FAA Perspective on Challenges Posed by Aircraft Noise

To: New York Community Aviation Roundtable

By: Federal Aviation Administration

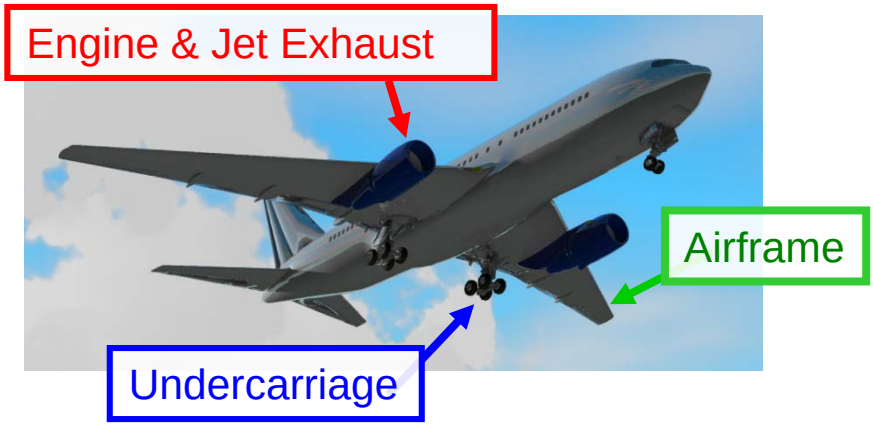
Date: October 30, 2017

Outline

- **Introduction**
- **Addressing the Aircraft Noise Challenge**
  - Impacts of Noise
  - Mitigation
- **Closing observations**

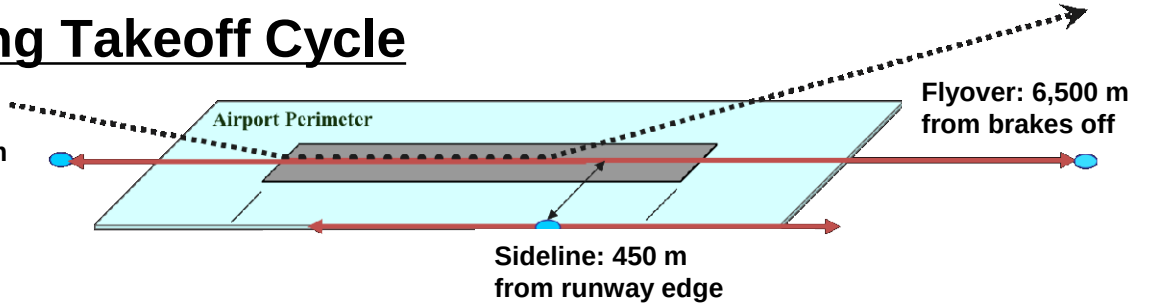
Community Noise from Aircraft

Aircraft Noise

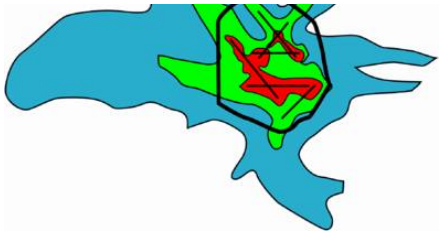


All noise sources contribute to acoustic signature – both at takeoff and during landing

