BOS BLOCK 1 Full Work Group Response

Presentation to: Massport CAC

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The concepts in this presentation do not constitute, or imply, a reopening of the Boston Logan Airport Noise Study (BLANS)

Any designs identified for further development must go through the environmental process

How Did We Get Here?

- **An MOU was signed between Massport and FAA September, 2016**
- **Formation of 7100.41A PBN Full Working Group (FWG)**
  - May, 2018 FAA formed PBN FWG via FAA Order 7100.41A
  - FWG consists of Industry, Air Traffic Facilities, and Massport/MIT
  - Reviewed BOS BLOCK 1 recommendations to determine operational feasibility
  - Designed procedures in an attempt to mitigate BOS BLOCK 1 concerns and address FAA procedural requirements

FAA JO 7100.41A

The Performance Based Navigation (PBN) Implementation Process

Performance Based Navigation (PBN) Procedures

- Area Navigation (**RNAV**) Procedures
  - RNAV SIDS
  - RNAV STARS
  - Q and Y Routes
  - T Routes
  - TK Routes

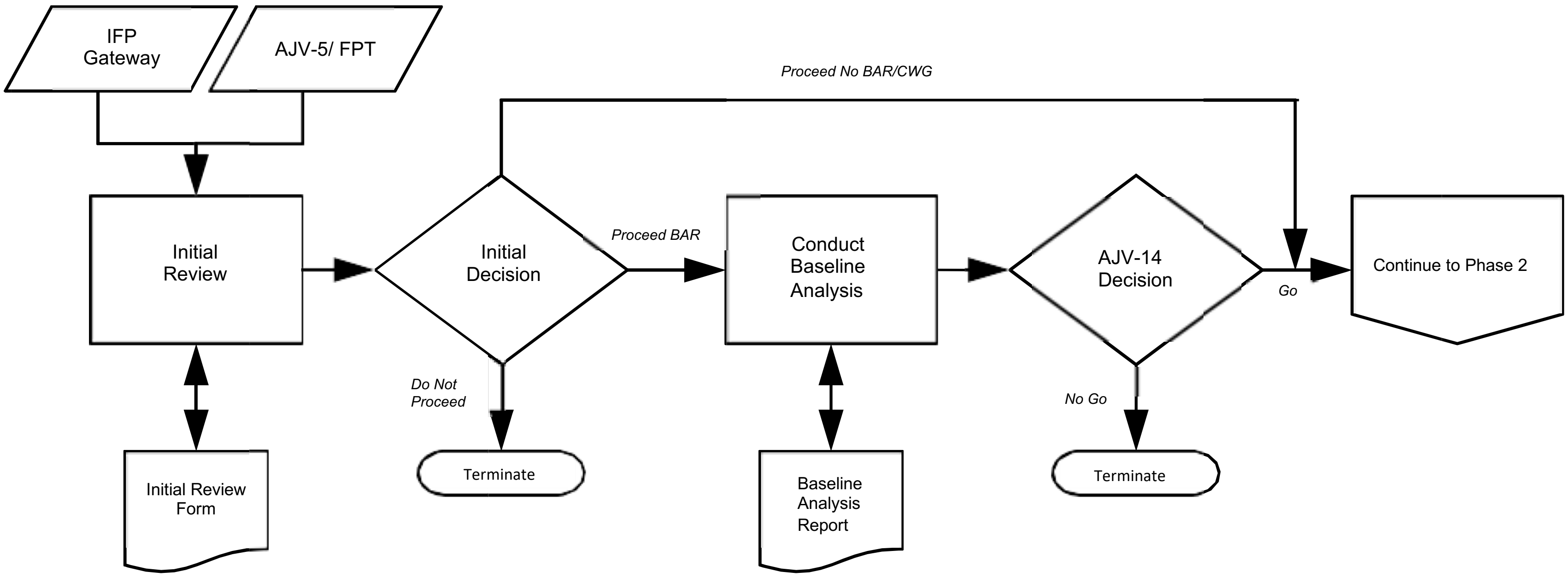
- Required Navigation Performance (**RNP**) Procedures
  - RNAV RNP Approaches
  - RNAV RNP SIDs

PBN IMPLEMENTATION PROCESS

- Phase 1: Preliminary Activities
- Phase 2: Development Work
- Phase 3: Operational Preparation
- Phase 4: Implementation
- Phase 5: Post Implementation

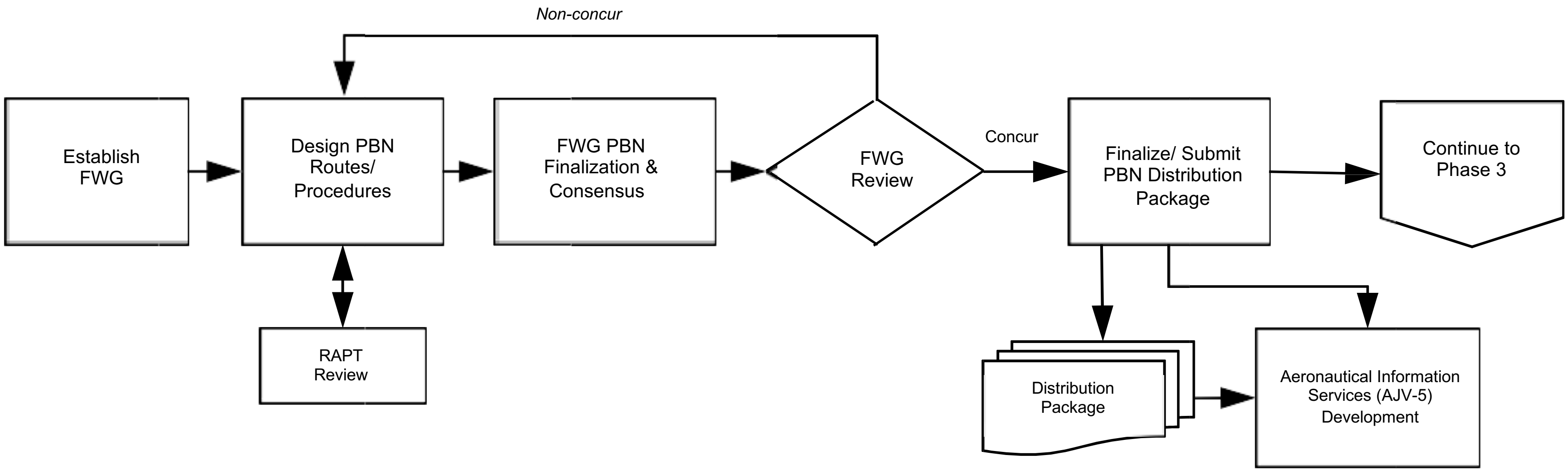
- **Environmental review runs concurrently with the PBN phases and is completed prior to implementation**

