2021 REDAC Fall Meeting

Research on Operational Procedures

Presented to: REDAC NAS Operations Subcommittee

By: Chris Dorbian
FAA Office of Environment & Energy
Aircraft Technology & Operations Division (AEE-200)

Date: September 1, 2021

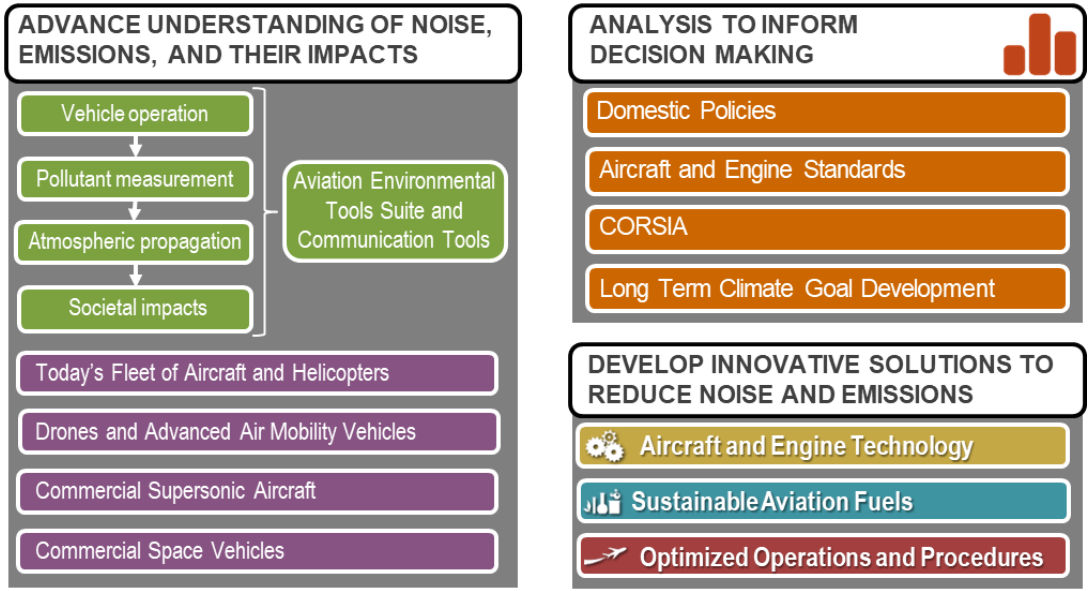
Federal Aviation Administration

Environmental & Energy (E&E) Strategy

E&E Mission: *To understand, manage, and reduce the environmental impacts of global aviation through research, technological innovation, policy, and outreach to benefit the public*

E&E Vision: *Remove environmental constraints on aviation growth by achieving quiet, clean, and efficient air transportation*

E&E R&D Portfolio Activities & Programs



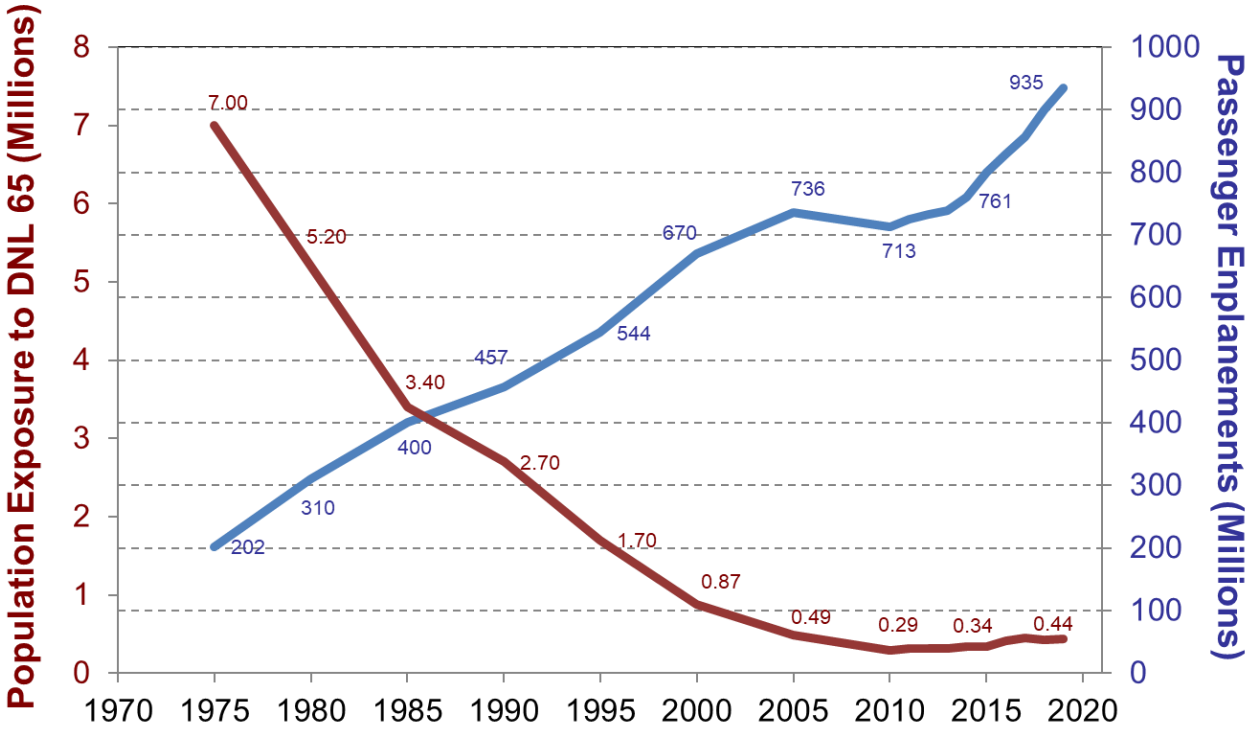
ASCENT
AVIATION SUSTAINABILITY CENTER
www.ascent.aero/

