Block 2 Requests

Cindy L. Christiansen

Massport Community Advisory Committee (MCAC)

Milton Representative

Aviation Subcommittee Meeting April 18, 2018

Braintree Town Hall

Requests are followed by Justifications. Justifications are followed by slides with Yellow backgrounds that contain Requests and Questions we would like to have answered.

1

Requests for Block 2 Study

1. **Dispersion studies that could benefit all approach paths at Logan and across the nation**
   1. **RNAV Families as suggested by Dr. Tom Reynolds**
   2. **30-degree Angled approaches, or greater, that meet up with the straight-in at 3 nm from displace threshold, similar to what the FAA shows it can do by the 4L RNAV Visual angled approach**
2. Increased altitudes that could benefit all approach paths at Logan and across the nation
3. Conduct field work to witness
   1. Location of approach flight paths 4R and 4L
   2. Consequences of the unique configuration at Logan that uses Closely Spaced Parallel Runways (CSPR) for approaches
4. Operational and Conformance Factors

2

Dispersion – Justifications for Request

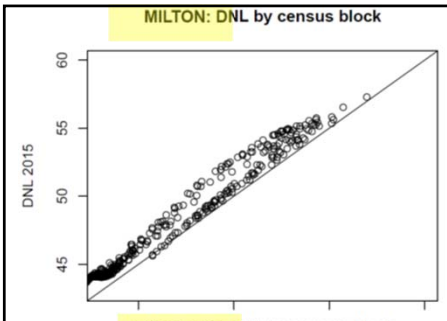
- Approach flight path concentration has been gradual, not the off/on switch like for departure paths
- FAA updated Approach Procedures to Runways 4R, 15R, 22L, 33L on 12/15/2011 that enabled RNAV/WAAS/LPV instrument approaches
- Not all aircraft were equipped to use the RNAV/WAAS/LPV instrument approaches on 12/15/2011
- **In 2013 RTCA**, a not-for-profit aviation association that serves as the 'private' in a public-private relationship with FAA, **identified WAAS as an in-progress enabler for APPROACHES.**
- **Block 1 Test Criteria were equally met by 4R/4L but residents, elected officials and I were told to wait.**
- **Although new paths and waypoints were considered "low hanging fruit" for flight paths over some communities in Block 1 work, those under 4R and 4L were told to wait for this more complex study need until Block 2. We have waited.**

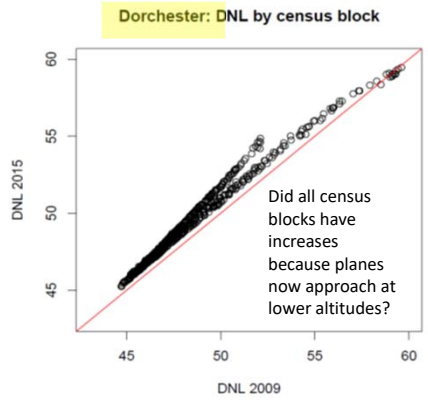
3

Dispersion – Justifications for Request, continued

- Approach path concentration has occurred and complained about across the country, not just in the Boston area, e.g., BWI, DCA, SFO, SDA
- Similar to what is being studied for departures
- 2012/2013 Massport Environmental Data Report (EDR) states it is obvious that arrival paths have been concentrated (p 186)
- Approaches have been moved away from some and concentrated onto others without their consent
  - I think that changes in DNL by city/town affected by the 4's help to defend this statement – see the next 3 slides

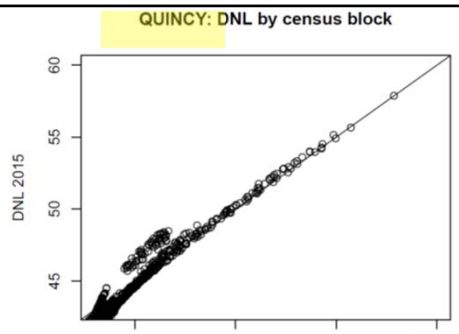
4

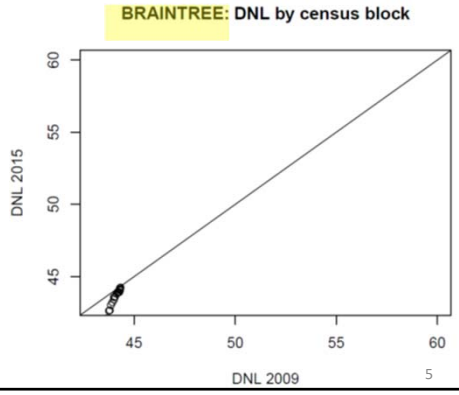




DNL has increased in Milton, decreased elsewhere

- **DNL in 2009 vs 2015**
- **Census blocks above the diagonal line had increased noise in 2015.**
- **Similar # of arrivals in each year – the reason these 2 years were chosen given the DNL data available to me**





5

DNL has increased in Milton and Dorchester, Parts of Quincy, decreased elsewhere

- **Dorchester**
  - All census blocks had DNL>45 in 2009 and 2015
  - Fewer than 2% of the 677 census blocks had a DNL decrease in 2015 compared to 2009
  - **35% of the census blocks had an increase of 1 dB or greater, all within proximity to the 4R&L approach paths**
- **Quincy**
  - 78% of the 1,078 census blocks had decreases in 2015 compared with 2009; 40% had decreases of 1 dB or greater
  - **5% of the census blocks had an increase of 1 dB or greater; these blocks are on the west side of Quincy and, like in Dorchester and Milton, are the blocks closest to the 4R approach path**

