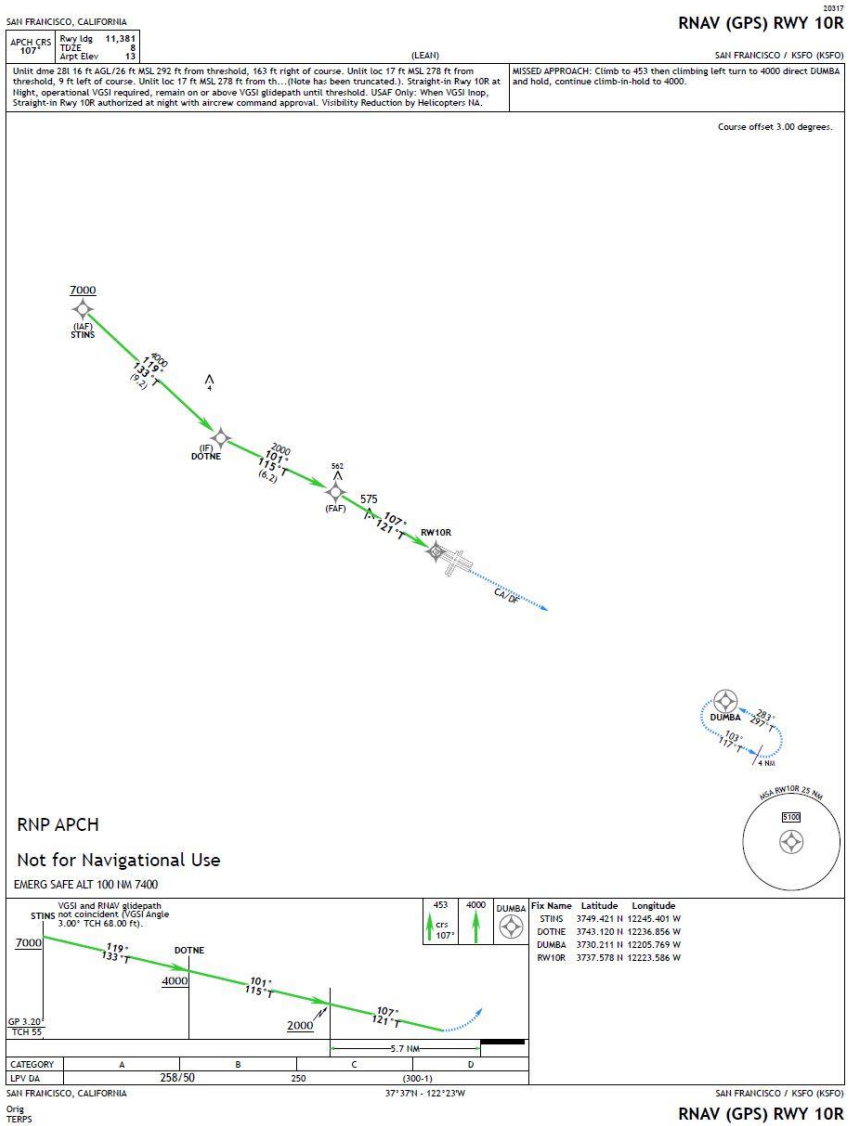
SFO GLS Concept: 10R



10R GLS Procedure Image TARGETS, Background Image Google Earth

GLS B RWY 10R

- GPA: 3.20°
- Opportunity: 0%
- CSPR: No
- Final approach course is offset 3.00 degrees north of the centerline to achieve lowest possible minimums
- This procedure is not considered to reduce noise impact



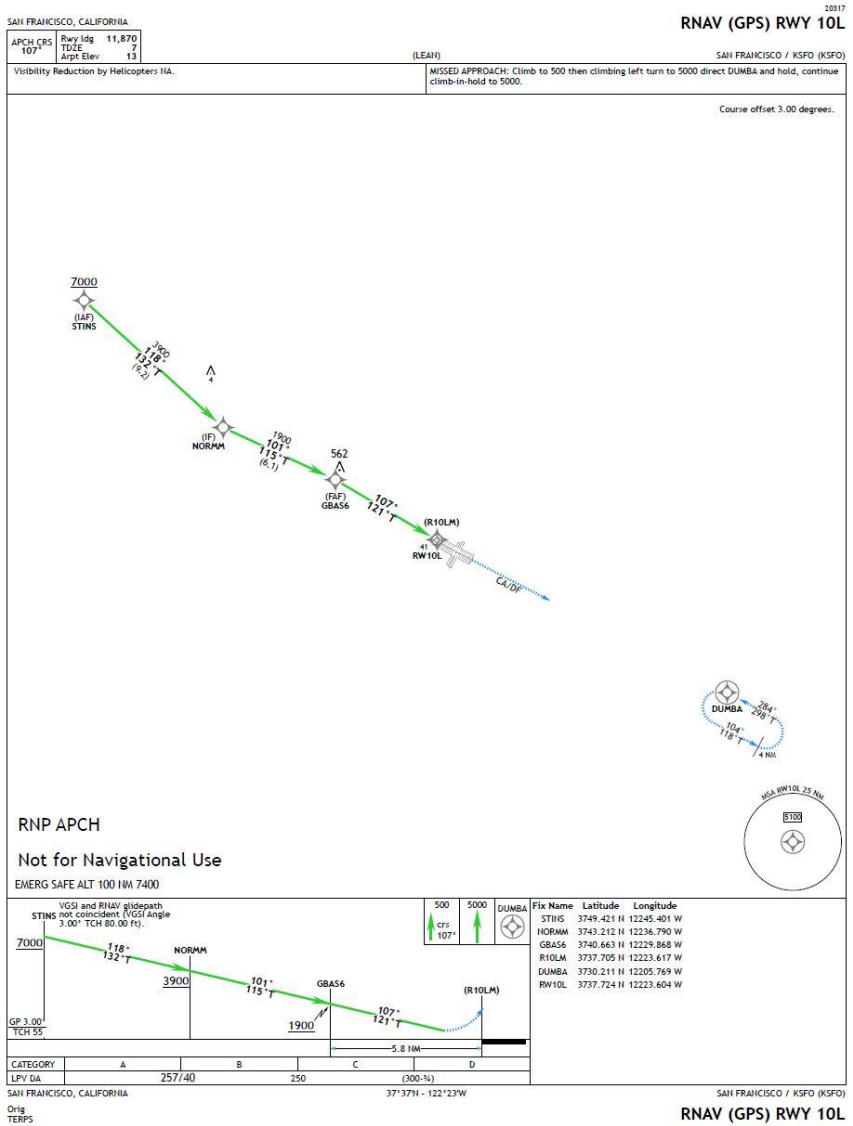
10R GLS Flight Inspection Graphic from GPD

SFO GLS Concept: 10L

10L GLS Procedure Image TARGETS, Background Image Google Earth

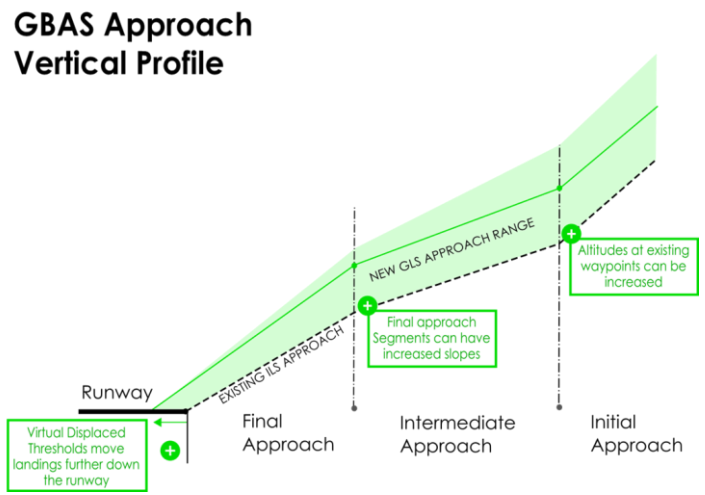
GLS RWY 10L

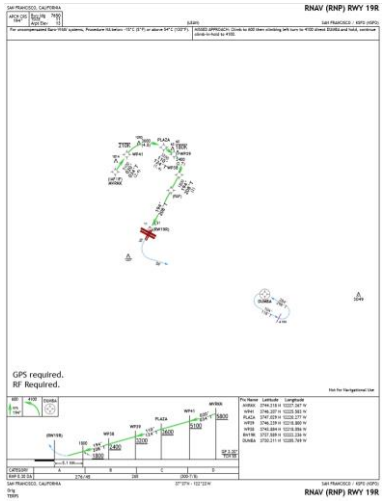
- GPA: 3.00º
- Opportunity: 0%
- CSPR: No
- Final approach course is offset 3.00 degrees north of the centerline to achieve lowest possible minimums
- This procedure is not considered to reduce noise impact

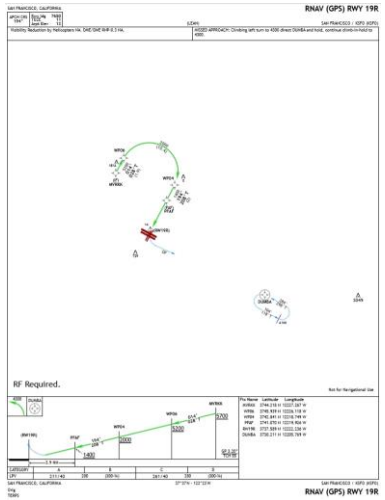


10L GLS Flight Inspection Graphic from GPD

GBAS Innovative Approach Evaluation Status







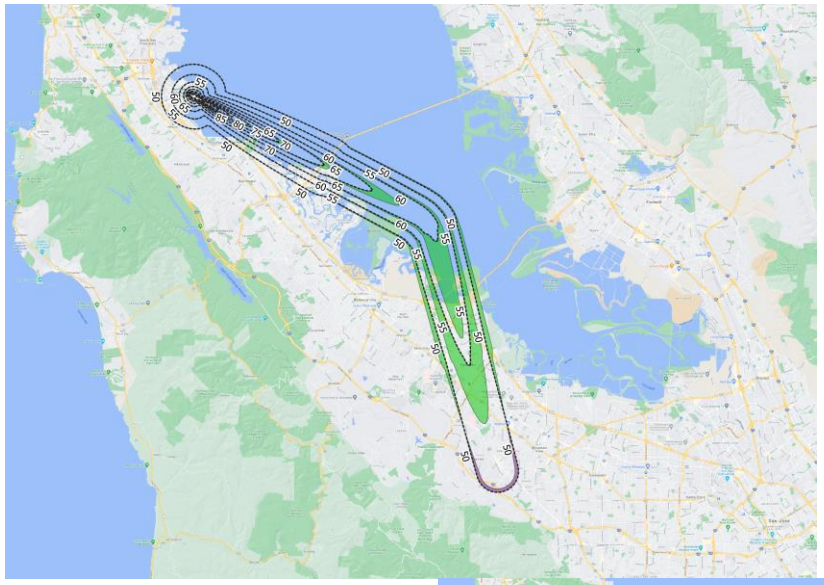
Group 2 Innovative Approach Concepts (Beyond 5 Years)

- GLS CAT II with a 3.00^{o} or 3.10^{o} GPA
- 19R RNP to GLS
- Virtually Displaced Threshold
- Short final RNP to GLS
- Additional concepts that emerge from exploration with residents, airlines and air traffic

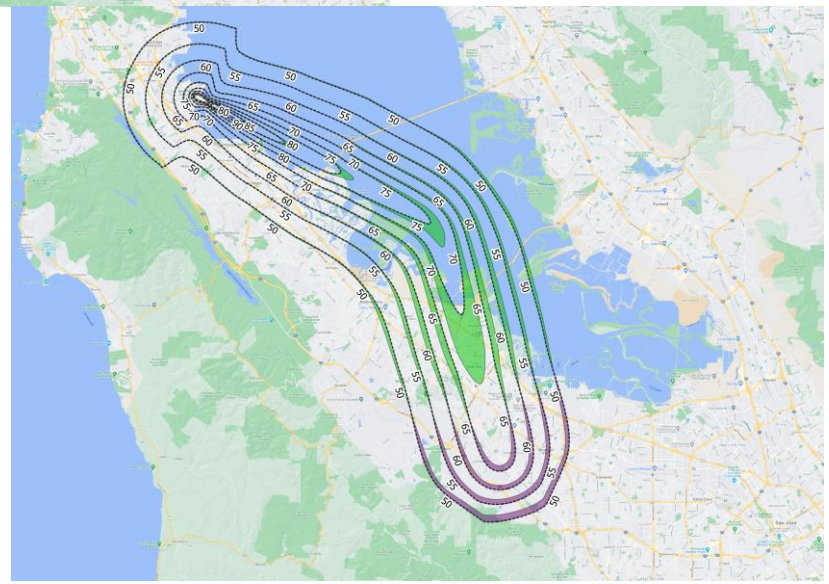
Innovative GLS Approach Noise Consideration

Single Event Noise Analysis

- FAA AEDT v3C with Eurocontrol BADA 4
- LAMAX
- SEL (1 Second)
- Noise sensors utilized both 0.1 Nmi Grid Spacing and existing SFO Noise Monitor Locations
- Noise analysis is presented as areas where single event noise could be expected to change
  - Green areas indicate potential reductions in noise over an area
  - Purple areas indicate potential expansions in noise over an area



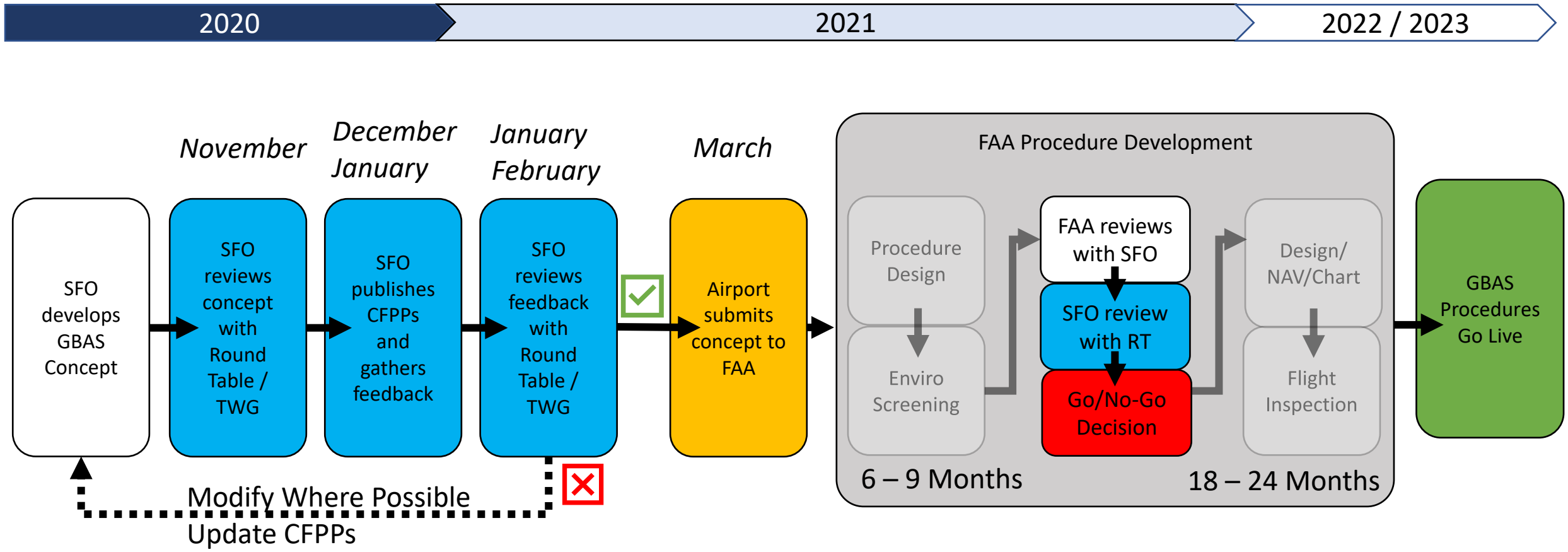
28R GLS LAMAX Noise Analysis from AEDT v3C (BADA 4), Background Image Google Maps XYZ Layer



28R GLS SEL Noise Analysis from AEDT v3C (BADA 4), Background Image Google Maps XYZ Layer

Screenshare from GIS

SFO GLS Procedure Development and Community Evaluation



Timeline to FAA Procedure development will depend on outreach

Feedback From TWG

GBAS Project Team is Seeking Feedback from the TWG

- Initial thoughts on innovative GLS concepts?
- Are there additional formats or materials that should be generated?
  - Google Earth files
  - GIS capable materials
  - Additional flight procedure information (ARINC 424)
- Which of these should be included in the Community Flight Procedure Packages?
  - Flight Inspection Graphics
  - Maps
  - Tables
- Best ways to gather feedback from residents?

