

**Report of the
Select Committee on South
Bay Arrivals**

Approved November 17, 2016

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November 17, 2016

The Honorable Anna Eshoo
Congresswoman, 18th District
698 Emerson Street
Palo Alto, CA 94301

The Honorable Sam Farr
Congressman, 20th District
701 Ocean Street, Room 318C
Santa Cruz, CA 95060

The Honorable Jackie Speier
Congresswoman, 14th District
155 Bovet Road, Suite 780
San Mateo, CA 94402

Dear Honorable Members of Congress:

With this letter I convey to you the final Recommendations of your Select Committee on South Bay Arrivals.

These Recommendations reflect the work of the 12 Member Committee and their 12 Alternates (see Attachment A), empaneled by you, over the course of almost two dozen meetings during the past six months (see Attachment B).

While your original charge to the Committee was essentially limited to the six sets of “feasible” actions identified as part of the Federal Aviation Administration’s Northern California Initiative, the Committee also considered other potential solutions suggested during the course our hearings, and offered Recommendations where appropriate (see Section 2).

The Committee also identified a number of “longer-term issues” for deliberation and potential action in the future (see Section 3); as well as a number of “process issues” that the Committee thought worth highlighting (see Section 4).

Report of the Select Committee on South Bay Arrivals

While this report runs almost 30 pages in length, our Recommendations might succinctly be summarized as:

- Fly at higher altitudes;
- Fly over locations with fewer people;
- Avoid noisy flight maneuvers; and,
- Implement noise reducing retrofits where possible.

While the Committee has not made any effort to “rank order” or prioritize Recommendations, there are two I feel it appropriate to highlight for your consideration.

First, the very challenging and high profile issue of whether or not to abandon the SERFR flight procedure/path in favor of a flight procedure/path along the ground track formerly used for the BSR flight procedure/path (see Item 1.2).

The Committee did in fact recommend such a change on an 8-4 vote as a near-term remedial action (consistent with other criteria set forth in Recommendation 2 of Item 1.2). It is important, however, to note that the Committee has also recommended (on a 12-0 vote) the identification and development of a better procedure and path for the long-term (as noted in Recommendation 4 of Item 1.2).

The Committee earnestly hopes that the need for this longer-term effort will not be overlooked in the understandable desire to provide near-term relief.

Second, the Committee also took note of the fact that the creation of an ongoing body to assess and address airport noise issues in the three county area is in many respects essential to the successful implementation of the Recommendations contained in this Report; and to addressing issues likely to arise in the future.

Finally, this letter would be incomplete if it did not express thanks to the many who made this effort possible and productive. That, of course, includes you, the three Members of Congress who empaneled the Select Committee, and your staffs, who lent considerable support throughout the effort.

Thanks as well to the 12 Members of the Select Committee and their 12 Alternates. It should be noted that in virtually every meeting of the Select Committee all 12 seats were filled; most often by the 12 Members of the Committee, but with exemplary service from their Alternates as needed.

At least two thirds of the Alternates participated in the process in some significant way, allowing the Committee to be fully functioning throughout its six month tenure, and providing additional and valuable expertise and perspective to the process.

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Technical support was provided by the Federal Aviation Administration, whose staff was on hand at each and every one of our three community meetings, 10 working meetings, and five technical briefings to both listen and respond to questions.

As you well know, the process began with considerable public skepticism about the ability and willingness of the FAA to engage in a meaningful way. I must tell you that the staff of the FAA was exemplary in its persistence, patience, and professionalism throughout the process.

Special thanks to the City of Palo Alto for hosting the Committee's 10 Working Meetings, and for the considerable multimedia support that entailed as well.

But perhaps most importantly, thanks go to the members of the public who first raised these issues, who organized to make themselves heard, who testified in great numbers (approximately 250 in our first three Community Meetings, and approximately 130 at the subsequent Working Meeting of the Committee set-aside for public comment), and whose written comments – in the form of comment cards, letters, and emails – exceed more than 3,500 to date.

These various public communications were essential to informing the understanding of the Committee as we crafted the Recommendations we now present to you.

Having conveyed these Recommendations to you, we now ask that you continue your engagement with the FAA to ensure their timely implementation to the fullest extent practicable.

The Committee believes these Recommendations have the potential to provide real relief. We hope that relief arrives sooner rather than later.

Sincerely,



S. Joseph Simitian
County Supervisor, Fifth District

Chair, Select Committee on South Bay Arrivals

Transmittal Letter – Attachment A
List of Members and Alternates, Select Committee on South Bay Arrivals

| Member | Alternate |
|--|--|
| Supervisor Joe Simitian Santa Clara County Board of Supervisors | Supervisor Mike Wasserman Santa Clara County Board of Supervisors |
| Councilmember Ann Wengert Town of Portola Valley | Mayor Elizabeth Lewis Town of Atherton |
| Councilmember Mary-Lynne Bernald City of Saratoga | Councilmember Jean Mordo City of Los Altos |
| Vice Mayor Gary Waldeck Town of Los Altos Hills | Vice Mayor Gregory Scharff City of Palo Alto |
| Supervisor Bruce McPherson Santa Cruz County Board of Supervisors | Mayor Donna Lind City of Scotts Valley |
| Supervisor John Leopold Santa Cruz County Board of Supervisors | President George Purnell Happy Valley School Board |
| Councilmember Don Lane City of Santa Cruz | Mayor Cynthia Matthews City of Santa Cruz |
| Mayor Ed Bottorff City of Capitola | Councilmember Dennis Norton City of Capitola |
| Supervisor Dave Pine San Mateo County Board of Supervisors | Councilmember Jeffrey Gee City of Redwood City |
| Mayor Mark Addiego City of South San Francisco | Councilmember Bob Grassilli City of San Carlos |
| Councilmember Sam Hindi City of Foster City | Councilmember Peter Ohtaki City of Menlo Park |
| Vice Mayor Larry Moody City of East Palo Alto | Mayor Donna Rutherford City of East Palo Alto |

Transmittal Letter – Attachment B
List of Meeting Dates, Times and Locations; Select Committee on South Bay Arrivals

| Date | Time | Location |
|-------------------------------|-------------|--|
| <i>Organizational Meeting</i> | | |
| May 6, 2016 | 2:00pm | San Francisco International Airport |
| <i>Community Meetings</i> | | |
| May 25, 2016 | 6:00pm | Santa Cruz Civic Auditorium |
| June 15, 2016 | 6:00pm | Sequoia High School, Redwood City |
| June 29, 2016 | 6:00pm | Mountain View Center for the Performing Arts |
| <i>Working Meetings</i> | | |
| July 15, 2016 | 2:00pm | Palo Alto City Hall Council Chambers |
| July 22, 2016 | 2:00pm | Palo Alto City Hall Council Chambers |
| August 4, 2016 | 1:00pm | Palo Alto City Hall Council Chambers |
| August 18, 2016 | 1:00pm | Palo Alto City Hall Council Chambers |
| September 1, 2016 | 1:00pm | Palo Alto City Hall Council Chambers |
| September 29, 2016 | 1:00pm | Palo Alto City Hall Council Chambers |
| October 13, 2016 | 1:00pm | Palo Alto City Hall Council Chambers |
| October 27, 2016 | 1:00pm | Palo Alto City Hall Council Chambers Public Comment |
| November 3, 2016 | 2:00pm | Palo Alto City Hall Council Chambers |
| November 17, 2016 | 1:00pm | Palo Alto City Hall Council Chambers |
| <i>Technical Briefings</i> | | |
| May 20, 2016 | 1:00pm | Teleconference |
| May 23, 2016 | 3:00pm | Teleconference |
| October 13, 2016 | 10:00am | Palo Alto City Hall, Council Conference Room |
| October 20, 2016 | 11:00am | Teleconference |
| November 14, 2016 | 9:00am | Teleconference |

GLOSSARY

Air Traffic Control (ATC): A service operated by the appropriate authority to promote the safe, orderly, and expeditious flow of air traffic.

Altitude MSL: Aircraft altitude measured in feet above mean sea level.

Arrival and Departure Procedures: Refers to a published procedure. Once the procedure is assigned, the procedure is designed to be flown with minimal to no communication with Air Traffic Control (ATC).

Decibel: In sound, decibels measure a scale from the threshold of human hearing, 0 dB, upward towards the threshold of pain, about 120-140 dB. Because decibels are such a small measure, they are computed logarithmically and cannot be added arithmetically.

Day Night Sound Level (DNL): DNL is a measure of the annual average noise in a 24-hour day. It is the 24-hour, logarithmic- (or energy-) average, A-weighted sound pressure level with a 10-decibel penalty applied to the nighttime events that occur between 10:00pm and 7:00am.

DNL Contour: The "map" of noise exposure around an airport. FAA defines significant noise exposure as any area within the 65dB DNL contour; that is the area within an annual average noise exposure of 65 decibels or higher.

Fixes: In aviation, a fix is a virtual navigational point that helps aircraft maintain their flight path. Fix is a generic name often interchanged with waypoint or intersection.

Fleet Mix: The mix of differing aircraft types operated at a particular airport or by an airline.

Frequency Weightings: Used to allow a sound level meter to measure and report noise levels that represent what humans hear. These are electronic filters within a sound level meter that are used to adjust the way in which the instrument measures the noise. The most commonly used Frequency Weightings are 'A', 'C' and 'Z.' DNL incorporates only "A" weighted decibels.

Glide Slope: Generally a 3-degree angle of approach to a runway. Provides vertical guidance for aircraft during approach and landing.

Ground Track: The path an aircraft flies over the ground.

Hold Procedure (Holding): A predetermined maneuver which keeps aircraft within a specified airspace while awaiting further clearance from ATC.

Instrument Flight Rules (IFR): Rules governing the procedures for conducting instrument flight.

NextGen: An encompassing term for the ongoing, wide-ranging transformation of the United States' national airspace system. It has sometimes been described as an evolution from a ground-based system of air traffic control to a satellite-based system of air traffic management.

Optimized Profile Descent (OPD): An arrival procedure that is designed to allow aircraft to use idle engine power and reduce level-offs during descent.

Procedures, general: A published, standardized set of instructions that an aircraft can fly with minimal input from ATC. Procedures are designed with strict separation criteria from other procedures.

Runway: A long strip of land or water used by aircraft to land on or to take off from. For aircraft arriving to San Francisco International Airport, the primary Runways used are Runway 28 Right (28R) and 28 Left (28L), which are parallel to each other.

Sequencing: The lining up of aircraft into a single flow by ATC so that all aircraft are separated to appropriate criteria. This is normally mentioned in association with landing.