6

DNL has increased in Milton and Dorchester, Parts of Quincy, decreased elsewhere

- Milton
  - 60% of the 405 census blocks had increases of 1 dB or greater in 2015 compared with 2009, **10% greater than 2 dB, 5% greater than 2.5 dB**, and, as in Dorchester, the greatest increases occur along the 4R&L approach paths
  - Only 0.5% of Milton's census blocks had decreases in 2015 compared to 2009, with the greatest decrease being only 0.12 dB
- Braintree and Weymouth
  - All the 33 census blocks in Braintree and all the 130 census blocks in Weymouth that are included in the EDR had DNL < 45 in 2009 and remained less than 45 in 2015
  - No census block in either community had an increase in DNL in 2015 when compared to 2009
  - Although all census blocks started with DNLs < 45, each decreased further in 2015 with 38% of the blocks in Braintree and 46% of the blocks in Weymouth **dropping by 1.5 dB or greater**

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Dispersion – Justifications for Request, continued

- **Another MIT Expert has suggested a "hybrid "multi-RNAV procedure" solution**

"There has long been the idea of **a hybrid "multi-RNAV procedure"** solution where the current RNAV procedure defines the center-line track of **a family of RNAVs**, with other family members offset by 1 and 2 nmi left and right of the center-line which ultimately all converge at about a 5 nmi final for arrivals, or diverge to these families a few miles after departure. When the airport is operating in a given configuration for long periods, each individual track could be **used for an hour at a time** to spread the noise within a swath similar to what would naturally result from vectored arrivals, but still enabling benefits of optimized RNAV procedures to be achieved."

January 13, 2016 email from Dr. T Reynolds, MIT Lincoln Labs to FAA and Dr. R.J.Hansman

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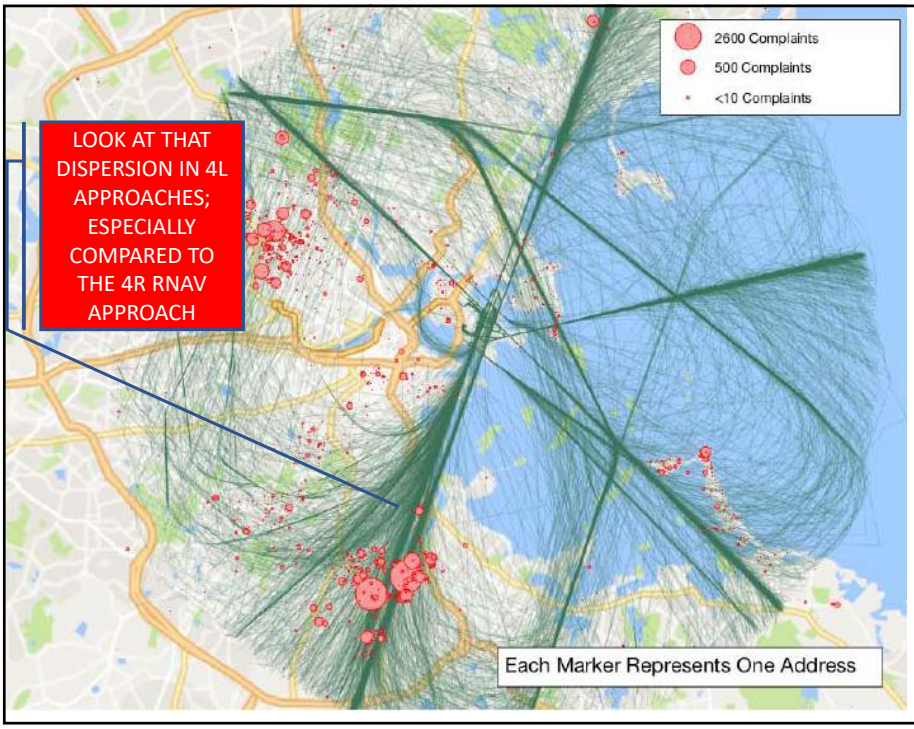

DISPERSION

Although this MIT graphic was included in an early MIT presentation to show location of those filing complaints, it also reveals that the current instrument approaches (RNAVs) have condensed flight paths when compared to the one with no current RNAV. Can you identify it?

