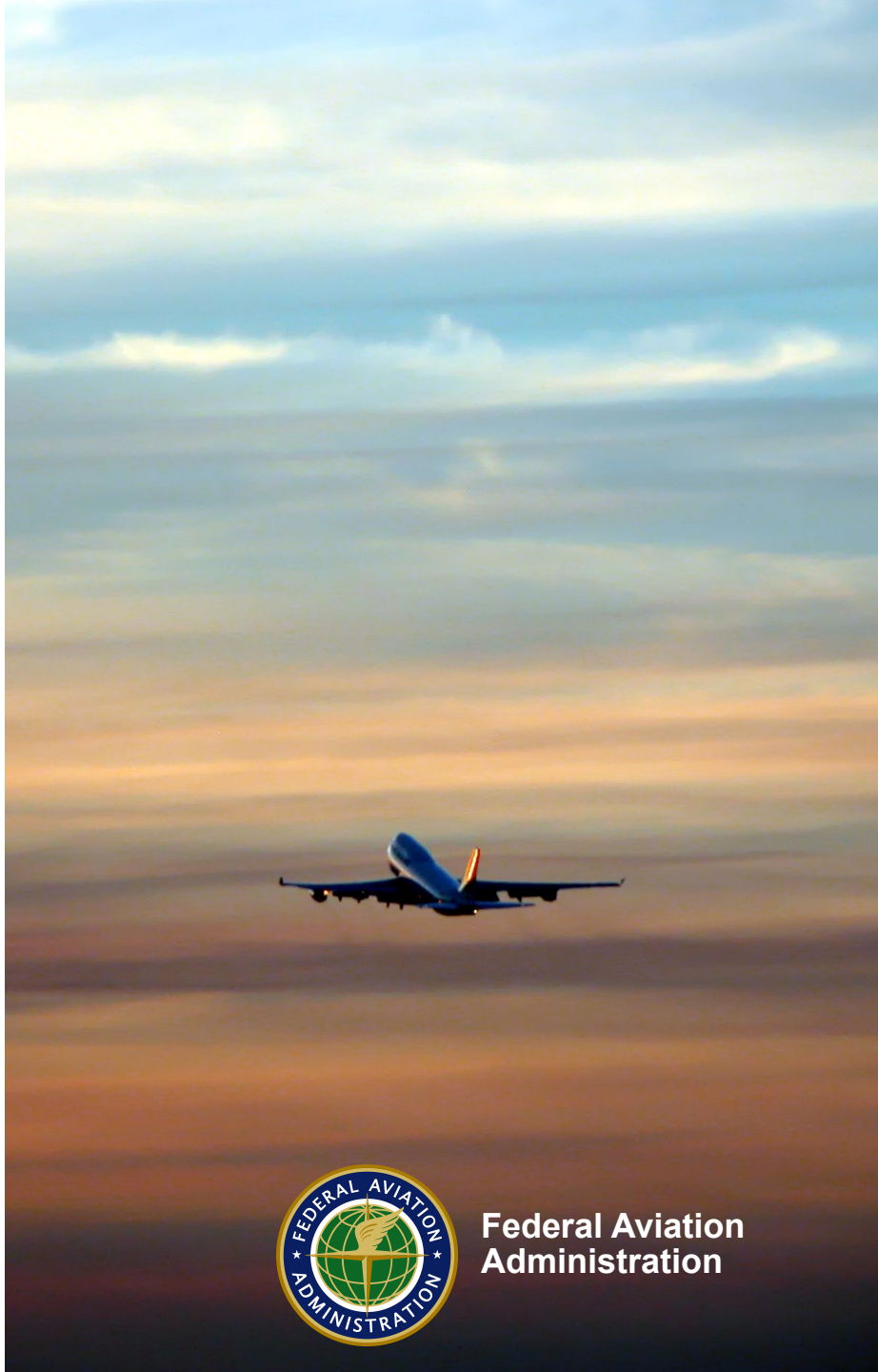
2019 REDAC Fall Meeting

Aircraft Operations for Low Noise

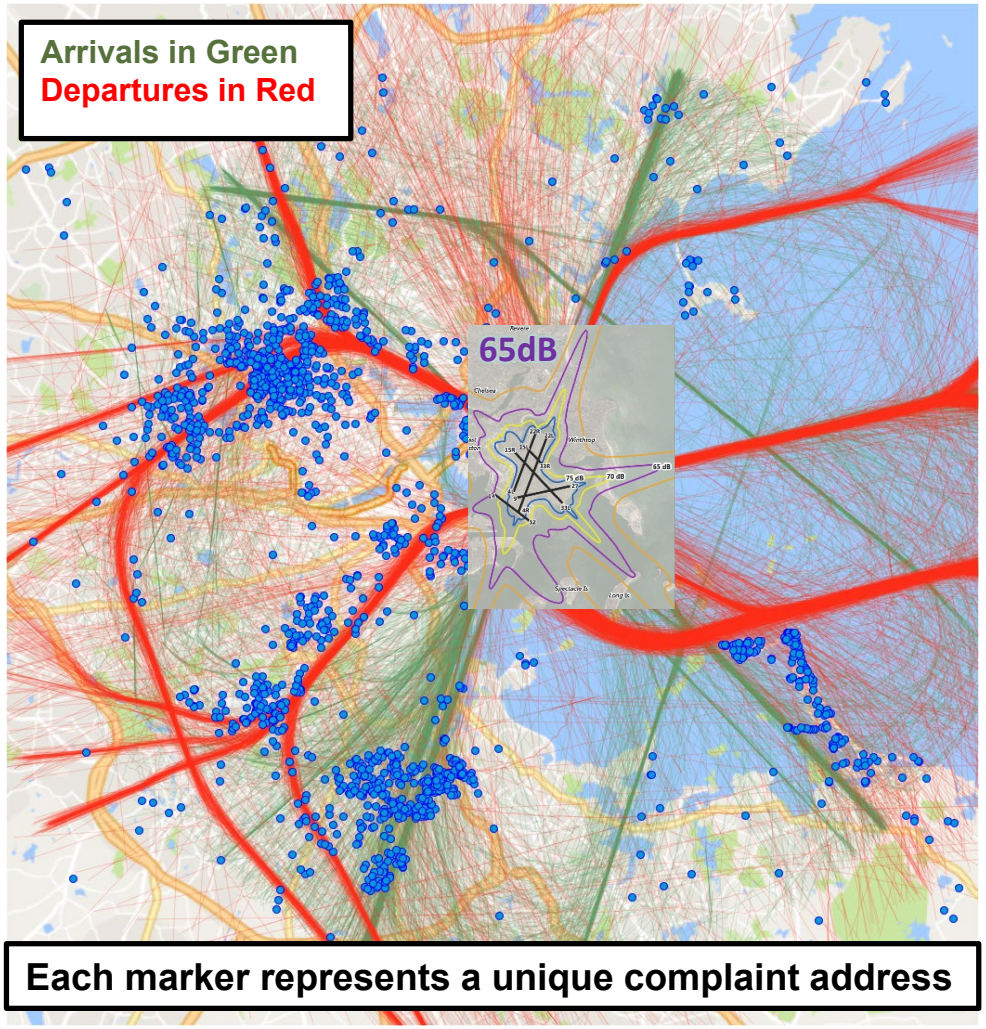
By: Chris Dorbian

Date: September 10, 2019



Today's Situation

- Aircraft noise from 1970s is different than aircraft noise today. Aircraft from 1970s produced the same acoustic energy as 10 to 30 aircraft operations today.
- A few, but relatively loud, events in 1970s would result in DNL 65 dB. Many, relatively quiet events today would also result in DNL 65 dB. However, noise experience would be very different.
- Precision navigation is being implemented to increase the safety and efficiency of the NAS. It also leads to a reduction in the overall number of people exposed to noise from aircraft operations.



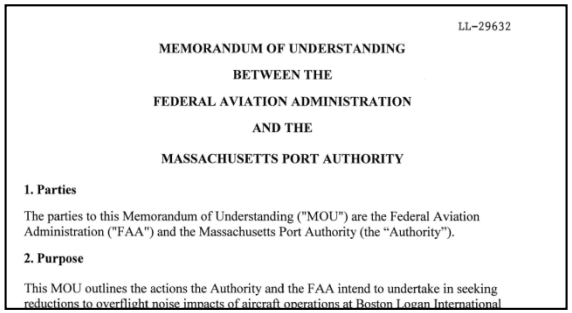
Source:
Brenner, M., Hansman, R. J., Comparison of Methods for Evaluating Impacts of Aviation Noise on Communities, 2017

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



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

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)

