Massport and FAA RNAV Pilot Study Overview
Public Briefing

February 22, 2017
State Transportation Bld.
Boston, MA

As of 02/10/2017
Agenda

• Welcoming Remarks
  – Tom Glynn (Massport CEO)
  – David Carlon (Massport CAC Chair)
  – FAA (TBD)
• Massport\FAA RNAV MOU Pilot, Overview
  – Flavio Leo (Massport)
  – John Hansman (MIT)
• Public Comment
Massport/FAA RNAV MOU Context
An outcome of RNAV is concentration of flights...

**Example- Departures - Runway R33L**
FAA and Massport MOU on RNAV Pilot Study

• RNAV Procedures Nationwide Deployment by FAA
• Overflight noise versus concentration
• Discussions with communities and elected
• Engagement with FAA
  – National Issue
  – Specific solutions to test
  – National model to address RNAV related issues
• Near-term actionable ideas tested and, if successful, applied to other runways and nationwide (12 to 18 month process)
• Collaboration with Massport CAC for review and input
• Massport CAC opportunity to add ideas
  – Narrow focus on RNAV, limited and prioritized by the Massport CAC
Boston Logan Context
Boston Logan International Airport

- Largest Commercial Airport in New England Region
- Over $13 Billion in Annual Economic Impact
- Over 17,000 Direct Jobs
  - About 80% Private Sector
- Over 100,000 Total Direct/Indirect Jobs
- Origin and destination airport- over 90% of passengers originate or end trips from Boston
- Served by all major airlines and not a major connecting hub
- Extensive domestic and international non-stop service. Varied aircraft fleet mix
- Demand is driven primarily by local socio-economic conditions
Boston Logan is an urban airport

- The airport has been operating for over 90 years
- The FAA is responsible for choosing which runways to use
- For safety, aircraft land and depart into the wind
- Current and forecasted weather is primary
- Other operational factors include runway closures, fleet mix, efficiency

Wind and weather patterns are the primary driver of the number of hours and flights a particular runway’s configuration is used by the FAA. Depending on the runways in use, different neighborhoods/communities are overflown.
Based on wind/weather, the FAA uses Logan runways in combinations to safely and efficiently meet demand. Based on which configuration the FAA selects, different communities are impacted
Southwest Flow Operating Configuration

- Arrivals to R 22L and 27
- Departures from R 22L and 22R

Diagram showing runway configurations and directions for arrivals and departures on Runways 22R, 22L, and 27.
Arrivals to Runways 4L and 4R
Departures from R 9, 4L, and 4R

Northeast Flow Operating Configuration
Northwest Flow Operating Configuration

- Arrivals to R 33L, 33R, 32 and 27
- Departures from R 33L and 27

Runway 33R
Runway 33L
Runway 27
Runway 32
Non-Jet
Southeast Flow Operating Configuration

- **Arrivals to R 15R, 15L**
- **Departures from R 15R, 14 and 9**

Runways:
- Runway 15L
- Runway 15R
- Runway 14
- Runway 9

Non-Jet
Although flights fluctuate year to year, over the long term Logan Airport is serving more passengers on fewer flights.

For Example...
- 2014 to 2015 flights up +2.5% and passengers up +5.7%
- 2008 to 2009 flights down -7.1% and passengers down -2.3%
New engine technology has reduced noise by greater than 95% since the 1980s. About 97% of Logan’s fleet meets engine stage 4 standards, the strictest noise and emissions designation.

In the 1980s a typical aircraft at Logan was the B727-200. Today a typical aircraft is the A320 or B737-8. Point Shirley is located in Winthrop.
Reflecting new engine technology and a reduction of total flights, Logan’s noise emissions contours have shrunk significantly over the last decades.

Note: 65db DNL is FAA’s designation of significant noise exposure.
Because of Logan’s urban location, Massport has developed a comprehensive noise abatement program.