Landing Takeoff Cycle



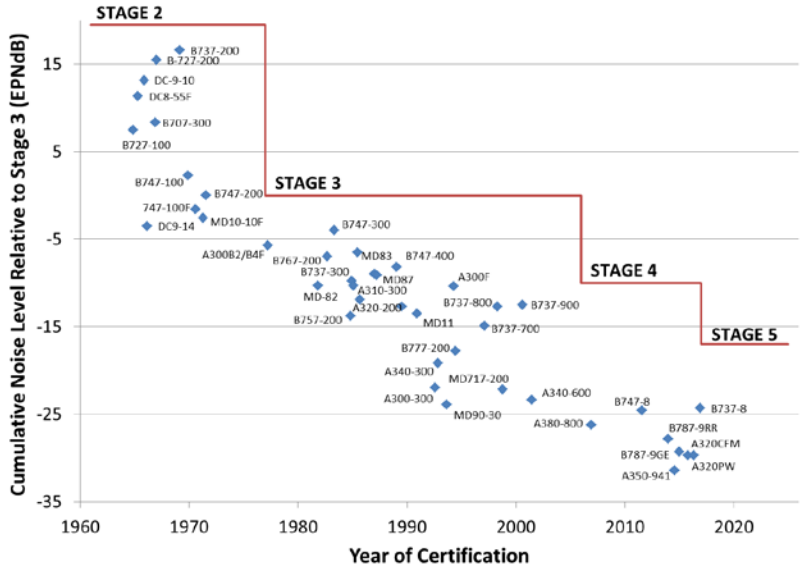
Community Exposure

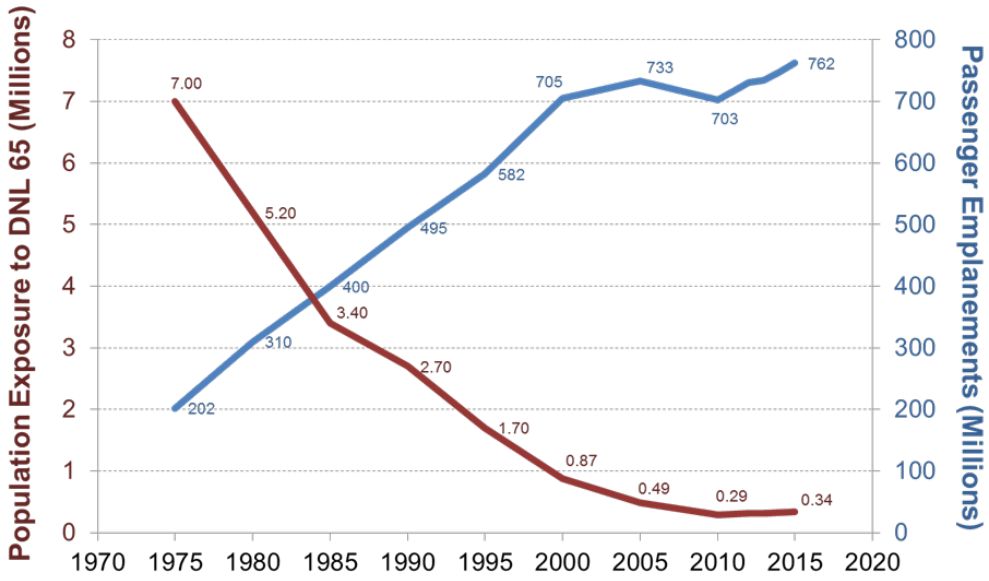


Community exposure set by aircraft types and operational tempo over day and night

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:
1. http://www.gao.gov/archive/2000/rc00153.pdf
2. http://www.gao.gov/assets/310/309622.pdf

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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 involvement
- **Mitigation**
  - Airframe and engine technology
  - Operational procedures
  - Land use planning

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)*

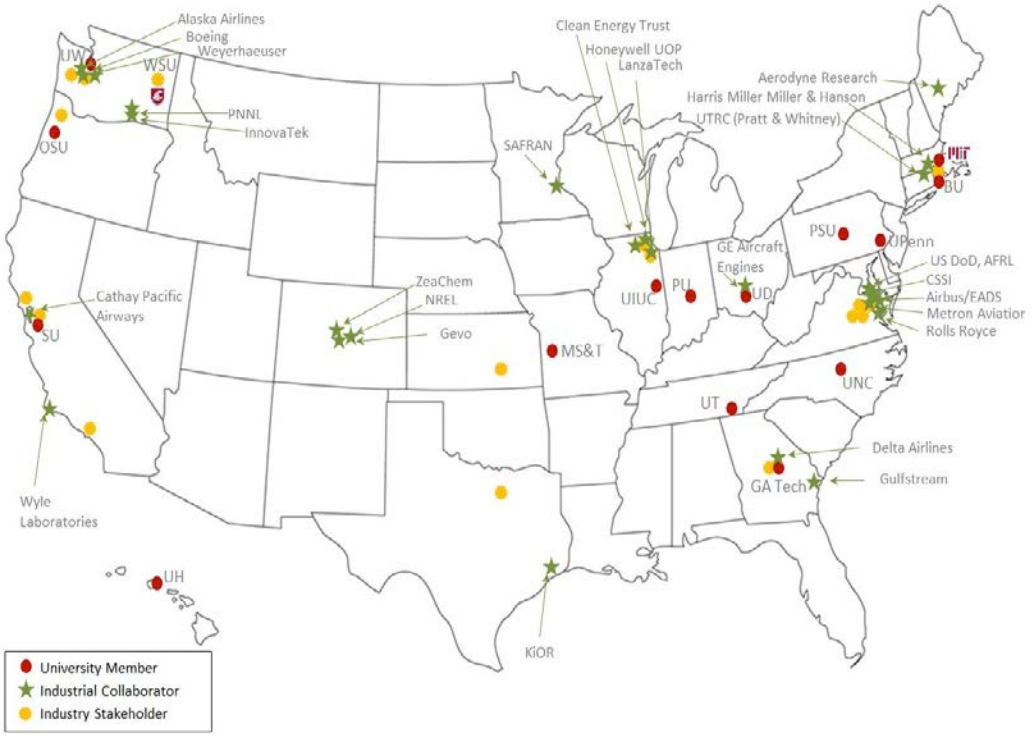
University of Illinois at Urbana-Champaign (UIUC)*

University of North Carolina at Chapel Hill (UNC)

University of Pennsylvania (UPenn)