Continuous Lower Energy, Emissions & Noise
CLEEN
Federal Aviation Administration
www.faa.gov/go/cleen/

CAAFI
www.caafi.org/

the VOLPE center

Historical Trends in Noise Exposure and Enplanements



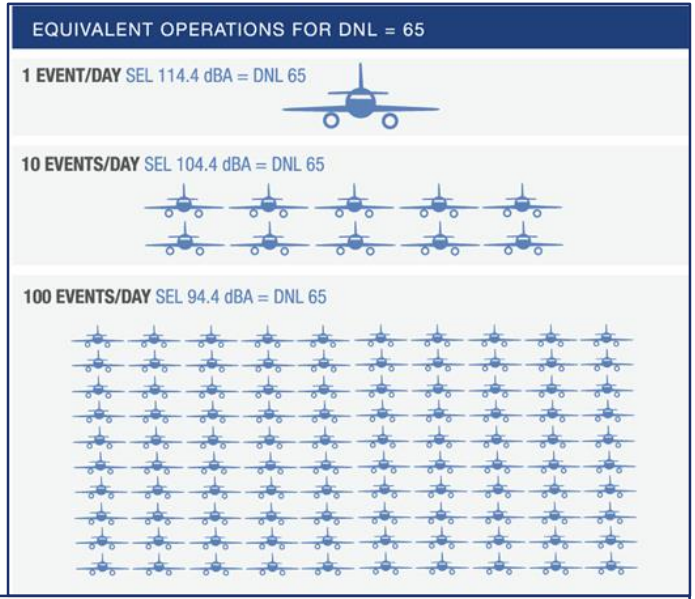
Over a ninety percent decrease in community noise exposure while increasing enplanements by nearly a factor of five; however, the noise experience is different than it was in decades past

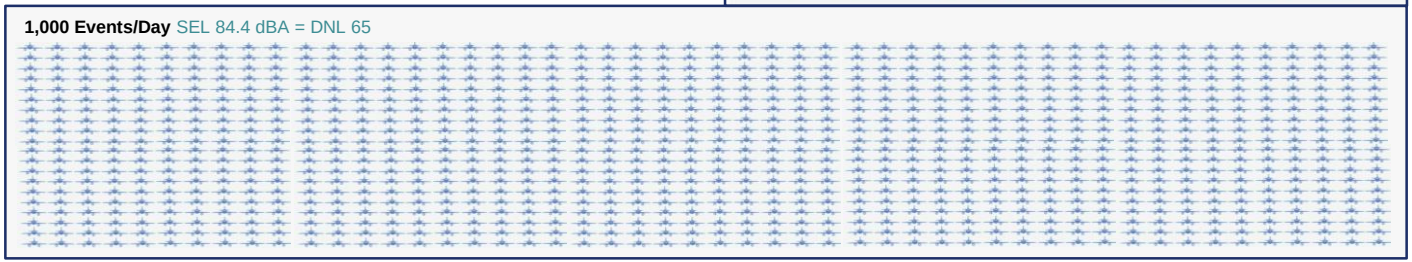
Data source: FAA enplanement data and noise analyses using AEDT

Federal Aviation Administration

Aircraft Noise in the Last Decade (1 of 2)

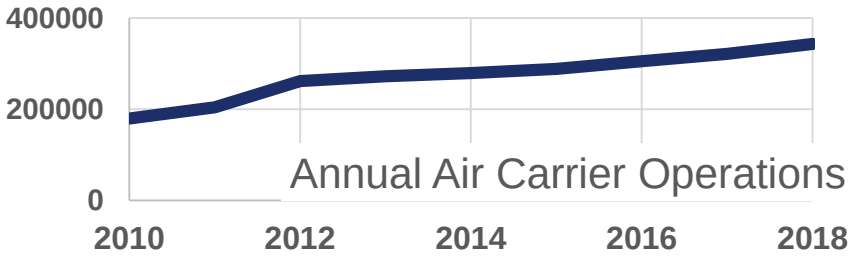
- Aircraft noise from 1970s is different than aircraft noise today.
- A single aircraft from the 1970s produced the same acoustic energy as 10 to 30 aircraft operations today.
- A few, but relatively loud, operations in the 1970s would result in DNL 65 dB. Many, relatively quiet operations today would also result in DNL 65 dB. However, the noise experience is very different.