Phase 1



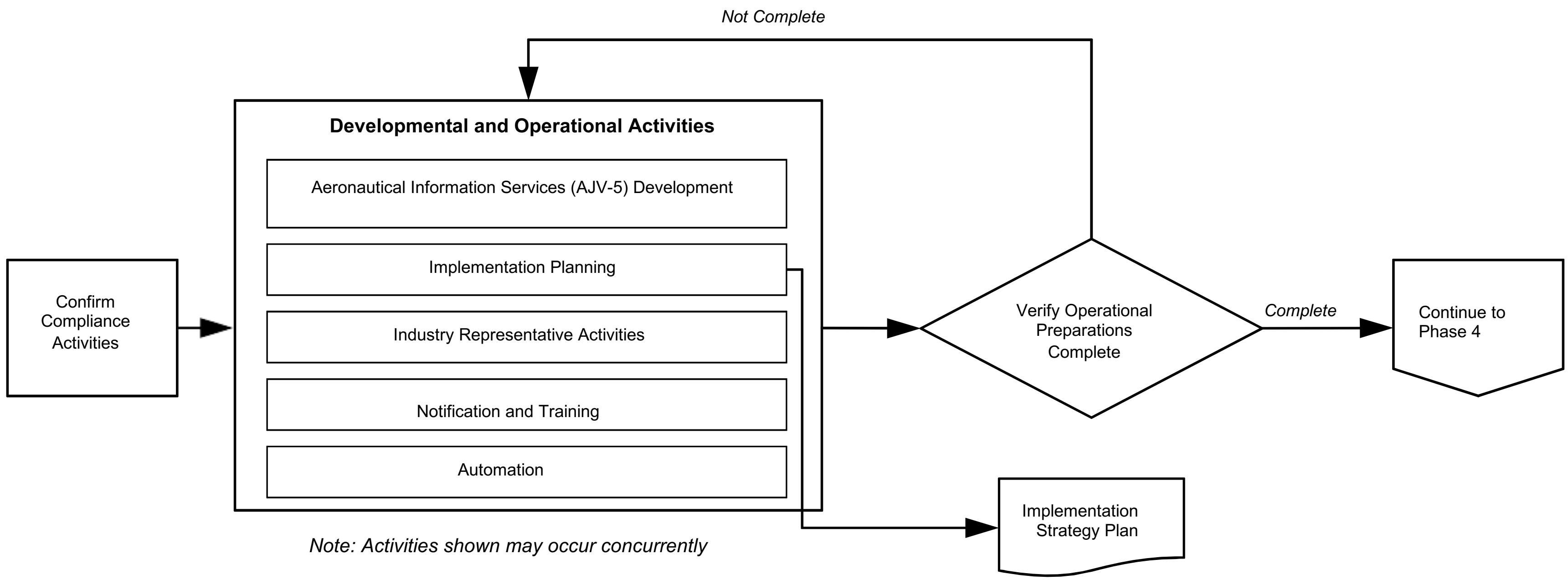
- ❖ Justify Work
- ❖ Validate Need
- ❖ Validate Priority
- ❖ Compare with other Requests

Phase 2



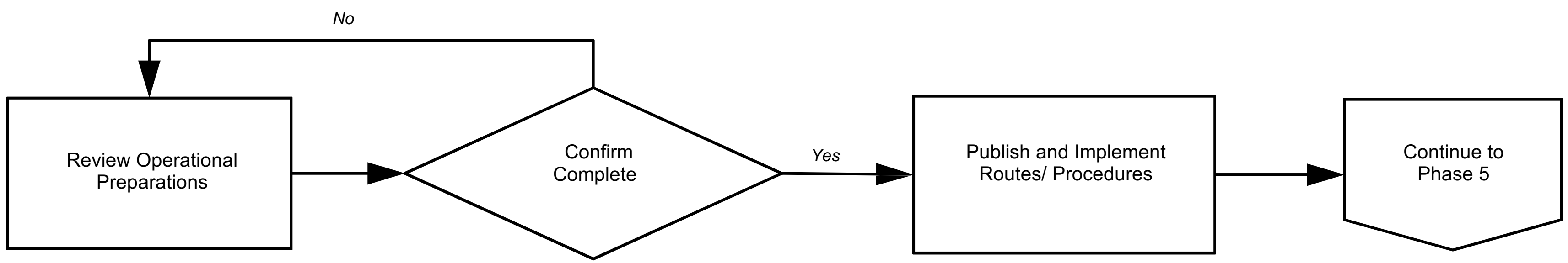
- ❖ Establish FWG
- ❖ Develop Procedure Designs
- ❖ Documents are Prepared and Distributed
- ❖ Industry Flight Simulations

Phase 3



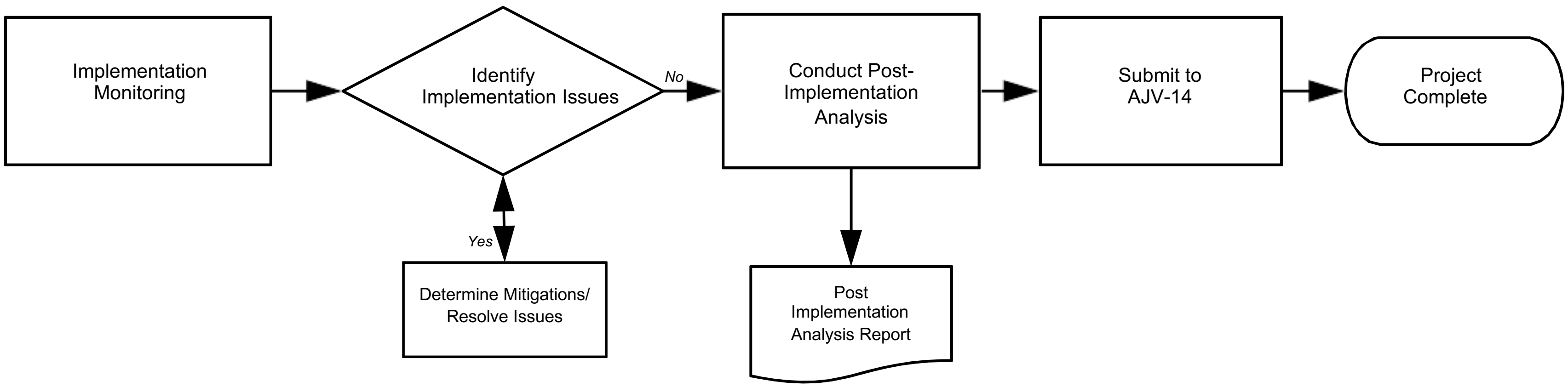
- Designs are:
  - Finalized
  - Evaluated for Safety
  - Flight Checked
  - Sent for Publication
- Air Traffic:
  - Develops and Administers Training
  - Develops Standard Operating Procedures (SOPs)
  - Adapts Automation Software
- Industry:
  - Develops and Administers Training
  - Adapts Flight Plan Filing Automation

Phase 4



- ❖ Publish Procedures
- ❖ Implement Procedures

Phase 5



- ❖ Validate Procedure is Working Properly
- ❖ Identify and Mitigate Issues

BOS Block 1

Status Update

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	

(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

Primary Benefit: Reduced airframe and total noise during climb below 10,000 ft. (beyond immediate airport vicinity)

- **A separate Work Group has been identified as this recommendation falls outside the scope of the PBN Implementation Process**
  - **Work Group is composed of the following FAA Lines of Business**
    - **Flight Standards**
    - **System Operations**
    - **Operations Support Group**
    - **Air Traffic Control**
    - **Office of Environment and Energy (AEE)**

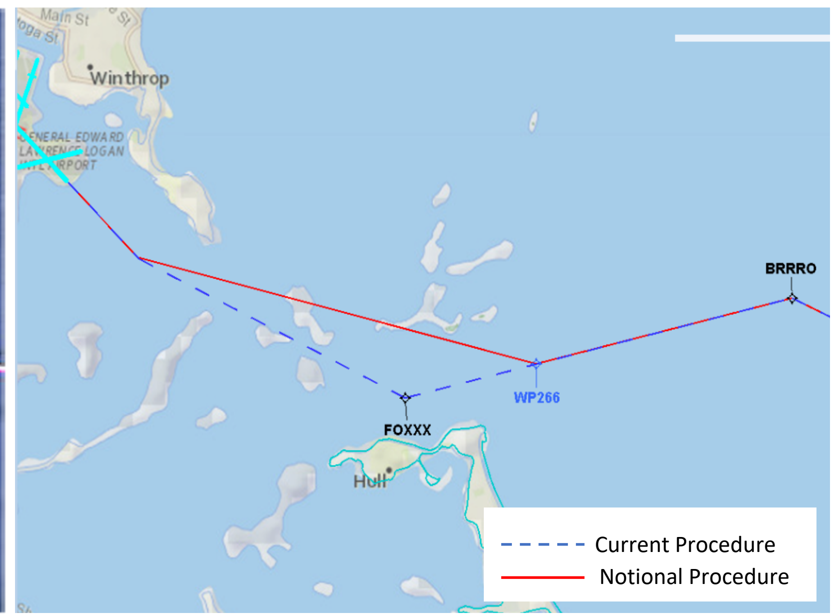
(1-D2)

Modify RNAV SID from Runway 15R to move tracks further to the north away from populated areas.