9

Don't be fooled by the MIT density plots

- "Red" = 9 or more fly overs/day, on average, in a year
  - 9/day is 3,300 /year
  - 139/day, like in parts of Milton, is 50,700/year
  - 3,300/year is tolerable; 50,700/year is not tolerable
- The "zoom" is so high that it masks the concentration of flights at 2000 feet and lower, like they are over Milton and Dorchester
  - Departures are higher sooner and this is less of a problem in their density plots
- Other serious, obvious mistakes put into question the quality of the work
  - For example, no information on how high a plane has to be to be counted

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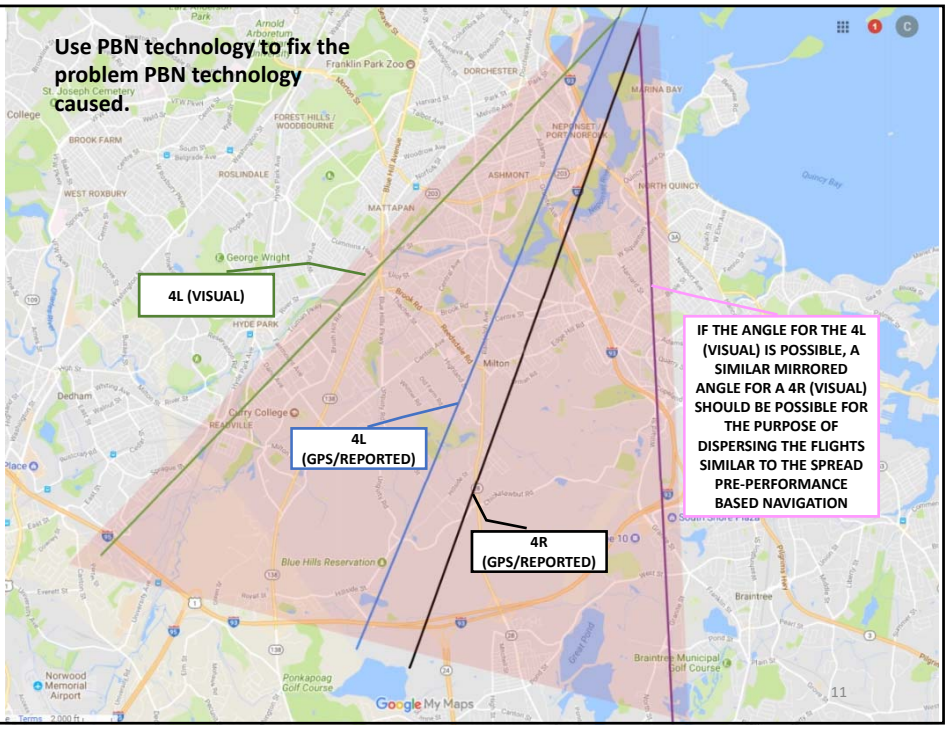
DISPERSION

Why not "strings of the harp", i.e., a "family of RNAV paths" within this triangle? We know that the FAA thinks it can have the two 4L RNAV paths shown. If these two are possible, then so are others to the east of 4R. 4L(Visual) meets up with 4R(GPS) at about 3.0 nm from the runway end.

Are greater angles at the intersection possible?
How many paths are possible?
How can multiple paths to the same runway ends be rotated?
Hourly? Daily?



Block 2 Study Requests for Approaches (not just the 4's)

Dispersion studies that could benefit all approach paths at Logan and across the nation

- **RNAV Families as suggested by Dr. Tom Reynolds**
  - **How many RNAV approaches, along with the straight-in, are possible if one is focused on helping those on the ground?**
  - **How can these be rotated?**
- **30-degree Angled approaches, or greater, that meet up with the straight-in at 3 nm from displace threshold, similar to what the FAA shows it can do by the 4L RNAV Visual angled approach**
  - **Can these be used in Instrument conditions? If not, why not?**
  - **Are greater angles possible if one is focused on helping those on the ground?**
  - **This could be helpful to approaches to 22R especially if angled approaches to the east of the approach centerline could be used (mostly over the water)**

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Block 2 Study Requests for Approaches (not just the 4's)

- **ALL WORK DONE WITH 4R APPROACHES MUST INCLUDE 4L PROCEDURES TOO**
- **Please do a better job on the density plots for approaches and provide a more appropriate version.**
  - **Use a zoom level that is appropriate for the altitude of the procedure**
  - **When dividing the area into 1-square acre blocks, the blocks need to align with the angle of the flight path, otherwise the graphic could show more dispersion than is actually there.**
  - **It is inappropriate to use the categorization of 9+ as the highest grouping when some areas have fly overs in the 100+, making the graphs misleading. Please re-do.**
  - **When counting, one must define what counts – please do that on the requested re-done density plots**

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Requests for Block 2 Study

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Increase Approach Altitudes – Justifications for Request

- Several changes from 2009 4R Procedure Chart compared to current Chart
  - Sidestep to 4L
  - **Final Approach Fix altitude was 1800 ft for the instrument approach and now is 1700**
- Radar based-navigation altitudes were higher
  - A change to 4r approached procedure produced, August 2011, effective 12/15/2011, same day as WAAS
    - notes a change to the FAF (MILTT) based on new use of formula 2-16b.
- Increased altitude helps all communities under approach paths, even those under the potential new dispersed RNAV family paths

