FAA Perspective on Challenges Posed by Aircraft Noise

To: Quiet Skies Caucus
By: Federal Aviation Administration
Date: July 25, 2017
Outline

• Introduction
• Addressing the Aircraft Noise Challenge
  – Impacts of Noise
  – Outreach
  – Mitigation
  – Community Engagement
• Closing observations
Community Noise from Aircraft

Aircraft Noise

- Engine & Jet Exhaust
- Airframe
- Undercarriage

All noise sources contribute to acoustic signature – both at takeoff and during landing

Landing Takeoff Cycle

- Approach: 2,000 m from threshold
- Airport Perimeter
- Sideline: 450 m from runway edge
- Flyover: 6,500 m from brakes off

Community Exposure

Community exposure set by aircraft types and operational tempo over day and night
Historical Trends: Source Noise and Noise Exposure

- A factor of 20 decrease in community noise exposure has been accompanied by increased community concerns.
- GAO Reports state environmental issues can cause delay in projects\(^1,2\).
- The implementation of precision aircraft navigation over the last few years has been accompanied by increased airport community concerns regarding noise.

Source:
Addressing the Aircraft Noise Challenge

- **Understanding Impact of Noise**
  - Noise impacts: annoyance, sleep, cardiovascular health and children’s learning
  - Improving modeling capabilities
  - Evaluating current aircraft, helicopters, commercial supersonic aircraft, unmanned aerial systems, and commercial space vehicles

- **Outreach**
  - Increase public understanding
  - Community outreach

- **Mitigation**
  - Land use planning
  - Vehicle operations
  - Airframe and engine technology
  - Aircraft architecture
ASCENT Center of Excellence

Lead Universities:
Washington State University (WSU)*
Massachusetts Institute of Technology (MIT)

Core Universities:
Boston University (BU)
Georgia Institute of Technology (Ga Tech)
Missouri University of Science and Technology (MS&T)
Oregon State University (OSU)*
Pennsylvania State University (PSU)*
Purdue University (PU)*
Stanford University (SU)
University of Dayton (UD)
University of Hawaii (UH)*
University of Illinois at Urbana-Champaign (UIUC)*
University of North Carolina at Chapel Hill (UNC)
University of Pennsylvania (UPenn)
University of Tennessee (UT)*
University of Washington (UW)*

* Denotes USDA NIFA AFRI-CAP Leads and Participants & Sun Grant Schools

Advisory Committee - 58 organizations:
5 airports
4 airlines
7 NGO/advocacy
9 aviation manufacturers
11 feedstock/fuel manufacturers
22 R&D, service to aviation sector

For more information: https://ascent.aero/
# ASCENT Expertise in Public Health

<table>
<thead>
<tr>
<th>ASCENT Universities</th>
<th>School of Public Health*</th>
<th>NIEHS Funded Studies**</th>
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<tr>
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<td>Washington State University</td>
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*Based on listing by The Council on Education for Public Health (CEPH) as an accredited institution ([http://ceph.org/accredited/search/](http://ceph.org/accredited/search/))

**Based on listing by the NIEHS grants search engine ([https://tools.niehs.nih.gov/portfolio/index.cfm/portfolio/search](https://tools.niehs.nih.gov/portfolio/index.cfm/portfolio/search))
ICAO CAEP Environmental Report
AVIATION NOISE IMPACTS: STATE OF THE SCIENCE

Contents:
1. Introduction
2. Community Annoyance
3. Children’s Learning
4. Sleep Disturbance
5. Health Impacts
6. Civilian Supersonic Aircraft: A Future Source of Aviation Noise
7. Conclusions

Available at:
http://www.icao.int/environmental-protection/Pages/env2016.aspx
Annoyance

• **Objective:** To ensure that an accurate understanding of the relationship between aircraft noise exposure and its effects on communities around airports is available
  – A comprehensive community annoyance survey around 20 representative U.S. airports for all aircraft types has been conducted
  – A helicopter specific annoyance survey is in active development

• **Results:** Annoyance survey results will provide updated information on the percent of the population highly annoyed to different levels of aircraft and helicopter noise exposure