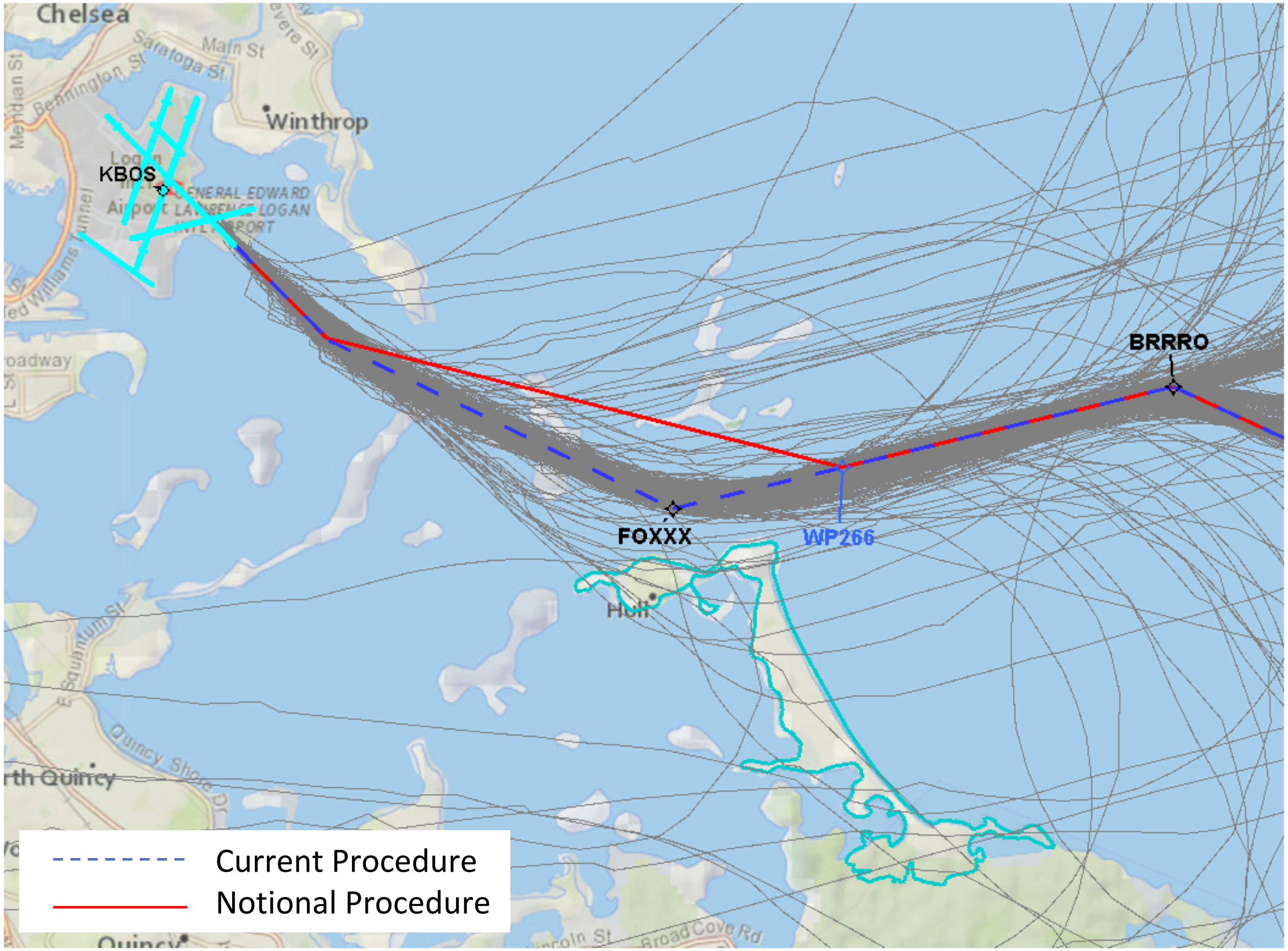
Primary Benefit: Departure flight paths moved north away from Hull

