Short Term Aircraft Noise Monitoring

Brisbane

Prepared for the Mission Blue Drive Neighborhood
San Francisco International Airport Noise Abatement Office
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Technical Report #022016-P51-966

February 2016
The San Francisco International Airport (SFO) Noise Abatement Office conducted short term noise monitoring in Brisbane, to determine the noise level within the neighborhood from aircraft operations at SFO. The equipment used to measure the sound level was an Environmental Monitor Unit 2200 noise monitor and Type 41DM-2 microphone manufactured by Bruel & Kjaer. The measurements consisted of monitoring the A-weighted decibels (dBA) in accordance with procedures and equipment which comply with International Electrotechnical Commission, and measurement standards established by the American National Standards Institute for Type I instrumentation. The microphone was calibrated prior to the start of the measurement. The monitor was housed in a weatherproof case and powered by a standard exterior electrical wall outlet. The microphone was mounted on a tripod at a height of approximately 7 feet (see Figure 1). The sound levels at the site were continuously monitored and the results stored on the onboard memory and periodically transferred to a removable memory stick for decoding. The decoded noise data were then processed in the Airport Noise and Operations Management System (ANOMS) for identification, noise to flight track matching and Community Noise Equivalent Level (CNEL) metric calculations.

**Aircraft Noise Analysis**

Noise measurements were taken at the Mission Blue Community Center starting April 28, 2015 to May 14, 2015 using a sound level threshold of 55dBA. This report evaluates periods where full 24 hour days of data are available, from April 29 through May 13. There were 351 identified correlated aircraft noise events associated with other Bay Area airports and 1,726 identified correlated aircraft noise events associated with SFO operations over the 15 day period. Table 1 below lists these events, along with community events detected by date and events’ daily energy averages.

Table 2 below provides the resulting CNELs for this measurement period, while Tables 3, 4 and 5 provides details of SFO Events by Daytime, Evening and Nighttime hours. For the 1,726 aircraft noise events, the average aircraft generated Maximum Noise Level (Lmax) was 65dBA, the average Sound Exposure Level (SEL) was 75dBA, and the average aircraft noise event duration was 32 seconds. The computed levels for the average Aircraft CNEL was 52dBA, the average Community CNEL was 53dBA, and the Total CNEL was 56dBA. For comparison purposes, the cumulative aircraft noise level at permanent noise monitor #7 located approximately 1.3 miles southeast was 50dBA for the same period.

**Table 1 - Noise Events by Date**

<table>
<thead>
<tr>
<th>Date</th>
<th>SFO Events</th>
<th>Average</th>
<th>Average</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SEL</td>
<td>Lmax</td>
<td>SEL</td>
<td>Lmax</td>
</tr>
<tr>
<td>4/29/2015</td>
<td>133</td>
<td>75</td>
<td>65</td>
<td>12</td>
</tr>
<tr>
<td>4/30/2015</td>
<td>123</td>
<td>76</td>
<td>65</td>
<td>21</td>
</tr>
<tr>
<td>5/1/2015</td>
<td>136</td>
<td>77</td>
<td>66</td>
<td>38</td>
</tr>
<tr>
<td>5/2/2015</td>
<td>125</td>
<td>77</td>
<td>67</td>
<td>30</td>
</tr>
<tr>
<td>5/3/2015</td>
<td>105</td>
<td>77</td>
<td>67</td>
<td>21</td>
</tr>
<tr>
<td>5/4/2015</td>
<td>140</td>
<td>75</td>
<td>65</td>
<td>18</td>
</tr>
<tr>
<td>5/5/2015</td>
<td>100</td>
<td>75</td>
<td>65</td>
<td>14</td>
</tr>
<tr>
<td>5/6/2015</td>
<td>108</td>
<td>77</td>
<td>66</td>
<td>24</td>
</tr>
<tr>
<td>5/7/2015</td>
<td>171</td>
<td>77</td>
<td>66</td>
<td>38</td>
</tr>
<tr>
<td>5/8/2015</td>
<td>194</td>
<td>77</td>
<td>67</td>
<td>43</td>
</tr>
<tr>
<td>5/9/2015</td>
<td>139</td>
<td>76</td>
<td>66</td>
<td>20</td>
</tr>
<tr>
<td>5/10/2015</td>
<td>101</td>
<td>76</td>
<td>66</td>
<td>16</td>
</tr>
<tr>
<td>5/11/2015</td>
<td>15</td>
<td>72</td>
<td>62</td>
<td>10</td>
</tr>
<tr>
<td>5/12/2015</td>
<td>10</td>
<td>71</td>
<td>62</td>
<td>18</td>
</tr>
<tr>
<td>5/13/2015</td>
<td>125</td>
<td>77</td>
<td>67</td>
<td>28</td>
</tr>
<tr>
<td>Total</td>
<td>1,726</td>
<td>351</td>
<td>624</td>
<td>351</td>
</tr>
</tbody>
</table>

4 SFO Events are Single SFO Aircraft, Multiple SFO Aircraft and Simultaneous SFO and Non-SFO Aircraft.

SEL and Lmax are in decibels A-weighted.
Table 2 – Aircraft Noise Climate over 15 Days

<table>
<thead>
<tr>
<th></th>
<th>Lowest Level (dBA)</th>
<th>Highest Level (dBA)</th>
<th>Average Level (dBA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aircraft</td>
<td>44</td>
<td>55</td>
<td>52</td>
</tr>
<tr>
<td>Community</td>
<td>51</td>
<td>56</td>
<td>53</td>
</tr>
<tr>
<td>Total</td>
<td>54</td>
<td>58</td>
<td>56</td>
</tr>
</tbody>
</table>

Table 3 - SFO Aircraft Noise Data (Single Events) – Day (7:00 a.m. to 7:00 p.m.)

