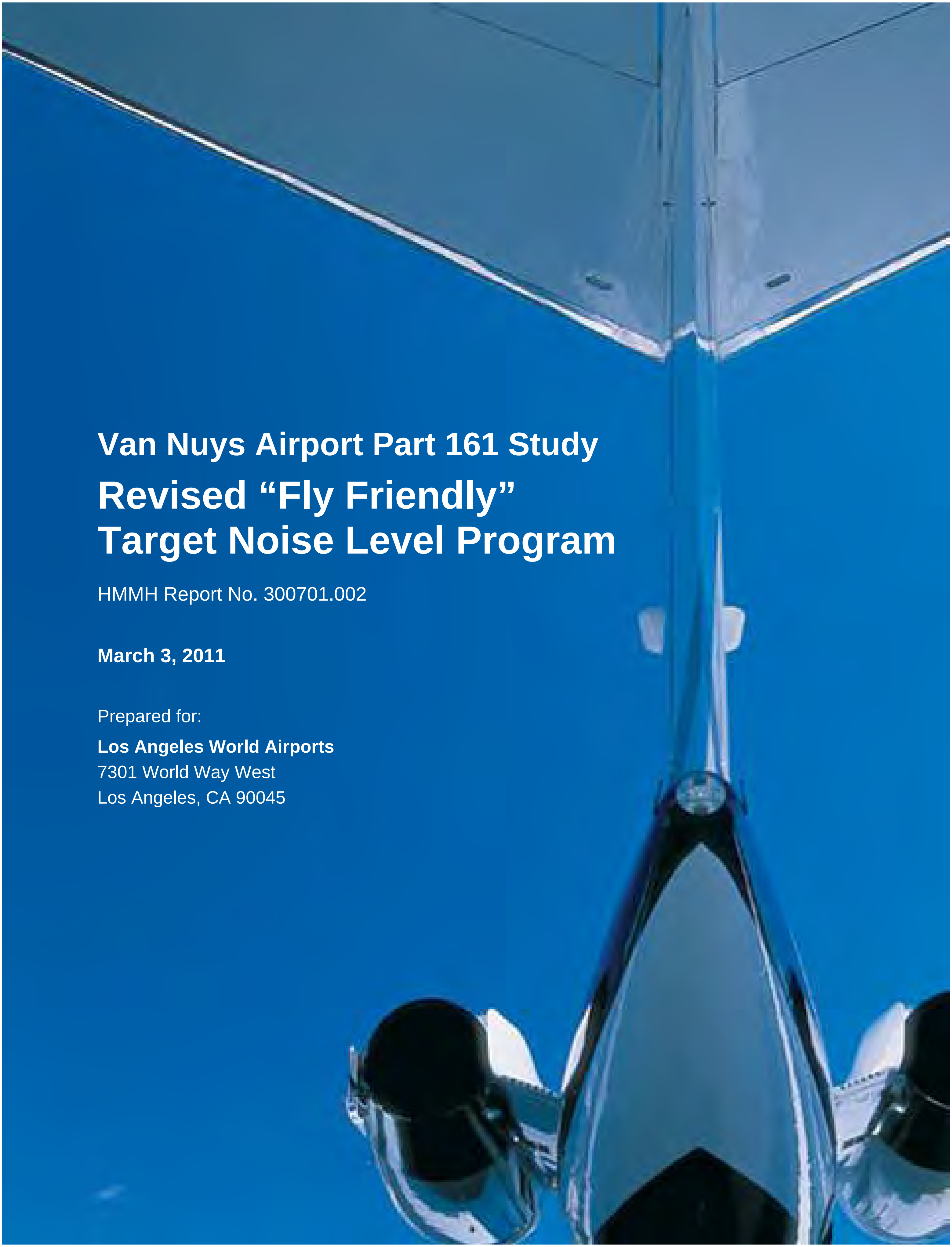

Van Nuys Airport Part 161 Study

Revised “Fly Friendly” Target Noise Level Program

HMMH Report No. 300701.002

March 3, 2011

Prepared for:

Los Angeles World Airports
7301 World Way West
Los Angeles, CA 90045

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EXECUTIVE SUMMARY

Los Angeles World Airports (LAWA) considers noise compatibility to be a high-priority, continuing process; over many decades of effort, it has established an extensive noise management program at Van Nuys Airport (VNY). One of the existing voluntary noise abatement measures is the so-called "Fly Friendly" program that encourages jet aircraft pilots to follow flight procedures that result in measured departure noise levels below aircraft-type-specific targets.

In January 2003, LAWA completed a Federal Aviation Administration (FAA) Part 150 study to review the noise management program. One of the study recommendations was to make the Fly Friendly program a formal rule, with penalties assessed on operations that exceeded the established target levels. The study acknowledged that implementation of this proposal would require LAWA to conduct a second study under another FAA regulation, Part 161.

LAWA retained a consulting team led by HMMH to conduct a study under that regulation to assess this proposal and several other use restrictions. The VNY Part 161 study led to three primary conclusions regarding the Fly Friendly program:

- LAWA would be unlikely to be able to defend a formal Fly Friendly program.
- The voluntary Fly Friendly program has resulted in measurable noise reduction.
- LAWA should focus on enhancing the voluntary program to maximize its ongoing benefits

This report presents the results of follow-up analyses and other work undertaken related to the final recommendation, leading to the following principal conclusions and recommendations:

- There are no obvious "bad performers" whose operations disproportionately affect overall noise exposure and would be clear targets for penalties.
- LAWA should set the targets to affect an equal percentage of operations of each aircraft type.
- The target levels should be set to provide noise reduction approximating the benefit that would result from full adherence to the existing targets; which would be achieved through targets affecting five percent of departures.
- It would be most appropriate to pursue further reduction in departure noise levels through an updated and expanded voluntary program. Specific recommendations are made for the establishment and implementation of such a program, including:

  Recommended target noise levels

  Estimating potential benefits

  Developing targets for new aircraft types

  Enhancing program effectiveness

  Determining when to reassess the program

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1 INTRODUCTION

Los Angeles World Airports (LAWA) considers noise compatibility to be a high-priority, continuing process; over many decades of effort, it has established an extensive noise management program at Van Nuys Airport (VNY). The program – and LAWA’s commitment to its implementation and improvement – is widely recognized for its innovation and benefits. Major elements include:

- voluntary noise abatement operating procedures to reduce or shift noise exposure away from sensitive land uses
- formal use restrictions to reduce existing noise exposure and prevent increased noise exposure
- remedial land use measures to address residual incompatible land uses
- preventive land use measures to deter introduction of new incompatible land uses
- a noise and operations monitoring system that includes noise monitoring at fixed locations, collection of flight operations information (including flight tracks, altitude profiles, and aircraft, operator, and other flight identification data), and that correlates measured noise levels with specific flight operations and any associated noise complaints that LAWA receives

One of the existing voluntary noise abatement measures is the so-called “Fly Friendly” program[1] that encourages jet aircraft pilots to follow flight procedures that result in measured departure noise levels below aircraft-type-specific targets. LAWA has implemented the program continuously since its establishment in 1994. Section 2 describes the program’s development and ongoing application.

In January 2003, LAWA completed a Federal Aviation Administration (FAA) Part 150 study to review the noise management program.[2] LAWA submitted the required Part 150 documentation to the FAA in August 2003.[3] It proposed 35 “Noise Compatibility Program” (NCP) measures, including seven new use restrictions, one of which proposed making the Fly Friendly program a formal rule, with penalties assessed on operations that exceeded the established target levels.[4]

The NCP submission acknowledged that further pursuit of the proposed use restrictions would require LAWA to conduct a second study under another FAA regulation, Part 161.[5] LAWA retained a consulting team led by HMMH to conduct a study under that regulation to assess these seven proposals, and several others subsequently added by LAWA, ultimately leading a total of 12 options. The study commenced in 2005.

Over the next five years, the VNY Part 161 study process led to the following primary results:

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[1] Some LAWA publications refer to this measure as the “Fly Neighborly” or “Quiet Jet Departure” program.

[2] 14 CFR Part 150, "Airport Noise Compatibility Planning” provides airports with guidance on technical, documentation, and public consultation procedures to follow in assessing airport noise exposure and land use compatibility, and developing programs to minimize, mitigate, and prevent existing and future incompatible land uses through noise abatement and land use measures. Part 150 is a voluntary program.

[3] “Van Nuys Airport Part 150 Study, Noise Compatibility Program Report with Noise Exposure Maps (NEM) and Noise Compatibility Program (NCP) Mitigation Measures,” Prepared by Environmental Management Division, City of Los Angeles, Los Angeles World Airports, August, 2003.

[4] Noise Compatibility Program (“NCP”) measure 31.

[5] 14 CFR Part 161, “Notice and Approval of Airport Noise and Access Restrictions,” which sets forth notice and analysis requirements airport proprietors must address prior to adoption of use restrictions affecting operations in certain aircraft type categories.

- Adoption and implementation (through a city ordinance) of a "noisier aircraft phaseout" under a Part 161 "grandfather" provision that addressed the objectives of several of the proposed restrictions to limit operations in the noisiest aircraft types operating at VNY[6]
- Determination that LAWA would be unlikely to be able to defend the other proposed restrictions – *including a formal Fly Friendly* program – under statutory conditions for approval set forth in Part 161 or under contractual commitments LAWA had made when accepting federal grants[7]
- Determination that the voluntary Fly Friendly program had resulted in measurable noise reduction and that an updated program could yield further benefits

LAWA staff presented these results to the LAWA Board of Airport Commissioners and the VNY Citizens Advisory Council (CAC) at separate meetings in February 2010, and recommended that:

- Part 161 efforts related to adoption of further use restrictions should be tabled
- Further efforts under the Part 161 study related to the Fly Friendly program should focus on enhancing the voluntary program to maximize its ongoing benefits

Both groups endorsed these recommendations. *This report presents the results of follow-up analyses work undertaken related to the second recommendation. The analyses include using data collected since 1994 to develop refined targets for the largest and most specific feasible list of jet aircraft models, to recommend potential improvements to the program to maximize its continuing effectiveness, and to estimate the potential associated benefits.*

[6] LAWA analyzed the environmental impacts of the noisier aircraft phaseout pursuant to the California Environmental Quality Act (CEQA), as documented in "Van Nuys Airport Noisier Aircraft Phaseout Final Environmental Impact Report," Los Angeles World Airports, March 2009.

[7] In particular FAA grant assurance 22(a), "Economic Nondiscrimination," which states that an airport operator "will make its airport available as an airport for public use on fair and reasonable terms and without unjust discrimination to all types, kinds, and classes of aeronautical use."

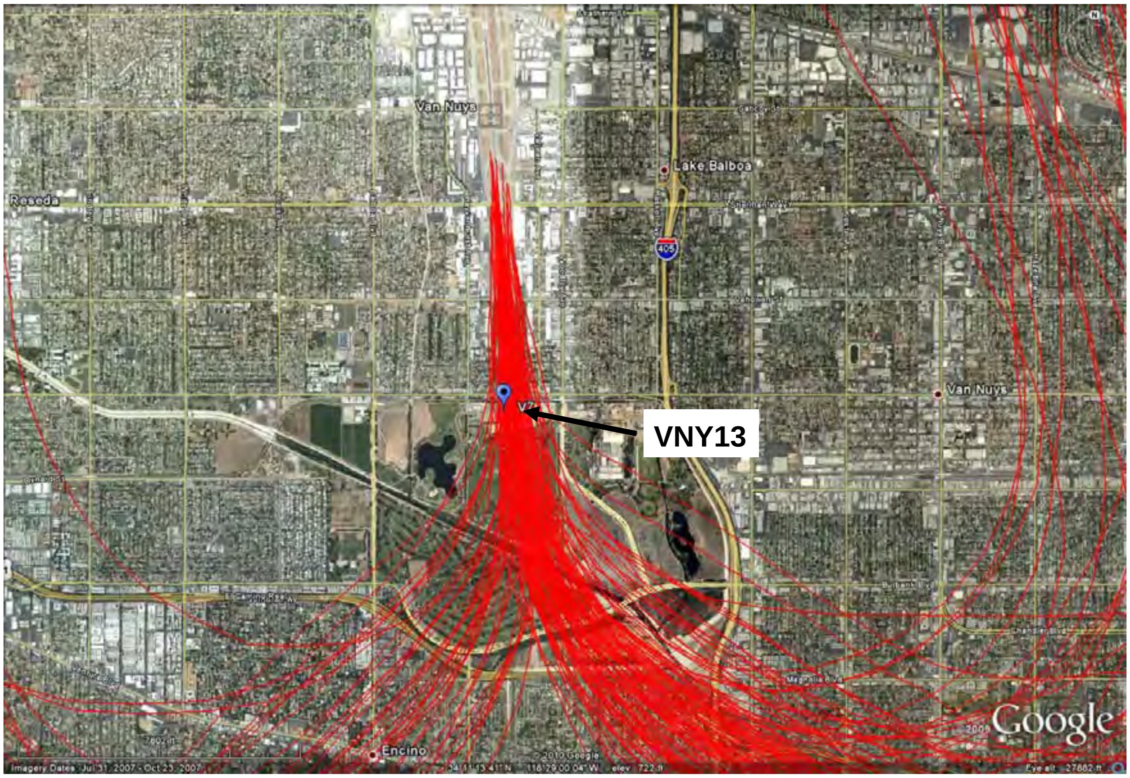
2 FLY FRIENDLY PROGRAM BACKGROUND

The VNY Fly Friendly program encourages jet pilots to conduct departures so measured noise levels are below established aircraft-type-specific targets at monitoring location "VNY13," shown in Figure 1. The monitor is approximately 6,000 feet south of the airport, and is approximately 14,000 feet from the start-of-takeoff-roll point on Runway 16R, the primary runway used by jets at VNY.[8] Figure 2 depicts the monitor location with a sample of jet departure tracks.

Figure 1 VNY Noise Monitor VNY13 (Formerly V7) Location
Source: HMMH, 2011

[8] Over approximately the same time frame as the VNY Part 161 study, LAWA subsequently obtained an updated, state-of-the-art monitoring from Brüel & Kjær Environmental Management Solutions (B&K EMS), utilizing the firm's "ANOMS 8™" software. That system became fully operational at VNY on November 4, 2009. As part of the monitoring system upgrade, LAWA relabeled this monitor VNY13 on July 1, 2009; prior to that date it was labeled "V7."

Figure 2 Noise Monitor VNY13 with a Sample of Jet Departure Flight Tracks
Source: HMMH, 2011



The Fly Friendly program focuses on Runway 16R because, during most years, over 80% of all jet departures at the airport are on this runway.[9] It focuses on monitor VNY13 because it is directly under the preferred noise abatement departure flight path for this runway, which calls for jets to fly straight out until past this point.[10] Concentration on this runway end and this monitoring location results in a program that encourages pilots to utilize procedures that benefit residents closest to the airport, where departure noise levels typically are highest, in the area most often affected by jet departures.

The targets are set in terms of the single event noise exposure level (SENEL) measured at VNY13 for the departure.[11]

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[9] As documented in Appendix B, Table B.4.1 of the "Van Nuys Airport Noisier Aircraft Phaseout Final Environmental Impact Report," Los Angeles World Airports, March 2009.

[10] The VNY "No Early Turn Program" calls for takeoffs on Runway 16R to "climb straight out 2.2 miles, measured from the VNY very-high-frequency omnidirectional range (VOR) antenna (which is located off the north end of the airport) and attain a minimum altitude of 1,800 feet above mean sea level (MSL) prior to turning." Most LAWA publications describe this measure in the following visual-reference terms: "Climb straight out over flood basin before starting turn unless instructed by air traffic control." Monitor VNY13 is at the north end of the flood basin.

[11] California Department of Transportation ("Caltrans") Division of Aeronautics regulations require airports to use SENEL to describe the cumulative noise exposure for individual aircraft operations. In simple terms, SENEL is the one-second-long steady-state level that contains the same amount of acoustical energy as the actual time-varying level during the operation, calculated over the period when the level exceeds a selected threshold. The threshold is generally set low enough that the calculated SENEL differs by less than a tenth of a decibel from the level for the entire event. The Caltrans noise regulations are set forth in California Code of Regulations (CCR), 1990, Title 21, Subchapter 6, Noise Standards (Register 90, No. 10, 3/10/90).

2.1 Program Implementation

The VNY Noise Management Office (NMO) continuously monitors jet departure SENEL values at VNY13. The monitoring system provides detailed information about the specific aircraft type and operator, the coordinates of the radar-determined flight track, and the measured noise level as the aircraft flies past the monitor. From this information, the NMO can determine which aircraft and operators exceed the applicable target. While there is no formal penalty for an exceedance, LAWA sends letters to operators exceeding targets and publishes monthly reports on exceedances, listed by operator. LAWA has found that these practices act as an effective compliance incentive.

Pilots can contact the NMO to identify targets for specific aircraft, to discuss procedures that other pilots operating similar aircraft types have found successful, and to obtain measurement results from their prior departures. The NMO has found that pilots frequently take advantage of the access to this information to develop, test, and refine departure procedures, so as to improve their noise abatement performance. Undoubtedly, the letters sent to operators and the published lists of exceedances encourage this positive behavior. Furthermore, as discussed in Section 3.1 of this report, empirical analyses undertaken for this study indicate the program has led to measurable noise reduction.

An important element of the initial program implementation was a "Letter of Commitment" in which jet operators agreed to the following "quiet flying" principles:

- Pilots will fly aircraft using noise abatement techniques as outlined in manufacturers' operating manuals or National Business Aircraft Association (NBAA) Noise Abatement Program.
- Pilots will work to research complaints from local residents regarding individual flights and to encourage participation by other jet operators.
- Voluntary compliance will help forestall more drastic measures to reduce noise.

2.2 Original Program Development

The NMO set the original targets by averaging the arithmetic mean of: (1) average measured departure SENEL values for the given aircraft type and (2) an Integrated Noise Model (INM) SENEL estimate for a comparable aircraft type. Because the permanent monitoring system was relatively new at VNY at the time, limited measurement data were available – fewer than 10 measurements for some aircraft types. In addition, INM estimates were available for only nine aircraft types:

- Boeing 727 B727Q9
- Canadair CL600
- Cessna CNA500
- McDonnell-Douglas DC9Q9
- Grumman Gulfstream GIIB
- Israeli Aircraft IAI1125
- Lear LR25
- Lear LR35
- Mitsubishi MU3001

The NMO "mapped" all actual jet aircraft measured at VNY13 to one of these types, which required relatively crude substitutions in some cases.

2.3 Examination of Fly Friendly Program in the VNY Part 161 Study

One of the use restrictions that LAWA included in the scope of the VNY Part 161 study was to make the Fly Friendly program a formal, mandatory rule, with operators fined for exceeding the targets. Consistent with penalty provisions of the existing "Van Nuys Airport Noise Abatement and Curfew Regulation" (City of Los Angeles Ordinance No. 155,727) operators and individual aircraft also would be denied permission to operate at the airport after three violations in a three-year period.

Part 161 implements requirements set forth by the U.S. Congress in the Airport Noise and Capacity Act of 1990 ("ANCA")[12] related to notice and analysis requirements that airport proprietors must address prior to adoption of use restrictions affecting aircraft certificated by the FAA as "Stage 2" or "Stage 3" under the Part 36 regulation.[13] The requirements are most significant for restrictions affecting Stage 3 aircraft, which make up the majority of jet operations at VNY. In very simple terms, Part 161 requires that airports conduct detailed benefit-cost analyses to demonstrate that the noise benefits of a proposed restriction would exceed the costs, that there are no non-restrictive approaches to achieving the objectives of the restriction, and that the rule would meet six statutory conditions for approval.[14]

The ANCA requirements and the potential application of penalties, including fines and denial of airport use, required that the Part 161 study include detailed analysis of the target noise levels. The analysis included using data collected since 1994 to determine: (1) if the voluntary program had been effective in reducing noise levels, and (2) whether it was reasonable to expect that a formal program would lead to further noise reduction that could not be achieved through a non-restrictive approach.

As discussed in Section 1, the Part 161 analyses resulted in a determination that the voluntary Fly Friendly program had resulted in measurable noise reduction and that an updated program could yield further benefits, and a recommendation that further efforts under the Part 161 study related to the Fly Friendly program should focus on enhancing the ongoing program, including the following major steps:

- Develop updated targets for a more comprehensive list of jet types operating at VNY
- Assess the past effectiveness of the program in reducing departure noise levels
- Identify the need and options for revising the target-setting approach
- Recommend potential improvements to the program to improve its ongoing effectiveness
- Recommend mechanisms for LAWA to add targets for new aircraft models
- Recommend mechanisms for LAWA to identify *when* and *how* targets should be adjusted

Section 3 discusses analyses that HMMH and LAWA undertook to develop and recommend updated targets for use in a voluntary program. Section 4 presents the final recommended targets and implementation-related issues.

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[12] Pub. L. No. 101-508, 104 Stat. 1388, as recodified at 49 United States Code (U.S.C.) 47521- 47533

[13] FAA defines noise criteria in 14 CFR Part 36, "Noise Standards: Aircraft Type and Airworthiness Certification." For transport category "large" aircraft (with maximum takeoff weights of 12,500 pounds or more) and turbojet-powered aircraft, Part 36 identifies four "stages" of aircraft with respect to their relative noisiness: Stage 1 aircraft have never been shown to meet any noise standards, Stage 2 aircraft meet original noise limits set in 1969, Stage 3 aircraft meet more stringent limits set in 1977, and Stage 4 aircraft meet the most stringent limits set in 2005.

[14] Specifically, the analysis must permit the FAA to find that:

(1) the restriction is reasonable, nonarbitrary, and nondiscriminatory
(2) the restriction does not create an unreasonable burden on interstate or foreign commerce
(3) the restriction is not inconsistent with maintaining the safe and efficient use of the navigable airspace
(4) the restriction does not conflict with a law or regulation of the United States
(5) an adequate opportunity has been provided for public comment on the restriction
(6) the restriction does not create an unreasonable burden on the national aviation system

3 PART 161 ANALYSIS OF TARGETS

The Part 161 analysis of the Fly Friendly program included detailed, aircraft-type-specific analysis to objectively identify achievable targets that would produce further reduction in noise exposure. This analysis was undertaken in four primary steps:

- Developing updated targets for the most detailed list of jet types feasible, following the original target-setting methodology, to take advantage of all measurements since 1994 and of additional jet SENEL estimates available from the current INM version as applied at VNY for the Part 161.
- Assessing whether there are any obvious targets that might yield significant noise reduction while affecting few operations; i.e., limits that might meet the Part 161 benefit-cost criterion.
- Identifying and assessing potential alternative methods for establishing productive targets.
- Evaluating the defensibility of applying targets in a mandatory program.

Sections 3.1 through 3.4 summarize these four steps. Appendices A, B, and C contain three interim Part 161 memoranda that present a more complete discussion.

3.1 Applying the Original Target-Setting Method to Develop Updated and Expanded Targets

In February 2008, HMMH and LAWA completed an analysis that applied the original target-setting method to develop updated and expanded SENEL targets for jet aircraft types that operate regularly at VNY. Appendix A presents the memorandum that describes this analysis in full detail.

The analysis utilized measurement data from the VNY monitoring system for January 1998 through May 2007 that provided aircraft-type-specific SENEL measurements at monitor VNY13 with sample sizes for individual aircraft models ranging from the hundreds to thousands. It also utilized HMMH's detailed application of the most current version of the INM available at the time (Version 7.0a) to develop SENEL estimates for 21 INM jet aircraft types for use in this exercise (up from the nine utilized in the original target-setting process).[15]

Table 1 on the following page presents the results of this first-round analysis of updated and expanded targets. The last column of the table shows that most of the updated targets are lower than the existing targets; overall, in fact, the updated targets are 2.2 decibels (dB) lower on average, suggesting the Fly Friendly program delivered some success in reducing departure levels.

The last column also shows that the difference between the existing and updated targets varies significantly among aircraft types, which suggests that using the original target-setting approach might result in targets that penalize some types more than others. Section 3.3 discusses additional analyses undertaken to address this matter.

Additionally, in a limited number of cases, the updated targets were higher than existing targets. Further investigation revealed that these results were largely related to fleet mix transitions affecting the manner in which aircraft were grouped in the measurements over time. For example, in some instances, manufacturers offered more versions of a given aircraft model that increased variation in noise levels; e.g., multiple engine types or weights. In other cases, consolidation in the fleet reduced noise-related variation among aircraft of a given type. These discrepancies were addressed in the course of undertaking final target refinements, as discussed in Section 4.

[15] Appendix B.4 of the "Van Nuys Airport Noisier Aircraft Phaseout Final Environmental Impact Report," cited in footnote 6, describes the development of the baseline Part 161 INM contours in detail.

Table 1 Updated and Expanded Targets Using the Original Target-Setting Methodology
Source: HMMH, 2008

VNDS SENEL Output (January 1998 - May 2007)			INM SENEL Output		New Target (Average of VNDS Mean and INM Estimate)	Existing VNY13 Target	Existing Minus New Target (Positive means existing is higher)
Aircraft Type Listed in VNDS	Sample Size	Arithmetic Mean	INM Aircraft Type	Average Day (66.1° F, 29.96 in-Hg) SENEL			
A3	294	108.0	A3_RAY	110.9	109.5	108.4	-1.1
B727	1,449	104.3	727LAC	102.6	103.5	109.7	6.3
B737	294	92.3	737700	94.0	93.2	95.7	2.6
BAC-111	21	103.3	BAC111	101.6	102.5	108.7	6.3
Beech 400	2,572	87.6	MU3001	93.2	90.4	92.3	1.9
Cessna 550	4,957	85.9	MU3001	93.2	89.6	90.3	0.7
Cessna 551	301	86.7	MU3001	93.2	90.0	90.3	0.3
Cessna 560	6,543	86.7	MU3001	93.2	90.0	91.4	1.5
Cessna 750	4,856	82.4	CNA750	84.0	83.2	none	
Challenger 600	2,362	83.5	CL600	88.5	86.0	90.0	4.0
Cessna 500	5,694	85.7	CNA500	88.6	87.2	90.0	2.8
Cessna 650	1,593	89.0	CIT3	90.7	89.9	92.6	2.8
DC-9	94	99.3	DC93LW	103.8	101.6	99.4	-2.1
Embraer 135	308	85.8	EMB145	82.6	84.2	none	
Falcon 2000	3,519	88.6	CL600	88.5	88.6	none	
Falcon 10	329	87.3	LEAR35	89.4	88.4	92.5	4.2
Falcon 20	1,552	89.7	FAL20	97.9	93.8	92.5	-1.3
Falcon 50	1,887	90.7	FAL50	95.5	93.1	91.7	-1.4
Falcon 900	1,147	88.9	FAL900	95.5	92.2	none	
GALX	580	88.4	IA1125	92.4	90.4	none	
Gulf 2	8,956	97.4	GII	102.7	100.1	100.8	0.7
Gulf 3	7,506	96.7	GIIB	100.0	98.4	99.7	1.4
Gulf 4	13,568	86.5	GIV	83.9	85.2	90.0	4.8
Global Express	847	88.8	GV	90.1	89.5	none	
Gulf 5	2,808	86.8	GV	90.1	88.5	none	
HS125-400/600	9,052	88.1	LEAR25	104.6	96.4	93.8	-2.6
HS800/1000	3,229	86.7	LEAR35	89.4	88.1	93.8	5.7
Astra/WW25	821	88.5	IA1125	92.4	90.5	90.5	0.0
Jetstar	456	93.6	LEAR35	89.4	91.5	99.0	7.5
L29 Delfin	16	93.3	T-38A	105.7	99.5	none	
LR24	2,043	96.5	LEAR25	104.6	100.6	102.3	1.8
LR25	4,383	98.9	LEAR25	104.6	101.8	103.6	1.8
LR28	221	97.2	LEAR25	104.6	100.9	none	
LR31	1,637	83.9	LEAR35	89.4	86.7	91.0	4.3
LR35	9,675	84.1	LEAR35	89.4	86.8	90.5	3.8
LR36	2,927	85.2	LEAR35	89.4	87.3	91.5	4.2
LR45	1,498	84.4	LEAR35	89.4	86.9	none	
LR55	4,776	85.4	LEAR35	89.4	87.4	91.8	4.4
LR60	4,672	83.5	LEAR35	89.4	86.5	93.5	7.1
MU30	243	90.4	MU3001	93.2	91.8	none	
PRM1	455	85.9	CNA500	88.6	87.3	none	
SBR1	833	93.3	LEAR25	104.6	99.0	95.1	-3.8
T38	56	100.1	T-38A	105.7	102.9	102.6	-0.3

3.2 Are There Limits That Produce Significant Noise Reduction While Affecting Relatively Few Operations?

The overall goal in a Part 161 study is to identify restrictions with high benefit-cost ratios; i.e., those that achieve a relatively large noise reduction compared to the number of restricted operations.[16]

The first step in the Part 161 fly friendly analysis considered the implications of enforcing the updated target noise levels (presented in Table 1) on a formal, restrictive basis. This analysis was conducted for the jet aircraft types contributing the most to overall noise exposure at VNY. Table 2 lists those types, shows the percent of measured departures that would exceed the existing and updated targets, and shows the reduction in energy-average SENEL if all the exceedances were reduced to the targets; i.e., assuming a formal rule would force operators to at least meet the targets.

Table 2 Percent of Operations Exceeding Existing or Updated Targets
Source: HMMH, 2008

Aircraft Type listed in VNDS	VNDS Sample Size (Jan. 1998 - May 2007)	Existing Target			Updated Target		
		Existing SENEL Target	% Operations Exceeding Target	SENEL Reduction [See Note]	Updated Target (from Table 1)	% Operations Exceeding New Target	SENEL Reduction [See Note]
A3	294	108.4	50.3	-3.1	109.5	40.1	-2.5
LR25	4383	103.6	8.4	-0.7	101.8	21.6	-1.2
SBR1	833	95.1	36.6	-7.5	99.0	22.2	-5.2
LR28	221	none	-	-	100.9	26.2	-1.4
Gulf 2	8956	100.8	16.1	-0.9	100.1	28.4	-1.2
LR24	2043	102.3	4.7	-0.4	100.6	12.3	-0.8
Jetstar	457	99.0	9.6	-0.4	91.5	70.2	-4.7
Falcon 20	1553	92.5	20.2	-2.2	93.8	14.4	-1.7
MU30	243	none	-	-	91.8	19.8	-0.3
HS125-400/600	9052	93.8	4.7	-1.0	96.4	1.6	-0.7
Beech 400	2573	92.3	9.4	-0.5	90.4	28.4	-1.3
Falcon 10	329	92.5	5.5	-0.2	88.4	43.5	-1.6
Cessna 560	6543	91.4	7.0	-0.8	90.0	20.8	-1.2
HS800/1000	3229	93.8	1.2	-0.2	88.1	37.8	-2.0
Cessna 551	301	90.3	8.6	-0.7	90.0	13.0	-0.8
Cessna 550	4957	90.3	6.5	-0.3	89.6	16.4	-0.5
LR36	2928	91.5	2.5	-0.5	87.3	23.8	-1.5
LR55	4776	91.8	2.3	-0.2	87.4	26.0	-1.4
LR35	9675	90.5	2.9	-0.5	86.8	18.7	-1.4
LR31	1637	91.0	1.0	-0.1	86.7	20.3	-1.0
LR45	1498	none	-	-	86.9	18.7	-0.4
LR60	4673	93.5	0.2	-0.2	86.5	15.7	-0.9
Average:				-0.6			-1.2
Note: Energy-average SENEL reduction resulting from reducing measured levels for exceedances to the relevant target.							

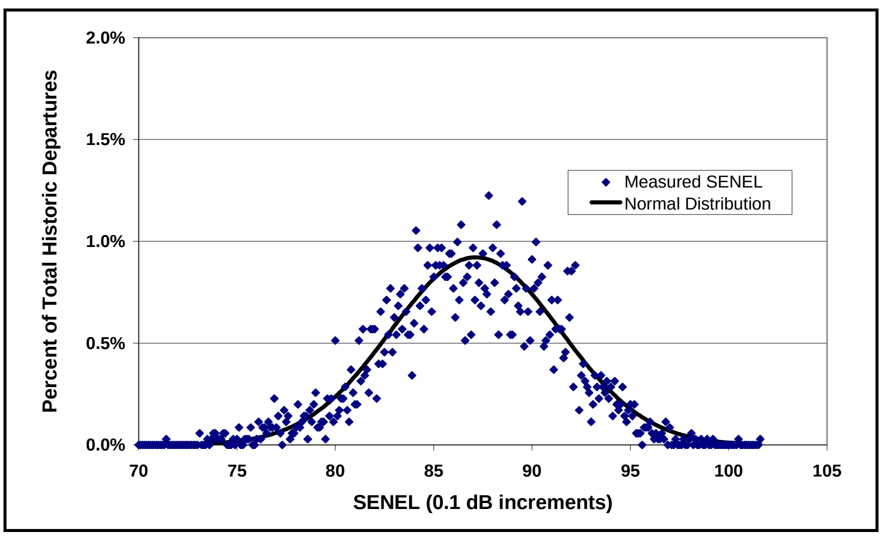
[16] Appendices B and C reproduce memoranda that describe the related analyses in greater detail.

Table 2 shows that most jet models would exceed the new targets more often than the existing targets. It also shows large variation among aircraft types in terms of both the percent of operations that would exceed the targets and the resulting reduction in energy-average SENEL. *Therefore, using the existing target-setting approach as the basis for a formal restriction could be challenged on the basis that it resulted in "unreasonable" discrimination among aircraft types, thereby failing to meet one of the six statutory conditions for approval (as summarized in footnote 14).*

Since fining pilots for exceeding the updated targets would lead to high numbers of “violations,” the next step in this analysis examined whether the measured data suggest that limits affecting only a small number of very loud departures would lead to significant reduction of total aircraft noise exposure; i.e., in term of the Community Equivalent Noise Exposure Level (CNEL).[17] In other words, do the data suggest any “obvious” targets that would represent a straightforward basis for effective and defensible noise limits that would affect only a small number of “bad performers?”

Obvious target values would exist if a few unusually loud departures dominated an aircraft type’s energy-average SENEL. Analysis of the SENEL data at VNY13 for the jet aircraft types that operate at the airport showed them to have varying distributions, but with none exceeding a statistically normal (“Gaussian”) distribution at higher SENEL levels. As a case in point, Figure 3 provides a graphical example for a representative aircraft type – the Beechjet 400. The figure depicts the distribution of measured departure SENEL values compared to a normal distribution with the same statistical mean and standard deviation. The analysis does not reveal unusually loud events beyond the normal distribution (e.g., well above 100 dB).[18]

Figure 3 Comparison of Measured Beechjet SENEL (January 1998 – May 2010) at VNY13 to Comparable Normal Distribution
Source: HMMH, 2009



The overall conclusion of this analysis was that measured departure noise levels are distributed in a statistically “normal” fashion (i.e., along a “bell-curve”). A normal distribution means that sound levels exhibit “expected” variability. For any aircraft type there are no “outliers,” or groupings of

[17] Caltrans noise standards regulations (discussed in footnote 11) require airports to use CNEL to describe cumulative noise exposure for all aircraft operations over any given number of days. It is most often used to describe quarterly or annual exposure. Under Part 161, when applied in California, the fundamental basis for determining the noise benefits of a restriction is reduction of sensitive land uses within CNEL contours.

[18] Appendix D presents the distributions of measured SENEL for all aircraft types.

exceptionally loud SENEL, as might be the case if one or a few pilots frequently used particularly noisy departure procedures – procedures that might be modified to produce less noise.

In simple terms, there do not appear to be a handful of bad performers with undue influence on overall noise exposure that suggest “obvious” targets for a restriction.

3.3 Identifying and Assessing Potential Alternative Methods for Establishing Productive Targets for Use in a Mandatory Program

Since the first-round analyses revealed that the original target-setting approach could be challenged as discriminatory and did not suggest a basis for identifying obvious noise limits, further analyses were undertaken to investigate alternative methods for setting targets. Methods were specifically sought that would continue LAWA’s practice of providing an across-the-board incentive to pilots of all aircraft types to operate as quietly as feasible and to address the Part 150 objective of pursuing an “equitable” approach, that which places equal burden on all operators.

Consistent with these goals, two alternative target-setting approaches were identified that considered equity from two perspectives:

- A goal of achieving the same decibel reduction in energy-average SENEL for each aircraft type.
- A goal of affecting the same percentage of operations in each aircraft type.

Sections 3.3.1 and 3.3.2 summarize the analyses of these two approaches for the jet aircraft types contributing the most to overall noise exposure at VNY listed in Table 2. The analyses considered the relationship between percent of operations affected and noise benefit achieved. Appendix B presents the full detail of the analyses.

3.3.1 Setting targets to achieve the same reduction in SENEL for each aircraft type

This target-setting approach quantified the effects of choosing targets that would lower each aircraft type’s energy-average SENEL a specified number of decibels. Targets were examined that would lower each aircraft’s energy-average SENEL by 1 dB, 1.5 dB and 3 dB. For simplicity, Table 3 (on the following page) gives the results for achieving a 1 dB reduction in each aircraft type’s energy-average SENEL.

The last column shows that there are relative significant differences among aircraft type in the percentages of operations that must be reduced to achieve the desired one decibel reduction. Using this approach to establish targets would clearly affect some aircraft types more than others. As shown in Table 3 of Appendix B, the analysis of the 1.5 and 3 dB reduction goals revealed similar variation and, as would be expected, the need to affect significantly greater percentages of operations to achieve the more aggressive targets.

This analysis led to the conclusion that targets based on an equitable noise-reduction goal would not place an equal burden on all operators or provide an equal incentive to all pilots.

Table 3 Targets Required and Percent of Operations Affected to Achieve a One-Decibel SENEL Reduction

Source: HMMH, 2008

Aircraft Type as Listed in VNDS	January 1998 - May 2007 Measurements		SENEL Limit and Percent of Operations That Must Be Reduced to Target to Achieve a One Decibel Energy-Average SENEL Reduction	
	Sample Size	Energy-Average SENEL	SENEL Limit	Percent of Operations That Must Be Reduced to Target
A3	294	110.5	112.8	17.3
LR25	4383	100.8	102.5	16.1
SBR1	833	100.2	107.5	6.4
LR28	221	99.6	101.7	22.6
Gulf 2	8956	99.3	100.7	22.6
LR24	2043	98.4	99.9	17.7
Jetstar	457	95.6	97.5	19.9
Falcon 20	1553	92.3	96.7	7.0
MU30	243	90.8	90.2	70.4
HS125-400/600	9052	90.4	94.3	4.1
Beech 400	2573	89.4	91.2	23.0
Falcon 10	329	88.7	89.7	25.8
Cessna 560	6543	88.6	90.8	15.5
HS800/1000	3229	88.5	90.4	18.6
Cessna 551	301	88.1	89.4	18.6
Cessna 550	4957	87.2	88.4	27.1
LR36	2928	86.8	88.9	12.0
LR55	4776	86.8	88.5	18.1
LR35	9675	85.7	88.1	12.0
LR31	1637	85.3	86.8	19.8
LR45	1498	85.3	85.6	38.2
LR60	4673	84.8	86.3	17.3

3.3.2 Setting targets to affect the same percentage of departures in each aircraft type

This target-setting approach analyzed setting targets so that the same percentage of departures in each aircraft type would be expected to exceed the applicable target. The analysis indicated that setting targets to result in exceedances by two percent, five percent, and ten percent of departures in each aircraft type would reduce overall energy-average SENEL by approximately 0.3 dB, 0.5 dB, and 0.7 dB, respectively.