Design recommended by MIT

Notional design by Full Work Group as of October 4, 2018



RWY 15R Transition (TXN) current and notional designs with recent radar tracks

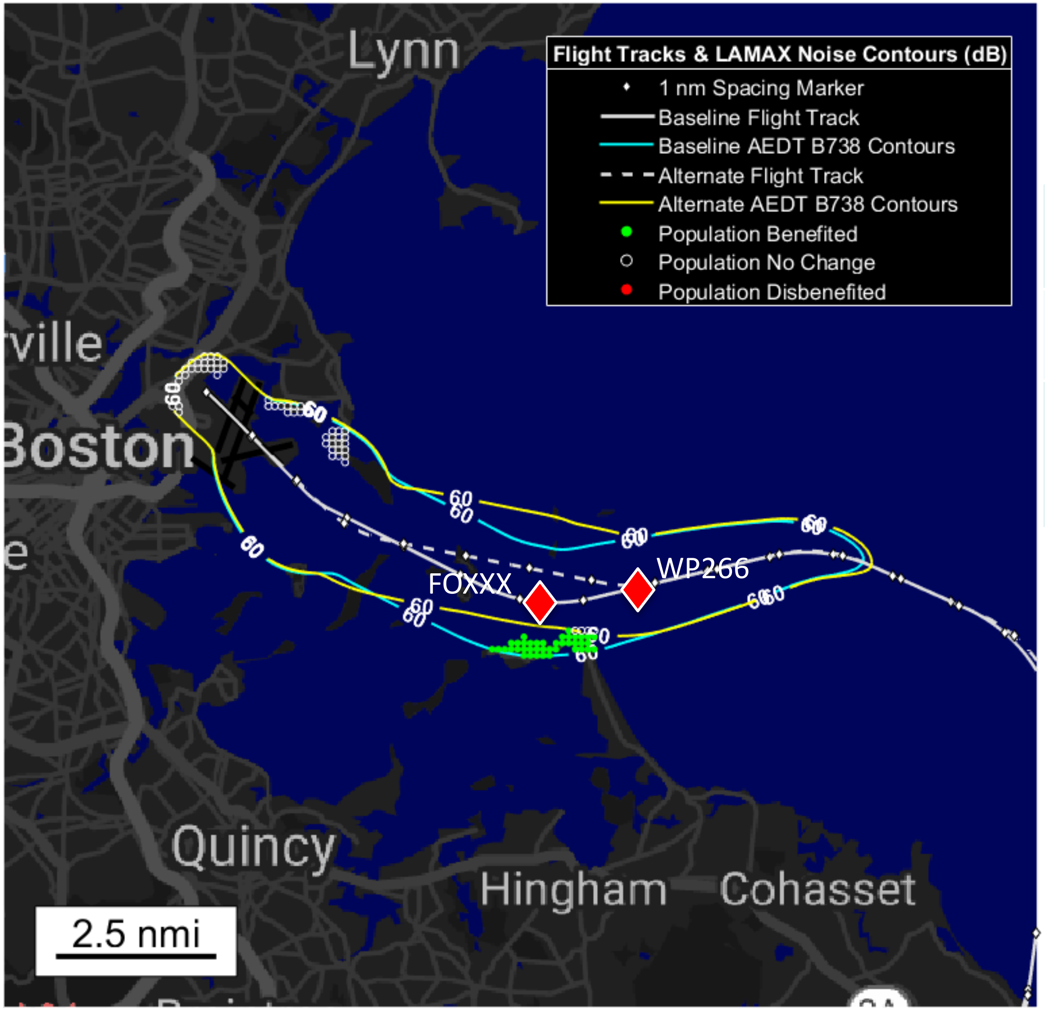


WP266 is located approximately 1.58 nm east of FOXXX

- Radar tracks August, 2018

(1-D2)
MIT Estimates RWY 15R TXN Modification

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



B737-800
Population Exposure ($L_{A,MAX}$)

	60dB
Current RNAV	5,838
.41 RNAV	4,815
Difference (Current RNAV – .41 RNAV)	1,023

(1-D3)

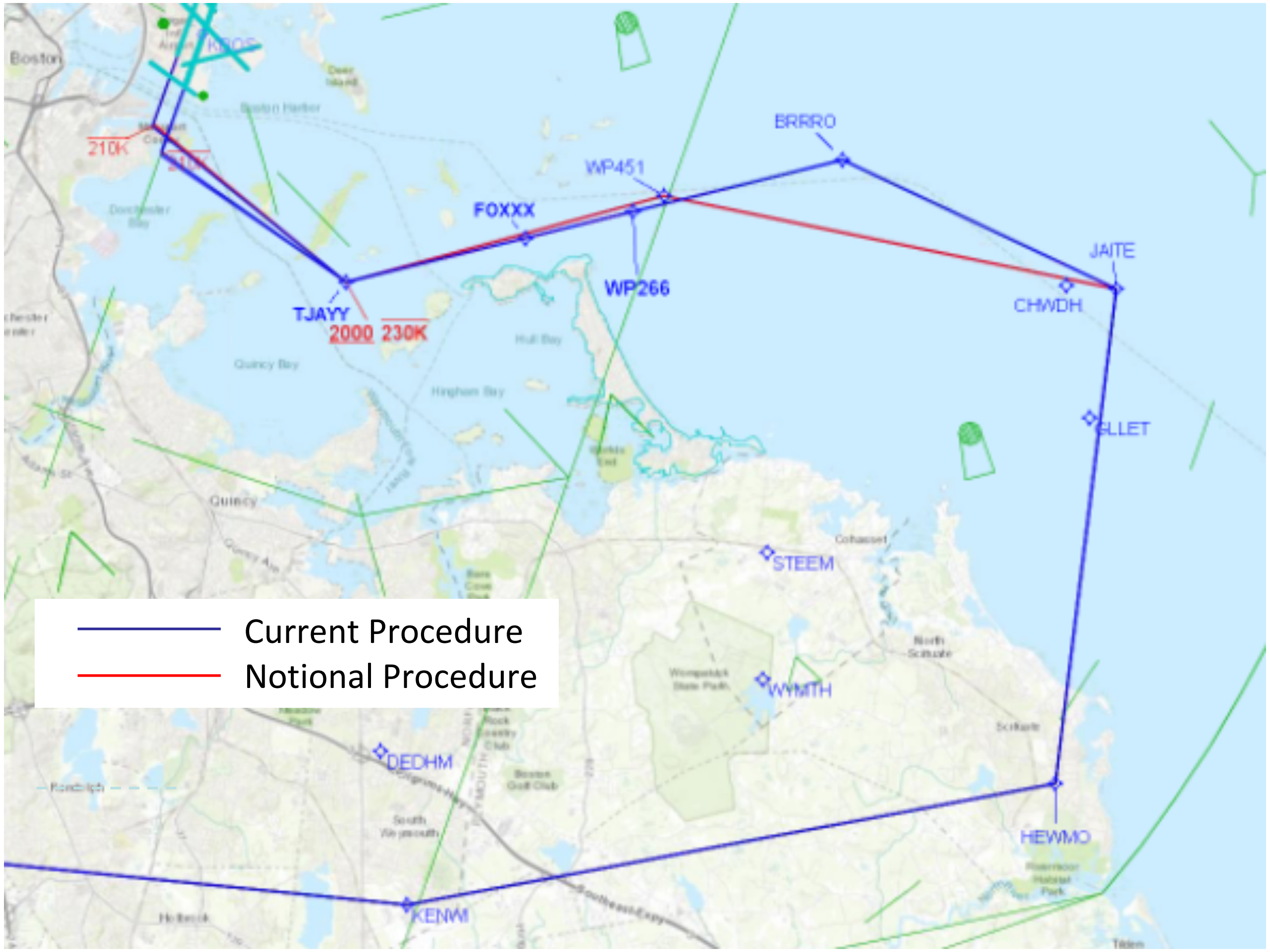
Modify RNAV SID from Runway 22L and 22R to initiate turns sooner after takeoff and move tracks further to the north away from populated areas

Primary Benefit: Departure flight paths moved north away from Hull and South Boston

Option A: Climb to intercept course (VI-CF) procedure
Option B: Climb to altitude, then direct (VA-DF) procedure
Option C: Heading-based procedure

(1-D3a)

Option A: Climb to intercept course (VI-CF) procedure



- RWY 27 arrival separation requirements keep RWY22 transitions from moving further north
- Unable to move track further from HULL
- Shoreline crossing north of HEWMO would be at lower altitude
- Original designs were not flyable
- Current designs are the result of extensive study by industry and the FAA with the intent to be as far away from Hull as possible
- After extensive review by the FWG, no further design changes are feasible

(1-D3b)

Option B: Climb to altitude, then direct (VA-DF) procedure

- **Aircraft navigational limitations resulted in termination of the earlier VA-DF procedure in 2011**
  - 2011 MITRE study confirmed aircraft navigational limitations
  - Meetings with Industry resulted in recommendation of VI-CF procedures
  - VI-CF procedures were developed and currently in use

- **Wide splay of aircraft tracks were rejected by community**
  - There were numerous community complaints from South Boston and Hull that aircraft were too close/overflying the communities
  - 2011 HMMH study commissioned by Massport confirmed wide splay of aircraft tracks; Recommended VI-CF procedures to correct
  - VI-CF procedures were developed and currently in use

- **The current Work Group reviewed the VA-DF option and determined Runway heading to 520ft prior to turning to the first waypoint is not feasible**
  - Would cause heavy/low performing aircraft to fly over Hull due to delayed turns because of slower climb rates

(1-D3c)
Option C: Heading-based procedure

- ❖ **Increases verbiage between Local Control, Departure Control and pilots**
- ❖ **Increases probability of readback/hearback errors, a safety issue**
- ❖ **Shortening departure paths cause conflicts with ROBUC STAR, particularly with heavy/low performing aircraft**
- ❖ **Current procedures from 4R, 9, 15R, 22R/22L provided noise benefits to shoreline communities**
- ❖ **Logan CAC requested RNAV SID departures in lieu of vector based procedures**

  * Vector based procedures are in direct conflict with BLANS (BLANS Table 3-2)