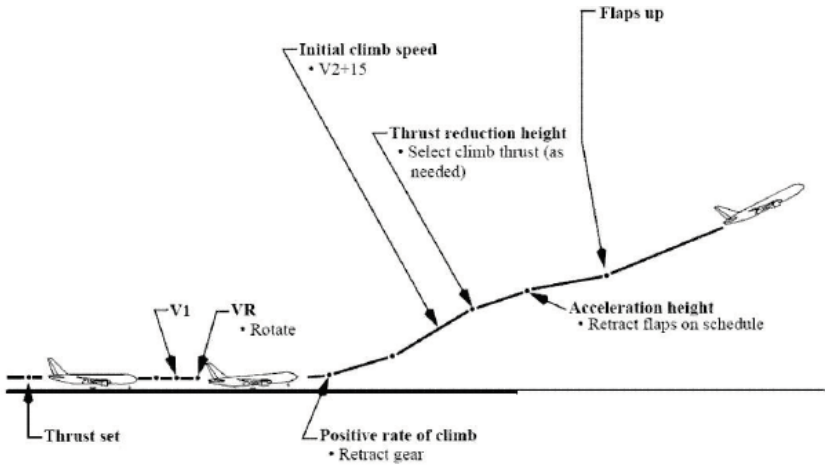
ASCENT Project 23 website https://ascent.aero/project/analytical-approach-for-quantifying-noise-from-advanced-operational-procedures/
AEDT website https://aedt.faa.gov/
Massport MOU https://www.faa.gov/news/updates/?newsId=86645
FAA CLEEN Program
https://www.faa.gov/about/office_org/headquarters_offices/apl/research/aircraft_technology/cleen/

Massport MOU Block 1 Final Recommendations

Proc. ID D = Dep. A = Arr.	Procedure	Primary Benefits	Status
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)	**Pending** (will address in Reauth. Sec. 179 report)
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	**Advanced**
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	**Rejected** (separation requirements; aircraft performance issues)
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	**Advanced**
1-A1a	*Option A*: Published instrument approach procedure		
1-A1b	*Option B*: Public distribution of RNAV Visual procedure		

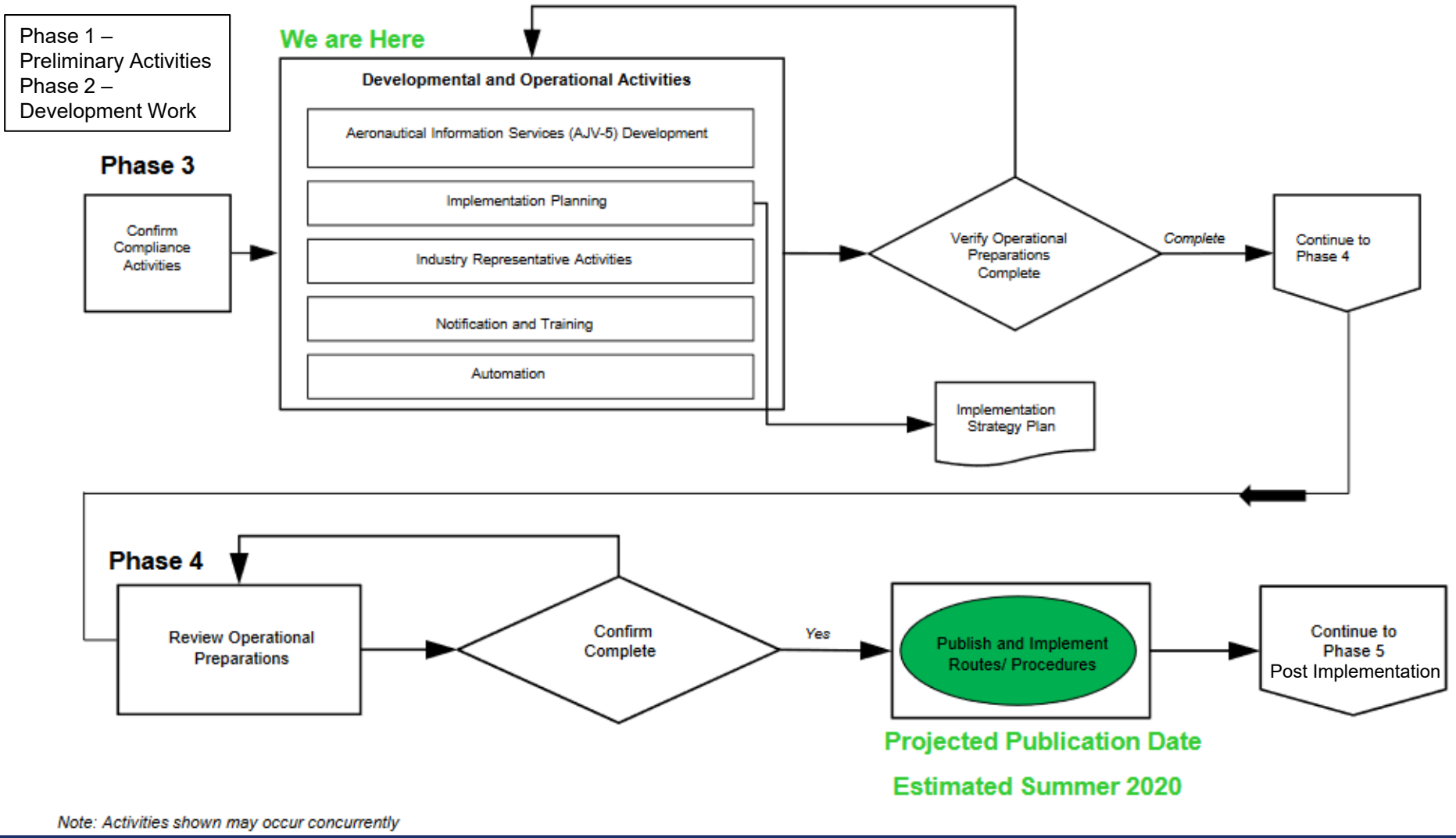
Block 1: Reduced Speed Climb (1-D1)