For simplicity, Table 4 presents the results of setting the targets to affect five percent of the departures of each aircraft type.[19] The table gives the target and the resultant reduction in energy-average SENEL for each aircraft type. It also gives the average reduction (0.5 dB) of the total energy-average SENEL. To the extent that jet departures have a significant effect on overall noise exposure, the CNEL could be reduced by a similar amount. This reduction of 0.5 dB is close to the 0.6 dB average noise reduction that would be achieved through formal enforcement of the existing target levels.

[19] Section 4.2.2 of the memorandum reproduced in Appendix B presents the full analysis of this alternative for three percentage targets (i.e., two percent, five percent, and ten percent exceedances in each aircraft type).

Table 4 Targets Required to Result in Exceedances by Five Percent of Departures in Each Aircraft Type and Resulting Reduction in Energy-Average SENEL

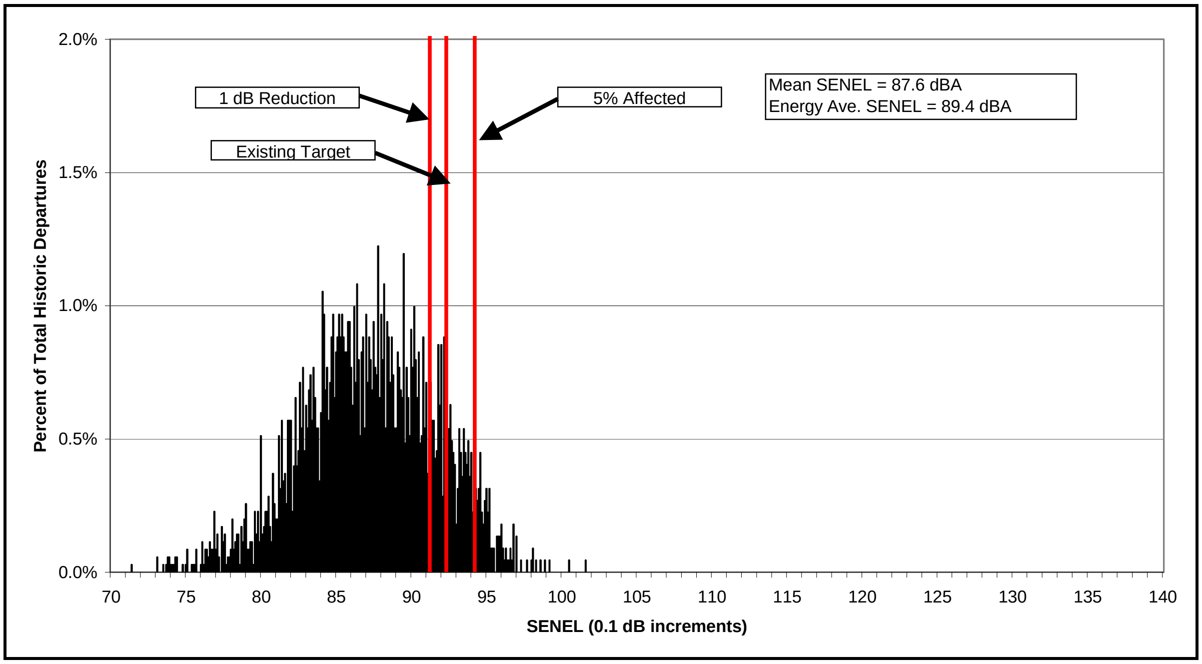
Source: HMMH, 2008

Aircraft Type as Listed in VNDS	January 1998 - May 2007 Measurements		Five Percent of Operations Reduced to Target	
	Sample Size	Energy-Average SENEL	Required Noise Limit	Energy- Average SENEL Reduction
A3	294	110.5	115.6	-0.2
LR25	4383	100.8	104.9	-0.5
SBR1	833	100.2	108.5	-0.6
LR28	221	99.6	104.2	-0.2
Gulf 2	8956	99.3	103.3	-0.4
LR24	2043	98.4	102.2	-0.4
Jetstar	457	95.6	100.2	-0.2
Falcon 20	1553	92.3	97.6	-0.8
MU30	243	90.8	92.8	-0.1
HS125-400/600	9052	90.4	93.7	-1.0
Beech 400	2573	89.4	94.2	-0.3
Falcon 10	329	88.7	92.6	-0.2
Cessna 560	6543	88.6	92.4	-0.6
HS800/1000	3229	88.5	92.9	-0.3
Cessna 551	301	88.1	91.3	-0.6
Cessna 550	4957	87.2	90.6	-0.3
LR36	2928	86.8	90.8	-0.6
LR55	4776	86.8	91.2	-0.3
LR35	9675	85.7	90.0	-0.6
LR31	1637	85.3	89.9	-0.2
LR45	1498	85.3	88.4	-0.2
LR60	4673	84.8	88.6	-0.5
Average:				-0.5

Because targeting two percent of the departures resulted in a total reduction (0.3 dB) that was less than that of the existing targets, and because affecting ten percent of operations was considered to be an unachievable goal, targets affecting five percent of departures were judged most appropriate.

Figure 4 shows how various target SENEL values can relate to the entire distribution of measured SENEL, using more than 2,500 Beechjet 400 departure measurements at monitor VNY13 as an example. The figure plots the percent of measured levels at each SENEL value (in tenths of a decibel) as a percentage of the total measurements. As listed in Table 3 and Table 4, the energy-average SENEL is 89.4 dB. As shown, both the existing target of 92.3 dB (from Table 1), and the target of 91.2 that would be required to achieve a 1 dB reduction of energy-average SENEL (from Table 3) result in a much larger percentage of departure exceedances for this aircraft compared to the 94.2 dB target for a five percent exceedance rate (from Table 4).

Figure 4 Relationships of Various Targets to Entire Distribution of Measured SENEL at VNY13 for Beechjet 400
Source: HMMH, 2010



3.3.3 Conclusions from First Round Part 161 Analyses

Noise reduction results in Table 3 and Table 4 are better balanced across aircraft types than existing or updated targets based on the historic target-setting approach (Table 1). However, Table 3 reveals that the “equal noise reduction” approach results in large variation across aircraft types in terms of the percent of operations that would be affected by enforcement. Moreover, all three noise reduction levels investigated affect a large portion (over 50%) of operations in many types.

On the other hand, the “equal percent of operations” approach presented in Table 4 is designed to affect the same portion of operations in each aircraft type. The resulting limits meet the Part 150 intent to continue the existing “equitable” approach; i.e., to place equal burden on pilots and operators of all aircraft types. The limits at which five percent of operations are affected result in an overall average noise reduction of approximately 0.5 dB that is very close to the 0.6 dB average noise reduction that would be achieved from enforcement of LAWA’s existing informal target levels (see Table 2).

Consequently, this round of analysis resulted in two recommendations:

- LAWA should base the targets to affect an equal percentage of operations of each aircraft type
- The target levels should be set to provide noise reduction approximating the benefit that would result from full adherence to the existing targets; i.e., approximately 0.6 dB.

The remaining analyses focus on application of these recommendations.

3.4 Evaluating the Defensibility of Applying Targets in a Mandatory Program

If the targets are made mandatory, they would be enforced under the penalty provisions of City of Los Angeles Ordinance No. 155,727, "Van Nuys Airport Noise Abatement and Curfew Regulation" which includes two provisions of note:

- Section 7(c) states (in part):

  "Exclusion of Aircraft for Violations. In the event an aircraft has been operated in violation of any provision of this regulation on three or more occasions within a three-year period of the first violation, whether piloted by the same or different individuals, then it shall be presumed that future operations of said aircraft will result in continued violations. The Airport Manger shall thereafter deny said aircraft permission for a period of three years to tie-down, be based at, or takeoff from Airport except a new owner of the aircraft can appeal the denial decision."

- Section 7(d) states:

  (b) Denial of Use of Airport. In the event any person has violated any provision of this regulation three (3) or more times within a three year period of the first violation, then for a period of three years thereafter, such person shall be deemed a persistent violator and be denied permission to depart from Airport in an aircraft owned, borrowed, rented or leased by such person and denied the right to lease, rent or use space for any aircraft (including tie-down) at Airport.

The available SENEL measurement data provide a means for estimating the effects of mandatory targets on users of VNY. The analysis focused on frequent operators at the airport, who would be at greatest risk of facing denial of use. The analysis was undertaken in two steps:

- What is the noise abatement performance of frequent users? (Section 3.4.1)
- Would frequent users be at risk of facing denial of use? (Section 3.4.2)

3.4.1 Noise abatement performance of frequent airport users

Frequent VNY users might reasonably be expected to be "good performers" because of their familiarity with the noise abatement program, general interest in being a "good neighbor," and related efforts to "fly quietly." Figure 5 confirms this hypothesis. Each point in the figure represents the performance of a unique aircraft; it plots the percent of its departures that exceeded the "five percent target" (from Table 4) for that aircraft type against the average number of monthly departures that it performed. Exceedances *decline* as frequency of airport use *increases*.

Figure 6 presents an alternative and perhaps more significant presentation of the measurement data. Using the Learjet 35 as an example, it plots the distributions of measured SENEL for aircraft that depart more than once per month and less than once per month. The shift in SENEL is clearly visible; the energy-average SENEL for frequent users is 1.7 dB lower.

These two figures clearly support the assumption that more frequent or "regular" VNY users are more likely to operate "quietly" and meet targets than less-frequent users.

Appendix F presents an expanded range of these plots, including operator-by-operator exceedances of the recommended "five percent" targets"[20] by operators with 25 or more departures in January 1998 through May 2010 for:

- All aircraft types (full scale and zoomed in to exclude the two most frequent operators)
- Each individual aircraft type

[20] These plots include the effect of upper and lower limits discussed in Section 4.1.2.

Figure 5 Percent of Departures by Specific Aircraft Exceeding Targets Set to Capture Five Percent of the Departures in that Aircraft Type
Source: HMMH, 2010

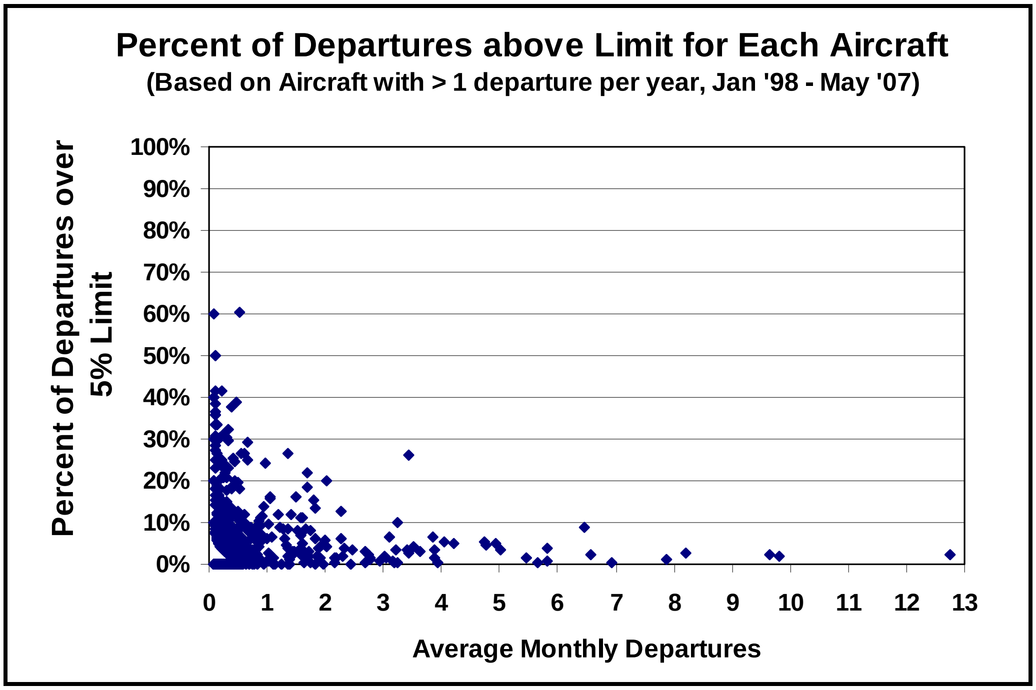
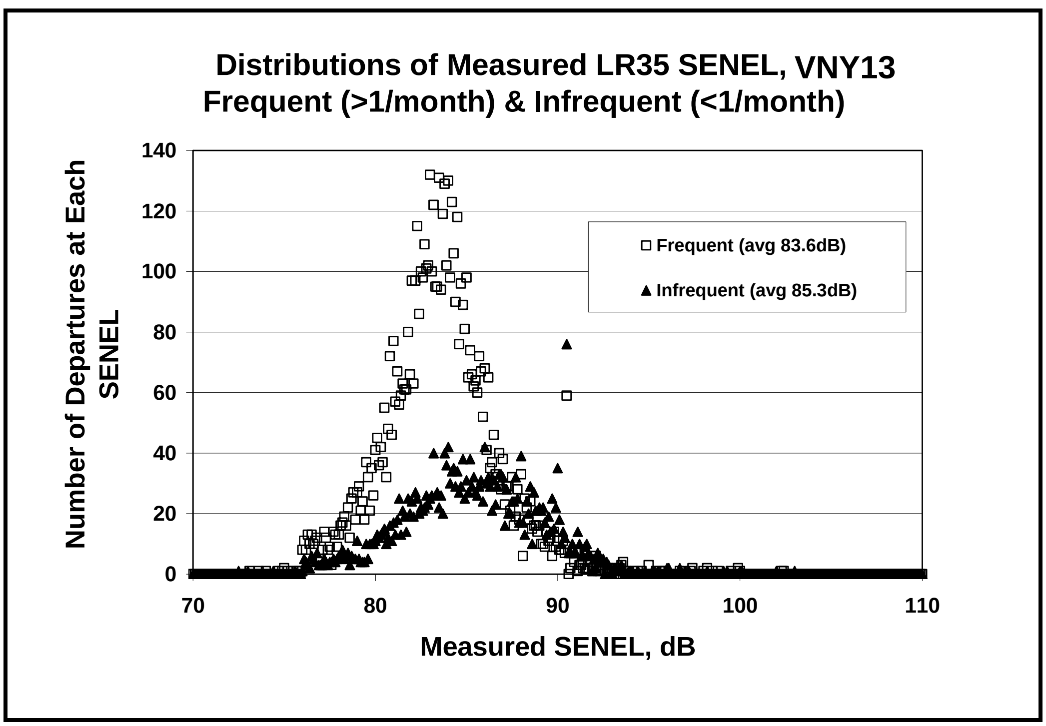


Figure 6 Comparison of SENEL of Frequent and Infrequent Users of VNY
Source: HMMH, 2010



3.4.2 Effect of mandatory targets on frequent users

While regular users appear to have greater success operating their aircraft in a manner that addresses the VNY target noise level program objectives, the question arises as to whether their high rate of departures might still lead to denial of airport use; i.e., would their frequent use of VNY lead these aircraft to violate the five percent threshold three or more times within a three year period?

To test this possibility, Table 5 lists the three aircraft with the most operations plotted on Figure 5. These aircraft are represented on the figure by the three points at the lower right corner of the plot. As shown on the plot and in the table, these aircraft exceed the five percent targets very infrequently relative to most aircraft. Table 6 presents information on the timing of these exceedances. Despite their excellent performance relative to the five percent targets, as a result of their high overall level of activity at the airport, even at these "very good performers" would face denial of use of VNY. None of them have a three-year period without an exceedance.[21] This result suggests that a mandatory rule might be counterproductive, by penalizing operators likely to be among the best performers.

Table 5 Specific Information about Three Specific Aircraft Conducting the Most Frequent Departures Shown in Figure 5
Source: HMMH, 2010

Average Monthly Departures	Aircraft	N Number	Operator	Total Departures	Associated Five Percent Limit	Exceedances of Five Percent Limit
12.8	C560	N54DD	International Jet Aviation	1442	92.4	2.4%
9.8	LR24	N664CL	Zenith Insurance Company	1108	102.2	1.8%
9.6	LR35	N364CL	Clay Lacy Aviation Inc.	1090	90	2.2%

Table 6 History of Target Exceedances for the Three Specific Aircraft Conducting the Most Frequent Departures Shown in Figure 5
Source: HMMH, 2010

Aircraft	Number of Departures Exceeding Five Percent Limit by Calendar Year									
	1998	1999	2000	2001	2002	2003	2004	2005	2006	Jan. - May '07
C560	3	10	4	4	0	1	2	0	8	2
LR24	10	2	2	0	4	0	2	0	no data	no data
LR35	7	7	1	3	3	2*	0	0	1*	0

* - The first exceedance occurred on April 3, 2003, the second on May 26, 2003 and the third on April 4, 2006.

[21] Appendix C summarizes the full analysis summarized in this section, and specifically addresses the effects of prohibiting VNY use after three exceedances in three years.

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4 CONCLUSIONS AND RECOMMENDATIONS

The preceding analyses lead to six primary conclusions and recommendations:[22]

- The existing program has produced measurable noise reduction.
- There are no obvious “bad performers” whose operations disproportionately affect overall noise exposure and would be clear targets for penalties.
- LAWA should set the targets to affect an equal percentage of operations of each aircraft type.
- The target levels should be set to provide noise reduction approximating the benefit that would result from full adherence to the existing targets; i.e., approximately 0.6 dB. As discussed in Section 3.3.2, the analysis indicated that targets affecting five percent of departures would most closely address this objective.
- A formal program is likely to deny airport use to even the “best performers” (i.e., those with the most experience and fewest exceedances) and hence face implementation and regulatory barriers that make it unlikely LAWA could obtain FAA approval through the Part 161 process or implement the rule – if approved – in a cost-effective manner.
- It would be most appropriate to pursue further reduction in departure noise levels through an updated and expanded voluntary program.

This section presents specific suggestions to implement and evaluate these recommendations, including:

- Recommended target noise levels (Section 4.1)
- Estimating potential benefits (Section 4.2)
- Developing targets for new aircraft types (Section 4.3)
- Enhancing program effectiveness (Section 4.4)
- Determining when to reassess the program (Section 4.4.3)

4.1 Recommended Target Noise Levels

Table 7 presents recommended target noise levels to implement the five-percent target-setting exceedance approach. The table expands on the aircraft types included in Table 4, to address the most extensive list of types feasible, based on historic data. The table also incorporates the results of adjustments to address two considerations:

- The effects of the recently adopted four-step “noisier aircraft phaseout” at VNY discussed in Section 1. Section 4.1.1 addresses this matter in greater detail.
- Maintaining the existing upper and lower target limits to avoid weakening the incentive provided to the noisiest aircraft or unreasonably affecting operators who have invested in “inherently quiet” aircraft. Section 4.1.2 addresses this matter in greater detail.

Table 7 does not include targets for aircraft with too few historic operations to calculate accurate targets based on the five percent approach. Section 4.3 discusses this matter in greater detail, including recommending targets for current aircraft types with a small historic sample and an ongoing approach to address these aircraft and new types that might be introduced.

[22] For additional elaboration on the basis of the conclusions, see Sections 3 and 4 of Appendix C.

Table 7 Proposed Targets Based on Exceedances by Five Percent of Departures at VNY13
Source: HMMH, 2011

Aircraft Type listed in ANOMS	Number of Historic Departures[1]	Original SENEL Target (dB)	Updated SENEL Target (dB) [Note]	Approximate Historic % Exceedance [Note]
A3	304	108.4	110.0	39.2%
B727	210	109.7	110.0	22.3%
LJ25	4594	103.6	105.6	5.0%
LJ28	221	n.a.	104.2	5.0%
GLF2	10349	100.8	103.8	5.1%
GLF3	9293	99.7	103.1	5.3%
LJ24	2181	102.3	102.7	5.0%
L329/L29B (Jetstar)	402	99.0	99.7	5.6%
FA50	2445	91.7	98.4	5.0%
B737	1968	95.7	97.9	5.4%
FA20	770	92.5	96.0	5.4%
SBR1	651	95.1	95.8	5.1%
WW24	3573	93.8	95.7	5.2%
G150	162	n.a.	95.5	5.6%
F900	1830	91.9	95.2	5.5%
C650	2138	92.6	94.8	5.4%
BE40	3513	92.3	94.2	5.0%
GLEX	1619	n.a.	93.7	5.0%
H25A/B/C	14269	93.8	93.6	5.1%
MU30	337	n.a.	93.4	6.5%
C560	10037	91.4	93.3	5.2%
ASTR	1081	92.6	93.3	5.1%
GALX	2088	n.a.	93.2	5.0%
FA10	382	92.5	92.7	5.2%
GLF4	18757	99.0	92.4	5.0%
GLF5	4670	n.a.	92.2	5.4%
C551	321	90.3	91.4	5.2%
F2TH	2648	n.a.	91.2	5.2%
LJ55	5898	91.8	91.1	5.0%
C550	6670	90.3	91.0	5.0%
C525	3462	90.0	90.9	5.6%
LJ36	2970	91.5	90.8	5.0%
LJ35	11837	90.5	90.1	5.0%
CL30	332	n.a.	90.0	5.1%
LJ31	1925	91.0	90.0	4.7%
C501	1407	90.0	90.0	3.2%
PRM1	1722	n.a.	90.0	3.1%
E135	930	n.a.	90.0	2.8%
C500	2037	90.0	90.0	2.3%
CL60/61/64	3728	90.0	90.0	2.0%
LJ60	6205	93.5	90.0	1.9%
C750	7511	n.a.	90.0	0.7%
LJ45	2116	n.a.	90.0	0.7%
C510	374	n.a.	90.0	0.5%
C680	362	n.a.	90.0	0.3%
E50P	189	n.a.	90.0	0.0%
EA50	154	n.a.	90.0	0.0%

Note: As discussed in Section 4.1.2, these targets incorporate 110.0 and 90.0 dB “ceiling” and “floor” values. For aircraft between these limits, the exceedance rate is not exactly 5% in all cases because of the manner in which historic data cluster in tenth decibel increments. In some cases, clustering makes it impossible to pick targets with exactly 5% exceedance rates.

4.1.1 Adjusting analysis to account for effects of noisier aircraft phase-out

As discussed in Section 1, the City of Los Angeles recently passed an ordinance that implemented a four-step “noisier aircraft phaseout” at VNY. For affected aircraft types, the specific aircraft that would be banned at the airport starting January 1, 2011 were eliminated from the target-setting analysis, to ensure that the targets were based on the noisiest five percent of the aircraft that would continue to operate after the first. Including the historic data for the banned aircraft in the analysis would have resulted in higher (i.e., more lenient) targets for the aircraft that can continue to operate.

The noisier aircraft phaseout prohibits operations at VNY by aircraft that exceed specified takeoff noise levels, according to a four-phase program implemented over eight years.[23] The phased reduction in maximum takeoff noise levels at VNY is lowered as follows:

- Starting January 1, 2009: 85 A-weighted decibels (dBA)[24]
- Starting January 1, 2011: 83 dBA
- Starting January 1, 2014: 80 dBA
- Starting January 1, 2016: 77 dBA

Table 8 lists the types that have been restricted through 2011.

Table 8 Aircraft Phased-Out by 2011; i.e., Those Exceeding the 83.0 dBA Limit
Source: HMMH, 2010

Manufacturer	Airplane	Estimated dBA
Lockheed	Jetstar L329	88.7
Sabre Corp	Sabre 70	87.9
Raytheon	Hawker-125 400A	85.3
Raytheon	Hawker-125 3a/R	84.8
Raytheon	Hawker-125-3a/Ra	84.8
Sabre Corp	Sabre 60	84.7
Sabre Corp	Sabre 60a	83.8
Sabre Corp	Sabre 40a	83.4
Raytheon	Hawker-125 1a	83.1

The next phase-out year is 2014 and many aircraft will be affected. As that date approaches, LAWA should consider recalculation of the target for each affected aircraft type. The recalculation should take into account the most current data for the subset of aircraft in any type that will not be restricted.

4.1.2 Preservation of original target bounds

The existing SENEL targets in Table 1 range from 90.0 to 109.7 dB. As shown in Table 4, the target-setting methodology based on the SENEL value exceeded by five percent of historic departures results in some targets outside this range. LAWA has concluded that the updated program should maintain the existing upper and lower bounds, for the following primary reasons:

- The 90.0 dB lower bound is based on a prior LAWA decision to focus staff resources on the noisiest operations at the airport. The aircraft for which new targets would be below 90 dB are the

[23] The ordinance exempts certain operations, such as those operated by the military or other government agencies, for emergency purposes, and in certain “historic” aircraft models. Those limited exemptions are not of significant relevance to this discussion.

[24] Under the City ordinance, these takeoff level limits are based on “estimated takeoff noise levels, as set forth in AC36-3H (or in any revision, supplement, or replacement thereof listing the noise levels).”

quietest using VNY; they are "inherently" quiet by design. They reflect a significant financial investment by operators in the most advanced technology with associated noise benefits. Setting lower limits for these aircraft would divert staff resources away from the focus on noisier aircraft.

- The current highest SENEL target of 109.7 dB is based on the original target-setting approach. If this upper limit was abandoned, the five-percent target-setting approach would make targets for the noisiest aircraft more lenient, potentially leading to reduction in the program's benefit.

For these primary reasons, the recommended targets presented in Table 7 maintain the current program's existing upper and lower bounds. For simplicity, the existing 109.7 dB SENEL target ceiling was rounded to 110 dB.

4.2 Estimating Potential Benefits – Reduction of Exceedances

The ultimate objective of the fly friendly program is to reduce exceedances of targets. The analysis summarized in Section 3.4.1 led to the observation that frequent VNY users are more likely to meet targets. That analysis provides a basis for estimating the potential benefit of the enhanced program.

Every jet type considered in the target-setting process was analyzed to identify differences in "quiet-flying" performance between frequent and infrequent users. The potential benefit was estimated by calculating the reduction in exceedances that would be achieved if the frequency of exceedances by *all regular users* matched that of *"well-performing" regular* users. A "regular" user was defined to be one that conducted at least 25 departures in a given aircraft type in the January 1998 through May 2010 data sample used in setting updated targets. Since this definition of regular user still reflects a relatively low frequency of operation (less than two departures a year), it is a very conservative basis for estimating benefits.[25] A "well-performing" user is one whose exceedance rate was less than the overall rate for that type (i.e., less than the rate listed in the right-hand column of Table 7).

Table 9 presents key elements of this analysis, including:

- First column: Aircraft types into which the VNY monitoring system (ANMOS) categorizes jets.
- Second column: Number of departure measurements in the data sample used in this project.
- Third column: Percent of departures by regular users
- Fourth column: Percent of departures by well-performing regular users
- Fifth column: Percent of departures by well-performing regular users that were exceedances
- Six column: Percent of departures that would be exceedances if all regular users matched the exceedance rate of well-performing regular users, with no change for less-frequent users.
- Seventh column: Resulting historic reduction in exceedances
- Eighth column: Annual reduction in exceedances over the actual time period which each aircraft type operated at VNY, which was less than 12 years and five months for some types

Using the Lear 55 (LJ55) as an example, the new target (from the right-hand column in Table 7) is based on a 5% historic exceedance rate. The new overall exceedance rate will be 3.8% if all regular users operate as quietly as well-performing users. The 1.2% improvement applied to the 5,898 total historic operations would reduce the number of exceedances by approximately 71 (1.2% of 5,898), or approximately 5.7 a year over the January 1998 through May 2010 time period.

[25] As shown in Figure 5 in Section 3.4.1, the best performance is achieved by operators conducting departures at least twice a *month*.

Table 9 Potential Reduction in Exceedances through Application of Recommended Targets at VNY13
Source: HMMH, 2011

Aircraft Type Listed in ANOMS	# Historic Departures (January 1998 – May 2010)	% Departures by Regular Users (>25 Historic Total)	% Departures by Well-Performing Regular Users	Exceedance % by Well-Performing Regular Users	Exceedance % if All Regular Users Perform Well	Reduction in Exceedances	
						Historic Total	Potential Annual
A3	304	99.0%	20.4%	37.2%	37.2%	6	0.6
ASTR	1081	61.9%	52.8%	2.7%	4.0%	12	1.0
B727 [Note]	210	53.8%	0.0%	-	20.1%	5	0.5
B737	1968	89.9%	65.5%	3.1%	3.6%	35	3.5
BE40	3513	71.9%	59.4%	3.8%	4.4%	22	1.8
C500	2037	82.8%	62.8%	1.4%	1.7%	12	1.0
C501	1407	74.1%	71.7%	2.3%	3.2%	1	0.0
C510	374	87.4%	48.4%	0.3%	0.3%	1	0.6
C525	3462	71.8%	52.1%	4.0%	4.5%	39	3.1
C550	6670	78.0%	59.0%	2.7%	3.4%	105	9.5
C551	321	62.0%	34.8%	1.5%	3.6%	5	0.4
C560	10037	85.9%	77.7%	3.4%	3.9%	129	10.4
C650	2138	69.9%	61.3%	3.3%	4.9%	11	0.9
C680	362	83.4%	83.4%	0.3%	0.3%	0	0.0
C750	7511	93.0%	84.6%	0.5%	0.5%	9	0.7
CL30	332	64.2%	39.3%	3.6%	4.7%	1	1.3
CL60/61/64	3728	68.6%	59.3%	1.2%	1.5%	19	1.5
E135	930	83.9%	44.8%	2.5%	2.5%	3	0.5
E50P	189	49.7%	49.7%	0.0%	0.0%	0	0.0
EA50	154	30.3%	30.3%	0.0%	0.0%	0	0.0
F2TH	2648	80.2%	72.2%	3.2%	4.7%	12	2.2
F900	1830	61.7%	42.7%	2.6%	4.2%	24	1.9
FA10	382	33.7%	24.4%	0.0%	4.7%	2	0.2
FA20	770	48.8%	25.4%	2.3%	3.8%	12	1.6
FA50	2445	70.5%	64.4%	2.5%	3.7%	31	2.5
G150	162	66.3%	66.3%	5.3%	5.6%	0	0.0
GALX	2088	91.0%	57.9%	3.1%	3.6%	30	6.8
GLEX	1619	77.3%	53.5%	2.6%	3.3%	28	4.3
GLF2	10349	86.4%	59.9%	2.6%	3.4%	179	14.4
GLF3	9293	81.4%	62.5%	3.2%	4.1%	114	9.2
GLF4	18757	86.9%	63.1%	3.5%	4.0%	192	15.5
GLF5	4670	81.3%	37.1%	2.8%	3.2%	102	8.2
H25A/B/C	14269	83.8%	65.8%	1.9%	3.5%	228	18.4
L329/L29B	402	71.4%	37.5%	3.4%	3.8%	7	0.6
LJ24	2181	88.2%	75.4%	3.0%	4.1%	19	1.5
LJ25	4594	87.0%	70.8%	1.8%	3.4%	76	6.1
LJ28 [Note]	221	71.9%	0.0%	-	4.2%	2	0.3
LJ31	1925	79.1%	48.2%	2.8%	3.6%	20	1.6
LJ35	11837	88.7%	77.6%	2.5%	3.4%	193	15.5
LJ36	2970	93.4%	37.0%	2.2%	2.5%	73	6.4
LJ45	2116	86.5%	67.0%	0.4%	0.5%	4	0.3
LJ55	5898	90.6%	73.0%	2.8%	3.8%	71	5.7
LJ60	6205	84.7%	53.0%	1.1%	1.2%	44	3.5
MU30[7]	337	83.1%	0.0%	-	6.0%	2	0.4
PRM1	1722	80.3%	37.5%	1.1%	1.3%	31	6.6
SBR1	651	77.5%	53.7%	2.4%	3.5%	10	0.8
WW24	3573	83.1%	53.5%	3.0%	3.6%	58	4.7
TOTAL	160642					1977	176

Note: B727 and LJ28 calculated by applying the overall exceedance rate from the right-hand column in Table 7 to all regular operators and assuming no change in exceedances for less frequent operators.

4.3 Developing Targets for New Aircraft Types

Table 9 presents recommended targets and associated data for the largest and most specific possible range of jet aircraft types currently permitted to operate at VNY for which sufficient data are available to set targets in a statistically meaningful way. However, this fleet is not stagnant; the Fly Friendly program must accommodate new jet aircraft types that initiate operations at the airport. This section recommends a process for LAWA to utilize to establish new targets, including:

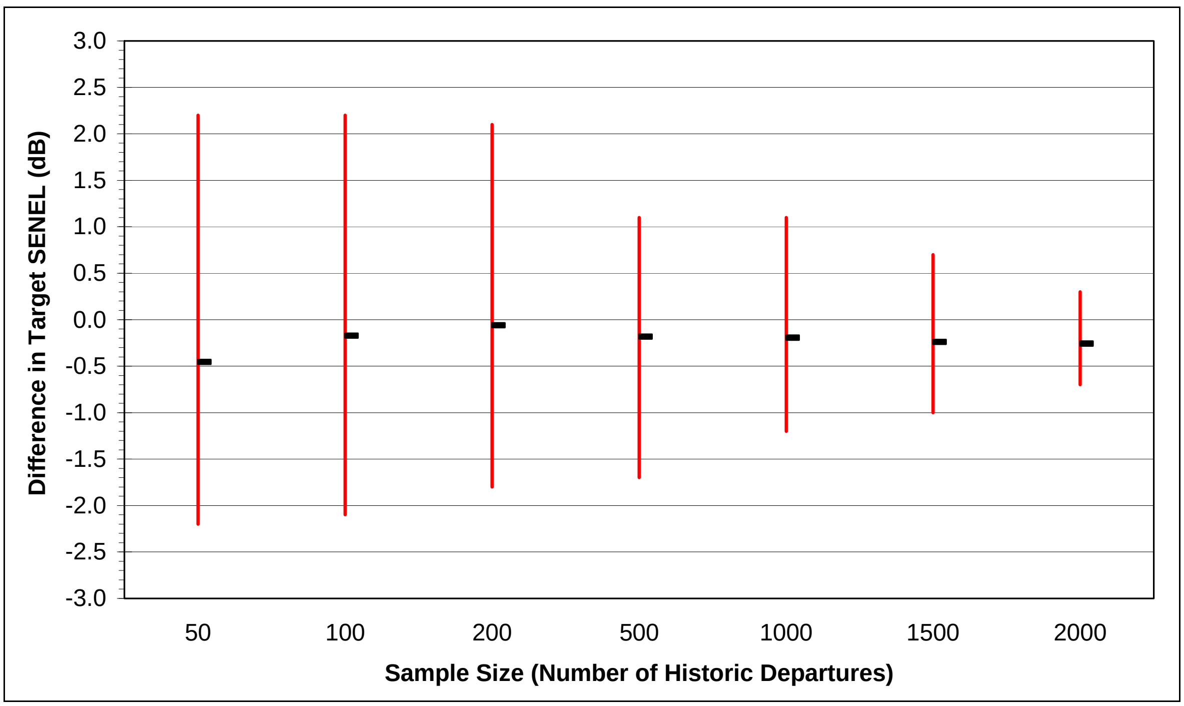
- Determining when sufficient data are available to set targets based on measurement results
- Setting targets for use until sufficient data are available to set targets based on measurements
- Recommended targets for relatively new aircraft currently operating at the airport

4.3.1 Determining when sufficient data are available to set targets based on measurements

To be reliable, target development depends on statistical analysis of a large data set of measured SENEL by aircraft type. A key question is: *How many measurements are required to yield a reasonably accurate target?*

To answer this question, the historic measurement data were analyzed to estimate how target variability decreases with increasing SENEL measurement sample sizes. All measured data for each aircraft type were divided into samples of increasing size, starting with the oldest measurements. The sample sizes were 50, 100, 200, 500, 1000, 1500, and 2000. For each aircraft type, a five percent target was determined for each sample size. The range of targets across all aircraft types was determined for each sample size, as shown in Figure 7.

Figure 7 Target Variability across All Jet Aircraft Types with Increasing Measurement Sample Size
Source: HMMH, 2010



Though the variability does not reduce to approximately plus or minus one decibel or less until a sample size of approximately 1,000 is reached, years may be required to accumulate this many measurements for a given aircraft type. Consequently, a reasonable set of recommendations is:

- Determine a target SENEL for a new type when the measurement sample reaches 100 departures
- Update the target if and when the historic sample size reaches 1,000 departures

An Excel spreadsheet has been developed for computing the five percent exceedance target for any aircraft with measured SENEL data. Appendix D presents instructions for the spreadsheet’s use.

4.3.2 Setting initial targets for use until sufficient data are available to set targets based on measurement results

To establish targets for new types with fewer than 100 departures, a reasonable approach would be to assign an initial or “surrogate” target based on measurement data for a comparable aircraft type.

Comparison of SENEL distributions for the new and older aircraft could assist in this process. To aid with selecting the initial surrogate target SENEL, Appendix E presents the distributions of the currently available measurement data by aircraft type and their associated targets.

4.3.3 Recommended targets for aircraft currently operating at the airport for which insufficient data are available to set targets based on measurement results

A number of relatively new aircraft types currently operate at VNY which have not conducted sufficient operations at the airport to provide a statistically sufficient basis for establishing targets in a formal manner, as discussed in Section 4.3.2.

Table 10 identifies these types and recommends interim targets. The distributions of measurement data collected to date for these four aircraft are presented in the last pages of Appendix E.

Table 10 Recommended SENEL Targets for New Aircraft Types with Insufficient Operations to Establish Based on Historic Data

Source: HMMH, 2011

Aircraft Type as Listed in ANOMS	Available Measurement Sample size	Recommended SENEL Target (dB)	Percent Exceedance to Date	Primary Basis for Recommended Target
FA7X	24	94.0	12.5%	Comparison of the very coarse distribution for the FA7X to the distributions of other aircraft and FAA certification levels led to a target based on the average of those for the F900 and FA10.
CRJ2	31	90.0	3.2%	Limited data samples suggest these aircraft types fall into the “inherently quiet” category for which the 90.0 dB SENEL target floor applies.
CRJ7	30	90.0	0.0%	
LJ40	51	90.0	0.0%	

4.4 Enhancing Program Effectiveness through “Good Performer” Awards

As discussed in Section 2.1, LAWA uses two primary mechanisms to encourage operators to comply with the fly friendly program; (1) letters to operators exceeding targets, and (2) monthly reports summarizing exceedances, listed by operator. As discussed in Section 3.1, empirical analysis undertaken for this study indicates these incentives appear to have led to measurable noise reduction. While LAWA does not assess any formal penalties on operators who create exceedances, both of these mechanisms are forms of “negative” feedback.

As also discussed in Section 2.1, LAWA offers to provide data and other guidance to operators who seek assistance in reducing exceedances, and has found that pilots frequently take advantage of this opportunity to develop, test, and refine departure procedures, so as to improve their noise abatement performance. This operator interest, coupled with the program's success, is evidence of a highly constructive working relationship.