(1-A1)
Implement an over water RNAV approach procedure with RNP overlay to Runway 33L that follows the ground track of the JetBlue RNAV Visual procedure as closely as possible

Primary Benefit: Arrival flight paths moved over water instead of over the Hull peninsula and points further south

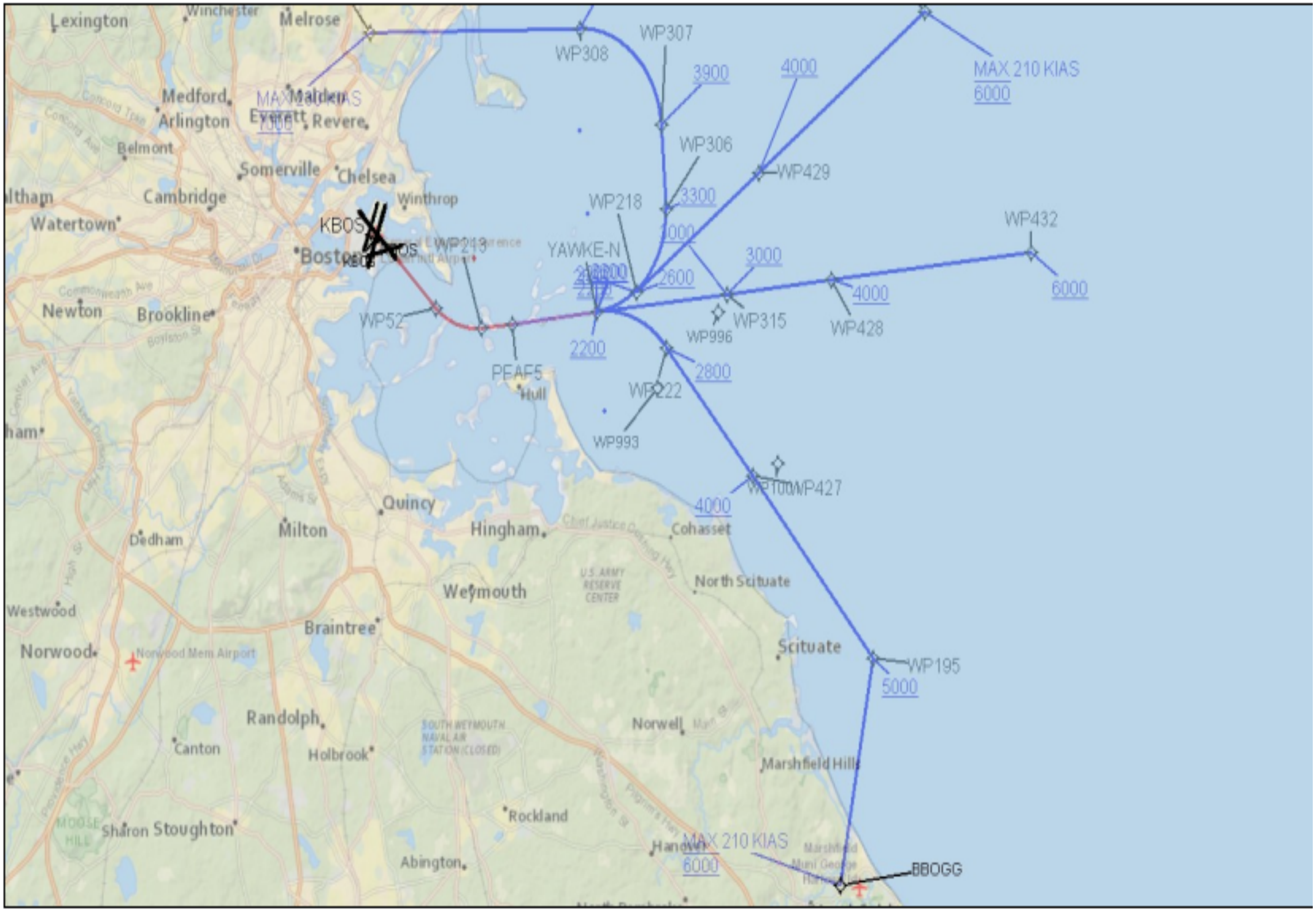
* The following designs are intended for use when operational conditions allow, primarily when Nocturnal Procedures are in use during periods of very low traffic volume

NOCTURNAL STARs

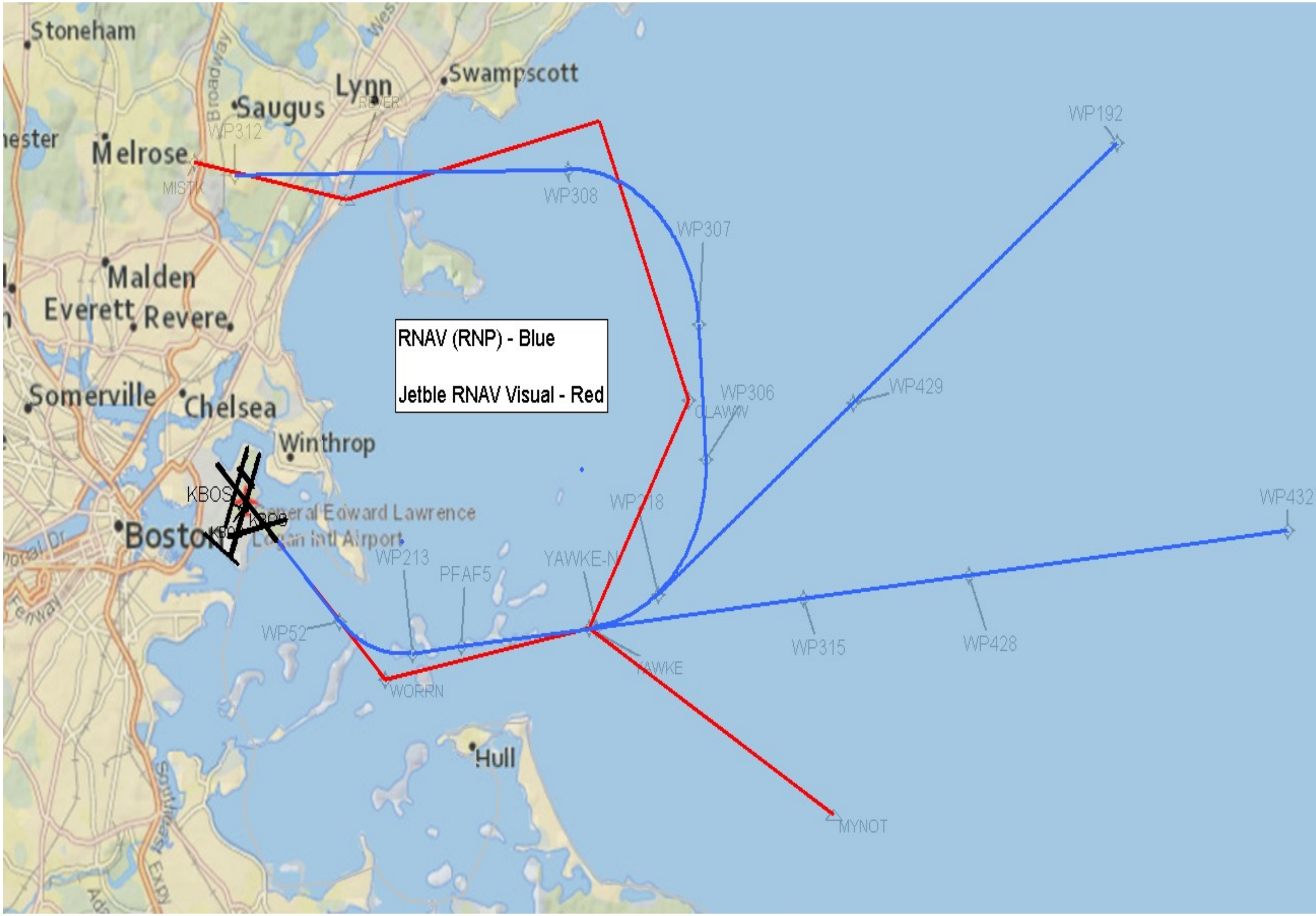
- **OBJECTIVE - Mirror the ROBUC, JFUND and OOSHN RNAV STARs with runway transitions that connect to RNAV approaches developed during evaluation of the Block 1 recommendations**

