LAX/Community Noise Roundtable

Work Program A13 –
North Downwind Arrival Study Results

June 8, 2016
Presentation Outline

• Background
• Study Roles
• Study Design
• Study Elements
• Study Results
• Questions and Answers
Background

• 2012 – LAWA begins receiving complaints about low, loud, frequent aircraft noise events over Culver City
  – Culver City lies beneath the North Downwind Arrival course into LAX, which has been in use for decades

• 2014 – LAWA examines aircraft altitudes over Culver City and finds no obvious changes in aircraft altitudes or flight track locations
  – Culver City becomes a member of the LAX/Community Noise Roundtable and Culver City residents frequently attend Roundtable meetings to express concerns about low, loud, and frequent aircraft noise events
Background

- October 2015 – Residents north and south of the North Downwind Arrival course perceive aircraft are lower, louder, and more frequent

- November 2015 – LAWA examines flights over Pacific Palisades and finds no obvious changes in aircraft altitudes and flight track locations

- January 2016 – FAA SoCal TRACON Staff Present on the North Downwind Arrivals to the LAX Roundtable; finds no obvious changes in aircraft flight track locations
Background

- March 2016 – LAWA authorizes ESA and HMMH to begin the North Downwind Arrival Study
- May 2016 – The LAX/Community Noise Roundtable adopts Work Program Item A13 - North Downwind Arrival Study
- June 2016 - The LAX/Community Noise Roundtable holds a special meeting to review and discuss the North Downwind Arrival Study results
Background – Key Terms

- **North Downwind Arrival** – The standard arrival course for aircraft arriving from the north and west of LAX

- **Santa Monica VOR** – A navigational aid on the southwest edge of Santa Monica Airport (SMO)

- **Radial** – An electronic signal with a specific heading to or from a VOR

- **Fix/Waypoint** – A named coordinate in the airspace that aircraft fly to/over
Background – Key Terms

- **National Airspace System (NAS)** – The navigable airspace that is controlled by the Federal Aviation Administration

- **Area Navigation (RNAV)** – Permits navigation on any desired flight path

- **Vectors** – Directions provided by the air traffic controllers to pilots to navigate from point to point
Background – Key Terms

- SMO VOR
- 068° Radial
- JAVSI Fix
Background – Key Terms

• SMO VOR

Source: Google Earth, ESA 2016
Background – Key Terms

• **Federal Aviation Administration (FAA)** – The federal agency responsible for the safe and efficient use of the NAS

• **Los Angeles World Airports (LAWA)** – Owner/operator of Los Angeles International Airport (LAX)

• **Airlines/aircraft operators** – Schedule aircraft arrivals and departures and make aircraft purchases to meet passenger demands

• **Passengers** – Create the travel demand that drives when and how frequently the airlines schedule flights; fund research and development for newer/quieter aircraft through ticket taxes
Study Roles

- **LAWA** – Initiate and fund the study effort and review the study results
- **ESA** – Develop the scope of work for the Study, review HMMH’s work, and present the Study Results
- **HMMH** – Serve as an independent consultant analyzing large amounts of flight track and altitude data over several years
- **Roundtable** – Provide a forum for the Study results to be reviewed and discussed
Study Design

• Look at flight track and altitude data in new ways; focused on visual images and data trends

• Analyze the data in a fine-grain manner on a month-over-month, year-over-year basis to identify any changes

• See if the data reveal any new insights into the origin of the community’s aircraft noise complaints
Study Design

- Identify up to ten locations for data analysis
  - Generally associated with areas of increased noise complaints or navigational fixes
- Analyze data from 2010 through 2015 on a monthly basis
- Assess Changes in Slant Distance
- Prepare Altitude Distribution Graphs
- Analyze Time of Day Distribution
- Prepare Flight Track Density Plots
Study Design

• Review Historic Arrival Procedures and Fixes

• Compare Average Sound Exposure Levels

• Analyze Changes in Aircraft Fleet Mix

• Prepare a Technical Memorandum

• Present the Study Results at a Special LAX/Community Noise Roundtable Meeting
Study Design

• LAWA staff also performed extensive additional analyses including:
  – Analyzing the timing and geographic distribution of aircraft noise complaints
  – Comparing the timing of notable events (e.g., major runway closures) to the increase in aircraft noise complaints in the vicinity of the North Downwind Arrival

• The net result of this effort was a comprehensive, detailed, and thorough examination of aircraft operations, flight tracks, altitudes, slant distances, fleet mix, aircraft noise levels, and noise complaints related to the North Downwind Arrival from 2010 through 2015
Study Results

• Due to the quantity of data analyzed, we are providing examples from several representative locations during tonight’s meeting

• The representative examples are indicative of the changes we saw in the other data sets for the other locations along the length of the North Downwind Arrival course
Study Results – Review Arrival Procedures

- There is only one published arrival procedure associated with the North Downwind; a Standard Terminal Arrival Route (STAR) called SADDE SIX

- SADDE SIX was published as early as 2004 and continues to be used through today
Study Results – Review Arrival Procedures

• On September 20, 2012, the FAA published two RNAV STAR arrival procedures; SYMON and KEACH. However, on September 19, 2012, the FAA published a Notice to Airmen (NOTAM) indicating the procedure was not available for use.