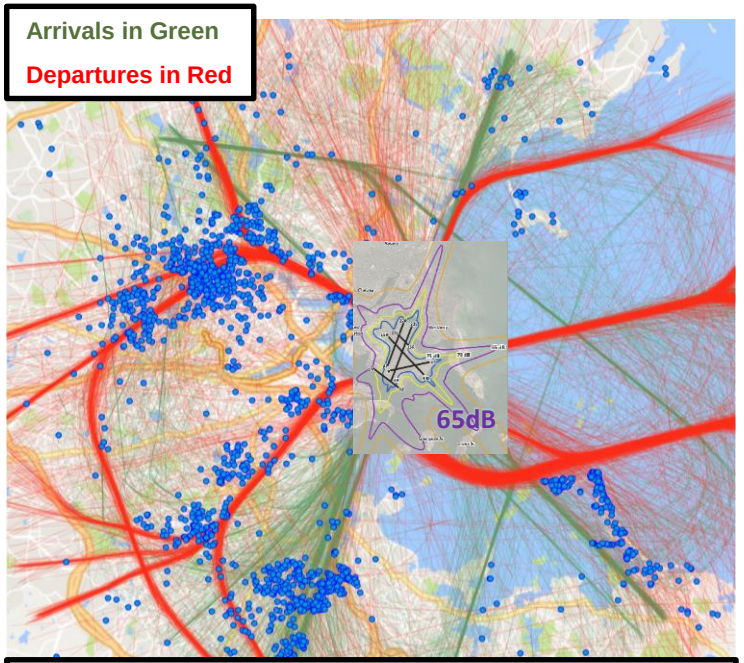




Aircraft Noise in the Last Decade (2 of 2)

- Recent efforts to modernize the national air transportation system have required changes in aircraft operational patterns
- While modernization is needed to increase public safety and system efficiency, the changes in operational patterns have also led to increased concern about aircraft noise
- While air space redesigns have been taking place, operations by air carriers have also increased
- Airport communities that are outside the DNL 65 dB contour are expressing concerns about aircraft noise





Each marker represents a unique complaint address

Data Sources:

Brenner, M., Hansman, R. J., "Comparison of Methods for Evaluating Impacts of Aviation Noise on Communities," 2017

FAA Data on Annual Air Carrier Operations for Boston Logan International Airport

Federal Aviation Administration

FAA Noise Research Program – Overview

Effects of Aircraft Noise on Individuals and Communities

- Speech Interference and Children's Learning
- Neighborhood Environmental Survey
- Health and Human Impacts Research
  - Cardiovascular Health
  - Sleep Disturbance
- Economic Impacts

Noise Modeling, Noise Metrics and Environmental Data Visualization

- Aviation Environmental Design Tool
- Noise Screening
- Environmental Data Visualization
- Supplemental Noise Metrics

Reduction, Abatement and Mitigation of Aviation Noise

- Aircraft Source Noise Reduction
- Noise Abatement
- Noise Mitigation Research

FAA Efforts Relating to Low Noise Aircraft Operations

1. Investigation of operational opportunities for noise reduction:

- Airlines largely determine *what* aircraft fly and *when*
- There might be opportunities to change *where* aircraft fly (through precision navigation) and *how* aircraft are flown
- Must consider the entirety of the airspace and ensure the continued safety of operations
- Concepts being evaluated:
  - Route changes
  - Thrust / speed / configuration management
  - Vertical profile modifications
  - Systematic dispersion

2. Validation of noise abatement procedures

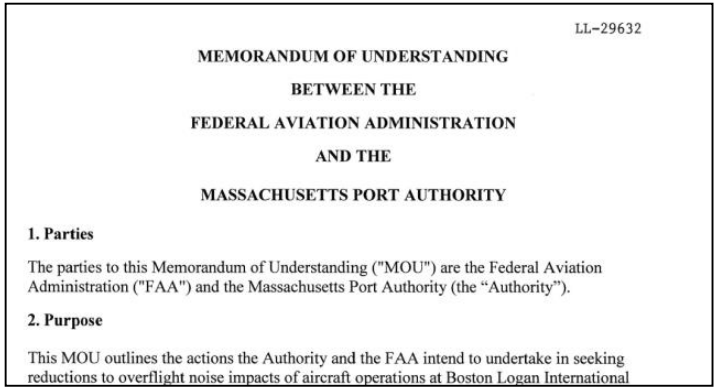
- Operationally validate (through flight sim/testing, noise measurement, etc.) noise management concepts