- **New Nocturnal STARs**
  - LUNAA (RNAV) STAR (mirrors ROBUC)
  - BUNNT (RNAV) STAR (mirrors JFUND)
  - CGURL (RNAV) STAR (mirrors OOSHN)

Notional RNAV (RNP) RWY33L

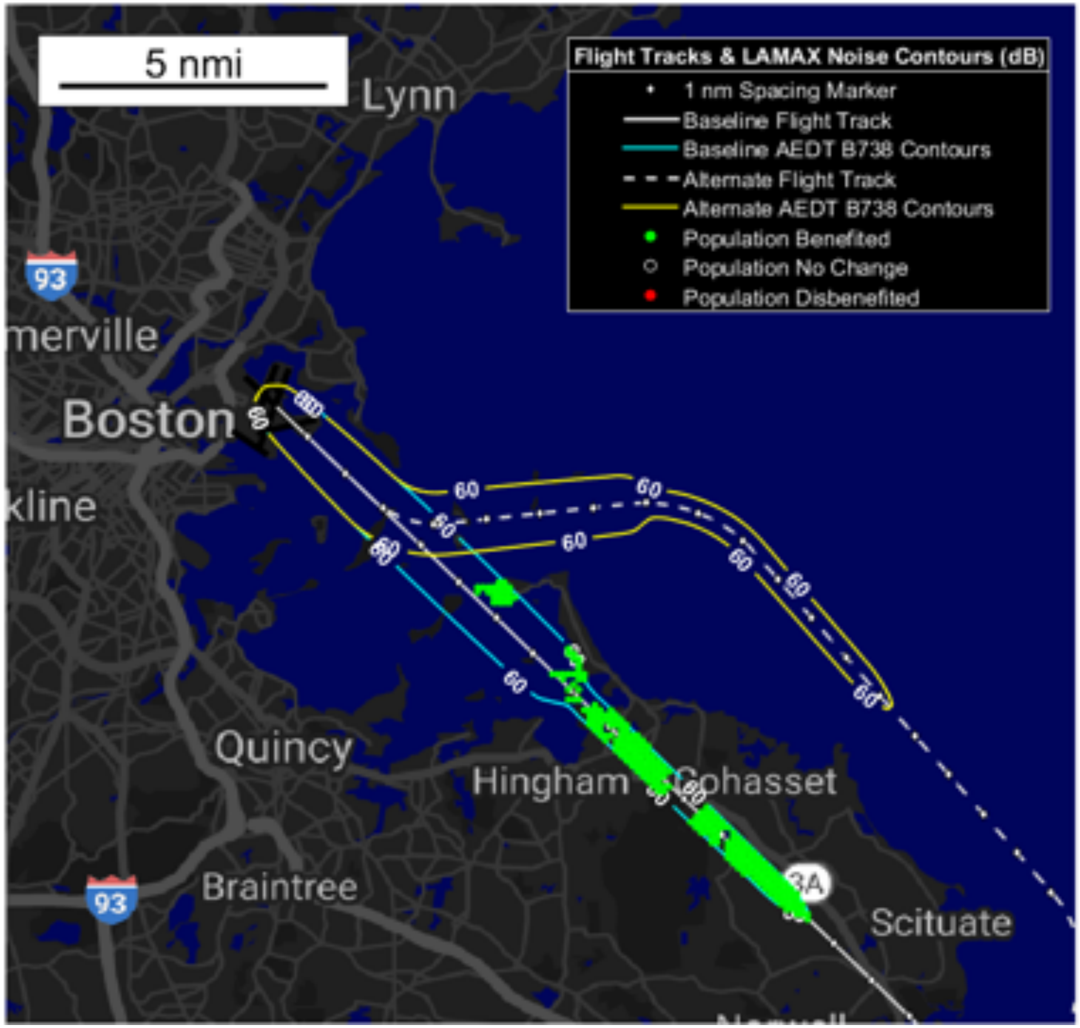


RNAV (RNP) RWY33L with RNAV VISUAL



MIT Noise Evaluation of RNAV (RNP) RWY 33L Notional Design

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



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

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

RNAV (GPS) RWY 33L Recommendations

RNAV (GPS) RWY 33L - Introduction

- Development tasked to overlay to the extent possible JetBlue RNAV Visual Rwy 33L Approach
- OSG-FPT has designed 7 designated versions of the procedure
- All 7 had issues identified by either Industry, CAC or failed safety criteria

RNAV (GPS) RWY 33L Approach (version 1)

- **Industry Concerns**
  - Airlines expressed concern that an offset final to runway 33L can cause confusion to pilots. Pilots may assume approach runway 32 thinking that it is runway 33L during night hours
  - Being in a turn at low altitude when turning to final approach
  - Reflections off water at night which could cause confusion for the pilot

RNAV (GPS) RWY 33L Approach (version 3)

- **Procedure was developed and flight inspected**
- **Flight Standards office approved a waiver to allow the use of a 39° turn on final for this procedure**
- **Was reviewed by Massport and Community Advisory Committee**
- **Modifications currently being reviewed by Industry**

  * Industry expressed that they will be unwilling to fly turns greater than the 39° in the final phase of flight, the maximum allowed
- **Prior to publication of the procedure, Massport and CAC asked the FAA to move route further from Hull**

RNAV (GPS) RWY 33L Approach (version 2,4,5)

- **Version 2,4,& 5: Concept of a straight-in final approach segment based on an initial segment that overflies the Nahant Causeway – while maintaining additional lateral separation from Hull**

- **Concepts included various final approach fix altitudes, segment lengths, and descent gradients greater than safety standards allow**