Standard Instrument Departure (SID): A published IFR departure procedure from an airport printed for pilot/controller use in graphic form to provide obstacle clearance.

Speed Brakes: Moveable aerodynamic devices on aircraft that reduce airspeed during descent and landing.

Standard Terminal Arrival Route (STAR): A published IFR arrival procedure to an airport printed for pilot/controller use in graphic form.

Time Based Flow Management: TBFM uses time instead of distance to help air traffic controllers sequence air traffic by directing aircraft to be at a specific location at a specific time, which optimizes arrival flow.

Terminal Radar Approach Control (TRACON): FAA air traffic facility that uses radar and non-radar capabilities to provide approach control services to aircraft arriving, departing, or transiting airspace controlled by the facility.

Vector: A heading issued to an aircraft to provide navigational guidance by radar; i.e., a series of instructions from ATC directing an aircraft between two end points.

Visual Flight Rules (VFR): Rules that govern the procedures for conducting flight under visual conditions. The term "VFR" is also used to indicate weather conditions that are equal to or greater than the minimum VFR requirements.

Waypoint: A waypoint is a predetermined reference point in physical space used for purposes of navigation. It is also known as a fix.

UNDERLYING PRINCIPLES

1. Minimizing aircraft noise must be a priority of the FAA when designing procedures, and of Air Traffic Control (ATC) when vectoring flights. Airline efficiency may have to be compromised to some degree to minimize noise exposure on the ground.
2. Aircraft noise should not be an afterthought in FAA planning and operations; nor should aircraft noise be moved randomly without regard to the relative noise burden experienced by communities below. A small number of communities should not be disproportionately affected when there are ways to avoid or disperse aircraft noise.
3. Reducing aircraft noise at night is an urgent priority. Given the availability of airspace in the nighttime hours, it should be an extremely rare occurrence that a flight path is disruptive to the community. Further, “nighttime” should be defined as 12 midnight to 6:00am, but should be expanded to include the hours of 11:00pm-12:00am and 6:00am-7:00am whenever possible.
4. When designing new procedures, the FAA must include affected communities as stakeholders. Aircraft noise not only disrupts quality of life but also has significant and well documented adverse impacts on the health and well-being of individuals residing under flight paths, particularly children.
5. No matter how effectively the airspace, or any specific procedure, is re-designed, the value of the change will only be as helpful as the extent to which it is followed. ATC should adhere to published procedures except when safety considerations require vectoring. The rate of adherence to published procedures should be monitored.
6. Meaningful metrics for measuring aircraft noise should be used when working with the Committee’s Recommendations. Limiting the metrics to use of DNL is inadequate and unacceptable. A baseline of aircraft noise should also be established. The recent agreement between the FAA and the Massachusetts Port Authority (which owns and operates three airports: Boston Logan International Airport; Hanscom Field; and Worcester Regional Airport), to use real-world single-event noise data from communities in order to develop a supplemental noise metric to measure and track noise and flight concentration is a development the Committee supports and points to as an example of a meaningful metric.
7. Reducing the noise impacts caused by NextGen should be a priority.
8. The FAA should demonstrate its ongoing commitment to working with communities throughout the San Francisco Bay Area, including, but not limited to, the three counties represented on the Select Committee on South Bay Arrivals, by: (a) monitoring resultant noise levels following implementation of Recommendations from the Select Committee; (b) participating with successor committees to the Select Committee; and (c) leading all future procedural, waypoint, and flight path development activities undertaken in response to continuing health and noise issues associated with local air traffic in consultation with the affected communities.

Adopted by the Select Committee.

(Vote: 11 Aye, 1 Nay, 0 Absent or Abstain)

SECTION 1: FAA NORTHERN CALIFORNIA INITIATIVE, FEASIBILITY GROUPS 1 THROUGH 6

In November 2015, the “*FAA Initiative to Address Noise Related Concerns in Santa Cruz/Santa Clara/San Mateo/San Francisco Counties*” was released. Known as the Northern California Initiative, or NorCal Initiative, it included a number of proposed technical solutions that were brought to the FAA to analyze, study, and/or evaluate. On May 16, 2016, the results of Phase 1 of the NorCal Initiative was released, consisting of a Feasibility Study (Study) of the proposed technical solutions. The FAA then grouped the solutions deemed feasible into six groups, as discussed further below in Section 1 of this Report.

1.1 Feasibility Group 1: SFO Class B Amendment

Class B airspace is the restricted airspace around the nation’s busiest commercial airports designed to ensure a higher level of safety for aircraft landing at the airport. It can be visualized as an upside down wedding cake. The airport is at the center of the cake topper with the airspace reaching to 10,000 feet over the airport in a series of concentric circles. To the south, SFO’s Class B airspace reaches roughly to the junction of Summit Road/Skyline Boulevard/Highway 17 (approximately 35 miles from SFO) in the Santa Cruz Mountains.

The FAA has advised the Committee that there is an identified problem in that the SFO Class B airspace, as currently configured, does not fully provide containment of the entire flight path (the so called “SERFR procedure”), which approaches SFO from the south over the Santa Cruz Mountains (see Appendix C, Page C1: Map of BSR and SERFR). As a result, aircraft are required to “level off” to stay within the airspace (or “cake”). Leveling off, however, means aircraft are taken off their Optimized Profile Descent (OPD), or idle descent to final approach. This change in glide path requires aircraft to use speed brakes, increase thrust, or take other actions which in turn generate more noise. This leveling off is presently occurring just off the Capitola coastline (near the point in space known as the EPICK waypoint), as well as over the Mid-Peninsula.

Feasibility Group 1 contains proposals to amend the SFO Class B airspace to fully contain the SERFR procedure by altering the size or shape of the airspace (or the size or shape of the cake layers) to keep aircraft inside the airspace (or cake) and on their OPD. Once the SFO Class B is amended, the expectation is that more flights will fully execute an OPD and no longer need to make altitude and speed adjustments, thereby reducing the noise exposure near the Capitola coastline (i.e., the EPICK waypoint) and over the Mid-Peninsula.

Recommendation: The Select Committee recommends adoption of Feasibility Group 1. Additionally, any changes to the SFO Class B airspace to fully contain the SERFR procedure should also allow OPD arrivals on any other arrival procedure from the south that might replace, or supplement, the SERFR procedure.

(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

Technical Note: Feasibility Group 1 encompasses seven of the items in the Study: 1.d.i; 1.d.ii; 2.b.i; 2.c.iii; 2.d.ii; and, 3.d.ii.

1.2 Feasibility Group 2: Transition the SERFR Standard Terminal Arrival Route (STAR) Back to the BSR Ground Track Prior to EPICK

Feasibility Group 2 contains proposals to move the arrival procedure from the south, back west to a similar ground track previously used for the BSR procedure. This design would put the SERFR flight path back over the BSR ground track, roughly 3-4 miles to the west of where the path currently reaches the Santa Cruz County coastline (near the City of Capitola) (see Appendix C, Page C1: Map of BSR and SERFR). However, it should be noted that even with a “return to the BSR ground track,” aircraft would not actually fly the same conventional procedure as the previous BSR. The BSR procedure predated NextGen and did not use satellite-based navigation. NextGen uses satellite navigation and Optimal Profile Descents (OPD). These Optimal Profile Descents include some waypoints with an altitude control “window” providing a range of altitudes (from lowest to highest; e.g., 7,000 feet to 9,000 feet) that aircraft must be within when crossing the waypoint. In addition, and speaking generally, the pre-NextGen flights were relatively dispersed as compared to present-day NextGen procedures which consolidate, to a greater degree, flights along a narrower path.

The FAA has advised the Committee that a new flight procedure that is GPS-based and that contains an OPD could be designed to fly the old BSR ground track, as suggested in the proposals in Feasibility Group 2.

Recommendation 1: The Select Committee recommends that arrivals into SFO from the south use the BSR ground track for a new NextGen procedure that incorporates the criteria contained in Recommendation 2 below.

(Vote: 8 Aye, 4 Nay, 0 Absent or Abstain)

Recommendation 2: The Committee recommends that the new NextGen procedure for arrivals into SFO from the south be implemented as soon as feasible and include the following criteria:

1. Results in noise modeling of the proposed new procedure that has an equivalent or less DNL noise exposure along its entire route when compared to the noise modeling of the BSR 2014 procedure;
2. Uses flight altitudes at least as high as (and preferably higher) than the historic BSR procedure along its entire route;
3. Starts from a point over the Monterey Bay and reaches the shoreline at an altitude no lower than 12,500 feet mean sea level;
4. Utilizes a new BSR waypoint equivalent to the EDDYY waypoint at or above 6,000 feet to ensure flights cross the MENLO waypoint at or above 5,000 feet and maintain idle power until the HEMAN waypoint;
5. Prioritizes and adheres as closely as possible to an OPD terminating at the HEMAN waypoint;
6. Incorporates a modification to Class B airspace if needed;
7. Uses flight altitudes that are as high as possible while still allowing idle power flight;
8. Is designed to avoid the use of speed brakes; and,

9. Will be subject to future capacity limitations, particularly during nighttime hours and when vectoring exceeds current levels.
(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

Recommendation 3: The Committee recommends that within three months of completing implementation of the new procedure described in Recommendations 1 and 2 above, the FAA will meet with the Ad-Hoc Subcommittee referred to in Item 3.1, Recommendation 1, in this Report (Need for an Ongoing Venue to Address Aircraft Noise Mitigation) to review whether the new procedure has resulted in an equivalent or less DNL noise exposure along its entire route when compared to 2014 noise modeling of the BSR procedure. The permanent entity referred to in Item 3.1, Recommendation 2, in this Report (Need for an Ongoing Venue to Address Aircraft Noise Mitigation) will continue to monitor the implementation of the new procedure. The Committee further recommends that the FAA work with the Ad-Hoc Subcommittee, the permanent entity, and the affected communities to make adjustments to the new procedure, if needed, to reduce its noise exposure.
(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

Recommendation 4: The Select Committee recommends that the FAA, in consultation with the permanent entity and the community, search for and develop a new flight procedure for arrivals into SFO from the south that: (a) meets each of the criteria in Recommendation 2 above; (b) takes maximum advantage of areas of non-residential use, such as unpopulated mountainous areas, industrial areas, parkland, cemeteries, etc; and (c) reduces noise exposure to the maximum extent possible. The Committee further recommends that this procedure be implemented as soon as feasible; however, the Committee recognizes that it will take considerably longer to implement than the procedure referenced in Recommendations 1 and 2 above.
(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

Technical Note: Feasibility Group 2 encompasses two of the items in the Study: 1.f.i and 3.d.ii.