- Discussions with NASA/industry on noise modeling methods/assumptions indicate that there is little to no noise benefit
- No longer under consideration for MOU, but continuing to investigate other speed management concepts
- **Reauthorization, Sec. 179:** *Airport noise mitigation and safety study:* "Not later than 1 year after enactment, the FAA shall initiate a study to review and evaluate existing studies and analyses of the relationship between jet aircraft approach and takeoff speeds and corresponding noise impacts on communities surrounding airports"
- On target to meet October 2020 deadline for report to Congress



- **Baseline**: Typical profile includes thrust reduction at 1,000' AGL followed by an **acceleration to 250 kt climb speed** and **flap retraction**
- **Recommended procedure:** Thrust reduction at 1,000' AGL followed by an **acceleration to 220 kt climb speed or minimum safe airspeed in clean configuration, whichever is greater** until a TBD altitude (i.e. 6,000' or 10,000')

7100.41A PBN Procedure Development Process



Note: Activities shown may occur concurrently

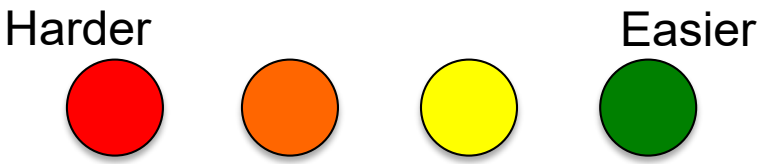
Potential Block 2 Procedures

Block 2 Arrival Mods

- Lateral Path Changes
  - Runway 22L
    - RNAV approach with RNP Overlay
  - Runway 4R
    - RNAV approach with RNP Overlay
    - RNP approach
- Vertical Path Changes
  - Delayed Deceleration Approach
  - Continuous Descent RNAV Profiles
    - 4R Arrivals from South
    - 4R Arrivals from North

Block 2 Departure Mods

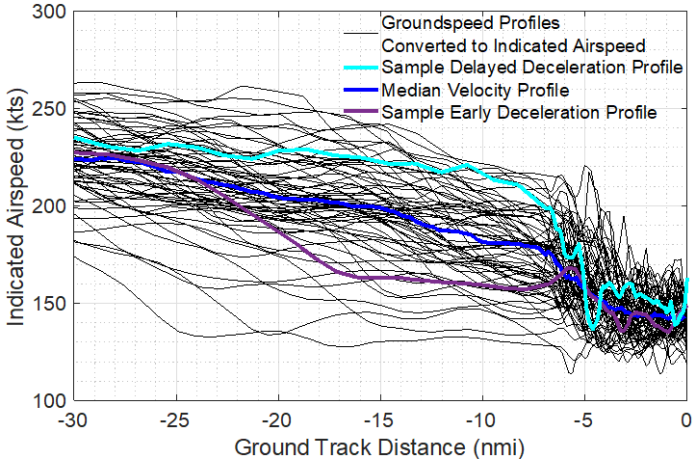
- **22 Departure**
  - Re-recommend 1-D3c: when 27 not in use, heading-based departure then re-join RNAV SID
- **33L and 27 Dispersion**
  - Altitude-based dispersion
    - 3000ft
    - 4000ft
  - Controller-based dispersion
  - Divergent heading dispersion
  - RNAV SID Waypoint Relocation