University of Tennessee (UT)*

University of Washington (UW)*



•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

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

For more information:
https://ascent.aero/

Federal Aviation Administration

ASCENT Expertise in Public Health

ASCENT Universities	School of Public Health*	NIEHS Funded Studies**
Boston University	Yes	Yes
Georgia Institute of Technology	No	Yes
Massachusetts Institute of Technology	No	Yes
Missouri University of Science and Technology	No	Yes
Oregon State University	Yes	Yes
Pennsylvania State University	Yes	Yes
Purdue University	Yes	Yes
Stanford University	No	Yes
University of Dayton	No	No
University of Hawaii	Yes	Yes
University of Illinois at Urbana-Champaign	Yes	Yes
University of North Carolina	Yes	Yes
University of Pennsylvania	Yes	Yes
University of Tennessee	Yes	Yes
University of Washington	Yes	Yes
Washington State University	No	Yes

*Based on listing by The Council on Education for Public Health (CEPH) as an accredited insititution (http://ceph.org/accredited/search/)

**Based on listing by the NIEHS grants search engine (https://tools.niehs.nih.gov/portfolio/index.cfm/portfolio/search)

International 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

WHITE PAPER ON AIRCRAFT NOISE*
AVIATION NOISE IMPACTS:
STATE OF THE SCIENCE

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*This White Paper represents the summary of the scientific literature review undertaken by researchers and internationally-recognized experts. It does not represent a consensus view of ICAO.

Noise is defined as "unwanted sound". Aircraft noise is one, if not the most detrimental environmental effect of aviation. It can cause community annoyance, disrupt sleep, adversely affect academic performance of children, and could increase the risk for cardiovascular disease of people living in the vicinity of airports. In some airports, noise constrains air traffic growth. This white paper summarizes the state of the science of noise effects research in the areas noise measurement and prediction, community annoyance, children's learning, sleep disturbance, and health.

Introduction

Purpose: The goal of this paper is to briefly summarize the current state of scientific knowledge regarding the adverse effects of aircraft noise emissions on the public. Every effort has been made to base the findings upon peer-reviewed publications, carefully reviewed by specialists from around the world. The topics addressed here are community annoyance, children's learning, sleep disturbance, health impacts, and the noise of supersonic aircraft. This white paper also provides some background information on noise measurement and prediction, as well as technical definitions for the interested reader.

Task of the panel: Aircraft noise discussions can be very emotional, and politicians and legislators often struggle to define limit values that both protect the population against the adverse effects of aircraft noise but do not restrict the positive societal effects of air traffic. Noise effects researchers have an important advisory role. They derive so-called exposure-response functions that allow health impact assessments and therefore inform political decision-making. The efforts of the Noise Panel were directed at assessing the current state of the science and provide contracting states with a brief overview of the impacts of aircraft noise on communities. This white paper constitutes a consensus among its authors who have considerable experience in noise effects research, and is based on input from an international expert panel workshop held on February 10 and 11, 2015 in Alexandria, VA, USA. Noise effects depend, among others, on housing structure and cultural values, and legislation and limit values accordingly differ considerably between contracting states. Therefore, the authors did not try to suggest specific limit values, but rather pointed to existing exposure-response functions and recommendations of international organizations.

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

Federal Aviation Administration

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

More Information:
ASCENT Project 017 website:
https://ascent.aero/project/noise-exposure-response-sleep-disturbance/

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 exists between noise exposure and student test scores
  - 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
  - 2017 – complete follow-up ACRP study on neighborhood schools in Los Angeles
  - Additional studies are being planned which will seek to cover broader cross-section of schools around U.S. airport communities.

More Information:
- ACRP 02-26: Assessing Aircraft Noise Conditions Affecting Student Learning http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=2797
- ACRP 02-47: Assessing Aircraft Noise Conditions Affecting Student Achievement--Case Studies http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=3693

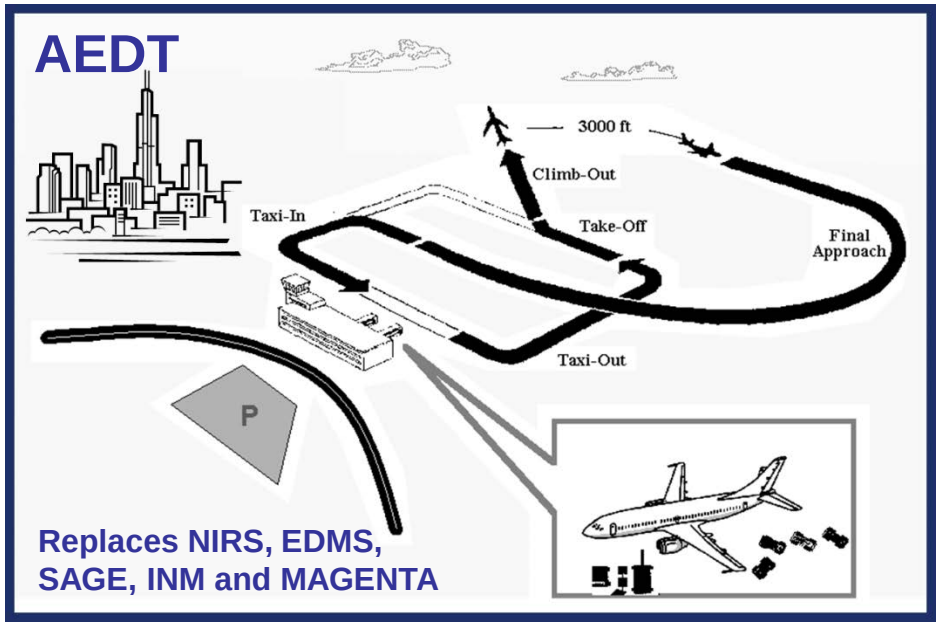
Noise Complaint Initiative

- 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 finishing a test in the Eastern Service Center and plan to expand to the Central and Western Service Centers for additional testing
- Anticipate finalized testing by the end of 2017 with full implementation in 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 capability 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