1.3 Feasibility Group 3: Increasing Percentage of NIITE Flights Which Remain on NIITE Until at Least the NIITE Waypoint

Feasibility Group 3 applies to nighttime operations on the NIITE procedure (which does not include all flights at night). These flights depart SFO over the San Francisco Bay (Bay), reach the NIITE waypoint in the Bay north of the Bay Bridge, then turn to the northeast to fly out of the Bay Area over several East Bay communities (see Appendix C, Page C2: Map of NIITE). About 35 percent of NIITE flights are currently turning early. Because the flights turn earlier, they are at a lower altitude when they turn; and consequently may generate more noise exposure on the ground.

Feasibility Group 3 contains proposals to increase the percentage of these eastbound NIITE flights that remain on the path until reaching the waypoint, thereby reducing early turns which cross land at lower, noisier altitudes. The FAA has advised the Committee that the result should be less noise exposure for some East Bay communities; such change, however, is not expected to provide benefit to residents in the three-county area served by the Committee. The Committee’s understanding is that the proposed change would not limit the FAA’s ability to route more arrival traffic over the BDEGA East leg (including, for instance, OCEANIC arrivals in the middle of the night).

Recommendation: The Select Committee recommends adoption of Feasibility Group 3.
(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

Technical Note: Feasibility Group 3 encompasses five of the items in the Study: 2.a.ii.a; 2.a.ii.c; 2.g.ii; 3.d.i; and, 3.d.ii.

1.4 Feasibility Group 4: Create a New South Transition for the NIITE Standard Instrument Departure (SID)

Feasibility Group 4 also applies to nighttime operations on the NIITE procedure (which does not include all flights at night). These flights depart SFO over the San Francisco Bay (Bay), reach the NIITE waypoint in the Bay north of the Bay Bridge, then turn to the northeast to fly out of the Bay Area over several East Bay communities (see Appendix C, Page C2: Map of NIITE). The NIITE procedure does not provide a path for nighttime departures headed to southern destinations.

Currently, nighttime SFO departures headed to southern destinations use the SSTIK departure procedure. These nighttime operations on the SSTIK departure procedure depart SFO over the San Francisco Bay (Bay) to the northeast and quickly loop back around over the Peninsula communities of Brisbane, San Bruno, and South San Francisco to head to southern destinations. Because flights currently departing on the SSTIK procedure make a quick loop from the Bay down over the Peninsula, they do so with related noise exposure for the Peninsula communities below. A number of these communities have asked if other flight paths might be explored.

Feasibility Group 4 proposes that nighttime SSTIK departures use the NIITE procedure up to the NIITE waypoint, which is in the Bay north of the Bay Bridge, then the aircraft would head west out over the Golden Gate Bridge. By keeping the SSTIK departures over the Bay and Pacific

Ocean, the aircraft are able to gain altitude over unpopulated areas. As a result, when they are eventually flying over the San Francisco Peninsula on their way to southern destinations they will do so at a higher altitude (and will thus be quieter). The Committee's understanding is that the proposed change would not limit the FAA's ability to route more arrival traffic over BDEGA East leg (including, for instance, OCEANIC arrivals in the middle of the night).

Recommendation: The Select Committee recommends adoption of Feasibility Group 4.
(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

Technical Note: Feasibility Group 4 encompasses six of the items in the Study: 1.f.iii; 2.a.ii.a; 2.f.i; 2.g.ii; 3.d.i; and, 3.d.ii.

1.5 Feasibility Group 5: Increasing Percentage of CNDEL Flights Which Remain on CNDEL Until at Least the CNDEL Waypoint

The CNDEL is a departure procedure from the Oakland International Airport, with aircraft heading northwest over the San Francisco Bay (Bay) to the CNDEL waypoint which is located off the northwesterly end of Alameda Island (see Appendix C, Page C3: Map of CNDEL). Under the current procedure/path, aircraft reach the waypoint and then turn west and south over Brisbane and South San Francisco. Sixty percent of the CNDEL departures are currently turned before the CNDEL waypoint. This means they reach the San Francisco Peninsula sooner and at lower altitudes. These turns are due to spacing and sequencing the CNDEL aircraft with other departing aircraft in the Bay Area airspace.

Feasibility Group 5 contains proposals to increase the percentage of CNDEL departures that stay on the procedure longer and do not turn prior to the CNDEL waypoint, thereby reducing the number turning before the CNDEL waypoint and crossing land at lower, noisier altitudes. The Committee's understanding is that the proposed change would not limit the FAA's ability to route more arrival traffic over BDEGA East leg (including, for instance, OCEANIC arrivals in the middle of the night).

Recommendation: The Select Committee recommends adoption of Feasibility Group 5 with the goal of having 100 percent of CNDEL departures stay on the procedure longer and not turn prior to the CNDEL waypoint.
(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

Technical Note: Feasibility Group 5 encompasses eight of the items in the Study: 1.a.ii; 1.b.i; 1.b.ii; 1.c.ii; 2.a.ii.a; 2.a.ii.b; 3.d.i; and, 3.d.ii.

1.6 Feasibility Group 6: Improve Aircraft Set Up and Sequencing Between Facilities

Aircraft are sequenced to ensure they arrive on the final approach course safely and at repeated intervals allowing for airport operational efficiency. Existing metering tools aid in this air traffic management, but aircraft “vectoring” (turning aircraft off the assigned procedure) and “holding” (a maneuver designed to delay an aircraft already in flight while keeping it within a specified airspace) affect a substantial number of flights, especially in congested airspaces such as the San Francisco Bay Area. Vectoring also is a source of noise; it often involves aircraft turning and changes in speed, with increased noise exposure on affected communities.

Feasibility Group 6 contains proposals to use new, more effective, time-based flow management tools currently in development to allow for better sequencing (i.e., spacing) of aircraft to reduce the percentage of aircraft that are vectored or held prior to the final approach path to SFO. New metering tools are not an immediately available fix; however, the technology to create Terminal Sequencing and Spacing (TSS), or Time-Based Flow Management (TBFM), is in development. In the future, the expectation is that such technological advances will allow for aircraft flows to be taken into account and assigned an order well in advance of final approach. The benefit of such technological advances are two-fold: (1) reduced percentage of vectored or turned aircraft and related noise exposure; and (2) greater ability to leave aircraft on Optimized Profile Descent (OPD), with an idle descent that is quieter.

The Select Committee hopes that the FAA will support the implementation of TSS or TBFM even if that means delaying some take-offs at the airport of origin. When implementing TSS or TBFM, the FAA should use it to relieve the concentration of flights over impacted communities (as opposed to increasing flights in so-called noise corridors). In particular, TSS or TBFM should be used to reduce vectoring in the area of the MENLO waypoint.

Recommendation: The Select Committee recommends adoption of Feasibility Group 6.

(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

Technical Note: Feasibility Group 6 encompasses five of the items in the Study: 3.b.i; 3.b.ii; 3.c.i; 3.c.ii; and, 3.d.ii.

SECTION 2: OTHER POTENTIAL SOLUTIONS

In the course of the Select Committee’s deliberations, a number of additional potential solutions were identified. Each of these proposed “Other Potential Solutions” is discussed further below.

2.1 Airbus A320 Aircraft Family Wake Vortex Generators Retrofit

Airbus’s A320 family of aircraft built before 2014 makes a whistling (or whining) sound on approach due to wing design. The Committee was advised that the whistle (whine) can be reduced by mounting a small air deflector on each wing. The cost of such technology is reportedly modest (\$3,000-\$5,000 per aircraft). The noise reduction from the retrofit has been claimed to be from between 2 to 11 decibels depending on the phase of flight and angle of the aircraft along the approach. Roughly 35 percent of the aircraft arriving and departing SFO need the retrofit.

Recommendation: The Select Committee recommends that the Airbus family aircraft arriving or departing SFO undergo the retrofit at the earliest possible opportunity. The Committee takes notes of the fact that one major airline flying into and out of SFO has proposed to retrofit its fleet over the next 2-3 years. While the commitment to retrofit is welcome news, the Committee finds that the time period is unnecessarily and unacceptably long.

(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

2.2 Northern Arrivals (BDEGA) into SFO

SFO arrivals from points north arrive via the BDEGA arrival procedure/path. Arriving aircraft reach a point roughly over Daly City and then continue south flying past SFO, using either the Peninsula (the so-called West leg) or San Francisco Bay (the so-called East leg), to essentially make a U-turn and land on Runways 28L and 28R, respectively (See Appendix C, Page C4: Map of BDEGA, OCEANIC, SERFR, and DYAMD). The FAA has advised the Committee that the BDEGA East leg shares the final approach path into SFO with aircraft arriving from the east on the DYAMD arrival procedure. Aircraft using the East leg, or over-the-bay route, obviously have a dramatically reduced noise exposure versus aircraft using the West leg, which fly over the highly populated Mid-Peninsula.

In years past, there was a roughly equal split of aircraft using the West and East legs of the BDEGA arrival procedure/path. The FAA has advised the Committee that ten years ago, in May 2006, the “split” between the two legs was 52 percent West leg and 48 percent East leg. In May 2016, roughly 70 percent of the arriving aircraft used the Peninsula (the so-called West leg), while roughly 30 percent of arriving aircraft used the San Francisco Bay (the so-called East leg). This overutilization of the Peninsula or West leg negatively affects the highly populated Mid-Peninsula communities.

Recommendation 1: The Select Committee recommends that aircraft flying on the BDEGA procedure utilize the so-called East leg (over the San Francisco Bay) as much as possible, in order to minimize noise over the Peninsula. The Committee

further recommends that the FAA assess the potential of formalizing this procedure so that it is more likely to be used.

(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

Recommendation 2: The Select Committee recommends that all aircraft flying on the BDEGA procedure during nighttime hours, when air traffic flows are reduced, use the East leg, unless safety considerations prohibit such a flight path.

(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

2.3 Woodside VOR (Navigational Beacon)

Aircraft fly in the vicinity of the Woodside VOR, a ground-based navigational aid, to arrive at SFO. Aircraft activity in this area includes aircraft arrivals from numerous origin points, including but not limited to OCEANIC arrivals, which come in from the west from overseas (See Appendix C, Page C4: Map of BDEGA, OCEANIC, SERFR, and DYAMD).

Based on discussions between and among SFO, the FAA, the SFO Airport/Community Roundtable, and local elected officials, a new noise abatement procedure was implemented at the Woodside VOR in July 1998. Pursuant to this procedure, for those flights routed over the Woodside navigational beacon, “traffic permitting,” air traffic controllers shall clear SFO OCEANIC arrivals to cross the Woodside VOR at or above 8,000 feet mean sea level.

