Realizing a 21st Century Noise Policy

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Marie-Jo Fremont, Concerned Residents of Palo Alto

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AGENDA

- Major Changes: NextGen and Neighborhood Environmental Survey
- Communities Experience of Noise
- Noise Policy Requirements and New Thinking to Realize a 21st Century Noise Policy

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PROBLEM STATEMENT

3 TECHNICAL DISCUSSION

Metrics in common use for predicting noise impacts are largely expedient in nature. They are not supported by theory-based understanding of the causes of community reaction to noise, but rather on historical studies of perception of loudness, convenience of measurement, and on custom that has been codified in regulation. This section examines the rationales for use of

I-INCE Supplemental Metrics Report April 2015, based on study for DOT, Mestre *et al.* 2011

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CORE ASSERTIONS

1. Convenience of measurement and expediency cannot be at the cost of misrepresenting the communities' lived experience for decision-making
2. The wrong metric cannot be fixed by refinements
3. Generalizations should not be made from unrepresentative samples

Requirement – policy changes in metrics for decision-making; metrics for understanding are insufficient

FAA NOISE POLICY REVIEW – AN OPENING FOR A CHANGE IN HISTORICAL INCOMPLETENESS

”Communities concerns regarding noise
have and continue to be a primary factor underlying
the FAA’s noise-related policies.”

Adam Scholten, Donald Scata Jr., and Fabio Grandi – FAA
Joseph Czech – HMMH, *inter-noise 2023*

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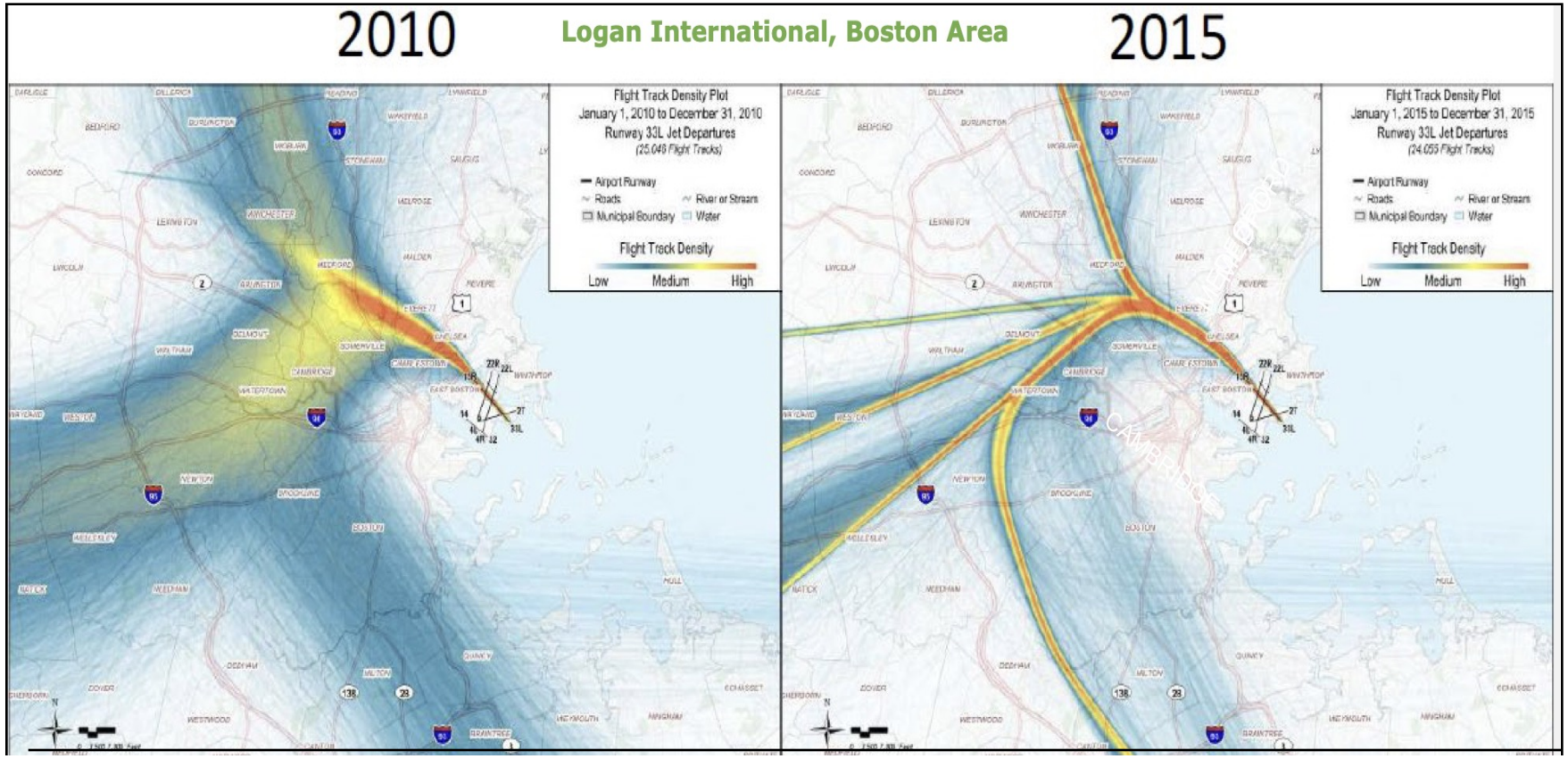
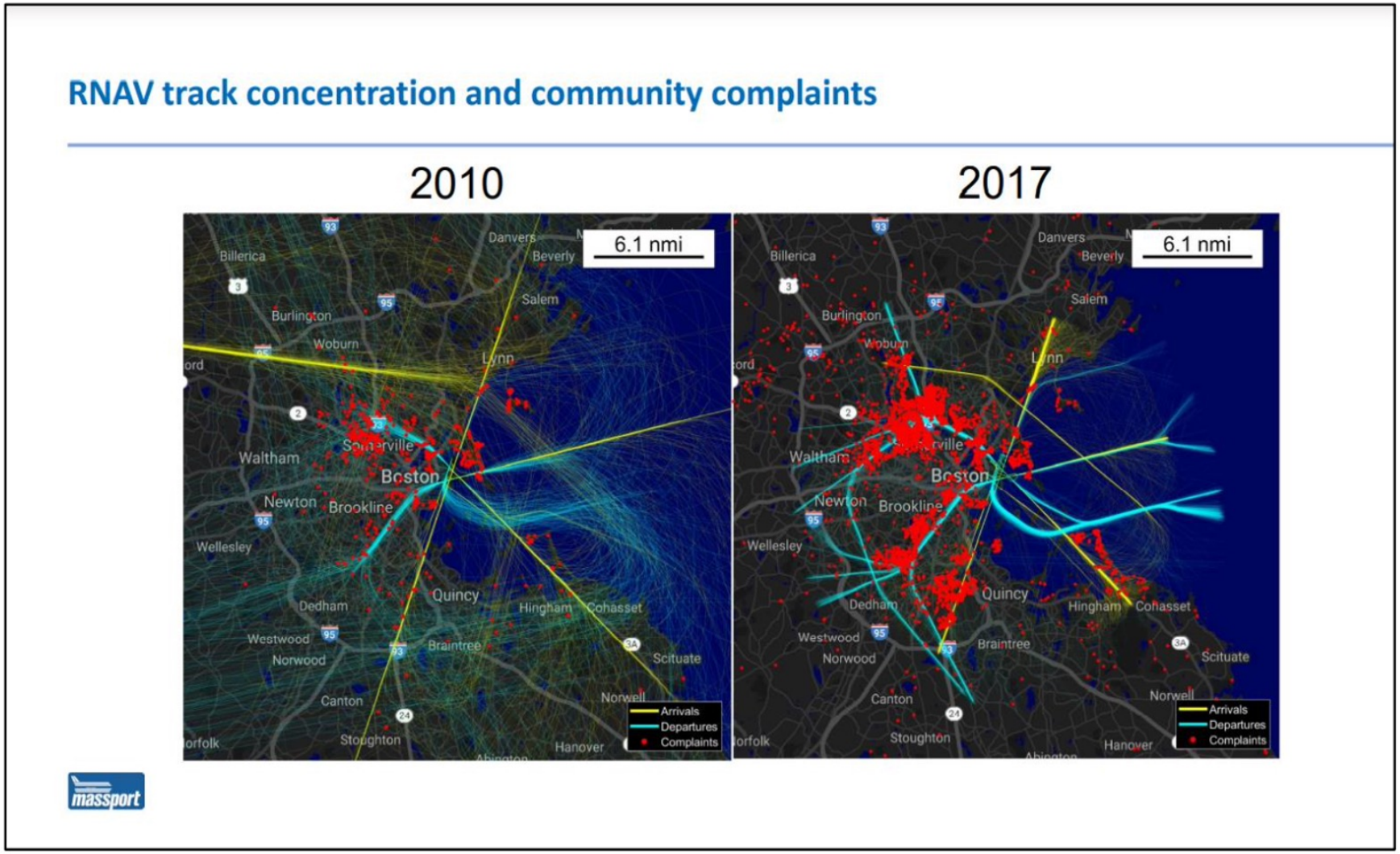
MAJOR CHANGE: NEXTGEN – NEW/DIFFERENT NOISE IMPACTS

- Higher track concentration causes new and different noise impacts
- Resulting in lots of winners, many big losers



MAJOR CHANGE: NEXTGEN – NEW/DIFFERENT NOISE IMPACTS, CONT.