3. Advancement of tools, processes, and policies

- Execution of knowledge, guidance, & tools/options to manage noise
- Examination of metrics to facilitate assessment/communication of noise impacts

FAA-Massport MOU

- Memorandum of Understanding signed in September 2016 established framework for cooperation between Massport & FAA to explore operational changes to mitigate noise impacts
- MIT developed noise evaluation framework (through ASCENT-23) and is applying it (through Massport funding) to BOS to build and assess procedures
- FAA and industry are providing feedback on the operational feasibility of these ideas
- MIT ideas separated into two blocks:
  - Block 1: Clear noise benefit, no equity issues, limited operational/technical barriers
  - Block 2: More complex due to potential operational/technical barriers or equity issues



LL-29632

MEMORANDUM OF UNDERSTANDING

BETWEEN THE

FEDERAL AVIATION ADMINISTRATION

AND THE

MASSACHUSETTS PORT AUTHORITY

1. Parties

The parties to this Memorandum of Understanding ("MOU") are the Federal Aviation Administration ("FAA") and the Massachusetts Port Authority (the "Authority").

2. Purpose

This MOU outlines the actions the Authority and the FAA intend to undertake in seeking reductions to overflight noise impacts of aircraft operations at Boston Logan International

Massachusetts Port Authority
One Harborside Drive
East Boston, MA 02128-2909
Telephone (617) 568-5000
www.massport.com

December 20, 2017

Ms. Amy Corbett
Regional Administrator
Federal Aviation Administration
New England Region
1200 District Avenue
Burlington, MA 01803-5299

RE: FAA\MPA RNAV MOU Block 1 Ideas: Request for FAA Review and Implementation for Boston Logan International Airport

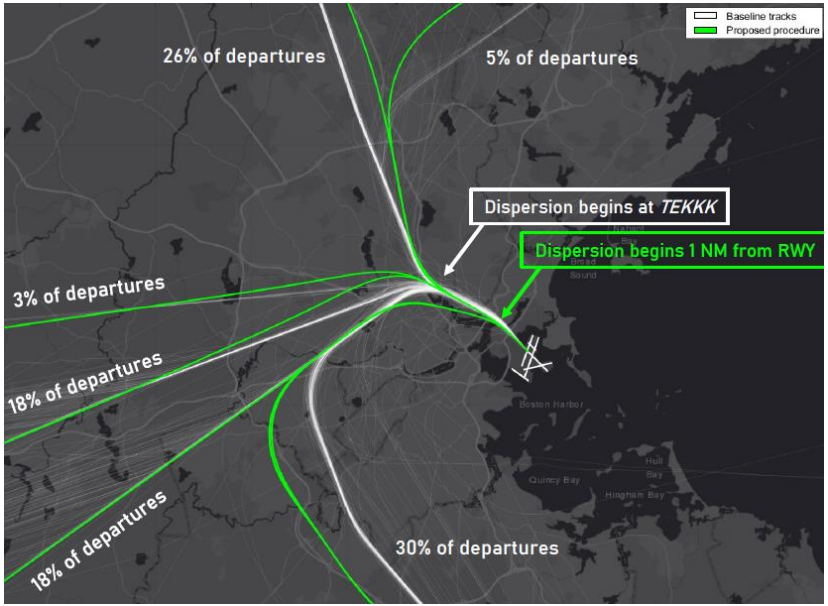
Dear Ms. Corbett:

I am writing to request that the Federal Aviation Administration (FAA) review and implement the Block 1 procedure recommendations by the Massachusetts Institute of Technology (MIT) study team as a result of the Memorandum of Understanding (MOU) between the FAA and the