<table>
<thead>
<tr>
<th>1,261 Correlated Noise Events</th>
<th>Lowest Level (dBA)</th>
<th>Highest Level (dBA)</th>
<th>Average Level (dBA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aircraft Lmax</td>
<td>56</td>
<td>76</td>
<td>66</td>
</tr>
<tr>
<td>Aircraft SEL</td>
<td>63</td>
<td>85</td>
<td>76</td>
</tr>
<tr>
<td>Noise Event Duration (in seconds)</td>
<td>8 seconds</td>
<td>120 seconds</td>
<td>32 seconds</td>
</tr>
</tbody>
</table>

Table 4 - SFO Aircraft Noise Data (Single Events) – Evening (7:00 p.m. to 10:00 p.m.)

<table>
<thead>
<tr>
<th>207 Correlated Noise Events</th>
<th>Lowest Level (dBA)</th>
<th>Highest Level (dBA)</th>
<th>Average Level (dBA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aircraft Lmax</td>
<td>55</td>
<td>74</td>
<td>66</td>
</tr>
<tr>
<td>Aircraft SEL</td>
<td>64</td>
<td>83</td>
<td>76</td>
</tr>
<tr>
<td>Noise Event Duration (in seconds)</td>
<td>8 seconds</td>
<td>70 seconds</td>
<td>31 seconds</td>
</tr>
</tbody>
</table>

Table 5 - SFO Aircraft Noise Data (Single Events) – Night (10:00 p.m. to 7:00 a.m.)

<table>
<thead>
<tr>
<th>258 Correlated Noise Events</th>
<th>Lowest Level (dBA)</th>
<th>Highest Level (dBA)</th>
<th>Average Level (dBA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aircraft Lmax</td>
<td>56</td>
<td>80</td>
<td>66</td>
</tr>
<tr>
<td>Aircraft SEL</td>
<td>64</td>
<td>84</td>
<td>76</td>
</tr>
<tr>
<td>Noise Event Duration (in seconds)</td>
<td>8 seconds</td>
<td>120 seconds</td>
<td>32 seconds</td>
</tr>
</tbody>
</table>

SSTIK Procedure

Aircraft departures off Runway 01L, which flew a quarter of a mile of SSTIK (Appendix 2) were also evaluated for this measurement period. The daily average of 01L departures that flew a quarter of a mile SSTIK was 39%. An average of 65% of those operations registered a noise event at the noise monitor.