- New and more complaints especially for communities away from airport



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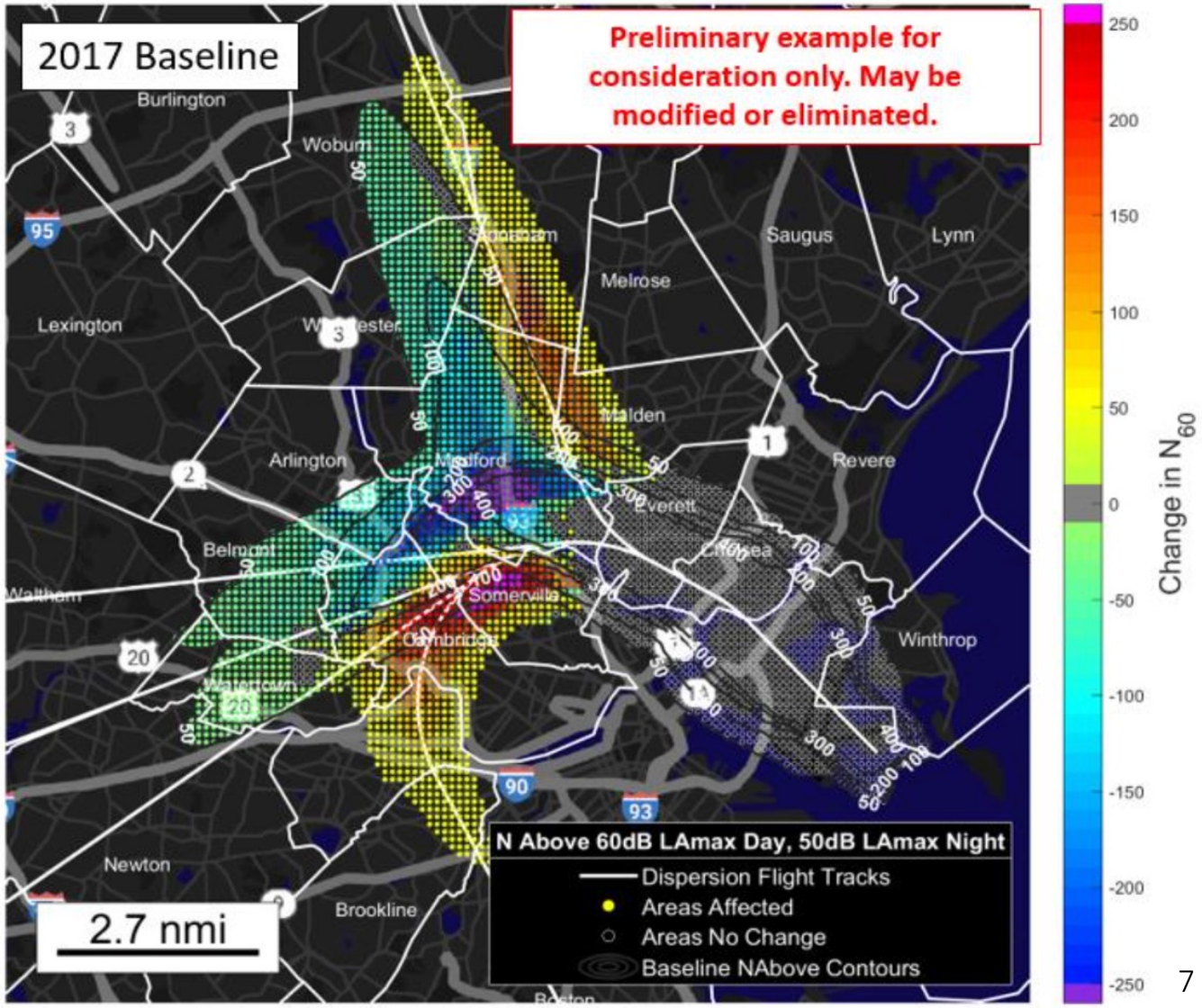
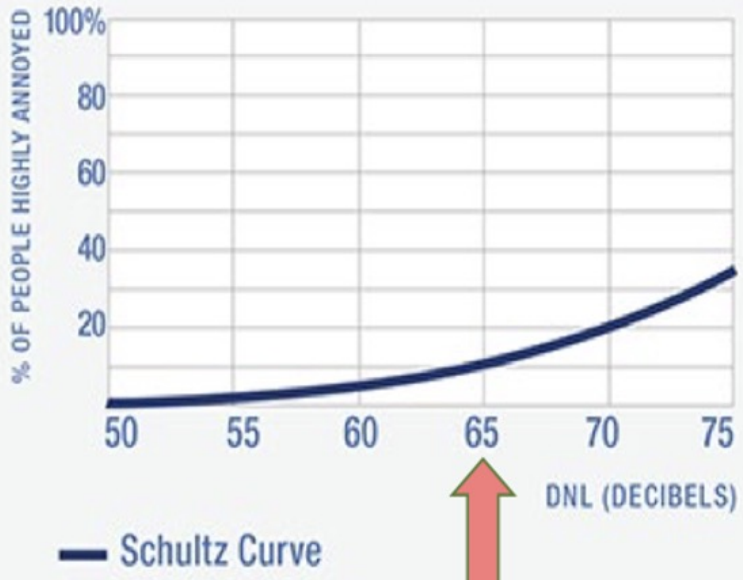
MAJOR CHANGE: NEXTGEN – NEW/DIFFERENT NOISE IMPACTS, CONT.

- Event counts determined by N60 day/N50 night with 50 Peak Day overflights correlates to 80%+ complaint locations
  - Alternatively, DNL 45 Peak Day
- A small track change (1 nautical mile) makes a big difference in being a “winner” versus a “loser” with 250 overflights plus/minus
- BOS 33L runway departures
- Source: MIT, Yu



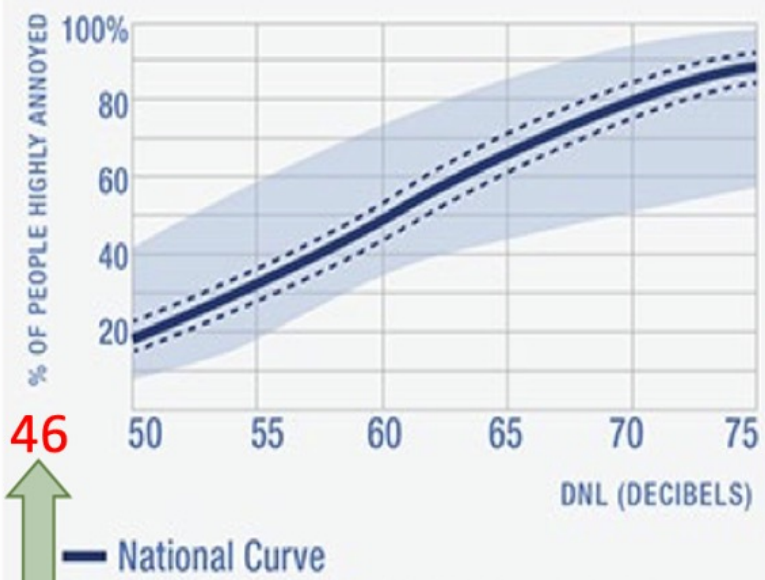
SCHULTZ CURVE



*Federal Interagency Committee on Noise (FICON). (1992). Federal Agency Review of Selected Airport Noise Analysis Issues. Report for the Department of Defense, FICON, Washington, DC.