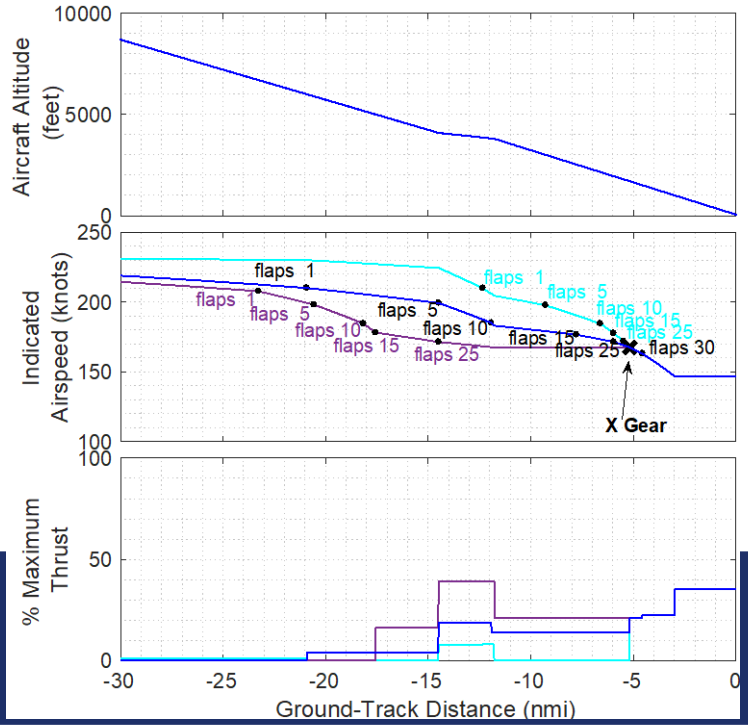
Preliminary/Subject to Change

Delayed Deceleration Approaches

Velocity Radar Data for B737-800 4000ft Level Offs into 4R

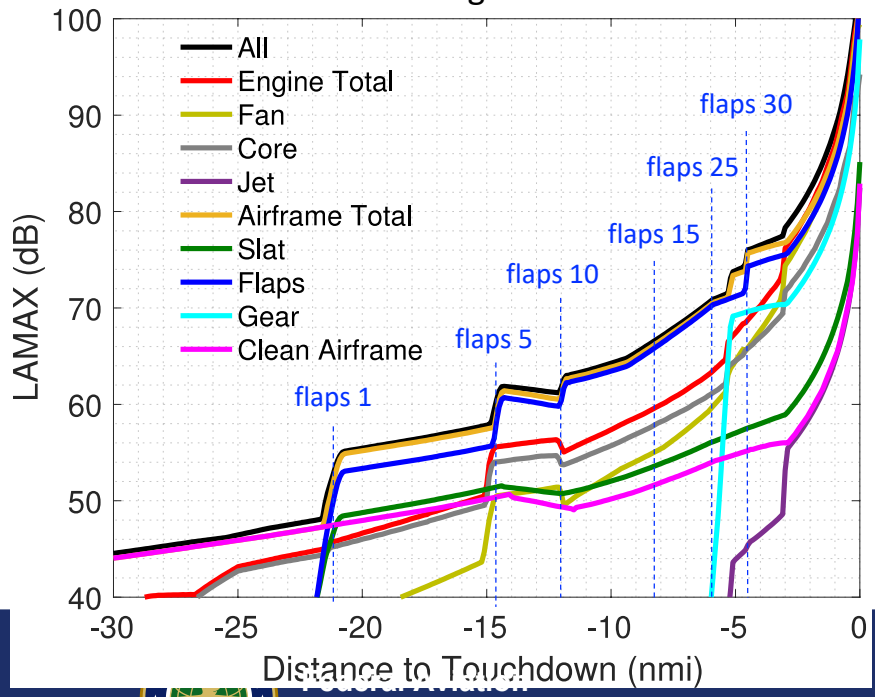


Modeled Profiles



- Reduce noise by delaying extension of flaps
- Potential concerns from ATC and pilots regarding different deceleration rates and managing traffic
- Must decelerate early enough to assure stable approach criteria
- Additional study/validation needed to understand noise impact

Example Noise Component Breakdown Under the Flight Track



Aircraft Noise Abatement Procedure Modeling and Validation

- Objective: Develop an approach to modeling and validating advanced operational flight procedures that incorporate modified configurations and speeds
- Working with NASA & industry to identify opportunities for demonstration/measurement of high potential procedures
- Interested in collecting detailed aircraft state data and correlating with noise measurement
  - Data mining of operational data to identify noise abatement opportunities and improve tools

Image Source: DLR

ATR – Noise Abatement Procedure Usage and Effectiveness

- Objective: Develop recommendations and best practices for more effective and frequently-used noise abatement procedures