• Both procedures were removed from publication by the FAA on August 19, 2015.

• Since these procedures were not available for use, they do not appear to have contributed to the increase in the noise complaints associated with the North Downwind Arrival.
Study Results – Data Analysis Locations

• Seven (7) Community-based locations

• Three (3) Navigational fixes

Source: Google Earth, HMMH 2016
## Study Results – Gate Configuration and Locations

<table>
<thead>
<tr>
<th>Analysis Points/Gates</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Geographic Reference</th>
<th>Elevation (ft)</th>
<th>Heading (deg)</th>
<th>L/R - Width (ft)</th>
<th>Floor (ft)</th>
<th>Ceiling (ft)</th>
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<tr>
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<td>100</td>
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<td>Palms Blvd &amp; McLaughlin Ave</td>
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</tr>
</tbody>
</table>

Source: LAWA, HMMH 2016
Study Results – Data Analysis Locations

Source: Google Earth, HMMH 2016
Study Results – Data Analysis Locations

Source: Google Earth, HMMH 2016
Study Results – Activity Levels

- Aircraft operations increased 22% on the North Downwind Arrival over the six-year analysis period.
- This increase is consistent with the growth in overall traffic at LAX.

Source: HMMH 2016
### Study Results – Fleet Mix Group Categories

<table>
<thead>
<tr>
<th>Group</th>
<th>Sample Aircraft Type</th>
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</thead>
<tbody>
<tr>
<td>Large Narrow-Body</td>
<td>B727, B757, B787</td>
</tr>
<tr>
<td>Large Wide-Body</td>
<td>A330, A340, B747, B777, MD11</td>
</tr>
<tr>
<td>New Large Aircraft</td>
<td>A380, B748</td>
</tr>
<tr>
<td>Small Jet</td>
<td>B717, CRJ, E145, Business Jets</td>
</tr>
<tr>
<td>Small Narrow-Body</td>
<td>A320, B737, MD80, MD88, MD90</td>
</tr>
<tr>
<td>Small Wide-Body</td>
<td>A300, A310, B767</td>
</tr>
<tr>
<td>Non-Jet</td>
<td>Wide Range of Piston-Driven Aircraft</td>
</tr>
</tbody>
</table>

Source: HMMH 2016
Study Results – Change in Fleet Mix by Category

- The Small Narrow-Body, Small Jet, Large Narrow-Body, and New Large Aircraft categories have grown steadily since 2012.

- The Non-Jet aircraft steadily declined over the six-year study period.

Source: HMMH 2016
Study Results – Change in Fleet Mix by Category

Source: HMMH 2016
• Sound exposure levels (SEL) for each gate location were modeled using the Standard Grid calculation feature of the FAA’s Integrated Noise Model (INM) Version 7.0d

• HMMH used a proprietary software system called RealContours™ that turned each radar flight track into a modeled track for use in the INM to calculate the daily SELs for each aircraft group/category for each gate

• The daily SELs were then averaged to compute an average monthly SEL value for each aircraft group or category at each key location

• Monthly SELs were calculated for the month of April from 2010 through 2015 as well as October 2014 and October 2015
• The Large Narrow-Body group is showing a slight upward trend in average SEL values
Study Results – Sound Exposure Level Calculations

• The Large Wide-Body group is showing virtually no change in average SEL values during the six-year study period
• Since 2012, the New Large Aircraft group is showing a slight increase in average SEL values
• The Small Narrow-Body group is showing virtually no change in average SEL values over the six-year study period
With the exception of October 2015, the Non-Jet group is generally showing a slight decrease in average SEL values over the six-year study period.
Study Results – Time of Day Distribution

Hourly Activity Levels
2010 vs 2015

Source: HMMH 2016
• Altitude and slant distances graphs were prepared for each aircraft category for each gate for the six-year study period

• The graphs for each gate were compared on a month-to-month basis to identify any changes that may have occurred over the six-year period

• With the exception of the non-jet aircraft category, the month over month results were relatively consistent

