2019 REDAC Spring Meeting

Research to Lower Noise through Operational Procedures

By: Joseph DiPardo
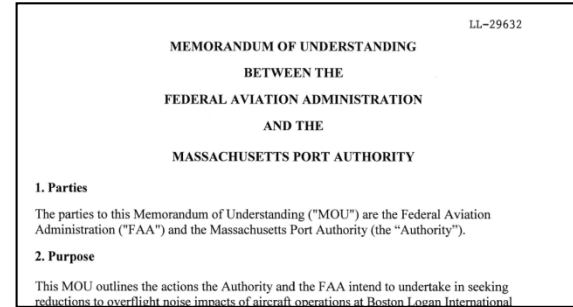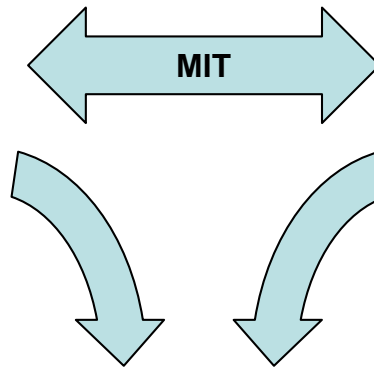Date: March 19, 2019

Federal Aviation Administration

Multiple Efforts Underway to Develop Noise-Abating Operational Procedures

ASCENT-23
Developed analytical framework for assessing operational procedures

AEDT
Development efforts underway to improve modeling capabilities

MIT

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

LL-29632

FAA–Massport MOU (BOS case study; FAA collaborative effort on Noise)

Industry/Gov't. Collaboration
- **Industry collaboration (e.g., UPS, OEMs)**
- **Discussions with NASA underway**

Knowledge, Guidance, & Tools/Options to Abate Noise

CLEEN Program (e.g., Flight Management System enhancements)

PBN Operations at Low Altitude (AJV / MITRE)

Application of ELSO and Open SIDs (ATR / MITRE)

Noise Abatement Procedure Usage and Effectiveness (ATR / MITRE)

Steeper Noise Abatement Approach Operational Feasibility (ATR / MITRE)

ATR = Airport Technology Research (joint AEE/APP)

Federal Aviation Administration

Massport/FAA/MIT MOU Technical Approach

- **Collect Data and Evaluate Baseline Conditions**
  - Pre and Post RNAV
  - Community Input (Meetings and MCAC)
- **Identify Candidate Procedure Modifications**
  - 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
- **Model Noise Impact**
  - Standard and Supplemental Metrics
- **Evaluate Implementation Barriers**
  - Aircraft Performance
  - Navigation and Flight Management (FMS)
  - Flight Crew Workload
  - Safety
  - Procedure Design
  - Air Traffic Control Workload
- **Recommend Procedural Modifications to Massport and FAA**
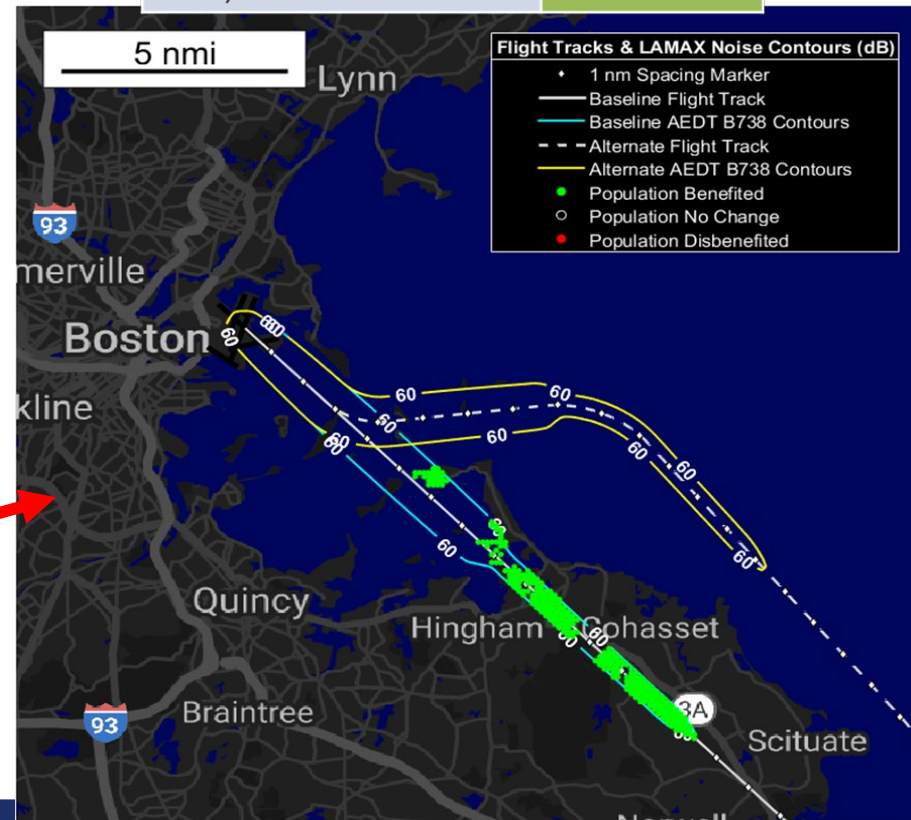- **Repeat for Block 2**