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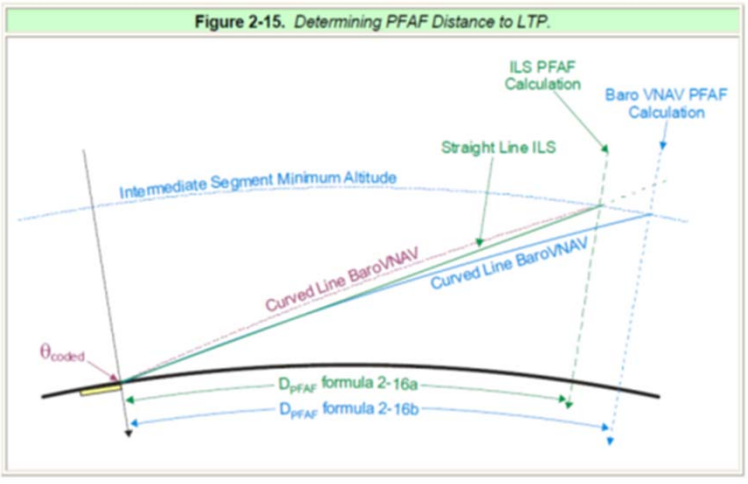
Increase Approach Altitudes – Justifications for Request

2.13 Determining Precise Final Approach Fix/Final Approach Fix (*PFAF/FAF*) Coordinates *(see figure 2-15).*

Figure 2-15. *Determining PFAF Distance to LTP.*



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2-46

Increase Approach Altitudes – Justifications for Request

- This formula is in 8260.54A - The United States Standard for Area Navigation and caused the 8/11/2011 (corrected from 2001) write up of the updated 4R procedure, with effective date 12/15/2011.
- That order was cancelled 9/28/2012 and replaced with 8260.58
  - **8260.58 - United States Standard for Performance Based Navigation (PBN) Instrument Procedure Design**
- We need help from the consultants to better understand the effects caused by changes to the mathematic formulae required when FAA began its gradual switch from radar (2-dimensional) to GPS PBN (3-dimensional) navigation
- References in this slide also used here in the presentation

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Increase Approach Altitudes – Justifications for Request

Although community input here and across the country is consistent: planes on approach are lower now and we want them higher, like they used to be

Studying steeper approach paths were rejected on "safety grounds" in Prof Hansman's 9/28/2017 (p59) briefing:

- Note: Team also reviewed and **rejected** based on environmental or **safety grounds**
  - **Steeper approaches on arrivals**
  - R4R Arrivals Expressway alignment

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Increase Approach Altitudes – Justifications for Request

- Consultant simulated noise impact improvements from two types of steeper approaches
- Reported that higher altitudes and steeper approaches are a safety concern because of "landing excursions"
  - Landing excursions are accidents where aircraft veer off or overrun the runway due to difficulties with speed management
- Cited 14 fatal accidents over a 10-year period between 2006 and 2015 that were classified as landing excursions.
- **No other work was reported.**

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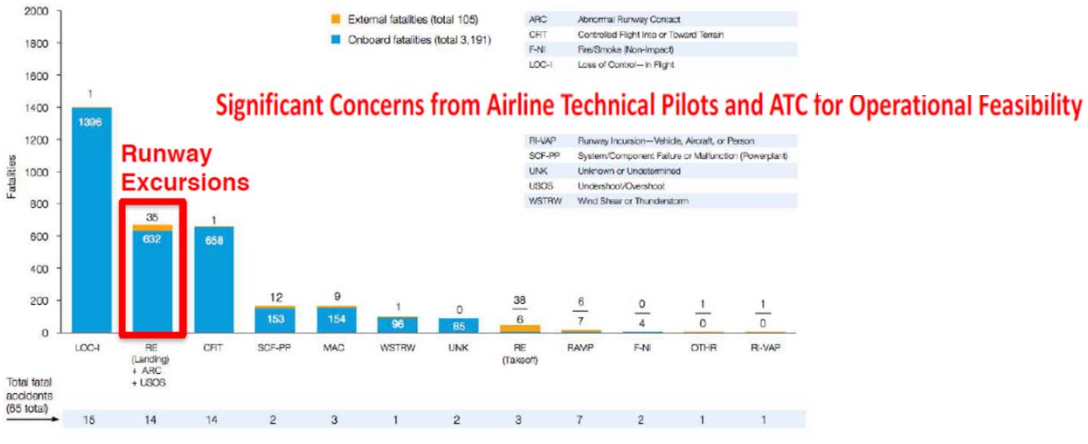
MIT ICAT Safety Concerns - High-Energy Approaches

Fatalities by CICTT Aviation Occurrence Categories
Fatal Accidents | Worldwide Commercial Jet Fleet | 2006 through 2015

Hansman, 5/5/2017, page 58 and 59



Note: Principal categories as assigned by CAST.

For a complete description of CAST/ICAO Common Taxonomy Team (CICTT) Aviation Occurrence Categories, go to www.intlaviationstandards.org.

Figure source: The Boeing Company http://www.boeing.com/resources/boeingdotcom/company/about_bca/pdf/statsum.pdf

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Increase Approach Altitudes – Justifications for Request

- **Upon my review there is no documentation indicating that these 14 accidents were caused by a steep approach.**
  - **None** of the 14 accidents occurred **in the United States**. One accident occurred in each of these locations: Russia, Norway, Indonesia, Angola, Brazil, Thailand, Honduras, Sudan, Netherlands, Japan, India, Columbia, Ghana, and the Republic of Congo
  - The last 2 accidents, in Ghana in 2012 and in the Republic of Congo in 2015, involved 30-year old cargo aircraft.
  - Four of the fourteen were associated with wet runways and weather.
- **No relevant data or reference given to indicate that a steep approach is associated with runway excursions.**