1992, 30 years ago

NATIONAL CURVE



2021

TC-21-4 Analysis of NES

Jan 2021 released NES study shows:

- **12.3% of people highly annoyed at DNL46**
- **instead of the antiquated Schultz Curve and 1992 FICON 12.3%* highly annoyed at DNL65.**

WHY?

Schultz Curve	NES Curve
All transportation noise	Aviation noise
Combination of multiple surveys and questions	Specific study designed to capture annoyance to aviation noise
Used data from multiple countries	US data from residents living around 20 US airports
Inappropriate statistical model (best they had)	State of the art statistical model
Inconsistent with what communities report as significant noise	Closer to what communities report as significant noise

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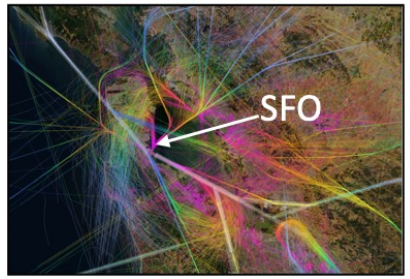
TWO NOISE ENVIRONMENTS – ONE SIZE DOES NOT FIT ALL

	Community	 Near Airport	 Away from Airport
	Noise Sources	Departures, arrivals, and ground-based operations	Departures and/or arrivals: concentrated corridors and high frequency overflights
	Ambient Noise	Typically, urban or suburban	Typically, suburban or rural
Different Noise Requires Different Solutions	Metrics	DNL and non-DNL	Non-DNL e.g., N-Above-Ambient
	Thresholds	Realistic thresholds	Realistic thresholds
	Noise Reduction Strategies	Examples: sound insulation, land use, ground-based noise abatement	Examples: avoid residential, quiet procedures, flight dispersion

- Different costs for noise reduction strategies, not all based on population exposure

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COMMUNITIES EXPERIENCE THE "COUNT" OF EVENTS

Table 1 from FAA Report to Congress, April 14, 2020, page 19

Additions in Red are for Emphasis

Table 1. Noise Metrics

	Noise Level	Time of Day	Number of Events
L_{eq}	✓		✓
DNL	✓	✓	✓ ?
LAeq(hr) (e.g. 16hr, 8hr)	✓	✓	✓
L_{den}	✓	✓	✓
CNEL	✓	✓	✓
SEL and CSEL	✓		
L_{max}	✓		
PSF[a]	✓		
NA[b]	✓	✓	✓
TA[c]	✓		
Time Audible[d]	✓		

Time of Day is easy to account for using different thresholds.

[a] PSF, or pounds per square foot, is functionally a measure of "noise level" instead of decibels. PSF is typically used as a measure of the peak overpressure of a sonic boom.
[b] NA is the number of noise events above a certain noise level threshold.

For remaining footnotes see FAA report

NOISE EVENTS: HOW MANY, HOW LOUD, WHEN AND HOW FREQUENT

- DNL level does not represent the count of events
- 1, 10, 100, or 1,000 events = same DNL 65 dB
- Source: FAA

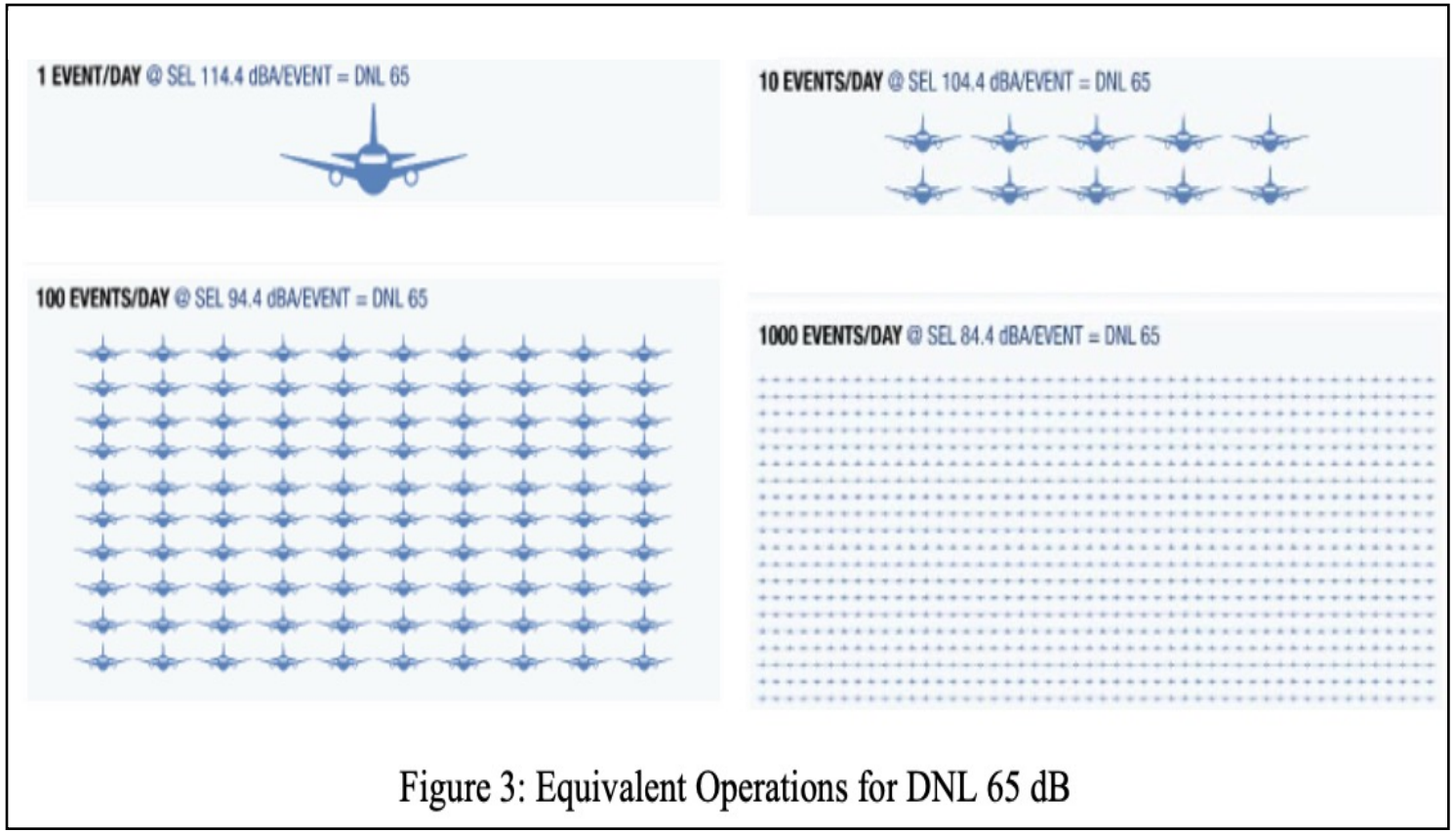

Figure 3: Equivalent Operations for DNL 65 dB

DNL DILUTES THE COUNT OF EVENTS

- Additional aircraft events increase DNL by smaller and smaller amounts
- Source: MIT, Brenner