• The following slides offer a sample slant distance graph for Santa Monica Canyon and for sample altitudes for 2014 and 2015 for four representative gate locations
Study Results – Slant Distances by Year

Santa Monica Canyon

0  1  2  3  4  5  6  7  8  9  10  11  12  13  14  15  16  17  18  19  20  21  22  23

2010  2011  2012  2013  2014  2015
With the exception of non-jet aircraft, the altitudes are consistent across aircraft categories from 2014 to 2015.
• With the exception of non-jet aircraft, the altitudes are consistent across aircraft categories from 2014 to 2015
• With the exception of non-jet aircraft, the altitudes are consistent across aircraft categories from 2014 to 2015
• With the exception of non-jet aircraft, the altitudes are consistent across aircraft categories from 2014 to 2015
Study Results – Flight Track Density Maps

- Flight track density maps were developed for each month over the six-year analysis period

- As a result, 72 Flight track density maps were prepared, which were individually examined for noticeable changes throughout the six-year period

- The data are generally consistent until the summer of 2014, remain changed for approximately 12 months, and then return to the patterns of the previous four years

- The following images illustrate these recent changes
Study Results – Altitude Distribution Graphs

• Altitude distribution graphs were developed for all ten gates, each month over the six-year analysis period

• As a result, 720 altitude distribution graphs were prepared (i.e., 72 for each gate), which were examined for noticeable changes throughout the six-year period

• As with the flight track density graphs, the data are generally consistent until the summer of 2014, remain changed for approximately 12 months, and then return to the patterns of the previous four years

• The following images illustrate these recent changes
Study Results

Study Results – Altitude Distribution Graphs

Primary Flight Corridor

Flight Track Dispersion

Gate Center Point

Left of Center Point (North)

Right of Center Point (South)

Deviation -270  Altitude 9920
Malibu_Colony Jul 2014

Deviation -270  Altitude 9920
Malibu_Colony Feb 2015

Deviation -270  Altitude 9920
Study Results

Malibu Colony Aug 2015

Deviation -120  Altitude 9920
Study Results – Altitude Distribution Graphs

Malibu_Colony Oct 2015

Deviation -60  Altitude 9920
Santa_Monica_Canyon Feb 2014

Deviation 6540  Altitude 8115
Study Results

Santa Monica Canyon Apr 2014

Deviation 6555  Altitude 8085
Study Results

Santa Monica Canyon Oct 2014

Deviation 6555
Altitude 7845
Study Results – Altitude Distribution Graphs

Santa Monica Canyon May 2015

Deviation 6630   Altitude 7875
Study Results

Santa_Monica_Canyon Jul 2015

Deviation 6600   Altitude 7815

[Heatmap of data distribution with axis labels: Deviation (ft) on the x-axis and Altitude (ft) on the y-axis.]
Study Results

Study Results – Altitude Distribution Graphs

Santa_Monica_Canyon Sep 2015

Deviation 6660   Altitude 8040

The graph above shows the distribution of deviations and altitudes for the Santa Monica Canyon in September 2015. The data points represent various measurements, with the concentrations highlighting areas of significant occurrences.
Santa_Monica_Canyon Oct 2015

Deviation 6660  Altitude 7830
Santa Monica Canyon Nov 2015

Deviation 6660  Altitude 7920
Study Results

Culver_City Jan 2015

Deviation -280  Altitude 6020
Culver_City May 2015

Deviation -270
Altitude 6070
Study Results

Study Results – Altitude Distribution Graphs

Culver_City Jun 2015

Deviation -270  Altitude 6040
Study Results

Study Results – Altitude Distribution Graphs

Culver_City Sep 2015

Deviation -360  Altitude 6280
Adams_Vermont Apr 2014

Deviation 2113  Altitude 4900
Study Results – Altitude Distribution Graphs

Adams_Vermont Jun 2014

Deviation 2113  Altitude 4940
Adams_Vermont May 2015

Deviation 2038  Altitude 4420
Study Results – Histogram Deviation Graphs

• For each altitude distribution graph, a histogram was created for the range of altitudes and relative gate location for each month for each gate.

• The histogram peak altitude depicts where the most concentrated altitudes occurred, while the histogram deviation plot indicates changes in gate crossing locations.

• These values were compared on a month-to-month basis for each gate to determine whether any changes occurred over the six-year period.

• Two changes in the nominal location of flight tracks were revealed:
  – One west of the SMO VOR in approximately July 2011
  – One east of the SMO VOR in approximately June of 2014
Study Results – Histogram Deviation Graphs

- The gate deviation graph reflects a change in gate crossing location in approximately July 2011.