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Increase Approach Altitudes – Justifications for Request

- **No runway excursion accidents in the United States or Canada in the last 10 years even though there are many approach paths with greater than 3.0-degree glideslopes here.**
  - **San Diego**'s Runway 27 is a 3.5-degree glideslope
  - **Las Vegas** Runway 1 has a 3.4-degree glideslope
  - **Van Nuys** has a 3.5-degree glideslope
  - **Toronto** has 2 runways with 3.2-degree and greater glideslopes
  - **Many others**
- Heathrow Airport Study, 2016, ***3.2º Slightly Steeper Approach Trial Report***, found
  - No increase in missed approaches
  - No unintended consequences
  - Fewer noise complaints
  - Substantial noise reduction
  - Contrary to pre-study pilot opinions, speed management was not a problem and **was slightly improved** for the higher 3.2-degree approach glideslope.

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Increase Approach Altitudes – Justifications for Request

"At the call two weeks ago when MIT summarized approach operations, we had a discussion about **approach angles steeper than the standard 3 degrees to mitigate noise by getting aircraft at higher altitudes at a given distance from the airport. London City Airport (LCY) is one of the airports that uses a 5.5 degree approach angle for both noise and high-rise building reasons.** I could not find any specific noise analysis of steeper approaches, but I am attaching **a document I wrote some years ago when working on the "Silent Aircraft Initiative"** which includes background info on steeper approaches in pages 5-9. "

December 17, 2014 email from Dr. T Reynolds, MIT Lincoln Labs to FAA and Dr. R.J.Hansman

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Increase Approach Altitudes – Justifications for Request

- **UPS Study of increased Glideslope shared by FAA**

"The B767 and MD-11 were found capable of flying dual-segment steep approaches up to and including 4.00° angles with adequate margins for error. … **Based on the study results, 4.00° is the maximum recommended angle.**"

STEEP SEGMENTED APPROACHES UPS AIRLINES – EUROPE CHIEF PILOT GROUP

FEASIBILITY STUDY, prepared by Captain Dash Roberts. Shared on March 8, 2016 in email from Christopher Dorbian (FAA) to Dr. R. J. Hansman and others

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Block 2 Study Requests for Approach Altitude (not just for the 4's)

- **Please conduct increased-altitude studies; these could benefit all those under approach paths at Logan and across the nation**
- **Please answer these questions:**
  - **If there are legitimate safety concerns, what are they and how do those concerns trump the feasible in the referenced studies if one's purpose is to reduce the burden to those on the ground?**
  - **What are the noise benefits for increase altitudes?**
  - **What are the changes to altitude caused by FAA's mathematical formula changes used for satellite navigation paths compared to radar navigation?**
    - **Did these satellite-based formula changes also affect departure altitudes?**

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Requests for Block 2 Study

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2. Increased altitudes that could benefit all approach paths at Logan and across the nation
3. **Conduct field work to witness**
   1. **Location of approach flight paths 4R and 4L**
   2. **Consequences of the unique configuration at Logan that uses Closely Spaced Parallel Runways (CSPR) for approaches**
4. Operational and Conformance Factors

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Conduct Field Work – Justifications for Request

- Communities in Dorchester, Milton, and Quincy continue to ask that the MIT Study consultants visit the areas being flown over by the 4R and 4L approaches
- From information provided during MCAC meetings, Professor Hansman, and the CEOs of Massport and study consultant HMMH live under or in areas under 33L departures, making them familiar with that path
- Professor Hansman has expressed willingness to visit Dorchester, Milton and Quincy to several Milton residents and me

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Conduct Field Work – Justifications for Request

- Reduced separation on a single path is disturbing; reduced separation on Closely Spaced Parallel Runways is inhumane exposure inflicted on those under and within the sandwich. Anyone recommending or allowing this should experience it first
- Data provided by Massport, one day in 2009 and one day in 2017, shows a shift in the flight path.
  - Map projection
- Even this shift does not fully explain the discrepancies reported by those directly under the flight paths.

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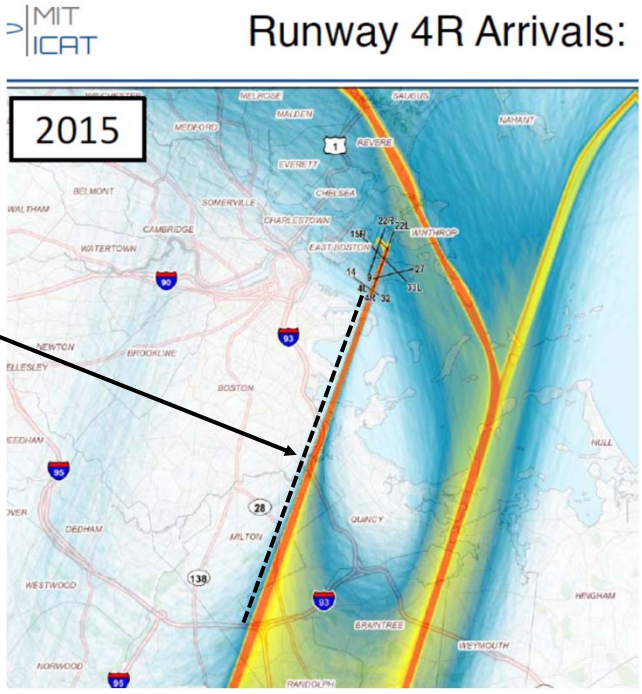
Why field work?