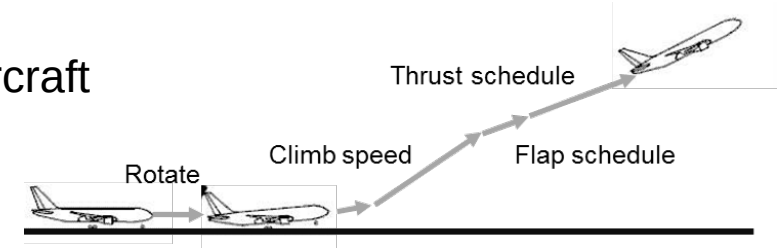
Aircraft Operations

Opportunities for noise reduction:

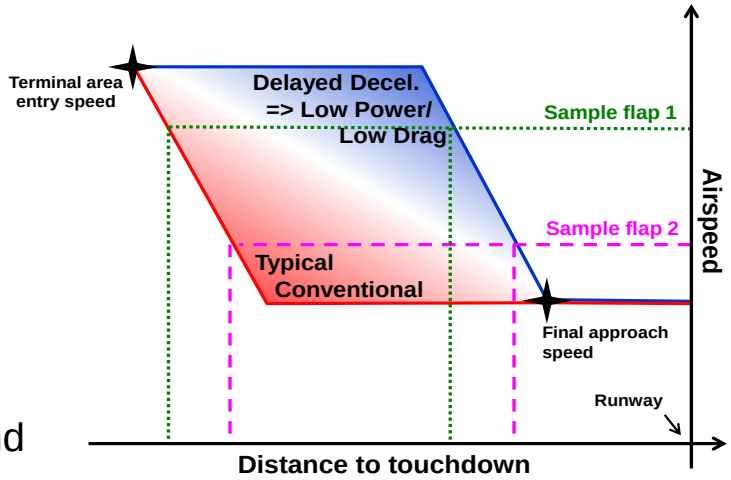
- Precision navigation determines *where* aircraft fly
- Airlines determine *when* the aircraft fly
- There might be opportunities to change *how* aircraft are flown to reduce noise

Concepts being evaluated:[1]

- **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**



Takeoff Profile



Delayed Deceleration Approach

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/

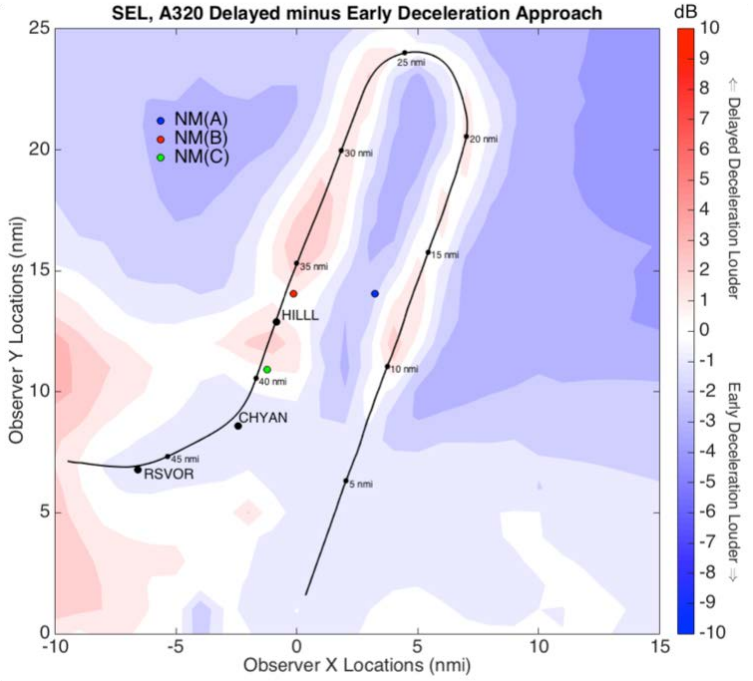
Modeling Operational Improvements

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 COE 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



More Information:
ASCENT Project 23 website: https://ascent.aero/project/analytical-approach-for-quantifying-noise-from-advanced-operational-procedures/