Next Steps

Next Steps Between SFO Roundtable TWG and SFO GBAS Project Team

NOV/DEC20 - Update the FlySFO website, GBAS section, with additional materials reviewed today

NOV/DEC20 - Gather feedback from TWG via email (Please contact Bert Ganoung)

DEC20 – Participate in SFO Roundtable

DEC20 - Explore opportunity to engage with TWG specifically for GBAS Project in December

DEC20 – Upload CFPPs to FlySFO website

Questions

Rinaldi Wibowo
SFO Planning, Design and Construction
GBAS PM
Rinaldi.Wibowo@flysfo.com

Bert Ganoung
SFO Planning, Design and Construction
Manager of Noise Abatement
Bert.Ganoung@flysfo.com

Nupur Sinha
SFO Planning, Design and Construction
Acting Director of Planning and Environmental Affairs
Nupur.Sinha@flysfo.com

https://www.flysfo.com/community/noise/making-sfo-quieter/sfos-initiatives-tackle-noise

Backup Material

Innovative GLS Approach Noise Consideration

Approach Profiles

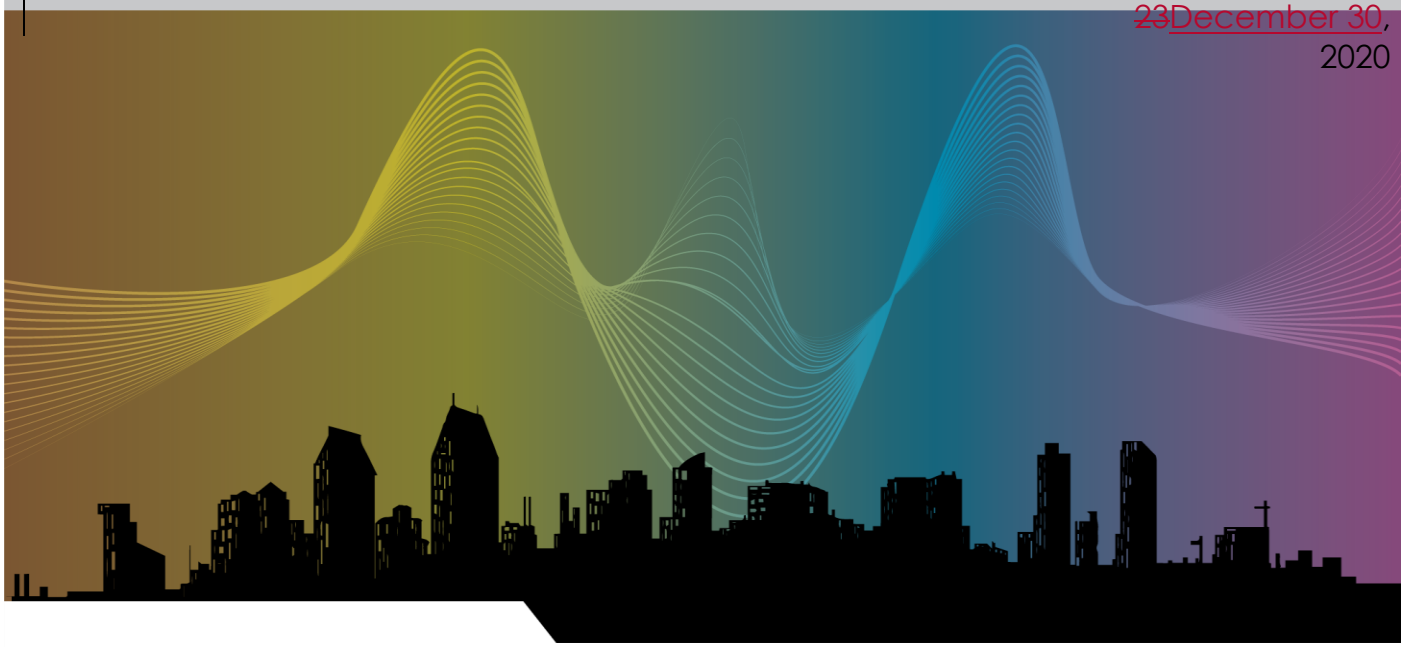
- Generic narrowbody aircraft (multiple types), approaching SFO at near maximum structural landing weight
- Aircraft approaches are modeled to decelerate throughout the approach using reduced thrust applications, flap deployment and gear deployment
- Current analysis does not consider
  - Bank angle
  - Aerodynamic deceleration devices
  - Terrain

Approaches Evaluated

- Evaluating Innovative GLS Approach Concepts that are not replicas/overlays of existing procedures (10L, 10R, 28L GLS-B, 28R GLS-B)
- GBAS Project Team is working with NCT to determine an “equivalent” to the 28R Down the Bay procedure for single event modeling
- 28R GLS Bridge Visual is considered an overlay of the existing approach

Report #2020-007

~~October~~ ~~23~~December 30, 2020



Review of Remote Monitoring Terminal Thresholds

Prepared for:
San Francisco International Airport
PO Box 8097
San Francisco, CA 94128-8097

Prepared by:
20201 SW Birch Street, Suite 250
Newport Beach, CA 92660
T: 949-250-1222 | F: 949-250-1225
Airports@AirportNetwork.com

Contents

Appendix

1. Background

BridgeNet International was contracted by the San Francisco International Airport's (SFO) Noise Office to review aircraft noise event thresholds at five (5) Remote Noise Monitoring Terminals (NMTs). This review of aircraft noise events includes conducting an analysis of measured noise levels and recommending noise thresholds and durations that should be used in the future.

In the fall of 2019, SFO installed a new noise system, the Envirosuite (EVS) Airport Noise and Operations Monitoring System (ANOMS), to replace the airport's existing ANOMS that was installed in 2006. The system underwent various hardware and software upgrades, but the basic noise event detection process has remained essentially the same. The software upgrade did not include changes to how noise events are calculated and correlated to aircraft. Historically, SFO operated with a variance to its state operating certificate due to the airport's status as a "noise problem airport" because there were incompatible land uses[1] within the 65 CNEL. In 2002, the airport no longer needed to operate with a variance because it no longer had incompatible land uses within the 65 CNEL noise contour, which meant that all sensitive land uses within the 65 CNEL were either sound insulated or had granted an avigation easement to the airport. While the airport has operated without a variance for 18 years, it still abides by the standards in Title 21 for a noise problem airport, including the requirement in Section 5033 of Title 21 requiring noise monitoring systems to be submitted and approved by the state as part of an airport's Noise Monitoring Plan.

Per Section 5001 of Title 21, the thresholds of the NMTs should be 10 dB below the appropriate CNEL value; for the purposes of this analysis, the appropriate CNEL value is 65 CNEL as described in Section 5012 of Title 21. Should an airport need a waiver to the 10 dB value, per Section 5070 of Title 21, an airport can apply for a waiver that demonstrates an airport will still maintain the required accuracy of 1.5 CNEL using a different threshold value. Since 2011, SFO has operated with a waiver for noise thresholds at certain NMTs. This analysis will review these noise threshold values to determine their continued applicability at NMTs ~~8,~~ 12, 15, 18 and 19 and for any potential application for NMT 8. This report will describe the background, or ambient noise levels, and aircraft noise levels at each of the monitors and the supporting analysis for continuing to use a threshold different than 55 dB and identify an optimum threshold specific to the conditions at each of the above locations.~~.~~

[1] As defined in Section 5014 of Title 21:
https://govt.westlaw.com/calregs/Document/ICD7B5DE0D45011DEB97CF67CD0B99467?originationContext=document&transitionType=StatuteNavigator&needToInjectTeNMT=False&viewType=FullText&contextData=%28sc.Default%29

2. Definition of Terms

Characteristics of Sound

Sound can be described technically in terms of amplitude (loudness), frequency (pitch), or duration (time). Frequency (or pitch) is measured in hertz (Hz). The standard unit of measurement for the loudness of sound is the decibel (dB). Decibels are based on a 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).

Human hearing 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 measure loudness in a way that reflects how the human ear actually perceives sound. Community noise levels are measured in terms of this A-weighted decibel scale (or dBA), which is widely used in industrial and environmental noise-management contexts.

Propagation of Noise

Outdoor sound levels decrease as a result of several factors, including increased distance from the sound source, atmospheric absorption (characteristics in the atmosphere that absorb sound), and ground attenuation (characteristics on the ground that absorb sound). If sound radiates 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 power of the sound wave.

Atmospheric temperature and humidity also influence the sound levels received by the observer. How much sound is absorbed by the atmosphere depends on the 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 and sound travels farther. Higher frequencies are more readily absorbed than the lower frequencies. The fluctuations in sound levels created by atmospheric conditions increase with distance and become particularly important at distances greater than 1,000 feet. Over large distances, lower frequency sounds become dominant as the higher frequencies are attenuated. Noise propagation is one of the reasons that aircraft noise will be higher one day than other days even when the same aircraft are flying the same path and altitude.

Noise Metrics

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

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, typically from one to 24 hours. This study presents single event measurement results.

- **Maximum Noise Level,** or Lmax, is the maximum or peak sound level during an aircraft noise event. The metric accounts only for the 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. Typical single event noise levels range from over 90 dBA close to the airport to the low 50s dBA at more distant locations.
- **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.
- **Community Noise Equivalent Level (CNEL)** is an average noise over twenty-four hours; it applies a weighting factor that penalizes noise events occurring during the evening and night hours (when humans are typically more sensitive to noise and sleep disturbance is a concern). More specifically, noises occurring during the evening (from 7 PM to 10 PM) are penalized by 5 dB, while noises occurring during the night (10 PM to 7 AM) are penalized by 10 dB. CNEL noise levels near airports range from 70 CNEL directly next to an airport to less than 45 CNEL at more distant locations.

  CNEL is influenced most by the loudest aircraft operating at an airport, which at SFO is typically a wide-body passenger or cargo jet traveling long distances (~~,~~ such as to Europe or Asia). At SFO~~,~~ the aircraft that most influence the CNEL contour are the Boeing 777, other large jets like the Boeing 787, and historically the Boeing 747~~,~~ which recently stopped being used for passenger service, but is still used by cargo carriers. The CNEL contours are influenced to a lesser extent by operations conducted by smaller aircraft; these aircraft influence the contour due to ~~–~~the larger number of operations (~~,–~~for example, narrow-body jets on domestic routes). The CNEL noise levels at locations along the peninsula (i.e. departure procedures along the gap) are especially dominated by the larger jet aircraft in that many of these operations also occur during the evening and night penalty period of 5 dB and 10 dB, respectively.

  Note that measuring CNEL at levels below 55 CNEL becomes less precise because the noise from aircraft events can be close to existing ambient noise, and it is not always technically possible to separate the two. CNEL differs from the Lmax values which are numerically higher than CNEL values because the CNEL represents an average that

includes both peak sounds ~~(~~like the Lmax~~)~~ and lower values when aircraft noise is not present.

3. Purpose

The purpose of this analysis is to support SFO's acceptance of the new ANOMS that was installed in the fall of 2019; in particular, the accuracy of identifying and correlating measured noise to flights at SFO. This system was submitted for review and acceptance to the State of California in 2020. The goal of this analysis is to determine the most effective and accurate thresholds and NMT settings to be used to identify the noise levels due to aircraft flights while in compliance with Title 21 standards.

Additionally, this analysis supports Section 5032 of Title 21 that validates the noise impact boundary, which reviews locations of the NMTs relative to the outer-most points of the 65 CNEL contour. Per Section 5032, "The locations shall be selected to facilitate locating the maximum extent (closure points) of the noise impact boundary when the contour extremities encompass incompatible land uses."

4. Methodology

4.1 Remote Monitoring Terminal Locations

The five NMTs chosen are shown in **Figure 1** and are located in or close to the 65 CNEL; these locations were chosen for their positions relative to departure and arrival noise. It should be noted that Site 12 is between the 60 and 65 CNEL, and is one of two sites that measures noise from the primary arrival path to Runways 28L/R. **Table 1** shows the existing noise thresholds at these NMTs; these values were approved by the State of California in December 2011 and is not inclusive of all the NMTs with threshold waivers[2].

[2] In December 2011 the State of California approved a threshold waiver for the following NMTs: 1,4,5,6,12,14,15,16,17,18, and 19.

Table 1 – Current NMT Threshold Values

NMT	City	Location	Latitude	Longitude	NMT Threshold, dBA
8*	Millbrae	Behind departure roll for Runways 1L/1R	37.6022	-122.385728	65
12	Foster City	Approach path to Runways 28L/28R	37.565328	-122.252728	65
15	South San Francisco (Oyster)	SSTIK departures over Brisbane	37.662811	-122.379716	64
18	Daly City	Gap departure along centerline	37.65722	-122.46716	63
19	Pacifica	Gap departure at the left of centerline	37.65833	-122.48106	65

*NMT 8 was not approved for a different threshold by the State of California in 2011.
Source: San Francisco International Airport Noise Office

This analysis will correlate noise events to a nearby flight using Title 21 guidelines to determine an appropriate threshold for the five NMTs in Table 1. This analysis, as guided by Section 5032 of Title 21, will determine the delta of measured and modeled noise to be within 1.5 dB annual CNEL. While NMTs should ideally be located in areas with ambient noise levels less than 55 dB (i.e. away from noisy sources such as freeways, railroad tracks, etc) many of the NMTs at SFO are in urban areas with ambient levels higher than 55 dB. This analysis will determine suggested thresholds based upon the type of operations a site is exposed to, the level of noise from aircraft events and the background noise environment.

4.2 Data Requirements

The following steps were taken to gather noise information from the five NMTs:

1. Extracted 10 days of ANOMS noise and radar data from November and December 2019 to determine existing NMT thresholds for:
    a. Ambient noise. Ambient background noise represents the typical residual noise that exists in the area independent of the aircraft noise. The results are presented in terms of the L% statistical noise levels. The L% is the percent of time that the noise is above that level. The L50 or mean noise level, which is defined as the point at which half the time the noise is above that value and half below that value.
    b. Minimum noise event duration (note: this value has been determined to be eight (8) seconds for each NMT),
    c. Maximum noise event duration. The current duration of 120 seconds was used; this is the maximum duration allowable in ANOMS. Durations that are too long can produce false positives of assigning an aircraft event to a non-aircraft noise event; these false positives are manually adjusted. Conversely, if the duration is set to a

shorter time, the NMT may not capture the full extent of an aircraft event. In this case, the NMT will assign one aircraft event to multiple shorter noise events.

d. Correlation of noise events to aircraft flights using the point of closest approach (PCA). Note this correlation is a BridgeNet process and may not exactly match ANOMS process.
e. Noise event thresholds, in dBA and
f. One-second Leq time history.