To further enhance the program's success and build on the operators' cooperative attitude, we recommend that LAWA add a *positive* incentive to the program's implementation, in the form of "Good Performer" awards. Other airports have found that such awards are an effective means of encouraging compliance with noise abatement programs and in reducing single event noise levels. Examples include:

- Westchester County Airport (NY) "Spirit of Noise Abatement Awards" – http://airport.westchestergov.com/index.php?option=com_content&view=article&id=2567&Itemid=100034
- Naples Municipal Airport (FL) "Noise Abatement Program" – http://www.flynaples.com/index.php/noise-abatement/noise-abatement-award
- Fort Lauderdale Executive Airport (FL) "Achievements in Community Excellence (ACE) Award" – http://ci.ftlaud.fl.us/fxe/noise.htm
- Truckee-Tahoe Airport (CA) "Fly Quiet Program" – http://www.truckeetahoeairport.com/community_flyquiet_main.html

4.4.1 Potential Award Program Elements

Based on experience at other airports, an effective award program should include the following elements:

- **A catchy name**; e.g., the VNY "Friendly Flyers," "First-Rate Flyers," "Quiet-Flying Friends," "Awesome Aviators," etc. The selection of a name offers a positive opportunity to involve the public in the program's design and establishment. For example, LAWA might consider sponsoring a contest to select a name through the Citizens Advisory Council (CAC). When the enhanced program is presented to the CAC, LAWA could announce that any interested parties are invited to suggest names, with the CAC voting on a winner (perhaps from a shortlist prepared by LAWA) at its next meeting. LAWA could offer a modest prize for the winner; e.g., a gift certificate for dinner at the Airtel Plaza, etc.
- **Quantitative exceedance criteria**; e.g., the maximum number of exceedances or percentage of departures causing exceedances. Section 4.4.2 presents a quantitative analysis of potential target thresholds. The criteria should include a defined evaluation period. Most airports present these types of awards annually, a frequency which offers an acceptable balance between LAWA staff workload associated with program implementation, and reasonably frequent and timely recognition.
- **Complementary award criteria**. Other airports with similar target noise level programs have also set award criteria linked to other noise abatement program objectives. For example, the Westchester County (NY) Airport "Spirit of Noise Abatement Awards" are presented to operators who made no flights during the midnight to 6:30 a.m. "voluntary restraint from flying" period, and who cause no high-range noise events (90 dBA or higher at any of the airport's 20 noise monitoring sites). The VNY awards could require that an operator stay under the exceedance limit and not violate any of the formal VNY noise rules over the evaluation period.
- **An awards ceremony.** Some airports hold special annual meetings. Others use a regular advisory committee meeting. In either case, the ceremony should include an appropriate

opportunity to recognize the winners. Most airports have found that a reception with modest refreshments is well-received and offers an opportunity for all interested parties, including both aviation and community interests, to interact in a positive forum.

- **Physical awards.** Other airports have found that award winners appreciate trophies, medals, plaques, or other forms of recognition that they can display in their offices.
- **Publication of awards.** Perhaps the most important incentive is public recognition; e.g., a press release congratulating and thanking the winners, a listing of winners on the VNY website, an announcement at a LAWA Board of Airport Commissioners meeting, etc.
- **Physical rewards.** Other airports also have found that modest rewards, such as gift certificates, tee shirts, hats, etc. that the operator can distribute among its staff are appreciated, although this form of incentive is less important than public recognition.

4.4.2 Award Program Exceedance Criteria

Two key questions are: “*What would constitute reasonable exceedance criteria?*” and “*How many award winners would those criteria produce?*” These questions are directly related, because the number of award winners increases with the number of exceedances allowed. The objective is to select exceedance criteria that both represent a reasonable challenge and produce a reasonable number of winners.

Once again, the historical data provide a quantitative basis for answering these questions, as shown in Table 11.

Table 11 Relationship between Exceedance Limit Maximum Percent of Departures Exceeding Targets and Potential Number of Award Winners
Source: HMMH, 2011

Minimum Annual Departures [Note 1]	**Award Level (Maximum Allowed Exceedance Percentage)**	**Analysis Based on January 1998 – May 2010 Data**	
		Number of Eligible Operators [Note 2]	**Resulting Number of Award Winners** [Note 3]
100	1%	15	0
50	2%	28	4
34	3%	54	18
25	4%	91	63

Note 1: The minimum number of annual departures required for an operator to not exceed the award level assuming one annual exceedance.
Note 2: Operators with individual historic average annual departures ≥ the minimum number of annual departures required to be a frequent operator at a particular award level.
Note 3: These estimates are based on the annual average over the entire twelve year and five month data sample; the actual number of award winners would vary from year to year.

This analysis suggests that a maximum allowable exceedance rate of three percent would result in approximately 20 award winners on average, if the awards were limited to operators who conducted at least 35 annual departures on Runway 16R. Therefore, we recommend that the awards include the following exceedance-related eligibility criteria:

- The operator must conduct at least 30 Runway 16R departures in all jet aircraft types in the year
- The operator must exceed the applicable targets no more than three percent of the time (based on an exceedance rate rounded to the nearest whole percentage)

All operators would continue to receive letters from LAWA notifying them of individual exceedances, to serve as an ongoing educational element of the program.

4.4.3 Determining When to Reassess the Program

A final decision is determining when the program eligibility criteria – including target levels – might be reconsidered. Such a reassessment might be appropriate when the total annual exceedance for all operators and aircraft types falls to three percent of total annual jet departures on Runway 16R at monitor VNY13. At this time, LAWA might consider making the program more stringent or other revisions. This type of reassessment is common at airports with similar award programs, which are necessitated by a program's success in reducing noise levels.

APPENDIX A MEMORANDUM ON APPLYING THE ORIGINAL TARGET-SETTING METHOD TO DEVELOP UPDATED AND EXPANDED TARGETS

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MEMORANDUM

To: Bob Holden and Scott Tatro, Los Angeles World Airports
From: Bob Behr and Ted Baldwin
Date: February 23, 2008
Subject: Updated and Expanded VNY Quiet Jet Departure Program Target Noise Level Analysis
Reference: HMMH Project 300701.006

1. INTRODUCTION

This memorandum presents the results of HMMH's analysis of Integrated Noise Model (INM) estimates and noise measurements from the Van Nuys Data System (VNDS) to develop updated and expanded Single Event Noise Exposure Level (SENEL) targets at permanent noise monitors V7 and V1, for jet aircraft types that operate regularly at Van Nuys Airport (VNY).

2. BACKGROUND

The VNY Quiet Jet Departure Program[1] encourages jet pilots to conduct departures so that measured noise levels are below established aircraft-type-specific targets at monitoring location "V7", which is approximately 6,000 feet south of the airport (approximately 14,000 feet from brake release on Runway 16R). The Noise Management Office (NMO) monitors noise levels at V7 and contacts jet operators that exceed targets. The program is designed to assist pilots to develop and use takeoff procedures that reduce off-airport noise exposure. Pilots can contact the NMO to identify targets for specific aircraft. An important element of the program is a "Letter of Commitment" in which jet operators agree to use quiet departure procedures to avoid exceeding the targets.

LAWA initiated the program in February 1994. The targets were set by averaging the arithmetic mean of measured departure levels for the given aircraft type with an Integrated Noise Model (INM) SENEL estimate. Because the permanent monitoring system was relatively new at VNY at the time, limited measurement data were available – fewer than 10 measurements for some aircraft types. In addition, it appears INM estimates were available for only nine aircraft types – the B727Q9, CL600, CNA500, DC9Q9, GIIB, IAI1125, LR25, LR35, and MU3001. The NMO "mapped" actual aircraft to one of these types, which required relatively crude substitutions in some cases.

LAWA requested that HMMH assist in developing updated and expanded targets to improve the value of the program, including taking into account the more extensive measurement results the NMO has collected in the past 14 years, developing SENEL estimates for a broader range of aircraft types, and establishing targets for monitor V1, to address Runway 34L departures.

There is no formal penalty associated with exceeding the target noise level. However, the February 2003 VNY Part 150 Study[2] proposed establishment of "a system of monetary penalties (fines) to be imposed on aircraft operators who violate noise abatement policies at VNY." This measure is one of the use restriction proposals that the HMMH Team is assessing the in the VNY Part 161 study. Expanded and updated targets will increase the analytical precision of that assessment.

3. RESULTS

The appended tables present the results of HMMH's analyses of updated SENEL targets at permanent noise monitors V1 and V7 for a broader range of jet aircraft that regularly depart VNY.

One overall point is worth noting: *The updated target values are generally lower than the existing targets.* This difference may reflect the effectiveness of pilot efforts to fly as quietly as possible and the overall success of the Quiet Jet Departure Program. The Part 161 analysis must take that success into account, since fining pilots for exceeding targets based on optimized performance could lead to

[1] Also sometimes referred to as the "Fly Friendly Program" or "Fly Neighborly Program."
[2] Noise Compatibility Program ("NCP") measure 31.

\\Fs1\vol1\PROJECTS\300701_VNY_Part_161\Task_06_Required_Analyses_of_Proposed_Restrictions\alt_3_fly_friendly_with_fines\3_Update_Orig_Targets\080223_vny_updated_target_levels_analysis.doc unreasonably high numbers of "violations." As we have discussed, our next step in this area is statistical analysis to seek targets that reflect truly "poor" performance.

4. ANALYTICAL PROCESS

The tables basically summarize the process we followed in developing the targets, which was intended to follow the steps LAWA undertook in establishing the original values. The tables are largely self-explanatory, but here is a summary of the columns in each:

1. **Aircraft Type Listed in VNDS** - These are the aircraft types included in the VNDS database available to HMMH for January 1998 through May 2007. They include the aircraft types listed in the "VNY Jet Departure Noise Statistics (1/1/98 - 4/15/01)" spreadsheet that Stephen Zetsche prepared on September 28, 2005. The aircraft types were limited to jet aircraft for which there the VNDS included measured SENEL values at sites V1 and V7.
2. **Sample Size** - The number of measurements at either V1 or V7 for the aircraft type contained in the VNDS for the January 1998 through May 2007 time period.
3. **Minimum** - The minimum measured SENEL values in the sample.
4. **Maximum** - The maximum measured SENEL.
5. **Mean** - The arithmetic average of the measured SENEL. Stephen Zetsche indicated in his work that this was the "average" to be used in calculating the target level.
6. **Median** - The median measured SENEL.
7. **INM A/C** - Self-explanatory.
8. **INM Profile** - The profile used in the modeling, either the INM standard or the user-defined version we developed for the Part 161, and for which we received FAA approval. We have provided documentation on the user-defined profiles previously. The T-38A profile is the standard military profile used for modeling in the Air Force's Noisemap modeling program.
9. **Takeoff Weight** - The takeoff weight that we modeled.
10. **Hot Day INM SENEL Output** - The SENEL calculated using the INM for VNY's elevation, 100°F and a barometric pressure of 29.90 inches of mercury (in-Hg). Meteorological conditions were determined using historical weather data to approximate recorded high temperatures and average sea-level pressure for the normally warmer months at the airport.
11. **Average Day INM SENEL Output** - The SENEL calculated using the INM for VNY's elevation, 66.1°F and a barometric pressure of 29.96 inches of mercury (in-Hg). Meteorological conditions were determined using historical weather data to approximate annual average temperatures and average sea-level pressure at the airport.
12. **Cold Day INM SENEL Output** - The SENEL calculated using the INM for VNY's elevation, 40°F and a barometric pressure of 30.05 inches of mercury (in-Hg). Meteorological conditions were determined using historical weather data to approximate recorded low temperatures and average sea-level pressure for the normally cooler months at the airport.
13. **Aircraft Type Listed in VNDS** - Same as column 1.
14. **INM A/C** - Same as column 7.
15. **Hot Day VNDS / INM Average** - The arithmetic average of the VNDS measured mean (column 5) and the INM calculated SENEL for hot day conditions (column 10).
16. **Average Day VNDS / INM Average** - The arithmetic average of the VNDS measured mean (column 5) and the INM calculated SENEL for average day conditions (column 11).
17. **Cold Day VNDS / INM Average** - The arithmetic average of the VNDS measured mean (column 5) and the INM calculated SENEL for cold day conditions (column 12).

18. **Existing VNDS target** - Self-explanatory (from Zetsche spreadsheet). This column is only in the V7 spreadsheet, since there are no targets for V1.
19. **Existing Minus Average** - the Target minus VNDS / INM Average (i.e., column 18 minus column 16). This is a measure of how much higher the existing target is from the “new” target. In almost every case, the difference is positive, indicating that he new targets will be lower than the existing targets. This column is only in the V7 spreadsheet, since there are no targets for V1.

We will provide you the spreadsheets on which these tables are based, to assist you in your review.

HARRIS MILLER MILLER & HANSON INC.

Memorandum to: Bob Holden and Scott Tatro, LAWA Page 5
Updated and Expanded VNY Quiet Jet Departure Program Target Noise Level Analysis February 23, 2008

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Data for Target SENEL Determination at V7 Noise Monitor

VNDS SENEL Output (January 1998 - May 2007)					
Aircraft Type Listed in VNDS	Sample Size	Minimum	Maximum	Mean	Median
A3	294	77.4	118.5	108.0	108.5
B727	1,449	78.4	114.3	104.3	105.0
B737	294	76.0	104.3	92.3	92.2
BAC-111	21	94.8	110.6	103.3	102.2
BEECH 400	2,572	73.5	99.2	87.6	87.8
Cessna 550	4,957	73.9	102.5	85.9	85.9
Cessna 551	301	76.7	100.0	86.7	87.0
Cessna 560	6,543	72.8	111.5	86.7	86.8
Cessna 750	4,856	72.9	100.0	82.4	82.3
Challenger 600	2,362	73.7	104.7	83.5	83.5
Cessna 500	5,694	73.6	110.8	85.7	85.9
Cessna 650	1,593	75.0	103.0	89.0	89.4
DC-9	94	76.9	109.4	99.3	99.1
Embraer 135	308	76.5	92.4	85.8	86.4
Falcon 2000	3,519	72.4	108.7	88.6	88.8
Falcon 10	329	76.8	96.2	87.3	88.0
Falcon 20	1,552	73.1	112.2	89.7	89.7
Falcon 50	1,887	76.0	112.3	90.7	91.6
Falcon 900	1,147	76.4	105.1	88.9	89.3
GALX	580	76.8	95.7	88.4	89.1
Gulf 2	8,956	74.5	112.0	97.4	98.2
Gulf 3	7,506	74.6	124.3	96.7	97.5
Gulf 4	13,568	73.5	104.7	86.5	86.7
Global Exp	847	76.1	112.9	88.8	89.4
Gulf 5	2,808	76.0	102.8	86.8	87.5
HS125-400/600	9,052	73.5	112.3	88.1	88.3
HS800/1000	3,229	74.2	106.7	86.7	87.0
Astra/WW25	821	76.3	104.0	88.5	89.4
Jetstar	456	75.5	102.2	93.6	94.1
L29 Delfin	16	82.0	99.1	93.3	93.4
LR24	2,043	76.0	110.5	96.5	97.3
LR25	4,383	73.6	111.3	98.9	99.5
LR28	221	76.2	106.1	97.2	97.6
LR31	1,637	73.7	96.5	83.9	83.9
LR35	9,675	72.5	103.0	84.1	83.9
LR36	2,927	73.5	105.8	85.2	85.2
LR45	1,498	75.6	91.9	84.4	84.9
LR55	4,776	74.2	103.8	85.4	85.4
LR60	4,672	73.9	101.3	83.5	83.4
MU30	243	76.3	95.5	90.4	90.7
PRM1	455	76.3	93.3	85.9	86.5
SBR1	833	75.4	112.6	93.3	92.4
T38	56	77.8	110.5	100.1	102.1

INM SENEL Output					
INM A/C	INM Profile (INM std. or FAA-approved user-defined)	Takeoff Weight	Hot Day (100° F, 29.90 in-Hg) SENEL	Aver. Day (66.1° F, 29.96 in-Hg) SENEL	Cold Day (40° F, 30.05 in-Hg) SENEL
A3_RAY	A3 NADP	69,400	109.9	110.9	109.7
727LAC	727 NADP	167,375	103.5	102.6	102.3
737700	Standard	154,400	93.3	94.0	93.4
BAC111	Standard	82,525	101.0	101.6	101.2
MU3001	Standard	14,000	92.6	93.2	92.8
MU3001	Standard	14,000	92.6	93.2	92.8
MU3001	Standard	14,000	92.6	93.2	92.8
MU3001	Standard	14,000	92.6	93.2	92.8
CNA750	Standard	35,600	84.1	84.0	83.3
CL600	Standard	35,900	87.1	88.5	88.1
CNA500	Standard	14,600	87.5	88.6	88.3
CIT3	Standard	19,900	88.5	90.7	90.3
DC93LW	Standard	113,900	99.6	103.8	100.1
EMB145	Standard	45,320	83.2	82.6	82.1
CL600	Standard	35,900	87.1	88.5	88.1
LEAR35	L35 NADP	18,200	88.9	89.4	89.0
FAL20	Standard	28,600	97.2	97.9	97.3
FAL50	Standard	18,200	94.7	95.5	95.1
FAL900	Standard	18,200	94.7	95.5	95.1
IA1125	Standard	23,400	90.5	92.4	92.0
GII	Standard	64,700	102.1	102.7	102.4
GIIB	Standard	69,600	106.7	100.0	99.7
GIV	GIV NADP	74,500	82.4	83.9	84.4
GV	Standard	90,400	88.6	90.1	89.5
GV	Standard	90,400	88.6	90.1	89.5
LEAR25	L25 NADP	14,900	104.0	104.6	104.2
LEAR35	L35 NADP	18,200	88.9	89.4	89.0
IA1125	Standard	23,400	90.5	92.4	92.0
LEAR35	L35 NADP	18,200	88.9	89.4	89.0
T-38A	NOISEMAP	10,279	104.5	105.7	104.4
LEAR25	L25 NADP	14,900	104.0	104.6	104.2
LEAR25	L25 NADP	14,900	104.0	104.6	104.2
LEAR25	L25 NADP	14,900	104.0	104.6	104.2
LEAR35	L35 NADP	18,200	88.9	89.4	89.0
LEAR35	L35 NADP	18,200	88.9	89.4	89.0
LEAR35	L35 NADP	18,200	88.9	89.4	89.0
LEAR35	L35 NADP	18,200	88.9	89.4	89.0
LEAR35	L35 NADP	18,200	88.9	89.4	89.0
LEAR35	L35 NADP	18,200	88.9	89.4	89.0
MU3001	Standard	14,000	92.6	93.2	92.8
CNA500	Standard	14,600	87.5	88.6	88.3
LEAR25	L25 NADP	14,900	104.0	104.6	104.2
T-38A	NOISEMAP	10,279	104.5	105.7	104.4

Aircraft Type from VNDS	INM A/C	VNDS / INM Average (Note 1)			Existing V7 Target	Existing Minus Average (Note 2)
		Hot Day Average	Aver. Day Average	Cold Day Average		
A3	A3_RAY	109.0	109.5	108.9	108.4	-1.1
B727	727LAC	103.9	103.5	103.3	109.7	6.3
B737	737700	92.8	93.2	92.9	95.7	2.6
BAC-111	BAC111	102.2	102.5	102.3	108.7	6.3
BEECH 400	MU3001	90.1	90.4	90.2	92.3	1.9
Cessna 550	MU3001	89.3	89.6	89.4	90.3	0.7
Cessna 551	MU3001	89.7	90.0	89.8	90.3	0.3
Cessna 560	MU3001	89.7	90.0	89.8	91.4	1.5
Cessna 750	CNA750	83.3	83.2	82.9	none	n.a.
Challenger 600	CL600	85.3	86.0	85.8	90.0	4.0
Cessna 500	CNA500	86.6	87.2	87.0	90.0	2.8
Cessna 650	CIT3	88.8	89.9	89.7	92.6	2.8
DC-9	DC93LW	99.5	101.6	99.7	99.4	-2.1
Embraer 135	EMB145	84.5	84.2	84.0	none	n.a.
Falcon 2000	CL600	87.9	88.6	88.4	none	n.a.
Falcon 10	LEAR35	88.1	88.4	88.2	92.5	4.2
Falcon 20	FAL20	93.5	93.8	93.5	92.5	-1.3
Falcon 50	FAL50	92.7	93.1	92.9	91.7	-1.4
Falcon 900	FAL900	91.8	92.2	92.0	none	n.a.
GALX	IA1125	89.5	90.4	90.2	none	n.a.
Gulf 2	GII	99.8	100.1	99.9	100.8	0.7
Gulf 3	GIIB	101.7	98.4	98.2	99.7	1.4
Gulf 4	GIV	84.5	85.2	85.5	90.0	4.8
Global Exp	GV	88.7	89.5	89.2	none	n.a.
Gulf 5	GV	87.7	88.5	88.2	none	n.a.
HS125-400/600	LEAR25	96.1	96.4	96.2	93.8	-2.6
HS800/1000	LEAR35	87.8	88.1	87.9	93.8	5.7
Astra/WW25	IA1125	89.5	90.5	90.3	90.5	0.0
Jetstar	LEAR35	91.3	91.5	91.3	99.0	7.5
L29 Delfin	T-38A	98.9	99.5	98.9	none	n.a.
LR24	LEAR25	100.3	100.6	100.4	102.3	1.8
LR25	LEAR25	101.5	101.8	101.6	103.6	1.8
LR28	LEAR25	100.6	100.9	100.7	none	n.a.
LR31	LEAR35	86.4	86.7	86.5	91.0	4.3
LR35	LEAR35	86.5	86.8	86.6	90.5	3.8
LR36	LEAR35	87.1	87.3	87.1	91.5	4.2
LR45	LEAR35	86.7	86.9	86.7	none	n.a.
LR55	LEAR35	87.2	87.4	87.2	91.8	4.4
LR60	LEAR35	86.2	86.5	86.3	93.5	7.1
MU30	MU3001	91.5	91.8	91.6	none	n.a.
PRM1	CNA500	86.7	87.3	87.1	none	n.a.
SBR1	LEAR25	98.7	99.0	98.8	95.1	-3.8
T38	T-38A	102.3	102.9	102.3	102.6	-0.3

Notes:

1. The VNDS/INM Average is determined by averaging the VNDS Mean and the INM value for the respective day.

2. Existing Minus Average is determined by subtracting the Average Day Average from the existing target. Some results may appear off by 0.1 dB due to rounding.

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APPENDIX B MEMORANDUM ON DEVELOPMENT OF FEASIBLE, PRODUCTIVE, AND DEFENSIBLE TARGETS

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MEMORANDUM

To:	Bob Holden and Scott Tatro, Los Angeles World Airports
Copy:	Bob Behr, HMMH; Beverly Jones and Peter Stumpp, SH&E
From:	Nicholas P. Miller, J. Eric Cox, and Ted Baldwin
Date:	August 14, 2008
Subject:	Recommended Approach to Take in Establishing Mandatory VNY Quiet Departure Targets
Reference:	HMMH Project 300701.006

1. INTRODUCTION

This memorandum presents results of second round analysis of noise measurements from the Van Nuys Data System (VNDS) for use in updating and expanding Single Event Noise Exposure Level (SENEL) targets at noise monitors V7 and V1, for jet aircraft types that operate regularly at Van Nuys Airport (VNY). It builds on the February 23, 2008 HMMH memorandum titled "Updated and Expanded VNY Quiet Jet Departure Program Target Noise Level Analysis." That memorandum recommended target levels appropriate for continuation of the existing *voluntary* program. This memorandum considers targets for a *formal* program, with fines assessed for exceedences.

The primary result of this analysis is a two-part recommendation that: (1) we base the Part 161 analysis on targets selected to affect roughly an equal percentage of operations in each aircraft type, and (2) we set the target levels to provide noise reduction approximating the benefit that would result from full adherence to the existing targets.[1]

This phase of the analysis focuses on jet aircraft types and noise monitor V7 only, consistent with LAWA's ongoing implementation of the voluntary program. Once LAWA has approved the SENEL target determination methodology to use in the Part 161 (i.e., either accepting our recommendation or some alternative) we will complete a final analysis to generate updated target levels for the remaining propeller aircraft in the VNDS system, and target levels for jets and propeller types at monitor V1.

2. BACKGROUND

The VNY Quiet Jet Departure Program encourages jet pilots to conduct departures so that measured noise levels are below aircraft-type-specific targets at monitoring location "V7", which is approximately 6,000 feet south of the airport (approximately 14,000 feet from brake release on Runway 16R). The Noise Management Office (NMO) monitors noise levels and contacts jet operators who exceed targets. The program is designed to assist pilots to develop and use takeoff procedures that reduce off-airport noise exposure.

LAWA initiated the program in February 1994. The NMO set the original targets by averaging the arithmetic mean of measured departure levels for the given aircraft type with an Integrated Noise Model (INM) SENEL estimate. Because the VNY noise monitoring system was relatively new at the time, limited measurement data were available – fewer than 10 measurements for some aircraft. INM estimates were available for only nine aircraft – the B727Q9, CL600, CNA500, DC9Q9, GIIB, IAI1125, LR25, LR35, and MU3001. The NMO "mapped" all aircraft models to one of these types.

LAWA requested HMMH assist in developing targets that take into account measurements made since 1994, use INM SENEL estimates for a more comprehensive range of aircraft types, and include targets for monitor V1, to address Runway 34L departures. The February 2008 memorandum presented those updated and expanded targets, for continued use in a *voluntary* program.

Noise Compatibility Program ("NCP") measure 31 of the February 2003 VNY Part 150 Study proposed establishment of "monetary penalties (fines) to be imposed on aircraft operators who violate

[1] As discussed in the preceding memorandum, the existing targets suffer from several weaknesses, including their limited number (which requires applying them in a very liberal manner as surrogates for many aircraft types), the limited measurements on which they were based, and the limited and somewhat outdated INM modeling used in their development.

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noise abatement policies at VNY." This proposal is one of the formal restrictions under consideration in the VNY Part 161 Study. It requires identification of highly defensible targets.

3. RELATIONSHIP TO PREVIOUS WORK – PURPOSE OF SECOND ROUND ANALYSIS

The February 23, 2008 memorandum presented a first-round analysis of updated and expanded targets at permanent monitors V7 and V1, for jet aircraft types that operate regularly at VNY. That analysis employed the same methodology used to develop targets in 1994; i.e., averaging the arithmetic mean of measured departure levels with INM SENEL estimates.

The updated targets from the first-round analysis were generally lower than existing targets. This difference may reflect the overall success of the VNY Quiet Jet Departure Program; it is reasonable to infer that lower measured values used in development of updated targets relate at least partially to the effectiveness of pilot efforts to fly as quietly as possible.

Table 1 compares existing and HMMH-updated target levels at monitoring location V7 for aircraft types contributing most significantly to overall noise exposure at VNY.[2]

Table 1 - Existing and HMMH Updated Target SENEL Data at Monitoring Location V7

Aircraft Type as Listed in VNDS	Sample Size[1]	Energy Average SENEL	Existing SENEL Target	% Ops Reduced to Target	Energy Av SENEL Reduction	HMMH Calculated Target[2]	% Ops Reduced to Target	Energy Av SENEL Reduction
A3	294	110.5	108.4	50.3	-3.1	109.5	40.1	-2.5
LR25	4383	100.8	103.6	8.4	-0.7	101.8	21.6	-1.2
SBR1	833	100.2	95.1	36.6	-7.5	99.0	22.2	-5.2
LR28	221	99.6	none	-	-	100.9	26.2	-1.4
Gulf 2	8956	99.3	100.8	16.1	-0.9	100.1	28.4	-1.2
LR24	2043	98.4	102.3	4.7	-0.4	100.6	12.3	-0.8
Jetstar	457	95.6	99.0	9.6	-0.4	91.5	70.2	-4.7
Falcon 20	1553	92.3	92.5	20.2	-2.2	93.8	14.4	-1.7
MU30	243	90.8	none	-	-	91.8	19.8	-0.3
HS125-400/600	9052	90.4	93.8	4.7	-1.0	96.4	1.6	-0.7
BEECH 400	2573	89.4	92.3	9.4	-0.5	90.4	28.4	-1.3
Falcon 10	329	88.7	92.5	5.5	-0.2	88.4	43.5	-1.6
Cessna 560	6543	88.6	91.4	7.0	-0.8	90.0	20.8	-1.2
HS800/1000	3229	88.5	93.8	1.2	-0.2	88.1	37.8	-2.0
Cessna 551	301	88.1	90.3	8.6	-0.7	90.0	13.0	-0.8
Cessna 550	4957	87.2	90.3	6.5	-0.3	89.6	16.4	-0.5
LR36	2928	86.8	91.5	2.5	-0.5	87.3	23.8	-1.5
LR55	4776	86.8	91.8	2.3	-0.2	87.4	26.0	-1.4
LR35	9675	85.7	90.5	2.9	-0.5	86.8	18.7	-1.4
LR31	1637	85.3	91.0	1.0	-0.1	86.7	20.3	-1.0
LR45	1498	85.3	none	-	-	86.9	18.7	-0.4
LR60	4673	84.8	93.5	0.2	-0.2	86.5	15.7	-0.9
Average:					-0.6			-1.2

1 - VNDS SENEL Output (January 1998 - May 2007)

2 - VNDS/INM Average Day Average from Table 2 of 2/23/08 HMMH Memo "Updated and Expanded VNY Quiet Jet Departure Program Target Noise Level Analysis"

[2] To simplify the analyses presented in this memorandum, the aircraft types presented in Tables 1, 2, and 3 are those that are represented by the five INM types that contributed the most to overall Community Noise Equivalent Level (CNEL) calculations, as identified in the February 21, 2007 HMMH memorandum "Open Issues Related to Modeling Noise Abatement Departure Profiles;" i.e., the Lear 35, GII, Lear 25, MU3001, and A3

For each aircraft type, Table 1 presents the VNDS sample size, energy average measured SENEL, existing and HMMH-updated targets, the percent of operations exceeding each target, and the reduction in energy average SENEL that would result if the sound levels of all operations that exceed the target were reduced to the target. For example, the VNDS includes 8,956 Gulf(stream) 2 departure measurements at V7, with an energy average SENEL of 99.3 dB. The existing target for the Gulf 2 is 100.8 dB, 16.1% of the measured operations exceed the target, and if all those that exceeded the target were reduced in level to 100.8 dB, the energy average for all Gulf 2 would be reduced by 0.9 dB. The HMMH-updated target for the Gulf 2 is 100.1 dB, 28.4% of the measured operations exceed this target, and if all those that exceeded the target were reduced in level to 100.1 dB, the energy average for all Gulf 2 would be reduced by 1.2 dB.

The historic target-setting approach is designed to capture a high percentage of operations. Table 1 indicates that, for most aircraft types, enforcement of the updated targets would affect many more operations than the existing target levels. In all but one case (the HS125-400/600) more than 12% of previously measured operations exceeded the updated targets; for over half the types, over 20% of the previously measured operations exceeded the updated targets.

It would be unrealistic to expect to be able to defend a program penalizing such a high fraction of operations. The Part 161 must consider targets that reflect truly "poor" performance so that noise benefits exceed the economic costs of the restriction. Such a program could take two basic approaches: (1) it could continue the existing LAWA philosophy of applying an equal incentive to pilots of all aircraft types to operate as quietly as feasible, or (2) it could focus on the "noisiest" aircraft. The Part 150 clearly intended to pursue the existing "equitable" approach that places equal burden on operators of all aircraft types.

4. METHODOLOGY FOR IDENTIFYING FORMAL TARGET LEVELS

A two-step process was undertaken to seek formal targets with a reasonable relationship between noise benefit and effects on users. As a first step, the VNDS data and energy-average data analyses summarized in Table 1 were analyzed to determine whether obvious targets could be identified that would provide significant noise benefit compared to the portion of operations affected. As discussed in Section 4.1, this step was unfruitful. Therefore, Section 4.2 considers target-setting approaches based on more equitable relationships between noise benefit and percent of operations affected.

4.1 Can obvious targets be identified?

Two approaches were pursed to seek obvious target levels where significant noise benefit could be achieved by restricting a relatively small share of operations; i.e., "magic bullet" target levels.

The first approach involved statistical analysis of VNDS data at V7 for aircraft types contributing most to CNEL to see if the noise measurement results revealed a small number of statistical outliers to consider restricting. The analysis showed that SENEL distributions vary by aircraft type, but none are inconsistent with a "normal" or "Gaussian" distribution at higher SENEL values. In other words, measured levels exhibit "expected" variability; for any aircraft type there are no exceptionally loud SENEL values as might be the case if a few pilots used particularly noisy departure procedures – procedures that might be modified to produce less noise. From a practical standpoint, this means that there are no obvious "bad performers" to pursue to achieve noise reduction for relatively little effort.

The second approach involved considering the relationship of target level to energy-average SENEL, to determine if there was a target that might yield a particularly significant drop in noise level. As expected, the results show that lower targets result in lower energy average levels. However, the reduction in level is relatively continuous; no target produces a discontinuous drop in energy average. In other words, reductions of target level only gradually reduce energy average SENEL.

Hence, neither the SENEL distributions from the VNDS data, nor the relationships of exceedences to target level point to any obvious target levels where significant noise benefit could be achieved by restricting a relatively small share of operations.

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4.2 What are potential bases for identifying equitable targets?

Since the previous step did not identify obvious targets, two target-setting methods were investigated based on the relationship between the percent of operations affected to benefit achieved. Both methods continue the existing LAWA philosophy of applying an incentive to pilots of all aircraft types to operate as quietly as feasible. The Part 150 clearly intended to pursue this existing "equitable" approach, which places equal burden on all operators. The first method is based on the goal of achieving the same decibel reduction in energy average SENEL for each aircraft type. The second method is based on the goal of affecting the same percent of operations in each aircraft type.

4.2.1 Method 1: Achieve Equal Reduction of Energy Average SENEL for Each Aircraft Type

The first method sets decibels of reduction in energy average SENEL as the goal and computes the target level and the percent of operations that would have to be reduced to that target to achieve the desired reduction for each aircraft type. Table 2 presents the results.

Table 2 - Redeveloped SENEL Target Data for Equal Noise Reduction Method

Aircraft Type as Listed in VNDS	Sample Size[1]	Energy Average SENEL	1 dB Energy Ave. SENEL Reduction: % Ops Reduced to Target	1 dB Energy Ave. SENEL Reduction: Target SENEL	1.5 dB Energy Ave. SENEL Reduction: % Ops Reduced to Target	1.5 dB Energy Ave. SENEL Reduction: Target SENEL	3 dB Energy Ave. SENEL Reduction: % Ops Reduced to Target	3 dB Energy Ave. SENEL Reduction: Target SENEL
A3	294	110.5	17.3	112.8	23.8	111.5	49.0	108.6
LR25	4383	100.8	16.1	102.5	28.9	101.1	62.2	98.5
SBR1	833	100.2	6.4	107.5	7.8	106.4	11.9	103.4
LR28	221	99.6	22.6	101.7	28.5	100.7	46.2	98.0
Gulf 2	8956	99.3	22.6	100.7	33.9	99.6	59.4	97.2
LR24	2043	98.4	17.7	99.9	30.8	98.6	64.5	96.2
Jetstar	457	95.6	19.9	97.5	28.4	96.4	51.9	93.8
Falcon 20	1553	92.3	7.0	96.7	11.2	94.7	39.0	90.9
MU30	243	90.8	70.4	90.2	79.4	89.6	90.9	88.0
HS125-400/600	9052	90.4	4.1	94.3	14.7	92.0	45.2	88.7
BEECH 400	2573	89.4	23.0	91.2	31.0	90.1	50.9	87.6
Falcon 10	329	88.7	25.8	89.7	39.2	88.7	64.4	86.5
Cessna 560	6543	88.6	15.5	90.8	24.3	89.5	50.6	86.7
HS800/1000	3229	88.5	18.6	90.4	28.0	89.2	52.9	86.6
Cessna 551	301	88.1	18.6	89.4	34.9	88.1	64.5	85.8
Cessna 550	4957	87.2	27.1	88.4	35.7	87.4	59.0	85.0
LR36	2928	86.8	12.0	88.9	23.8	87.3	59.3	84.5
LR55	4776	86.8	18.1	88.5	28.0	87.2	59.8	84.5
LR35	9675	85.7	12.0	88.1	20.7	86.5	56.9	83.4
LR31	1637	85.3	19.8	86.8	31.0	85.6	60.2	83.1
LR45	1498	85.3	38.2	85.6	51.5	94.7	75.2	82.7
LR60	4673	84.8	17.3	86.3	29.4	85.0	62.3	82.4

1 : VNDS SENEL Output (January 1998 - May 2007)

This table shows for the identified aircraft types the percent of operations that would exceed a target chosen to reduce the energy average SENEL for that aircraft type by 1, 1.5, and 3 dB, based on historic VNDS measurements. The 1 dB goal was chosen to be similar to what would be achieved by enforcement of the existing or HMMH-updated targets, while the 1.5 and 3 dB goals were chosen to reflect changes in CNEL considered significant by the Federal Aviation Administration (FAA).[3]

[3] In general terms, FAA Order 1050.1e, "Environmental Impacts: Policies and Procedures for Compliance with the National Environmental Policy Act," Washington, DC., 2004, (Appendix A, Section 14.4, p. A-61 – A-63) sets 1.5 and 3 dB increases in CNEL to be the thresholds of significant change at or above 65 dB CNEL and between 60 and 65 dB CNEL, respectively.

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For example, 16.1% of all LR25 departures would exceed a 102.5 dB target; reducing the SENEL produced by those operations to the target would reduce the measured energy average SENEL by one decibel (from 100.8 to 99.8 dB). Similarly, 22.6% of LR28 operations would exceed a target of 101.7 dB and would need to be reduced to this target to lower the energy average from 99.6 dB to 98.6 dB.

4.2.2 Method 2: Affect Same Percent of Operations in Each Aircraft Type

The second method sets percent of operations affected as the goal, and computes the target level and the resulting reductions in energy average SENEL. Table 3 presents the results.

Table 3 - Redeveloped SENEL Target Data for Equal Percent of Operations Affected Method

			2% of Operations Reduced to Target		5% of Operations Reduced to Target		10% of Operations Reduced to Target	
Aircraft Type as Listed in VNDS	Sample Size[1]	Energy Average SENEL	Energy Ave. SENEL Reduction	Target SENEL	Energy Ave. SENEL Reduction	Target SENEL	Energy Ave. SENEL Reduction	Target SENEL
A3	294	110.5	-0.1	116.3	-0.2	115.6	-0.4	114.4
LR25	4383	100.8	-0.1	107.5	-0.5	104.9	-0.7	103.5
SBR1	833	100.2	-0.2	109.6	-0.6	108.5	-2.3	104.7
LR28	221	99.6	-0.1	105.1	-0.2	104.2	-0.3	103.4
Gulf 2	8956	99.3	-0.2	104.8	-0.4	103.3	-0.7	101.8
LR24	2043	98.4	-0.2	104.2	-0.4	102.2	-0.7	101.0
Jetstar	457	95.6	0.0	101.5	-0.2	100.2	-0.5	98.9
Falcon 20	1553	92.3	-0.5	99.1	-0.8	97.6	-1.4	95.0
MU30	243	90.8	0.0	93.4	-0.1	92.8	-0.1	92.4
HS125-400/600	9052	90.4	-0.8	96.1	-1.0	93.7	-1.2	92.8
BEECH 400	2573	89.4	-0.1	94.9	-0.3	93.7	-0.6	92.2
Falcon 10	329	88.7	-0.1	93.1	-0.2	92.6	-0.3	91.9
Cessna 560	6543	88.6	-0.4	94.1	-0.6	92.4	-0.8	91.3
HS800/1000	3229	88.5	-0.2	93.7	-0.3	92.9	-0.5	91.8
Cessna 551	301	88.1	-0.3	94.2	-0.6	91.3	-0.7	90.2
Cessna 550	4957	87.2	-0.2	91.5	-0.3	90.6	-0.3	90.2
LR36	2928	86.8	-0.5	91.9	-0.6	90.8	-0.9	89.3
LR55	4776	86.8	-0.2	92.1	-0.3	91.2	-0.5	89.9
LR35	9675	85.7	-0.4	91.2	-0.6	90.0	-0.8	88.6
LR31	1637	85.3	-0.1	90.9	-0.2	89.9	-0.5	88.4
LR45	1498	85.3	-0.1	89.2	-0.2	88.4	-0.3	84.5
LR60	4673	84.8	-0.3	90.1	-0.5	88.6	-0.7	87.4
Average:			*-0.3*		*-0.5*		*-0.7*	

1 - VNDS SENEL Output (January 1998 - May 2007)

The computations were performed for targets that would affect two, five, and ten percent of the departures in each aircraft type, based on historic VNDS measurements. For example, two percent of LR25 operations would exceed a 107.5 dB target and the energy average SENEL would be reduced by 0.1 dB if all the operations exceeding the target were reduced in level to that target.