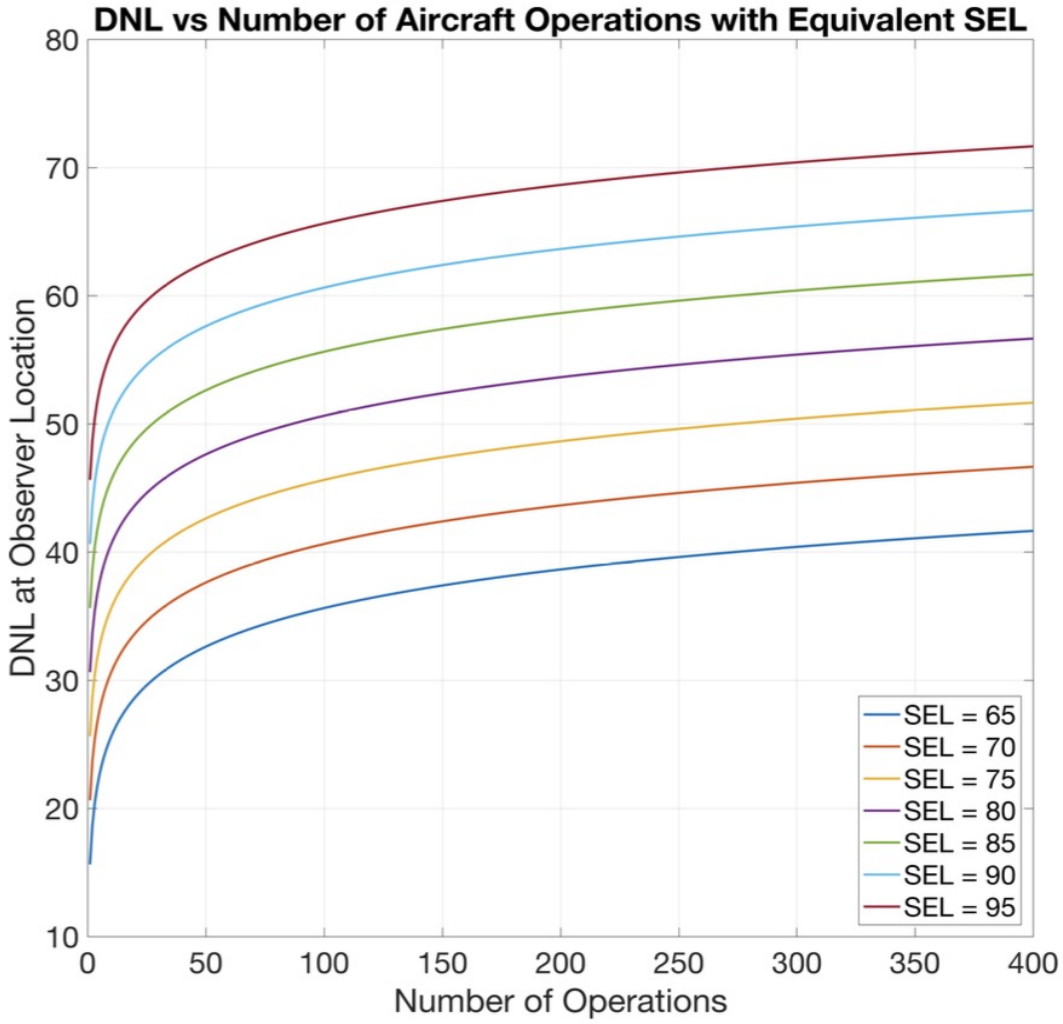

Figure 7: DNL vs. Number of Operations for Different SEL Values

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PEOPLE DO NOT HEAR AN ANNUAL AVERAGE "FICTITIOUS" DAY

DNL 45 correlates w/80%+ complainants (MIT, Yu)

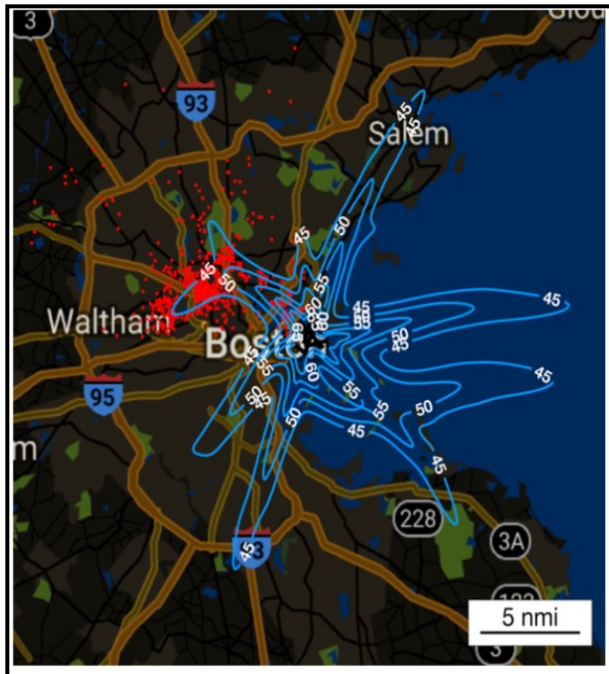

Figure 25: Annual Average Day DNL Contours

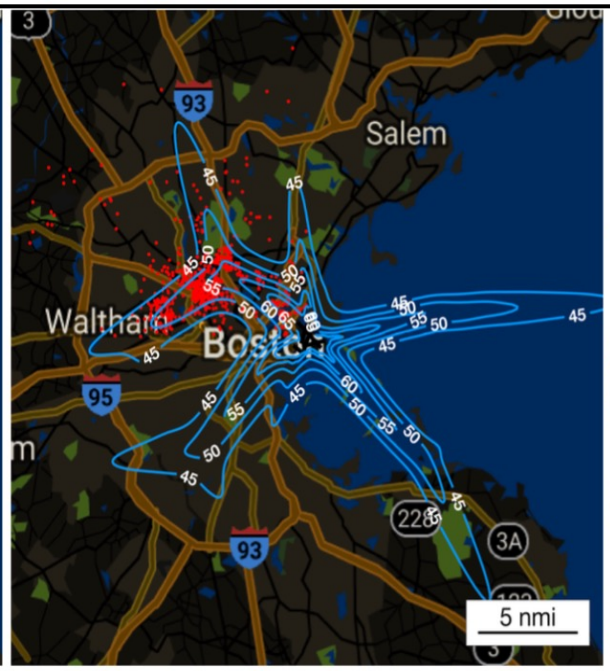

Figure 26: 33L Peak Day DNL Contours

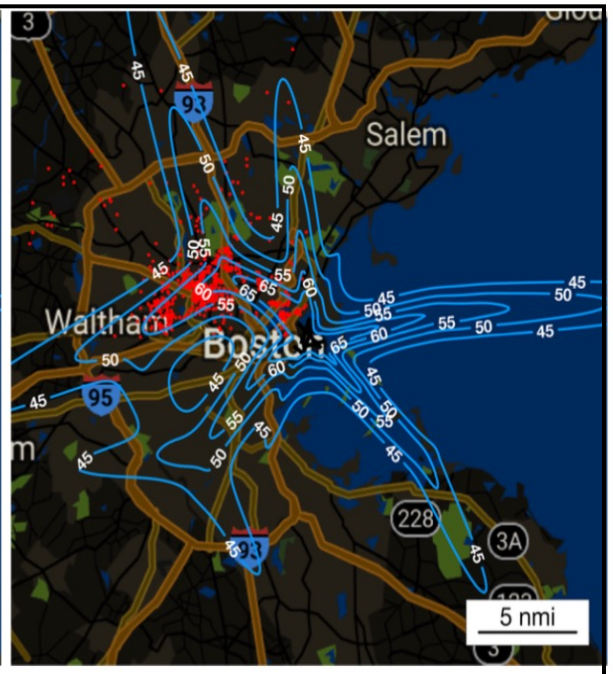

Figure 27: 33L Peak Hour DNL Contours

Table 19: 33L Departures Complainant Coverage for All Scenarios by DNL Contour Level

Contour Level	Annual Average Day	33L Peak Day	33L Peak Hour
45dB DNL	54.21%	87.26%	93.39%
50dB DNL	14.66%	66.11%	88.94%
55dB DNL	8.05%	21.27%	74.04%
60dB DNL	3.49%	8.53%	30.05%
65dB DNL	0.12%	5.17%	9.38%

Table 20: Contour Area and Population Exposure for All Scenarios by DNL Contour Level

Contour Level	Annual Average Day		33L Peak Day		33L Peak Hour	
	Contour Area (nmi^2)	Pop Exposure	Contour Area (nmi^2)	Pop Exposure	Contour Area (nmi^2)	Pop Exposure
45dB DNL	107.43	554,679	114.80	879,087	236.90	1,345,823
50dB DNL	47.88	198,862	51.54	443,925	98.30	795,659
55dB DNL	20.28	61,017	21.86	153,988	43.44	384,738
60dB DNL	7.99	19,852	9.18	49,200	18.24	131,671
65dB DNL	3.38	1,568	3.76	17,640	7.94	50,955

Source: MIT, Brenner

AAD – VASTLY UNDERESTIMATES IMPACTS

- DNL can use Peak Day, but still does not count the events to represent communities' lived experience
- Source: MIT, Yu

Table 2. Annual Average Day Operations vs Peak Day Operations*

	Procedure	Annual Average Day Operations		Peak Day Operations	Peak Day
BOS	33L dep	116	4.20x	487	May 18th, 2017
	27 dep	71	4.86x	345	September 18th, 2017
	4L/R arr	129	4.39x	567	October 12th, 2017
MSP	17 dep	174	2.42x	421	August 25th, 2017
	30L dep	151	2.61x	394	July 13th, 2017
	12L/R arr	239	2.83x	677	July 25th, 2017
	30R dep	128	2.36x	302	June 15th, 2017
LHR	9R dep	125	5.52x	690	July 17th, 2017
	27L/R arr	526	1.32x	696	June 30th, 2017
CLT	18L/C/R arr	258	3.12x	806	May 4th, 2017
	18C dep	156	2.81x	439	April 4th, 2017
	18L dep	185	2.72x	503	April 26th, 2017
	36R arr	146	2.35x	343	October 12th, 2017

*Note: Operations for parallel runways are the sum of all operations on the parallel runways.