2. Run a bulk analysis with different thresholds, starting as high as 70 dBA and working down to as low as 55 dBA in 1 dBA increment or when the background noise interfered with the results. The multiple thresholds were chosen to determine the point at which the most aircraft events were captured at each of the five NMTs or the threshold approached the ambient where continuous events were created. If a threshold is too low, it can create false positives, or incorrectly assign an aircraft even to a noise event that was from a different source. If a threshold is too high, it will not capture aircraft events and report a lower number of events. However it is import to note that even though not all events are captured, they are the lower noise level events and have a smaller, or negligible, contribution to the overall CNEL.. As determined in 2011 by the airport and approved by Caltrans, the threshold of 55 dBA is too low of a threshold at the NMTs referenced in this report, due to the location of the NMTs in areas with higher ambient noise levels.
    a. Durations settings were used to determine the minimum and maximum duration,
    b. Range setting to determine how far away an aircraft could be and still be considered to be a candidate source, and
    c. At each threshold, correlate aircraft overflight with a noise event to determine correlation rates and false positives.

Table 2 shows the 13 dates used for the data analysis; these days were chosen because they represented a typical operational configuration at SFO, which is aircraft arriving from the east on Runways 28 L/R and departing to the north on Runways 01 L/R commonly referred to as "West Flow."

Table 2 – Runway Use and Operation Counts

Date	Total Daily Flights at SFO	Flow
Nov. 1, 2019	1,265	West
Nov. 2, 2019	1,081	West
Nov. 3, 2019	1,285	West
Nov. 4, 2019	1,274	West
Nov. 5, 2019	1,189	West
Nov. 6, 2019	1,248	West
Dec. 9, 2019	1,188	West
Dec. 10, 2019	1,169	West
Dec. 11, 2019	1,200	West
Dec. 12, 2019	1,227	West

Dec. 13, 2019	1,228	West
Dec. 14, 2019	1,073	West
Dec. 15, 2019	1,210	West

Source: LT6 File Export from SFO ANOMS, 2019

An automated process was used to calculate noise events and when possible, correlated to an aircraft that generated the noise event. **Figures 2 – 4** show radar tracks from the date range for the analysis.

5. Ambient Noise Measurement Results

Ambient background noise represents the typical residual noise that exists in the background. These results are presented in **Table 3,** below. These levels include all noise sources, including aircraft and can be used as a guide to determine the residual noise that an aircraft event will need to produce that raises it above ambient to be measurable by an automated noise monitoring system. The L50 or mean noise level, which is defined as the point at which half the time the noise is above that value and half below that value. Other values of interest are the L90 and L10. The L90 is the background level that is exceeded 90% of the time. It generally reflects quiet periods. The L10 is the level that is exceed 10% of the time. It reflects the high noise level periods.

Ambient noise varies throughout the day; typically, ambient noise is reduced at night, therefore is lower than the daytime levels. When ambient noise is low, the sound of an aircraft may be distinct and measurable, while when ambient noise is higher the same aircraft emitting the same noise may be not audible or measurable above the background. The data in Table 3 show the ambient noise for a 24-hour period. The ambient noise levels at night are roughly 5 dBA quieter than in the daytime hours. Note that the ambient at Site 8 was consistently higher than other sites; NMT 12, 15, 18, and 19 are all between 48-51 dBA while the ambient noise at Site 8 is 62 dBA.

Table 3 – Ambient Noise Measurement Results

	Statistical Noise Levels (dBA)								
Noise Monitoring Terminal	Max	L1	L5	L10	**L50**	L90	L95	L99	Min
NMT 8	84	71	67	66	**62**	58	56	55	50
NMT 12	81	72	67	63	**51**	42	41	39	36
NMT 15	82	69	64	61	**51**	44	43	41	39
NMT 18	86	72	59	56	**50**	45	44	42	39
NMT 19	82	70	58	54	**48**	41	39	37	34

Source: BridgeNet International, 2020

The results show that Sites 12, 15, 18 and 19 have generally quiet background noise levels with an L50 level in the low 50s dBA. This means that more noise events can be measured when the signal-to-noise ratio between the aircraft noise and the background sound is roughly 10 dBA. While Sites 18 and 19 are quieter almost all the time represented by the L10 levels, Sites 12 and 15 have periods of time that the background noise is higher. This is likely from wind noise and would limit how low the threshold could be lowered at these sites without the background exceeding the ambient.

6. NMT Sites

The data presented in this section shows information using logarithmic and arithmetic mean. As noted in Section 3, logarithmic results are those that have been summed and are shown as an energy average. Arithmetic mean is the addition of each numerical value, divided by the number in the set. Additional data for each NMT is show in **Appendix A**. Each NMT section contains a table with data for each of the monitor thresholds, including:

- Number of events – the number of aircraft and non-aircraft events measured by the NMT for the time period.
- Number correlated events – the number of noise events assigned to a flight within the Point of Closest Approach. The PCA is a cylinder centered around the noise monitor that is two miles wide.
- Number nearby flights – all aircraft activity (arrivals or departures) overhead that were captured within the PCA.

6.1 NMT Site 8

NMT Site 8 is located behind Runways 01L/R. The primary source of aircraft noise are departures from Runways 01L/R, with Runway 01R generating higher noise events in that it is closer to the site. These runways are utilized by the majority of departures at SFO, mainly narrow body and regional jets and to a lesser extent, wide body jets. Over time, the aircraft fleet has changed, and aircraft generate less noise to the rear of the aircraft during take-off than in the past with older generation aircraft such as Stage 2 and older Stage 3. Thus, the peak sounds of the events are lower and harder to separate from background noise at this site with the current generation of aircraft. The site is also located near taxiway and hold pad locations that generate ground noise that is a more constant, and less event based like an aircraft flyover.

The ambient background noise levels at Site 8 are much higher than the other sites. This site is also exposed to freeway noise and airport ground activities. The 101 freeway is 1,000 feet to the east, where there is no sound barrier and areas of open space where the NMT has line of sight view to a portion of the freeway. Aircraft ground movements also contribute to the background noise. This includes aircraft idling, taxiing, queuing, and position prior to takeoff from Runways 01L/R at the runway end, and from aircraft taxiing to Runway 28L/R from the south International Terminal. The site is also exposed to other noise sources such as electric power transmission lines

to the east, railroad tracks used for cargo and passengers to the west, BART tracks, parking structure and lot for cars using Caltrans and BART to the south, and residential uses to the north. The site can have near constant noise in the 58 to 67 dBA range that may potentially be from each of these sources. This limits the ability of an NMT to measure lower-level aircraft noise events because these aircraft events are near the ambient level, and the noise event threshold must be greater than the ambient background.

This NMT is generally on the edge of the 65 CNEL noise contour. The current threshold for this NMT is 65 dBA. The site has measured both below and above 65 CNEL over the course of the last five years. Since it is located near sources of noise that can be louder than aircraft events, it has historically been difficult to correlate aircraft flights with noise events. This is due to its location behind the departure roll, which produces noise events that are not as loud as flyover events, low frequency vibratory noise that can be difficult to monitor, and as described above is near other noise sources that is at or near the noise from the aircraft flyover events. Also, the site is under two procedures, the BDEGA (arrival) and SSTIK (departure); while these flights do not generate loud events, they can be confusing to the ANOMS correlating process. Aircraft on the BDEGA arrival path fly over the top of SFO on approach to Runways 28L/R. SSTIK departures from Runways 01L/R also fly over or near NMT 8. With the current ANOMS system, it will often incorrectly correlate noise from other sources to an aircraft from these operations that fly over the site.

Table 4 shows the different thresholds and aircraft correlation based on these thresholds. These flights were correlated to noise events at NMT 8 at thresholds from 70 to 60 dBA. Because of the high ambient noise, noted in Section 5 of this report as 62 dBA, it was not possible to have a lower threshold.

Table 4 – NMT 8 Thresholds and Durations

Metric	Thresholds										
	60	61	62	63	64	65	B&K ANOMS 65	66	67	68	69
Number of Events	12,214	11,196	9,817	8,550	6,921	4,862		3,197	2,077	1,391	825
Number of Correlated Events	9,081	8,504	7,683	6,851	5,545	3,950	3,985	2,610	1,677	1,112	660
Duration (arithmetic mean)	29.4	28.7	28.1	27.1	25.5	23.5	45.7	23.1	23	20.8	19.4
Start to Peak (arithmetic mean)	12.5	12.4	11.9	11.5	11.0	10.0		9.8	10.1	9.1	8.2
dBA Max (logarithmic average)	69.2	69.4	69.7	70.1	70.6	71.5	71.8	72.6	74	74.8	76.1
SEL (logarithmic average)	80.7	80.9	81.2	81.5	82.0	82.7	84.7	83.7	84.8	85.6	87.0
Ground Distance (ft) (arithmetic mean)	5,179	5,209	5,189	5,148	5,167	5,053		4,934	4,850	4,768	4,591
Slant Range Distance (arithmetic mean)	5,688	5,689	5,681	5,630	5,642	5,542		5,440	5,350	5,183	5,071
Altitude (arithmetic mean)	855	808	829	810	792	821		847	826	699	786
CNEL Aircraft (logarithmic average)	66.84	66.82	66.59	66.22	65.96	65.23	**66.15**	64.19	63.45	62.43	60.79
CNEL Community (logarithmic average)	67.78	67.80	67.98	68.22	68.38	68.75		69.14	69.35	69.58	69.84
CNEL Total (logarithmic average)	70.35	70.35	70.35	70.35	70.35	70.35		70.35	70.35	70.35	70.35

Source: BridgeNet International, 2020

Based on the information in **Table 4,** the recommended threshold is 67 dBA; this is 2 dBA higher than the current threshold of 65 dBA. The recommended event duration minimum is eight (8) seconds and maximum is 120 seconds. This threshold will capture less events, but there will also

be less occurrences of ambient noise being mistaken for aircraft. Because of the high ambient levels and how ANOMS works, NMT 8 is consistently measuring 120 second events because the ambient noise level (62 dBA) exceeded the threshold.

While the primary aircraft flight noise captured at NMT 8 is from departures on Runways 01L/R, it will also capture departure roll noise from aircraft on Runways 28L/R. In order to capture noise from the Runway 28L/R departure roll, the range should also be set to 10,000 feet. This range setting should reduce correlations to high-altitude aircraft flying over the site. The BDEGA arrival path is right at 10,000 feet MSL (mean sea level) over the airport, so some aircraft will still potentially be captured. For the SSTIK departures, the aircraft are generally greater than 10,000 feet MSL.

The range is the distance, vertically and laterally, from the NMT to a candidate aircraft flight. An aircraft must be within that specified distance to be considered correlated to the aircraft noise event. An aircraft beyond that distance is not considered. When the range is too large, there is a greater potential for a poor correlation of a noise event an aircraft that likely did not cause the event. Too low of a range, the aircraft could be not correlated that did cause the event.

As previously stated, the site is continuously exposed to noise from the highway and from aircraft taxi/idle/positioning at the end of Runways 01L/R and end around taxiing. These sources of noise contribute to the overall noise at this site; however, the noise system currently does not correlate noise to airport ground activities. These activities are more characterized by long near continuous noise, but at a lower magnitude. Raising of the threshold to 67 dBA will improve the measurements by reducing the number of false correlated noise events, however, measuring within 1.5 CNEL will still be difficult to accomplish when using a threshold based monitoring system.

Due to NMT 8's location to the airfield, adjacent land uses and high ambient noise levels, this noise monitor is not recommended for use in correlating aircraft noise events for Title 21 purposes. This NMT is unable to meet Title 21 requirements as noted in Section 4.1 of this report.

6.2 NMT Site 12

This NMT is located on the approach path in Foster City, near the corner of Gull and Crane Avenues, outside of the 65 CNEL noise contour; the default threshold for this NMT is 55 CNEL; however, the threshold waiver was approved by Caltrans in 2011 for it to be raised to 65 dBA. The NMT is surrounded by residential land use and the primary noise source is from the residential land uses, including passing cars. The primary aircraft noise is from arriving aircraft on Runways 28L and 28R. These arrivals include aircraft that fly a straight-in approach as well as those that are on the offset approach to Runway 28R. **Table 5** shows the 58 – 67 dBA thresholds and aircraft correlation; the current threshold is shown in red.

Table 5 – NMT 12 Thresholds and Durations

Metric	Thresholds										
	58	59	60	61	62	63	64	65	EVS ANOMS 65	66	67
Number of Events	7,265	6,763	6,368	6,114	5,874	5,632	5,351	4,960		4,478	3,880
Number of Correlated Events	6,229	5,989	5,781	5,630	5,458	5,257	5,004	4,650	**4,587**	4,221	3,675
Total Number of Nearby Flights	7,739	7,739	7,739	7,739	7,739	7,739	7,739	7,739		7,739	7,739
Number of Correlated Events with duration > 60 seconds	102	60	48	30	25	19	10	10	**18**	5	0
dBA Max (logarithmic average)	71.0	71.2	71.3	71.4	71.5	71.6	71.8	72.0	**72.0**	72.2	72.6
CNEL Aircraft (logarithmic average)	63.64	63.56	63.47	63.37	63.25	63.10	62.89	62.63	**62.0**	62.25	61.71
CNEL Community (logarithmic average)	56.52	56.91	57.30	57.70	58.13	58.59	59.11	59.68	**59.3**	60.35	61.07
CNEL Total (logarithmic average)	64.41	64.41	64.41	64.41	64.41	64.41	64.41	64.41	**63.9**	64.41	64.41

Source: BridgeNet International, 2020

Based on the information in **Table 5**, the recommended threshold is 62 dBA; this is three decibels lower than the current threshold of 65 dBA and does not change the 1.5 CNEL measurement accuracy. The site may potentially measure 0.5 dBA higher, but still below 65 CNEL. This is due to the monitor being able to correctly correlate aircraft noise events generated by aircraft that are not the dominant noise aircraft as noted in Section 2 of this report. The recommended event duration minimum is eight (8) seconds and maximum is 120 seconds. This threshold and event duration will capture more events, correlating the highest number of flight events in the PCA to noise events. While it is recommended to lower the threshold, the current threshold does capture the majority of the acoustic energy and this change should only result in minor changes to the measured aircraft CNEL. The events should be continued to be analyzed to determine if there is an increase in 120 second events. If so, the threshold should be raised in 1 dBA increments and the data reprocessed.

To reduce false correlations to aircraft overflights, it is suggested that the range be reduced to 15,000 feet. The offset approach to Runway 28R is roughly 5,000 feet from NMT 12. Occasionally, NMT 12 will capture arrival noise from Runways 10L/R operations. These operations are higher and fly a wider path than those on approach to Runways 28L/R; decreasing the range should limit most correlations to aircraft on Runways 10L/R.

6.3 NMT Site 15

This NMT is located in Oyster Point in South San Francisco, in the parking lot of the marina. Surrounding land uses include the marina to the north, and the associated vehicle parking lot to the south, east and west. It is located outside of the 65 CNEL noise contour; the default threshold for this NMT is ~~65~~ 55 dBA, however, the threshold waiver was approved by Caltrans in 2011 for it to be raised to 64 dBA. The primary noise source is from the marina. The primary aircraft noise is from aircraft departing on Runway 01L using the SSTIK procedure and arrivals from the northwest that are headed to Runway 28R for landing. In December 2019, the monitor was moved approximately 1,300 feet to the west, on the western edge of the marina. The noise sources remain the same for aircraft and non-aircraft events and does not change the 1.5 CNEL measurement accuracy. The site is predicted to measure potentially 1 dBA CNEL higher with the lower

threshold, but still below 65 CNEL. This is due to the monitor being able to correctly correlate aircraft noise events generated by aircraft that are not the dominant noise aircraft as noted in Section 2 of this report.