5. RECOMMENDATIONS

The target SENEL results presented in Tables 2 and 3 are better balanced across aircraft types with regard to noise reduction than existing targets or updated and expanded targets developed using the historic target-setting approach (see Table 1). However, Table 2 reveals that the "equal noise reduction" approach results in large variation across aircraft types in terms of the percent of operations that would be affected by enforcement. In addition, all three noise reduction levels investigated affect a very large portion (over 50%) of operations in many aircraft types.

On the other hand, the "equal percent of operations" approach presented in Table 3 affects the same portion of operations in each aircraft type, by design. The resulting targets meet the Part 150 intent to continue the existing "equitable" approach; i.e., to place equal burden on operators of all aircraft types. The target levels at which five percent of operations are affected result in an overall average noise reduction (approximately 0.5 dB) that is very close to the average noise reduction that would be achieved from enforcement of LAWA's existing informal target levels (see Table 1).

Therefore, we recommend that the Part 161 analysis utilize the "equal percent of operations affected" approach presented in Table 3, with the target percentage set at five percent. Once LAWA has approved this recommendation, or an alternate target determination methodology, we will complete a final analysis to generate redeveloped target levels at monitor V7 for the remaining aircraft types in the VNDS, and also develop targets for monitor V1.

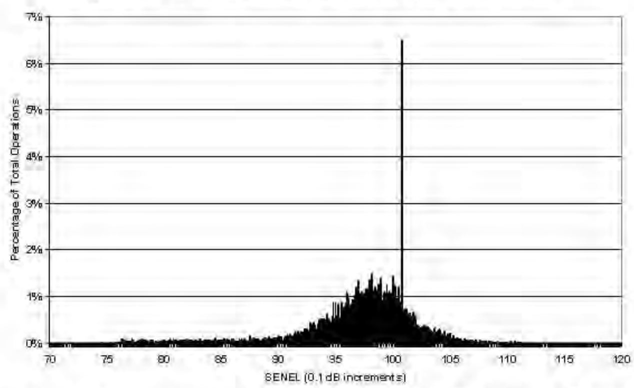
During the course of the preceding analysis, two potentially significant issues were identified that should be taken into consideration when considering implementation of a formal target program with fines: (1) adjusting targets to account for "reassignment" of measured noise levels in the VNDS in certain circumstances, and (2) identifying an approach to take in developing targets for newly introduced aircraft types. These two issues are discussed in Sections 5.1 and 5.2.

5.1 Treatment of Reassigned SENEL Values

Analysis of the SENEL distributions in the VNDS database revealed that some measurement values had been reassigned to match the target values. Through consultation with LAWA, it was determined that such adjustments are made if investigation of an exceedence indicates unusual conditions at the time of the operation may have affected measurement accuracy. In these situations, the SENEL value in the VNDS database is set at the target for the specific aircraft type. For example, adjustments are made when noise events have unusually long durations or when two aircraft are identified near the monitor at the same time, suggesting that the measured noise was affected by multiple sources.

To determine the potential effect of this reassignment on target calculations, the analysis methods discussed in Section 4.2 were applied to Gulf 2 SENEL distributions, a loud aircraft with a large sample size. Figure 1 shows the distribution of these SENEL in the VNDS database. The plot shows a spike at the current 100.8 dB target for the Gulf 2, associated with reassigned VNDS entries.

Figure 1 – Gulf 2 SENEL Distribution from VNDS



The issue is: How should these extra operations shown at 100.8 dB be redistributed and what would the effect be on the results of the two analysis methods? The redistribution method chosen was to reduce the number of operations in the spike at the existing target level to the number of operations at the next lowest SENEL value, and then redistribute the remaining operations over all higher SENEL values based on the existing relative proportions. Figure 2 shows the adjusted distribution.

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Figure 2 – Redistributed Gulf 2 SENEL Distribution

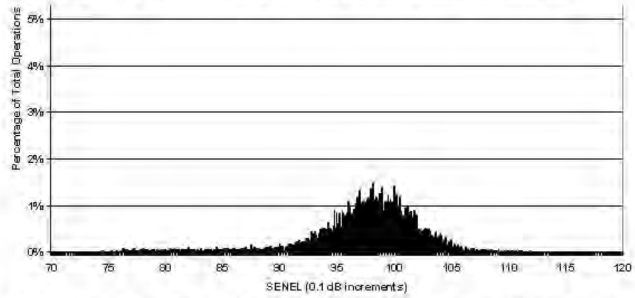

Table 4 presents the results of applying the two analysis methods to both the original distribution (Figure 1) and the adjusted distribution (Figure 2). This table gives the resulting target levels to achieve either the decibel reductions or the percent of operations affected. The effects of redistribution on the resulting targets are less than one decibel in all cases.

Table 4 – Gulf 2 Target SENEL Levels for Original and Redistributed Data

			Equal Noise Reduc'n Method			Equal % Op'ns Method			
	Sample Size[1]	Energy Average SENEL	Target SENEL for -1 dB Reduc'n	Target SENEL for -1.5 dB Reduc'n	Target SENEL for -3 dB Reduc'n	Target SENEL for 2% Op'ns	Target SENEL for 5% Op'ns	Target SENEL for 10% Op'ns	HMMH Calculated Target[2]
Original VNDS data	8956	99.3	100.7	99.6	97.2	104.8	103.3	101.8	100.1
Redistributed data	8956	99.5	101.2	100.0	97.5	105.2	103.9	102.5	100.2
Difference		*0.2*	***0.5***	***0.4***	***0.3***	***0.4***	***0.6***	***0.7***	*0.1*

1 - VNDS SENEL Output (January 1998 - May 2007)

2 - VNDS/INM Average Day Average from Table 2 of 2/23/08 HMMH Memorandum "Updated and Expanded VNY Quiet Jet Departure Program Target Noise Level Analysis"

5.1.1 Recommendation

Based on this analysis, we recommend that the target value be increased by 0.5 dB for all aircraft types where reassignment of VNDS data has occurred, to mitigate any skew in the target calculations.

5.2 Effects of Varying Sample Sizes

Sample size is important to consider when setting targets for new aircraft types. Table 5 presents the results of applying the two analysis methods to the Gulf 2 data for the full January 1998 through May 2007 data set and for 1998 data only. The effects on target calculations of using a one-year sample are less than one decibel.

Table 5 – Gulf 2 Target SENEL Levels for All VNDS Data and 1998 Data Only

			Equal Noise Reduc'n Method			Equal % Op'ns Method			
	Sample Size[1]	Energy Average SENEL	Target SENEL for -1 dB Reduc'n	Target SENEL for -1.5 dB Reduc'n	Target SENEL for -3 dB Reduc'n	Target SENEL for 2% Op'ns	Target SENEL for 5% Op'ns	Target SENEL for 10% Op'ns	HMMH Calculated Target[2]
Jan. '98 - May '07	8956	99.3	100.7	99.6	97.2	104.8	103.3	101.8	100.1
Jan. '98 - Dec. '98	949	99.5	101.0	99.9	97.3	104.9	103.6	102.3	100.3
Difference		*0.2*	***0.3***	***0.3***	***0.1***	***0.1***	***0.3***	***0.5***	*0.2*

1 - VNDS SENEL Output (January 1998 - May 2007)

2 - VNDS/INM Average Day Average from Table 2 of 2/23/08 HMMH Memorandum "Updated and Expanded VNY Quiet Jet Departure Program Target Noise Level Analysis"

5.2.1 Recommendation

New aircraft types will initially not have SENEL distribution data available for determination of an SENEL target value corresponding to five percent of operations affected. Thus, a surrogate target should be employed for an initial period of time while such data is collected. This temporary target could be determined from the redeveloped target levels for similar aircraft or from INM modeling of the particular aircraft type and NADP. Updated targets can later be calculated from the SENEL data collected while the surrogate target is in effect. *Our initial investigation suggests a measurement period of one year could generate a target level very near to the target that would be calculated from a much longer period of time.*

APPENDIX C MEMORANDUM ON RESULTS OF ANALYSES OF MANDATORY TARGETS

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MEMORANDUM

To: Bob Holden and Scott Tatro, Los Angeles World Airports
From: Nick Miller, Ted Baldwin, Bob Behr, and Eric Cox
Date: March 31, 2009
Subject: Review of Analyses of Establishing Mandatory VNY Departure Noise Limits
Reference: HMMH Project 300701.006

1. EXECUTIVE SUMMARY

This memorandum presents the HMMH analyses, results, and recommendations related to the third use restriction under consideration in the Van Nuys Airport (VNY) Part 161 study:[1]

> **Establish Fines for Violations of VNY Noise Abatement Policies**: Establish a system of monetary penalties (fines) to be imposed on aircraft operators who violate noise abatement policies. Make the voluntary VNY Fly Friendly program mandatory and establish penalties for violations of the program.

The proposed restriction would penalize operators of jet departures with measured departure noise levels that exceed type-specific limits at either of two permanent VNY monitors, V1 and V7. The rule would extend and formalize the voluntary program established in 1994. Over nine years of measurement data collected at V7 provide the basis for the analyses, which led to the following primary conclusions:

- *The existing program has produced measurable noise reduction.*
- *There are no obvious "bad performers" whose operations disproportionately affect overall noise exposure and are clear targets for penalties.*
- *A formal program faces implementation and regulatory barriers that make it unlikely LAWA could obtain FAA approval through the Part 161 process or implement the rule – if approved – in a cost-effective manner.*
- *It would be most appropriate to pursue further reduction in departure noise levels through an updated and expanded voluntary program.*

This section summarizes the analyses and results that led to these conclusions. Section 2 discusses the four-step data-analysis process in detail. Section 3 discusses implementation-related issues. Section 4 presents a recommendation related to maximizing effectiveness of continued application of the voluntary program.

1.1 Summary of Data Analyses and Results

Measurement data collected since establishment of the voluntary program were analyzed in four primary steps:

- Use the original target-establishment approach to develop updated and expanded targets using the extensive measurement data gathered since Fly Friendly program initiation in 1994.
- Determine whether there are any obvious limits that would yield significant noise reduction benefits but affect only unusually loud operations.
- Consider two potential approaches to establishment of formal limits.
- Assess the implication of formal limits in light of the enforcement provision which bans aircraft and operators from using VNY if a rule is violated three times within three years.

1.1.1 Develop updated and expanded target noise levels

The method used in 1994 to develop the targets for each aircraft type involved computation of a mean measured level that was averaged with the level computed using the FAA's Integrated Noise Model (INM). This averaging method was applied using the measurement data gathered daily since 1994, and the much updated and improved INM. Across all aircraft types, the noise level limits so derived are on average about two decibels (dB) quieter than the original targets. This 2 dB difference strongly suggests that the voluntary Fly Friendly program has had a beneficial effect. (Section 2.1 provides details of this analysis.)

[1] This memorandum builds on prior analyses provided to LAWA in two preceding HMMH memoranda on this topic: "Updated and Expanded VNY Quiet Jet Departure Program Target Noise Level Analysis" (February 23, 2008) and "Recommended Approach to Take in Establishing Mandatory VNY Quiet Departure Targets" (August 11, 2008).

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1.1.2 Can limits be identified that would affect few operations but produce a relatively large noise reduction?

The overall goal in a Part 161 study is to identify restrictions with high benefit-cost ratios; i.e., measures that achieve a relatively large reduction in sound energy (and therefore in CNEL) while affecting relatively few operations. This analysis step examined measurement data to determine if there was a straightforward basis for setting effective and defensible noise limits that affect only a small number of "bad performers." The analysis calculated how overall sound energy decreases as an increasing percentage of operations are affected, starting with the noisiest. The analysis showed that measured departure noise levels are distributed in a statistically "normal" fashion (i.e., along a "bell-curve") so that eliminating a few loud operations produces only a slight reduction in sound energy; i.e., there do not appear to be a handful of bad performers with undue influence on overall noise exposure. (Details are in Section 2.2.)

1.1.3 Alternative derivations of formal limits

To further assess the benefits and costs of formal limits, two methods were examined for establishing them:

- Limits designed to achieve average reductions for each aircraft type of 1 dB, 1½ dB, and 3 dB;
- Limits designed to eliminate 2%, 5%, and 10% of the loudest operations of each aircraft type.

The first analysis showed that enforcing limits designed to achieve just a 1 dB average reduction for each aircraft type would restrict a high percentage of operations overall and very different fractions of operations in different types. For example, to achieve a 1 dB average reduction would require restricting percentages of departures that vary from 7% for Falcon 20s to 38% for Lear 45s. The second method affects aircraft types equally by definition. The analysis showed that restricting the noisiest 5% of operations in each type would produce a 0.5 dB overall noise reduction, which is close to the 0.6 dB reduction that would be achieved through absolute adherence to the existing targets. Eliminating the noisiest 2% in each type reduced the overall average by 0.3 dB and eliminating the noisiest 10% reduced the overall average by 0.7 dB. (Details are in Section 2.3).

1.1.4 What are the effects of prohibiting use of the airport after three or more exceedances in three years?

This analysis evaluated limits set using the second method summarized above, to eliminate the loudest 5% in each aircraft type. Measurement data from 1998 to 2007 show that the most frequent operators at VNY would produce the fewest exceedances; aircraft that depart VNY more than about four times a month have the lowest percentage of operations exceeding the limits. This observation is further evidence of the effectiveness of the existing voluntary program; familiarity with the program appears to improve performance. However, the analysis also showed that frequent operators would exceed targets frequently enough to lead to them being banned from the airport after almost any three-year period. (Details are in Section 2.4.)

1.2 Implementation and Part 161 Related Considerations

The noise analysis suggests that a formal restriction would require LAWA to incur significant implementation-related effort and expense, and to face significant operator challenges related to ongoing implementation. It also is possible that the measure could be counterproductive, by inducing operators to alter their operations to avoid exceeding a formal limit, in ways that would redistribute noise in an undesirable manner, such as by altering flight paths in a manner that was inconsistent with the "no early turn" program.

With regard to Part 161, this measure would apply to Stage 3 aircraft, so it would trigger the additional burden associated with Stage 3 restrictions; i.e., demonstration of that benefits are reasonably likely to exceed costs, satisfaction of the six statutory conditions, and *FAA approval of the measure*. FAA's potential attitude toward this measure should be considered in light of long-standing agency policy guidance to airports that they consider this type of restriction to be unsafe and a type of measure the agency is unlikely to approve. (See Section 3.)

1.3 Recommendations

Based on the noise, implementation, and Part 161 related issues discussed in this memorandum, we recommend that LAWA pursue the objective of this measure through continued implementation of the voluntary Fly Friendly target noise level program, using the updated and expanded jet departure targets that HMMH previously provided LAWA. As noted throughout this memorandum, several aspects of our analysis provided objective bases for concluding that the existing program has been effective in reducing average departure noise levels. It is likely that an enhanced program using updated and expanded targets would help to provide even further noise reduction, by providing precisely defined targets that are more appropriate for a broader range of aircraft. Section 4 suggests an approach to improving performance through pilots sharing operating procedures.

2. DETAILED ANALYSES

2.1 Derive Updated and Expanded Targets

2.1.1 Background

The VNY Quiet Jet Departure Program encourages jet pilots to conduct departures so that measured noise levels are below established aircraft-type-specific targets at monitoring location "V7", which is approximately 6,000 feet south of the airport (approximately 14,000 feet from brake release on Runway 16R). The Noise Management Office (NMO) monitors noise levels at V7 and contacts jet operators that exceed targets. The program is designed to assist pilots to develop and use takeoff procedures that reduce off-airport noise exposure. Pilots can contact the NMO to identify targets for specific aircraft.

LAWA initiated the program in February 1994. The targets were set for each aircraft type by averaging the arithmetic mean of measured departure noise levels with an INM-based Single Event Noise Exposure Level (SENEL) estimate. Because the permanent monitoring system was relatively new at the time, limited noise measurement data were available – fewer than 10 measurements for some aircraft types. In addition, INM estimates were available for only nine aircraft types – the B727Q9, CL600, CNA500, DC9Q9, GIIB, IA1125, LR25, LR35, and MU3001. The NMO "mapped" actual aircraft to one of these types.

LAWA requested that HMMH assist in developing updated and expanded targets to improve the value of the program, including taking into account measurement results the NMO has collected since 1994, developing SENEL estimates for a broader range of aircraft types, and establishing targets for monitor V1, to address Runway 34L departures.

2.1.2 Results

Table 1 gives the newly derived targets for V1, which had no previous target levels. Table 2 shows the newly derived targets for V7. Most importantly, the new V7 targets average 2.2 dB lower than the existing target levels. This reduction suggests that the Fly Friendly program has made some difference. Sections 2.4 and Section 3 further confirm that experience with the current program produces lower departure levels.

2.1.3 Analytical Process

The tables summarize the process of developing the targets, following the steps LAWA used in establishing the original values. The tables are largely self-explanatory. They include the following columns:

1. **Aircraft Type Listed in VNDS** (Van Nuys Data System) - These are the aircraft types included in the VNDS database available to HMMH for January 1998 through May 2007. The aircraft types were limited to jet aircraft for which the VNDS included measured SENEL values at sites V1 and V7.
2. **Sample Size** - The number of noise measurements matched to aircraft operations at either V1 or V7 for the aircraft type contained in the VNDS for the January 1998 through May 2007 time period.
3. **Mean** - The arithmetic average of the measured SENEL.
4. **INM A/C** – Comparable INM aircraft type
5. **INM Profile** - The profile used in the modeling, either the INM standard or the user-defined version we developed for the Part 161, and for which FAA provided approval.
6. **Average Day SENEL** - The SENEL calculated using the INM for VNY's elevation, 66.1°F and a barometric pressure of 29.96 inches of mercury (in-Hg). Meteorological conditions were determined using historical weather data to approximate annual average temperatures and atmospheric pressure at the airport.
7. **New Target** - The arithmetic average of the VNDS measured mean (column 3) and the INM-calculated SENEL for average day conditions (column 6).
8. **Existing V7 Target** - Self-explanatory. This column is only in the V7 spreadsheet, since there are no targets for V1.
9. **Existing Minus New** - The existing V7 target minus new the new target (i.e., column 8 minus column 7). This is a measure of how much higher the existing target is from the updated target. In almost every case, the difference is positive, indicating that the new targets will be lower than the existing targets. This column is only in the V7 spreadsheet, since there are no existing targets for V1.

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Table 1 Derivation of New Targets for Monitor V1

VNDS SENEL Output (January 1998 - May 2007)			INM SENEL Output			New Limit (note 1)
Aircraft Type Listed in VNDS	Sample Size	Mean	INM A/C	INM Profile (INM std. or FAA-approved user-defined)	Aver. Day (66.1° F, 29.96 in-Hg) SENEL	
A3	57	104.8	A3 RAY	A3 NADP	115.0	109.9
B727	73	101.7	727LAC	727 NADP	104.7	103.2
B737	280	92.2	737700	Standard	97.1	94.7
BAC-111	11	105.4	BAC111	Standard	103.7	104.6
BEECH 400	479	88.0	MU3001	Standard	95.3	91.7
Cessna 550	942	85.1	MU3001	Standard	95.3	90.2
Cessna 551	53	86.3	MU3001	Standard	95.3	90.8
Cessna 560	1,245	86.6	MU3001	Standard	95.3	91.0
Cessna 750	921	82.4	CNA750	Standard	87.7	85.1
Challenger 600	474	82.9	CL600	Standard	90.7	86.8
Cessna 500	1,117	85.0	CNA500	Standard	90.7	87.9
Cessna 650	297	90.0	CIT3	Standard	92.7	91.4
DC-9	19	101.7	DC93LW	Standard	103.8	102.8
Embraer 135	77	84.8	EMB145	Standard	86.4	85.6
Falcon 2000	677	88.1	CL600	Standard	90.7	89.4
Falcon 10	52	86.5	LEAR35	L35 NADP	91.5	89.0
Falcon 20	327	89.2	FAL20	Standard	101.5	95.4
Falcon 50	382	91.4	FAL50	Standard	97.8	94.6
Falcon 900	224	89.9	FAL900	Standard	97.8	93.9
GALX	120	88.2	IA1125	Standard	94.8	91.5
Gulf 2	1,777	98.0	GII	Standard	106.0	102.0
Gulf 3	1,411	97.3	GIIB	Standard	103.2	100.3
Gulf 4	2,793	87.1	GIV	GIV NADP	85.9	86.5
Global Exp	183	88.8	GV	Standard	92.8	90.8
Gulf 5	583	87.6	GV	Standard	92.8	90.2
HS125-400/600	1,659	88.6	LEAR25	L25 NADP	107.0	97.8
HS800/1000	579	87.0	LEAR35	L35 NADP	91.5	89.3
Astra/WW25	171	89.3	IA1125	Standard	94.8	92.1
Jetstar	96	94.6	LEAR35	L35 NADP	91.5	93.1
L29 Delfin	4	95.7	T-38A	NOISEMAP	108.5	102.1
LR24	423	96.7	LEAR25	L25 NADP	107.0	101.9
LR25	899	99.1	LEAR25	L25 NADP	107.0	103.1
LR28	33	96.7	LEAR25	L25 NADP	107.0	101.9
LR31	293	84.7	LEAR35	L35 NADP	91.5	88.1
LR35	1,901	84.7	LEAR35	L35 NADP	91.5	88.1
LR36	549	86.5	LEAR35	L35 NADP	91.5	89.0
LR45	310	84.9	LEAR35	L35 NADP	91.5	88.2
LR55	951	86.8	LEAR35	L35 NADP	91.5	89.2
LR60	912	84.0	LEAR35	L35 NADP	91.5	87.8
MU30	47	91.2	MU3001	Standard	95.3	93.3
PRM1	88	84.8	CNA500	Standard	90.7	87.8
SBR1	159	95.0	LEAR25	L25 NADP	107.0	101.0
T38	16	92.7	T-38A	NOISEMAP	108.5	100.6

Note 1 - New Limit is the average of VNDS Mean and INM Average Day

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Table 2 Derivation of Targets for Monitor V7

VNDS SENEL Output (January 1998 - May 2007)			INM SENEL Output					
Aircraft Type Listed in VNDS	Sample Size	Mean	INM A/C	INM Profile (INM std. or FAA-approved user-defined)	Aver. Day (66.1° F, 29.96 in-Hg) SENEL	New Limit (Note 1)	Existing V7 Target	Existing Minus New (Note 2)
A3	294	108.0	A3 RAY	A3 NADP	110.9	109.5	108.4	-1.1
B727	1,449	104.3	727LAC	727 NADP	102.6	103.5	109.7	6.3
B737	294	92.3	737700	Standard	94.0	93.2	95.7	2.6
BAC-111	21	103.3	BAC111	Standard	101.6	102.5	108.7	6.3
BEECH 400	2,572	87.6	MU3001	Standard	93.2	90.4	92.3	1.9
Cessna 550	4,957	85.9	MU3001	Standard	93.2	89.6	90.3	0.7
Cessna 551	301	86.7	MU3001	Standard	93.2	90.0	90.3	0.3
Cessna 560	6,543	86.7	MU3001	Standard	93.2	90.0	91.4	1.5
Cessna 750	4,856	82.4	CNA750	Standard	84.0	83.2	none	
Challenger 600	2,362	83.5	CL600	Standard	88.5	86.0	90.0	4.0
Cessna 500	5,694	85.7	CNA500	Standard	88.6	87.2	90.0	2.8
Cessna 650	1,593	89.0	CIT3	Standard	90.7	89.9	92.6	2.8
DC-9	94	99.3	DC93LW	Standard	103.8	101.6	99.4	-2.1
Embraer 135	308	85.8	EMB145	Standard	82.6	84.2	none	
Falcon 2000	3,519	88.6	CL600	Standard	88.5	88.6	none	
Falcon 10	329	87.3	LEAR35	L35 NADP	89.4	88.4	92.5	4.2
Falcon 20	1,552	89.7	FAL20	Standard	97.9	93.8	92.5	-1.3
Falcon 50	1,887	90.7	FAL50	Standard	95.5	93.1	91.7	-1.4
Falcon 900	1,147	88.9	FAL900	Standard	95.5	92.2	none	
GALX	580	88.4	IA1125	Standard	92.4	90.4	none	
Gulf 2	8,956	97.4	GII	Standard	102.7	100.1	100.8	0.7
Gulf 3	7,506	96.7	GIIB	Standard	100.0	98.4	99.7	1.4
Gulf 4	13,568	86.5	GIV	GIV NADP	83.9	85.2	90.0	4.8
Global Exp	847	88.8	GV	Standard	90.1	89.5	none	
Gulf 5	2,808	86.8	GV	Standard	90.1	88.5	none	
HS125-400/600	9,052	88.1	LEAR25	L25 NADP	104.6	96.4	93.8	-2.6
HS800/1000	3,229	86.7	LEAR35	L35 NADP	89.4	88.1	93.8	5.7
Astra/WW25	821	88.5	IA1125	Standard	92.4	90.5	90.5	0.0
Jetstar	456	93.6	LEAR35	L35 NADP	89.4	91.5	99.0	7.5
L29 Delfin	16	93.3	T-38A	NOISEMAP	105.7	99.5	none	
LR24	2,043	96.5	LEAR25	L25 NADP	104.6	100.6	102.3	1.8
LR25	4,383	98.9	LEAR25	L25 NADP	104.6	101.8	103.6	1.8
LR28	221	97.2	LEAR25	L25 NADP	104.6	100.9	none	
LR31	1,637	83.9	LEAR35	L35 NADP	89.4	86.7	91.0	4.3
LR35	9,675	84.1	LEAR35	L35 NADP	89.4	86.8	90.5	3.8
LR36	2,927	85.2	LEAR35	L35 NADP	89.4	87.3	91.5	4.2
LR45	1,498	84.4	LEAR35	L35 NADP	89.4	86.9	none	
LR55	4,776	85.4	LEAR35	L35 NADP	89.4	87.4	91.8	4.4
LR60	4,672	83.5	LEAR35	L35 NADP	89.4	86.5	93.5	7.1
MU30	243	90.4	MU3001	Standard	93.2	91.8	none	
PRM1	455	85.9	CNA500	Standard	88.6	87.3	none	
SBR1	833	93.3	LEAR25	L25 NADP	104.6	99.0	95.1	-3.8
T38	56	100.1	T-38A	NOISEMAP	105.7	102.9	102.6	-0.3
						Average Reduction		2.2

Note 1. The new limit is determined by averaging the VNDS Mean and the INM value for the respective
Note 2. Existing Minus New is determined by subtracting the new limit from the existing target.
Some results may appear off by 0.1 dB due to rounding.

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2.2 Can limits be identified that would affect few operations but produce a large noise reduction?

As a first step in examining how enforcement of specific noise limits would affect VNY operators, the distributions of SENEL values collected at monitor V7 were analyzed for the five jet INM types contributing the most to calculated CNEL at VNY.[2] Table 3 lists the full range actual aircraft types associated with those five INM types. For each type, it shows what percent of measured departures would exceed the existing and updated targets. It also gives the reduction in energy average SENEL if all the departures exceeding the target were reduced in noise level to the targets.

Table 3 Percent of Operations Exceeding Existing or New Targets

		Existing Target			New Target		
Aircraft Type listed in VNDS	Sample Size[1]	Existing SENEL Target	Percent Operations Reduced to Target	Energy-Average SENEL Reduction (dB)	New Target[2]	Percent Operations Reduced to Target	Energy-Average SENEL Reduction (dB)
A3	294	108.4	50.3	-3.1	109.5	40.1	-2.5
LR25	4383	103.6	8.4	-0.7	101.8	21.6	-1.2
SBR1	833	95.1	36.6	-7.5	99.0	22.2	-5.2
LR28	221	none	–	–	100.9	26.2	-1.4
Gulf 2	8956	100.8	16.1	-0.9	100.1	28.4	-1.2
LR24	2043	102.3	4.7	-0.4	100.6	12.3	-0.8
Jetstar	457	99.0	9.6	-0.4	91.5	70.2	-4.7
Falcon 20	1553	92.5	20.2	-2.2	93.8	14.4	-1.7
MU30	243	none	-	-	91.8	19.8	-0.3
HS125-400/600	9052	93.8	4.7	-1.0	96.4	1.6	-0.7
BEECH 400	2573	92.3	9.4	-0.5	90.4	28.4	-1.3
Falcon 10	329	92.5	5.5	-0.2	88.4	43.5	-1.6
Cessna 560	6543	91.4	7.0	-0.8	90.0	20.8	-1.2
HS800/1000	3229	93.8	1.2	-0.2	88.1	37.8	-2.0
Cessna 551	301	90.3	8.6	-0.7	90.0	13.0	-0.8
Cessna 550	4957	90.3	6.5	-0.3	89.6	16.4	-0.5
LR36	2928	91.5	2.5	-0.5	87.3	23.8	-1.5
LR55	4776	91.8	2.3	-0.2	87.4	26.0	-1.4
LR35	9675	90.5	2.9	-0.5	86.8	18.7	-1.4
LR31	1637	91.0	1.0	-0.1	86.7	20.3	-1.0
LR45	1498	none	-	-	86.9	18.7	-0.4
LR60	4673	93.5	0.2	-0.2	86.5	15.7	-0.9
Average:				***-0.6***			***-1.2***

1 - VNDS SENEL Output (January 1998 - May 2007)

2 – New Limit from Table 2

The data in Table 3 show that most aircraft types would exceed the new targets more often than the existing targets. The data also show large variances among aircraft types in terms of both the percent of operations that would be affected by formal enforcement and the resulting reduction in the energy average SENEL.

Since fining pilots for exceeding the new targets would clearly lead to very high numbers of "violations", the next step in this analysis examined whether the measured data suggest that significant reduction of total sound energy (and therefore in CNEL) could be achieved by setting limits that would affect only very loud departures.

[2] The A3, L25LAC (LEAR25 using the Clay Lacey departure procedure), LEAR35, GII, and MU3001, as identified in the February 21, 2007 HMMH memorandum titled "Open Issues Related to Modeling Noise Abatement Departure Profiles."

Initial analysis of the VNDS SENEL data at V7 for the aircraft types listed in Table 3 showed them to have varying distributions, but with none exceeding a statistically “normal” (“Gaussian”) distribution at higher SENEL levels. This type of distribution means that sound levels exhibit “expected” variability; for any aircraft type there are no groupings of exceptionally loud SENEL as might be the case if one or a few pilots frequently used particularly noisy departure procedures – procedures that might be modified to produce less noise. Figure 1 compares the distribution of measured GII SENEL values with a normal distribution. As shown, there are relatively few operations that produce exceptionally high values. Had there been a modest group of operations clustered at the higher levels, say 115 to 120 dB, it would likely have been of value to test noise limits that would identify these operations and then fine or work with the pilots of those operations to reduce their levels to fall within the distribution of other operations.

Next, the relationship of the noise limit to energy-average SENEL was examined as an estimate of the effect on CNEL. Results showed that though as the limit is reduced, the energy average is reduced, and there is no clear limit that would significantly drop the energy average. In other words, reductions of noise limit only gradually reduce the energy average SENEL.

Figure 2 illustrates this situation; it shows the effect of eliminating louder operations on the energy average SENEL. For any reasonable percent of operations eliminated, there is no sudden reduction of the energy average SENEL. Neither the SENEL distributions from the VNDS data, nor the relationships of exceedances to noise limit suggest there are clusters of unusually loud operations that can be identified for quieting that will produce a large reduction in total sound energy (CNEL) relative to the numbers of operations affected. Consequently, two alternative methods were investigated that would quantify the relationships of percent of operations affected to benefit achieved.

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Figure 1 Comparison of Measured GII SENEL at V7 with Comparable Normal Distribution

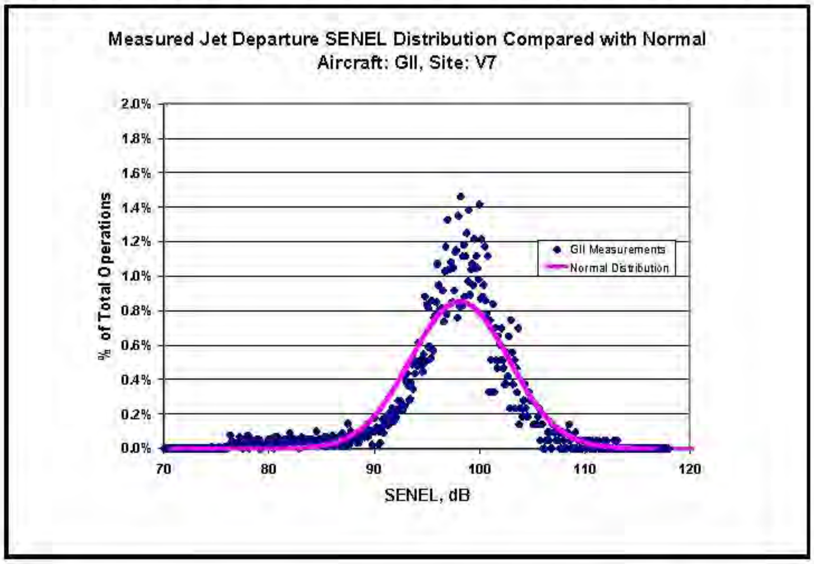
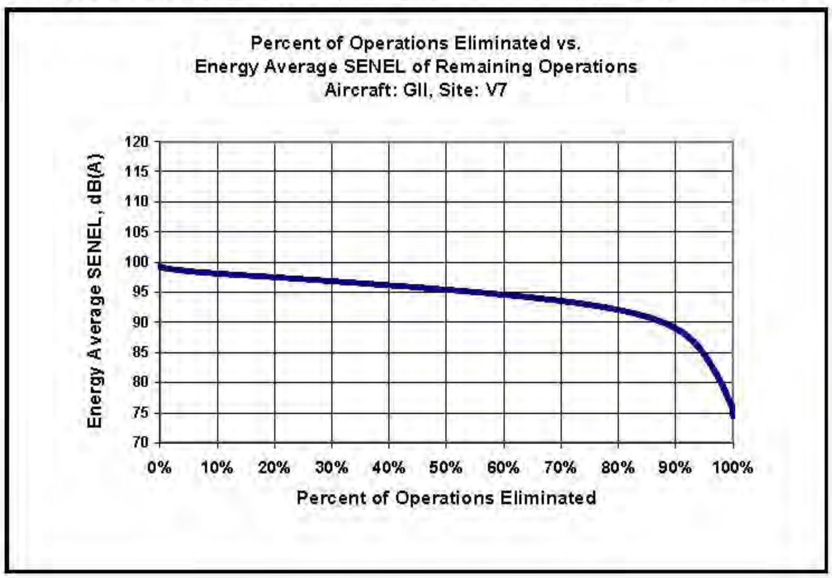


Figure 2 Effect on Energy Average SENEL of Eliminating Louder Operations



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2.3 Alternative Derivations of Limits

Since the previous analyses did not identify obvious noise limits, two methods were investigated based on the relationship between percent of operations affected and benefit achieved. Both methods continue LAWA's practice of providing an incentive to pilots of all aircraft types to operate as quietly as feasible. The Part 150 clearly intended to pursue this existing "equitable" approach, which places equal burden on all operators. The first method is based on achieving the same decibel reduction in energy average SENEL for each aircraft type. The second method is based on affecting the same percentage of operations in each aircraft type.

2.3.1 Method 1. Achieve Equal Reduction of Energy Average SENEL for Each Aircraft Type

The first method sets decibels of reduction in energy average SENEL as the goal and computes the noise limit and the percent of operations that would have to be reduced to that limit to achieve the desired reduction for each aircraft type. Table 4 presents the results.

Table 4 Noise Limits Required for Specific Decibel Reductions and Resulting Percent Operations Affected

			1 dB Energy Ave. SENEL Reduction		1.5 dB Energy Ave. SENEL Reduction		3 dB Energy Ave. SENEL Reduction	
Aircraft Type as Listed in VNDS	Sample Size[1]	Energy Average SENEL	Required Noise Limit	% Op'ns Reduced to Target	Required Noise Limit	% Opn's Reduced to Target	Required Noise Limit	% Op'ns Reduced to Target
A3	294	110.5	112.8	17.3	111.5	23.8	108.6	49.0
LR25	4383	100.8	102.5	16.1	101.1	28.9	98.5	62.2
SBR1	833	100.2	107.5	6.4	106.4	7.8	103.4	11.9
LR28	221	99.6	101.7	22.6	100.7	28.5	98.0	46.2
Gulf 2	8956	99.3	100.7	22.6	99.6	33.9	97.2	59.4
LR24	2043	98.4	99.9	17.7	98.6	30.8	96.2	64.5
Jetstar	457	95.6	97.5	19.9	96.4	28.4	93.8	51.9
Falcon 20	1553	92.3	96.7	7.0	94.7	11.2	90.9	39.0
MU30	243	90.8	90.2	70.4	89.6	79.4	88.0	90.9
HS125-400/600	9052	90.4	94.3	4.1	92.0	14.7	88.7	45.2
BEECH 400	2573	89.4	91.2	23.0	90.1	31.0	87.6	50.9
Falcon 10	329	88.7	89.7	25.8	88.7	39.2	86.5	64.4
Cessna 560	6543	88.6	90.8	15.5	89.5	24.3	86.7	50.6
HS800/1000	3229	88.5	90.4	18.6	89.2	28.0	86.6	52.9
Cessna 551	301	88.1	89.4	18.6	88.1	34.9	85.8	64.5
Cessna 550	4957	87.2	88.4	27.1	87.4	35.7	85.0	59.0
LR36	2928	86.8	88.9	12.0	87.3	23.8	84.5	59.3
LR55	4776	86.8	88.5	18.1	87.2	28.0	84.5	59.8
LR35	9675	85.7	88.1	12.0	86.5	20.7	83.4	56.9
LR31	1637	85.3	86.8	19.8	85.6	31.0	83.1	60.2
LR45	1498	85.3	85.6	38.2	94.7	51.5	82.7	75.2
LR60	4673	84.8	86.3	17.3	85.0	29.4	82.4	62.3

1 - VNDS SENEL Output (January 1998 - May 2007)

This table shows for the identified aircraft types the percent of operations that would exceed a limit chosen to reduce the energy average SENEL for that aircraft type by 1, 1.5, and 3 dB, based on historic VNDS measurements. The 1 dB goal was chosen to be similar to the average that would be achieved by enforcement of the existing targets or new limits (Table 3), while the 1.5 and 3 dB goals were chosen to reflect changes in CNEL considered significant by the FAA.[3]

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[3] In general terms, FAA Order 1050.1e, "Environmental Impacts: Policies and Procedures for Compliance with the National Environmental Policy Act," Washington, DC., 2004, (Appendix A, Section 14.4, p. A-61 – A-63) sets 1.5 and 3 dB increases in CNEL to be the thresholds of significant change at or above 65 dB DNL (CNEL) and between 60 and 65 dB DNL (CNEL), respectively.