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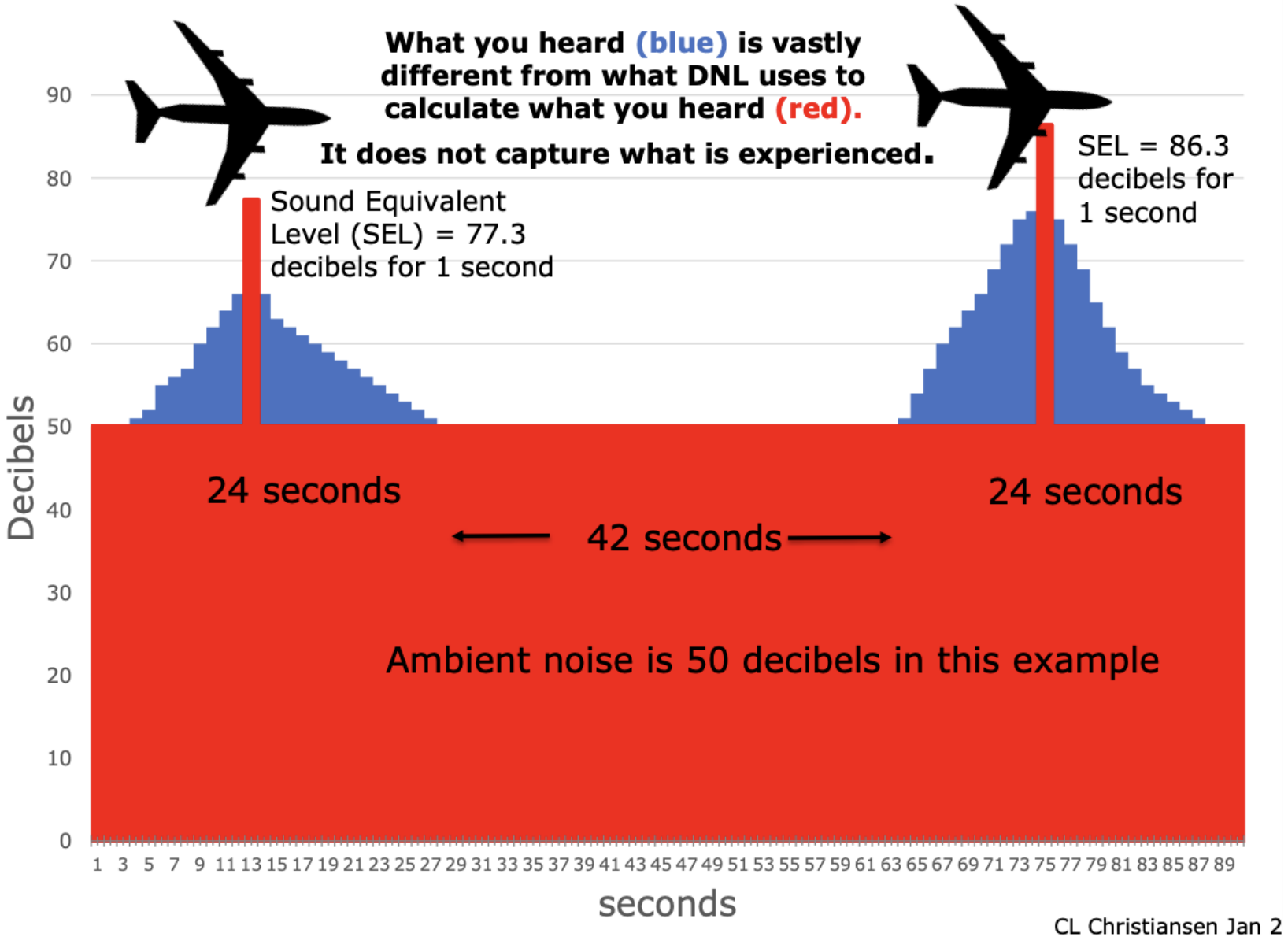
PEOPLE DO NOT HEAR SEL



CL Christiansen Jan 2

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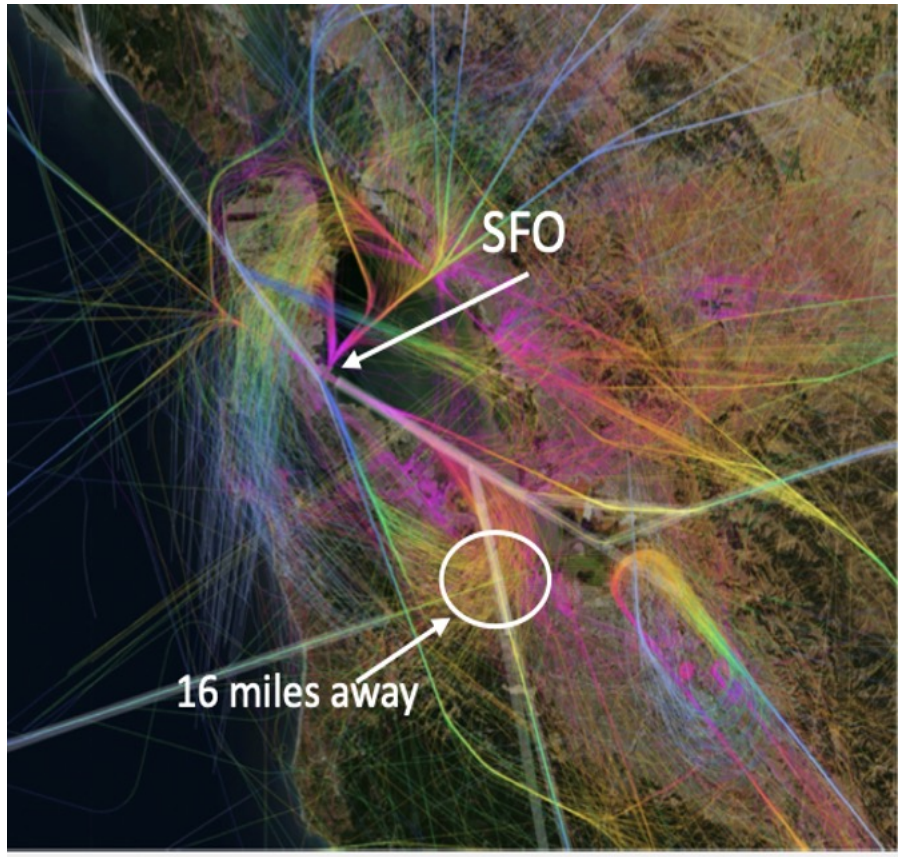
HIGHLY ANNOYING IMPACTS MAY NEVER REACH DNL 65

- **244 SFO Events/day on average**
  - Palo Alto, CA - ~16 Miles from SFO
  - ~60% SFO arrivals
  - Monitored Oct 30, 2018 – Jan 4, 2019
  - Aircraft CNEL: 52 dBA
- **To reach a 65 dB CNEL, Palo Alto would need almost 5,000 events PER DAY**
  - This would be an airplane every 17.7 seconds throughout a 24-hour period



NOISE ABOVE AMBIENT: USE MEASURED DATA

Qualitative Descriptors of Urban and Suburban Detached Housing Residential Areas and Approximate Daytime Residual Noise Level (L_{90}). Add 5 dB to These Values to Estimate the Approximate Value of the Median Noise Level (L_{50}).