Table 6 shows the different thresholds and aircraft correlation based on these thresholds.

Table 6 – NMT 15 Thresholds and Durations

Metric	Thresholds										
	57	58	59	60	61	62	63	64	EVS ANOMS 64	65	66
Number of Events	5,636	4,682	3,845	3,284	2,863	2,559	2,309	2,055		1,735	1,370
Number of Correlated Events	3,340	3,044	2,786	2,592	2,428	2,292	2,152	1,943	**1,909**	1,641	808
Total Number of Nearby Flights	9,605	9,605	9,605	9,605	9,605	9,605	9,605	9,605		9,605	9,605
Number of Correlated Events with duration <60 seconds	514	283	150	21	21	11	5	2	**9**	0	0
dBA Max (logarithmic average)	69.3	69.6	69.9	70.2	70.4	70.6	70.7	71.0	**70.9**	71.3	72.1
CNEL Aircraft (logarithmic average)	61.01	60.62	60.43	60.24	60.04	59.81	59.50	59.09	**58.23**	58.56	57.87
CNEL Community (logarithmic average)	56.69	57.59	57.95	58.27	58.57	58.87	59.23	59.62	**59.63**	60.05	60.47
CNEL Total (logarithmic average)	62.37	62.37	62.37	62.37	62.37	62.37	62.37	62.37	**62.00**	62.37	62.37

Source: BridgeNet International, 2020

Based on the information in **Table 6**, the recommended threshold is 60 dBA; this is four (4) dBA lower than the current threshold of 64 dBA. The recommended minimum duration is eight (8) seconds and the maximum duration remains at 60 seconds. This threshold and duration recommendation will ensure that long events are not falsely captured. While a lower threshold is recommended, the current threshold captures the majority of the acoustic energy and this change should only result in minor changes to the measured aircraft CNEL. The events should be continued to be analyzed to determine if there is an increase in 120 second events. If so, the threshold should be raised in 1 dBA increments and the data reprocessed.

6.4 NMT Site 18

This NMT is located in Daly City on Margate Street, between Shipley Avenue and Gellert Blvd. The site is surrounded by residential land uses on all sides and is located outside of the 65 CNEL noise contour; the default threshold for this NMT is 55 CNEL; however, the threshold waiver was approved by Caltrans in 2011 for it to be raised to 63 dB. The primary noise source is from residential land uses, including vehicle traffic. The primary aircraft noise is from wide body aircraft departing on Runways 28L/R using the GNNRR procedure and some aircraft using the GAP procedure. These aircraft are typically the largest and loudest that operate at SFO, flying to destinations in Asia and Europe. Since this monitor already captures noise events by these aircraft that are the dominate contributors to the CNEL contour, it does not change the 1.5 CNEL measurement accuracy. No change in the predicted measured CNEL noise level would occur with the lower threshold. However, more lower--level noise events would be detected and potential correlated.

Table 7 shows the different thresholds and aircraft correlation based on these thresholds.

Table 7 - NMT 18 Thresholds and Durations

Metric	Thresholds										
	56	57	58	59	60	61	62	63	EVS ANOMS 63	64	65
Number of Events	6,460	5,092	4,126	3,614	3,054	2,764	2,584	2,428	NA	2,334	2,264
Number of Correlated Events	2,169	1,993	1,806	1,634	1,461	1,352	1,270	1,198	**1,192**	1,157	1,124
Total Number of Nearby Flights	7,857	7,857	7,857	7,857	7,857	7,857	7,857	7,857		7,857	7,857
Number of Correlated Events with duration > 60 seconds	92	41	10	3	0	0	0	0	**0**	0	0
dBA Max (logarithmic average)	75.5	75.9	76.4	76.8	77.3	77.6	77.9	78.1	**78.2**	78.3	78.4
SEL (logarithmic average)	85.0	85.4	85.9	86.3	86.8	87.1	87.3	87.5	**87.5**	87.6	87.7
CNEL Aircraft (logarithmic average)	64.08	64.04	64.00	63.96	63.92	63.89	63.85	63.82	**63.5**	63.78	63.73
CNEL Community (logarithmic average)	56.54	56.78	57.00	57.19	57.36	57.50	57.66	57.81	**57.4**	57.96	58.12
CNEL Total (logarithmic average)	64.79	64.79	64.79	64.79	64.79	64.79	64.79	64.79	**64.4**	64.79	64.79

Source: BridgeNet International, 2020

Based on the information in **Table 7**, the recommended threshold is 63 dBA; this is the same as the current threshold. The recommended minimum duration is eight (8) seconds and the maximum duration is 60 seconds. This threshold and duration recommendation will continue to correlate aircraft flight events to noise. Lowering the threshold would potentially result in a higher number of false long-duration 120 second events.

6.5 NMT Site 19

This NMT is located in Pacifica in Fairmont Park, between Highway 1 and Hickey Blvd. The site is surrounded by parkland on all sides, followed by residential land uses and is located outside of the 65 CNEL noise contour; the default threshold for this NMT is 55 CNEL; however, the threshold waiver was approved by Caltrans in 2011 for it to be raised to 65 dB. The primary noise source is from activities at the park and residential land uses, include vehicle traffic. The primary aircraft noise is from wide body aircraft departing on Runways 28L/R using the GNNRR and GAP procedures. These aircraft are typically the largest and loudest that operate at SFO, flying to destinations in Asia and Europe. As with NMT Site 18, this monitor already captures noise events by these aircraft that are the dominate contributors to the CNEL contour and does not change the 1.5 CNEL measurement accuracy. With lowering the threshold by 1 dBA, the predicted CNEL noise level would be approximately 0.1 CNEL higher. However, more lower level noise events would be detected and potentially correlated.

Table 8 shows the different thresholds and aircraft correlation based on these thresholds.

Table 8 - NMT 19 Thresholds and Durations

Metric	Thresholds										
	58	59	60	61	62	63	64	65	EVS ANOMS 65	66	67
Number of Events	1,585	1,455	1,351	1,268	1,219	1,189	1,146	1,102		1,050	981
Number of Correlated Events	1,398	1,307	1,227	1,169	1,126	1,104	1,072	1,035	**1,037**	990	927
Total Number of Nearby Flights	1,688	1,688	1,688	1,688	1,688	1,688	1,688	1,688		1,688	1,688
Number of Correlated Events with duration > 60 seconds	5	4	3	3	3	3	3	2	**1**	2	2
dBA Max (logarithmic average)	73.9	74.2	74.5	74.6	74.7	74.8	74.9	75.0	**75.0**	75.2	75.4
SEL (logarithmic average)	84.1	84.3	84.5	84.7	84.8	84.8	84.9	84.9	**84.8**	85.0	85.0
CNEL Aircraft (logarithmic average)	61.26	61.23	61.19	61.15	61.10	61.04	60.97	60.87	**60.3**	60.74	60.55
CNEL Community (logarithmic average)	54.43	54.60	54.77	54.95	55.15	55.36	55.62	55.94	**56.2**	56.32	56.80
CNEL Total (logarithmic average)	62.08	62.08	62.08	62.08	62.08	62.08	62.08	62.08	**61.8**	62.08	62.08

Source: BridgeNet International, 2020

Based on the information in **Table 8**, the recommended threshold is 64 dBA; this is one (1) dBA lower than the current threshold. The recommended minimum duration is eight (8) seconds and the maximum duration is 60 seconds, which is 60 seconds lower. This threshold and duration recommendation will continue to correlate aircraft flight events to noise. While it is recommended that it is possible to lower the threshold, the current threshold does capture the majority of the acoustic energy and this change should only result in minor changes to the measured aircraft CNEL. The events should be followed to determine if there is an increase in 120 second events. If so, the threshold should be raised in 1 dBA increments and the data reprocessed.

7. Summary and Recommendations

Based on the analysis presented in Section 6, **Table 9** shows the recommended NMT thresholds and event detection for NMTs 8, 12, 15, 18 and 19. As noted in Section 6.1, NMT 8 is not recommended to be used for Title 21 purposes. All other NMTs studied in this report are recommended to continue to be used for Title 21 threshold correlation of aircraft noise that meet the requirements of Title 21, Section 5070 (i.e., measure aircraft noise within an accuracy of 1.5 CNEL. The recommended thresholds in this report are predicted to result in some small changes to the measured CNEL, and will more accurately correlate aircraft events to the associated noise of lower noise level events. These recommendations will ensure the NMTs are capturing more of the quieter aircraft events; the NMTs will continue to capture the louder events, which contribute more greatly to the shape and size of the noise contours.

Table 9 – Recommended NMT Thresholds and Duration

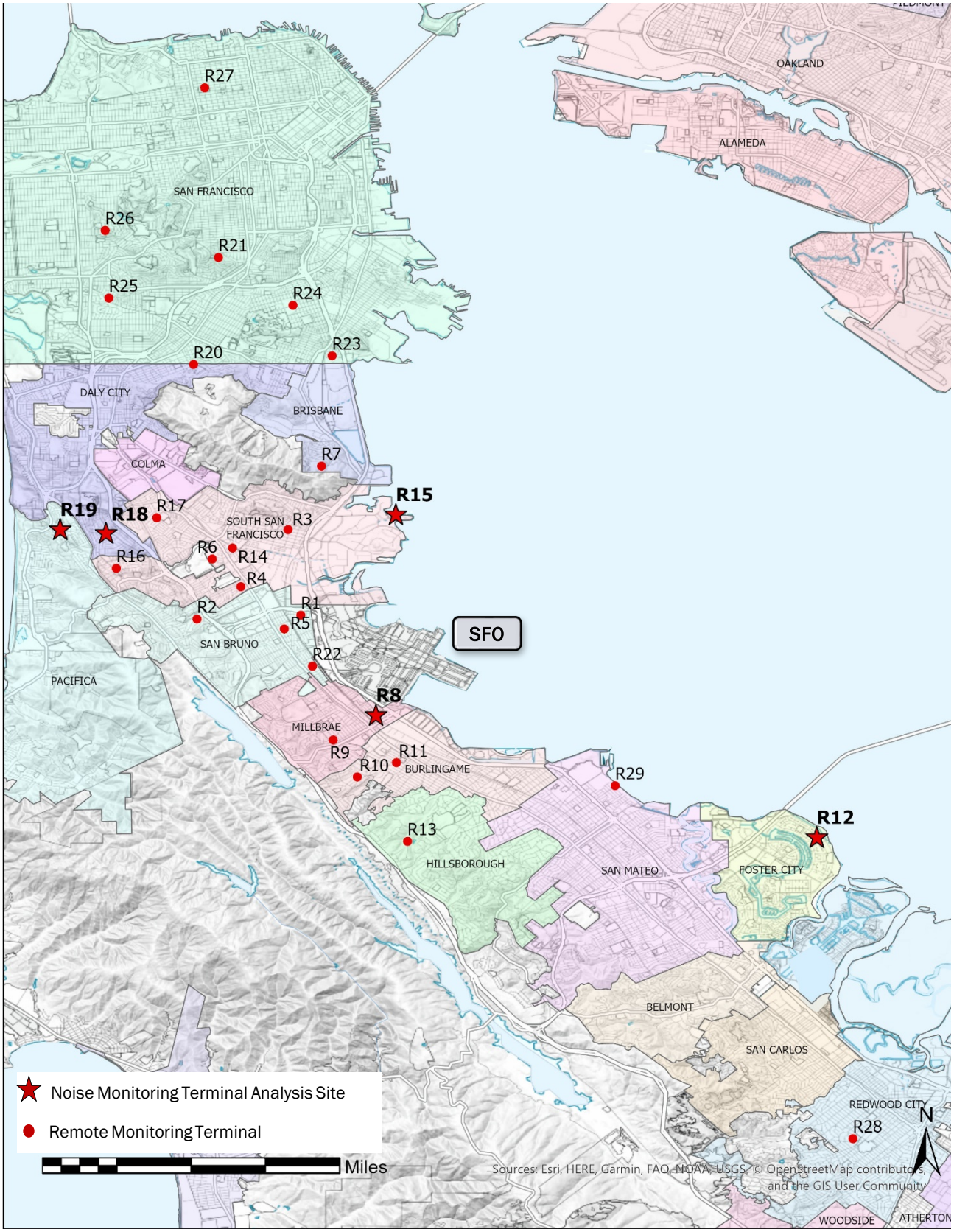
NMT	City	Location	Current NMT Threshold, CNEL	Recommended NMT Threshold, CNEL	Recommended NMT Minimum Duration	Recommended NMT Maximum Duration
8	Millbrae	Behind departure roll for Runways 1L/1R	65	67	8	60
12	Foster City	Approach path to Runways 28L/28R	65	62	8	60
15	South San Francisco (Oyster)	SSTIK departures over Brisbane	64	60	8	60
18	Daly City	Gap departure along centerline	63	63	8	60
19	Pacifica	Gap departure at the left of centerline	65	64	8	60

Source: BridgeNet International, July 2020

APPENDIX
Report Figures

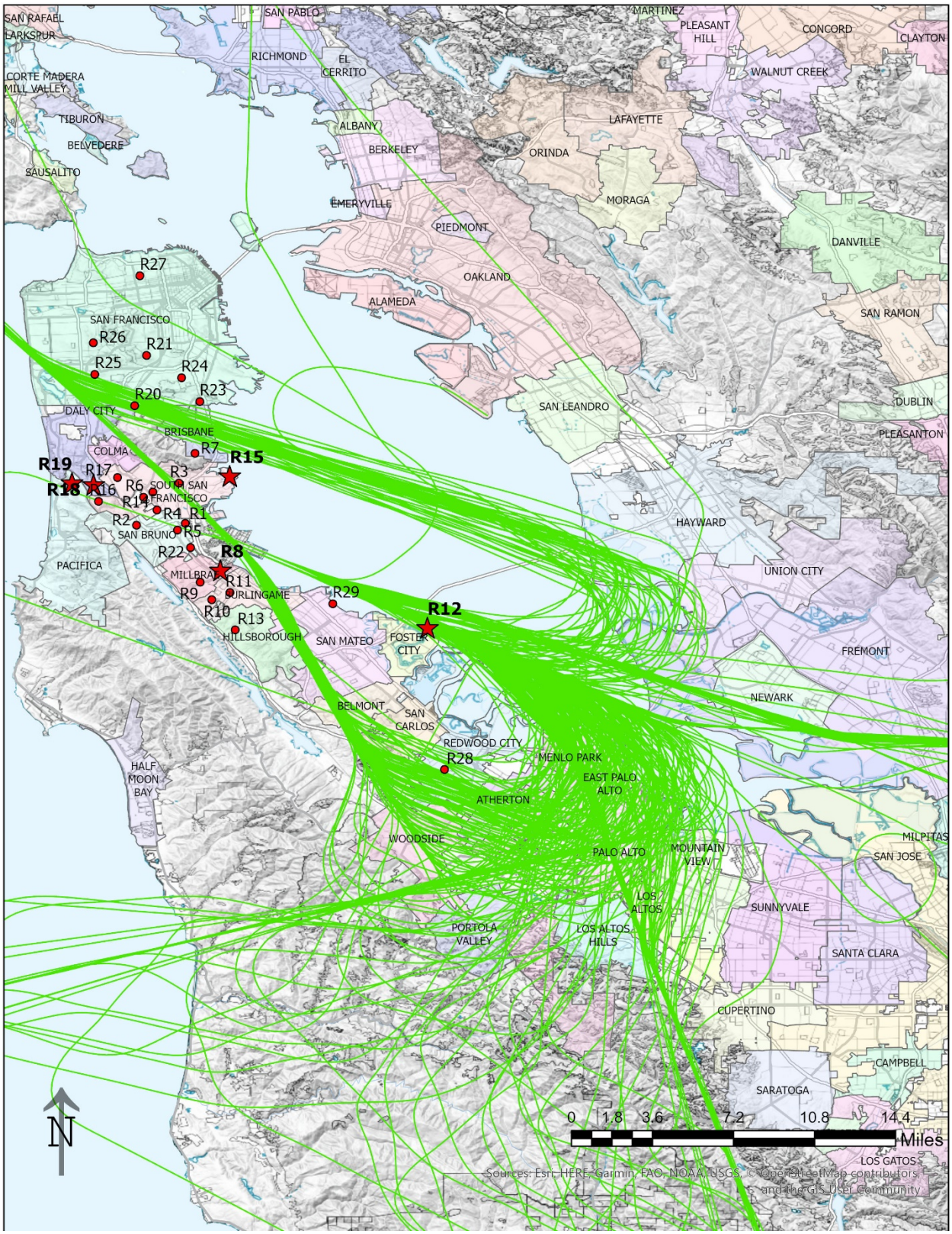
Figure 1
Noise Monitor Terminals Site Map