<table>
<thead>
<tr>
<th>Date</th>
<th>01L Departure</th>
<th>SSTIK (1/4 mi)</th>
<th>% of 01L Departure</th>
<th>Noise Events</th>
<th>% of SSTIK</th>
<th>SEL</th>
<th>Lmax</th>
<th>Duration</th>
<th>Altitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/29/2015</td>
<td>157</td>
<td>63</td>
<td>40%</td>
<td>37</td>
<td>59%</td>
<td>74</td>
<td>63</td>
<td>26</td>
<td>5,063</td>
</tr>
<tr>
<td>4/30/2015</td>
<td>198</td>
<td>75</td>
<td>38%</td>
<td>41</td>
<td>55%</td>
<td>75</td>
<td>64</td>
<td>31</td>
<td>4,740</td>
</tr>
<tr>
<td>5/1/2015</td>
<td>145</td>
<td>59</td>
<td>41%</td>
<td>40</td>
<td>68%</td>
<td>76</td>
<td>65</td>
<td>35</td>
<td>4,802</td>
</tr>
<tr>
<td>5/2/2015</td>
<td>162</td>
<td>77</td>
<td>48%</td>
<td>48</td>
<td>62%</td>
<td>76</td>
<td>66</td>
<td>31</td>
<td>4,467</td>
</tr>
<tr>
<td>5/3/2015</td>
<td>112</td>
<td>35</td>
<td>31%</td>
<td>19</td>
<td>54%</td>
<td>76</td>
<td>66</td>
<td>35</td>
<td>5,057</td>
</tr>
<tr>
<td>5/4/2015</td>
<td>169</td>
<td>65</td>
<td>38%</td>
<td>47</td>
<td>72%</td>
<td>74</td>
<td>65</td>
<td>24</td>
<td>4,823</td>
</tr>
<tr>
<td>5/5/2015</td>
<td>123</td>
<td>44</td>
<td>36%</td>
<td>26</td>
<td>59%</td>
<td>75</td>
<td>65</td>
<td>29</td>
<td>4,494</td>
</tr>
<tr>
<td>5/6/2015</td>
<td>136</td>
<td>50</td>
<td>37%</td>
<td>28</td>
<td>76%</td>
<td>76</td>
<td>65</td>
<td>35</td>
<td>5,019</td>
</tr>
<tr>
<td>5/7/2015</td>
<td>190</td>
<td>66</td>
<td>35%</td>
<td>49</td>
<td>74%</td>
<td>77</td>
<td>66</td>
<td>37</td>
<td>5,108</td>
</tr>
<tr>
<td>5/8/2015</td>
<td>213</td>
<td>86</td>
<td>40%</td>
<td>58</td>
<td>79%</td>
<td>77</td>
<td>67</td>
<td>35</td>
<td>4,773</td>
</tr>
<tr>
<td>5/9/2015</td>
<td>175</td>
<td>74</td>
<td>42%</td>
<td>46</td>
<td>62%</td>
<td>75</td>
<td>65</td>
<td>29</td>
<td>5,074</td>
</tr>
<tr>
<td>5/10/2015</td>
<td>135</td>
<td>54</td>
<td>40%</td>
<td>34</td>
<td>63%</td>
<td>74</td>
<td>67</td>
<td>27</td>
<td>4,987</td>
</tr>
<tr>
<td>5/11/2015</td>
<td>6</td>
<td>0</td>
<td>0%</td>
<td>4</td>
<td>-1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>4,468</td>
</tr>
<tr>
<td>5/12/2015</td>
<td>10</td>
<td>5</td>
<td>50%</td>
<td>2</td>
<td>40%</td>
<td>72</td>
<td>62</td>
<td>30</td>
<td>6,085</td>
</tr>
<tr>
<td>5/13/2015</td>
<td>98</td>
<td>40</td>
<td>41%</td>
<td>29</td>
<td>73%</td>
<td>77</td>
<td>67</td>
<td>37</td>
<td>5,025</td>
</tr>
<tr>
<td>2,029</td>
<td>793</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. These noise events were caused by 01L departures that did not fly a quarter of a SSTIK.
2. Duration is in seconds
Conclusion

Aircraft noise levels at Mission Blue Community Center are at levels expected in a community that is approximately 4.5 miles away from a large hub airport, but below several departure corridors serving four main commercial use runways (28L, 28R, 1L, 1R) at SFO. Actual aircraft noise measurements contribute 1.6dBA additional noise to the total cumulative average noise levels. The average Aircraft CNEL was 52dBA and the average Community CNEL was 53dBA. When Aircraft noise is added to the Community noise the Total CNEL results in 56dBA.

![Graph showing Aircraft CNEL and Community CNEL over time]

The California Code of Federal Regulations, Title 21, Division 2.5, Chapter 6, paragraph 5012 states: “The standard for the acceptable level of aircraft noise for persons living in the vicinity of airports is hereby established to be a community noise equivalent level of 65 decibels.” Since the average Aircraft CNEL was measured at 52dBA for Mission Blue Community Center, this residential area has an acceptable level of aircraft noise as defined by state law. The extent of the 65dBA CNEL noise impact contour at SFO is shown on page 3. This noise contour was generated using Federal Aviation Administration’s Integrated Noise Model (version 7.0d) and is a working draft of a noise exposure map update under Federal Aviation Regulations Part 150. The results of the field monitoring validates the extent of the 65dBA CNEL noise impact boundary confirming Aircraft CNEL is less than 65dBA CNEL for this location.
2014 Noise Exposure Map
Figure 1 – Microphone and Tripod (main) and Monitor (bottom right)
Noise Monitoring Location #966 (red colored circle - 2 mile radius) and Permanent Noise Monitor Sites
Appendix 1 – San Francisco Bay Area Major Jet Arrival and Departure Routes

West Flow Plan
Southeast Flow Plan
Appendix 2 - SSTIK Departure

**DEPARTURE ROUTE DESCRIPTION**

**TAKEOFF RUNWAYS 1L/R:** Climb heading 014° to S20 then left turn direct to SSTIK, then left turn direct to cross PORTE at/below 10000. Thence...

...on (transition). Maintain FL190, expect filed altitude 10 minutes after departure.

- **CISO TRANSITION (SSTIK3.CISO)**
- **EBAYE TRANSITION (SSTIK3.EBAYE)**
- **LOSIN TRANSITION (SSTIK3.LOSIN)**
- **NTELL TRANSITION (SSTIK3.NTEL)**
- **YYUNG TRANSITION (SSTIK3.YYUNG)**

**TAKEOFF OBSTACLE NOTES**

Rwy 1L: Ships beginning 1646' from DEI, right and left of centerline, up to 150' AGL/150' MSL.
Rwy 1R: Ships beginning 1173' from DEI, right and left of centerline, up to 150' AGL/150' MSL.

**TAKEOFF MINIMUMS**

Rwy's 1L/R: Standard with minimum climb of 500' per NM to 2000.

**NOTE:** RNAV 1.
**NOTE:** DME/DME/IRU or GPS required.
**NOTE:** RADAR required.
**NOTE:** Do not exceed 210K until leaving S20.

**NOTE:** Chart not to scale.