Description	Daytime Residual Noise Level in dB(A)		
	Typical Range	Average	EPA 1974
Quiet Suburban Residential	36 to 40 inclusive	38	50
Normal Suburban Residential	41 to 45 inclusive	43	55
Urban Residential	46 to 50 inclusive	48	60
Noisy Urban Residential	51 to 55 inclusive	53	65
Very Noisy Urban Residential	56 to 60 inclusive	58	70

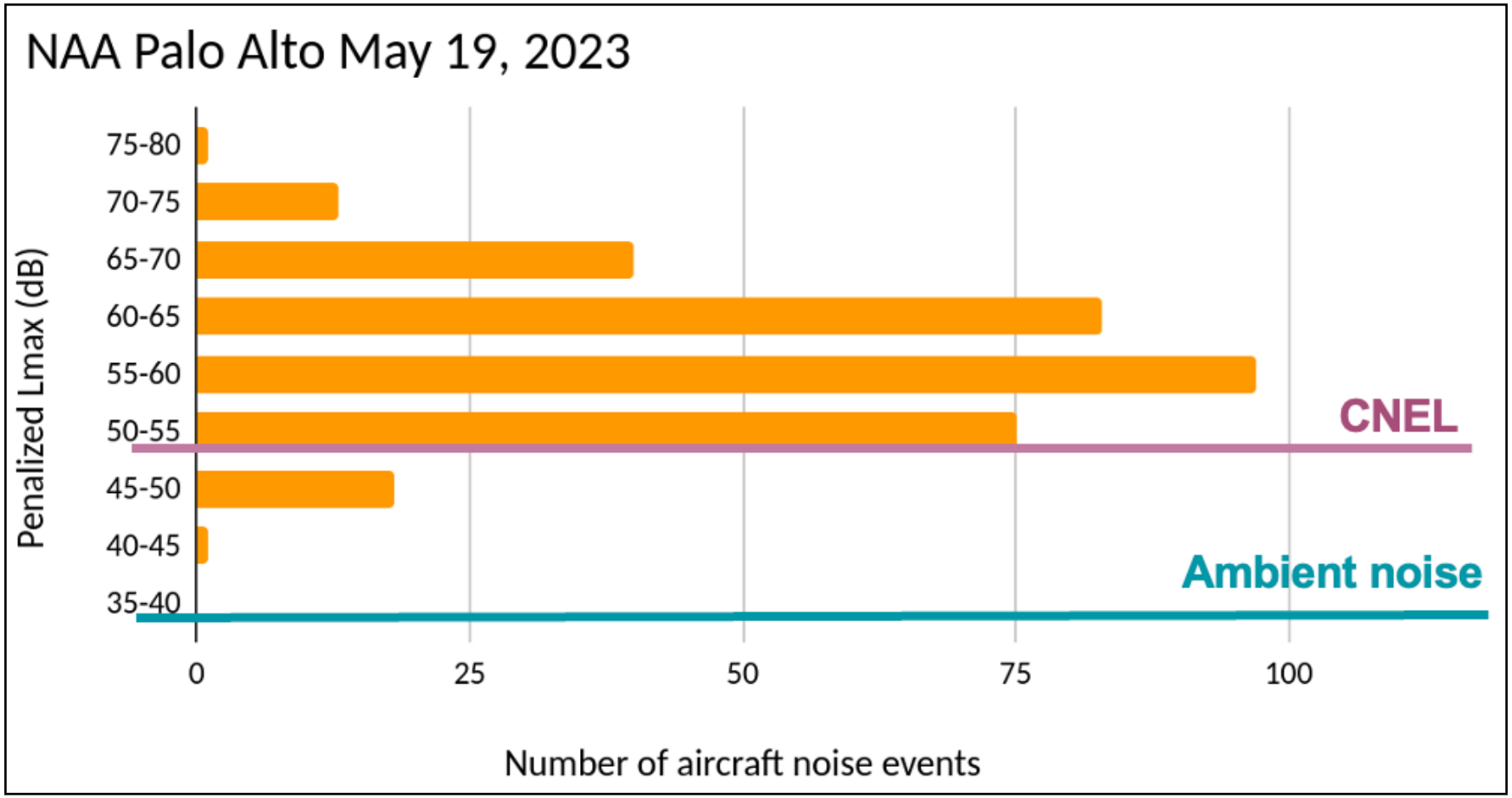
Source: EPA Community Noise Report NTID300.3, December 31, 1971

Source: EPA Information on Levels of Environmental Noise Requisite to Protect Health and Welfare Criteria for Noise Report 550/9-74-004, March 1974

MITRE Study	Palo Alto Monitoring
Suburban 55 dB?	Suburban 35 dB
Urban 65 dB?	
Rural 45 dB?	

N-ABOVE-AMBIENT EFFECTIVELY CAPTURES COMMUNITIES' LIVED EXPERIENCE

- **328 events above 35 dB ambient**
- More than 300 events at or above 50 dB levels
- People do not hear 50 dB CNEL



SFO Noise Office - ANEEM Data

Airport Events: SFO, PAO, SQL, SJC

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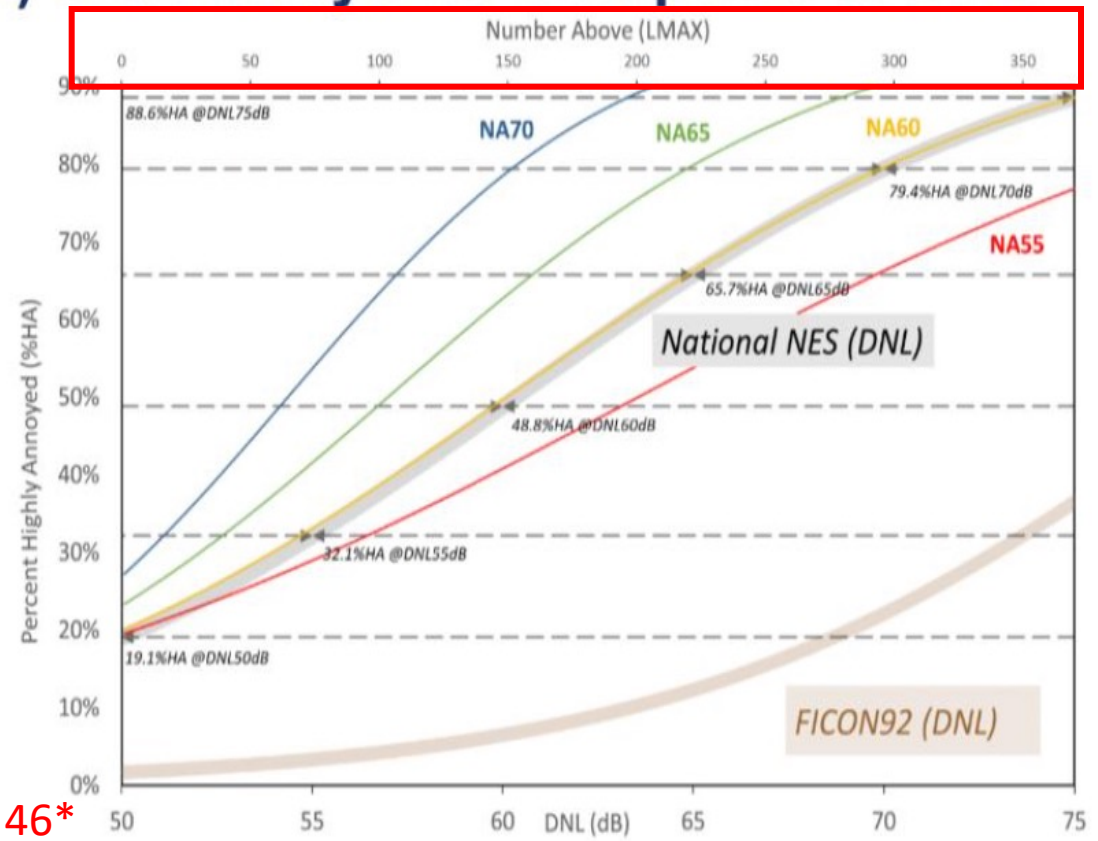
NUMBER ABOVE "A GOOD PREDICTOR OF ANNOYANCE"

NES Follow-On Analyses: Noise Metrics
Number Above (NA) and Annoyance Compared to DNL

- Number of events above (NA) a maximum sound level (L_{max})
- NES results analyzed for various NAL_{max} levels to develop dose-response curves
- $NA55L_{max}$ and $NA60L_{max}$ curves show consistent responses in percent highly annoyed when plotted over equivalent ranges to National NES (DNL) curve