The Committee received numerous reports from the community that this agreement is not currently honored. There are reports of aircraft flying over the Woodside VOR at altitudes appreciably lower than 8,000 feet, including at night when residents are particularly sensitive to noise. The Committee also found that there is an authorized Ocean Tailored Arrival (OTA), which specifically allows arriving OCEANIC aircraft to be at or above the Woodside VOR at 6,000 feet. This OTA is also used in the overnight hours when residents are particularly sensitive to noise. The FAA has advised the Committee that while OCEANIC flights represent just four percent of the daytime traffic arriving into SFO, OCEANIC flights represent thirty-six percent of the flights arriving at SFO at nighttime.

Recommendation 1: The Select Committee recommends that per the current noise abatement procedure, aircraft comply with the obligation to cross the Woodside VOR at 8,000 feet mean sea level, traffic permitting. The Committee further recommends that this altitude restriction, to the greatest extent possible and traffic permitting, also be applicable to all vectored flights that are in the vicinity of the Woodside VOR.

(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

Recommendation 2: The Select Committee recommends revision of the Woodside VOR Ocean Tailored Arrival to honor the existing noise abatement procedure to cross the Woodside VOR at 8,000 feet.

(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

Recommendation 3: The Select Committee recommends further restrictions to prohibit any overnight crossings at the Woodside VOR below 8,000 feet.
(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

2.4 Overnight Flights

Reducing noise at night is an urgent priority. Between midnight and 6:00am the number of flights into and out of SFO is significantly reduced. As a result, there is considerable potential for aircraft to be rerouted over unpopulated or less populated areas, specifically the San Francisco Bay and Pacific Ocean, instead of the San Francisco Peninsula.

Currently the management of SFO implements a number of overnight noise abatement procedures that are beneficial to the communities surrounding SFO. These procedures include, but are not limited to, prohibitions on “run-ups” of mounted aircraft engines for maintenance or test purposes between the hours of 10:00pm and 7:00am daily with limited exceptions and the use of auxiliary power units when aircraft are parked at the gate.

Separately, SFO also employs Nighttime Preferential Runway Use, which maximizes flights over water and minimizes flights over land and populated areas between 1:00am and 6:00am.

As discussed elsewhere in this Report, the Select Committee has made a number of additional Recommendations to mitigate in-flight aircraft noise during the night, including: Item 1.3 Increasing the Percentage of NIITE Flights Which Remain on NIITE Until at Least the NIITE Waypoint; Item 1.4 Create a New South Transition for the NIITE SID; Item 1.5 Increasing Percentage of CNDEL Flights Which Remain on CNDEL Until at Least the CNDEL Waypoint; Item 2.2 Northern Arrivals (BDEGA) into SFO; Item 2.3 Woodside VOR (Navigational Beacon); Item 2.8 Increase All Altitudes; Item 2.10 Runway Usage; and, Item 2.14 Redirect Southern Arrivals (SERFR) to an Eastern Approach into SFO).

Recommendation 1: The Select Committee recommends that all efforts be made to reduce in-flight aircraft noise over populated areas during “nighttime” hours when residents need a reprieve from aircraft noise so that they can sleep, including, but not limited to, the Recommendations made elsewhere in this Report. For purposes of this Report, “nighttime” should be defined as 12:00am to 6:00am, but should be expanded to include the hours of 11:00pm-12:00am and 6:00am-7:00am whenever possible.
(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

Recommendation 2: The Committee recommends that during “nighttime” hours, air traffic control make every effort to direct arrivals into a single stream to Runway 28R to reduce the noise exposure on the bayside communities of Redwood City and Foster City.
(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

Recommendation 3: The Committee recommends that the FAA, SFO, and industry users continue their efforts to establish new additional overnight noise abatement procedures within the next six months. This work should be done in consultation with other relevant stakeholders.

(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

2.5 MENLO Waypoint

The MENLO waypoint is located several city blocks south of the intersection of Willow Road and Highway 101. It is the final waypoint on the SERFR arrival procedure/path, which is an arrival procedure into SFO from the south that approaches the airport from the Santa Cruz Mountains (See Appendix C, Page C4: Map of BDEGA, OCEANIC, SERFR, and DYAMD). Aircraft on the SERFR arrival procedure/path then cross the MENLO waypoint to join the final approach path into SFO. The altitude of the MENLO waypoint is currently 4,000 feet. Given its location over a highly populated area, the location and altitude of the MENLO waypoint are problematic and a source of many community complaints.

The FAA has advised the Committee that in June 2016, an average of 183 aircraft arrived each day into SFO on the SERFR procedure/path, representing 30 percent of the arrivals into SFO. The FAA has also advised the Committee that currently 50 percent of the aircraft on the SERFR arrival procedure/path are vectored off the procedure/path prior to the MENLO waypoint. As discussed in Item 2.9 in this Report (Aircraft Vectoring), the vectored SERFR aircraft are eventually sequenced for merging onto the final approach into SFO. The FAA has also suggested that the Committee take note of the fact that there are other aircraft in the vicinity of the MENLO waypoint that are not related to the SERFR arrival procedure/path. These “other aircraft,” the FAA pointed out, represent 85 percent of the aircraft in the vicinity of the MENLO waypoint.

With all this in mind, it has been suggested that the altitude of the crossing at the MENLO waypoint be increased. It has also been suggested that a different final waypoint be established for the SERFR procedure, located to the east and/or north of the current MENLO waypoint (presumably over a less populated area and at a higher altitude). This suggestion could involve establishment of a new waypoint, or the use of existing waypoints, such as the ROKME or DUMBA waypoints. These waypoints are located in the San Francisco Bay, just to the north and south of the eastern shoreline of the Dumbarton Bridge, respectively. Under this suggestion, aircraft would cross at one of these waypoints, which would be at a higher altitude as compared to the current altitude at the MENLO waypoint, before joining the final approach into SFO.

Recommendation 1: The Select Committee recommends that the altitude of flights over the MENLO waypoint be 5,000 feet or higher.

(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

Recommendation 2: The Committee recommends that the FAA design a new procedure for arrivals into SFO from the south using the MENLO waypoint. The recommended procedure would cross the EDDYY waypoint (or equivalent) above 6,000 feet, continue at idle power to cross the MENLO waypoint at or above 5,000 feet,

and maintain idle power until the HEMAN waypoint (or other ILS 28L interception point). Such a procedure should also be designed to avoid the use of drag devices such as speed brakes.

(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

Recommendation 3: The Committee further recommends that all air traffic in the vicinity of the MENLO waypoint (including vectored traffic from other procedures) be kept at altitudes equivalent to those in Recommendation 1 above, even if not crossing directly over the MENLO waypoint.

(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

Recommendation 4: In order to facilitate Recommendations 1 and 2 above, the FAA should review whether the angle of the 28L glide slope can be increased in order to increase the altitude at the HEMAN waypoint, or equivalent.

(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

Recommendation 5: Finally, the Committee recommends that the FAA *assess* the feasibility of establishing a different waypoint for entry to the final approach into SFO on the SERFR arrival procedure (or any procedure that may replace it for arrivals from the south). A different waypoint could be established and located either to the east and/or north of MENLO, or by using existing waypoints FAITH, ROKME, or DUMBA. The new waypoint should be at a location that allows flight over compatible land uses (i.e., over water or sparsely populated land masses) and at a high enough altitude to ensure noise exposure of approaching aircraft is minimized. The Committee acknowledges that this Recommendation potentially involves working with stakeholders to revise the San Jose International Airport Class C airspace to maintain safety clearance requirements if the FAITH or ROKME waypoint options are pursued.

The Select Committee does not recommend that a different final waypoint be established for the SERFR procedure (or any procedure that may replace it for arrivals from the south), either through the establishment of a new waypoint or by using an existing waypoint, if such an action simply results in “noise shifting.”

(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

2.6 Raise the Floor of Altitude Control Windows on SERFR

An altitude control window at a waypoint provides a range of altitudes (from lowest to highest; e.g., 7,000 feet to 9,000 feet) that aircraft must be within when crossing the waypoint. The FAA has advised the Committee that the range of altitudes is provided because the aircraft fleet mix varies. The last leg of SERFR has only one altitude control window, at waypoint EPICK (just offshore from Capitola on the Santa Cruz County coast) with a range of 10,000 feet to 15,000 feet (See Appendix C, Page C1: Map of BSR and SERFR). By reducing the size of that window by 2,000 feet, so that its range is 12,000 feet to 15,000 feet, aircraft would be at a higher altitude when crossing the EPICK waypoint.

Recommendation 1: The Select Committee recommends that the FAA decrease the size of the altitude windows on the SERFR procedure or path so that aircraft crossing EPICK do so at a higher altitude.

(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

Recommendation 2: It is suggested that the arrival procedure for SERFR, or any subsequent route in this sub-region, be designed, if possible, to allow aircraft to reduce speed early, while over the Monterey Bay; beginning their Optimized Profile Descent into the Santa Cruz area and beyond in a fashion that affects fewer people.

(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

2.7 Increase the Altitude and Profile of Descents into SFO

An approach slope is the descent path that aircraft follow on final approach to land on a runway. An approach slope is also known as a glide slope, as the path is ideally a gentle downward slope. A commonly used approach slope in modern aviation is 3.0 degrees from the horizontal.

At SFO, the two main landing runways are 28L and 28R, and they are parallel to each other. Runway 28L has a glide slope of 2.85 degrees, while Runway 28R has a glide slope of 3.0 degrees. The variation in the glide slopes is a function of the two runways being parallel to each other. Other airports use a steeper glide slope. For instance, the Frankfurt airport is using 3.2 degrees while London City airport uses a glide slope of 5.5 degrees.

If the glide slope on both Runways 28L and 28R at SFO were increased, even if only by 0.15 degrees each, it would allow descending aircraft to begin their descent at a higher altitude, thereby reducing noise exposure on the ground.

Recommendation: The Select Committee recommends that the FAA determine the feasibility of increasing the glide slopes of SFO Runways 28R and 28L to the maximum extent consistent with safety and the Committee's goal of noise mitigation.

(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

2.8 Increase All Altitudes

Aircraft noise is noise pollution produced by any aircraft or its components. The noise is generated during the various phases of a flight, such as when the aircraft is: (a) on the ground while parked using auxiliary power units; (b) while taxiing; (c) during takeoff; (d) while over-flying enroute; and (e) during landing. Aircraft noise is also generated both underneath and lateral to departure and arrival paths. This latter form of aircraft noise has been the primary source of complaints since the March 2015 implementation of NextGen. At the risk of stating the obvious, the higher the altitude of departure and arrival paths, the quieter the experience is on the ground. Or, in other words, aircraft at higher altitudes tend to be quieter.