Runway Use

- Preferential
- Nighttime
- Opposite Direction
- Rotational

Departures

- Initial Heading
- Routing Downstream
- Nighttime

Arrivals

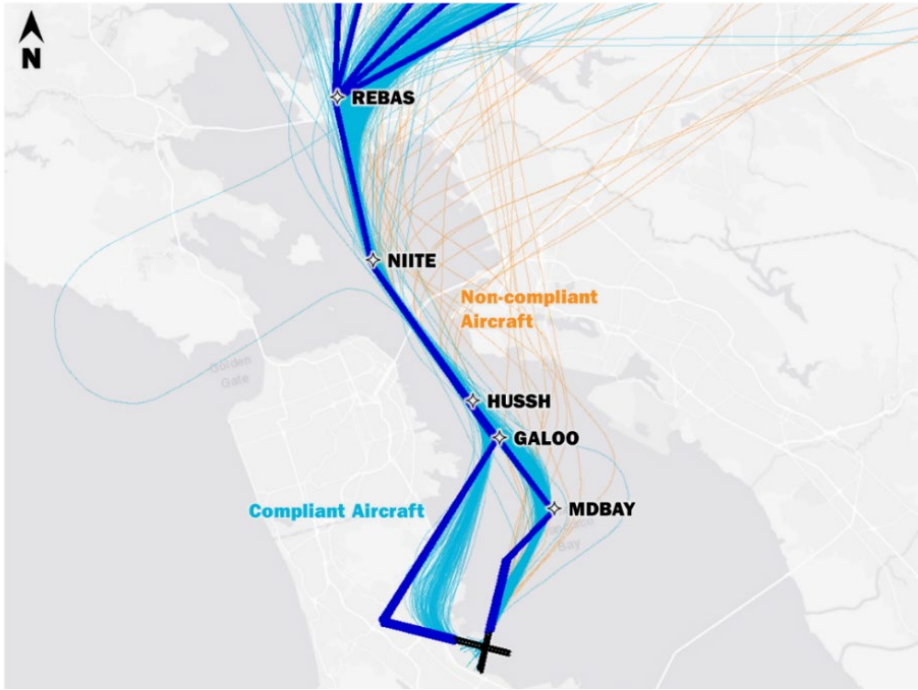
- Arrival Procedures
- Nighttime

- Analyzed data for these concepts at select locations

Project Conclusions

Recommendations

- Define noise abatement procedures in a way that can be implemented by ATC and flown by pilots
- Consider other operational factors that influence noise abatement procedure use (e.g., demand, weather)
- Consider use of instrument flight procedures (IFPS)
- Document and organize noise abatement procedures in a standardized manner
- Publicize and coordinate noise abatement procedures with relevant stakeholders
- Set realistic expectations of use and compliance for noise abatement procedures