• **Status and Timeline:**
  – By end of calendar year 2017, results from community annoyance survey and resulting noise policy considerations planned for release through federal register
  – By end of calendar year 2019, helicopter annoyance survey should be completed
  – Results from annoyance surveys will be considered when developing noise policy updates over next several years
Sleep Disturbance

- **Objective:** Develop and use an inexpensive, scientifically sound methodology to obtain objective measures of sleep disturbance from aircraft noise

- **Results:** Study results will be used to develop relationship between aircraft noise exposure and sleep disturbance. This data will inform future considerations regarding aviation noise in the U.S.

- **Status and Timeline:**
  - 2016 - 1st airport pilot study: established feasibility of unattended acquisition of acoustic and physiological field data, unattended sleep measurements
  - 2017 - 2nd airport pilot study: to determine field study recruitment methodology that maximizes response rate and minimizes cost; no staff; all equipment is mailed
  - 2018 - national field study begins: acquire current objective sleep disturbance data relative to varying degrees of exposure at many airports; 4-5 year effort
Cardiovascular Health

- **Objective:** Determine what, if any, correlation exists between cardiovascular disease and aviation noise. Comparing historic, modeled noise levels with existing epidemiological studies.

- **Results:** The research using Medicare data does suggest a positive link between certain levels of aircraft noise exposure and hospitalizations due to cardiovascular disease for persons over 65 years of age. However, this result is provisional, as the study relies on the Medicare database that has gaps and there are unexplained differences in the response of different communities.

- **Status and Timeline:**
  - Existing health study cohorts are being used to evaluate linkages between health outcomes and noise exposure while accounting for wide range of factors
  - 2015 – initiated ASCENT work using Medicare database – effort has been expanded to look at other health cohort databases
  - 2020 – complete research with current health cohorts
  - Seeking to leverage additional, existing heath studies to improve our understanding
  - Intend to use information to develop improved noise exposure metrics for consideration in future noise policy

More Information:
ASCENT Project 003 website:
https://ascent.aero/project/noise-impact-health-research/
Children’s Learning

- **Objective:** To better understand any potential effects of aviation noise exposure on the outcomes of reading comprehension and learning motivation in school age children

- **Results:** FAA participation Through the Airport Cooperative Research Program (ACRP)
  - The completed *Assessing Aircraft Noise Conditions Affecting Student Learning* research study has found that a small but statistically significant correlation between noise exposure and student test scores exists
  - A follow on research program on *Assessing Aircraft Noise Conditions Affecting Student Achievement* was initiated to examine specific case studies to measure factors at the individual classroom, teacher and student level

- **Status and Timeline:**
  - 2013 – completed initial ACRP study
  - Late 2017 – complete follow-up ACRP study on neighborhood schools in Los Angeles area
  - Additional studies are being planned which will seek to cover broader cross-section of schools around U.S. airport communities.

**More information:**
Noise Complaint Initiative

- Allow FAA to more efficiently and effectively respond to and address noise complaints in a clear, consistent and repeatable manner that is responsive to the public and applies the best use of FAA resources
- Established a cross-agency team to gather data on complaints, assess current processes, and recommend process improvements
  - Development of webpages to better educate the public on initiatives that FAA is taking to address aircraft noise
  - Development of a Noise Portal and associated repository to improve our internal coordination and result in more efficient and consistent responses to the public as well as provide a more effective means for the FAA to evaluate trends and identify areas of concern
- Currently conducting a test in the Eastern Service Center (ends in September)
- Pending successful results during the test period, the test will be expanded to the Central and Western Service Centers for additional testing
- Anticipate finalized testing by the end of 2017 with full implementation in early 2018
Modeling Noise

Aviation Environmental Design Tool (AEDT)
- Computes noise, fuel burn and emissions
- Required for all regulatory actions

AEDT Development Plan
- Current version of tool, AEDT2c, was designed to model DNL 65
- Developing AEDT3 with release in 2018
  - Seeking to improve ability at lower DNL
  - Improving takeoff weight and thrust modeling
  - Improving aircraft performance module
- Laying ground work to incorporate airframe noise more explicitly – looking to 2020 release