Recommendation: The Select Committee recommends that to the greatest extent possible, while still ensuring the safety of the aircraft, that the altitude be increased for all flight procedures/paths into and out of SFO.

(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

2.9 Aircraft Vectoring

Vectoring is assigned verbally by FAA air traffic controllers, and generally involves turning aircraft off the assigned procedure/flight path. Vectoring of SFO arrivals over the Mid-Peninsula is common and principally generated from three sources: (1) arrivals from the north (BDEGA); (2) to a lesser degree, overseas arrivals from the west (OCEANIC); and (3) the roughly 50 percent of the arrivals from the south (SERFR) that are currently vectored off the SERFR procedure/path (See Appendix C, Page C4: Map of BDEGA, OCEANIC, SERFR, and DYAMD). These arriving aircraft are vectored to properly sequence them for merging onto the final approach into SFO. It should be noted that while noise generated by vectoring in the first two instances (i.e., BDEGA and OCEANIC) occurs in the vicinity of the MENLO waypoint, the location of these operations is unrelated to the presence of the MENLO waypoint, as discussed further in Item 2.5 in this Report (MENLO Waypoint).

Vectoring can be a source of substantial noise. If the vectoring directive from Air Traffic Control to the pilot includes a change in speed, a turn, and/or an altitude restriction, an increase in noise is a likely result. On the other hand, if the vectoring directive is unrestricted, with the pilot not being given a speed or altitude restriction, it is unlikely that noise will result. The FAA has advised the Committee that vectoring is done for safety reasons, and that the specific directive provided is dependent on the variables present. Consequently, according to the FAA, it is not predictable what the noise exposure will be from vectoring.

Yet, vectoring is the source of many of the noise complaints presented to the Committee by the community. This is due in part because the aircraft vectoring over the Mid-Peninsula do so at low altitudes. In addition, the topography of the Mid-Peninsula is uneven. To further complicate the matter, while some members of the community have complained that vectoring is a source of noise, others warn that efforts to keep greater numbers of aircraft on the established flight paths concentrates even greater amounts of noise on those who live or work under the established flight track (this is the issue some advocates refer to as “sacrificial noise corridors”). So, if you vector,

you create noise over a relatively wide area; if you don't, you concentrate a greater amount of noise on a relative few (a smaller number) who are already heavily burdened.

It has been suggested that the altitude at which aircraft are vectored over the Peninsula be increased, to reduce the noise exposure experienced on the ground. It should be noted, however, that the FAA has advised the Committee that increases in the altitude of the BDEGA West leg vectored aircraft could require the aircraft to fly somewhat further south, in order to safely descend and make the U-turn to join the final approach into SFO.

Recommendation 1: The Select Committee recommends that the FAA identify locations that have the most compatible land uses for vectoring, such as over the Pacific Ocean or San Francisco Bay, and vector the SFO arriving air traffic in those locations to reduce noise exposure experienced on the ground.

(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

Recommendation 2: The Committee recommends that the FAA raise vectoring altitudes to maximum feasible altitudes over the Mid-Peninsula, with a focus on higher altitudes in the vicinity of the MENLO waypoint.

(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

2.10 Runway Usage

SFO operates on two sets of parallel runways that intersect midfield at a ninety-degree angle. Approximately 83 percent of the time aircraft depart on either Runway 01L (left) or 01R (right) and arrive on either Runway 28L (left) or 28R (right). Under this flow of traffic, SFO's acceptance rate for arriving traffic is 60 aircraft per hour. This arrival rate can be accommodated because with good visibility and weather, aircraft land side-by-side on Runways 28L and 28R as the pilots are able to see the other aircraft arriving on the parallel runway and can maintain visual separation.

The arriving traffic to Runway 28L is closer to the western edge of the San Francisco Bay (Bay), proximate to the bayside communities of Redwood City and Foster City. Runway 28R is farther removed from those communities. Greater use of Runway 28R has a reduced noise exposure for these bayside communities; however, the FAA advised the Committee that, for the most efficient operations at SFO (i.e., accommodating the greatest number of aircraft), Runways 28L and 28R are used simultaneously.

As detailed in this Report (Item 2.4 Overnight Flights), during the overnight hours the overall amount of air traffic is dramatically reduced. It has been suggested that, to the extent possible, 100 percent of nighttime flights should be directed by Air Traffic Control (ATC) in a single stream to Runway 28R to reduce the noise exposure on the communities of Redwood City and Foster City.

It has also been suggested that regardless of the time of day, and when conditions permit (including, but not limited to, the number of operations), ATC should direct aircraft to use Runway 28R. This includes use of the "noise friendlier" offset approach, which takes aircraft farther into the Bay before joining the final approach to SFO. Use of the offset approach not only benefits

Foster City and Redwood City, but because aircraft are joining the final approach farther into the Bay, it could allow for higher altitudes while the aircraft are crossing over the Mid-Peninsula area.

Recommendation: The Select Committee recommends that all feasible measures be taken to reduce the noise exposure to bayside communities, including Foster City and Redwood City, by directing air traffic to Runway 28R whenever possible. During the important overnight hours, every effort should be made to create a single stream of traffic, and to assign that traffic, safety permitting, to fly a “noise friendlier” offset approach to Runway 28R.

(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

2.11 Modify BRIXX Procedure into San Jose International Airport

The BRIXX arrival is an arrival procedure/path from the north into San Jose International Airport (SJC) which runs down the Peninsula, roughly over La Honda and Boulder Creek before turning and flying south and then turning east and north (essentially a big U-turn) to join the final approach into SJC (See Appendix C, Page C5: Map of BRIXX). The BRIXX path intersects with the SERFR arrival path (which approaches SFO from the south over the Santa Cruz Mountains), roughly just to the north of Mount McPherson in the Santa Cruz mountains.

The FAA has advised the Committee that, under NextGen, BRIXX basically overlaid a predecessor path, which was named GOLDN. The change to a satellite based navigation flight path, as opposed to the prior ground track flight path, resulted in the BRIXX arrival path becoming more concentrated; with vectoring moving southward, and moving closer to the designated flight path. The FAA further advised the Committee that roughly 76 percent of the BRIXX flights are vectored or turned off the path prior to the point where BRIXX intersects with SERFR. These changes resulted in complaints from residents in affected communities.

It has been suggested that these complaints be addressed by: (1) moving the intersection of BRIXX and SERFR farther to the north and east, potentially to waypoint EDDYY, which is located roughly over the Rancho San Antonio Open Space Preserve; and (2) increasing the altitude of BRIXX so that it is above the altitude of the SERFR arrival path.

The FAA has advised the Committee that these potential solutions raise a number of concerns. First, moving the flight path as suggested potentially moves noise further into the already impacted Mid-Peninsula area and places arriving aircraft at too high of an altitude too close to SJC. In order for those aircraft to safely land, the aircraft would have to fly even further south to make the necessary turn to the east and the north to join the final approach into SJC, potentially resulting in new noise exposure. Increasing the altitude of BRIXX also potentially limits the FAA’s ability to consider other potential solutions the Select Committee might advance, such as raising the altitude on SERFR.

Recommendation: The Select Committee recommends that, following implementation of changes to the current arrival route for aircraft from southern destinations, the FAA shall consider a new BRIXX procedure that maintains the highest possible altitude

at the point where it (BRIXX) intersects the new arrival route from the south. The FAA should make every attempt to raise the altitude high enough such that the DNL under the new intersection (where BRIXX and new arrival route from the south) is lower than the DNL under the current intersection (where BRIXX and the current SERFR route cross). The FAA shall review any proposed new BRIXX procedure with any successor committee as recommended in Item 3.1, Recommendations 1 and 2, in this Report (Need for an Ongoing Venue to Address Aircraft Noise Mitigation), and the affected communities.
(Vote: 10 Aye, 0 Nay, 2 Absent or Abstain)

2.12 Modify NRRLI Waypoint on the First Leg of SERFR

In the Carmel Valley (Monterey County), aircraft joining the SERFR arrival procedure/path turn over the Valley to reach the NRRLI waypoint. That turn has created adverse noise exposure on the ground. Prior to the March 2015 implementation of NextGen procedures, aircraft flew over the Carmel Valley in a straight line. It has been suggested that the NRRLI waypoint be moved to where the SERFR procedure/path intersects the coastline near the City of Seaside along the Monterey Bay.

The FAA has advised the Committee that this proposed solution, however, has the potential to move existing noise to another community. For that reason, the Select Committee has not endorsed this solution. The FAA may, however, wish to examine whether this proposed solution, or a variation thereof, could be effectively implemented without shifting noise.

Adopted by the Select Committee.

(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

2.13 San Jose International Airport Reverse Flow: Aircraft Arrivals

Under normal conditions, aircraft arriving at San Jose International Airport (SJC) arrive from the south and depart heading north. During inclement weather, or a significant change in wind direction over the San Jose area, the takeoff and landing approaches are temporarily reversed with aircraft arriving at SJC from the north and departing to the south. This “Reverse Flow” brings arriving aircraft in at lower altitudes to the west of SJC, over the communities of Palo Alto, Mountain View, and Sunnyvale. It has been suggested that the “Reverse Flow” approach could instead arrive from the east of SJC, using a “Normal Flow” departure procedure that is not used during “Reverse Flow” conditions.

The FAA has advised the Committee that this proposed solution, however, has the potential to move existing noise to another community (a community not represented by the congressional districts that established the Select Committee). For that reason, the Select Committee has not endorsed this proposed solution. The FAA may, however, wish to examine whether this proposed solution, or a variation thereof, could be effectively implemented without shifting noise.

Adopted by the Select Committee.

(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

2.14 Redirect Southern Arrivals (SERFR) to an Eastern Approach into SFO

As previously noted, SERFR is a southern arrival procedure/flight path into SFO (i.e., approaching SFO from the south over the Santa Cruz Mountains). Flights on the SERFR procedure include (among others) aircraft from the southwest, such as Phoenix and Houston. In June 2016, the SERFR carried an average of 183 aircraft per day, or 30 percent of the arriving aircraft into SFO.

It has been suggested by some that these aircraft from the southwest be removed from the SERFR arrival procedure, and instead use an eastern approach into SFO. Under this suggestion, aircraft would either use the existing DYAMD arrival procedure (which is for flights arriving at SFO from the east with a flight path that enters the Bay roughly between Fremont and Milpitas), or use a new procedure crossing the FAITH waypoint (which is located at the intersection of Hostetter Road and Morrill Avenue, east of Interstate 680 in East San Jose) (See Appendix C, Page C4: Map of BDEGA, OCEANIC, SERFR, and DYAMD).