- Noise abatement departure procedures
- Late night opposite direction operations
- Decibel restriction on R4L departures and 22R arrivals
- Unidirectional/Wind restriction use R14/32
- Residential and School Soundproofing Program
- Engine run-up restrictions
  - Limited time
  - Specific locations
- Encourage use of single engine taxiing and reverse thrust

- 24/7 noise complaint line 617-561-3333
- State of the art Noise Monitoring System
- Near live flight tracking on website
Overflights - Principals

- Safety for passengers and people on the ground
- Weather as factor
- Data driven
- Regional fairness across metropolitan region
- Massport CAC as regional voice
- Massport/FAA MOU to test five/plus experiments
Massport/FAA RNAV MOU Update
Officials will study plane noise after complaints about Logan

A new air navigation is concentrating more planes in and out of Logan into narrower flight paths, increasing the volume of noise for neighborhoods below.

By Megan Woolhouse | GLOBE STAFF OCTOBER 07, 2016

Facing increasing pressure from lawmakers, the Federal Aviation Administration and the Massachusetts Port Authority said they will consider changes to flight patterns in and out of Logan International Airport that have triggered thousands of noise complaints from residents.
Overview of Technical Process and Pilot Tests- Ideas reflect input from communities close to Boston Logan

1. **Persistence of RNAV departures**

2. **Increasing aircraft altitudes, Departures**

3. **Increase aircraft altitudes, Arrivals**

4. **RNAV separation requirements**

5. **Alternative RNAV Special designs**

6. **Other (?) – consistent with purpose of study and priority**

**Apply alternative metrics** – Develop supplemental metric(s) to better identify the potential for community impacts associated with proposed procedural changes
Critical Steps

• MOU with FAA Identifies roles and responsibilities
  – Commitment of resources to effort

• Technical Team and Work Program
  – MIT
  – HMMH
  – Ex-FAA Manager
  – FAA Technical Support\Coordination

• Coordinate with Massport CAC (and public) at important milestones
  – October 7th Announcement with FAA and elected officials
  – Massport Press Release
  – Briefing to CAC Executive Committee 10/24
  – Briefing to CAC Aviation Committee 11/2
  – Massport briefing to Executive Committee 11/29
  – Briefing to full Massport CAC 12/08
  – Briefing to Massport Executive Committee (2/14/17)
  – Public Meeting (2/22/17)
  – Ongoing Coordination
End Massport
Procedure Design for Logan Airport Community Noise Reduction

R. John Hansman
rjhans@mit.edu
Performance-Based Navigation (PBN)

NEXT GEN Components: RNAV/RNP
Moving to Performance-Based Navigation

Conventional Routes
Today’s airways connect ground-based navigation aids

RNAV
Area Navigation (RNAV) routes follow defined “waypoints”

RNP
Required Navigation Performance (RNP) routes within specified “containment area”

Limited Design Flexibility
Increased Airspace Efficiency
Optimize Use of Airspace

Source: Federal Aviation Administration
RNAV Track Concentration

Image Source: Massport

Source: ASDE-X
8 days in 2015
Impact of PBN Concentration

- Population sensitive to changes at levels well below the 65 DB “significant” Day-Night Noise Level (DNL)
- Overflight frequency perceived to increase under tracks
  - Precise overflight tracks make visual identification easier
- Exposure less attributable to “random” processes
  - Track directly related to procedure
- Traditional Metrics not perceived to capture overflight frequency
  - At lower DNL levels the number or frequency of events may be more important than DNL or Lmax
- Concentration raises issues of Equity
  - Popular to propose dispersion as a solution
  - Dispersion results in more noise impact
- Can PBN capability be used to reduce community noise impact
Noise Complaints at BOS:
One Dot per Address

Each dot represents an address that registered at least one complaint during period

**Complaint Data:** August 2015–July 2016
**Track Data:** ASDE-X from 12 days of operation, 2015-2016
Noise Complaints at BOS:
Dots Weighted by Complaint Frequency

Each dot represents an address that registered at least one complaint during period
Marker size corresponds to number of complaints registered by address