- See the shift in the actual flight paths compared with what is shown on the Massport flight monitor
  - Many in Milton report this
  - Residents in Dorchester too
- Witness the sandwich created by simultaneous approaches to 4R and 4L
  - Only configuration like this because the 22R/22L (opposite direction) have restrictions
- Observe the terrain, home/school locations
- Field work request by Milton on 5/5/2017; current request made through the Aviation Subcommittee Chair has gone unanswered

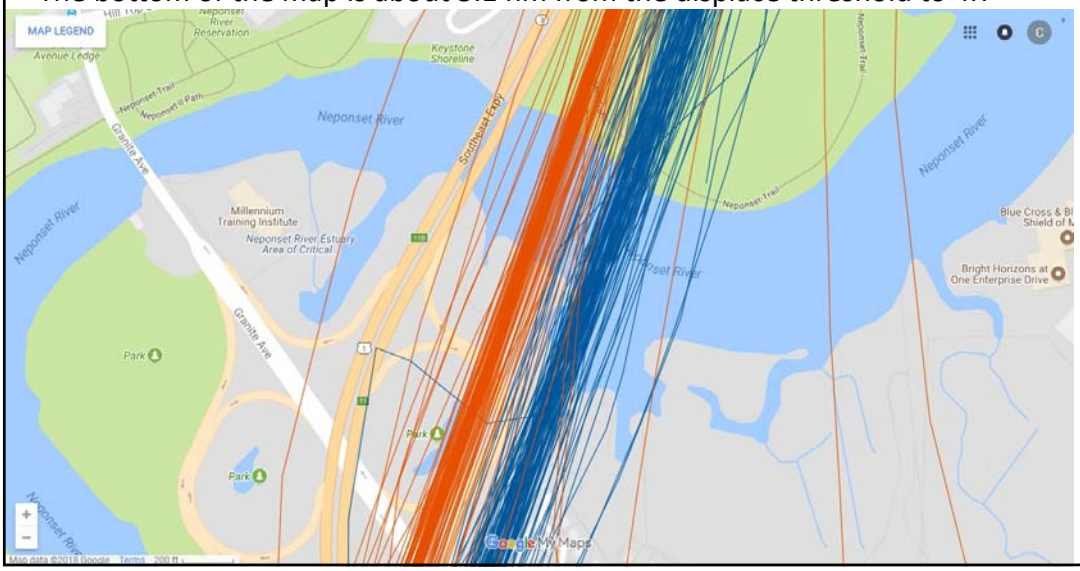


Jet Flight tracks to 4R between 3pm and 7pm

2009: 114 tracks (blue)

2017: 110 tracks (red)

The bottom of the map is about 5.1 nm from the displace threshold to 4R

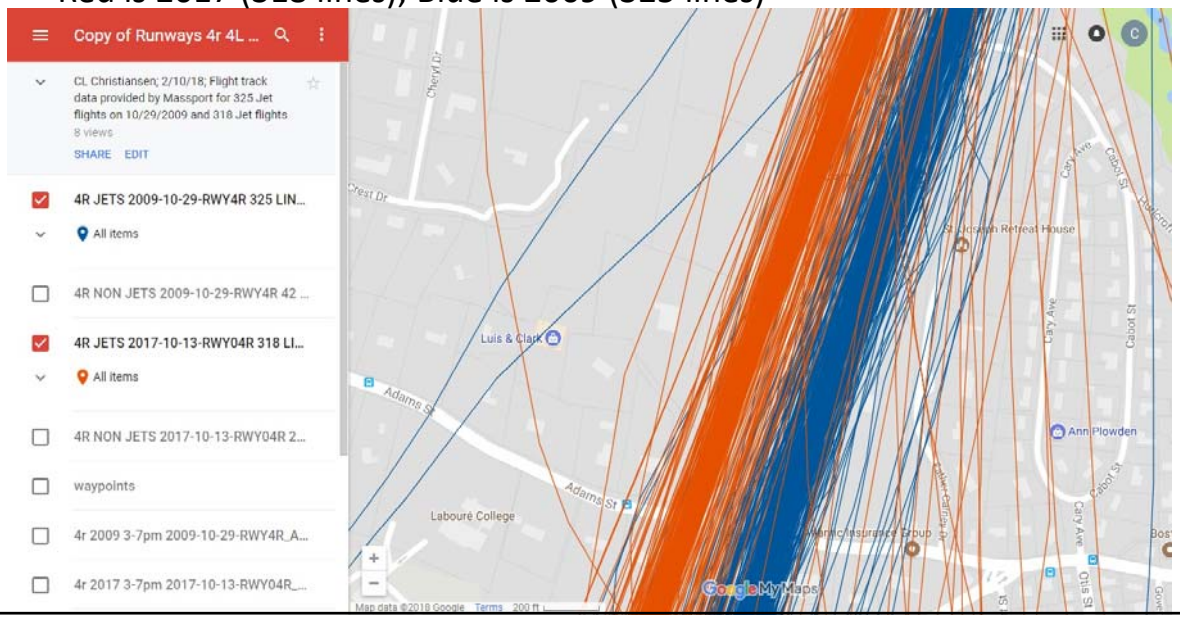


Two Whys?