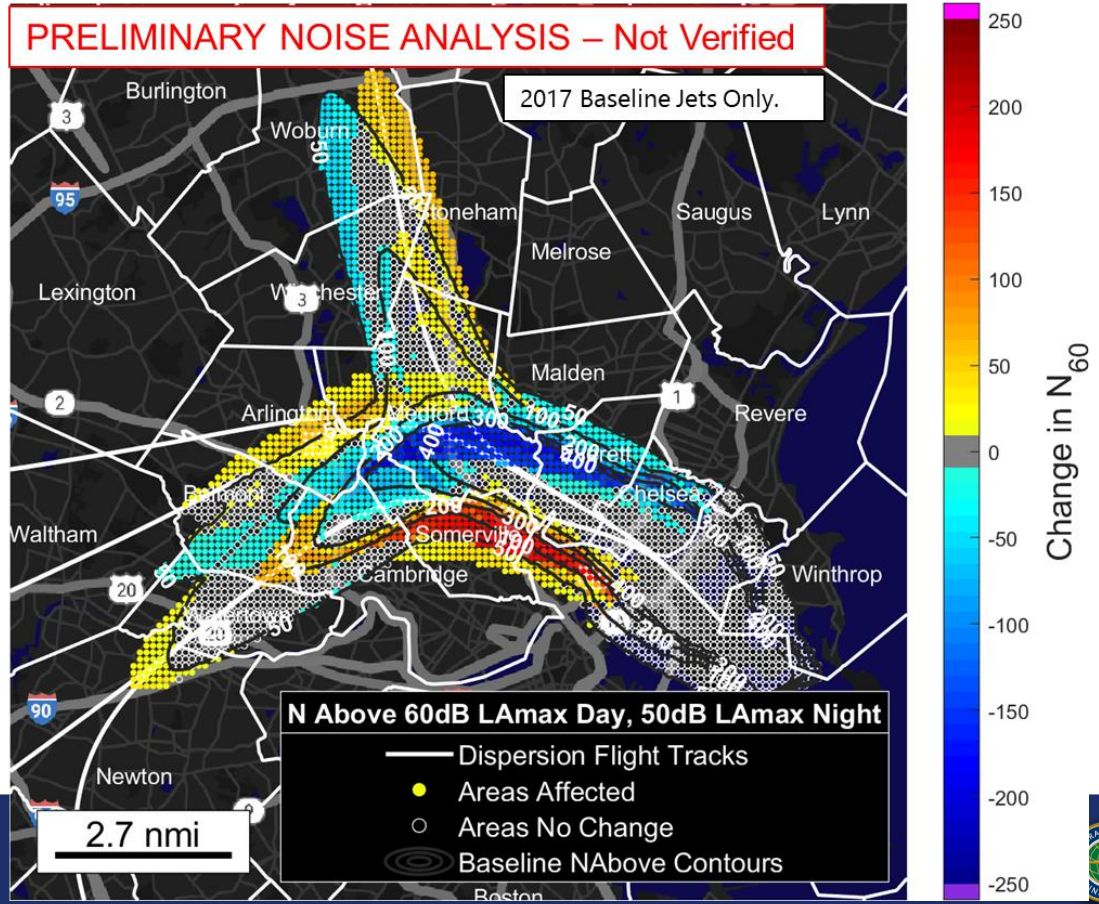
Example MOU Procedures

Block 1: 15R Departure

Block 2: 33L Departure



Communicating Impacts



Population Exposure

N_{60}	50x
Baseline 2017	335,823
Divergent Headings Rev 2	352,775
Baseline - Dispersion	-16,952

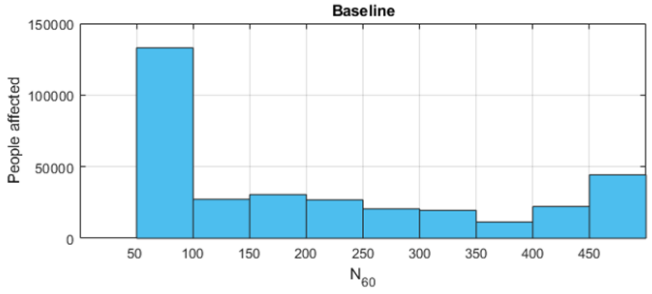
Analysis updated Oct. 17 2019 to remove Turboprops and refine lateral tracks
Modeling/Discretization effects near airport removed

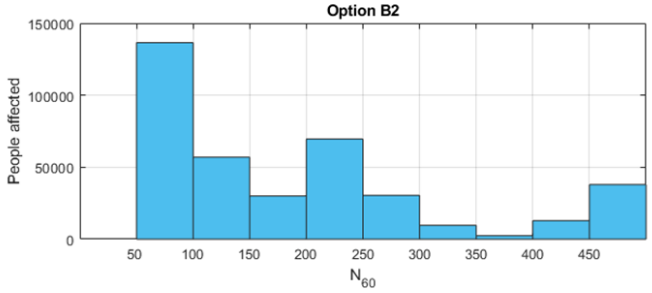
Analysis based on peak day operations; only includes 33L departures

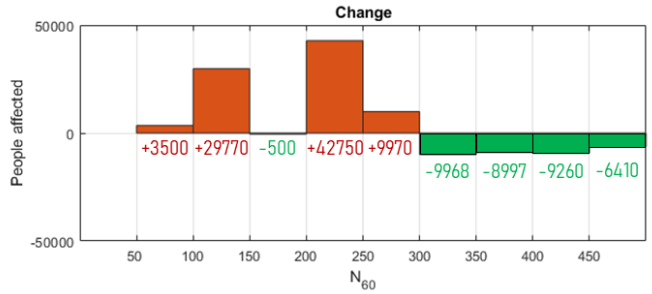
N_{60} Thresholds:
60dB $L_{A,max}$ Day, 50dB $L_{A,max}$ Night