For more information on AEDT or to download it, please visit: https://aedt.faa.gov/
Modeling Operational Improvements

Enhanced air traffic evaluation framework

- Seeking better integration of noise into flight procedure design
- Current analytical approach focused on engine noise
- New framework also considers airframe noise
- Being developed by MIT through ASCENT Project 23

Case study to test framework

- Testing framework to determine if it is able to evaluate procedures and procedure modifications with noise reduction potential
- Procedure ideas coming from MOU between FAA and MassPort
- Expect results in 2018
Aircraft Operations

Opportunities for noise reduction:
- Precision navigation determines *where* aircraft fly
- Airlines determine *when* the aircraft fly
- There might be opportunities to change *how* aircraft are flown to reduce noise

Concepts being evaluated:
- Route changes
- Thrust / speed management
  - Noise abatement departure procedures
  - Manage thrust and configuration to lower noise on takeoff and approach
- Vertical profile
  - Continuous climb operations
  - Continuous descent arrival
  - Modified approach angles
  - Staggered or displaced landing thresholds
  - Want to keep aircraft higher for longer periods and reduce level offs
- Reintroduce systematic dispersion

1. Concepts are being evaluated by the MIT Team as a part of the Massport-FAA MOU (see Project 23 website), MITRE, and other efforts within FAA. For more information on ASCENT Project 23: https://ascent.aero/project/analytical-approach-for-quantifying-noise-from-advanced-operational-procedures/
Continuous Lower Energy, Emissions & Noise (CLEEN)

- FAA led public-private partnership with 50-50 cost share from industry
- Reducing fuel burn, emissions and noise via aircraft and engine technologies and alternative jet fuels
- Conducting ground and/or flight test demonstrations to accelerate maturation of certifiable aircraft and engine technologies

<table>
<thead>
<tr>
<th></th>
<th>CLEEN I</th>
<th>CLEEN II</th>
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<tbody>
<tr>
<td><strong>Time Frame</strong></td>
<td>2010-2015</td>
<td>2016-2020</td>
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<tr>
<td><strong>FAA Budget</strong></td>
<td>~$125M</td>
<td>~$100M</td>
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<td><strong>Noise Reduction Goal</strong></td>
<td>32 dB cumulative noise reduction</td>
<td>32 dB cumulative noise reduction</td>
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<tr>
<td><strong>NOX Emissions Reduction Goal</strong></td>
<td>60% landing/take-off NOX emissions</td>
<td>75% landing/take-off NOX emissions</td>
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<tr>
<td><strong>Fuel Burn Goal</strong></td>
<td>33% reduction</td>
<td>40% reduction</td>
</tr>
<tr>
<td><strong>Entry into Service</strong></td>
<td>2018</td>
<td>2026</td>
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For more information: [http://www.faa.gov/go/cleen](http://www.faa.gov/go/cleen)
Noise Certification Standard

- Rulemaking required for Stage 5, which applies to new airplane design on or after December 31, 2017 and December 31, 2020 depending on airplane takeoff weight.
- Sets a lower noise limit for newly certificated airplanes and harmonizes the U.S. noise certification standards with those certificated under international standards.
- The FAA published the Notice of Proposed Rulemaking for the Stage 5 rule in January 2016.
- The rulemaking has been finalized and is currently awaiting Administration review prior to publication.
Culture Change Regarding Community Engagement

• 2016 was a transformational year for the FAA’s community involvement strategy and practices
• A comprehensive and strategic approach to community involvement efforts was central to this transformation
• Agency-wide guidance materials were developed and staff are being on best practices for engagement.
• Air Traffic Organization’s efforts around community involvement have focused on:
  o Organizational enhancements
  o Updated and enhanced policies
  o Development of internal guidance
  o Operationalizing enhanced community involvement
The FAA’s Commitment to Community Involvement

Our national aviation system is a vital transportation network connecting people and goods across the country and to other parts of the world. Building on a proud history of innovation in aviation, the Federal Aviation Administration (FAA) is now engaged in transforming the system to meet 21st century air travel needs. As we carry out our mission to provide the safest, most efficient aerospace system in the world, we are accountable to the American public.