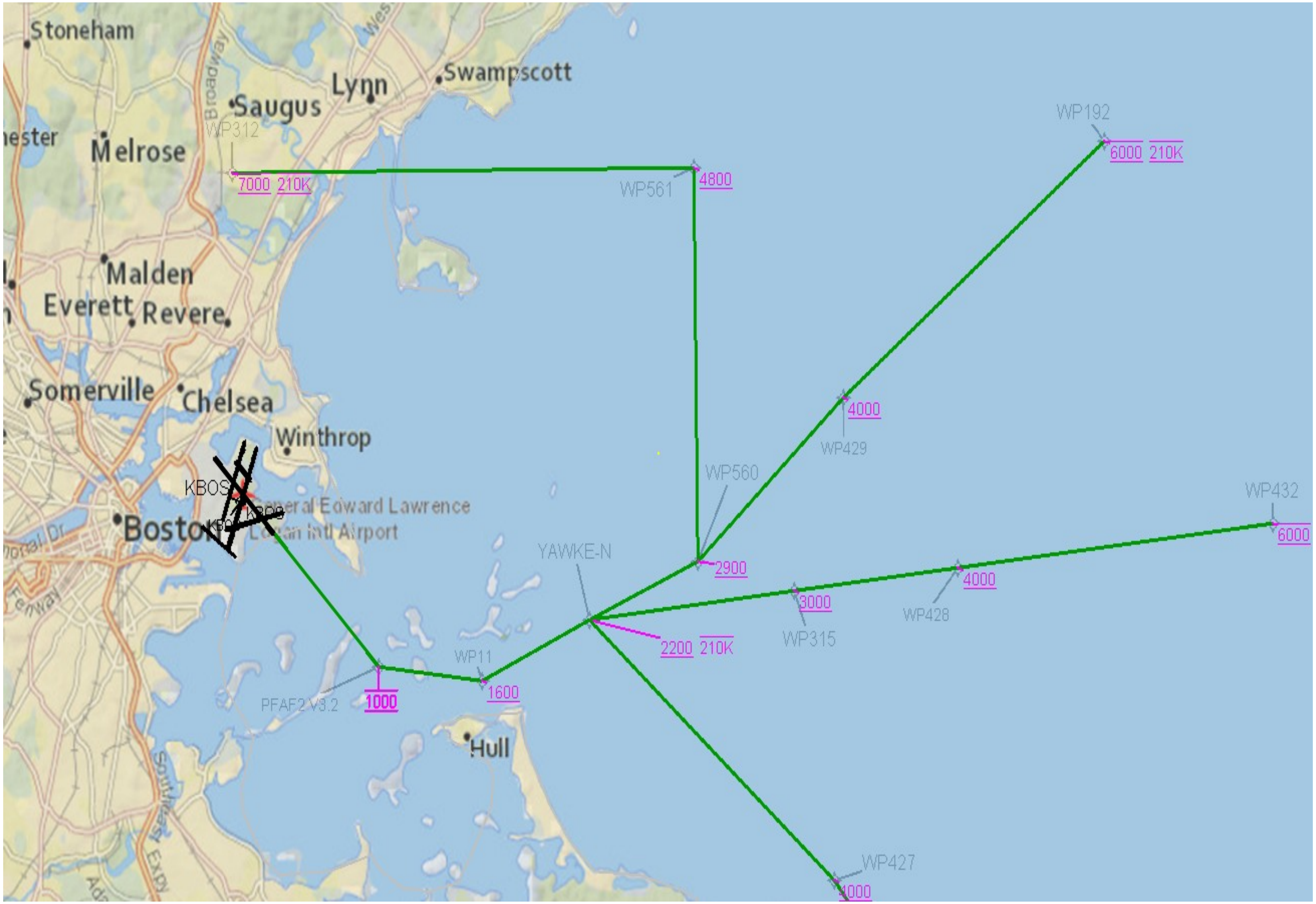
RNAV (GPS) RWY 33L Approach Versions 6 and 7

- Both version were proposed by Industry during collaborative Work Group meetings
- Were attempts to mimic Jet Blue Special RNAV Visual while meeting safety standards for RNAV GPS public procedures
- The tracks moved close to or over Hull (version 6)
- Moving the tracks created safety issues with obstructions (version 7)

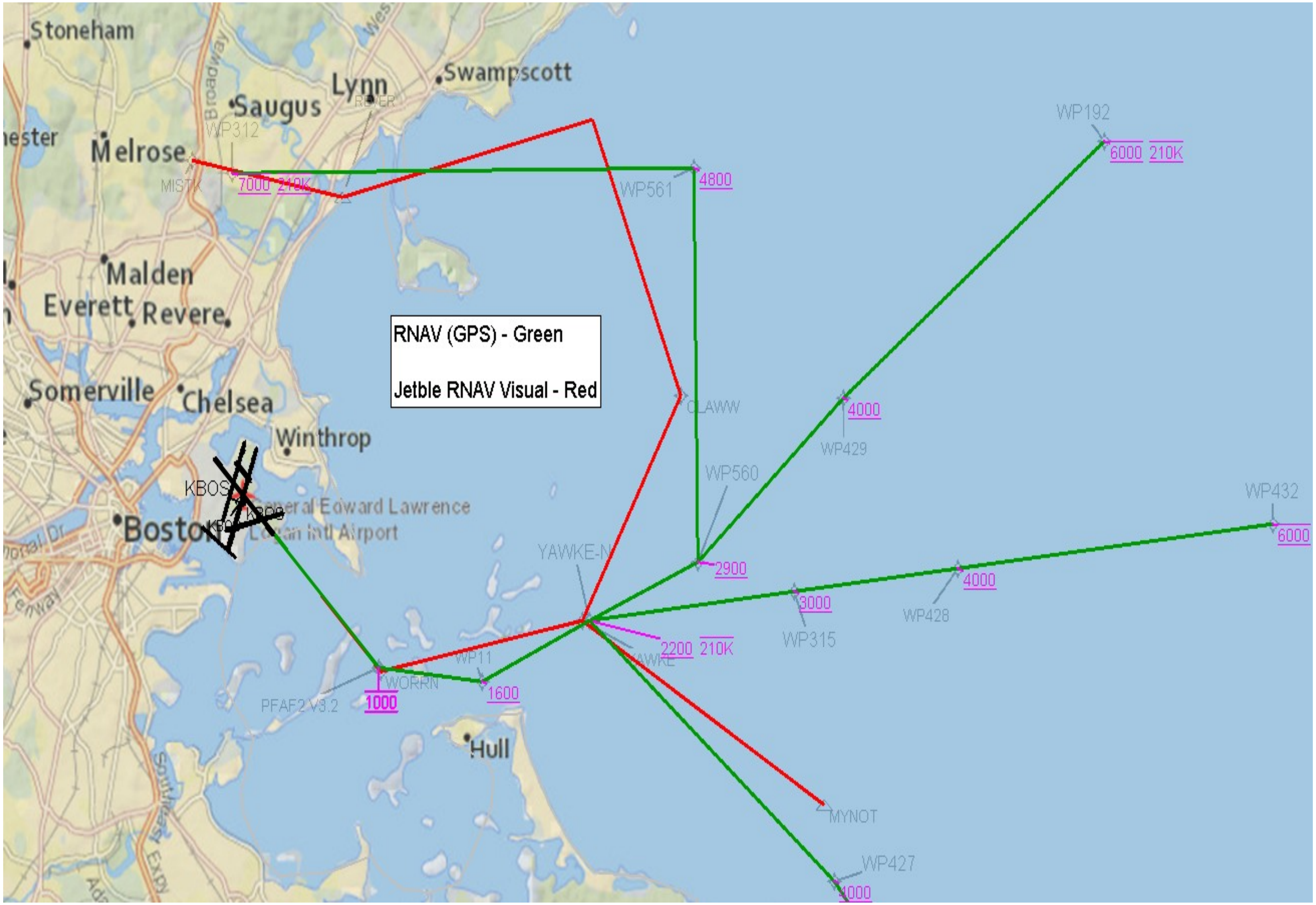
Traffic Flow Implications

- Use of RNP RWY33L will be limited when all traffic is not able to accept clearance
- RNP RWY 33L and ILS RWY 33L are not able to be used simultaneously due to dissimilar tracks and lack of sequencing tool
- RNP RYW33L and GPS RWY 33L can be used simultaneously due to similarity of track paths