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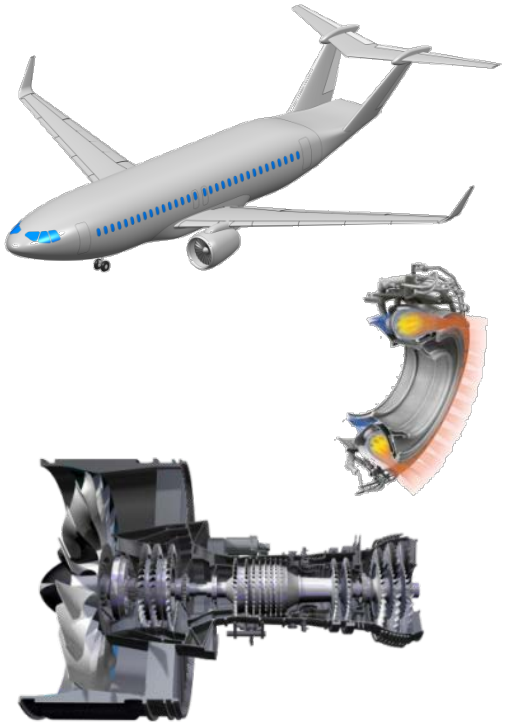
Continuous Lower Energy, Emissions & Noise (CLEEN)

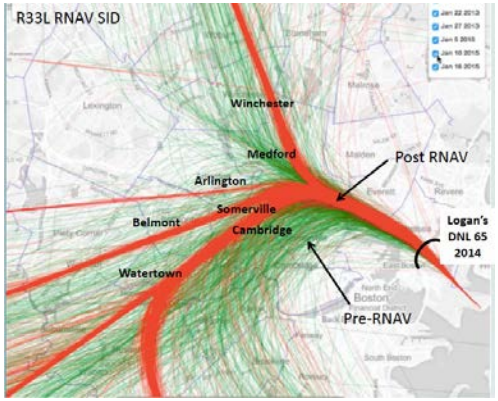
- FAA led public-private partnership with 50-50 cost share from industry
- Reducing fuel burn, emissions and noise by aircraft and engine technologies and alternative jet fuels
- Conducting ground and/or flight test demonstrations to accelerate maturation of certifiable aircraft and engine technologies

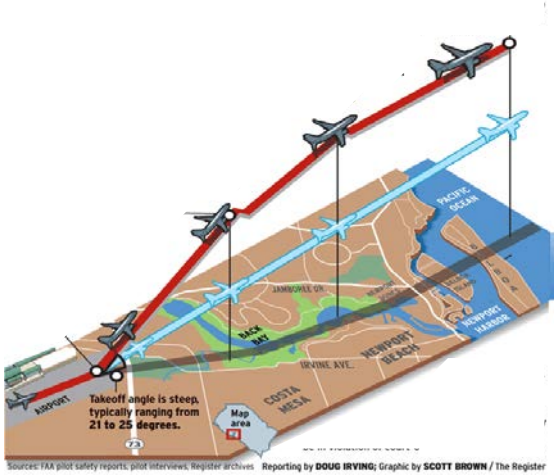
	CLEEN I	CLEEN II
Time Frame	2010-2015	2016-2020
FAA Budget	~$125M	~$100M
Noise Reduction Goal	32 dB cumulative noise reduction	32 dB cumulative noise reduction
NO_X Emissions Reduction Goal	60% landing/take-off NO_X emissions	75% landing/take-off NO_X emissions
Fuel Burn Goal	33% reduction	40% reduction
Entry into Service	2018	2026



Closing Observations

- There has been considerable progress in reducing aircraft noise over time but FAA recognizes that more progress is needed.
- FAA has an aggressive noise research program aimed at better understanding impacts and improving metrics.
- FAA's CLEEN Program is accelerating the commercialization of technologies to reduce noise and emissions.
- FAA research will allow identification of additional measures to reduce aircraft noise impacts on communities around airports.
- Dealing with new users of the NAS (UAS, Commercial Space, Civil Supersonic) and the additional challenges they present.