Block 1 Final Recommendations

Proc. ID D = Dep. A = Arr.	Procedure	Primary Benefits
1-D1	Restrict target climb speed for jet departures from Runways 33L and 27 to 220 knots or minimum safe airspeed in clean configuration, whichever is higher.	Reduced airframe and total noise during climb below 10,000 ft (beyond immediate airport vicinity)
1-D2	Modify RNAV SID from Runway 15R to move tracks further to the north away from populated areas.	Departure flight paths moved north away from Hull
1-D3	Modify RNAV SID from Runway 22L and 22R to initiate turns sooner after takeoff and move tracks further to the north away from populated areas.	Departure flight paths moved north away from Hull and South Boston
1-D3a	*Option A*: Climb to intercept course (VI-CF) procedure	
1-D3b	*Option B*: Climb to altitude, then direct (VA-DF) procedure	
1-D3c	*Option C*: Heading-based procedure	
1-A1	Implement an overwater RNAV approach procedure with RNP overlay to Runway 33L that follows the ground track of the jetBlue RNAV Visual procedure as closely as possible.	Arrival flight paths moved overwater instead of over the Hull peninsula and points further south
1-A1a	*Option A*: Published instrument approach procedure	
1-A1b	*Option B*: Public distribution of RNAV Visual procedure	

B737-800 60dB $L_{A,max}$
Population Exposure

	60dB
Straight In	2,954
RNP	0
Difference (Straight In– RNP)	2,954

Flight Tracks & LAMAX Noise Contours (dB)
- ⋅ 1 nm Spacing Marker
- —— Baseline Flight Track
- —— Baseline AEDT B738 Contours
- - - - Alternate Flight Track
- —— Alternate AEDT B738 Contours
- ● Population Benefited
- ○ Population No Change
- ● Population Disbenefited

Modeling Speed Management Concepts

- **ANOPP required for variable aircraft speed noise modeling**
  - AEDT not suited to capture noise changes based on speed

- **ANOPP requires detailed airframe information including wing aerodynamics**
  - Assumptions significantly affect level of benefit