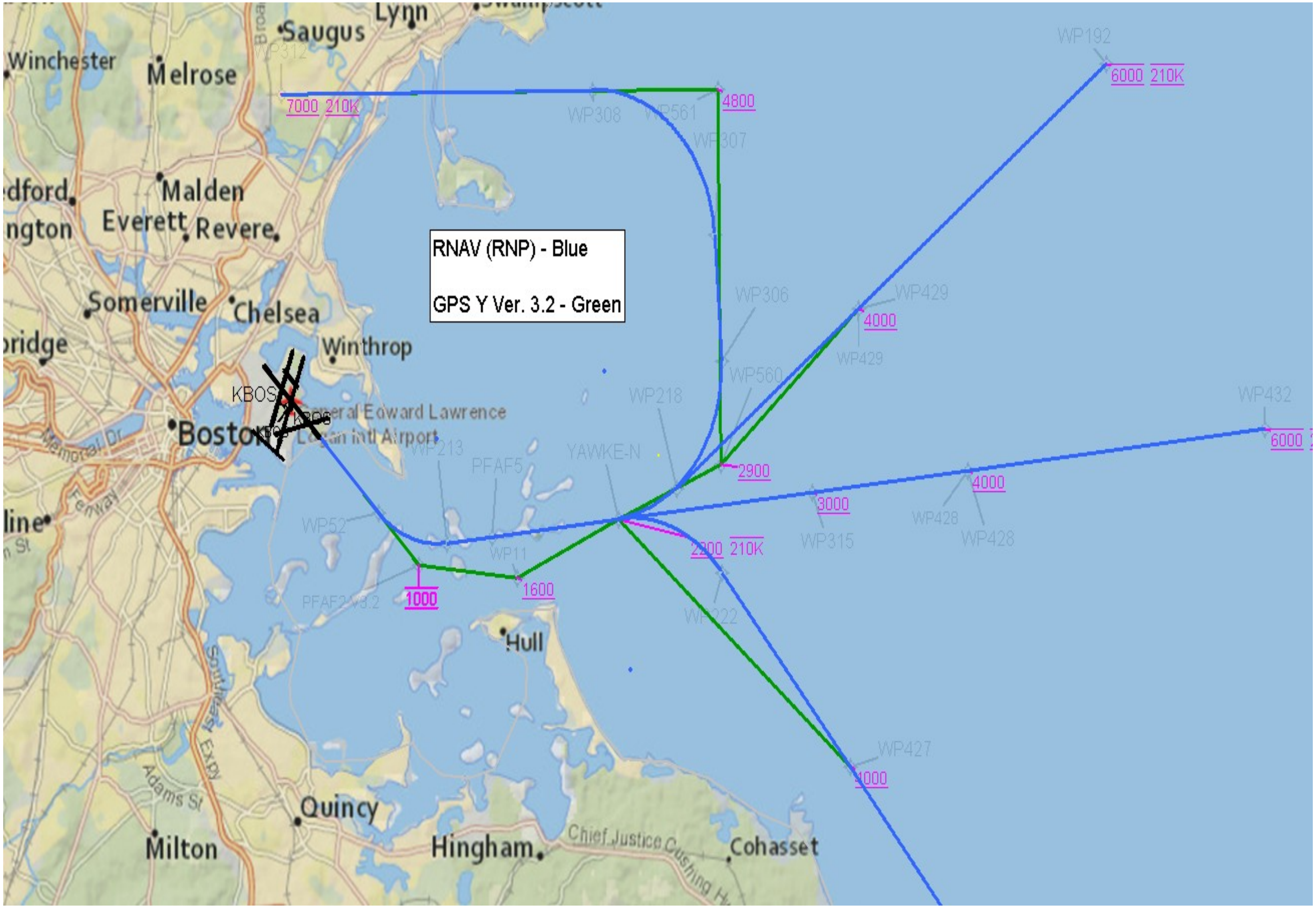
RNAV (GPS) RWY 33L (version 3)



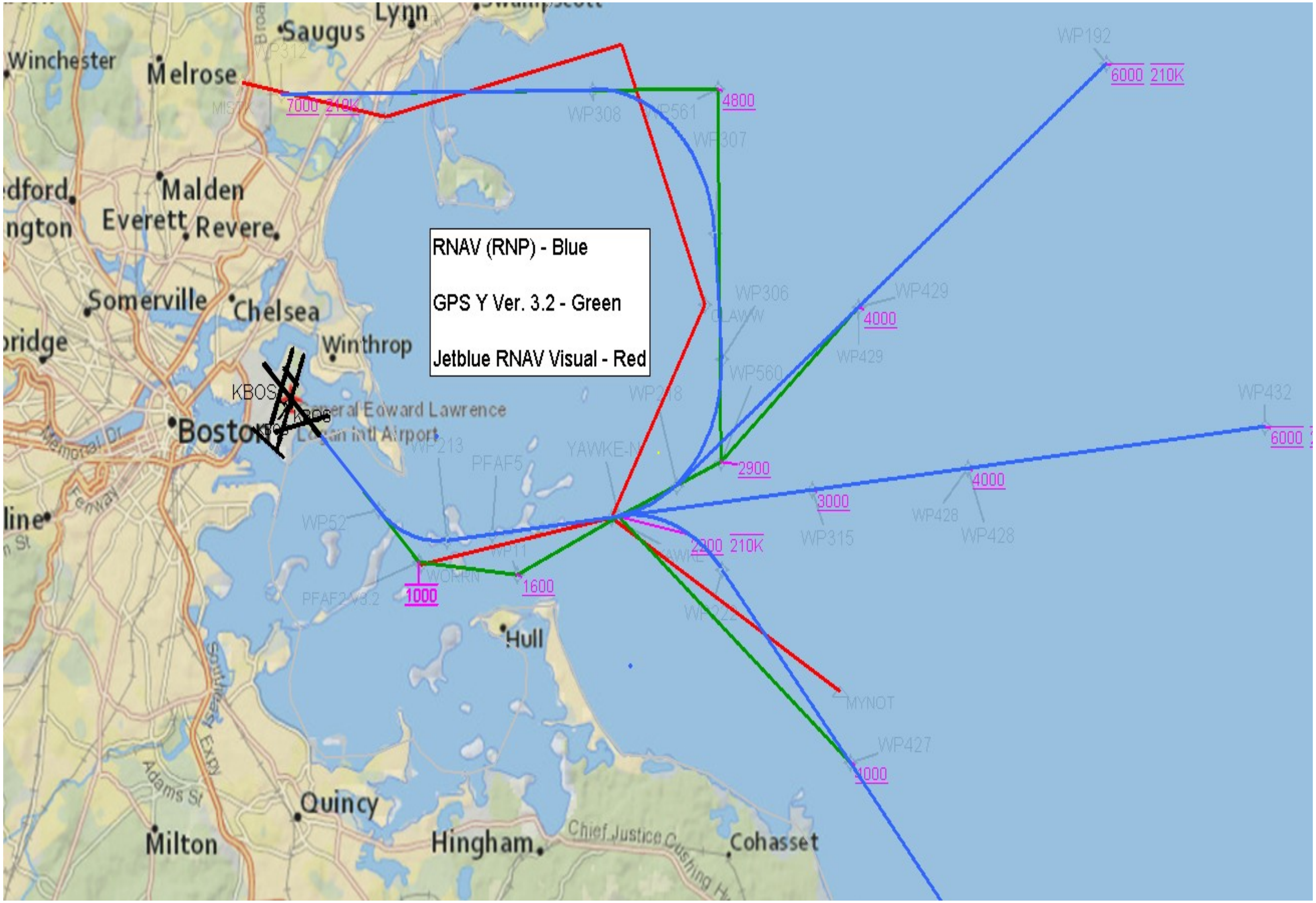
RNAV (GPS) RWY 33L With RNAV Visual



RNP RWY 33L and GPS RWY 33L



RNP RWY 33L and GPS RWY 33L with RNAV Visual



(1-A1b)

Option B: Public distribution of RNAV Visual procedure

The recommendation will be resolved by (1-A1)

QUESTIONS?