SAN FRANCISCO INTERNATIONAL –NOISE MONITOR TERMINAL THRESHOLD ANALYSIS



Source: BridgeNet International 2020

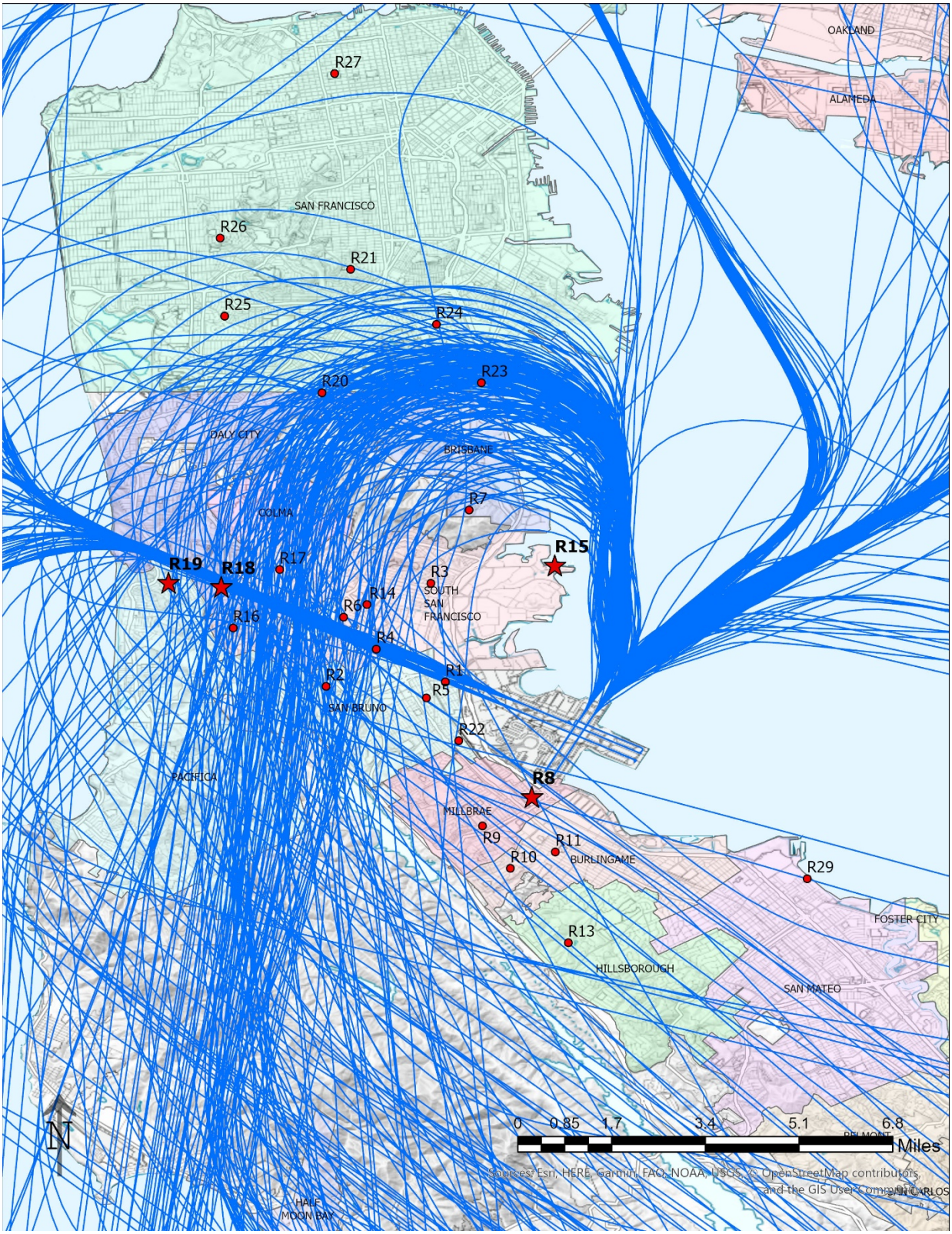
Figure 2
Arrival Radar Flight Tracks



SFO Runways 28L/R Arrival Tracks on November 1st, 2019

Source: BridgeNet International 2020

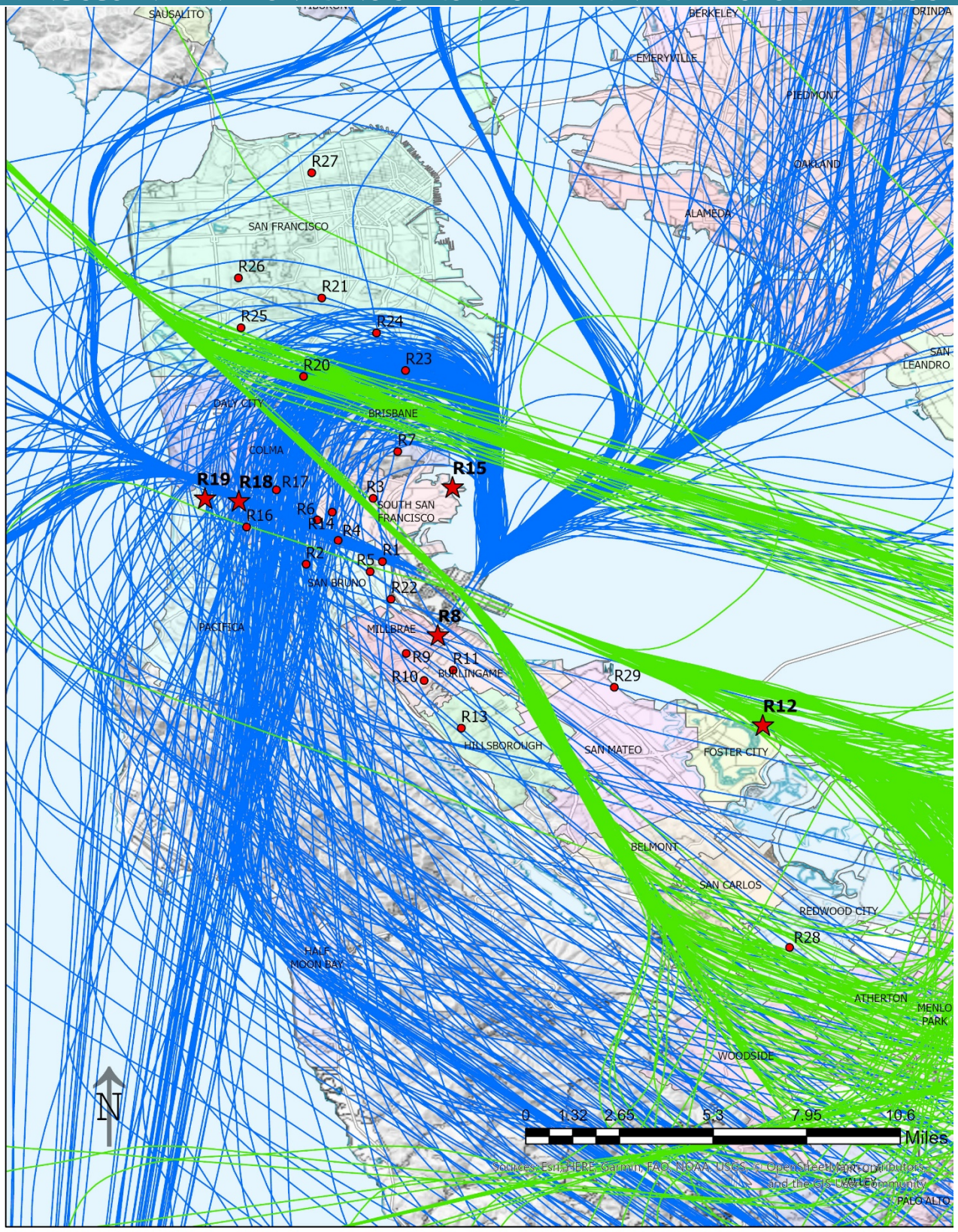
Figure 3
Departure Flight Tracks



SFO Runways 01L/R and 28L/R Departure Tracks on November 1st, 2019

Source: BridgeNet International 2020

Figure 4
Arrival and Departure Radar Flight Tracks



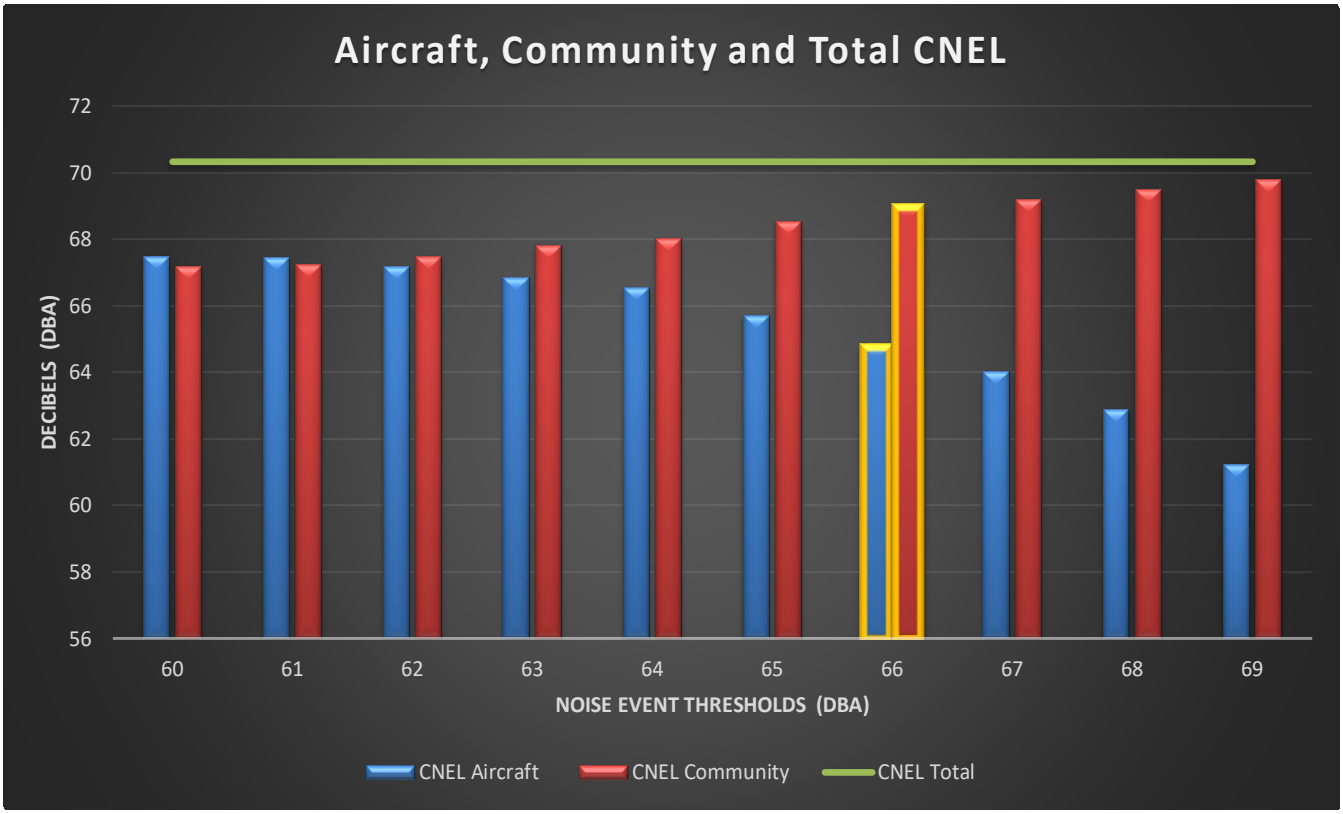
SFO Runways 01L/R and 28L/R Departure and Arrival Tracks on November 1st, 2019