*DNL extrapolated for 12.3% annoyance



Source: (Zhu, Jodts, Morganstein, and Kali, Westat, 2020)

Federal Aviation Administration

7

Figure 7.5-1 *Number above is shown to be a good predictor of annoyance*

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LAW MANDATES A SINGLE SYSTEM, NOT A SINGLE METRIC

(1) establish a single system of measuring noise, for which there is a highly reliable relationship between projected noise exposure and surveyed reactions of people to noise, to be uniformly applied in measuring the noise at airports and the areas surrounding such airports;

(2) establish a single system for determining the exposure of individuals to noise which results from the operations of an airport and which includes, but is not limited to, noise intensity, duration, frequency, and time of occurrence; and

Aviation Safety and Noise Abatement Act, 1979

Through the Aviation Safety and Noise Abatement Act (ASNA) of 1979, Congress directed the Federal Aviation Administration (FAA) to establish a single metric for assessing land use compatibility with respect to noise from aircraft operations, and to establish standards and methods for assessing the noise environment associated with ongoing aircraft operations near airports. In 1981, the FAA implemented the ASNA

DOT/FAA Analysis of the NES Survey, Final Report, February 2021

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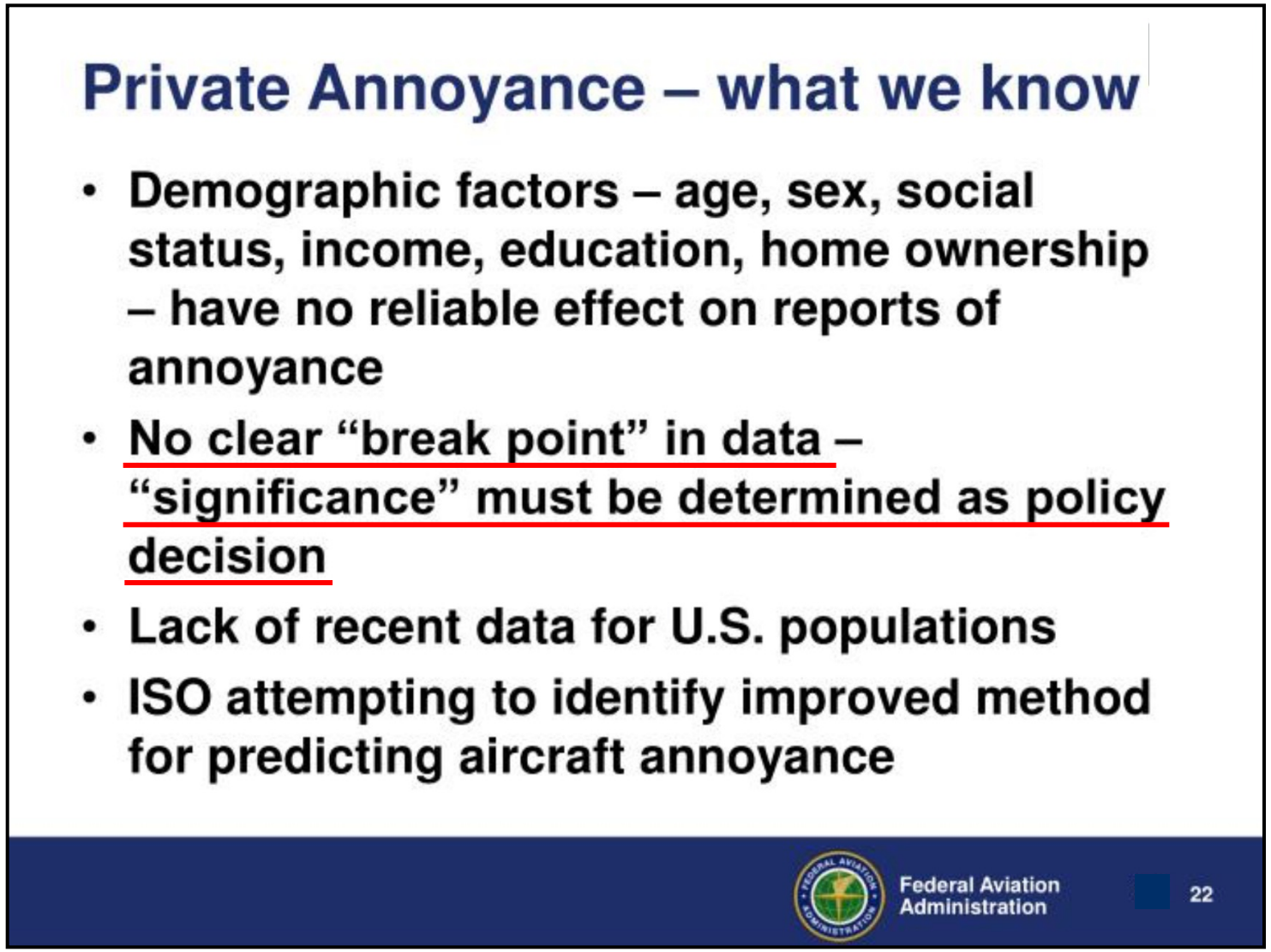
SEPARATE THE METRICS DECISION FROM THE "SIGNIFICANCE" THRESHOLD DECISION



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GENERALIZATIONS SHOULD NOT BE MADE FROM UNREPRESENTATIVE SAMPLES

PERFORMANCE BASED NAVIGATION (PBN) DASHBOARD – CY 2023				
Airport (NES Study)	RNAV SID	RNAV STAR	RNP APPROACH	Total IFR Operations
Bradley Intl, CT (BDL)	0	0	2	70,937
Albuquerque Intl, NM (ABQ)	9	5	6	44,051
Boston Logan Intl, MA (BOS)	9	3	1	387,062

- Did not find 3 of 20 NES airports in PBN dashboard: DSM, LIT, SAV
- Source: FAA Performance Based Navigation (PBN) Implementation and Usage, https://www.faa.gov/air_traffic/community_engagement/dashboard/

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FAA'S WESTAT NA STUDY

Study shows:

- "A clear increasing relationship between the number of events and high annoyance"

And concludes:

- "Replacing DNL with any (of the seven studied) NA Lmax measures is unwarranted"

The conclusion does not appear to be substantiated by currently provided data

The report has not been published or peer-reviewed

- "Full details of follow-on analyses conducted to date are available in a companion technical report" (Publication pending)
- All reports should be made available well in advance of FAA publishing its subsequent notice in the federal register

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OTHER FAA STUDIES

FAA's HMMH averaging study

- Daily DNL is better than AAD DNL
- Problem: it is still DNL, deficient representation of lived experience

FAA's HMMH weighting study

- Shoulder hours e.g., CNEL - different variations of DNL With a "Time Of Day" penalty, deficient representation of lived experience
- Such penalties can and should apply to any metric including NA

FAA's BAH/VHB significance thresholds study

- Lowering the threshold, increases number of people impacted
- Different costs for noise reduction strategies, not all based on population exposure

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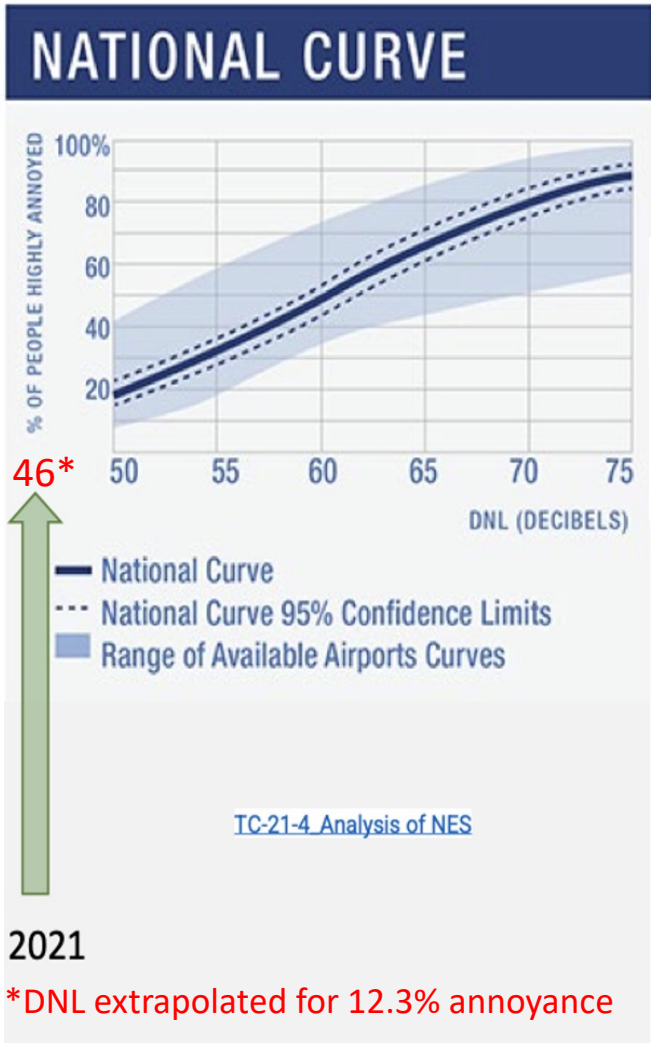
NEW THINKING TO REALIZE A 21ST CENTURY NOISE POLICY