For example, 16.1% of all LR25 departures would exceed a 102.5 dB limit; reducing the SENEL produced by those operations to the limit would reduce the measured energy average SENEL by one decibel (from 100.8 to 99.8 dB). Similarly, 22.6% of LR28 operations would exceed a limit of 101.7 dB and would need to be reduced to this level to lower the energy average from 99.6 dB to 98.6 dB.

2.3.2 Method 2: Affect Same Percent of Departures in Each Aircraft Type

The second method sets percent of departures affected as the goal, and computes the noise limit and the resulting reductions in energy average SENEL. Table 5 presents the results.

Table 5 Noise Limits to Affect Equal Percentages of Departure Operations and Resulting Reduction in Energy Average SENEL

Aircraft Type as Listed in VNDS	Sample Size[1]	Energy Average SENEL	2% of Operations Reduced to Target: Required Noise Limit	2% of Operations Reduced to Target: Energy Ave. SENEL Reduction	5% of Operations Reduced to Target: Required Noise Limit	5% of Operations Reduced to Target: Energy Ave. SENEL Reduction	10% of Operations Reduced to Target: Required Noise Limit	10% of Operations Reduced to Target: Energy Ave. SENEL Reduction
A3	294	110.5	116.3	-0.1	115.6	-0.2	114.4	-0.4
LR25	4383	100.8	107.5	-0.1	104.9	-0.5	103.5	-0.7
SBR1	833	100.2	109.6	-0.2	108.5	-0.6	104.7	-2.3
LR28	221	99.6	105.1	-0.1	104.2	-0.2	103.4	-0.3
Gulf 2	8956	99.3	104.8	-0.2	103.3	-0.4	101.8	-0.7
LR24	2043	98.4	104.2	-0.2	102.2	-0.4	101.0	-0.7
Jetstar	457	95.6	101.5	0.0	100.2	-0.2	98.9	-0.5
Falcon 20	1553	92.3	99.1	-0.5	97.6	-0.8	95.0	-1.4
MU30	243	90.8	93.4	0.0	92.8	-0.1	92.4	-0.1
HS125-400/600	9052	90.4	96.1	-0.8	93.7	-1.0	92.8	-1.2
BEECH 400	2573	89.4	94.9	-0.1	93.7	-0.3	92.2	-0.6
Falcon 10	329	88.7	93.1	-0.1	92.6	-0.2	91.9	-0.3
Cessna 560	6543	88.6	94.1	-0.4	92.4	-0.6	91.3	-0.8
HS800/1000	3229	88.5	93.7	-0.2	92.9	-0.3	91.8	-0.5
Cessna 551	301	88.1	94.2	-0.3	91.3	-0.6	90.2	-0.7
Cessna 550	4957	87.2	91.5	-0.2	90.6	-0.3	90.2	-0.3
LR36	2928	86.8	91.9	-0.5	90.8	-0.6	89.3	-0.9
LR55	4776	86.8	92.1	-0.2	91.2	-0.3	89.9	-0.5
LR35	9675	85.7	91.2	-0.4	90.0	-0.6	88.6	-0.8
LR31	1637	85.3	90.9	-0.1	89.9	-0.2	88.4	-0.5
LR45	1498	85.3	89.2	-0.1	88.4	-0.2	84.5	-0.3
LR60	4673	84.8	90.1	-0.3	88.6	-0.5	87.4	-0.7
Average:				*-0.3*		*-0.5*		*-0.7*

1 - VNDS SENEL Output (January 1998 - May 2007)

The computations were performed for targets that would affect 2%, 5%, and 10% of the departures in each aircraft type, based on historic VNDS measurements. For example, 2% of LR25 operations would exceed a 107.5 dB target and the energy average SENEL would be reduced by 0.1 dB if all the departures exceeding the target were reduced in level to that target.

2.3.3 Conclusion

The noise limit results presented in Table 4 and Table 5 are better balanced across aircraft types with regard to noise reduction than existing targets or the new limits developed using the historic target-setting approach (see Tables 1 and 2). However, Table 4 reveals that the "equal noise reduction" approach results in large variation across aircraft types in terms of the percent of operations that would be affected by enforcement. In addition, all three noise reduction levels investigated affect a large portion (over 50%) of operations in many types.

On the other hand, the "equal percent of operations" approach presented in Table 5 affects the same portion of operations in each aircraft type, by design. The resulting limits meet the Part 150 intent to continue the existing "equitable" approach; i.e., to place equal burden on operators of all aircraft types. The limits at which five percent of operations are affected result in an overall average noise reduction (approximately 0.5 dB) that is very close to the average noise reduction that would be achieved from enforcement of LAWA's existing informal target levels (see Table 3). Consequently, the next analysis was conducted assuming that the goal will be to set noise limits at the level that captures 5% of operations for each aircraft type.

2.4 What Are the Effects of Prohibiting Use of the Airport after Three Exceedances in Three Years?

2.4.1 Background

An important provision of this alternative is that violations (exceedances of formal limits) can result in denial of use of the airport. The penalty provisions of City of Los Angeles Ordinance No. 155,727, "Van Nuys Airport Noise Abatement and Curfew Regulation" that would apply to this restriction include two provisions of note:

- Section 7(c) states (in part):

  "Exclusion of Aircraft for Violations: In the event an aircraft has been operated in violation of any provision of this regulation on three or more occasions within a three-year period of the first violation, whether piloted by the same or different individuals, then it shall be presumed that future operations of said aircraft will result in continued violations. The Airport Manger shall thereafter deny said aircraft permission for a period of three years to tie-down, be based at, or takeoff from Airport" except a new owner of the aircraft can appeal the denial decision."

- Section 7(d) states:

  (b) Denial of Use of Airport. In the event any person has violated any provision of this regulation three (3) or more times within a three year period of the first violation, then for a period of three years thereafter, such person shall be deemed a persistent violator and be denied permission to depart from Airport in an aircraft owned, borrowed, rented or leased by such person and denied the right to lease, rent or use space for any aircraft (including tie-down) at Airport.

Using the measured data at V7, an analysis of noise limits can determine whether the Section 7(c) and (d) provisions will exclude many aircraft and operators from operating at VNY or even leasing, renting, or using space there. The analysis uses the historic data to estimate how many "violations" would have occurred had the noise limits been enforced. The limits examined are those determined in Section 2.3.2 to identify the loudest 5% of departures.

2.4.2 Frequent Users Appear Better Able to "Fly Quiet"

The measurement data suggest that aircraft that use VNY more frequently will produce fewer "violations" as a percent of their operations. First, as mentioned in Section 2.1.2, the new limits derived from measured data and the INM averaged 2.2 dB lower than the original targets. This reduction may be due to aircraft flying somewhat quieter than they were when the targets were first established in 1994. Second, measurement data show that the more an aircraft departs from VNY, the lower the percent of "violations."

Figure 3 presents the percent of aircraft departures with measured SENEL that exceed the 5% limits of Table 5.

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Figure 3 Percent of "Violations" as Determined with Measured SENEL and Limits Designed to Capture Five Percent of Departures

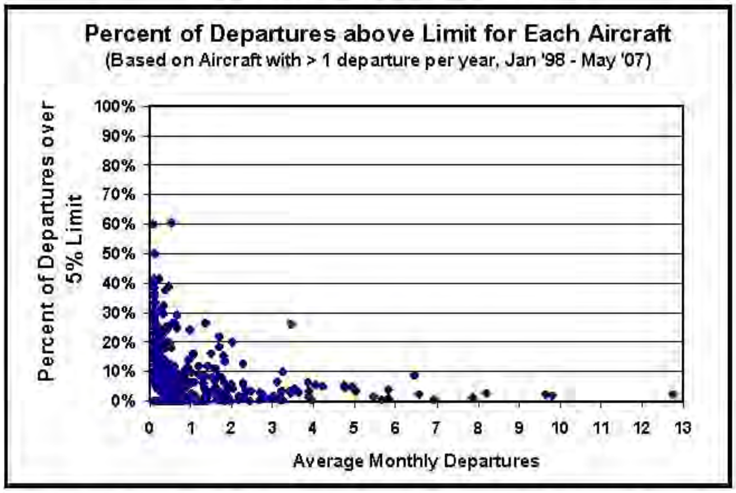

Figure 3 shows that for the aircraft with higher average monthly departures, the percent of those that exceed the 5% limit decreases. The question these data can answer is: *For those aircraft with the greatest number of departures (who have the most experience at VNY) would any of them have had sufficient "violations" to be prohibited from the use of VNY per Section 7(c) of Ordinance No. 155,727?* This question can be examined by analyzing the three aircraft that most frequently departed VNY in the January 1998 – May 2007 VNDS data sample used in this analysis, Table 6.

Table 6 Information about Most Frequent VNY Aircraft Departures

Av. Dep's. per Month	Aircraft	N Number	Operator	Total Dep's.	Associated 5% Limit	% Exceeding 5% Limit
12.8	C560	N54DD	International Jet Aviation Inc.	1442	92.4	2.4%
9.8	LR24	N664CL	Zenith Insurance Company	1108	102.2	1.8%
9.6	LR35	N364CL	Clay Lacy Aviation Inc.	1090	90	2.2%

Table 7 gives the number of departures that exceeded the limit for each aircraft for approximately nine and one-half years of data. The data show that C560 exceeded the three violation limit in any three-year period, the LR24 and LR35 exceeded it in any three years of the first seven years, and the LR35 just missed, by two days, of three exceedances within three years for the nine full years. These data provide another indication that the performance has generally improved over time with the current Fly Friendly program, but that even the most frequent users are eventually likely to be denied use of the airport. Since the "denial of use" provisions apply to aircraft and operators, the effect of a formal program would be extremely restrictive.

Table 7 Dates of Exceedance of Five Percent Noise Limit

Aircraft	Number of Departures Exceeding 5% Limit by Calendar Year									
	1998	1999	2000	2001	2002	2003	2004	2005	2006	Jan. - May '07
C560	3	10	4	4	0	1	2	0	8	2
LR24	10	2	2	0	4	0	2	0	no data	no data
LR35	7	7	1	3	3	2[1]	0	0	1[1]	0

1 - The first exceedance occurred on April 3, 2003, the second on May 26, 2003 and the third on April 4, 2006.

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3. IMPLEMENTATION AND PART 161 RELATED CONSIDERATIONS

The preceding analysis raises a number of implementation-related concerns related to the proposed formal target noise level alternative:

- Analysis of noise data measured at V7 over nine years suggests that virtually all aircraft and operators using the airport on a regular basis would be likely to exceed a reasonable limit enough times to prohibit them from using the airport in nearly any three-year period.
- To avoid fines and possible prohibition from use of the airport, operators may attempt to alter their departure procedures in undesirable ways. Though it is unlikely pilots would take unsafe actions, they may try to avoid flying over or too close to the monitors. Such action would ultimately be counter-productive relative to preferred noise abatement flight paths.
- Operators would be very likely to challenge measurements that identify a violation of the limit. VNY will need to be prepared to defend the measured levels. Such defense is likely to include the following types of challenges, among others that might benefit the operator's case:
  - Absence of other noises that may have affected the measured level
  - Presence or absence of other air traffic in the area that might have affected departure procedures
  - Method used to identify the specific aircraft that produced the measured sound level
  - Justification for setting limits,
  - Proper functioning and calibration of the monitoring equipment
  - Unusual meteorological conditions (e.g., temperature, air density, wind conditions, etc.) affecting aircraft performance or noise level
- Monitoring, documentation, and defense of limits are likely to require increased staffing. Legal counsel also will be required in the prosecution of violations and defense of challenges. It would not be unreasonable to expect the need to add one or two additional NMO staff to administer this rule.

With regard to Part 161, this measure would apply to Stage 3 aircraft, so it would trigger the additional burden associated with Stage 3 restrictions; i.e., demonstration that benefits are reasonably likely to exceed costs, satisfaction of the six statutory conditions, and FAA approval of the measure.

FAA's potential attitude toward this measure should be considered in light of long-standing agency policy guidance to airports. Specifically, FAA Advisory Circular 150/5020-1, "Noise Control and Compatibility Planning for Airports," Section 321 "Capacity Limits Based on Noise," published August 5, 1983, states:

> "Airport use restrictions are sometimes based upon noise limits. However, such restrictions often have uneven economic consequences and should be employed only after careful consideration of other alternatives and after thorough consultation with the affected parties. Some of the forms that such restrictions might take are as follows:
>
> "c. Restrictions based upon estimated single event noise levels. Since aircraft noise levels vary widely with changes in operational procedures, it may be possible to set limits on estimated-single event noise levels. ***However, it should be noted that this does not mean that the airport operator or community can set up a microphone and a noise level limit and challenge the pilots to 'beat the box.' The FAA considers this to be unsafe and has never approved such a scheme.*** Instead, a target noise level limit or threshold is discussed in advance with the FAA and the aircraft operators and an appropriate level is selected, balancing the needs of aviation and the noise impacts on the community. FAA Advisory Circular 36-3B, Estimated Airplane Noise Levels in A-Weighted Decibels is useful with this option." (Emphasis added.)

4. ENHANCED APPROACH TO VOLUNTARY PROGRAM IMPLEMENTATION

Based on the noise, implementation, and Part 161 related issues discussed in this memorandum, we recommend that LAWA pursue the objective of this measure through continued implementation of the voluntary Fly Friendly target noise level program, using either the updated and expanded jet departure targets that HMMH previously provided LAWA, or, preferably targets developed using the "equal percent of operations affected" approach discussed in Section 2.3.2.

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As noted throughout this memorandum, several aspects of our analysis provided objective bases for concluding that the existing program has been effective in reducing average departure noise levels. It is likely that an enhanced program using updated and expanded targets would help to provide even further noise reduction, by providing more precisely defined targets that are more appropriate for a broader range of aircraft.

In addition, the data analysis suggests that the effectiveness of the program could be further enhanced by increasing pilot interaction. As discussed, there is ample evidence that the most frequent aircraft operators (those departing once a month or more) tend to be quieter than less frequent users of VNY. As an example, Figure 4 presents data for Lear 35 aircraft, one of the most common jet types operating at VNY.

Figure 4 Measured Departure SENEL for Frequent and Infrequent Aircraft Operations

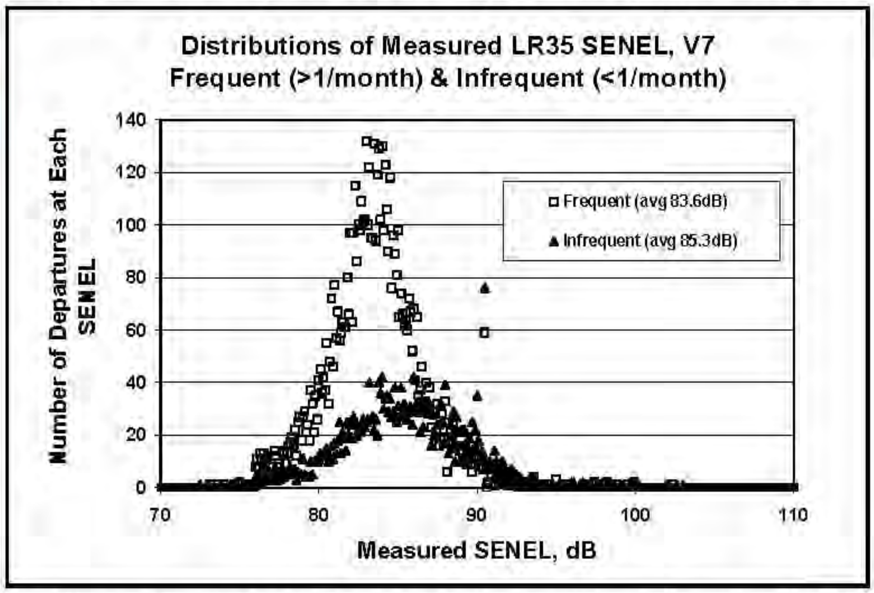

Figure 4 separates the measured SENEL distributions for departures conducted in two groups of LR35 aircraft: 1) those operating at VNY frequently – departing at least once a month on average, and 2) those operating at VNY less frequently – less than once per month. The plots clearly show the noise level distribution for infrequently operators is shifted to the right; that is to the "noisy" side of the SENEL axis, with an average SENEL approximately 1.7 dB higher than that for the frequent operators.

These data, together with those presented in Figure 3 raise the question: What departure procedures do the frequent users follow that result in lower noise levels? The techniques used by frequent operators should be shared with pilots of similar aircraft types, to determine if they could modify their procedures to improve performance. While LAWA NMO staff could act as a go-between, it would be most effective if a structure could be established for pilots to interact with each other, perhaps through a LAWA-sponsored workshop, training session, or even website.

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APPENDIX D INSTRUCTIONS FOR USE OF SPREADSHEET TO USE IN COMPUTING TARGET SENEL VALUES FROM NOISE MEASUREMENTS MADE AT NOISE MONITOR VNY13

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D.1 Introduction – Computing Target SENEL Values

The “Fly-Friendly” program at Van Nuys Airport uses “Target” values of SENEL to judge the noise made by individual aircraft departures as measured at noise monitor VNY13. Each aircraft type has a Target SENEL that pilots try not to exceed. The Targets are determined by historical SENEL data measured at VNY13. When more than 100 values of SENEL are collected for a specific aircraft type, the Excel Spreadsheet *COMPUTE_VNY_SENEL_TARGET_VNY13.xls* provides a means to compute a new target using these collected data.

D.2 Step 1: Export Necessary Data from ANOMS

The following table identifies the data needed and the Excel spreadsheet format for the data. These data will not only document the source of the data used, but also provide the information that the spreadsheet uses to compute and plot the results. Only departures on 16R or 16L are used. VNY is for confirmation that it is a departure from Van Nuys. Date, Time and Microphone_ID provide documentation. SENEL is the level that will be used to identify the target and INM_Type_ID documents how this aircraft is identified by ANOMS.

A	B	C	D	E	F	G
Runway_ID	Origin	Date	Time	Microphone_ID	SENEL	INM_Type_ID
16R or 16L	VNY					

D.3 Step 2: Open Target-Calculating Spreadsheet

Open the spreadsheet *COMPUTE_VNY_SENEL_TARGET_VNY13.xls*. This spreadsheet has four tabs. “Info” gives general descriptions of the other tabs; “Raw_Data” is the sheet into which the exported data are pasted. “Target_Calc” assists in identifying the target and also includes instructions; “Dist_plot” plots the SENEL values and shows where the target SENEL is located relative to the data.

D.4 Step 3: Paste Exported Data into “Raw_Data” Section of Spreadsheet

Open the Raw_Data tab.

Delete the data that are already there. This is most easily done by placing the curser in cell A2, holding down the shift key, then first pressing End and right arrow, then End and down arrow.

Release the shift key and press Delete key.

Put the cursor back in cell A2. (Edit, Go To…, Reference, type A2, OK)

Paste in the exported data, checking that the data in each column match the column headings.

Finally, sort the data by date. Easiest sorting technique is probably to highlight the entire sheet by placing the cursor in the left-most, upper corner, then use Data, Sort…, Sort by Date, Ascending, check “My data range has Header row”, OK. If there is a Sort Warning that some numbers are formatted as text, choose: “Sort anything that looks like a number, as a number.”

D.5 Step 4: Calculate Targets

Open the “Target_Calc” tab. Follow the instructions at the top of the sheet:

1. Check that the count of SENEL data points below is highlighted in green. (100+ operations)

2a. Find the target SENEL corresponding to the smallest % exceedance greater than or equal to 5%. Scan down the **% Exceedance** column until you identify the last occurrence of 5.x%.

2b. Default to an SENEL target of 90 or 110 dBA if the 5% target is beyond the upper or lower bound. If the SENEL value to the left of the 5.x% is less than 90, 90 will be the SENEL target value. If the SENEL is greater than 110, 110 will be the SENEL target value.

3. Change the coloring shown below (for the original data set) to the new 5% SENEL target level for this data set. Do this by using the cursor to highlight the cells with the coloring, selecting the "paint brush" in the tool bar, and then highlight the new SENEL and 5.x% cells. Remove the original coloring by highlighting a non-colored cell, and using the paint brush to remove the original coloring.

4. Move the "100" & "Target" cells to be alongside the new SENEL target data and copy a "0" & " " into the old cells. "Cut" the "100" and paste it into the row with the new target SENEL. Cut the word "Target" and paste it in the row, to the right of the 100. Enter "0" into the cell where the 100 was cut.

D.6 Step 5: Develop a Distribution Plot

1. Open the Dist_Plot tab.

2. Update the plot with the new SENEL target, % exceedance, total sample size, aircraft type, and also the date range from the Raw_Data worksheet.

3. Change the plot y-axis scale to 5% or 10%, if necessary to show all the data. For 10% use 1% as the major unit and adjust the text box size.

D.7 Step 6: Save the Spreadsheet with the Aircraft Name

Save the revised spread Target sheet with the aircraft identifier in the filename; e.g.:

COMPUTE_VNY_SENEL_TARGET_VNY13_A/CTYPE.xls.

This file will serve as documentation of the selection of the new target and confirm that the target was computed in accordance with the Fly Quiet program.

APPENDIX E DISTRIBUTIONS OF MEASURED SENEL AND TARGETS BASED ON LEVEL EXCEEDED BY FIVE PERCENT OF HISTORIC OPERATIONS

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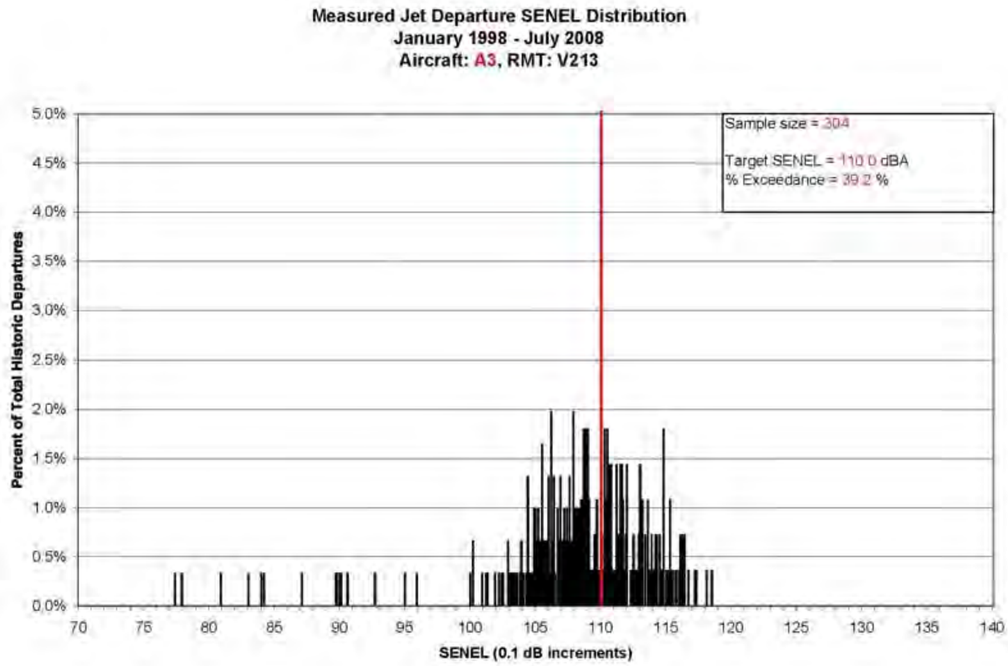
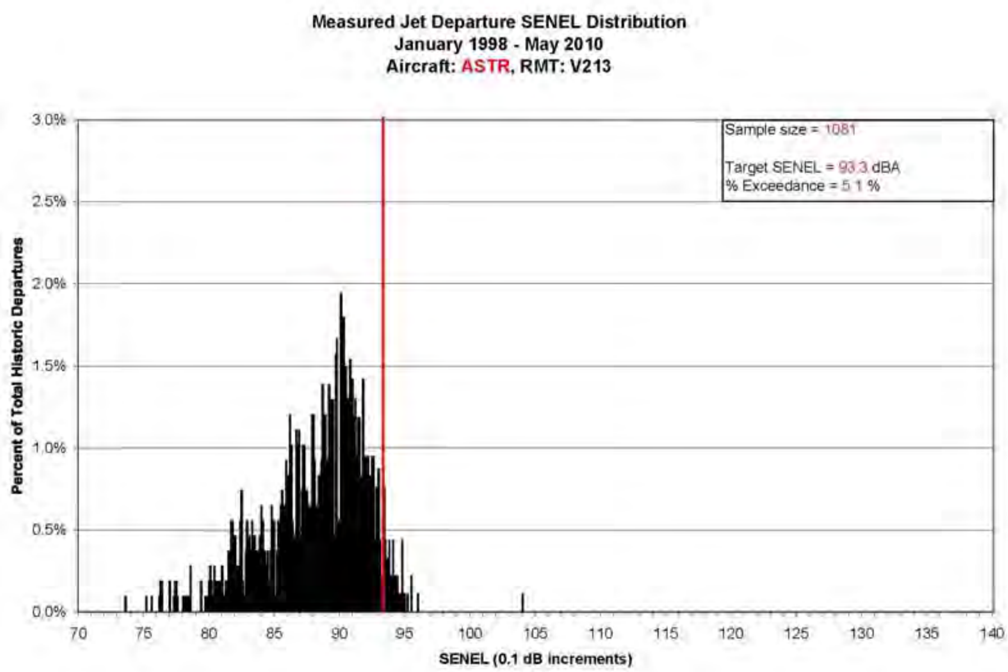
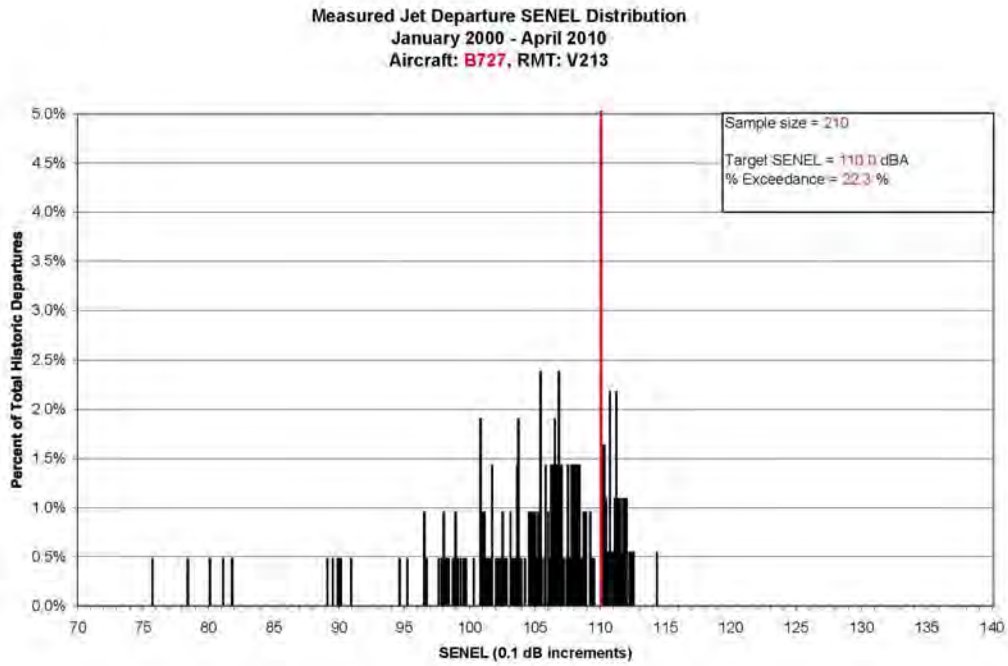
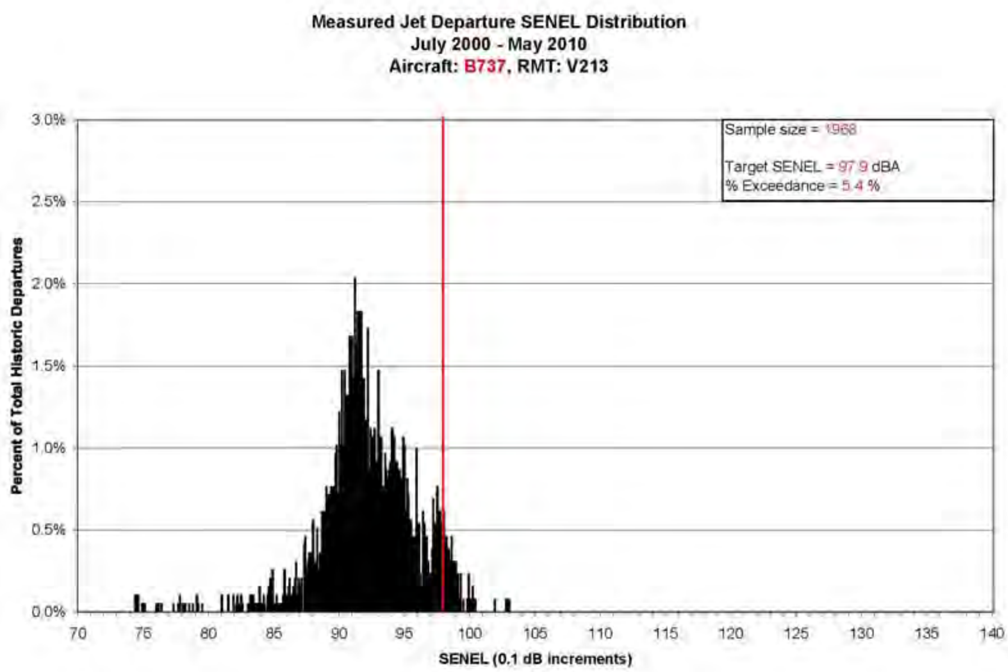
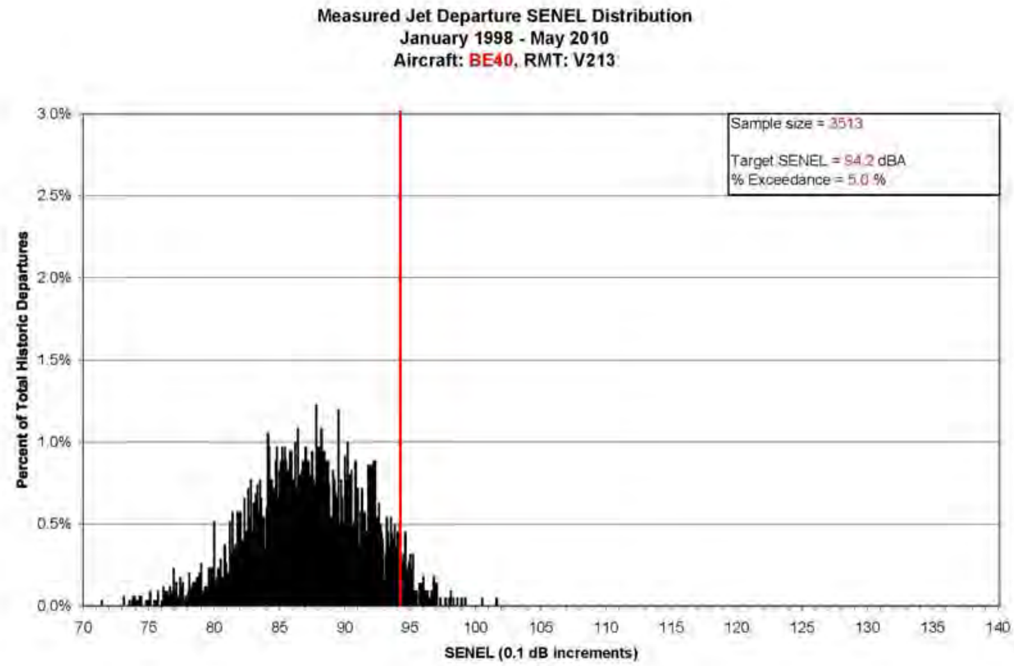
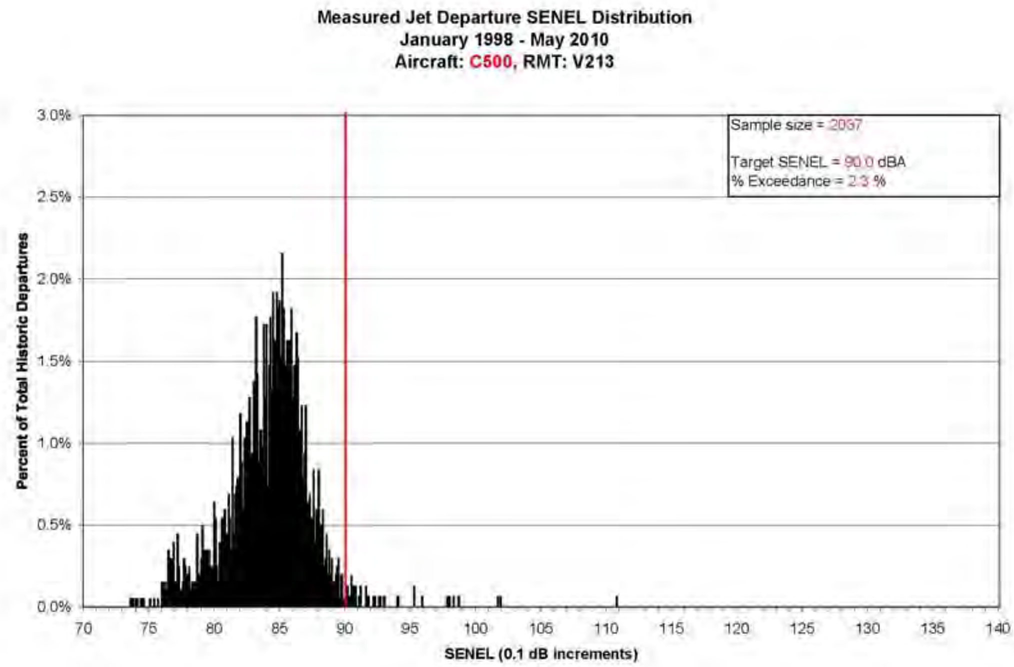

Measured Jet Departure SENEL Distribution
January 1998 - July 2008
Aircraft: A3, RMT: V213
Sample size = 304
Target SENEL = 110.0 dBA
% Exceedance = 39.2 %
Percent of Total Historic Departures
SENEL (0.1 dB increments)

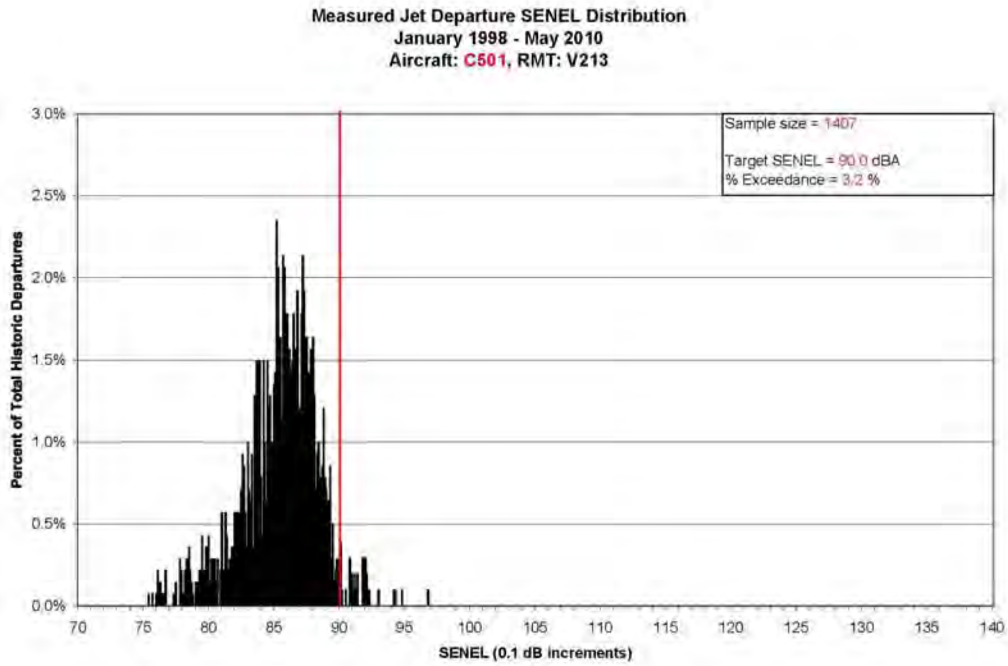

Measured Jet Departure SENEL Distribution
January 1998 - May 2010
Aircraft: ASTR, RMT: V213
Sample size = 1081
Target SENEL = 93.3 dBA
% Exceedance = 5.1 %
Percent of Total Historic Departures
SENEL (0.1 dB increments)

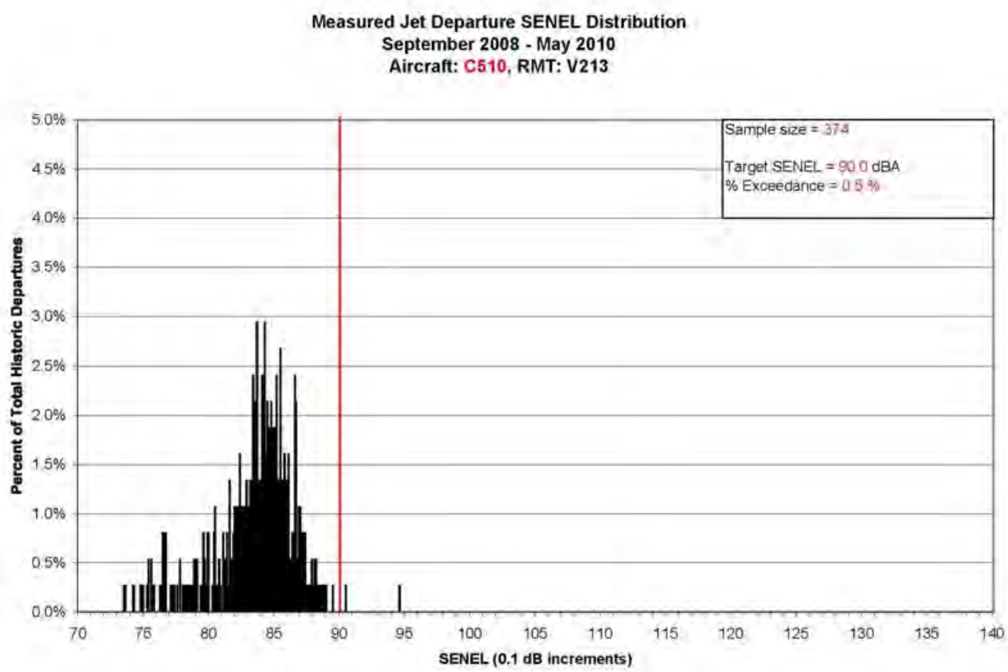

Measured Jet Departure SENEL Distribution
January 2000 - April 2010
Aircraft: B727, RMT: V213
Sample size = 210
Target SENEL = 110.0 dBA
% Exceedance = 22.3 %
Percent of Total Historic Departures
0.0%
0.5%
1.0%
1.5%
2.0%
2.5%
3.0%
3.5%
4.0%
4.5%
5.0%
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140
SENEL (0.1 dB increments)