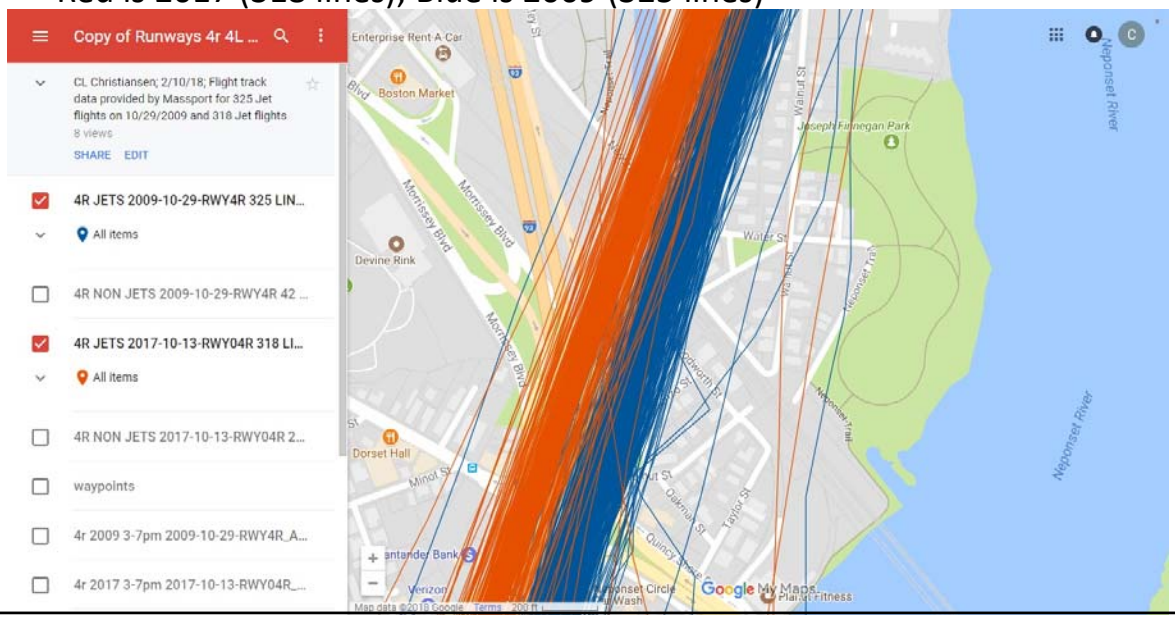
1. Why the shift?
2. Why insist that approaches have had no change when the concentration is evident when one uses an appropriate zoom level for the altitude of the planes?

30

About 6 nm from displace threshold
Red is 2017 (318 lines); Blue is 2009 (325 lines)



About 4 nm from displace threshold
Red is 2017 (318 lines); Blue is 2009 (325 lines)



Are all flight path maps off? Are exposure estimates off because of it?

My research

- Bing, Google (Massport online monitor uses Bing) Maps use Mercator Projections. Mercator
  - Distorts Latitude and longitude
  - Distorts Size and shape
- In the FAA June 2017 Charting Notice the FAA writes:
  *In all volumes of the digital-Terminal Procedures Publication (d-TPP) the FAA maintained **Instrument Approach Procedure charts**, published in PDF format, now carry georeferenced encoding for geographic positioning. Coordinate readings are based on a Lambert Conformal Conic projection, NAD83 Datum, and GRS 1980 Ellipsoid.*
  - Lambert Maintains correct area
  - Unique to Approaches

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Are all flight path maps off? Are exposure estimates off because of it?

My research

- This relates to the change in formula for altitudes at the FAF (see Request #2)
- Differences in distortion between Mercator and Lambert is more pronounced in NE/SW directions, not NW/SW so much in the New England area
- Aviation uses great circles (geodesic) as the shortest-distance flight
- Ship/boat navigation at sea often required non-distortion of compass directions
- Radar is 2-dimensional; does not include vertical needs of aviation
- GPS is 3-dimensional; includes vertical needs of aviation (as does WAAS)
- GPS navigation changed mathematical formulae for paths, altitude