IMPACTS	COMMUNITIES' LIVED EXPERIENCE
How many?	• Count of events
How loud?	• Loudness relative to ambient noise
When?	• Time of occurrence
How frequent?	• Cadence

What do I hear?	• Annoying events, not all acoustic energy
	  • Peak Day/not AAD, Lmax/not SEL
	  • NAA, not DNL (away from airports)
	• Address the 2 noise environments
	• No obfuscating factors (e.g., averaging)
	• Disregard convenience of measurement
	• Validate factors with monitoring

Health?	• Adverse effects on sleep, heart attacks, stroke, hypertension, diabetes, lead exposure resulting in reduced cognitive abilities, etc.



NEW THINKING TO REALIZE A 21ST CENTURY NOISE POLICY, CONT.

N-Above-Ambient (Peak Day/Hour) for Away from Airport Impacts

- Convenience of measurement and expediency cannot be at the cost of misrepresenting the communities' lived experience for decision making
- The wrong metric cannot be fixed by refinements
- Generalizations should not be made from unrepresentative samples

Requirement – policy changes in metrics for decision-making; metrics for understanding are insufficient

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THEN

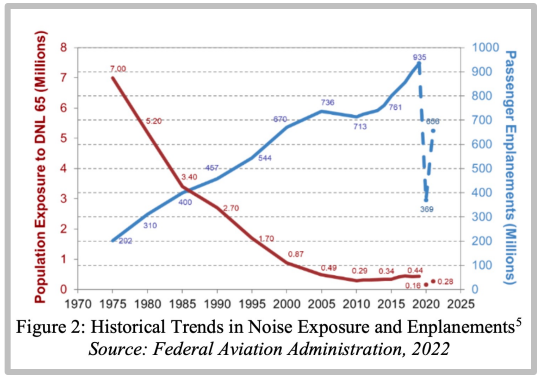
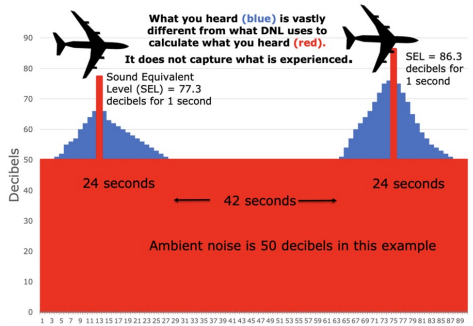
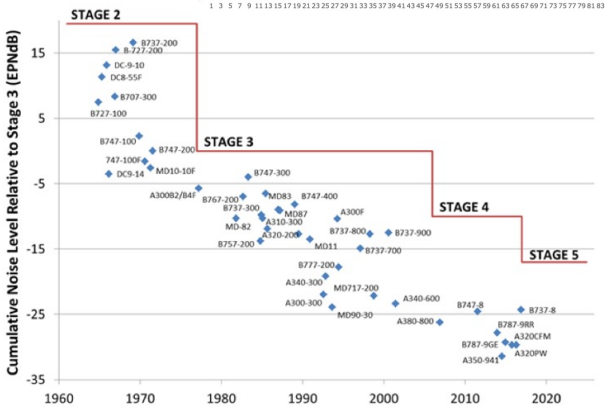
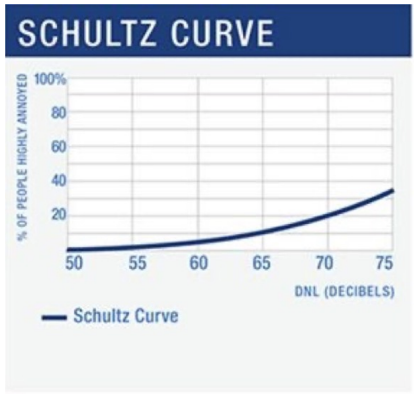


Figure 2: Historical Trends in Noise Exposure and Enplanements[5]
Source: Federal Aviation Administration, 2022







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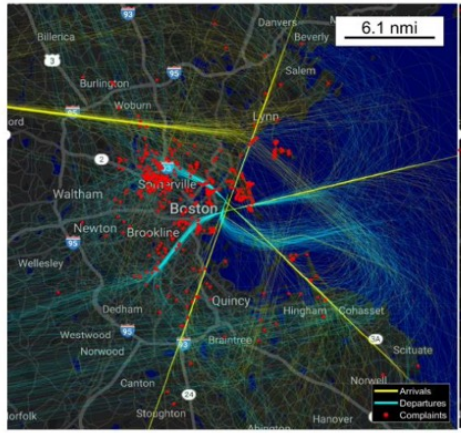
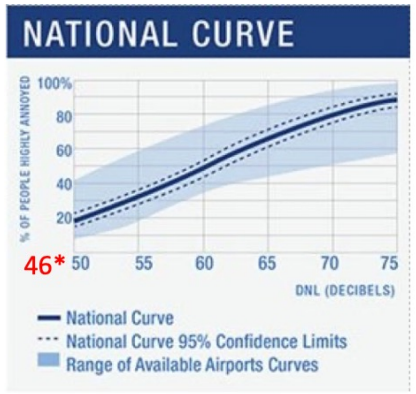


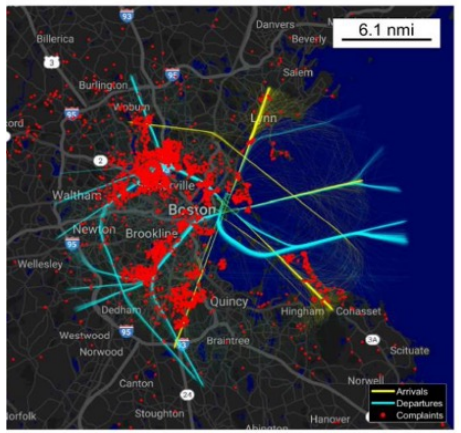
Equation 4: Formula for DNL. Source: HMMH [7]

$$DNL = 10 * log_{10}\left(\frac{1}{T}\left[\sum_{i=1}^{n_{day}} 10^{\frac{SEL_{i,day}}{10}} + \sum_{i=1}^{n_{night}} 10^{\frac{SEL_{i,night}+10}{10}}\right]\right)$$

NOW



*DNL extrapolated for 12.3% annoyance



Equation 3: Formula for N_{above}

$$N_{above} = \sum_{i=1}^{n_{day}} x_{i,day} + \sum_{i=1}^{n_{night}} x_{i,night}$$

Contour Level	Annual Average Day	33L Peak Day	33L Peak Hour
45dB DNL	54.21%	87.26%	93.39%
50dB DNL	14.66%	66.11%	88.94%
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		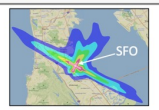	
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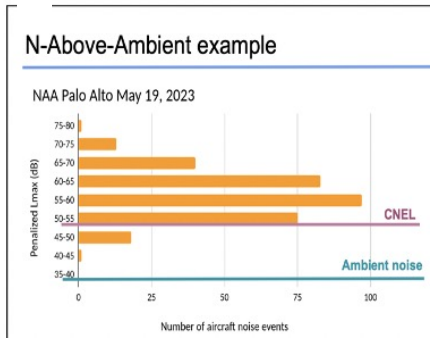
	Thresholds	Realistic thresholds	Realistic thresholds
	Noise Reduction Strategies	Examples: sound insulation, land use, ground-based noise abatement	Examples: avoid residential, quiet procedures, flight dispersion



Adverse Health Impacts