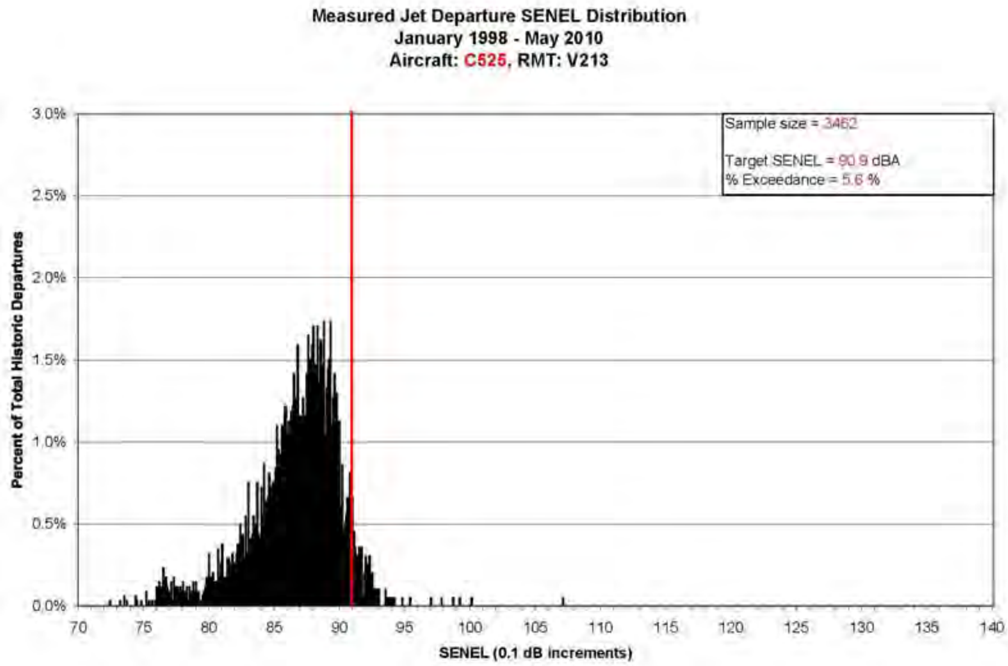

Measured Jet Departure SENEL Distribution
July 2000 - May 2010
Aircraft: B737, RMT: V213
Sample size = 1968
Target SENEL = 97.9 dBA
% Exceedance = 5.4 %
Percent of Total Historic Departures
0.0%
0.5%
1.0%
1.5%
2.0%
2.5%
3.0%
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140
SENEL (0.1 dB increments)

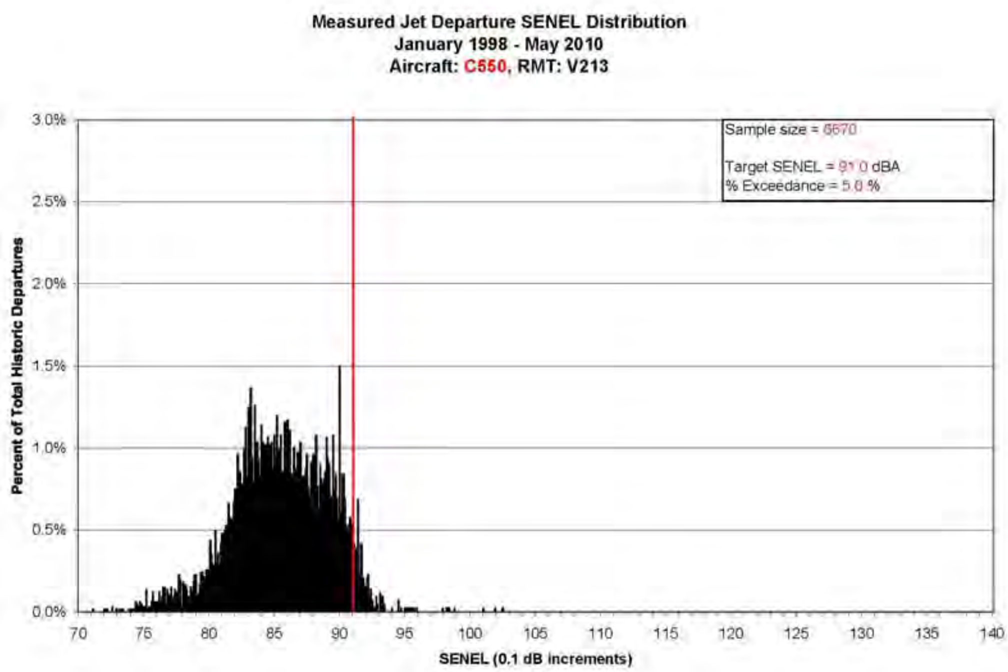

Measured Jet Departure SENEL Distribution
January 1998 - May 2010
Aircraft: BE40, RMT: V213
Sample size = 3513
Target SENEL = 94.2 dBA
% Exceedance = 5.0 %
Percent of Total Historic Departures
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140
SENEL (0.1 dB increments)

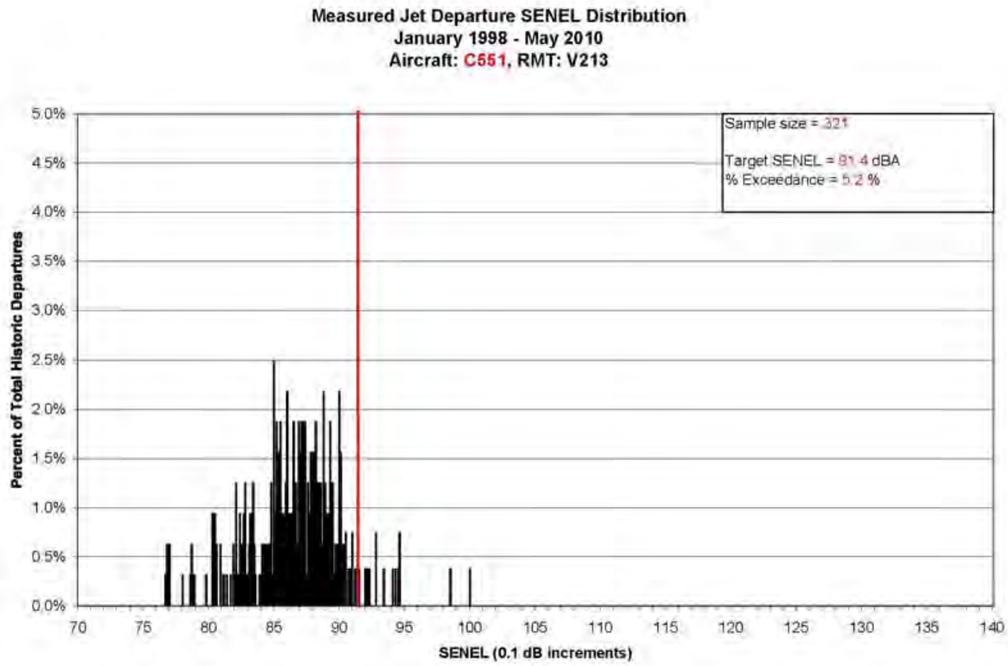

Measured Jet Departure SENEL Distribution
January 1998 - May 2010
Aircraft: C500, RMT: V213
Sample size = 2037
Target SENEL = 90.0 dBA
% Exceedance = 2.3 %
Percent of Total Historic Departures
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140
SENEL (0.1 dB increments)

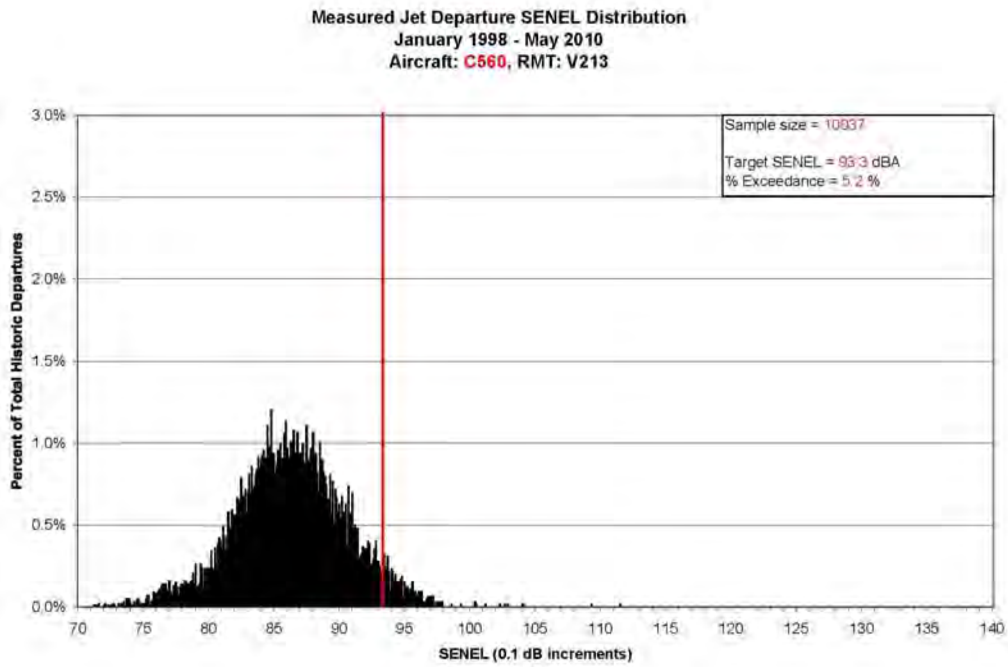

Measured Jet Departure SENEL Distribution
January 1998 - May 2010
Aircraft: C501, RMT: V213
Sample size = 1407
Target SENEL = 90.0 dBA
% Exceedance = 3.2 %
Percent of Total Historic Departures
SENEL (0.1 dB increments)
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
70 75 80 85 90 95 100 105 110 115 120 125 130 135 140

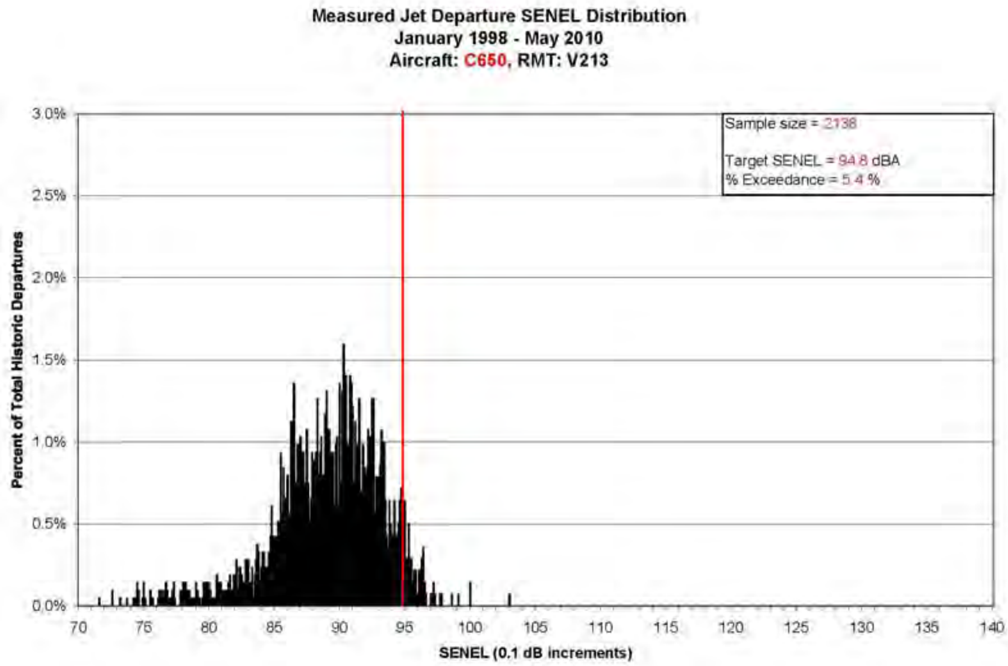

Measured Jet Departure SENEL Distribution
September 2008 - May 2010
Aircraft: C510, RMT: V213
Sample size = 374
Target SENEL = 90.0 dBA
% Exceedance = 0.5 %
Percent of Total Historic Departures
SENEL (0.1 dB increments)
5.0%
4.5%
4.0%
3.5%
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
70 75 80 85 90 95 100 105 110 115 120 125 130 135 140

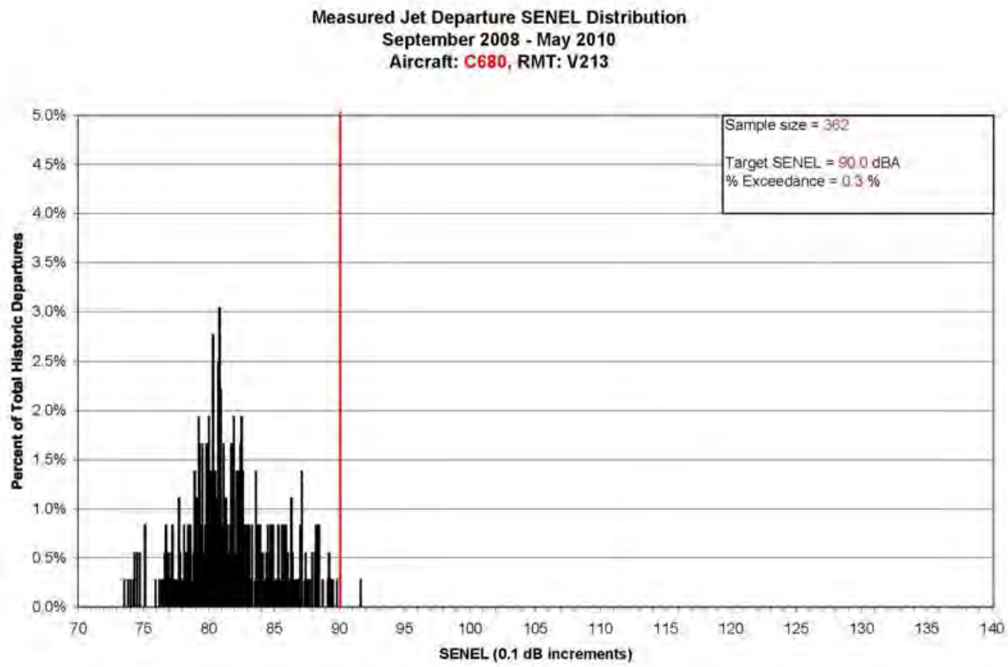

Measured Jet Departure SENEL Distribution
January 1998 - May 2010
Aircraft: C525, RMT: V213
Sample size = 3462
Target SENEL = 90.9 dBA
% Exceedance = 5.6 %
Percent of Total Historic Departures
SENEL (0.1 dB increments)
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140

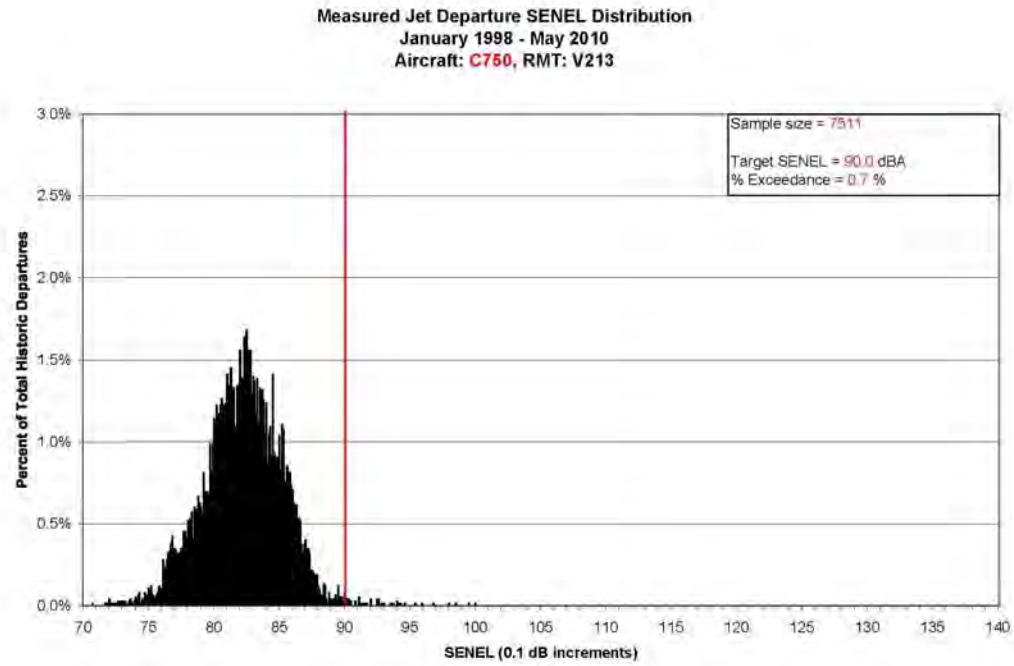

Measured Jet Departure SENEL Distribution
January 1998 - May 2010
Aircraft: C550, RMT: V213
Sample size = 6670
Target SENEL = 91.0 dBA
% Exceedance = 5.0 %
Percent of Total Historic Departures
SENEL (0.1 dB increments)
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140

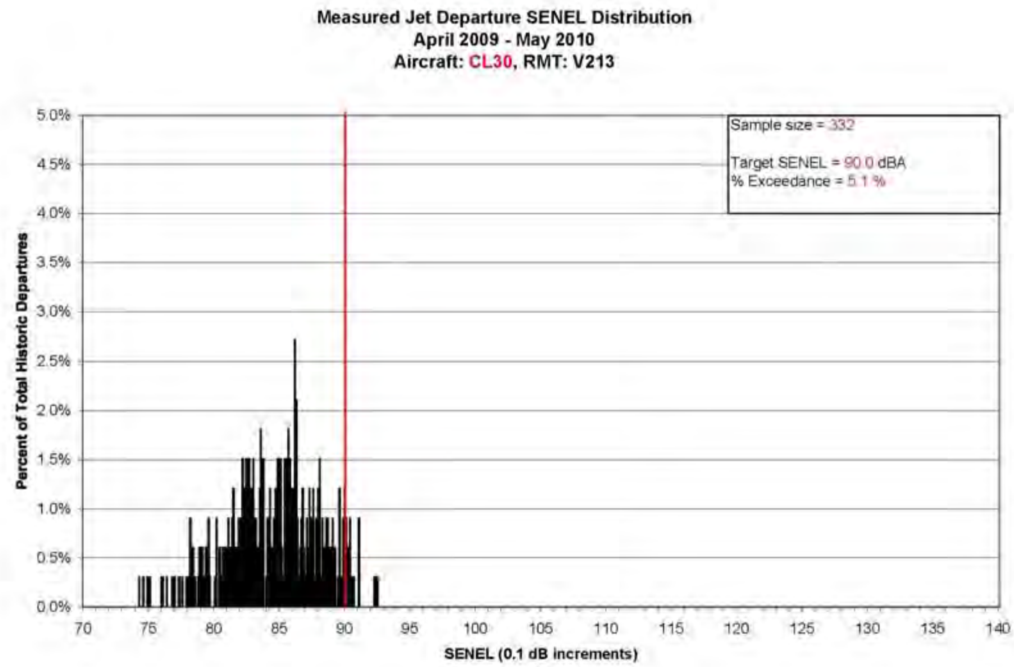

Measured Jet Departure SENEL Distribution
January 1998 - May 2010
Aircraft: C551, RMT: V213
Sample size = 321
Target SENEL = 91.4 dBA
% Exceedance = 5.2 %
Percent of Total Historic Departures
SENEL (0.1 dB increments)

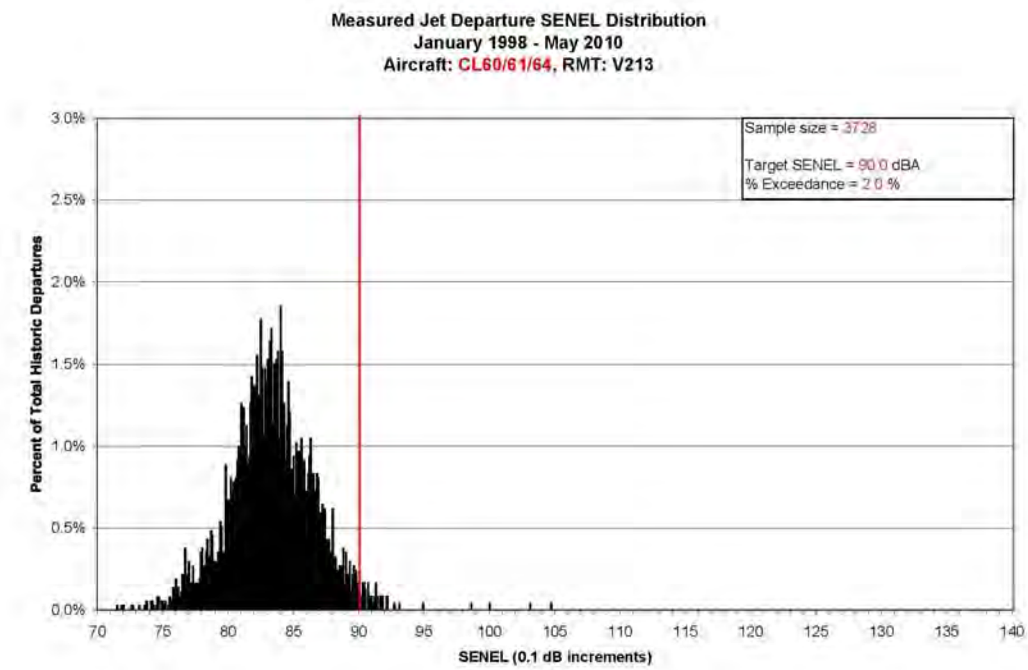

Measured Jet Departure SENEL Distribution
January 1998 - May 2010
Aircraft: C560, RMT: V213
Sample size = 10837
Target SENEL = 93.3 dBA
% Exceedance = 5.2 %
Percent of Total Historic Departures
SENEL (0.1 dB increments)

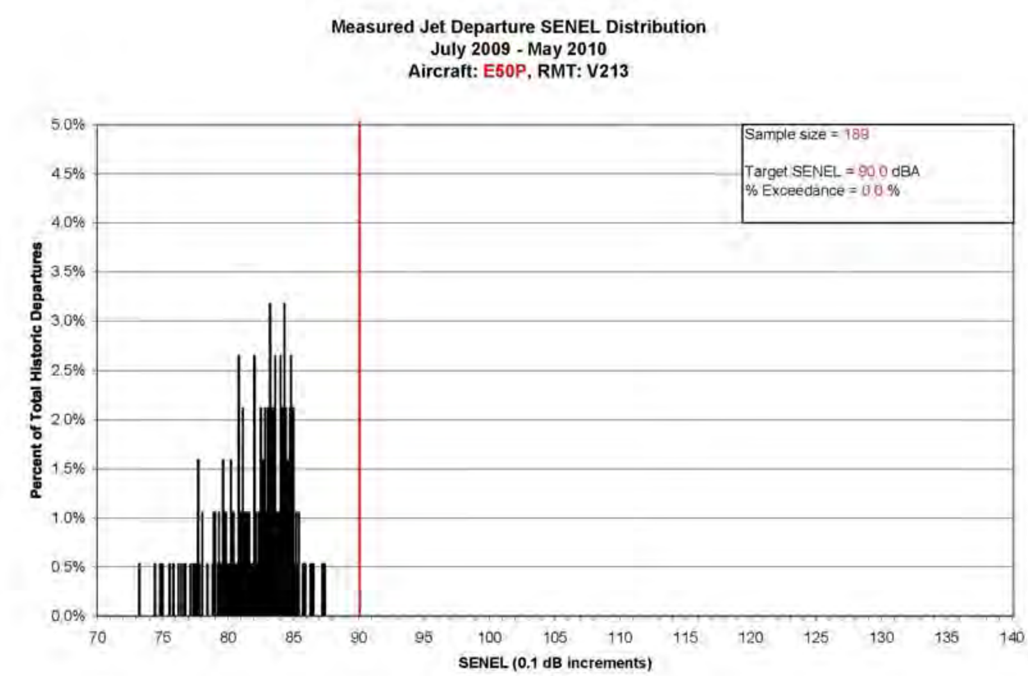

Measured Jet Departure SENEL Distribution
January 1998 - May 2010
Aircraft: C650, RMT: V213
Sample size = 2138
Target SENEL = 94.8 dBA
% Exceedance = 5.4 %
Percent of Total Historic Departures
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140
SENEL (0.1 dB increments)

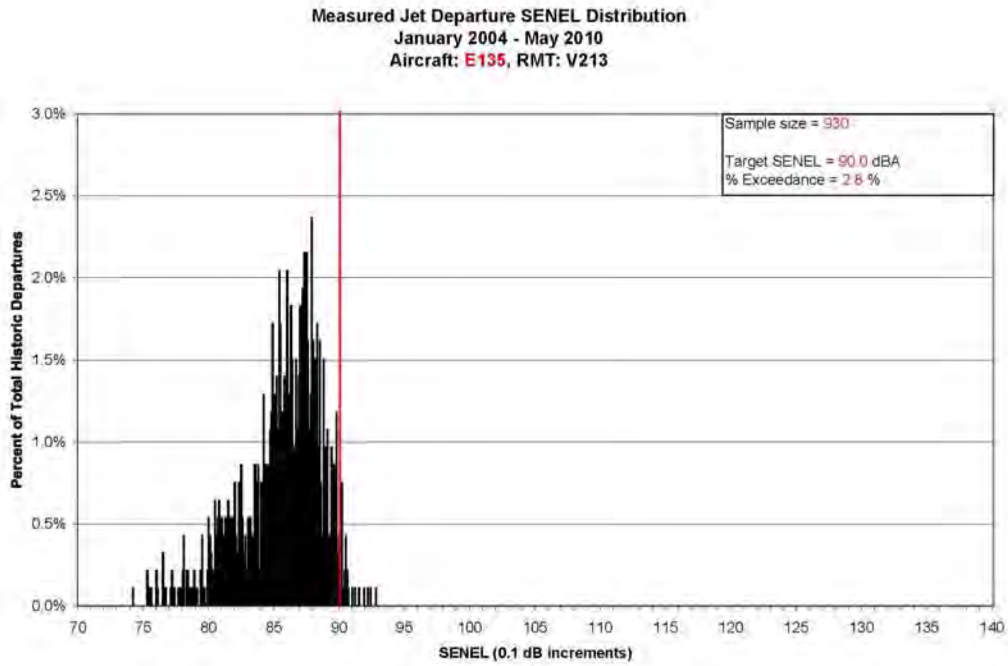

Measured Jet Departure SENEL Distribution
September 2008 - May 2010
Aircraft: C680, RMT: V213
Sample size = 362
Target SENEL = 90.0 dBA
% Exceedance = 0.3 %
Percent of Total Historic Departures
5.0%
4.5%
4.0%
3.5%
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140
SENEL (0.1 dB increments)

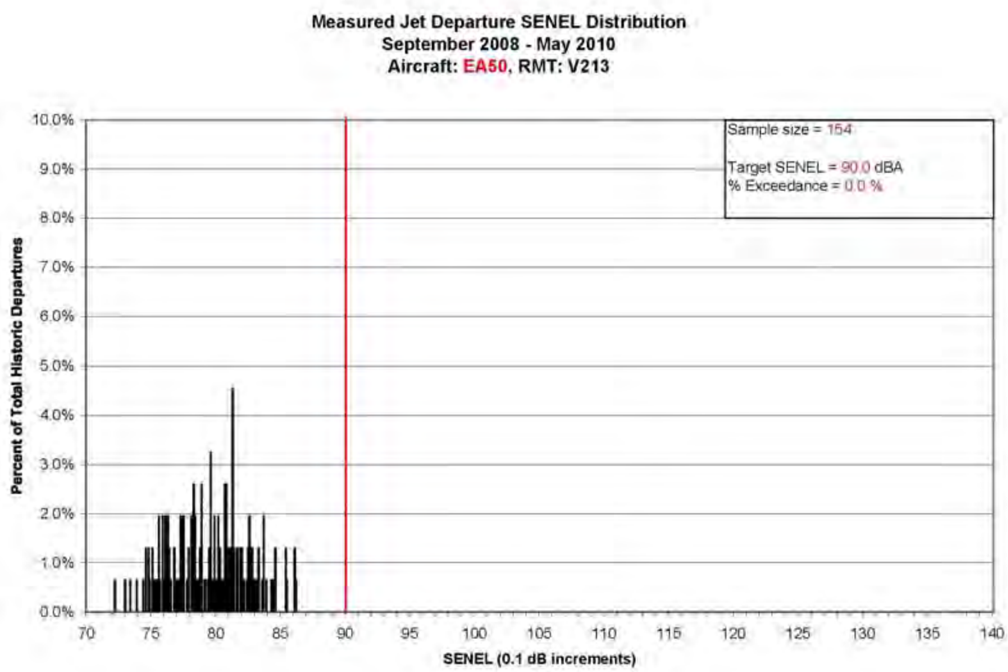

Measured Jet Departure SENEL Distribution
January 1998 - May 2010
Aircraft: C750, RMT: V213
Sample size = 7511
Target SENEL = 90.0 dBA
% Exceedance = 0.7 %
Percent of Total Historic Departures
SENEL (0.1 dB increments)


Measured Jet Departure SENEL Distribution
April 2009 - May 2010
Aircraft: CL30, RMT: V213
Sample size = 332
Target SENEL = 90.0 dBA
% Exceedance = 5.1 %
Percent of Total Historic Departures
SENEL (0.1 dB increments)

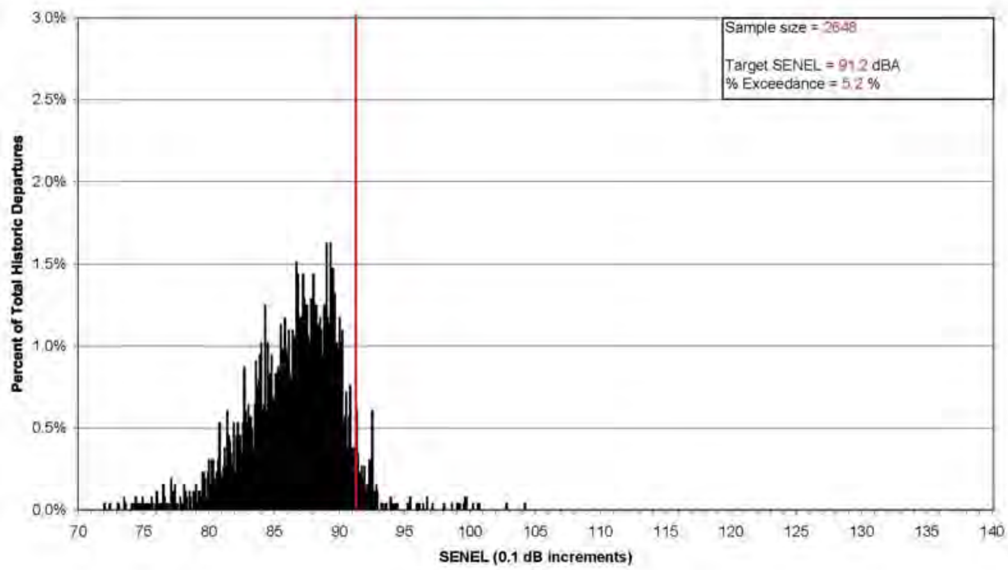

Measured Jet Departure SENEL Distribution
January 1998 - May 2010
Aircraft: CL60/61/64, RMT: V213
Sample size = 3728
Target SENEL = 90.0 dBA
% Exceedance = 2.0 %
Percent of Total Historic Departures
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140
SENEL (0.1 dB increments)


Measured Jet Departure SENEL Distribution
July 2009 - May 2010
Aircraft: E50P, RMT: V213
Sample size = 188
Target SENEL = 90.0 dBA
% Exceedance = 0.0 %
Percent of Total Historic Departures
5.0%
4.5%
4.0%
3.5%
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140
SENEL (0.1 dB increments)

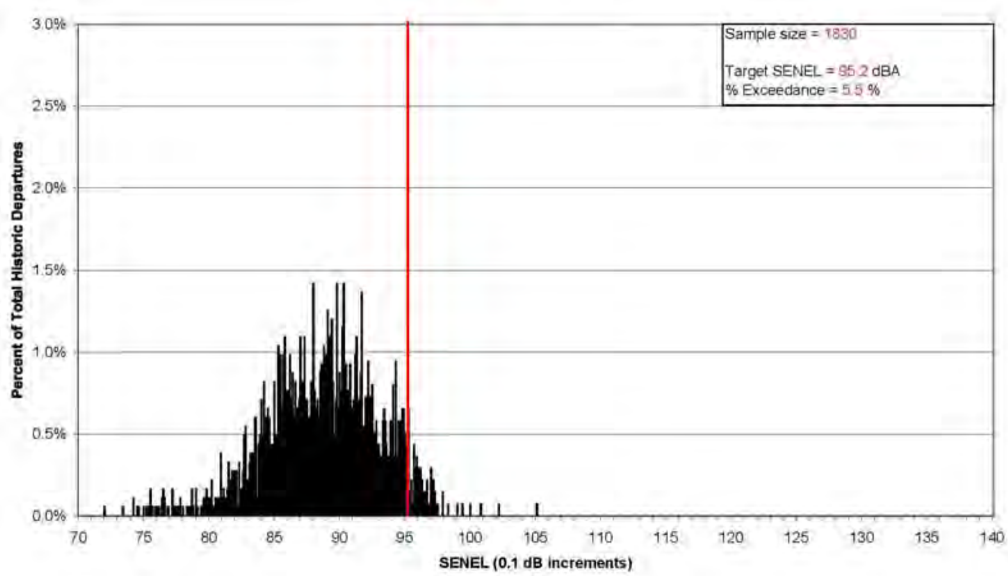

Measured Jet Departure SENEL Distribution
January 2004 - May 2010
Aircraft: E135, RMT: V213
Sample size = 930
Target SENEL = 90.0 dBA
% Exceedance = 2.8 %
Percent of Total Historic Departures
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140
SENEL (0.1 dB increments)

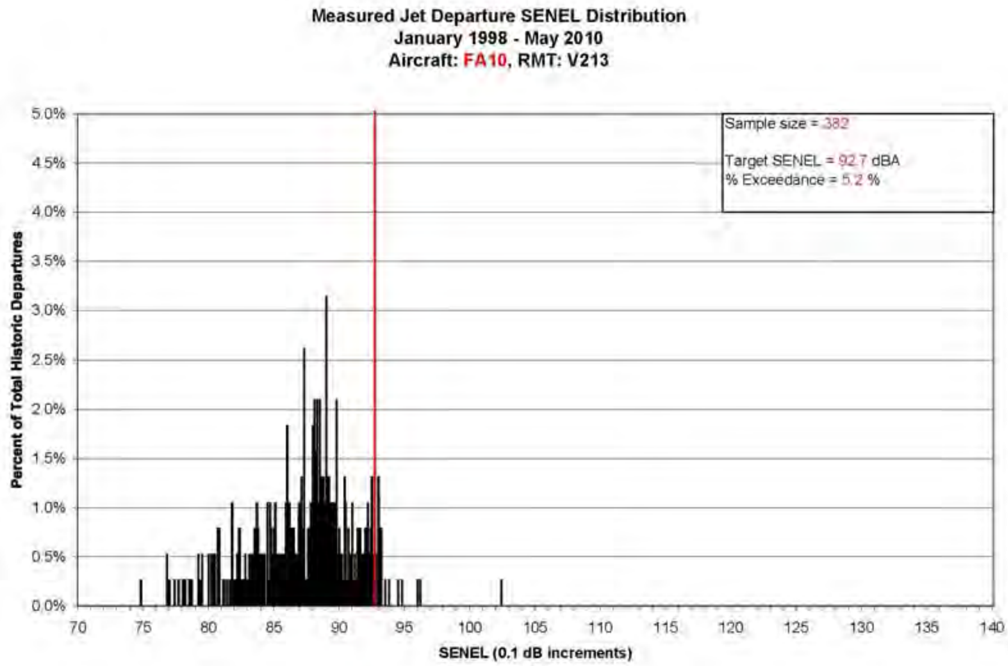

Measured Jet Departure SENEL Distribution
September 2008 - May 2010
Aircraft: EA50, RMT: V213
Sample size = 154
Target SENEL = 90.0 dBA
% Exceedance = 0.0 %
Percent of Total Historic Departures
10.0%
9.0%
8.0%
7.0%
6.0%
5.0%
4.0%
3.0%
2.0%
1.0%
0.0%
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140
SENEL (0.1 dB increments)

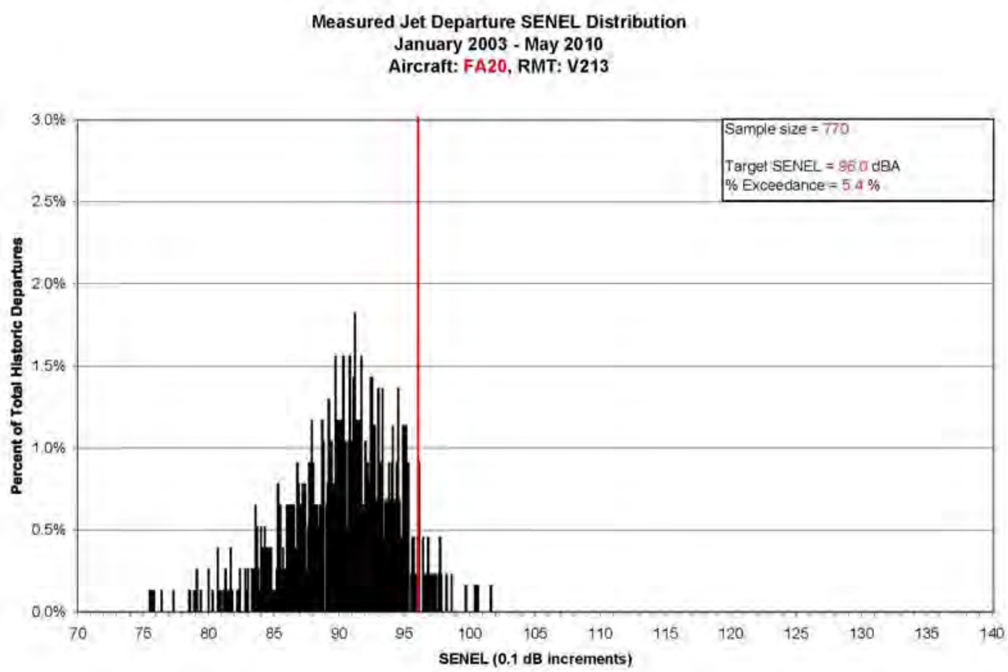
Measured Jet Departure SENEL Distribution
January 2005 - May 2010
Aircraft: F2TH, RMT: V213