Source: BridgeNet International 2020

Figure 5
NMT 8 – Threshold Analysis and Total CNEL

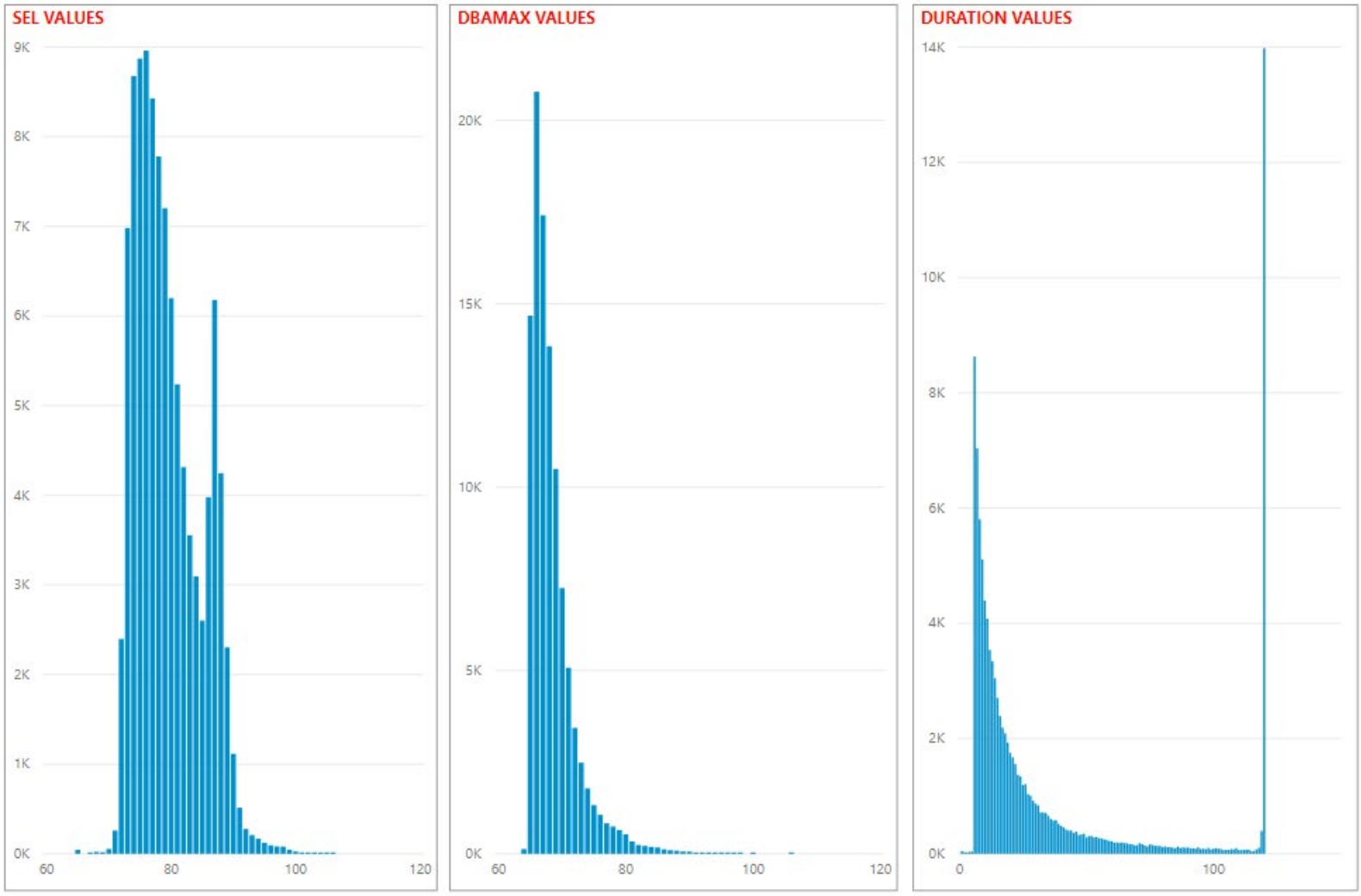
SAN FRANCISCO INTERNATIONAL –NOISE MONITOR TERMINAL THRESHOLD ANALYSIS

Metric	Thresholds										
	60	61	62	63	64	65	B&K ANOMS 65	66	67	68	69
Number of Events	12,214	11,196	9,817	8,550	6,921	4,862		3,197	2,077	1,391	825
Number of Correlated Events	9,081	8,504	7,683	6,851	5,545	3,950	3,985	2,610	1,677	1,112	660
Duration (arithmetic mean)	29.4	28.7	28.1	27.1	25.5	23.5	45.7	23.1	23	20.8	19.4
Start to Peak (arithmetic mean)	12.5	12.4	11.9	11.5	11.0	10.0		9.8	10.1	9.1	8.2
dBA Max (logarithmic average)	69.2	69.4	69.7	70.1	70.6	71.5	71.8	72.6	74	74.8	76.1
SEL (logarithmic average)	80.7	80.9	81.2	81.5	82.0	82.7	84.7	83.7	84.8	85.6	87.0
Ground Distance (ft) (arithmetic mean)	5,179	5,209	5,189	5,148	5,167	5,053		4,934	4,850	4,768	4,591
Slant Range Distance (arithmetic mean)	5,688	5,689	5,681	5,630	5,642	5,542		5,440	5,350	5,183	5,071
Altitude (arithmetic mean)	855	808	829	810	792	821		847	826	699	786
CNEL Aircraft (logarithmic average)	66.84	66.82	66.59	66.22	65.96	65.23	**66.15**	64.19	63.45	62.43	60.79
CNEL Community (logarithmic average)	67.78	67.80	67.98	68.22	68.38	68.75		69.14	69.35	69.58	69.84
CNEL Total (logarithmic average)	70.35	70.35	70.35	70.35	70.35	70.35		70.35	70.35	70.35	70.35



Source: BridgeNet International 2020

Figure 6
NMT 8 – SEL, dBA Max and Duration



These histogram plots of ANOMS correlated noise events for 2019. The left figure shows the number of events versus the measured SEL noise value, the middle graphic shows the number of events verses the correlated measured Lmax and the right side of the figure shows the number of evens versus the duration of the noise event.

Site 8 shows that there are many events in the lower range that are not being measured. Accordingly, this threshold should be reduced to measure these missing events. However, it should be noted that the duration for many events is 120 seconds, which is the maximum duration that ANOMS permits. This is showing that the background, or ambient noise, is above the threshold for extended periods. Increasing the threshold would capture more aircraft events, however, it would also falsely assign ambient noise to non-aircraft events. These are two counter findings; since the background noise at this site is high, the best option is to raise the threshold to be consistent with the high background.

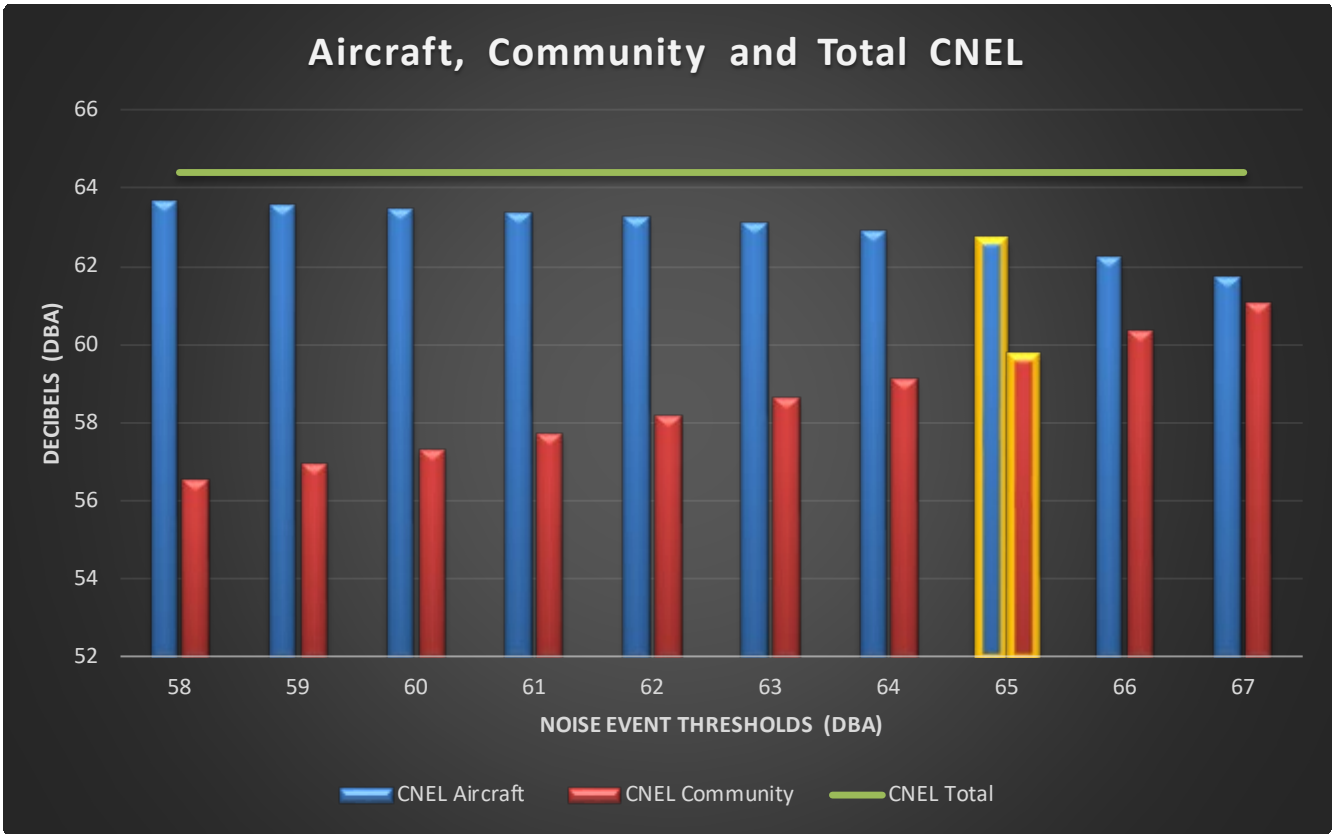
Source: BridgeNet International 2020

Figure 7
NMT 12 – Threshold Analysis and Total CNEL

SAN FRANCISCO INTERNATIONAL –NOISE MONITOR TERMINAL THRESHOLD ANALYSIS

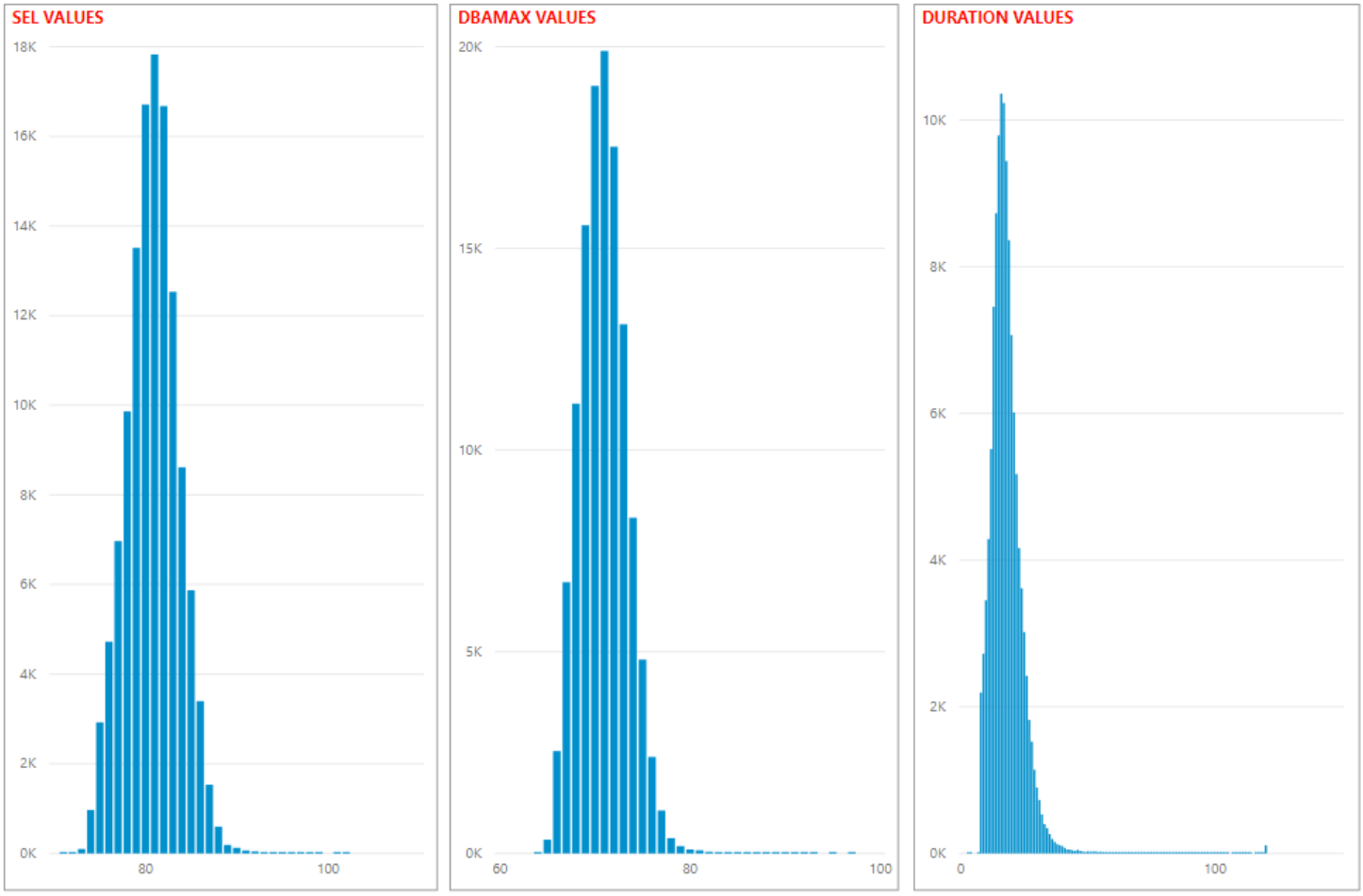
San Francisco International Airport RMT Noise Threshold Study
Site: RMT 12 (Approach to Runway 28)
Study Time Period: Nov 1, 2019 thru Nov 6, 2019 and Dec 9, 2019 thru Dec 15, 2019
Number of Study Days: 13
Noise Metric: CNEL

Metric	Thresholds										
	58	59	60	61	62	63	64	65	EVS ANOMS 65	66	67
Number of Events	7,265	6,763	6,368	6,114	5,874	5,632	5,351	4,960		4,478	3,880
Number of Correlated Events	6,229	5,989	5,781	5,630	5,458	5,257	5,004	4,650	**4,587**	4,221	3,675
Total Number of Nearby Flights	7,739	7,739	7,739	7,739	7,739	7,739	7,739	7,739		7,739	7,739
Duration (arithmetic mean)	28.7	26.8	24.9	22.9	21.0	19.3	17.6	16.1	**16.7**	14.7	13.5
Duration (standard deviation)	10.89	9.62	8.75	7.93	7.34	6.74	6.01	5.36	**7.06**	5.04	4.50
Number of Correlated Events with duration > 60 seconds	102	60	48	30	25	19	10	10	**18**	5	0
Start to Peak (arithmetic mean)	13.0	12.2	11.5	10.6	9.9	9.1	8.4	7.7		7.1	6.5
dBA Max (logarithmic average)	71.0	71.2	71.3	71.4	71.5	71.6	71.8	72.0	**72.0**	72.2	72.6
SEL (logarithmic average)	81.5	81.6	81.6	81.6	81.7	81.7	81.7	81.8	**81.8**	81.9	82.0
Ground Distance (ft) (arithmetic mean)	1,074	997	953	920	896	885	885	878		864	846
Slant Range Distance (arithmetic mean)	2,371	2,315	2,282	2,259	2,240	2,230	2,230	2,224		2,217	2,207
Altitude (arithmetic mean)	1,894	1,895	1,894	1,895	1,893	1,891	1,888	1,885		1,882	1,878
CNEL Aircraft (logarithmic average)	63.64	63.56	63.47	63.37	63.25	63.10	62.89	62.63	**62.0**	62.25	61.71
CNEL Community (logarithmic average)	56.52	56.91	57.30	57.70	58.13	58.59	59.11	59.68	**59.3**	60.35	61.07
CNEL Total (logarithmic average)	64.41	64.41	64.41	64.41	64.41	64.41	64.41	64.41	**63.9**	64.41	64.41
SEL Aircraft (arithmetic mean)	79.87	80.16	80.38	80.48	80.57	80.67	80.76	80.91		81.07	81.27



Source: BridgeNet International 2020

Figure 8
NMT 12 – SEL, dBA Max and Duration



These histogram plots of ANOMS correlated noise events for 2019. The left figure shows the number of events versus the measured SEL noise value, the middle graphic shows the number of events verses the correlated measured Lmax and the right side of the figure shows the number of evens versus the duration of the noise event.

If noise from a site is fully measured, then the SEL and Lmax values should show a classic bell curve, which can be seen in these histograms. The results from Sites 12, 15, 18 and 19 generally show that pattern.