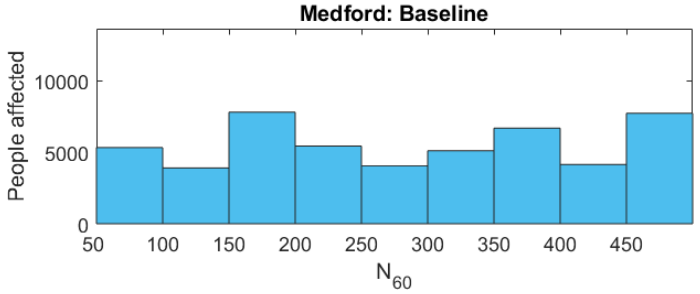
A Closer Look…

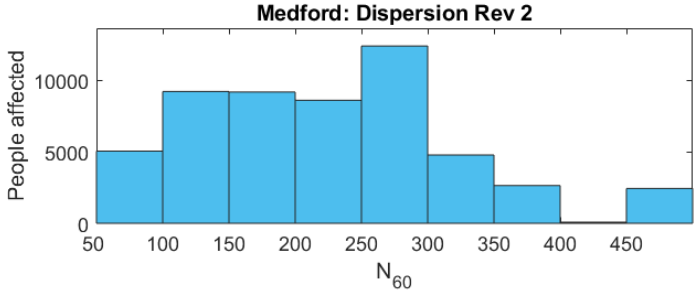
EXAMPLE ONLY

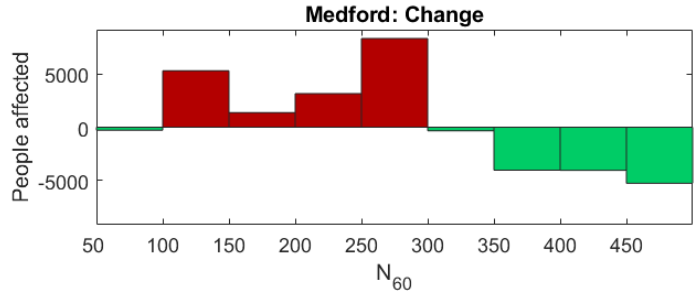


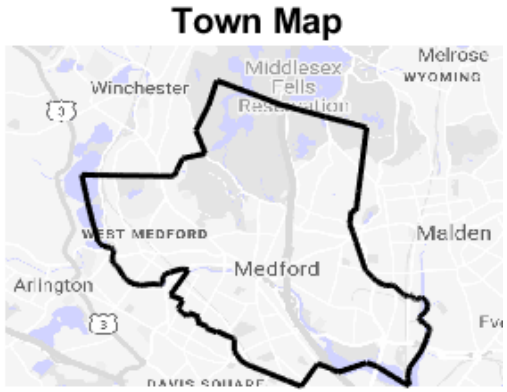


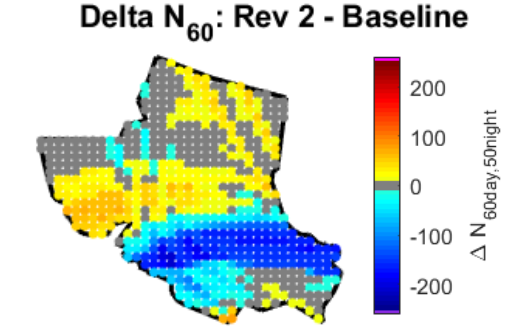






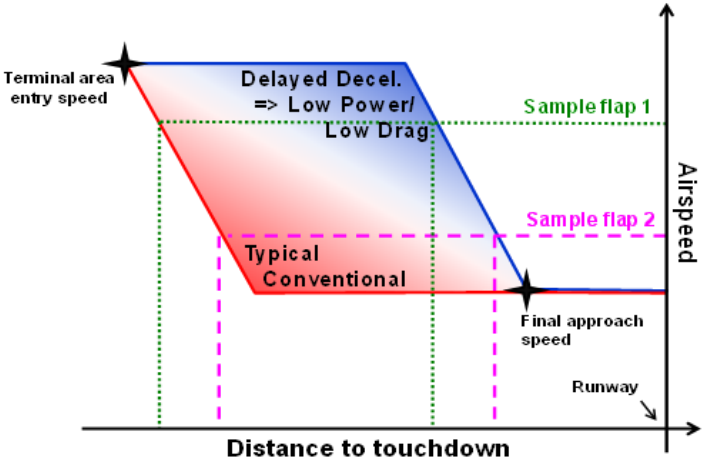


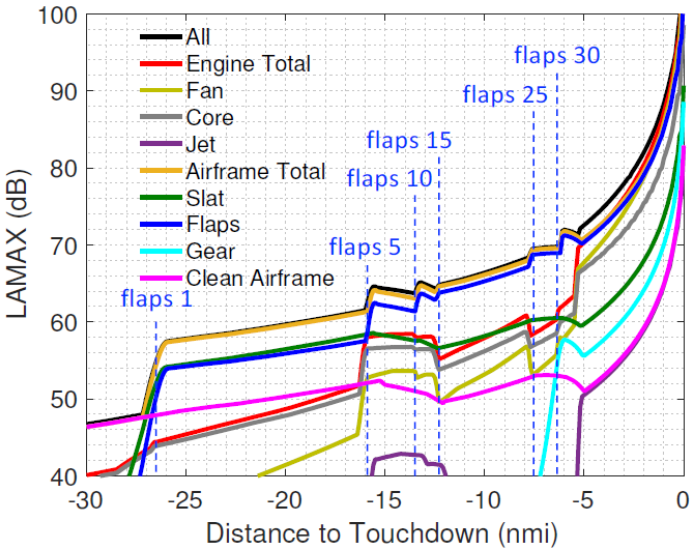




Changing Start of Deceleration on Arrival (Delayed Deceleration Approach)

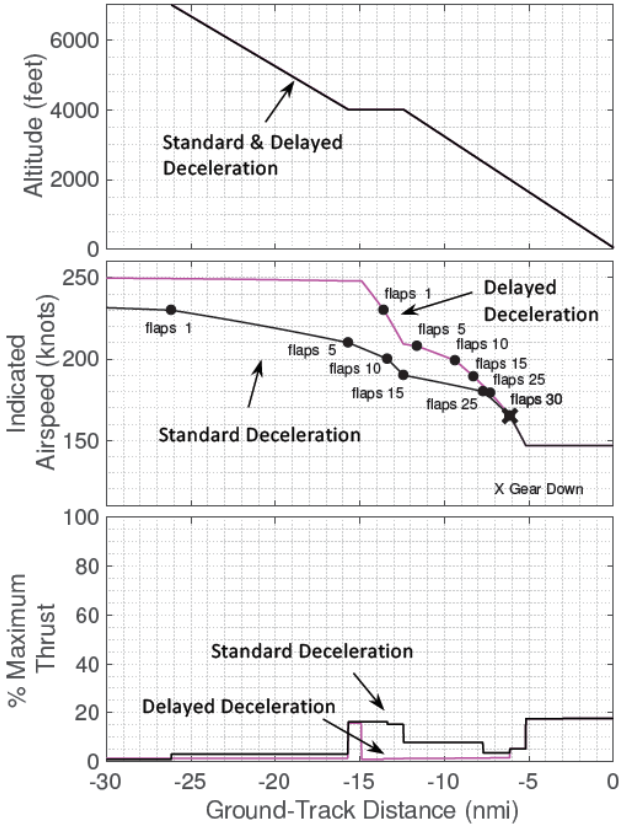