- **MIT currently working with NASA to determine proper model assumptions**

- **FAA Reauthorization Section 179 requires analyses of the relationship between aircraft approach and takeoff speeds and noise impacts on communities**
  - Airframe noise modeling critical to analysis of aircraft speed and community noise
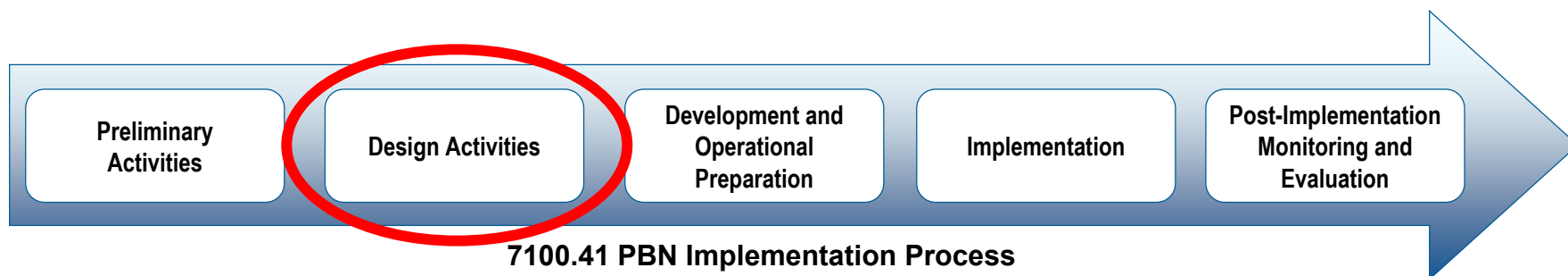
Block 1 Concept
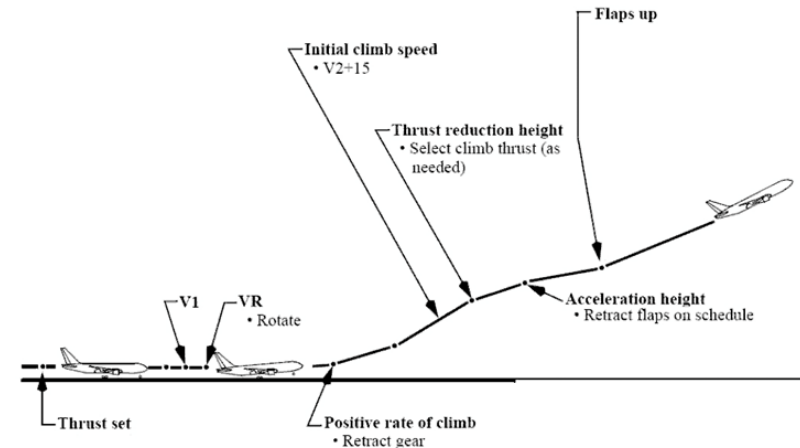
Block 2 Concept
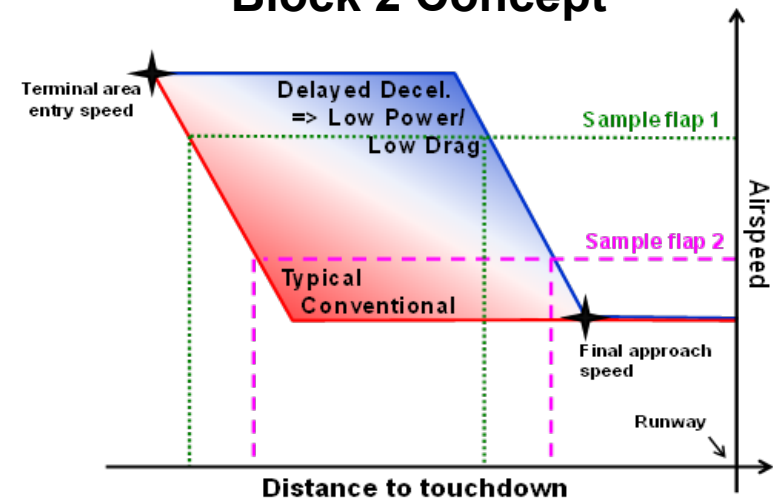
FAA 7100.41 Working Group

- **PBN implementation process to vet procedures with industry and facilities**

- **Stakeholders**
    - Airline operators
    - Airline associations
    - Pilot associations
    - Tower
    - TRACON
    - Center
    - FAA Operations Support Group
    - FAA Flight Standards
    - FAA Regional Office
    - FAA Office of Environment and Energy
   - Procedure designers
    - Massport
    - MIT

| Preliminary Activities | Design Activities | Development and Operational Preparation | Implementation | Post-Implementation Monitoring and Evaluation |

7100.41 PBN Implementation Process

Block 2 - Potential Concepts (Preliminary)