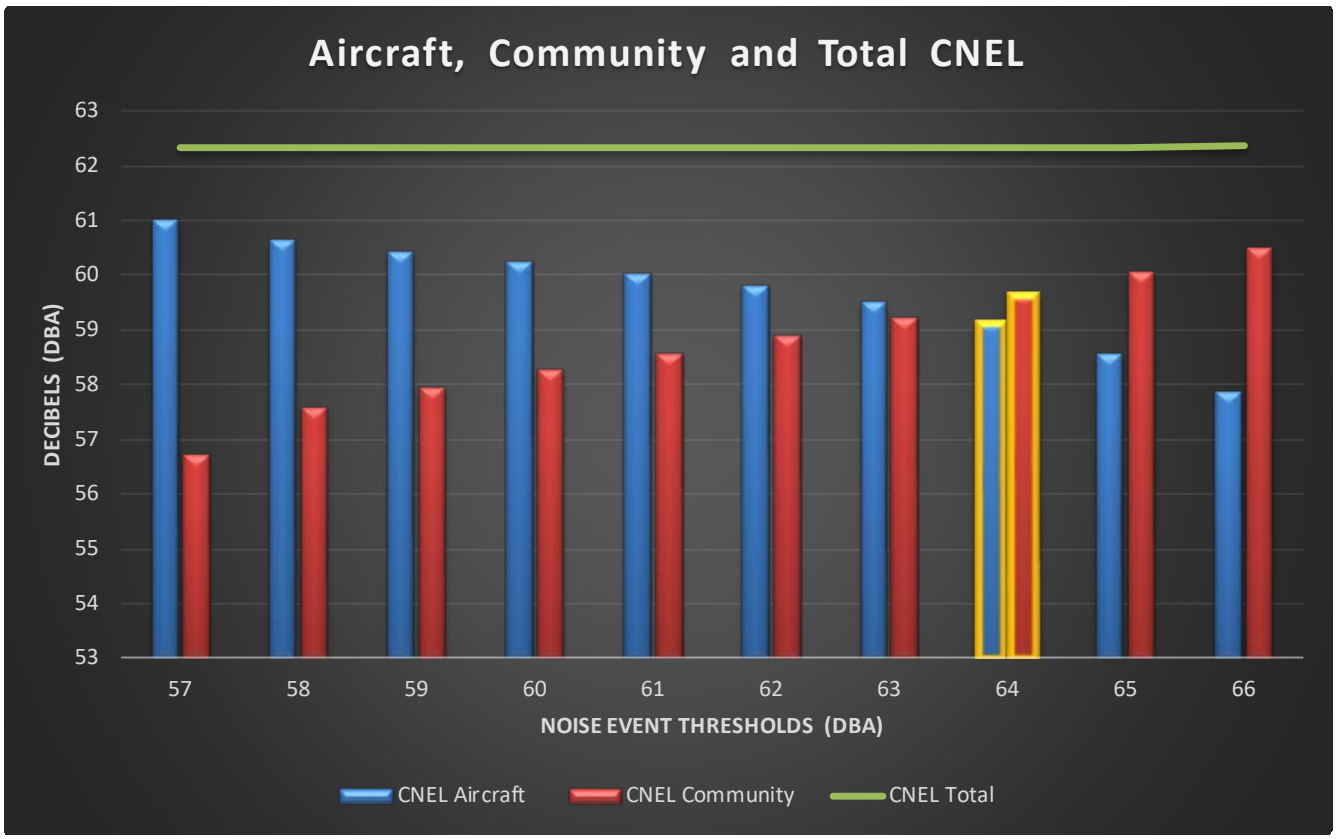
Source: BridgeNet International 2020

Figure 9
NMT 15 Threshold Correlation

SAN FRANCISCO INTERNATIONAL –NOISE MONITOR TERMINAL THRESHOLD ANALYSIS

San Francisco International Airport RMT Noise Threshold Study
Site: RMT 15 (SSTIK departure)
Study Time Period: Nov 1, 2019 thru Nov 6, 2019 and Dec 9, 2019 thru Dec 15, 2019
Number of Study Days: 13
Noise Metric: CNEL

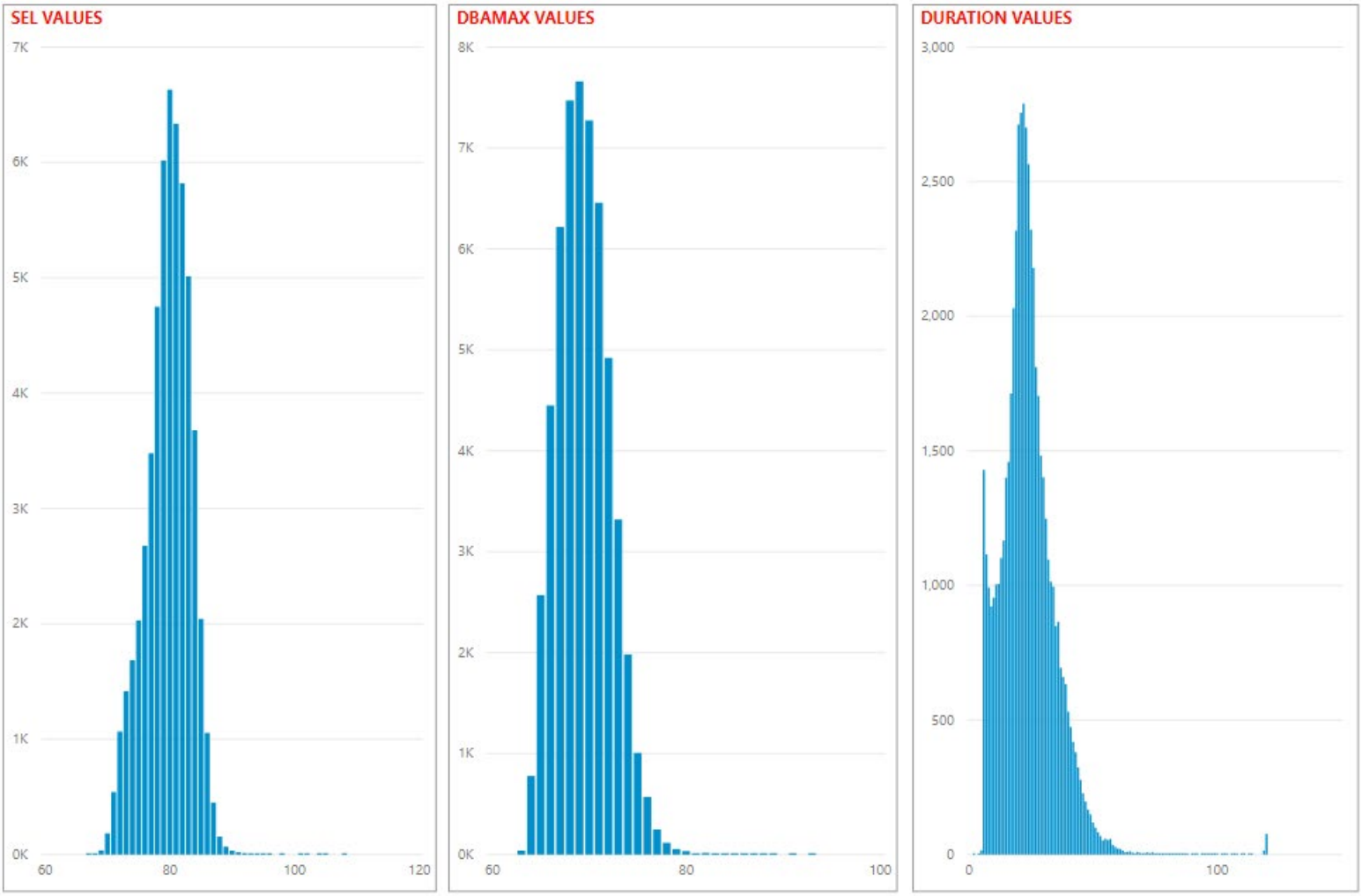
Operation	Runways	Metric	Thresholds 57	58	59	60	61	62	63	64	EVS ANOMS 64	65	66
		Number of Events	5,636	4,682	3,845	3,284	2,863	2,559	2,309	2,055		1,735	1,370
All	All	Number of Correlated Events	3,340	3,044	2,786	2,592	2,428	2,292	2,152	1,943	**1,909**	1,641	808
All	All	Total Number of Nearby Flights	9,605	9,605	9,605	9,605	9,605	9,605	9,605	9,605		9,605	9,605
All	All	Duration (arithmetic mean)	39.6	37.5	35.6	33.2	30.9	28.3	25.5	23.0	**26.5**	21.0	19.9
All	All	Duration (standard deviation)	20.78	18.26	15.72	13.49	11.96	10.90	10.18	9.51	**10.23**	8.83	7.47
All	All	Number of Correlated Events with duration > 60 seconds	514	283	150	21	21	11	5	2	**9**	0	0
All	All	Start to Peak (arithmetic mean)	17.6	16.5	15.5	14.4	13.3	12.2	11.1	10.0		9.3	8.7
All	All	dBA Max (logarithmic average)	69.3	69.6	69.9	70.2	70.4	70.6	70.7	71.0	**70.9**	71.3	72.1
All	All	SEL (logarithmic average)	81.2	81.5	81.7	81.8	81.9	82.0	81.9	82.0	**82.2**	82.1	82.9
All	All	Ground Distance (ft) (arithmetic mean)	8,649	8,550	8,466	8,415	8,389	8,384	8,341	8,310		8,219	7,422
All	All	Slant Range Distance (arithmetic mean)	9,163	9,056	8,977	8,911	8,882	8,866	8,813	8,782		8,689	7,900
All	All	Altitude (arithmetic mean)	2,199	2,236	2,277	2,290	2,314	2,321	2,315	2,321		2,309	2,321
All	All	CNEL Aircraft (logarithmic average)	61.01	60.62	60.43	60.24	60.04	59.81	59.50	59.09	**58.23**	58.56	57.87
All	All	CNEL Community (logarithmic average)	56.69	57.59	57.95	58.27	58.57	58.87	59.23	59.62	**59.63**	60.05	60.47
All	All	CNEL Total (logarithmic average)	62.37	62.37	62.37	62.37	62.37	62.37	62.37	62.37	**62.00**	62.37	62.37



Source: BridgeNet International 2020

Figure 10
NMT 15 – SEL, dBA Max and Duration

SAN FRANCISCO INTERNATIONAL –NOISE MONITOR TERMINAL THRESHOLD ANALYSIS



These histogram plots of ANOMS correlated noise events for 2019. The left figure shows the number of events versus the measured SEL noise value, the middle graphic shows the number of events verses the correlated measured Lmax and the right side of the figure shows the number of evens versus the duration of the noise event.

If noise from a site is fully measured, then the SEL and Lmax values should show a classic bell curve, which can be seen in these histograms. The results from Sites 12, 15, 18 and 19 generally show that pattern.

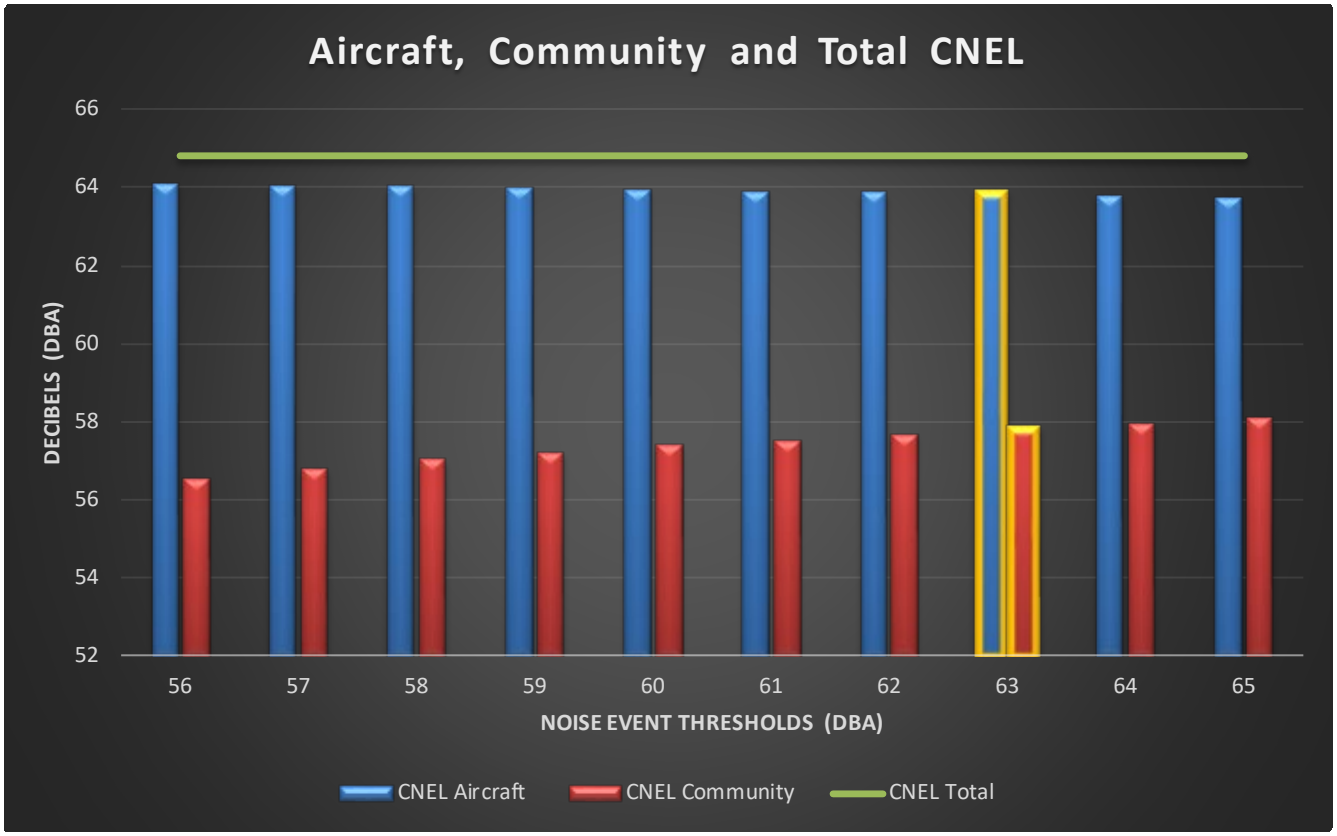
Source: BridgeNet International 2020

Figure 11
NMT 18 Threshold Correlation

SAN FRANCISCO INTERNATIONAL –NOISE MONITOR TERMINAL THRESHOLD ANALYSIS

San Francisco International Airport RMT No
Site: RMT 18 (Gap departure)
Study Time Period: Nov 1, 2019 thru Nov 6, 2019 and Dec 9, 2019 thru Dec 15, 2019
Number of Study Days: 13
Noise Metric: CNEL