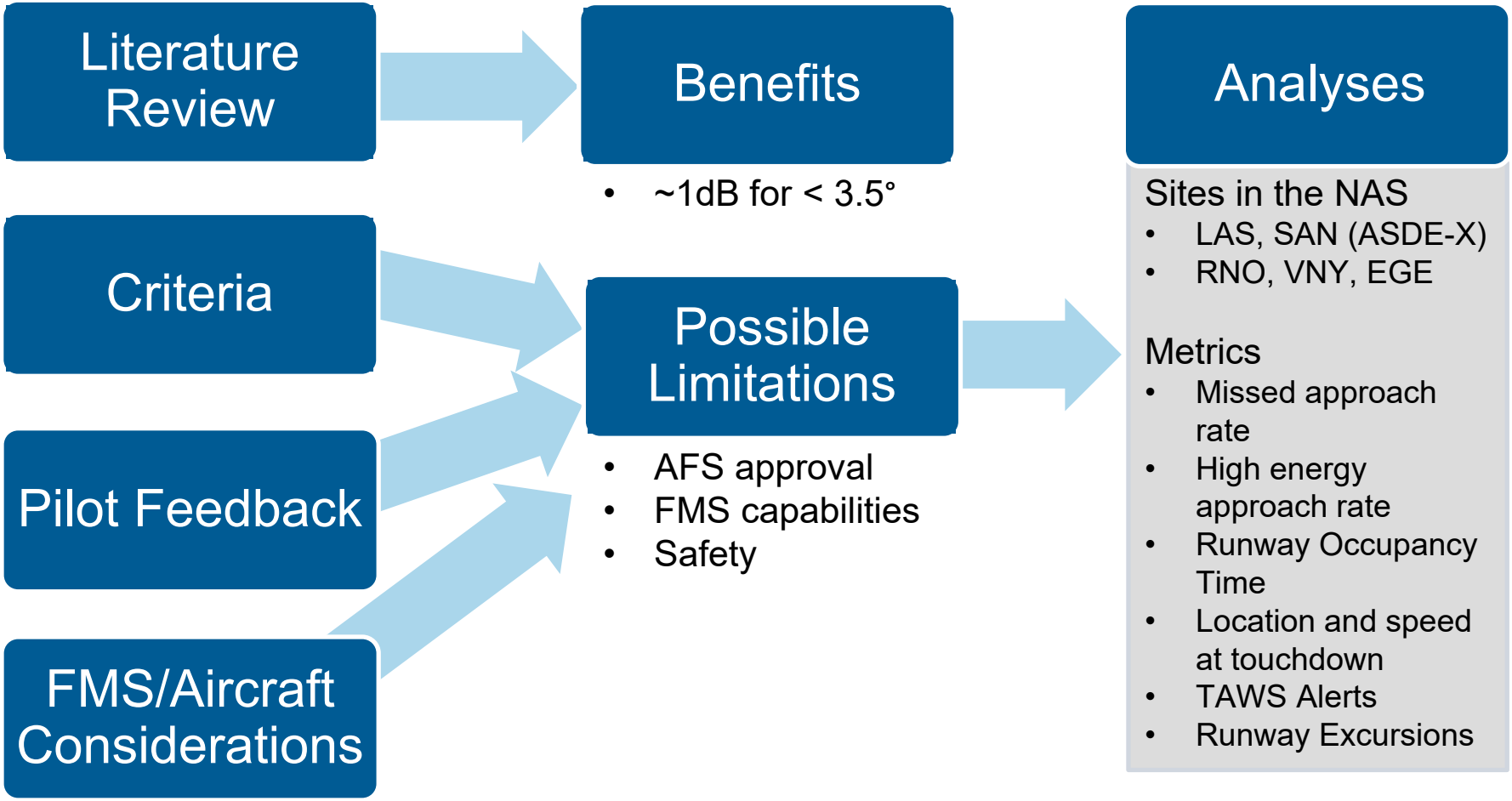
NCT SOP, Section 5-11-b, dated January 1, 2018
97% Compliance

Potential Next Steps

- Integrate best practices for NAP development into advisory circulars and the procedure design and implementation workflow
- Conduct in-depth review of NAPs at selected airports

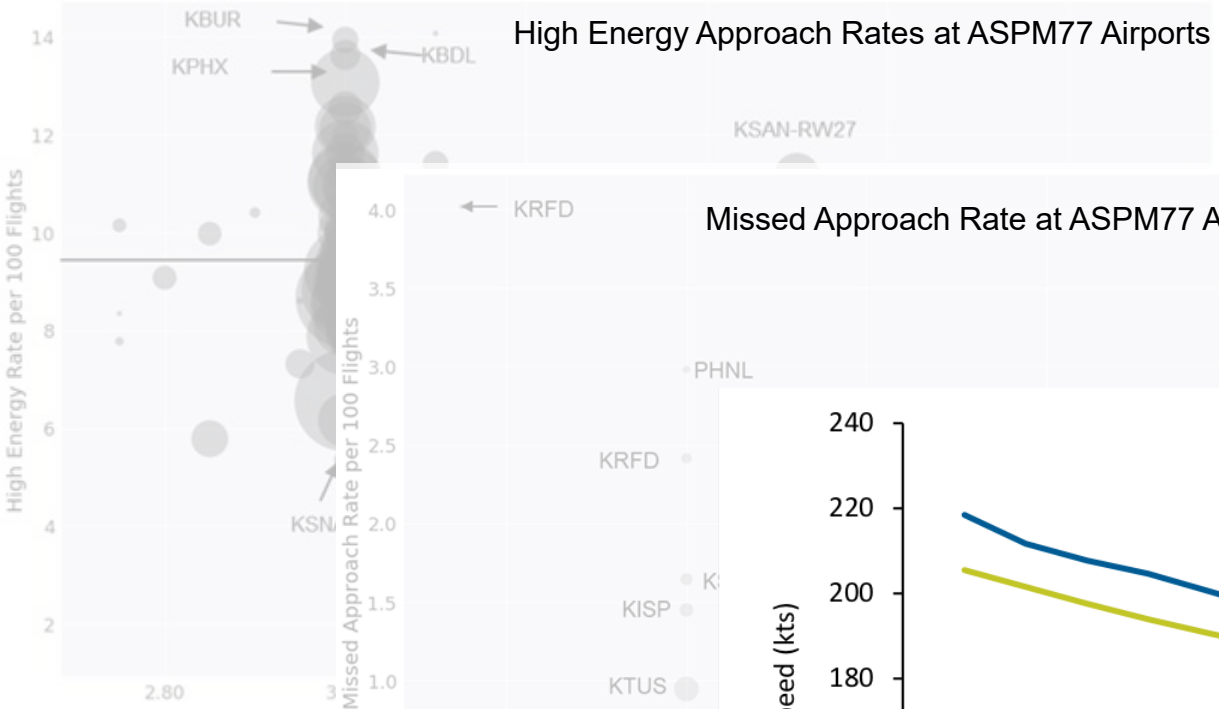
ATR – Steeper Approaches for Noise Abatement Operational Feasibility