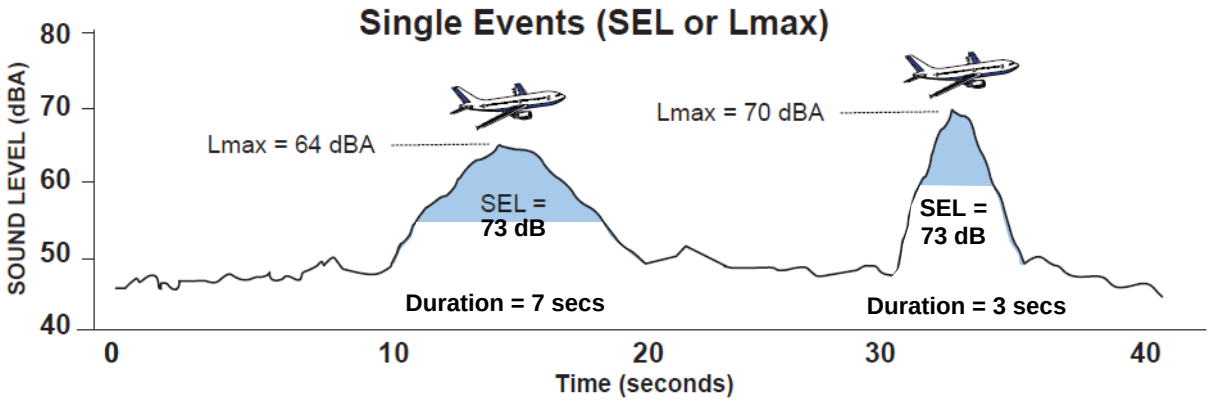




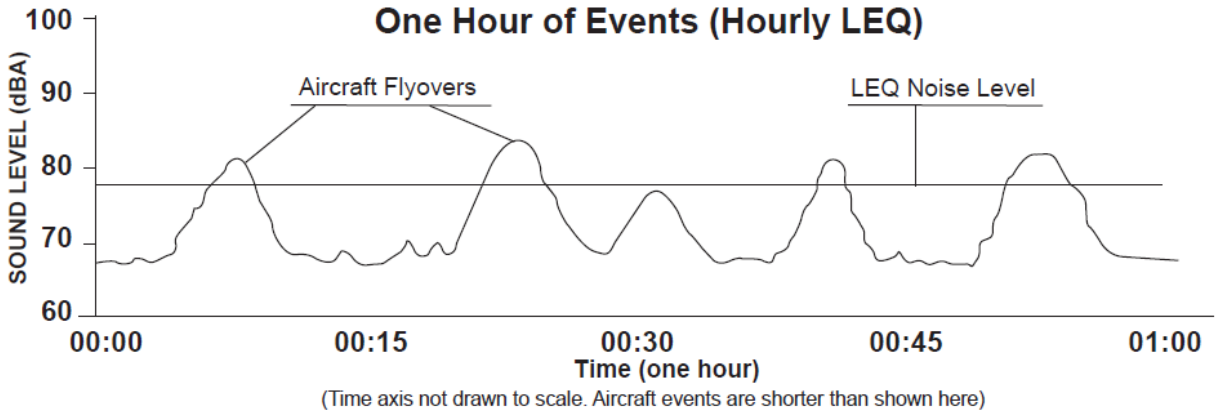
Additional Background

Noise Metrics for Population Exposure

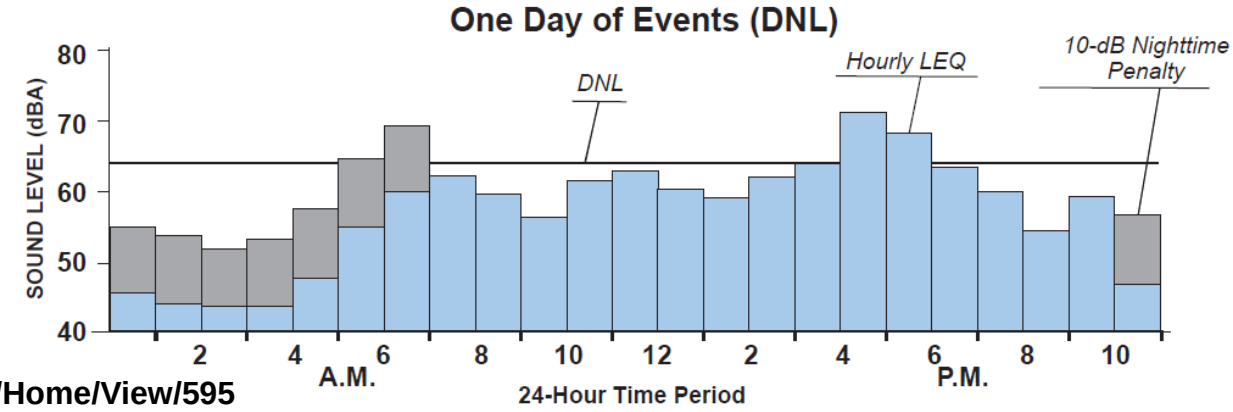
- Lmax - Maximum Noise Level
- SEL - Sound Exposure Level