Block 2 Arrival Mods

- Low-noise overwater approach procedures
  - Runway 22L
    - RNAV approach with RNP Overlay
  - Runway 4L and/or 4R
    - RNAV approach with RNP Overlay
    - RNP approach
- Vertical Path Changes
  - Steeper Approaches
  - Delayed Landing Gear Extension
  - Continuous Descent Profiles
    - RNP arrivals that would allow continuous descent procedures from the north
  - Delayed Deceleration Approach
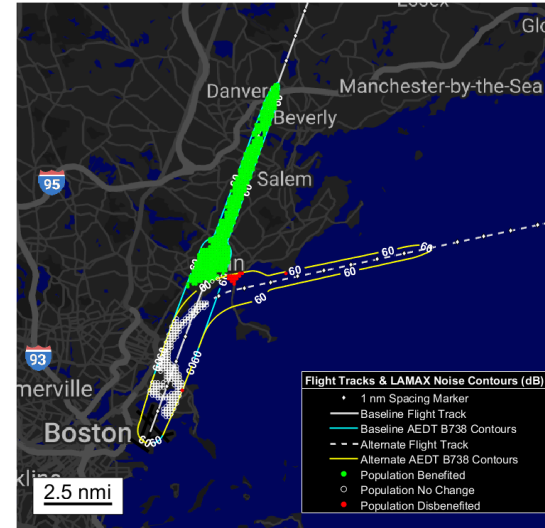
Runway 22L Arrival
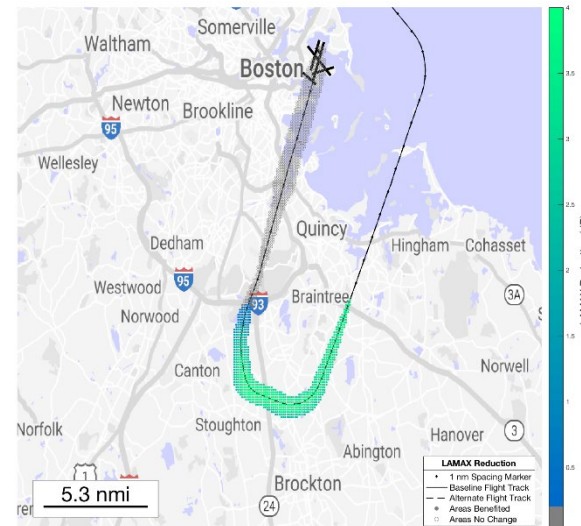
Continuous Descent Approach Example
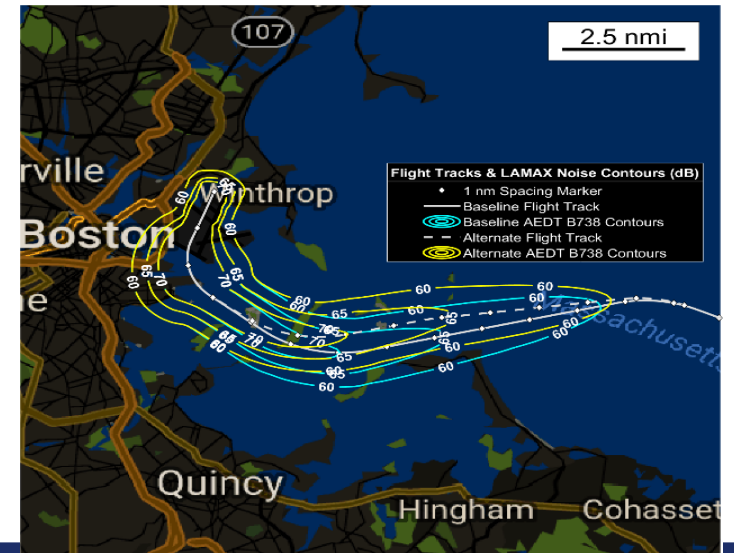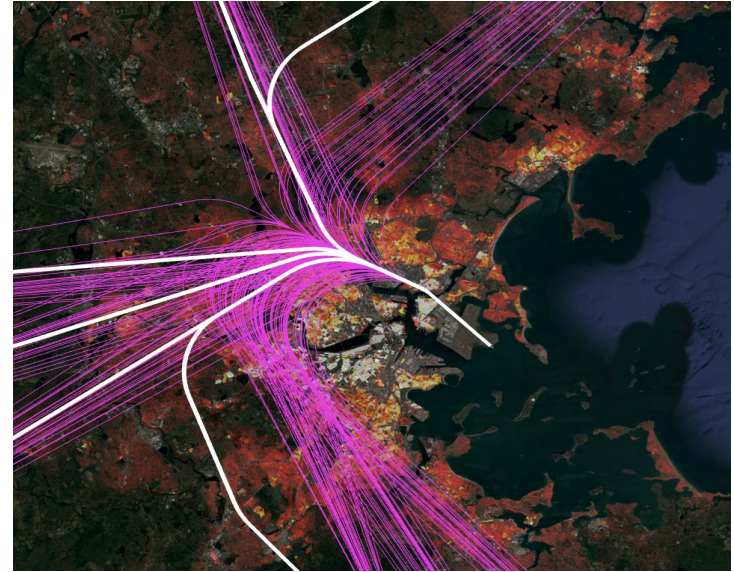
Preliminary/Subject to Change

Block 2 - Potential Concepts (Preliminary)