The FAA has advised the Committee that this proposed solution raises a number of potential concerns. In June 2016, the DYAMD already carried the greatest percentage of daily air traffic into SFO, an average of 253 aircraft per day, or 41 percent of the arriving traffic into SFO. The DYAMD arrival procedure also shares the final approach path into SFO with aircraft arriving from the north (on the BDEGA procedure), specifically the 30 percent of BDEGA arrivals that use the San Francisco Bay approach (the so-called East leg). Increasing the aircraft load on the DYAMD procedure as suggested reduces the opportunity to shift aircraft from the BDEGA Peninsula (so-called West leg) approach onto the BDEGA San Francisco Bay approach (so-called East leg). For that reason, the Select Committee has not endorsed this solution {see Item 2.2 in this Report [Northern Arrivals (BDEGA) into SFO]}.

With regard to creating a new procedure using the FAITH waypoint, the FAA has advised the Committee that this flight path has the potential to conflict with departures out of San Jose International Airport and move existing noise to another community (a community not represented by the congressional districts that established the Select Committee). For those reasons, the Select Committee has not endorsed this solution. However, it has been noted that the existence of an overnight curfew at San Jose International Airport might accommodate a new procedure using the FAITH waypoint as a potential solution in the overnight hours. The FAA may, therefore, wish to examine whether this proposed solution, or a variation thereof (e.g., at night), could be effectively implemented without shifting noise.

Adopted by the Select Committee.

(Vote: 11 Aye, 1 Nay, 0 Absent or Abstain)

2.15 Fan-in Overseas Arrivals (OCEANIC) into SFO

The OCEANIC arrival procedure into SFO comes in from the west from overseas locations, such as Asia, and Hawaii, with aircraft converging into a single path at the PIRAT waypoint which is off the coast. Once on a single path, the aircraft cross the San Francisco Peninsula at the Woodside VOR, a navigational beacon located in the Woodside area, and proceed to the final approach into SFO (See Appendix C, Page C4: Map of BDEGA, OCEANIC, SERFR, and DYAMD).

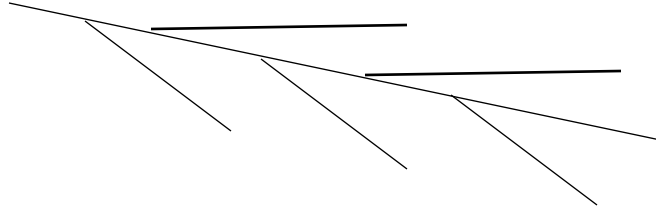
It has been suggested that the arriving OCEANIC aircraft could instead be “fanned-in” into the area of the Woodside VOR, using that point and other new waypoints to achieve dispersion of the arriving aircraft. The FAA has advised the Committee that it lacks the technology, i.e., metering tools, to implement this proposed solution. The presence of Special Use Airspace (SUA) along the coastline at this location (which restricts civilian aircraft from using that airspace), further constrains the FAA. The FAA has advised the Committee that while this solution might be feasible, there are a very low number of OCEANIC flights (roughly 31 flights per day in June 2016) per day. In addition, the FAA has advised the Committee that this solution also potentially moves noise to other communities. For these reasons, the Select Committee has not endorsed this solution.

Adopted by the Select Committee.

(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

2.16 Herringbone Approach to SFO Arrivals

It has been suggested that noise exposure along a specific corridor/flight path could be reduced if flights joined the path at various points, thus creating a “herringbone” or “trident” effect.



The “herringbone” or “trident” is a multiple approach concept for dispersion of arrivals to reduce the number of overflights along a single path. Using this concept, Air Traffic Control would be instructed to distribute arriving aircraft to multiple transition locations along the arrival path, hence the “herringbone” or “trident” patterns.

It has also been suggested that the herringbone approach could be applied to the SERFR arrival procedure, which approaches SFO from the south over the Santa Cruz Mountains. The FAA, however, has advised the Committee that it currently lacks the technology, i.e., metering tools, to implement this proposed solution. The congested San Francisco Bay Area airspace, with three major commercial airports in close proximity to each other, also potentially limits the applicability of this solution. Finally, the FAA has advised the Committee that a herringbone approach would likely result in an increase in vectoring. For these reasons, the Select Committee has not endorsed this solution. The FAA may, however, wish to examine whether this proposed solution, or a variation thereof, could be effectively implemented once the needed technological tools have been developed.

Adopted by the Select Committee.

(Vote: 11 Aye, 1 Nay, 0 Absent or Abstain)

2.17 Return to Pre-NextGen Procedures, Altitudes, and Concentration

A continuous thread to the public input received by the Committee was to simply return conditions, including aircraft procedures, altitudes, and concentration, to “how they were before NextGen.” While the Committee is sympathetic to this input, the FAA has repeatedly indicated that changes to the San Francisco Bay Area airspace pursuant to NextGen are **not** reversible. The FAA has repeatedly advised the Committee that the 2012 federal legislation reauthorizing the FAA required the FAA to adopt and use advanced technology to modernize the air transport system. For these reasons the Select Committee has not endorsed this proposed solution. However, the Select Committee recommends the implementation of a number of solutions to improve NextGen, as discussed throughout this Report.

Adopted by the Select Committee.

(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

SECTION 3: LONGER-TERM ISSUES

In the Select Committee's deliberations several longer-term issues were identified that went beyond the timeframe of the Committee's work plan. Each of these longer-term issues are of significance and the Committee recommends that resolution be pursued in as timely a manner as possible via appropriate channels.

3.1 Need for an Ongoing Venue to Address Aircraft Noise Mitigation

In the San Francisco Bay Area airspace, noise-related concerns are not confined to a single commercial airport. The three major commercial airports (SFO, Oakland International-OAK, and San Jose International-SJC) that ring the San Francisco Bay (Bay) have a combined 136 arrival and departure procedures (i.e., paths). These arrival and departure procedures crisscross the Bay and impact the three county area represented by the members of Congress who established the Select Committee on South Bay Arrivals. This presents an obvious challenge to those affected by and/or attempting to mitigate aircraft noise. As an example, Santa Cruz Mountains' residents affected by the SERFR arrival procedure from the south into SFO are also affected by the BRXXX arrival procedure from the north into SJC.

The need for a permanent entity to address these multi-county impacts became readily apparent to the Committee in the course of its work.

Recommendation 1: The Select Committee recommends that an Ad-Hoc Subcommittee consisting of two Members/Alternates from the Select Committee (or others yet to be named) from each County/Congressional District be convened by the three members of Congress who empaneled the Select Committee over the short-term to continue work on the issues identified in this Report, including the framework of the longer term entity referenced in Recommendation 2 immediately below. More specifically, the Ad-Hoc Subcommittee would consider: (1) the financial, administrative, and technical resources needed to support the permanent entity; (2) funding of the permanent entity; and (3) structure of the permanent entity. Among other tasks, the Ad-Hoc Subcommittee would also receive reports, if any, on the implementation of the Recommendations included in this Report. The Ad-Hoc Subcommittee would consult with the FAA, SFO, and local jurisdictions in developing a framework to support the permanent entity going forward and report to the Members of Congress with its recommendation within 120 days.

(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

Recommendation 2: The Select Committee strongly recommends that a permanent entity be established to address issues of aircraft noise in the three county area on an ongoing basis, and to provide a forum for community input. The Select Committee's schedule did not permit time to develop a recommended governance structure.

(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

3.2 Restricted/Special Use Airspace

Special Use Airspace (SUA) are areas designated for operations that require restrictions on aircraft not participating in those operations. These operations are often of a military nature. In the San Francisco Bay Area, there are SUA restrictions (military) along much of the Pacific coastline that constrain the FAA's flexibility to expand or restructure the use of civilian airspace.

Recommendation: While the Select Committee is not questioning the need for or importance of Special Use Airspace (SUA) in our region, the Committee recommends that the FAA review the SUA in our area with an eye towards better balancing special use restrictions and civilian aviation needs, particularly in the congested San Francisco Bay Area airspace.

(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

3.3 Noise Measurement

Following the March 2015 changes to the San Francisco Bay Area airspace that implemented NextGen performance based navigation technology and new flight procedures/paths, it became readily apparent to the Committee that the FAA's established noise measurement metrics are inadequate. They do not represent what is being experienced by people on the ground.

The existing metrics do not adequately identify or acknowledge ground level noise exposure, even when noise at the reported levels is enough to be noticeable and disturbing to the public. The shortcoming exists in large measure because the *cumulative* noise level (over a 24-hour period) is not high enough to technically constitute a "significant impact."

More specifically, the use of a Day-Night Average Sound Level (DNL) alone is ill-suited to assess ground level impacts, particularly from the standpoint of amplitude, duration, time of occurrence, and repetitiveness (concentration of flight paths). In addition, noise analysis at a community level (i.e., over a relatively broad swath) results in a blending of noise that does not reflect more localized impacts. Measuring noise more locally and precisely (e.g., at the census block level) would avoid this "blending" and diluting of noise exposure. The Committee also notes that, on the national level, numerous studies of alternative noise metrics highlight the deficiencies of DNL.

Further, the FAA's metrics rely on A-Weighting to measure sound pressure levels (e.g., the way the ear hears), commonly expressed in dBA. A-Weighting was originally intended only for the measurement of low-level sounds. Yet it is now commonly used for the measurement of environmental and industrial noise, including aircraft noise, as well as when assessing potential hearing damage and other noise health effects at all sound levels. However, because A-Weighting is applicable to only low levels, it tends to devalue the effects of low frequency noise in particular.

Other frequency weighting, such as "C-" and "Z-" Weightings are available. Use of these frequency weightings yields measurements of *all* noise, instead of only a small fraction of it.

The Committee strongly supports the efforts of the congressional Quiet Skies Caucus to require the FAA to lower the acceptable DNL threshold from the current level of 65, and to use supplemental metrics that characterize the true impact of airline noise experienced by people on the ground; and further encourages broader congressional consideration of these efforts.

Recommendation 1: The Select Committee recommends that the U.S. Congress require the FAA to adopt supplemental metrics for aircraft noise that characterize the true impact experienced by people on the ground.

(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

3.4 Capacity Limitations

The Select Committee understands that the growth in air traffic for the Bay Area is projected to increase by approximately 2 percent per annum. While overall capacity limitations have not been reached at San Francisco International Airport, the availability of additional daytime flight capacity is limited, and it is anticipated that future traffic growth can only be accommodated during nighttime hours. The impact of additional flights during overnight hours is significantly greater to those on the ground, and requires stricter nighttime regulations to avoid sleep interference, as discussed further in Item 2.4 in this Report (Overnight Flights). Longer term, increased traffic levels may necessitate implementation of capacity limitations, such as longer in-trail spacing between aircraft or assigned gate slots.