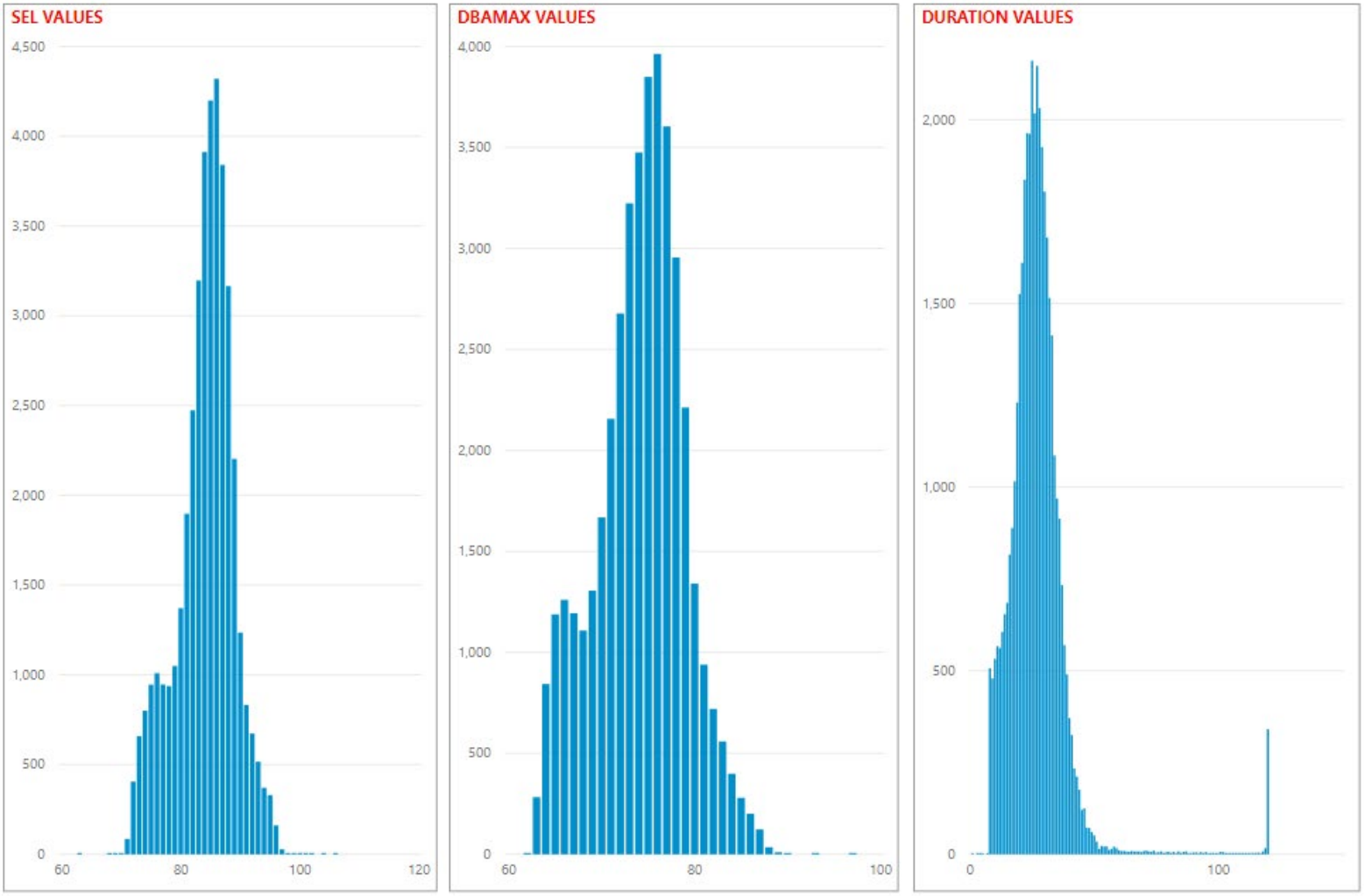
Metric	Thresholds										
	56	57	58	59	60	61	62	63	EVS ANOMS 63	64	65
Number of Events	6,460	5,092	4,126	3,614	3,054	2,764	2,584	2,428	NA	2,334	2,264
Number of Correlated Events	2,169	1,993	1,806	1,634	1,461	1,352	1,270	1,198	**1,192**	1,157	1,124
Total Number of Nearby Flights	7,857	7,857	7,857	7,857	7,857	7,857	7,857	7,857		7,857	7,857
Duration (arithmetic mean)	33.7	31.5	29.9	28.5	27.7	26.8	25.7	24.7	**25.2**	23.5	22.0
Duration (standard deviation)	15.42	13.85	12.32	11.33	10.00	8.94	8.04	7.02	**7.13**	6.30	5.69
Number of Correlated Events with duration > 60 seconds	92	41	10	3	0	0	0	0	**0**	0	0
Start to Peak (arithmetic mean)	17.4	16.6	16.0	15.6	15.4	15.1	14.6	14.2	NA	13.5	12.7
dBA Max (logarithmic average)	75.5	75.9	76.4	76.8	77.3	77.6	77.9	78.1	**78.2**	78.3	78.4
SEL (logarithmic average)	85.0	85.4	85.9	86.3	86.8	87.1	87.3	87.5	**87.5**	87.6	87.7
Ground Distance (ft) (arithmetic mean)	2,287	1,964	1,612	1,301	1,010	846	764	662	NA	647	615
Slant Range Distance (arithmetic mean)	5,696	5,302	4,855	4,444	4,034	3,798	3,667	3,534	NA	3,496	3,446
Altitude (arithmetic mean)	4,888	4,640	4,341	4,058	3,757	3,579	3,476	3,381	NA	3,346	3,307
CNEL Aircraft (logarithmic average)	64.08	64.04	64.00	63.96	63.92	63.89	63.85	63.82	**63.5**	63.78	63.73
CNEL Community (logarithmic average)	56.54	56.78	57.00	57.19	57.36	57.50	57.66	57.81	**57.4**	57.96	58.12
CNEL Total (logarithmic average)	64.79	64.79	64.79	64.79	64.79	64.79	64.79	64.79	**64.4**	64.79	64.79



Source: BridgeNet International 2020

Figure 12
NMT 18 – SEL, dBA Max and Duration

SAN FRANCISCO INTERNATIONAL –NOISE MONITOR TERMINAL THRESHOLD ANALYSIS



These histogram plots of ANOMS correlated noise events for 2019. The left figure shows the number of events versus the measured SEL noise value, the middle graphic shows the number of events verses the correlated measured Lmax and the right side of the figure shows the number of evens versus the duration of the noise event.

If noise from a site is fully measured, then the SEL and Lmax values should show a classic bell curve, which can be seen in these histograms. The results from Sites 12, 15, 18 and 19 generally show that pattern.

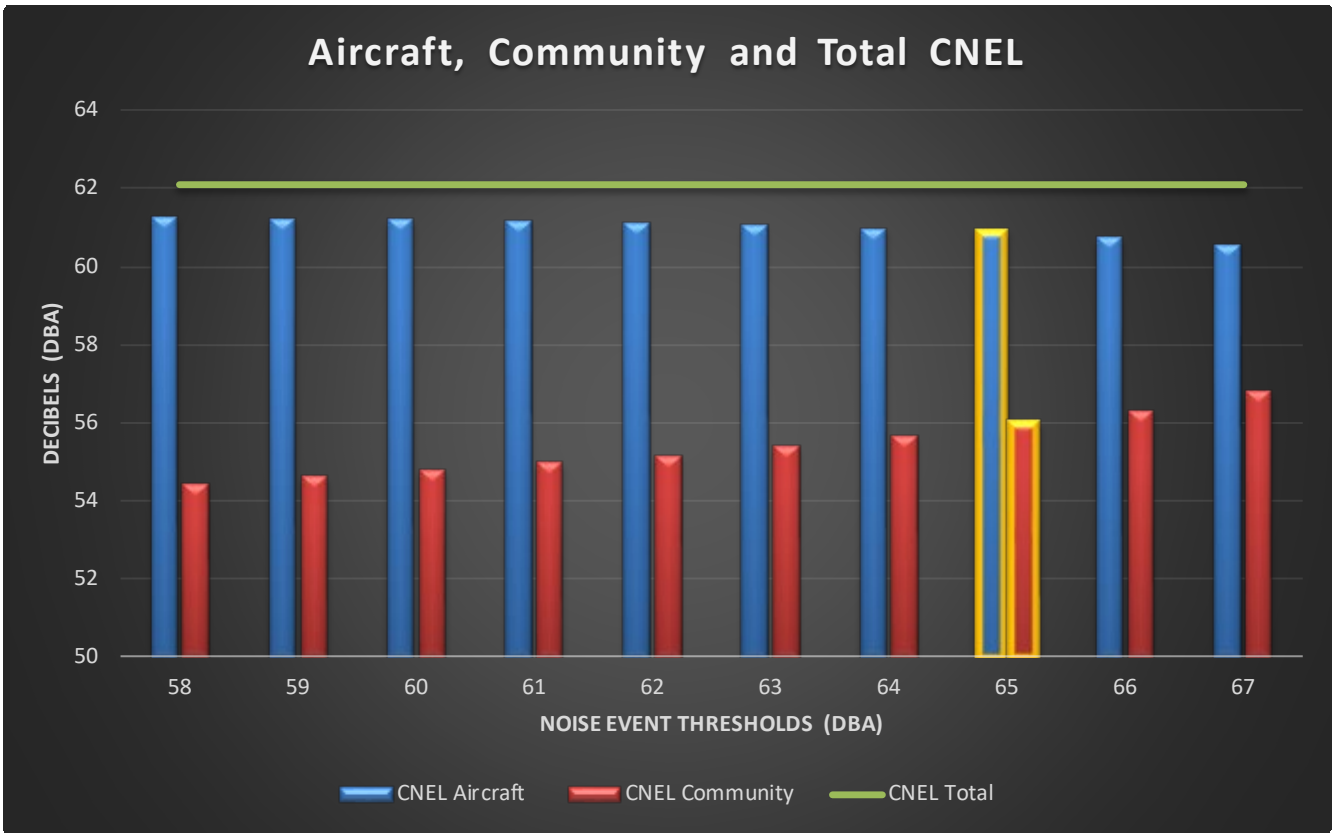
Source: BridgeNet International 2020

Figure 13
NMT 19 Threshold Correlation

SAN FRANCISCO INTERNATIONAL –NOISE MONITOR TERMINAL THRESHOLD ANALYSIS

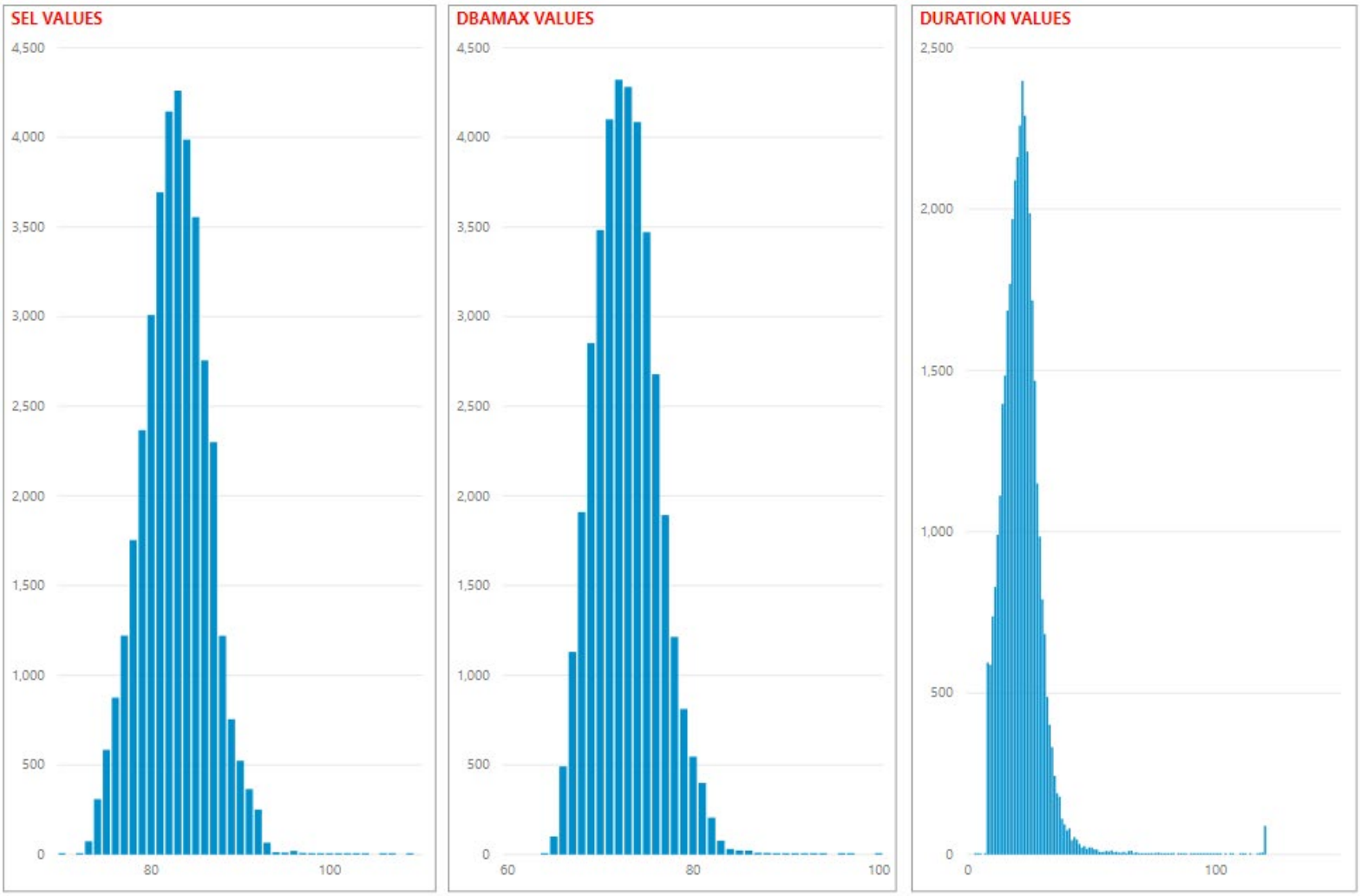
San Francisco International Airport RMT Noise Threshold Study
Site: RMT 19 (Gap departure)
Study Time Period: Nov 1, 2019 thru Nov 6, 2019 and Dec 9, 2019 thru Dec 15, 2019
Number of Study Days: 13
Noise Metric: CNEL

Metric	Thresholds										
	58	59	60	61	62	63	64	65	EVS ANOMS 65	66	67
Number of Events	1,585	1,455	1,351	1,268	1,219	1,189	1,146	1,102		1,050	981
Number of Correlated Events	1,398	1,307	1,227	1,169	1,126	1,104	1,072	1,035	**1,037**	990	927
Total Number of Nearby Flights	1,688	1,688	1,688	1,688	1,688	1,688	1,688	1,688		1,688	1,688
Duration (arithmetic mean)	29.4	28.3	27.3	26.1	24.9	23.3	21.8	20.2	**20.4**	18.7	17.3
Duration (standard deviation)	10.44	9.59	8.53	7.76	7.17	6.91	6.78	6.46	**6.62**	6.23	6.10
Number of Correlated Events with duration > 60 seconds	5	4	3	3	3	3	3	2	**1**	2	2
dBA Max (logarithmic average)	73.9	74.2	74.5	74.6	74.7	74.8	74.9	75.0	**75.0**	75.2	75.4
SEL (logarithmic average)	84.1	84.3	84.5	84.7	84.8	84.8	84.9	84.9	**84.8**	85.0	85.0
Ground Distance (ft) (arithmetic mean)	2,272.6	2,220.3	2,185.6	2,165.2	2,160.4	2,161.6	2,157.0	2,157.2		2,158.1	2,160.1
Slant Range Distance (arithmetic mean)	4,412	4,236	4,103	4,016	3,969	3,966	3,952	3,923		3,914	3,902
Altitude (arithmetic mean)	3,733	3,572	3,447	3,366	3,319	3,315	3,302	3,271		3,259	3,244
CNEL Aircraft (logarithmic average)	61.26	61.23	61.19	61.15	61.10	61.04	60.97	60.87	**60.3**	60.74	60.55
CNEL Community (logarithmic average)	54.43	54.60	54.77	54.95	55.15	55.36	55.62	55.94	**56.2**	56.32	56.80
CNEL Total (logarithmic average)	62.08	62.08	62.08	62.08	62.08	62.08	62.08	62.08	**61.8**	62.08	62.08



Source: BridgeNet International 2020

Figure 14
NMT 19 – SEL, dBA Max and Duration



These histogram plots of ANOMS correlated noise events for 2019. The left figure shows the number of events versus the measured SEL noise value, the middle graphic shows the number of events verses the correlated measured Lmax and the right side of the figure shows the number of evens versus the duration of the noise event.

If noise from a site is fully measured, then the SEL and Lmax values should show a classic bell curve, which can be seen in these histograms. The results from Sites 12, 15, 18 and 19 generally show that pattern.

Source: BridgeNet International 2020