Block 2 Departure Mods

- Dispersion
  - Runway 33L and 27
    - Altitude-based dispersion
      - 3000ft
      - 4000ft
    - Controller-based dispersion
    - Divergent heading dispersion
    - RNAV SID Waypoint Relocation
- RNP SID
  - Runway 22
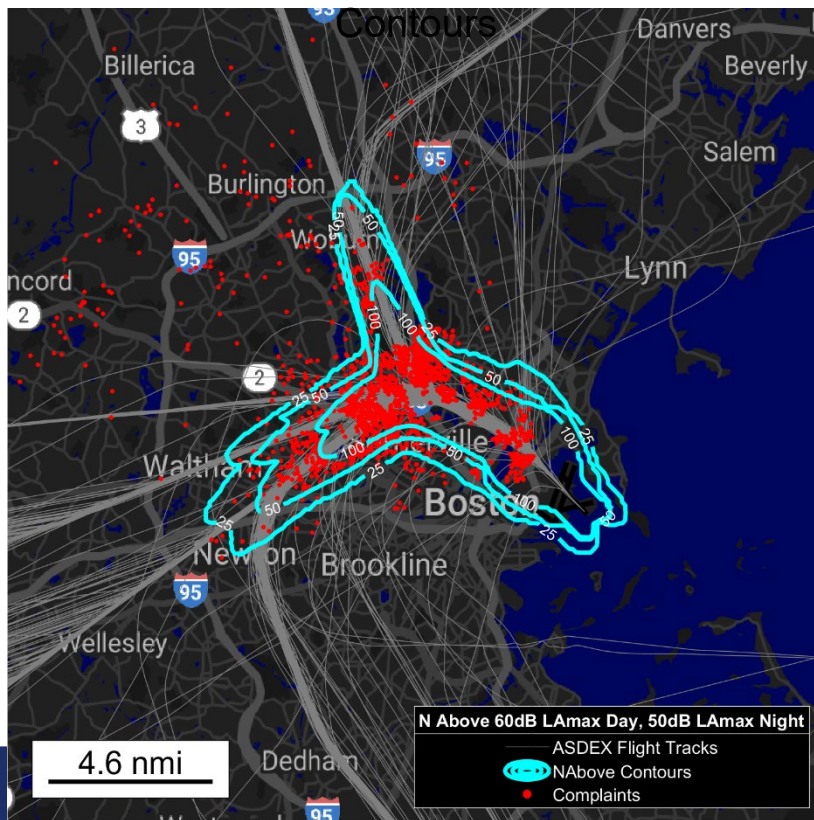   - Recent addition based on Block 1 status

Preliminary/Subject to Change

Alternate Noise Metric: Peak Day N_{Above}

- N_{Above} = Number of flights above threshold noise level on a peak day of runway use