- Leq - Equivalent Sound Level

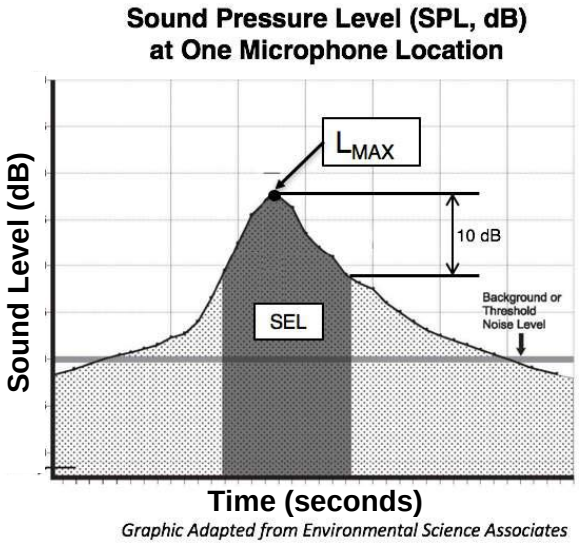


- DNL - Day-Night Average Sound Level

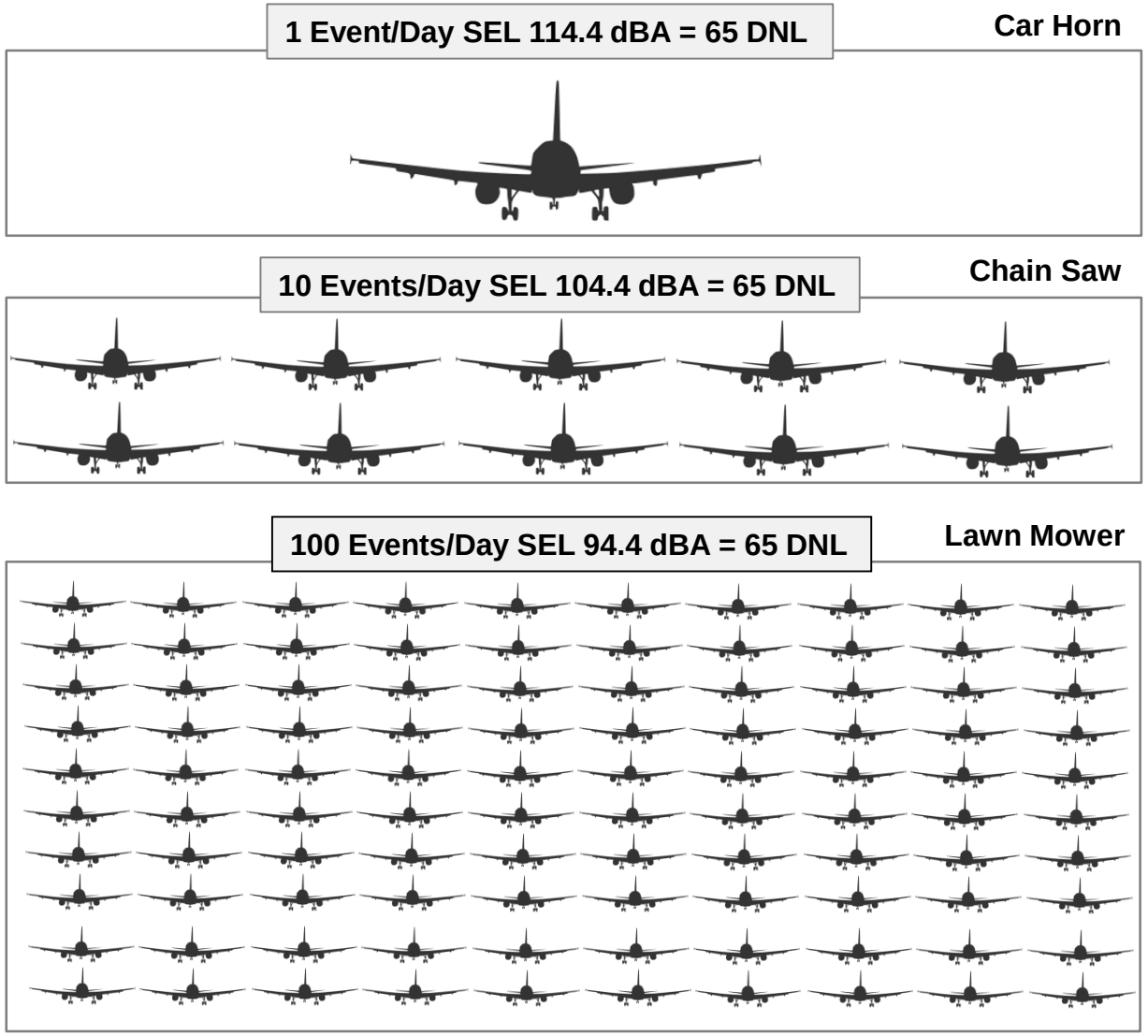


Source: ESA Airports
http://www.cityofnsb.com/DocumentCenter/Home/View/595

Equivalent Operations for DNL = 65



DNL provides cumulative noise exposure to many individual noise events



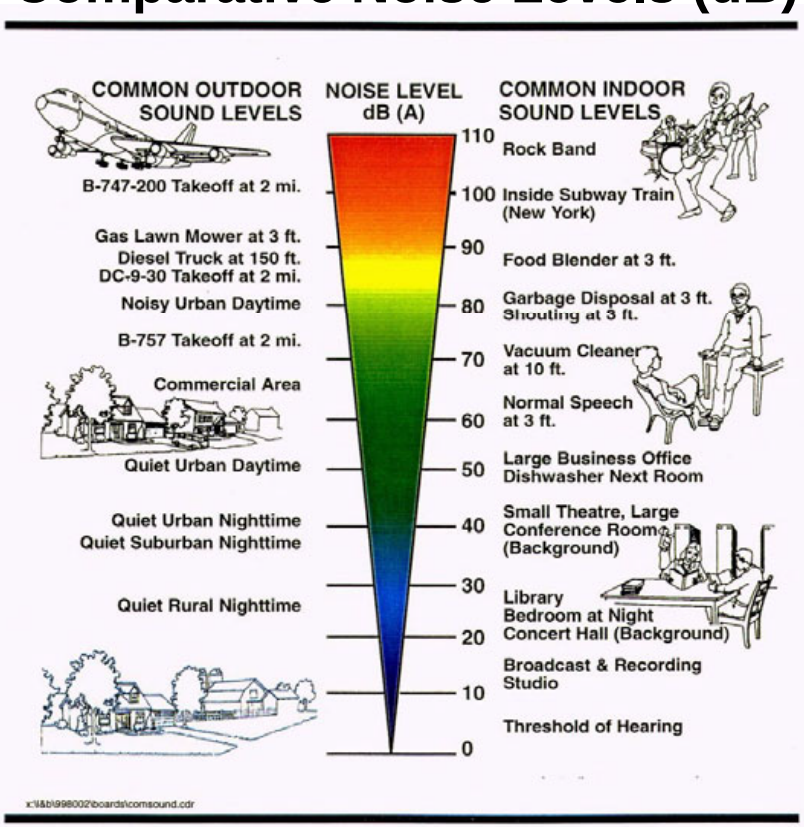
Typical Noise Value Comparisons

DNL Values in Residential Areas

Description	Typical Range DNL in dB	Average DNL in dB
Quiet Suburban Residential	48 – 52	50
Normal Suburban Residential	53 – 57	55
Urban Residential	58 – 62	60
Noisy Urban Residential	63 – 67	65
Very Noisy Urban Residential	68 – 72	70

Source: *Federal Agency Review of Selected Airport Noise Analysis Issues,* Federal Interagency Committee on Noise, August 1992.

Comparative Noise Levels (dB)



FAA Enhanced Community Involvement

Presented to: NYCAR

By: Julie Marks
Community Involvement Manager for
Airspace Projects

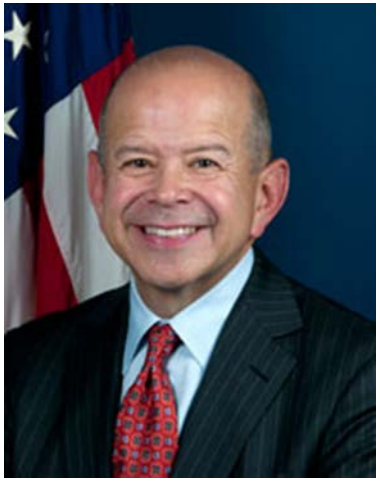
Date: October 30, 2017

Ongoing Culture Change Regarding Community Involvement

- **2016 was a transformational year for the US FAA's community involvement strategy and practices – and 2017 is equally transformational**

- **A comprehensive and strategic approach to community involvement efforts is central to this transformation**

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**.

Sincerely,

Michael P. Huerta
Administrator

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.

FAA Community Involvement Manual, 2016, http://www.faa.gov/nextgen/communityengagement/

FAA ATO Community Involvement Manager Role

Includes:

- **Agency focal and manager** for collaboration and coordination of community involvement activities associated with airspace projects, including performance-based navigation (PBN) procedures
- **Collaborates/coordinates across FAA Lines of Business (LOBs) and Staff Offices (SOs)** to support planning and execution of community outreach activities and ensure alignment with other community involvement programs
- **Coordinates and leads the ATO's community outreach activities** related to PBN and other airspace projects, including Metroplex