- Objective: Gain better understanding of the operational constraints on implementing steeper approaches for noise mitigation in the US



Safety and Operational Considerations

High Energy Approach Rates at ASPM77 Airports



Missed Approach Rate at ASPM77 Airports (1/2012-6/2017)

Average Approach Speeds at KSAN

Project Conclusions

Findings

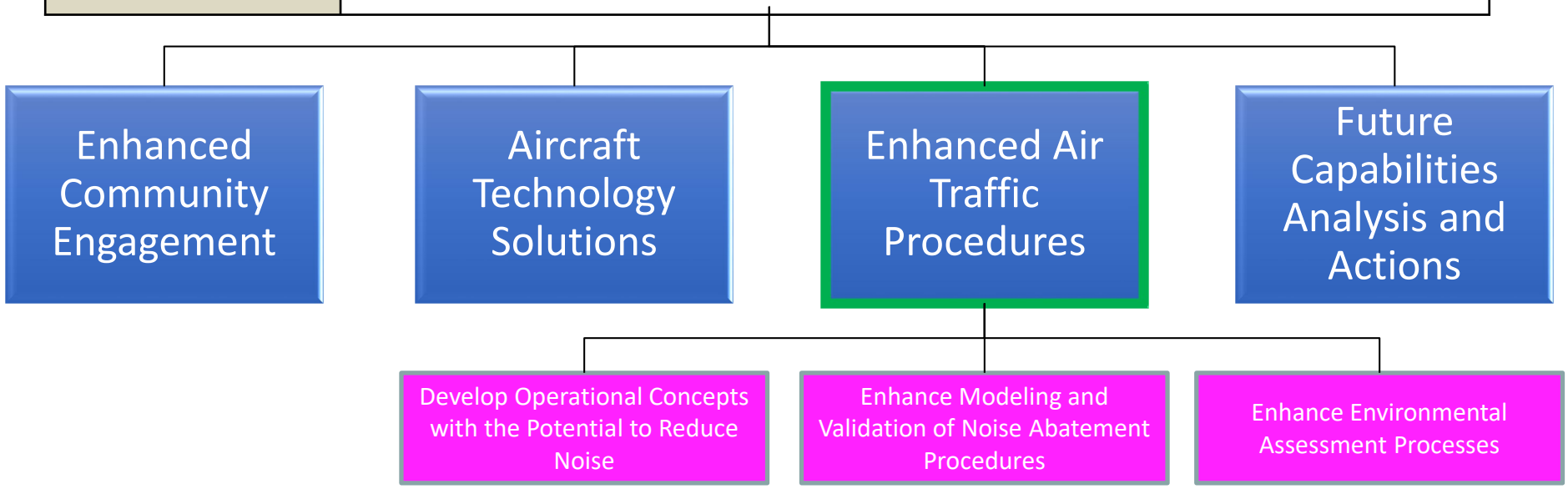
- Examination of multiple safety metrics showed no definitive trends indicating increased safety risks from steeper approaches
  - Currently used at many airports for terrain or obstacle avoidance – remain an effective way to enable access to the airport.
- Noise benefits for approach angles < 3.5 ° are small
- Approach angles > 3.5 ° may have detectable noise benefits, but have challenges
  - Require review and waiver from FAA Flight Standards Service
  - Certification standards, airline policies, autoflight system limitations, crew training requirements,…

Potential Future Implementation Activities (focused on > 3.5 °)

- Develop use cases
- Conduct additional simulations
- Conduct limited flight trials
- Conduct limited implementation
- Expand use throughout the NAS

NextGen Enterprise Risk Management Board: Noise Risk Mitigation Strategy

Risk ID	3573
Risk Title	Addressing Public Noise Concerns in Support of NAS Modernization
Risk Owner	Victoria Wei, Angela McCullough
Risk Statement	If the FAA does not appropriately address aircraft noise, then NAS modernization may not be fully realized.



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**
- **Seeking opportunities to operationally validate and measure concepts with potential to reduce noise**