**Complaint Data:** August 2015–July 2016
**Track Data:** ASDE-X from 12 days of operation, 2015-2016
Potential Uses of PBN for Reducing Noise

- **Spatial Management**
  - Noise preferred arrival and departure routes
    - Precise Lateral Trajectories
    - Low population density or background shielding
    - Critical point avoidance
  - Flight track dispersion or concentration

- **Vertical Management**
  - Modified Departure Angles
    - Speed or Thrust Scheduling
  - Modified Approach Angles
    - Continuous Descent Arrival (CDA)
    - 2 Segment or Steep Approaches

- **Speed/Drag Management**
  - Low power/low drag approach profiles (DDA)

- **Others?**
Technical Approach

• Collect Data and Evaluate Baseline Conditions
  – Pre and Post RNAV
• Identify current procedures which appear to have community noise benefit
• Determine Technical and Operational Limitations
  – Aircraft Performance
  – Navigation and Flight Management (FMS)
  – Flight Crew Workload
  – Safety
  – Procedure Design
  – Air Traffic Control Workload
• Identify Candidate Procedure Modifications
  • Block 1/Block 2
• Model Noise Impact
  – Standard and Supplemental Metrics
• Evaluate Implementation Barriers
• Recommend Procedural Modifications to Massport and FAA
• Repeat for Block 2
Departures

2015-2016 Noise Complaints at BOS
with 12 Days of Departure Tracks

Each Marker Represents One Address
Arrivals

2015-2016 Noise Complaints at BOS with 12 Days of Arrival Tracks

Each Marker Represents One Address
Project Schedule
Preliminary/Subject to Change

- FAA/ Massport Discussions    Winter – Fall 2016
- Announcement          Oct 2016
- Consultant Team Organization   Fall 2016
- Historical Flight Comparison\Analysis Dec to Feb 2016
- Block 1 Procedure Opportunity   Feb 2017
  - lower complexity, benefits with minimal/no negative impacts
  - DNL and Alternative Metrics (single event above threshold)
- Block 1 Recommendations    Apr 2017
- Block 2 Procedure Opportunity   Jun 2017
  - More complexity, benefits and potential negative impacts
  - DNL and Alternative Metrics (single event above threshold)
- Block 2 Recommendations    Fall 2017
- FAA Review Process     Ongoing/TBD
- Implementation/Final Report   TBD

Review\Input
MPA CAC
At Key Milestones
Noise and DNL: A Primer

- **Sound Pressure Level**
  - Ratio to minimum audible baseline
  - The dB is with reference to sound power (intensity)
  - A Weighting is a correction to reflect frequency range of human hearing
Examples of SPL from Overflights

Maximum Sound Pressure Level $L_{\text{max}}$

Source: Mathias Basner, Univ. of Penn. ASCENT 17 – Pilot Study on Aircraft Noise and Sleep
Effect of Background Level

Ex: 55 dB(A) Background noise due to Air-Conditioner

Source Mathias Basner, Univ. of Penn. ASCENT 17 – Pilot Study on Aircraft Noise and Sleep
Sound Exposure Level

- Starting point: raw SPL recordings (or 1s equivalent noise) for a specific observer
- Need a measure of **sound energy exposure** at that point
  - Solution: integrate the antilog of the raw dB trace
  - Notionally represented in figure by red shaded area
- Referred to as Sound Exposure Level (SEL) for a single overflight and observer location

Figure: A. Trani, Virginia Tech
Day-Night Level

- DNL incorporates the multitude of single-flight SEL building blocks
- Represents equivalent (average) noise level over a full day (86,400 seconds)
- 10 dB penalty for night operations

Figure: A. Trani, Virginia Tech
Implications of DNL

DNL vs Number of Operations

Change in DNL for a change in number of operations depends on the baseline number of operations.

10 Ops
10.41 dB

10 Ops
0.46 dB

DNL at Observer Location

Number of 80dB SEL Overflights
Shrinking DNL65 Impact at Airports

Note: 65db DNL is FAA’s designation of significant noise exposure.