- MIT has developed analytical framework for assessing changes to aircraft speed/thrust/configuration profile; e.g., Delayed Deceleration Approach
  - Reduce noise by delaying extension of flaps (known fuel benefits)
  - Must decelerate early enough to ensure stable approach criteria

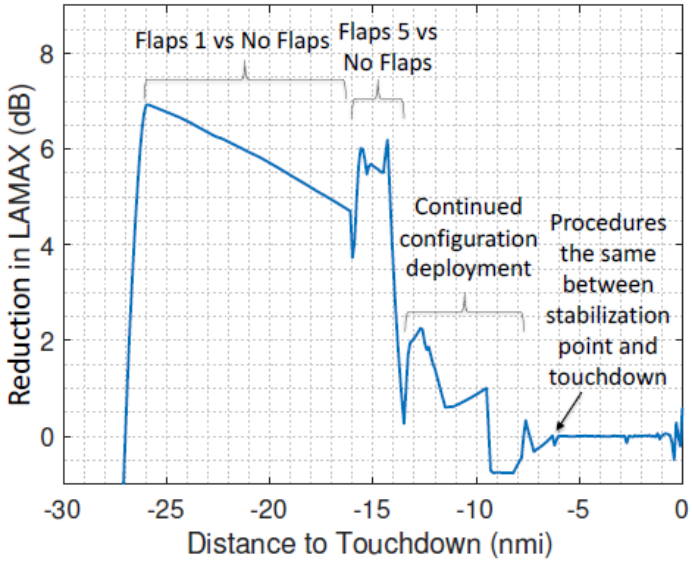




Under Flight Track Noise by Component, Representative Narrow Body Aircraft Approaches with 4,000 ft Level-Off