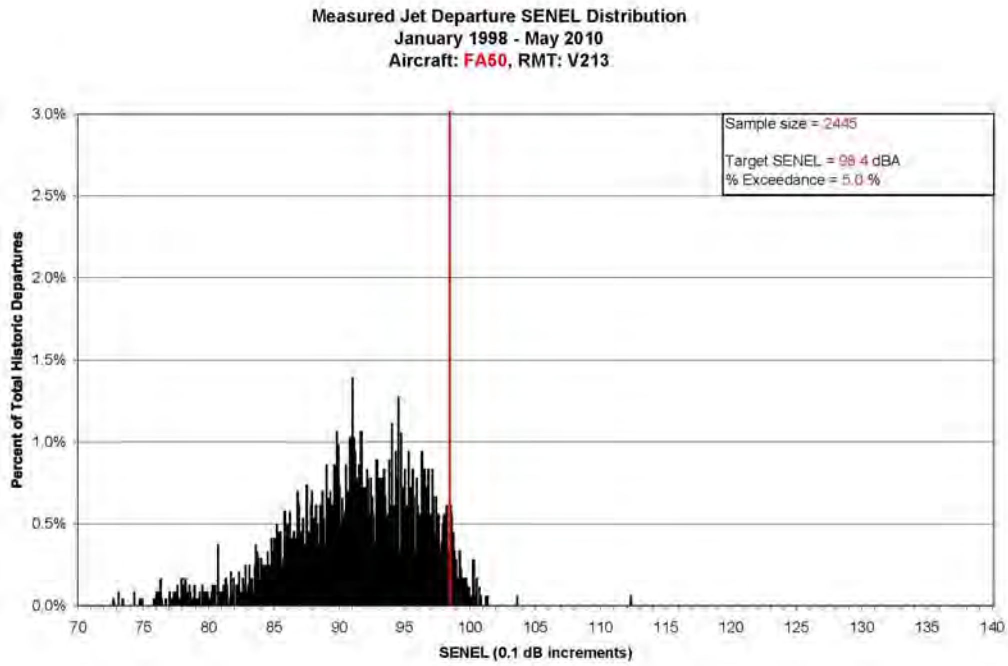


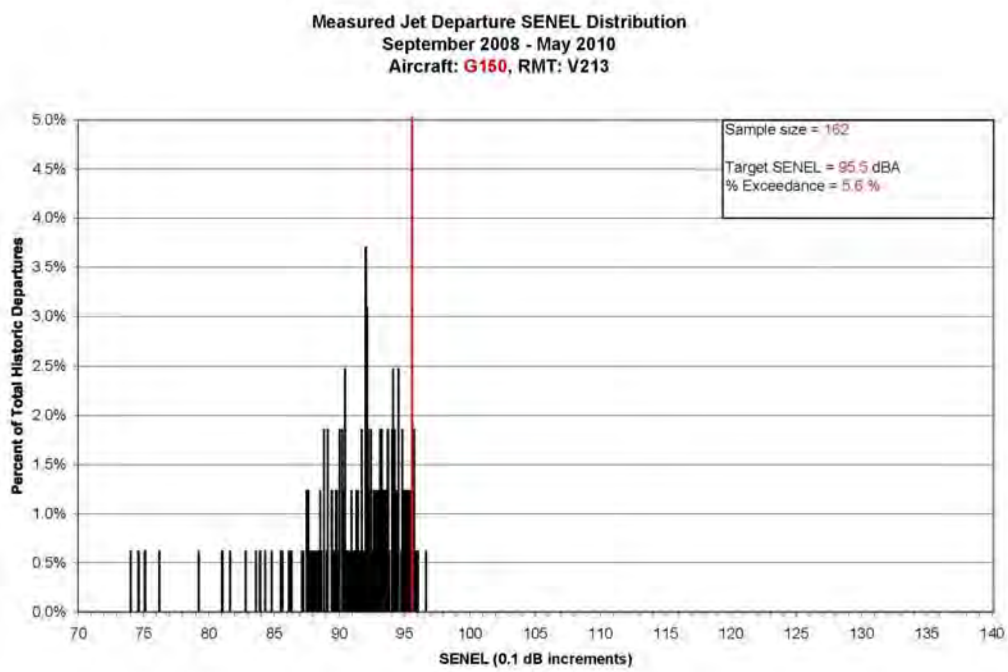
Measured Jet Departure SENEL Distribution
January 1998 - May 2010
Aircraft: F900, RMT: V213

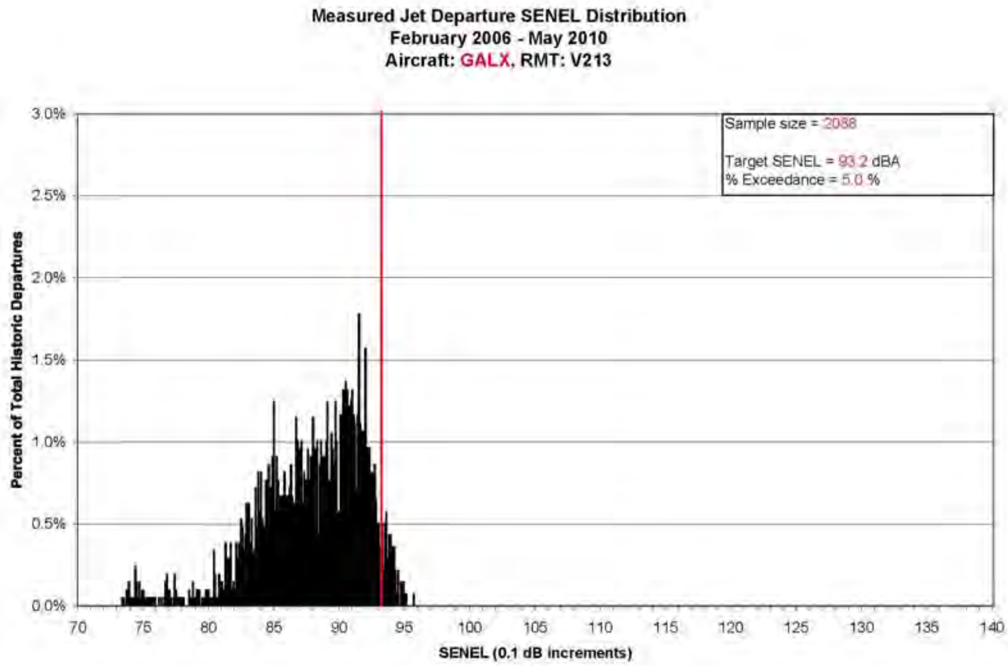


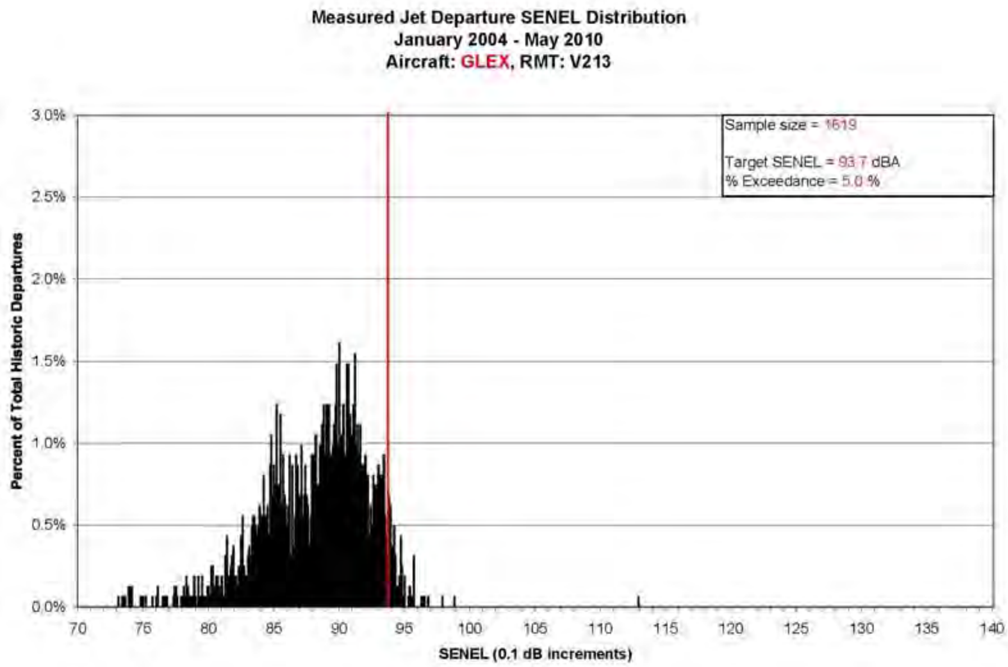

Measured Jet Departure SENEL Distribution
January 1998 - May 2010
Aircraft: FA10, RMT: V213
Sample size = 382
Target SENEL = 92.7 dBA
% Exceedance = 5.2 %
Percent of Total Historic Departures
SENEL (0.1 dB increments)

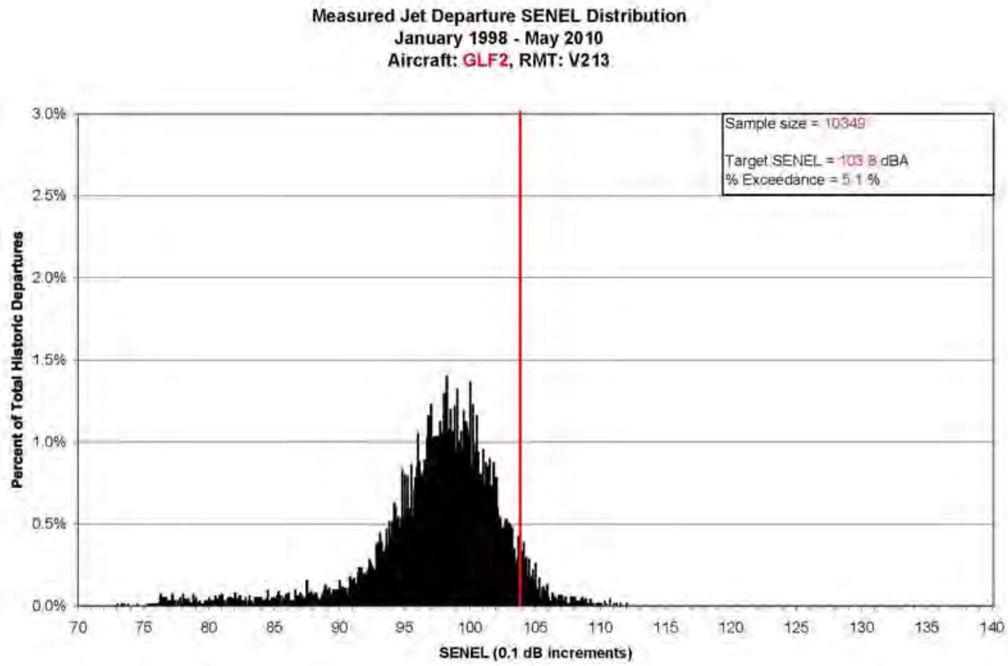

Measured Jet Departure SENEL Distribution
January 2003 - May 2010
Aircraft: FA20, RMT: V213
Sample size = 770
Target SENEL = 96.0 dBA
% Exceedance = 5.4 %
Percent of Total Historic Departures
SENEL (0.1 dB increments)

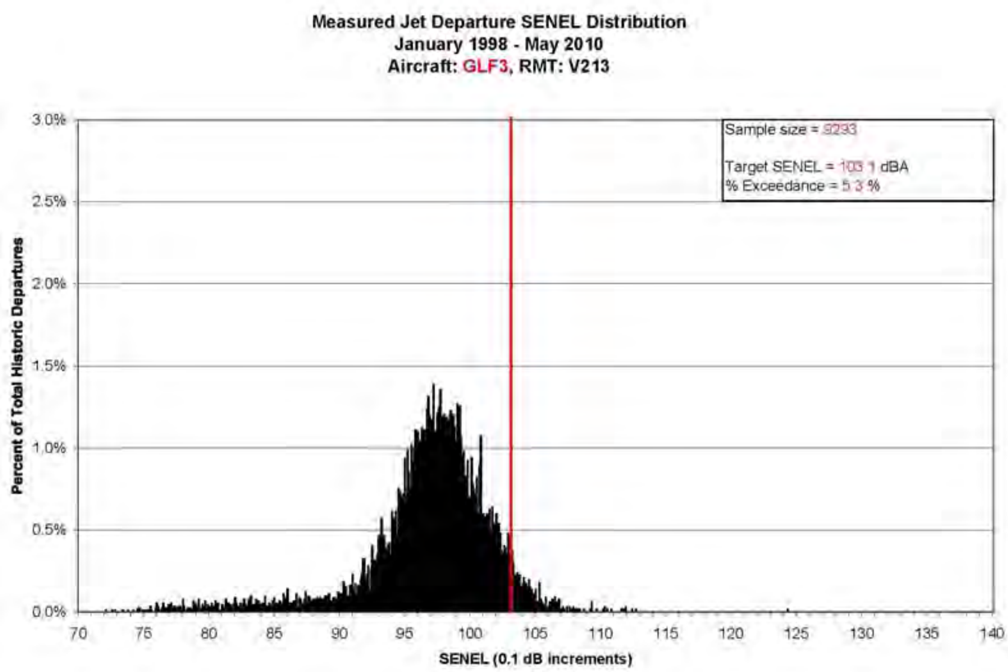

Measured Jet Departure SENEL Distribution
January 1998 - May 2010
Aircraft: FA50, RMT: V213
Sample size = 2445
Target SENEL = 98.4 dBA
% Exceedance = 5.0 %
Percent of Total Historic Departures
SENEL (0.1 dB increments)
0.0%
0.5%
1.0%
1.5%
2.0%
2.5%
3.0%
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140

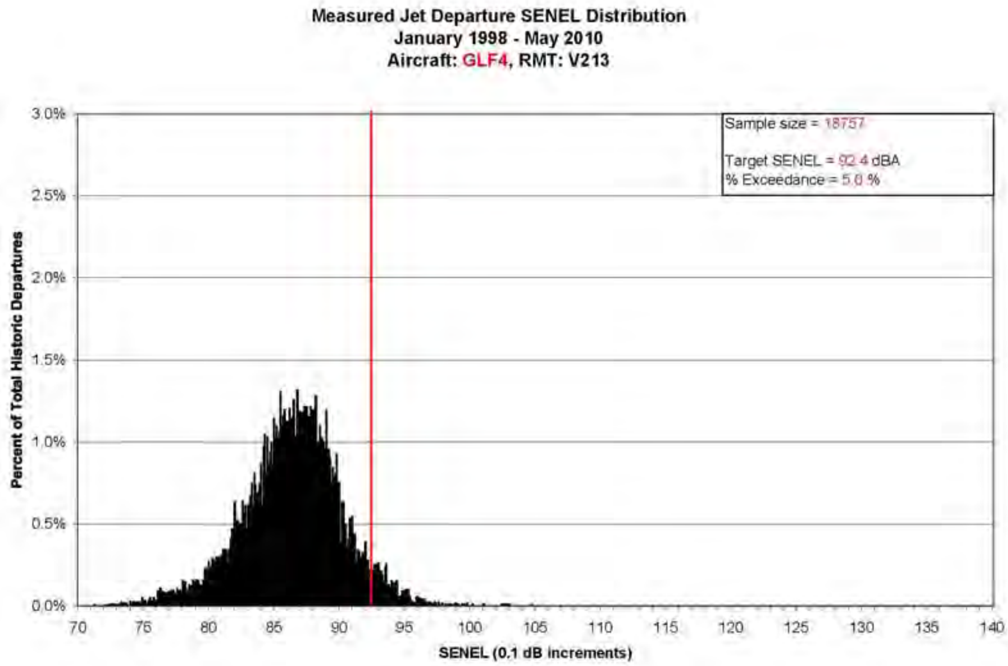

Measured Jet Departure SENEL Distribution
September 2008 - May 2010
Aircraft: G150, RMT: V213
Sample size = 162
Target SENEL = 95.5 dBA
% Exceedance = 5.6 %
Percent of Total Historic Departures
SENEL (0.1 dB increments)
0.0%
0.5%
1.0%
1.5%
2.0%
2.5%
3.0%
3.5%
4.0%
4.5%
5.0%
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140

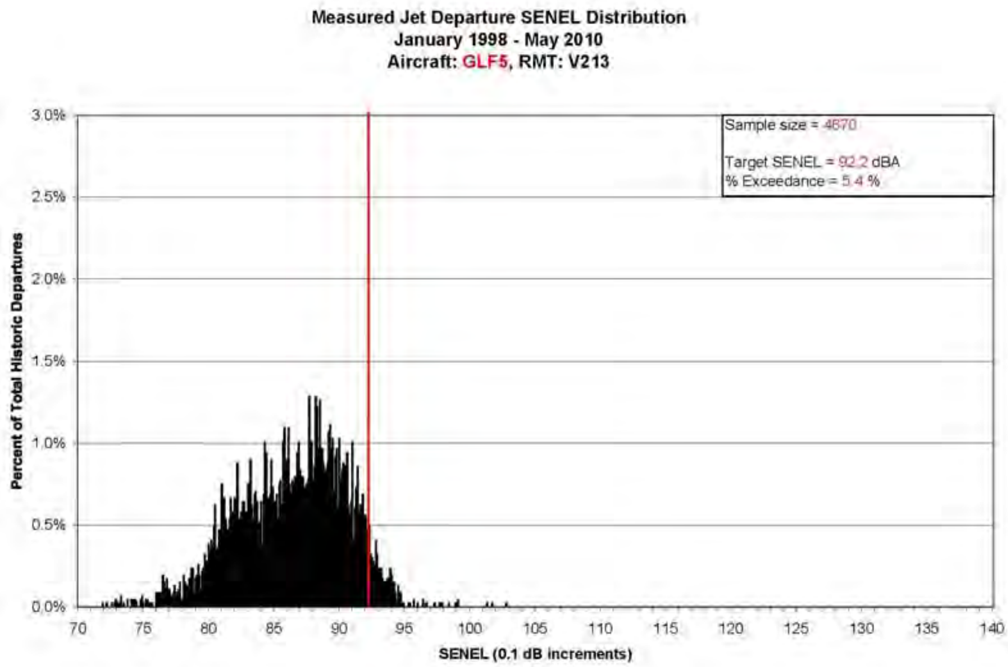

Measured Jet Departure SENEL Distribution
February 2006 - May 2010
Aircraft: GALX, RMT: V213
Sample size = 2088
Target SENEL = 93.2 dBA
% Exceedance = 5.0 %
Percent of Total Historic Departures
SENEL (0.1 dB increments)
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140

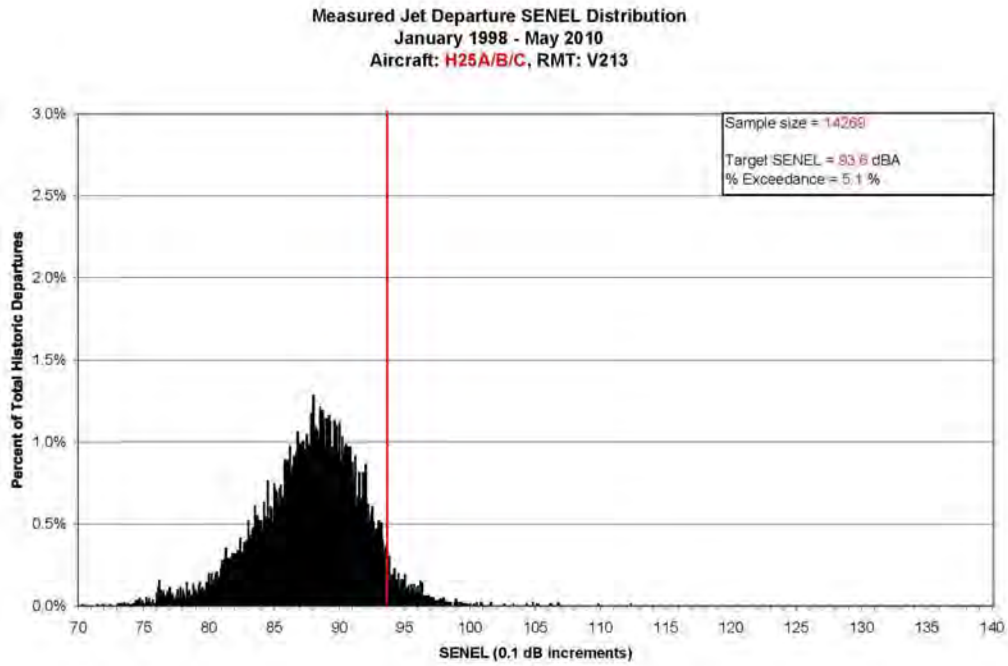

Measured Jet Departure SENEL Distribution
January 2004 - May 2010
Aircraft: GLEX, RMT: V213
Sample size = 1619
Target SENEL = 93.7 dBA
% Exceedance = 5.0 %
Percent of Total Historic Departures
SENEL (0.1 dB increments)
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140

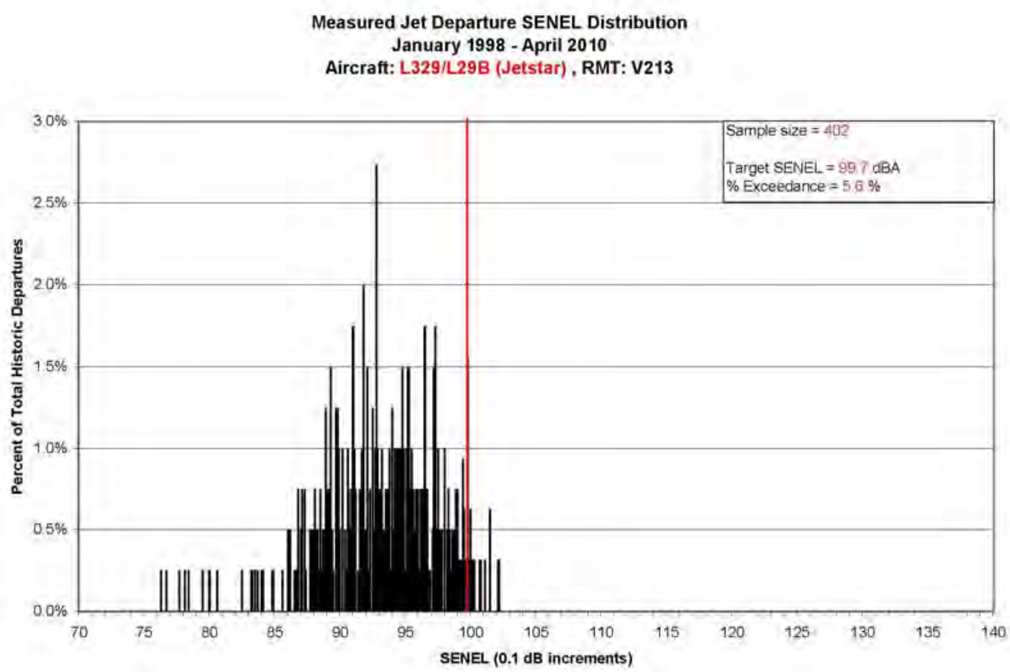

Measured Jet Departure SENEL Distribution
January 1998 - May 2010
Aircraft: GLF2, RMT: V213
Sample size = 10349
Target SENEL = 103.8 dBA
% Exceedance = 5.1 %
Percent of Total Historic Departures
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
70 75 80 85 90 95 100 105 110 115 120 125 130 135 140
SENEL (0.1 dB increments)


Measured Jet Departure SENEL Distribution
January 1998 - May 2010
Aircraft: GLF3, RMT: V213
Sample size = 9293
Target SENEL = 103.1 dBA
% Exceedance = 5.3 %
Percent of Total Historic Departures
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
70 75 80 85 90 95 100 105 110 115 120 125 130 135 140
SENEL (0.1 dB increments)

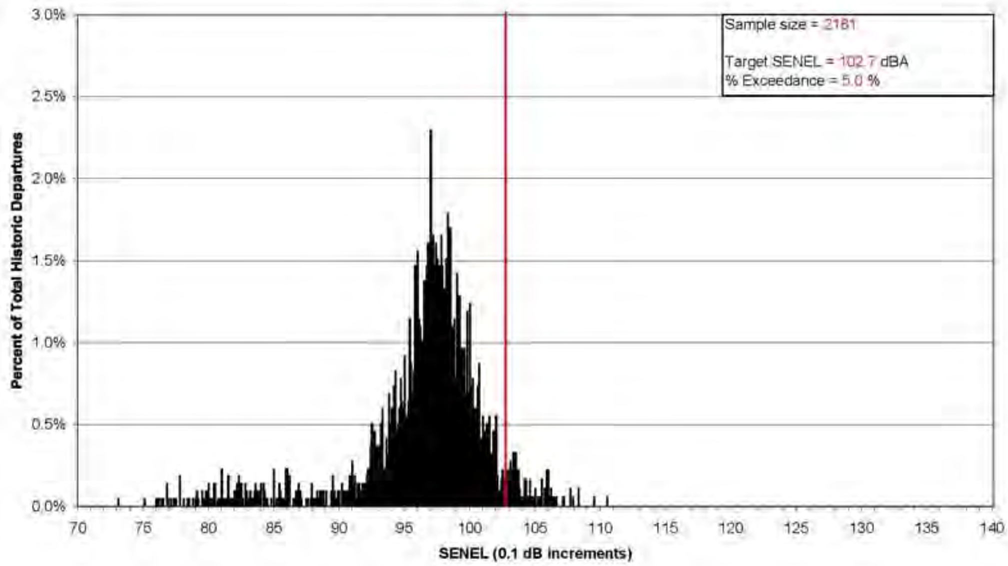

Measured Jet Departure SENEL Distribution
January 1998 - May 2010
Aircraft: GLF4, RMT: V213
Sample size = 18757
Target SENEL = 92.4 dBA
% Exceedance = 5.0 %
Percent of Total Historic Departures
SENEL (0.1 dB increments)
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140


Measured Jet Departure SENEL Distribution
January 1998 - May 2010
Aircraft: GLF5, RMT: V213
Sample size = 4670
Target SENEL = 92.2 dBA
% Exceedance = 5.4 %
Percent of Total Historic Departures
SENEL (0.1 dB increments)
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140

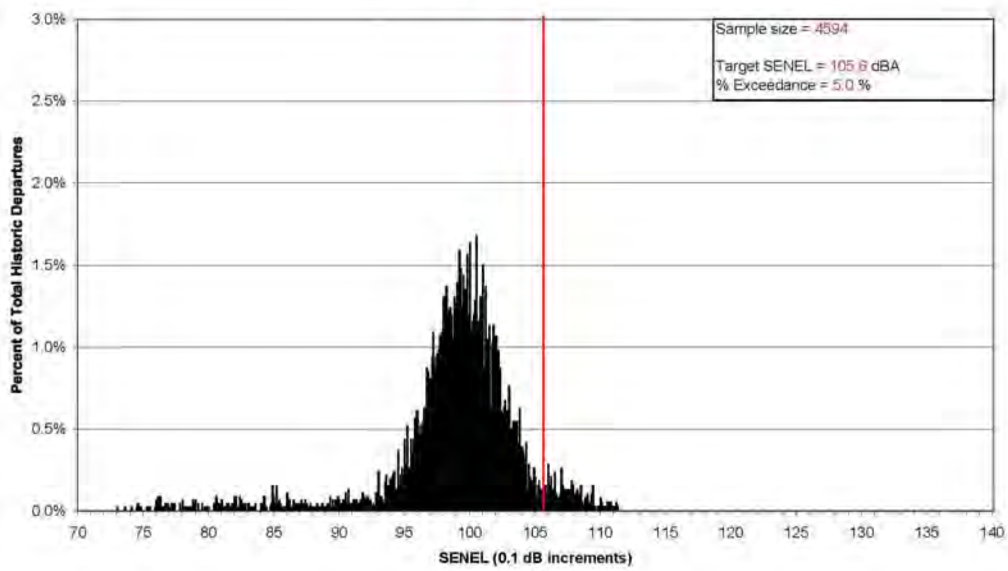

Measured Jet Departure SENEL Distribution
January 1998 - May 2010
Aircraft: H25A/B/C, RMT: V213
Sample size = 14269
Target SENEL = 93.6 dBA
% Exceedance = 5.1 %
Percent of Total Historic Departures
SENEL (0.1 dB increments)

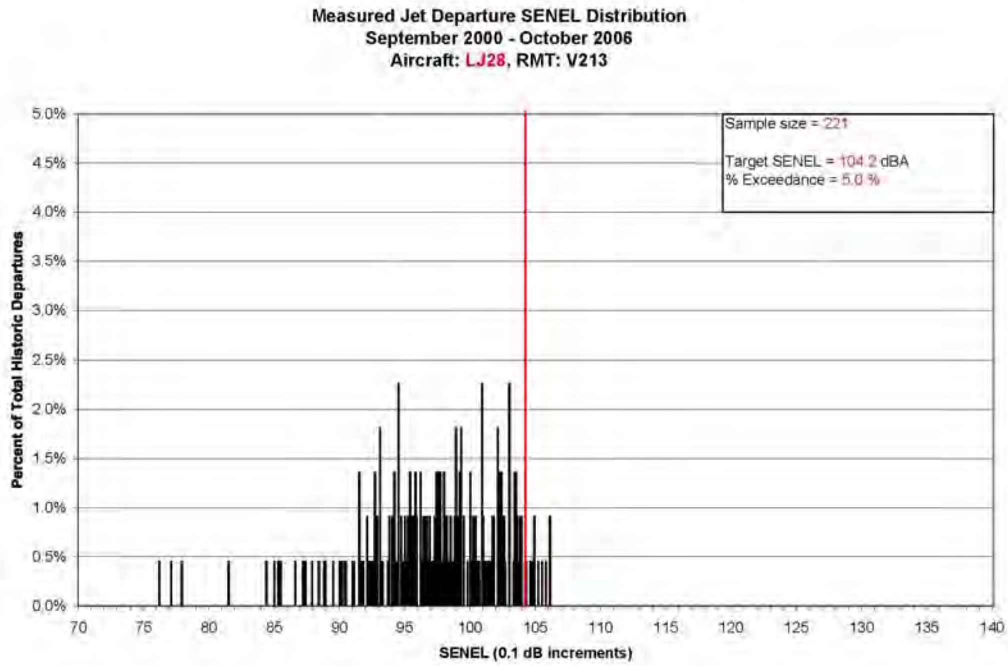

Measured Jet Departure SENEL Distribution
January 1998 - April 2010
Aircraft: L329/L29B (Jetstar) , RMT: V213
Sample size = 402
Target SENEL = 99.7 dBA
% Exceedance = 5.6 %
Percent of Total Historic Departures
SENEL (0.1 dB increments)

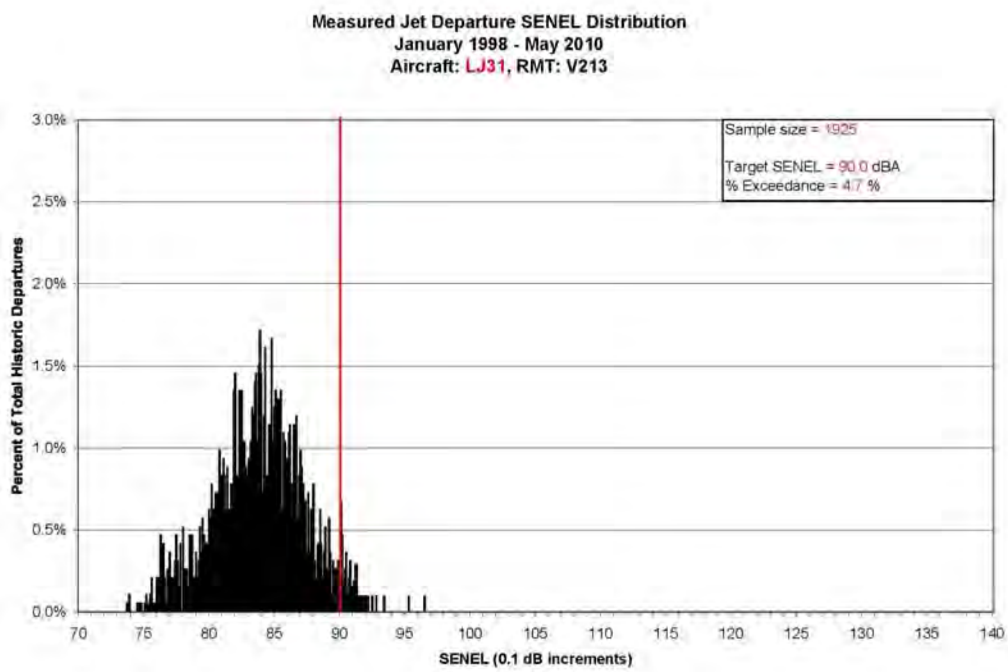
Measured Jet Departure SENEL Distribution
January 1998 - May 2010
Aircraft: LJ24, RMT: V213

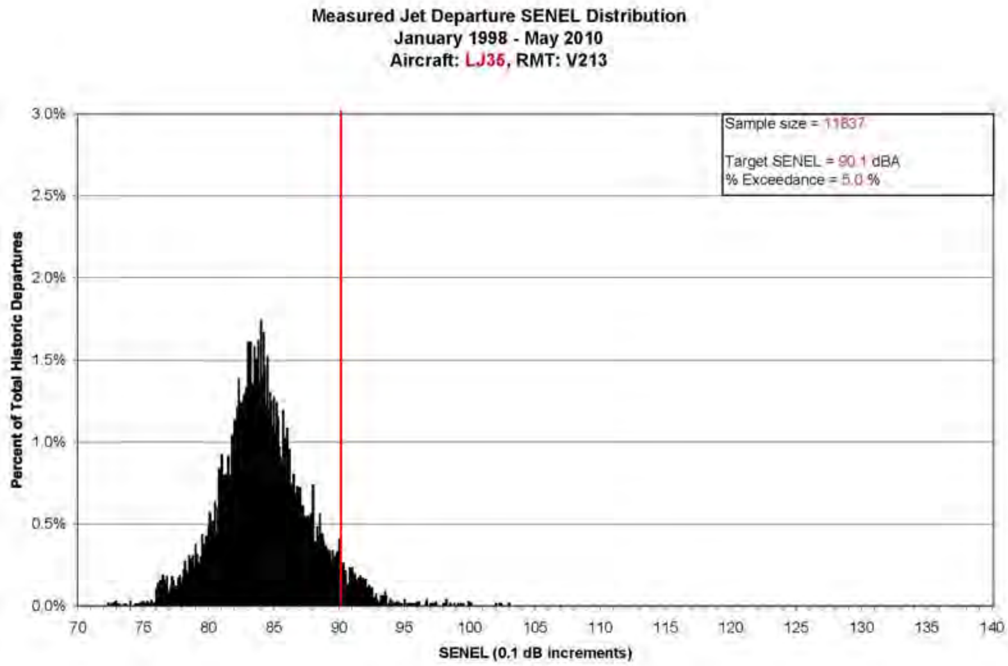


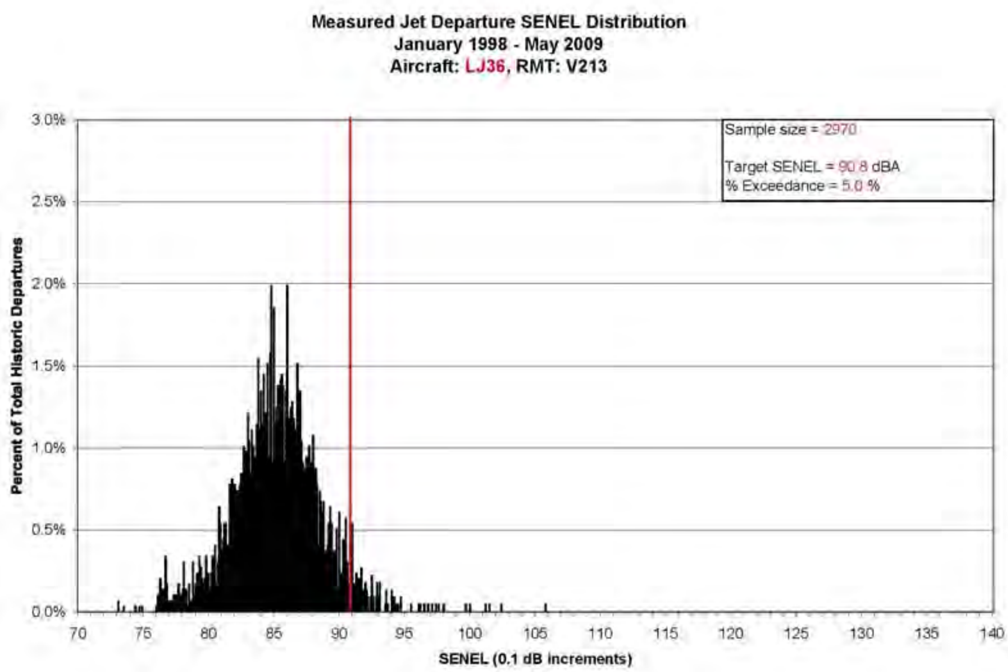
Measured Jet Departure SENEL Distribution
January 1998 - May 2010
Aircraft: LJ25, RMT: V213

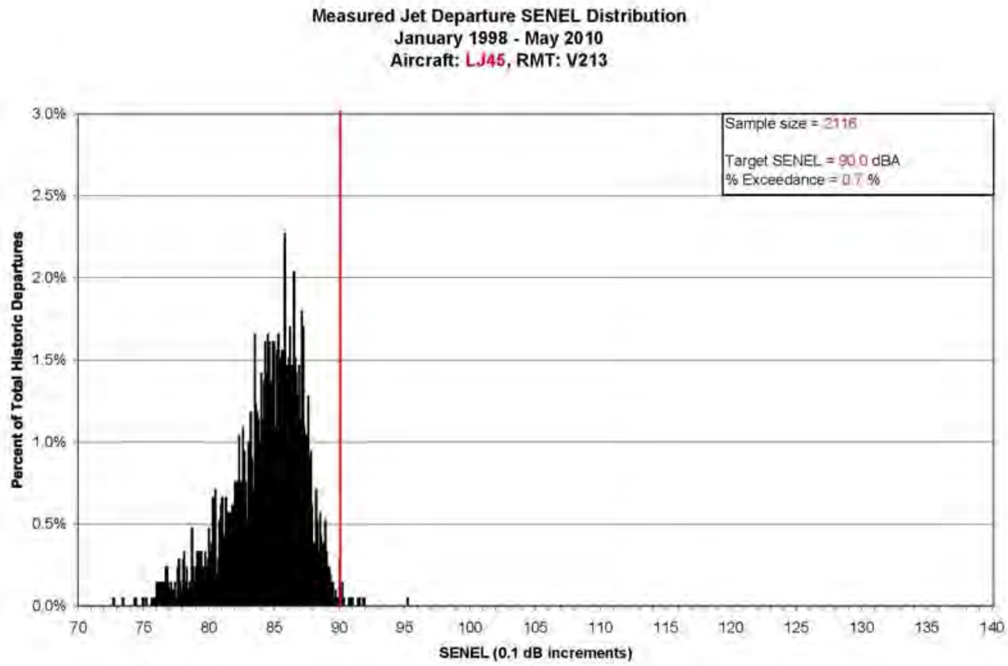


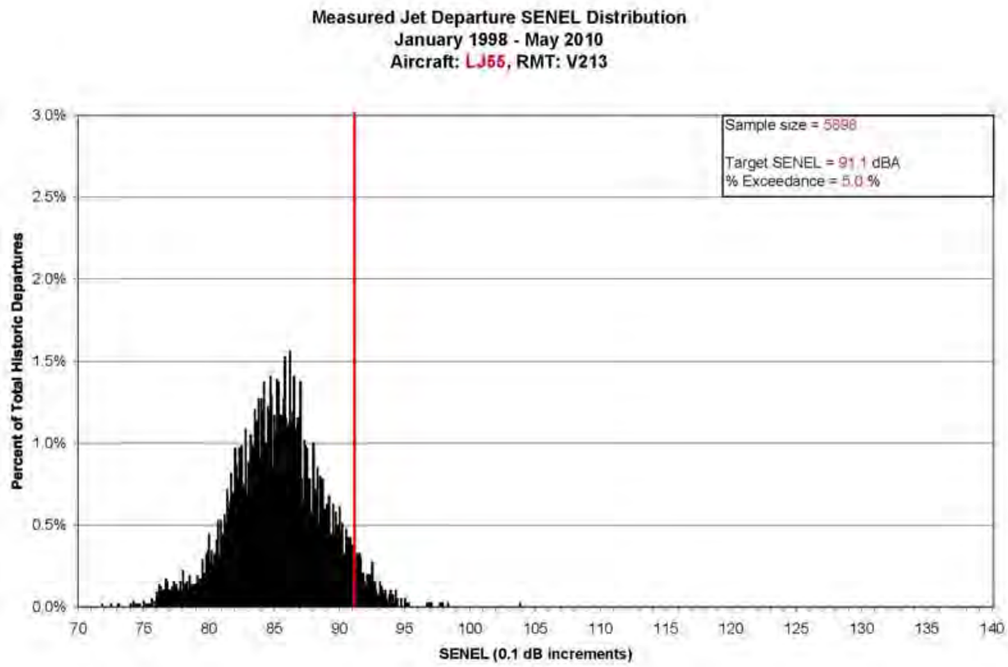

Measured Jet Departure SENEL Distribution
September 2000 - October 2006
Aircraft: LJ28, RMT: V213
Sample size = 221
Target SENEL = 104.2 dBA
% Exceedance = 5.0 %
Percent of Total Historic Departures
SENEL (0.1 dB increments)
0.0%
0.5%
1.0%
1.5%
2.0%
2.5%
3.0%
3.5%
4.0%
4.5%
5.0%
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140