- The altitude graph reflects a consistent histogram peak altitudes throughout the six-year study period.

Source: HMMH 2016
Study Results – Histogram Deviation Graphs

- The gate deviation graph reflects a change in gate crossing location in approximately July 2011.

- The altitude graph reflects a consistent histogram peak altitudes throughout the six-year study period.

Source: HMMH 2016
Study Results – Histogram Deviation Graphs

• The gate deviation graph reflects changes in gate crossing locations from April through October 2012

• The altitude graph reflects a range from approximately 6,900 feet to 6,000 feet over the six-year study period

Source: HMMH 2016
Study Results – Histogram Deviation Graphs

• The gate deviation graph reflects a couple of changes in gate crossing locations from January through August 2012.

• The altitude graph reflects a range from approximately 4,900 feet to 3,900 feet over the six-year study period.

Source: HMMH 2016
To examine whether there was a correlation between the changes in aircraft flight tracks and noise complaints, LAWA staff plotted noise complainant locations over representative flight tracks.

The complainant locations were grouped into four six-month periods during 2014 and 2015.

For clarity, the complainant distribution plots are presented in two groups:

- One for the areas to the west of the SMO VOR
- One for the areas east of the SMO VOR
Study Results – Complainant Distribution West of SMO VOR

Complainant Data:
January – June 2014

Flight Track Data:
April 2014

- Complainant Location

Source: LAWA, HMMH 2016
Study Results – Complainant Distribution West of SMO VOR

Complainant Data: July – December 2014

Flight Track Data: October 2014

- Complainant Location

Source: LAWA, HMMH 2016
Study Results – Complainant Distribution West of SMO VOR

Complainant Data: January – June 2015

Flight Track Data: April 2015

Complainant Location

Source: LAWA, HMMH 2016
Study Results – Complainant Distribution West of SMO VOR

Complainant Data: July – December 2015

Flight Track Data: October 2015

Complainant Location

Source: LAWA, HMMH 2016
Study Results – Complainant Distribution East of SMO VOR

Complainant Data:
January – June 2014

Flight Track Data:
April 2014

Source: LAWA, HMMH 2016
Study Results – Complainant Distribution East of SMO VOR

Complainant Data:
July – December 2014

Flight Track Data:
October 2014

- Complainant Location

Source: LAWA, HMMH 2016
Study Results – Complainant Distribution East of SMO VOR

Complainant Data: January – June 2015

Flight Track Data: April 2015

- Complainant Location

Source: LAWA, HMMH 2016
Study Results – Complainant Distribution East of SMO VOR

Complainant Data:
July – December 2015

Flight Track Data:
October 2015

Source: LAWA, HMMH 2016
### Study Results – Timeline 2010 - 2015

**Number of Individuals Reporting Noise Concerns Along the North Arrival Route**

#### Notable Events

- **7/21/2012 - 10/22/2012 Weekend RWY Closures - Marking Repairs**
- **9/1/2014 - 2/28/2015 FAA LOOP Departure Test**
- **3/6/2015 - 4/7/2015 RWY 25L Closure - RSA**
- **6/29/2015 - 10/5/2015 FAA So Cal Metroplex EA Release & Comment Period**
- **6/10/2015 - 10/8/2015 RWY 24R Closure - RSA**

#### Key Communities Along North Arrival Route:

<table>
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<tr>
<th>Community</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
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Study Results – Timeline 2014 - 2015

Number of Individuals Reporting Noise Concerns Along the North Arrival Route

Notable Events

- Temporary Narrowing of N. Arrival Flight Tracks
- FAA LOOP Departure Test
- RWY 25L Closure - RSA
- FAA So Cal Metroplex EA Release & Comment Period
- RWY 24R Closure - RSA
Summary

- Increases in Operations from 2010 to 2015 – 22%
  - All aircraft types except non-jet aircraft

- Changing Fleet
  - More regional jets
  - Ten-fold increase in New Large Aircraft (A380 and B748)
  - Large two-engine aircraft (B777 and B787) replacing large four-engine aircraft (B747)
  - Fewer non-jet aircraft

- SEL “trends” reflect the changing fleet mix within each category

- Altitudes and slant distances remain largely unchanged
Summary

• Noticeable temporary change in flight track density from Summer 2014 through Summer 2015 in Mar Vista, Culver City, Crenshaw, and Adams-Vermont gates

• Slight change in the flight track centroid at Malibu-Colony, Santa Monica Canyon, and Getty Villa gates in July of 2011

• Various events have resulted in increased awareness of the traffic flow, and resulted in increasing numbers on individuals submitting complaints, but there is no one explanation for this increase
Questions

Thank you for your attention!