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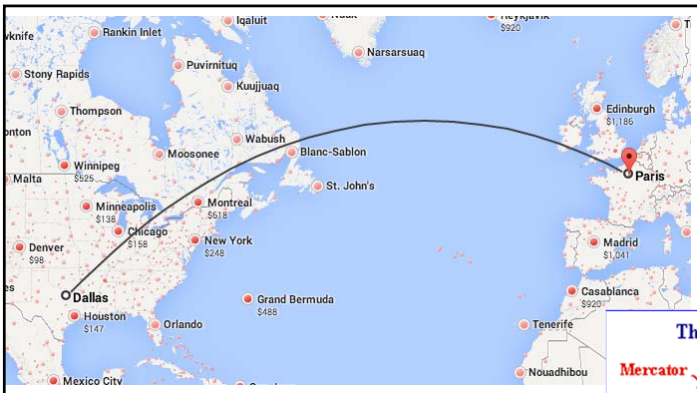
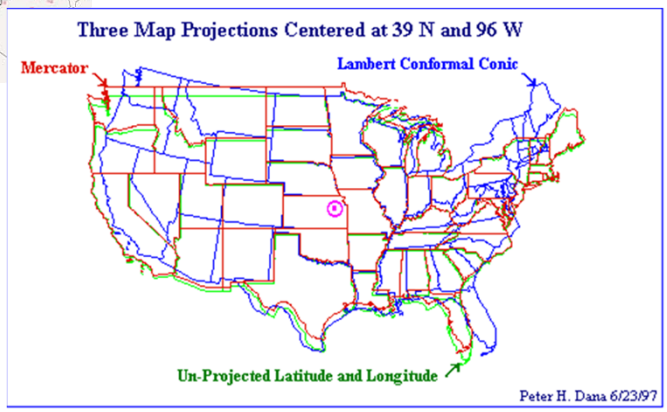
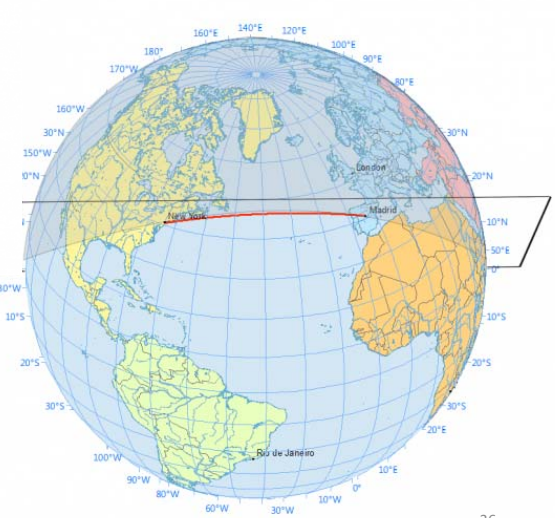


Mercator projection showing the SHORTEST path from Dallas to Madrid.

Overlay of Mercator (red) and Lambert (blue) projections. Check out New England



Shows paths from New York to Madrid.



The Mercator projection follows the 40-degree latitude line BUT the shortest distance for aviation is to follow the great circle (geodesic) determined path

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Are all flight path maps off? Are exposure estimates off because of it?

My research; See references in previous slide

From **8260.58 - United States Standard for Performance Based Navigation (PBN) Instrument Procedure Design**

> 3.1.74 Precise Final Approach Fix (PFAF). The PFAF is a calculated WGS-84 geographic position located on the final approach course where the designed vertical path (NPA procedures) or glidepath (APV and PA procedures) intercepts the intermediate segment altitude (glidepath intercept altitude). The PFAF marks the beginning of the FAS. The calculation of the distance from LTP to PFAF includes the earth curvature.

In 3.1.74, and throughout 8260.58, the person commenting had many comments that said

> These references must be interpreted to mean that the applicable procedural design elements must be relative to WGS-84 or FAA-approved equivalent geographic position

Block 2 Study Requests for Field Work and Questions

- **ALL WORK DONE WITH 4R APPROACHES MUST INCLUDE 4L PROCEDURES TOO**
- **Please Schedule a time to visit and experience the 4R/L approaches in Dorchester, Milton, and Quincy**
- **Please explain the differences in flight paths shown using Massport data from 2009 and 2017**
- **Please explain changes with respect to mathematical formulae changes for altitude and flight paths caused by the switch from radar to satellite navigation**
- **Please explain the effects of these changes to people on the ground who consistently report that flights are lower (departures too) and are not following the paths shown on the monitors or maps**

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Block 2 Study Requests for Field Work and Questions

- **What map projection and mathematical formulae (pre/post Order 8260.58) is used in:**
  - **AEDT software**
  - **HMMH density plot**
  - **ANOPP**
  - **IMN**
  - **Massport provided flight paths and profile graphs to the LCAC**
- **And what differences should we expect in paths and altitude if these map projections are different?**

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Conformance and Operational Factors – Justifications for Request

- Operational factors were studied as part of Block 1 work for departures but not for arrivals even though operational factors such as speed, flying clean, meet the stated requirements for Block 1 work. A way to correct this imbalance is to include operational factors for APPROACHES as part of Block 2 work
- Airframe noise was considered in Block 1 for departures but not for approaches
- It is well know that "flying dirty" increases noise for those on the ground.
- Since the first A/S Subcommittee meeting with the consultants on 5/5/17, the MCAC and residents have asked for simulation studies on several "what if" questions about conformance; there has been no work on this in the current study
- Hard to find any reason how studies of conformance and operational factors for APPROACHES would shift noise

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Block 2 Study Requests Conformance and Operational Factors for APPROACHES

- **Conduct simulation studies of the effect of noise reduction when requiring approaches to 4R/L to follow the fly-over, altitude, and speed requirements in the attached supplement**

- **Conduct simulation studies of the effect of noise reduction when requiring pilots to follow "clean" approaches to the runway ends**

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Block 2 Study Requests Conformance and Operational Factors for APPROACHES

- **Conduct simulation studies of the effect of conformance to path and altitude in the current approach procedures**

- **Report on all approach procedures known to reduce noise that are studied and reported here**
  - Civil Aviation Authority CAP1554: Review of Arrival Noise Controls

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