The views of communities—including local residents, the general public, and stakeholders—are important to the FAA as we take the next steps to advance the national aviation system. This update to the FAA’s Community Involvement Manual reaffirms our commitment to inform and involve the public and to give meaningful consideration to community concerns and views as the FAA makes aviation decisions that affect them.

Sincerely,

Michael P. Huerta
Administrator

## Community Involvement Guiding Documents (cont’d)

<table>
<thead>
<tr>
<th>FAA Community Involvement Guidance</th>
<th>Scope</th>
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<tbody>
<tr>
<td>FAA Community Involvement Manual*</td>
<td>Agency-wide guidance</td>
</tr>
<tr>
<td>ATO Community Involvement Plan*</td>
<td>ATO’s Report to Congress on outreach activities</td>
</tr>
<tr>
<td>Additional Guidance and Resources (under development)</td>
<td>More specific process guidance, best practices, and templates for Metroplex/single-site teams</td>
</tr>
</tbody>
</table>

Operationalizing Enhanced Community Involvement: Strategies and Techniques

- Public meetings (e.g., public workshops)
- Targeted meetings (e.g., advisory committees, roundtables)
- Internet and technology tools (e.g., webinars, websites, enhanced web-based informational products including simplified and standardized graphics)
- Social media (e.g., Facebook, Twitter)
- Traditional media (e.g., newspaper, mailings, TV and radio, press releases)
Closing Observations

• Quiet Skies Caucus Asks
  – Mandate a robust community engagement
  – Lower DNL level and require supplemental metrics
  – Airport operators are allowed mitigation options less than 65 DNL
  – Reform Section 213 Categorical Exclusions
  – Mandate Independent Research on Noise Health Impacts

• FAA’s Response
  – Community Involvement Manuals, Plans, Noise Complaint Initiative; Regional Administrators involvement, etc.
  – Study on 65 DNL and supplemental metrics are allowed
  – Noise mitigation can be considered outside the 65 DNL contour if there is a current Part 150 program in place
  – Very limited use and process requirements.
  – Ongoing Research with ASCENT Universities on Noise and Emissions Issues
Closing Observations

- Other FAA Efforts
  - Advancing our modeling tools to improve our ability to model aircraft noise.
  - Accelerating technology maturation with industry via CLEEN Program.
  - Examining potential means to reduce noise from the current fleet through operational procedure concepts.
  - Pursuing implementation of new noise standard (Stage 5) for new aircraft.
  - Ongoing work to develop better information to educate communities on noise issues/impacts.
  - Dealing with new users of the NAS (UAS, Commercial Space, Civil Supersonic) and the additional challenges they present.
Additional Background
Noise Metrics for Population Exposure

- **Lmax** - Maximum Noise Level
- **SEL** - Sound Exposure Level
- **Leq** - Equivalent Sound Level
- **DNL** - Day-Night Average Sound Level

Source: ESA Airports
http://www.cityofnsb.com/DocumentCenter/Home/View/595
Equivalent Operations for DNL = 65

DNL provides cumulative noise exposure to many individual noise events.
## Typical Noise Value Comparisons

### DNL Values in Residential Areas

<table>
<thead>
<tr>
<th>Description</th>
<th>Typical Range DNL in dB</th>
<th>Average DNL in dB</th>
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<tbody>
<tr>
<td>Quiet Suburban Residential</td>
<td>48 – 52</td>
<td>50</td>
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<tr>
<td>Normal Suburban Residential</td>
<td>53 – 57</td>
<td>55</td>
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<tr>
<td>Urban Residential</td>
<td>58 – 62</td>
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<tr>
<td>Noisy Urban Residential</td>
<td>63 – 67</td>
<td>65</td>
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<tr>
<td>Very Noisy Urban Residential</td>
<td>68 – 72</td>
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