- Threshold noise level used is 60dB $L_{A,max}$ day, 50dB $L_{A,max}$ night

- 50 flights on a peak day N_{Above} captures over 80% complaint locations

33L Peak Day N Above 60dB Day, 50dB Night

33L Departures Complainant Coverage for Peak Day by N Above Thresholds

Peak Day N Above	Complaints Captured
25x	90.0%
50x	83.8%
100x	59.9%

2017 Data
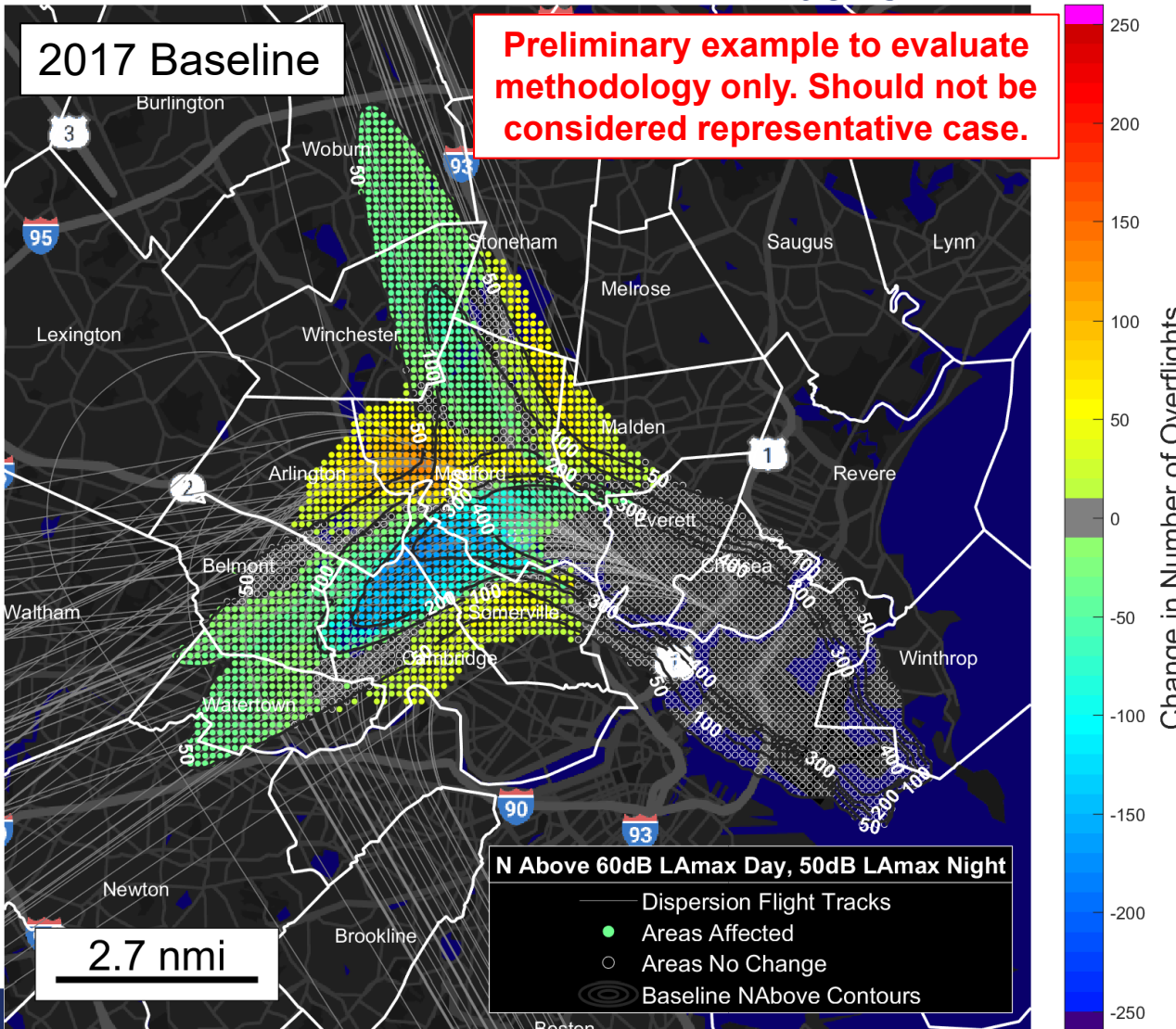
33L Departures Altitude-Based Dispersion at 3000ft Change in N_{Above}

2017 Baseline

Preliminary example to evaluate methodology only. Should not be considered representative case.

Change in Number of Overflights

N Above 60dB LAmax Day, 50dB LAmax Night

— Dispersion Flight Tracks
● Areas Affected
○ Areas No Change
⊚ Baseline NAbove Contours

2.7 nmi

Population Exposure

N_{60}	50x
Baseline 2017	336,643
Dispersion	342,387
Baseline - Dispersion	−5,744

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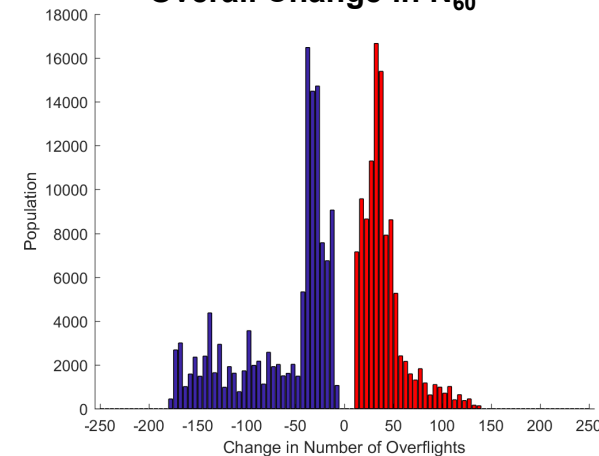
N_{60} Thresholds:
60dB $L_{A,max}$ Day, 50dB $L_{A,max}$ Night

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

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**

- **Developing tools to better assess benefits of advanced operational procedures**
  - Enhancing AEDT to model speed management procedures
  - Working with NASA to ensure proper application of ANOPP

- **Issues:**
  - Developing tools to assess noise benefit of changes to vertical procedures
  - Incorporating noise considerations into the procedure design process
    - What are the right metrics to assess noise benefits of procedures?
  - Engaging with stakeholders
    - Decision process for procedures with noise redistribution