DDA Noise Assessment

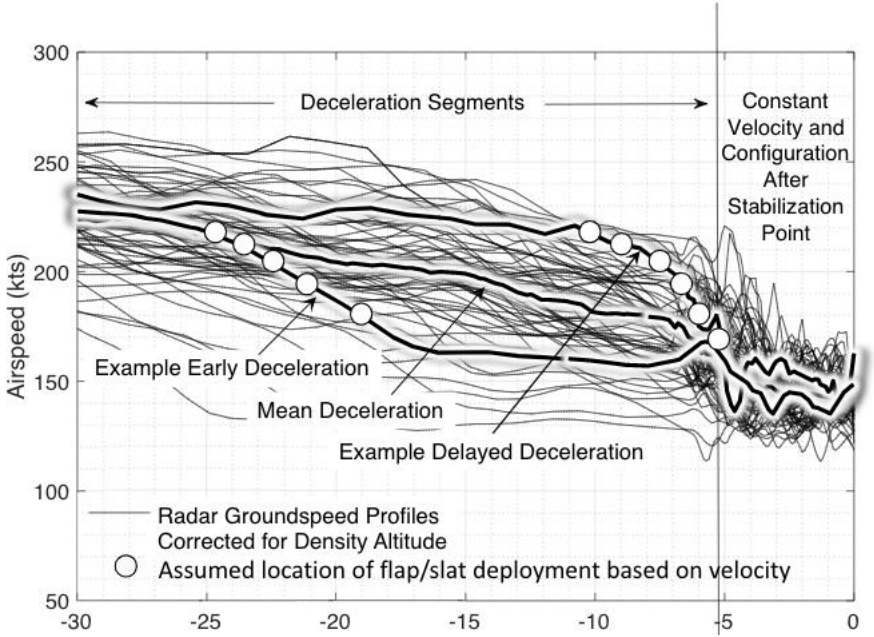




- Engine thrust on approach is relatively low → airframe noise components more easily heard
- Validation and implementation challenges remain

DDA Challenges

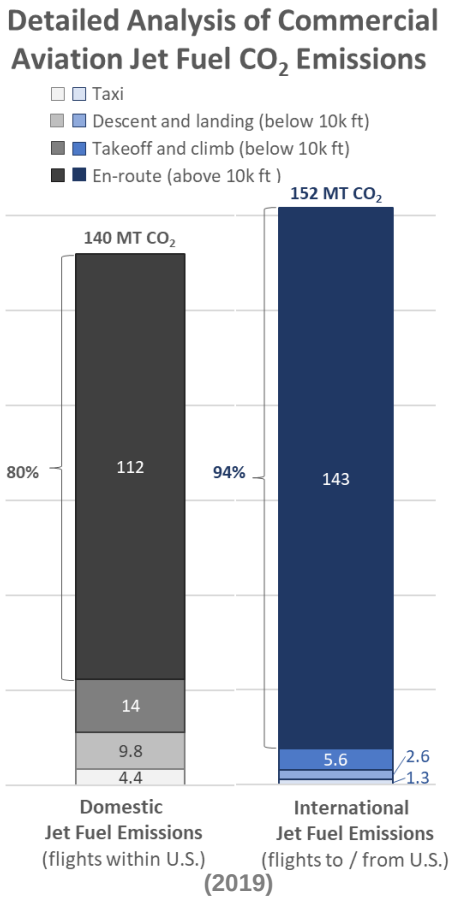
- **Operational validation of noise benefit**
  - Work ongoing to collect aircraft state and noise measurement data to support validation of noise modeling methodology and identification of low-noise behaviors
- **Pilot guidance**
  - Continued discussion with pilots
  - Examine DSTs: e.g., DLR Low Noise Augmentation System, A350 Flight Management System
- **Different deceleration rates for different aircraft creates ATM challenge in separating/sequencing aircraft**
  - Continued discussion with FAA ATO, ANG, and AVS
  - Current or future ATM tools that could support integration?



Early, Mean and Delayed Deceleration
(B738 arrivals into BOS)

Operational Opportunities for Reduced Climate Impact

- **Addressing climate change is a national (administration) priority**
- **Past research: Continuous Descent Arrival, Cruise Altitude and Speed Optimization, DDA, Surface Congestion Management**
- **New effort: ASCENT-78 Contrail Avoidance Decision Support and Evaluation**
- **Ongoing coordination (internal/external) on operational opportunities for fuel/emissions reduction**
- **Open to ideas/discussion**



Summary

- **Despite considerable progress in reducing aircraft source noise and community noise exposure, aviation noise remains a concern in many areas**
- **FAA is exploring operational opportunities to reduce the noise from the current fleet**
- **FAA is developing tools to better assess benefits of advanced operational procedures, operationally validating and measuring concepts with potential to reduce noise, and seeking mechanisms for implementation**
- **Reducing climate impact through operational efficiencies is also a high priority area**

Chris Dorbian

Federal Aviation Administration
Office of Environment and Energy

Email: christopher.dorbian@faa.gov