- **Liaison to the Noise Steering Group (NSG)** on community involvement activities
- **Collaborates/coordinates with industry stakeholders**

Airports and Industry are Strategic Partners in Community Involvement

- **NextGen Advisory Committee (NAC) Performance Based Navigation (PBN) Blueprint Community Outreach recommendations**
  - Form a specialized Community Outreach Team
  - Develop a standard Community Outreach Toolkit
  - Develop specific Local Community Outreach Toolkits
  - Develop ongoing, scalable Community Outreach Programs in collaboration with local airports and communities
  - Disseminate PBN Blueprint recommendations to encourage and foster community engagement
  - Incorporate best practices in PBN-related community engagement activities
- **This partnership is critical in considering and addressing community concerns**

PBN Aviation & Community Involvement

Key Decisions and Activities

- Project Initiation/ IRF Decision
- BAR
- Design Kickoff Decision
- Development Decision
- Implementation Decision

Preliminary Activities → **Design Activities** → **Development and Operational Preparations** → **Implement-ation** → **Post-Implementation**

Elected/Other Official, Airport, Airline, and Community Engagement Opportunities

The need for and level of engagement will vary based on project circumstances

Operationalizing ATO 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)

The need for and level of engagement will vary based on project circumstances

Operationalizing ATO Enhanced Community Involvement: Recent Best Practices

* Will vary based on * project circumstances

- Enhanced partnerships with airport and industry stakeholders
- Earlier and more frequent engagement with local officials and the public, including outside the normal environmental review process, e.g.,
  - Continued engagement with community roundtables to discuss issues & solutions
  - Public workshops and webinars
- Visualizations to convey locations of procedural changes relative to local landmarks
- Videos to explain more complex procedures and address areas of public concerns
- Interactive noise maps to correlate noise levels with geographic locations
- Design refinements based on community input

Thank you