Recommendation: The Select Committee believes these capacity issues should be considered by any successor committee, as recommended in Item 3.1, Recommendations 1 and 2, in this Report (Need for an Ongoing Venue to Address Aircraft Noise Mitigation).

(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

3.5 Aircraft Speed

The issue of aircraft speed and its impact on noise arose late in the Select Committee's deliberations.

Recommendation: The Select Committee believes the issue of aircraft speed and its impact on noise should be considered by any successor committee, as recommended in Item 3.1, Recommendations 1 and 2, in this Report (Need for an Ongoing Venue to Address Aircraft Noise Mitigation).

(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

SECTION 4: PROCESS ISSUES

In its deliberations, the Select Committee identified three process issues of note that warrant further consideration and follow-up.

4.1 Who Makes Recommendations to Whom

In the face of widespread concern about aircraft noise over portions of three counties, the Select Committee was empaneled to provide recommendations to Members of Congress on appropriate measures to eliminate or mitigate noise where practicable. The Committee members understood and accepted that assignment, and this Report represents the Committee's best effort to offer such recommendations.

That being said, the mitigation of aircraft noise is a highly technical matter. The Committee was wholly comprised of (elected) lay people. Charging a group of elected lay people with the responsibility for making recommendations in this area seems less than ideal, particularly when the FAA has the requisite expertise and responsibility to manage aircraft traffic in the public interest.

Simply put, notwithstanding the FAA's good faith effort to provide technical expertise to the Committee, the Committee's view is that the process is fundamentally backwards – the FAA should be going to Members of Congress and their affected constituencies with proposals for review and comment, not the other way around.

Recommendation: Should a similar process be employed here or elsewhere in the country in the future, the Select Committee recommends that, to the greatest degree possible, the FAA be charged with the responsibility for identifying and proposing solutions to mitigate noise concerns, and that community groups and elected officials be consulted for review and comment, and to offer additional suggestions.

(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

4.2 Need for Before/After Noise Monitoring

The lack of aircraft noise monitoring prior to the implementation of NextGen hampered the Committee's (and the public's) ability to measure and document the actual impacts of the changes that were implemented in March 2015. Looking ahead, the Committee is concerned that if the FAA fails to perform "before and after" noise measurements related to the implementation of Recommendations contained in this Report, there will likewise be an inability to measure, analyze and verify, and document the desired improvements. Accordingly, the Select Committee offers the following Recommendation.

Recommendation 1: The Select Committee recommends that the FAA and/or SFO monitor and document noise exposure of any feasible solutions before and after FAA

implementation to ensure impacts are verified, and to determine whether results are of a discernible benefit.

(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

Recommendation 2: The Committee recommends the implementation of a set of regional noise monitoring stations that will adequately monitor aircraft noise levels at carefully selected points in the San Francisco Bay Area and the three Congressional Districts represented on the Select Committee. Collected data shall be made available to citizens upon request.

(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

4.3 Ensuring Compliance

The Committee received significant comment from both the public, and the elected official members of the Committee, about prior understandings, directives, or agreements, including those regarding altitude restrictions, not being adhered to. Such comments suggest the need for compliance monitoring with respect to previously agreed to efforts, and with respect to newly identified noise mitigation efforts.

Recommendation: The Select Committee recommends careful documentation and ongoing compliance monitoring for any set of solutions accepted and implemented by the FAA. The Committee recommends that the Members of Congress ensure that the FAA takes the appropriate steps to measure and guarantee ongoing compliance.

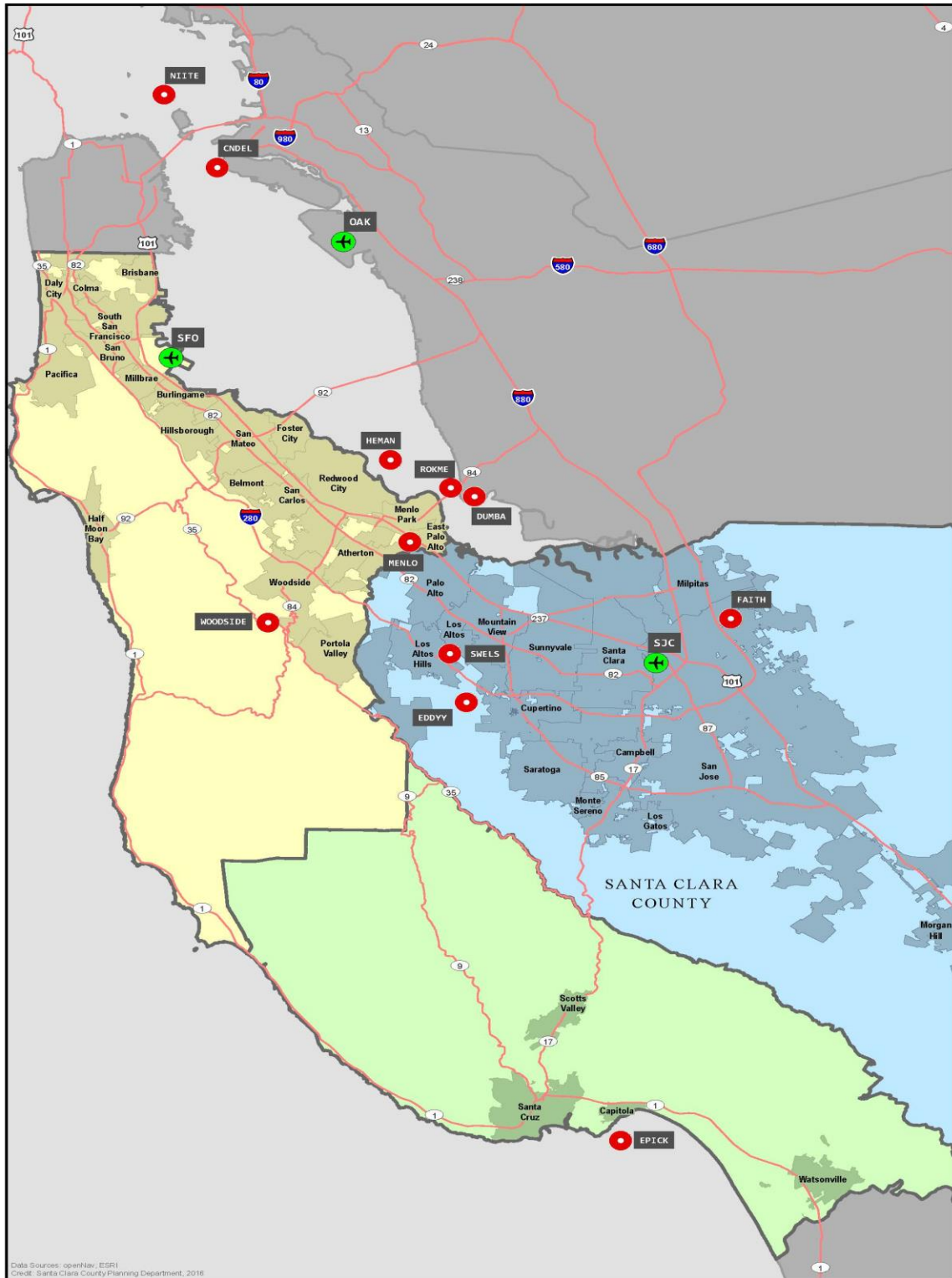
(Vote: 12 Aye, 0 Nay, 0 Absent or Abstain)

APPENDIX A: Vote Record

| Recommendation | Simitian, Chair | Leopold, Vice Chair | Pine, Vice Chair | Addiego | Bernald | Bottorff | Hindi | Lane | McPherson | Moody | Waldeck | Wengert | Total |
|-----------------------|------------------------|----------------------------|-------------------------|----------------|----------------|-----------------|--------------|-------------|------------------|--------------|----------------|----------------|--------------|
| UP | Y | Y | Y | Y | Y | N | Y | Y | Y | Y | Y | Y | 11-1-0 |
| 1.1 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 1.2 R1 | N | Y | Y | N | Y | Y | Y | N | N | Y | Y | Y | 8-4-0 |
| 1.2 R2 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 1.2 R3 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 1.2 R4 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 1.3 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 1.4 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 1.5 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 1.6 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 2.1 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 2.2 R1 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 2.2 R2 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 2.3 R1 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 2.3 R2 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 2.3 R3 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 2.4 R1 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 2.4 R2 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 2.4 R3 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 2.5 R1 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 2.5 R2 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 2.5 R3 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 2.5 R4 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 2.5 R5 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 2.6 R1 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 2.6 R2 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 2.7 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 2.8 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 2.9 R1 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 2.9 R2 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 2.10 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 2.11 | Y | Y | Y | Y | Y | Y | Y | -- | Y | Y | -- | Y | 10-0-2 |
| 2.12 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |

| Recommendation | Simitian, Chair | Leopold, Vice Chair | Pine, Vice Chair | Addiego | Bernald | Bottorff | Hindi | Lane | McPherson | Moody | Waldeck | Wengert | Total |
|-----------------------|------------------------|----------------------------|-------------------------|----------------|----------------|-----------------|--------------|-------------|------------------|--------------|----------------|----------------|--------------|
| 2.13 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 2.14 | Y | Y | Y | Y | N | Y | Y | Y | Y | Y | Y | Y | 11-1-0 |
| 2.15 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 2.16 | Y | Y | Y | Y | N | Y | Y | Y | Y | Y | Y | Y | 11-1-0 |
| 2.17 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 3.1 R1 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 3.1 R2 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 3.2 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 3.3 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 3.4 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 3.5 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 4.1 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 4.2 R1 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 4.2 R2 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |
| 4.3 | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | 12-0-0 |

APPENDIX B: Map of Key Waypoints



APPENDIX C: Maps of Selected Flight Paths: BSR and SERFR

BSR and SERFR Ground Tracks into SFO



Federal Aviation
Administration

APPENDIX C: Maps of Selected Flight Paths: NIITE

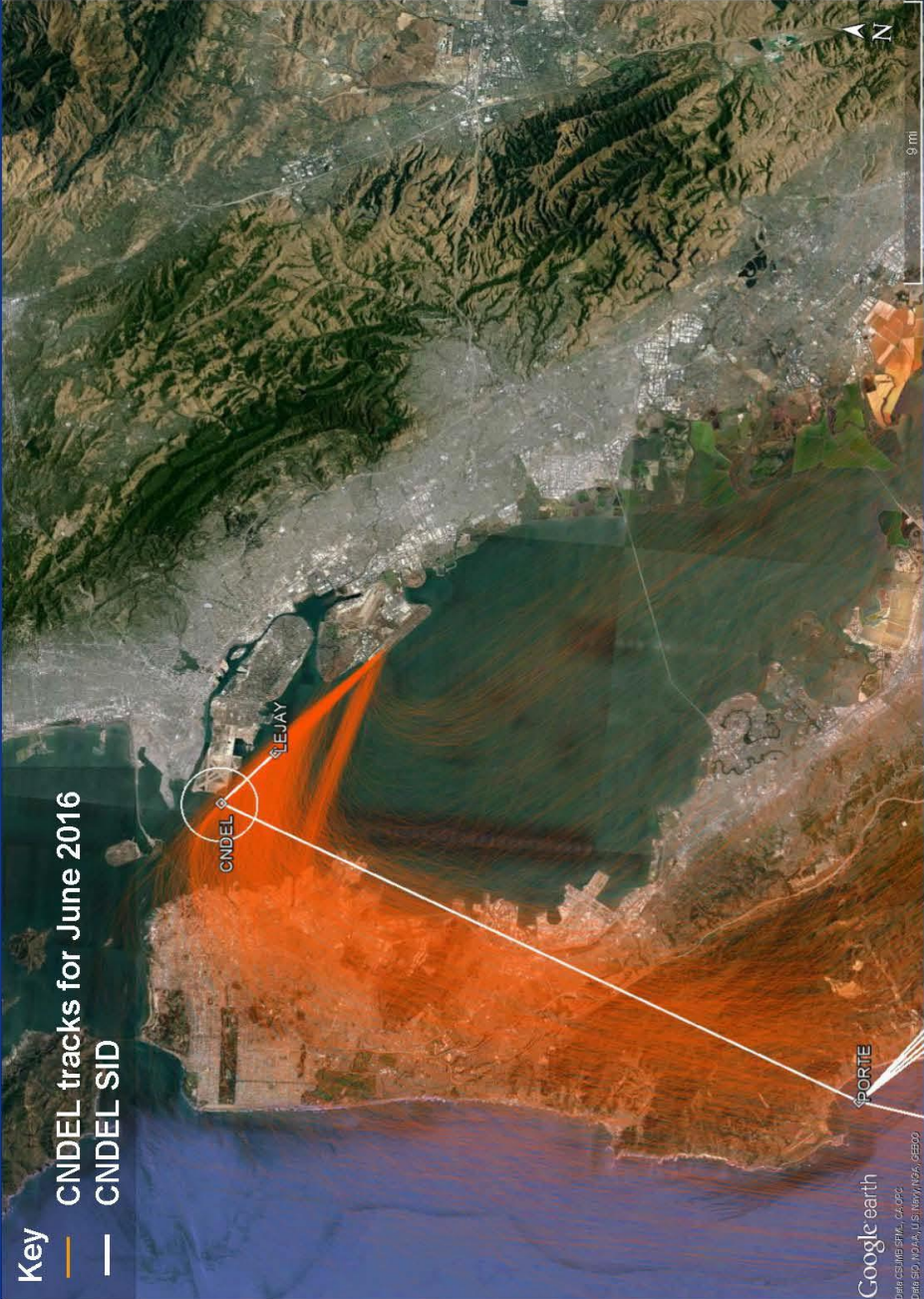
NIITE Departure Tracks from SFO June 2016



Federal Aviation Administration

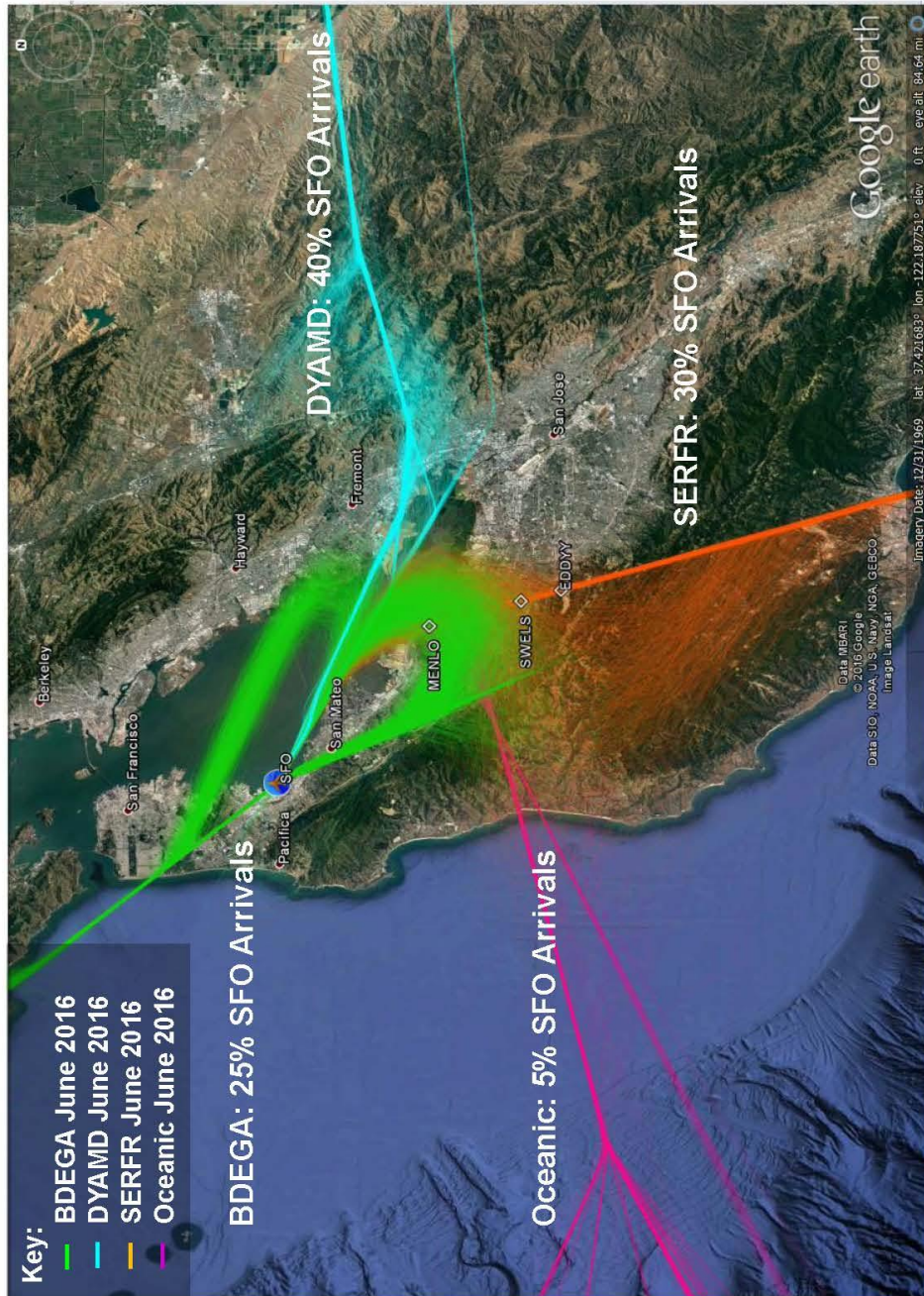
APPENDIX C: Maps of Selected Flight Paths: CNDEL

CNDEL Departure Tracks from OAK June 2016

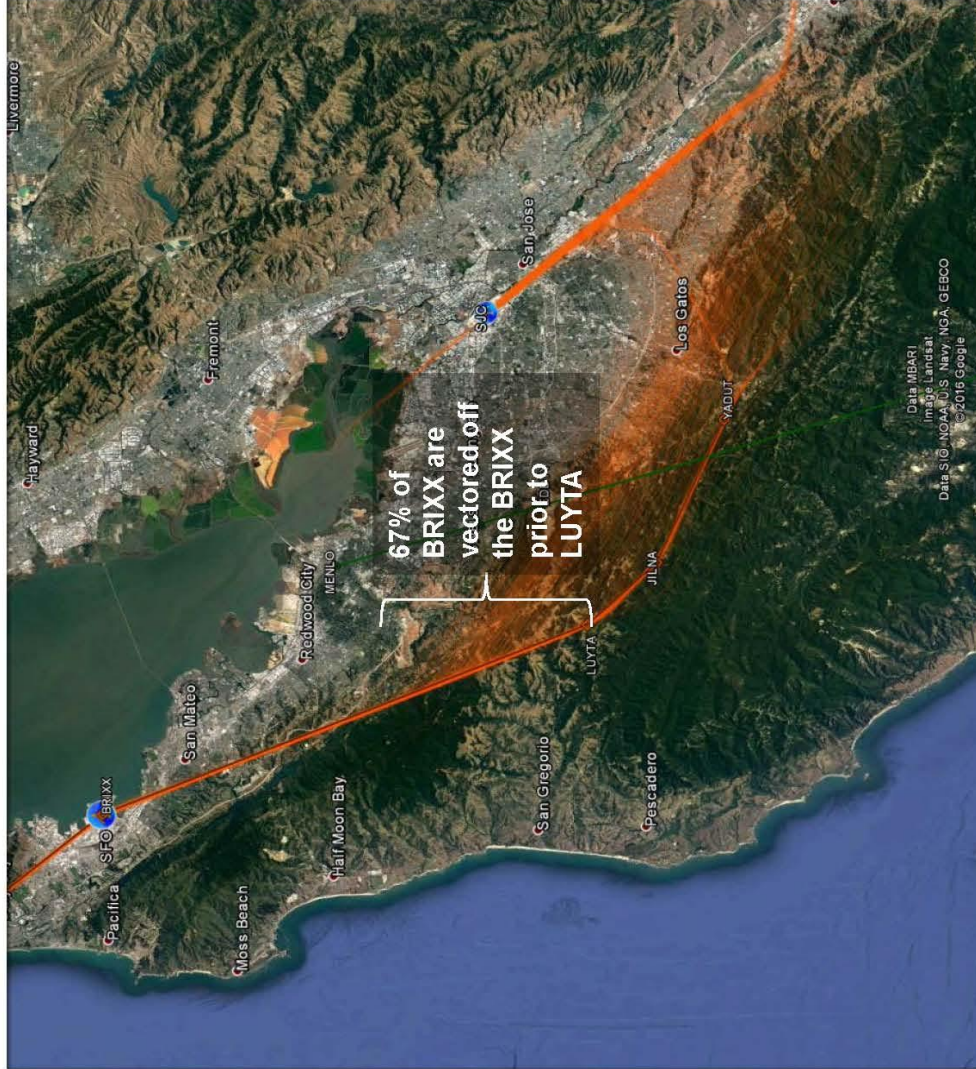


Federal Aviation Administration

Arrivals into SFO



BRIXX tracks into SJC: June 2016



Federal Aviation
Administration