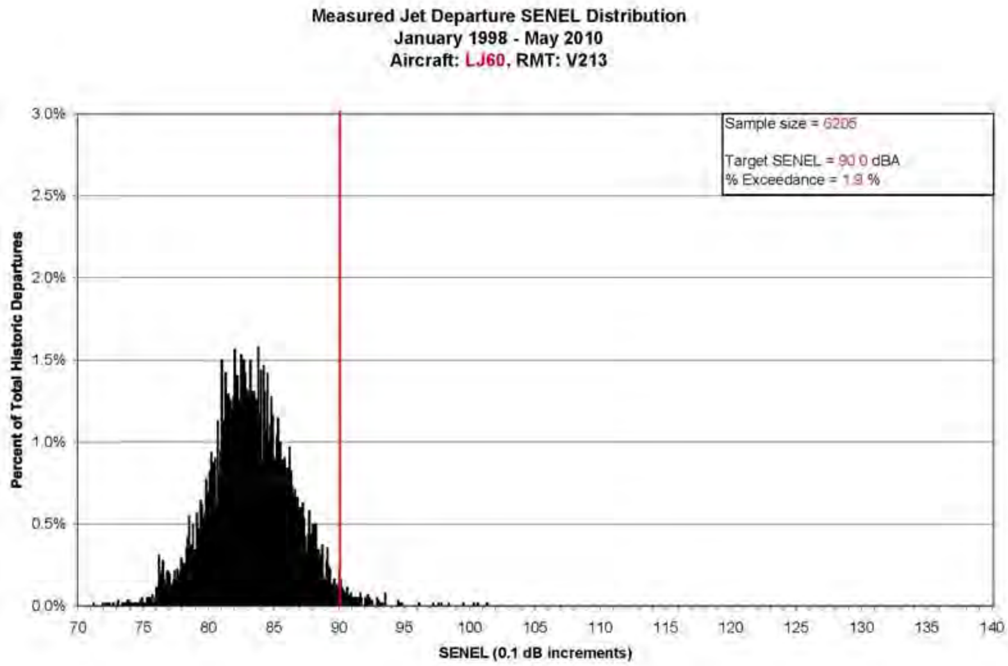

Measured Jet Departure SENEL Distribution
January 1998 - May 2010
Aircraft: LJ31, RMT: V213
Sample size = 1925
Target SENEL = 90.0 dBA
% Exceedance = 4.7 %
Percent of Total Historic Departures
SENEL (0.1 dB increments)
0.0%
0.5%
1.0%
1.5%
2.0%
2.5%
3.0%
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140

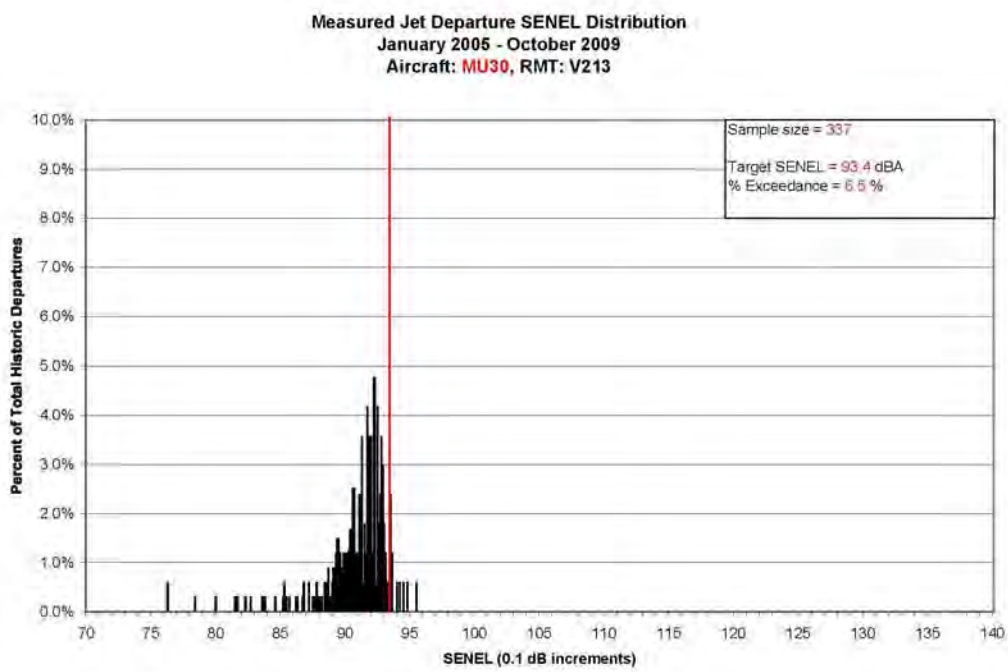

Measured Jet Departure SENEL Distribution
January 1998 - May 2010
Aircraft: LJ35, RMT: V213
Sample size = 11837
Target SENEL = 90.1 dBA
% Exceedance = 5.0 %
Percent of Total Historic Departures
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140
SENEL (0.1 dB increments)

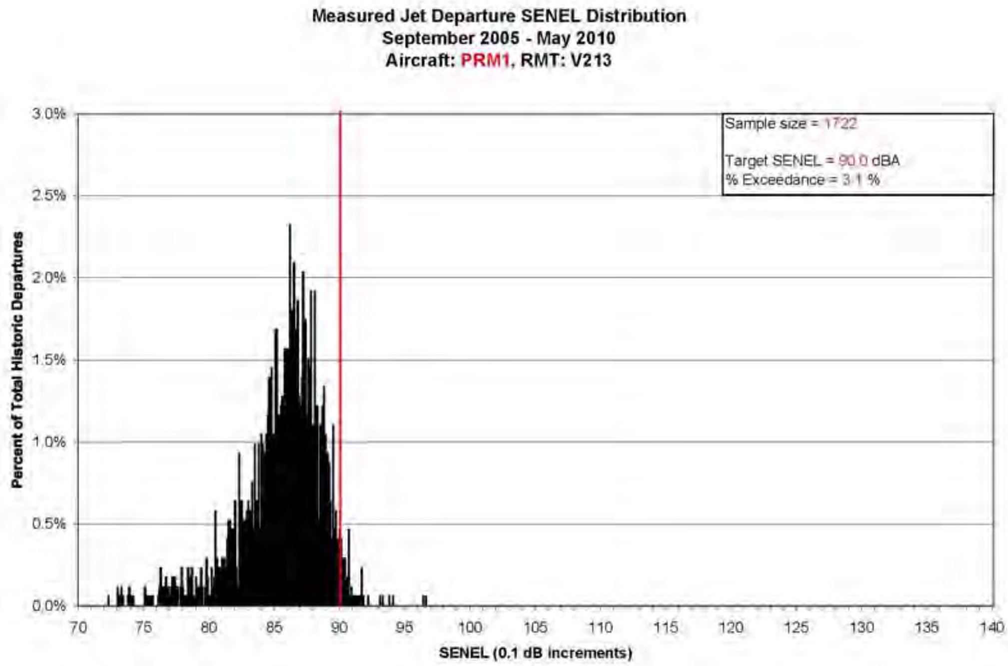

Measured Jet Departure SENEL Distribution
January 1998 - May 2009
Aircraft: LJ36, RMT: V213
Sample size = 2970
Target SENEL = 90.8 dBA
% Exceedance = 5.0 %
Percent of Total Historic Departures
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140
SENEL (0.1 dB increments)

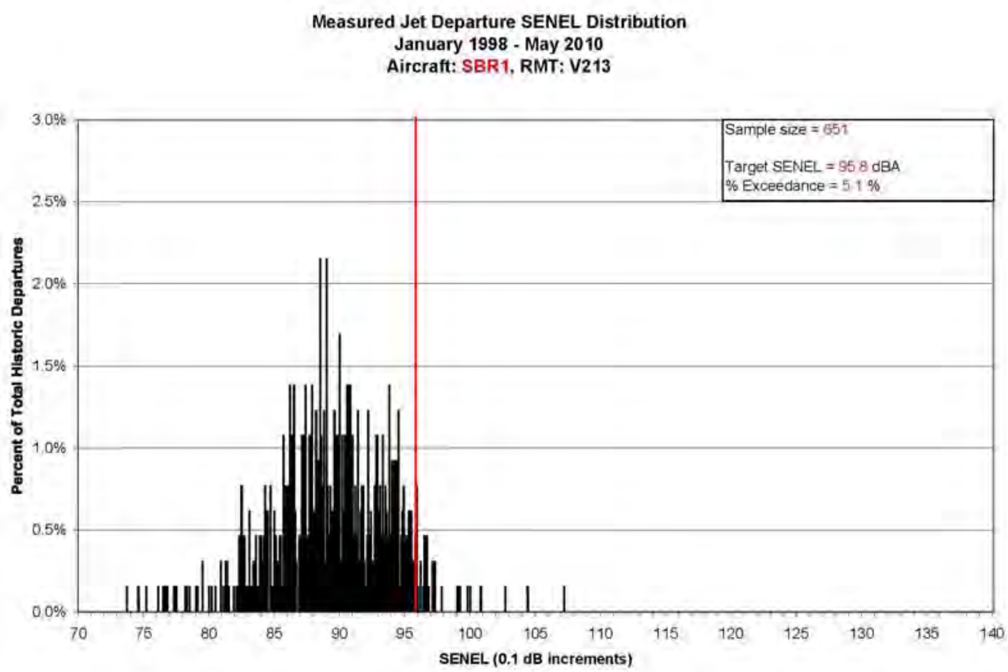

Measured Jet Departure SENEL Distribution
January 1998 - May 2010
Aircraft: LJ45, RMT: V213
Sample size = 2116
Target SENEL = 90.0 dBA
% Exceedance = 0.7 %
Percent of Total Historic Departures
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140
SENEL (0.1 dB increments)

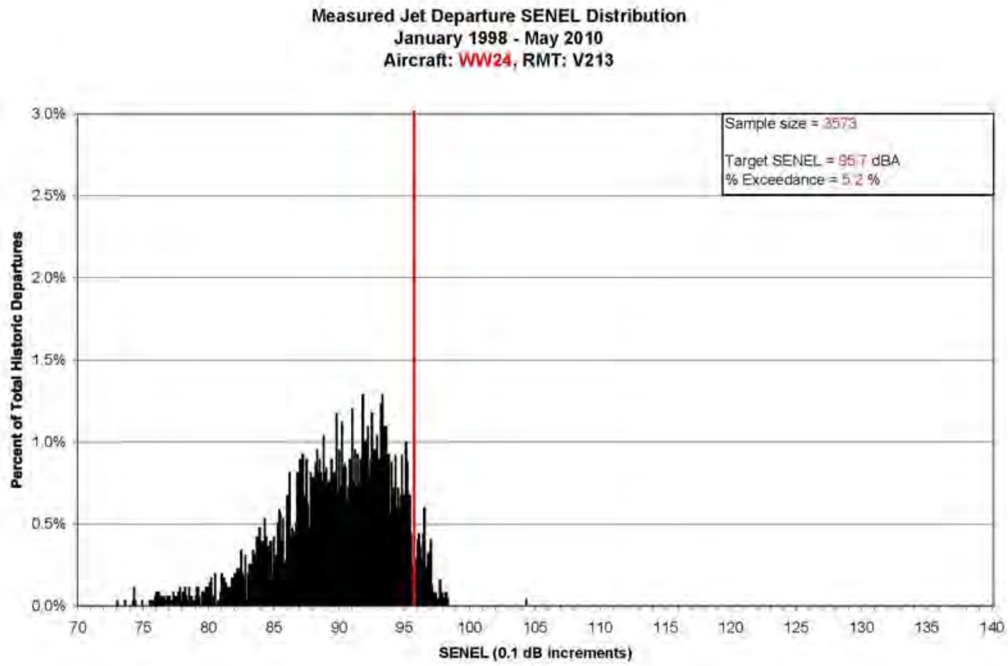

Measured Jet Departure SENEL Distribution
January 1998 - May 2010
Aircraft: LJ55, RMT: V213
Sample size = 5898
Target SENEL = 91.1 dBA
% Exceedance = 5.0 %
Percent of Total Historic Departures
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140
SENEL (0.1 dB increments)

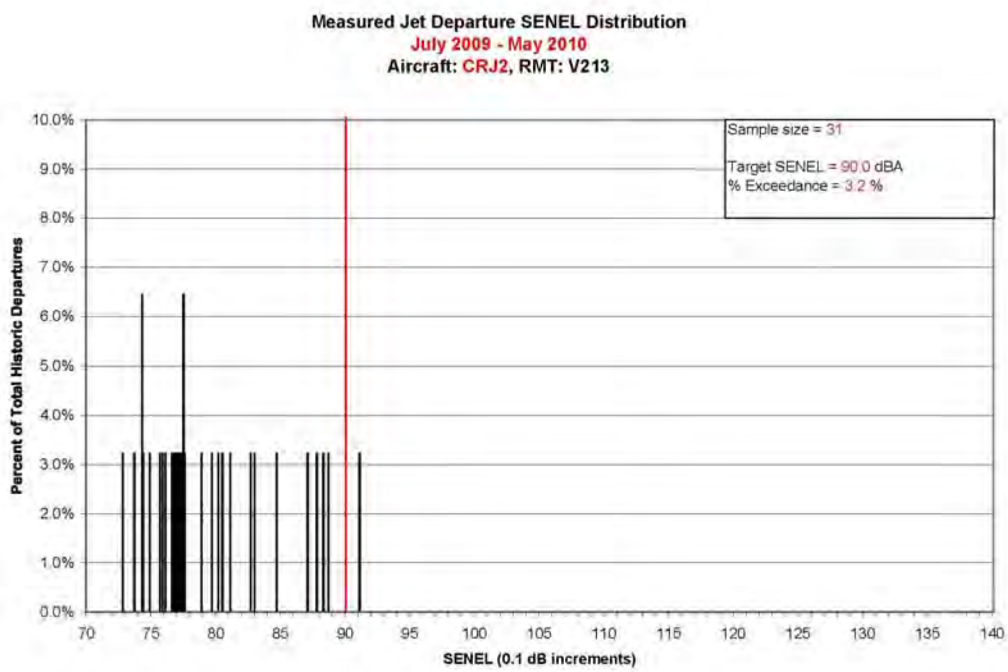

Measured Jet Departure SENEL Distribution
January 1998 - May 2010
Aircraft: LJ60, RMT: V213
Sample size = 6205
Target SENEL = 90.0 dBA
% Exceedance = 1.9 %
Percent of Total Historic Departures
SENEL (0.1 dB increments)

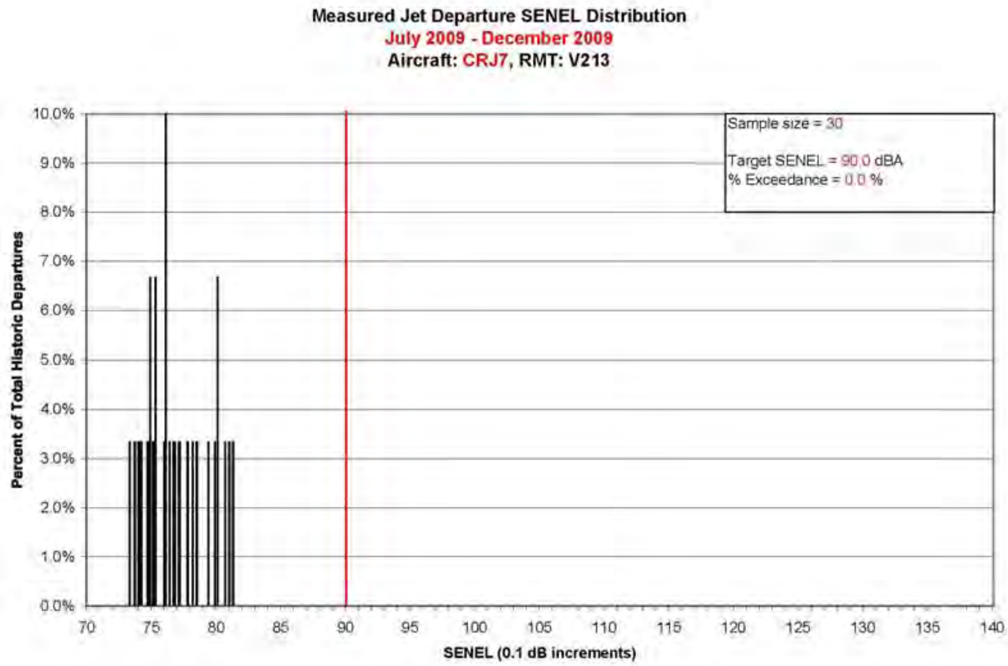

Measured Jet Departure SENEL Distribution
January 2005 - October 2009
Aircraft: MU30, RMT: V213
Sample size = 337
Target SENEL = 93.4 dBA
% Exceedance = 6.5 %
Percent of Total Historic Departures
SENEL (0.1 dB increments)

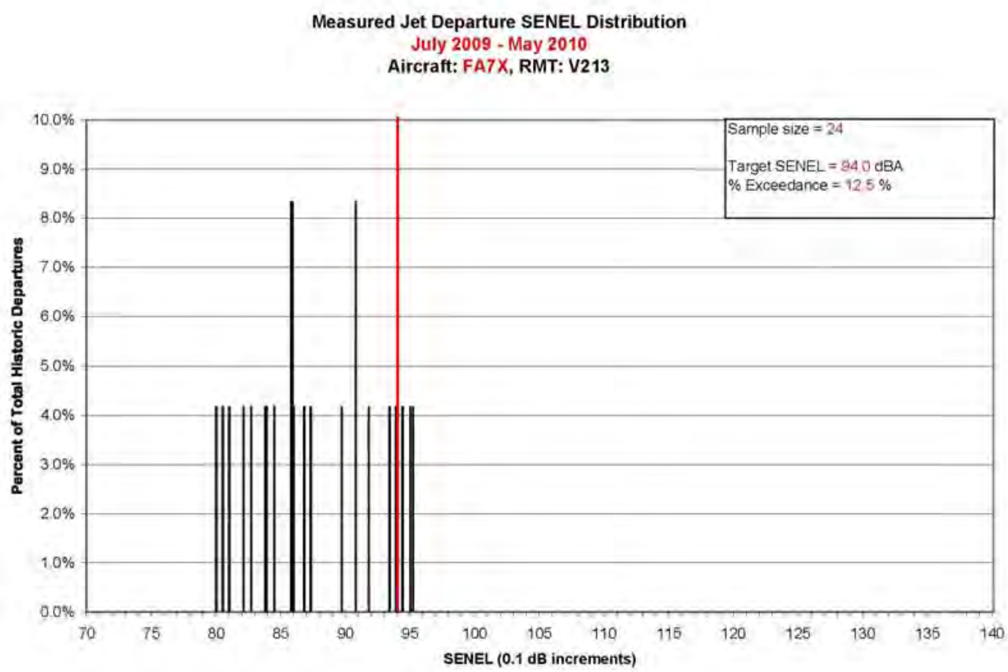

Measured Jet Departure SENEL Distribution
September 2005 - May 2010
Aircraft: PRM1, RMT: V213
Sample size = 1722
Target SENEL = 90.0 dBA
% Exceedance = 3.1 %
Percent of Total Historic Departures
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
70 75 80 85 90 95 100 105 110 115 120 125 130 135 140
SENEL (0.1 dB increments)

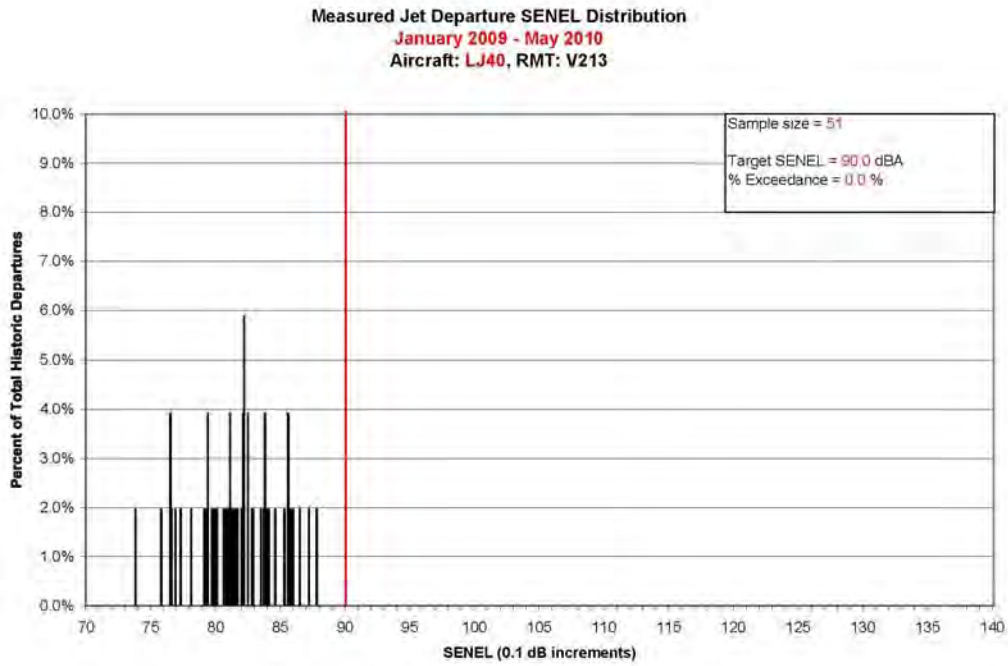

Measured Jet Departure SENEL Distribution
January 1998 - May 2010
Aircraft: SBR1, RMT: V213
Sample size = 651
Target SENEL = 95.8 dBA
% Exceedance = 5.1 %
Percent of Total Historic Departures
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
70 75 80 85 90 95 100 105 110 115 120 125 130 135 140
SENEL (0.1 dB increments)


Measured Jet Departure SENEL Distribution
January 1998 - May 2010
Aircraft: WW24, RMT: V213
Sample size = 3573
Target SENEL = 95.7 dBA
% Exceedance = 5.2 %
Percent of Total Historic Departures
SENEL (0.1 dB increments)


Measured Jet Departure SENEL Distribution
July 2009 - May 2010
Aircraft: CRJ2, RMT: V213
Sample size = 31
Target SENEL = 90.0 dBA
% Exceedance = 3.2 %
Percent of Total Historic Departures
SENEL (0.1 dB increments)


Measured Jet Departure SENEL Distribution
July 2009 - December 2009
Aircraft: CRJ7, RMT: V213
Sample size = 30
Target SENEL = 90.0 dBA
% Exceedance = 0.0 %
Percent of Total Historic Departures
SENEL (0.1 dB increments)


Measured Jet Departure SENEL Distribution
July 2009 - May 2010
Aircraft: FA7X, RMT: V213
Sample size = 24
Target SENEL = 94.0 dBA
% Exceedance = 12.5 %
Percent of Total Historic Departures
SENEL (0.1 dB increments)


Measured Jet Departure SENEL Distribution
January 2009 - May 2010
Aircraft: LJ40, RMT: V213
Sample size = 51
Target SENEL = 90.0 dBA
% Exceedance = 0.0 %
Percent of Total Historic Departures
10.0%
9.0%
8.0%
7.0%
6.0%
5.0%
4.0%
3.0%
2.0%
1.0%
0.0%
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140
SENEL (0.1 dB increments)

APPENDIX F PLOTS OF RECOMMENDED SENEL TARGET EXCEEDANCE BY OPERATORS WITH 25+ HISTORIC DEPARTURES, FOR ALL AND INDIVIDUAL AIRCRAFT TYPES, JANUARY 1998 - MAY 2010

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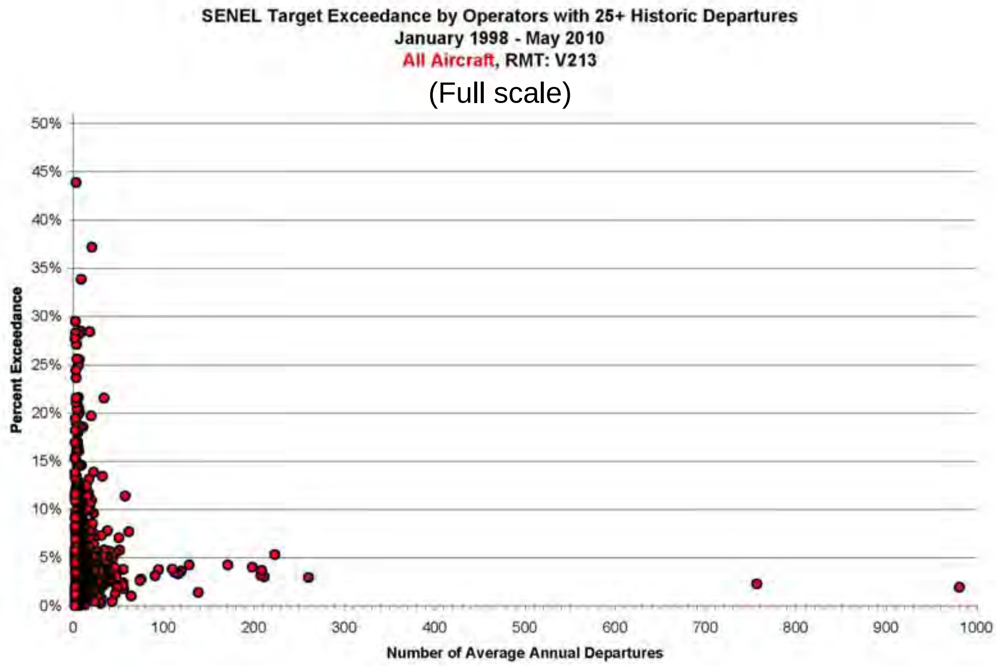
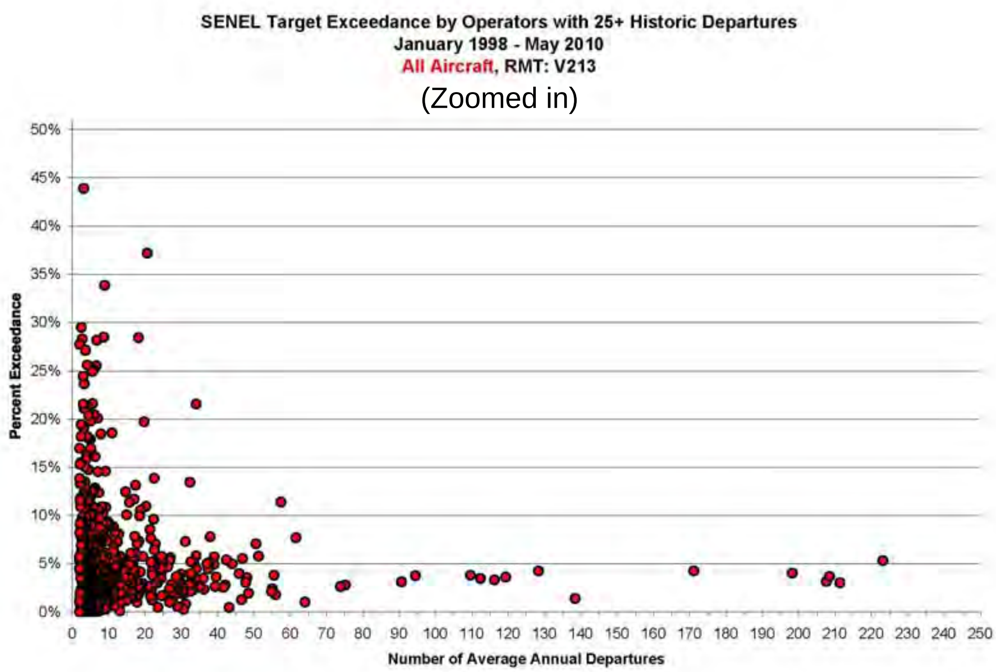
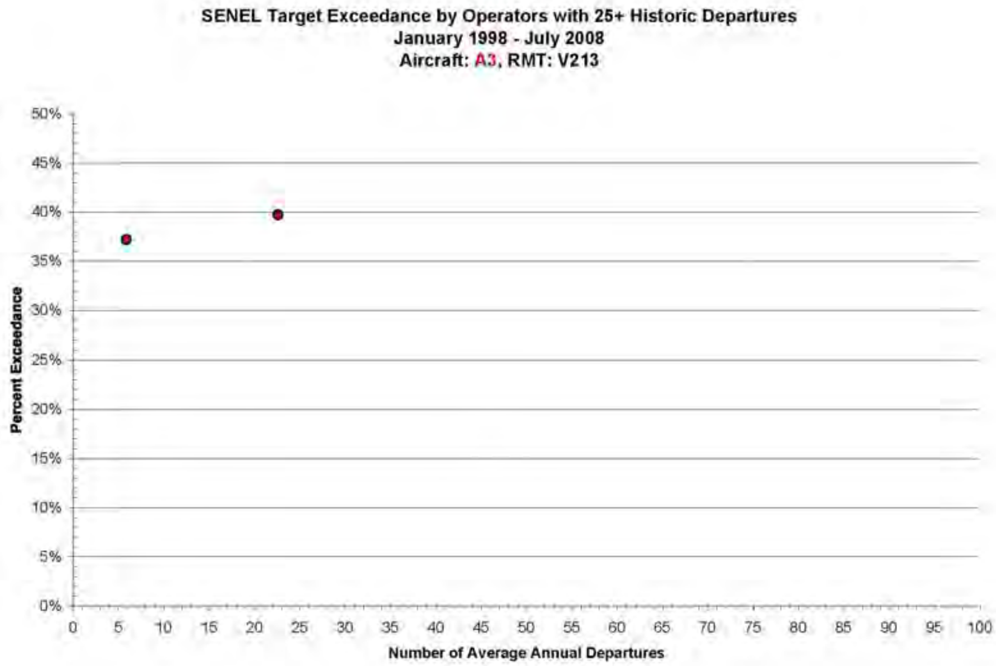
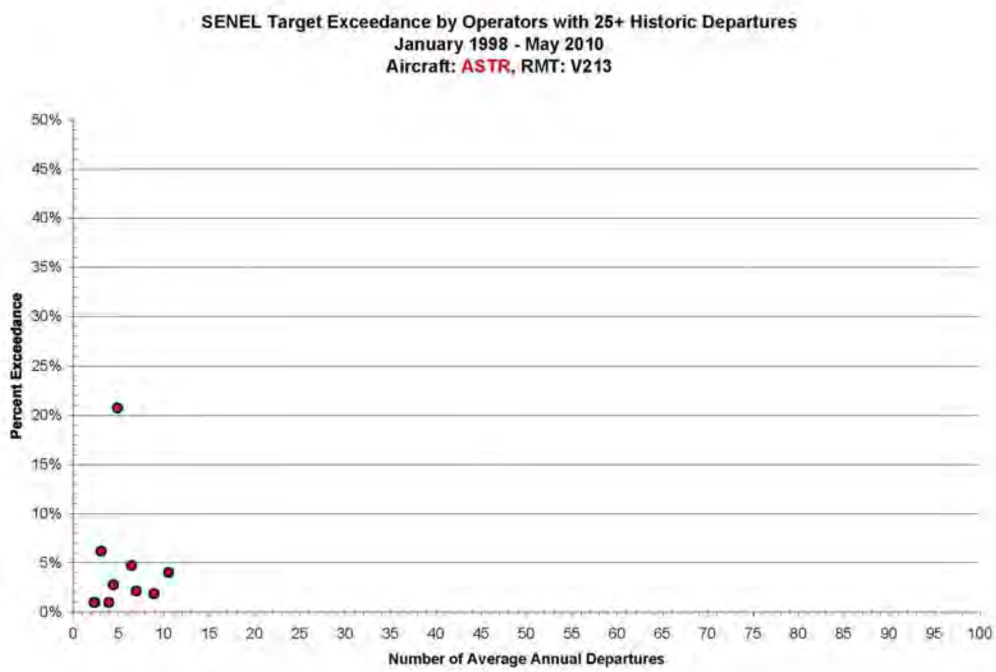
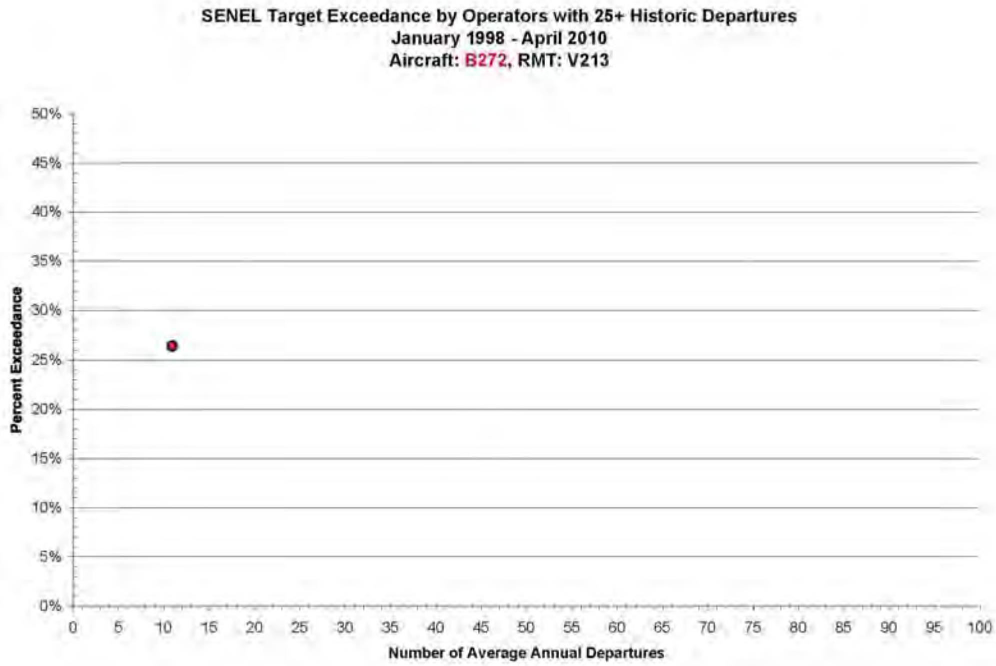
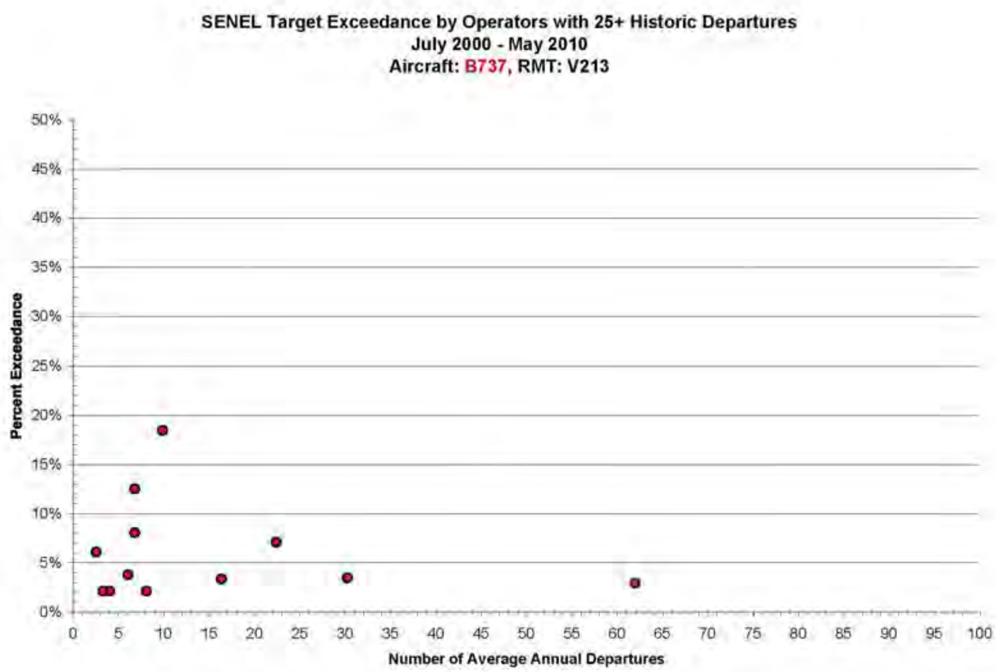

SENEL Target Exceedance by Operators with 25+ Historic Departures
January 1998 - May 2010
All Aircraft, RMT: V213
(Full scale)
Percent Exceedance
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
0
100
200
300
400
500
600
700
800
900
1000
Number of Average Annual Departures

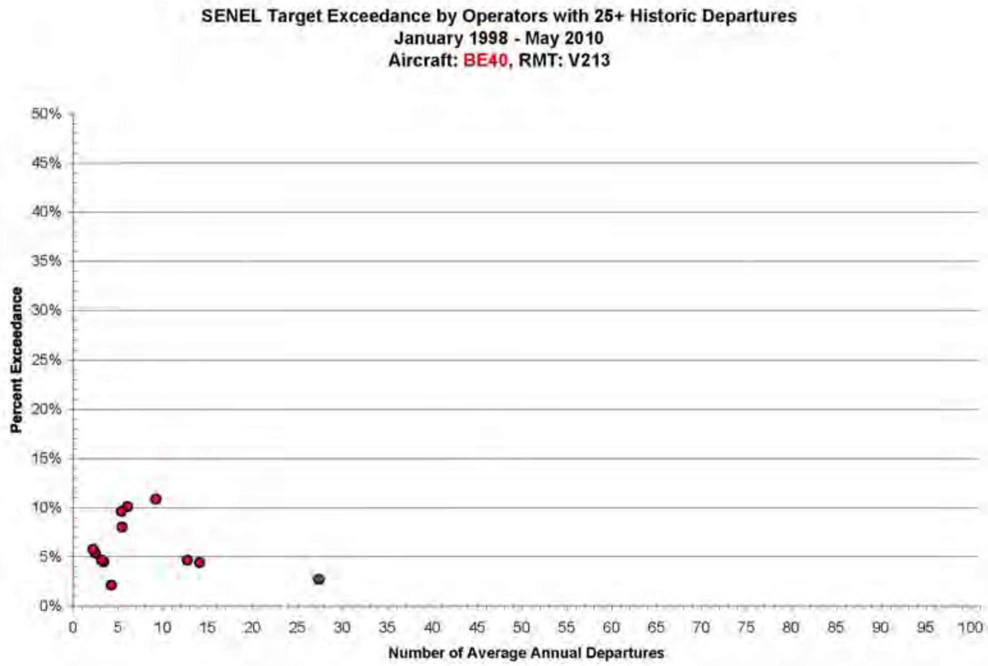

SENEL Target Exceedance by Operators with 25+ Historic Departures
January 1998 - May 2010
All Aircraft, RMT: V213
(Zoomed in)
Percent Exceedance
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250
Number of Average Annual Departures

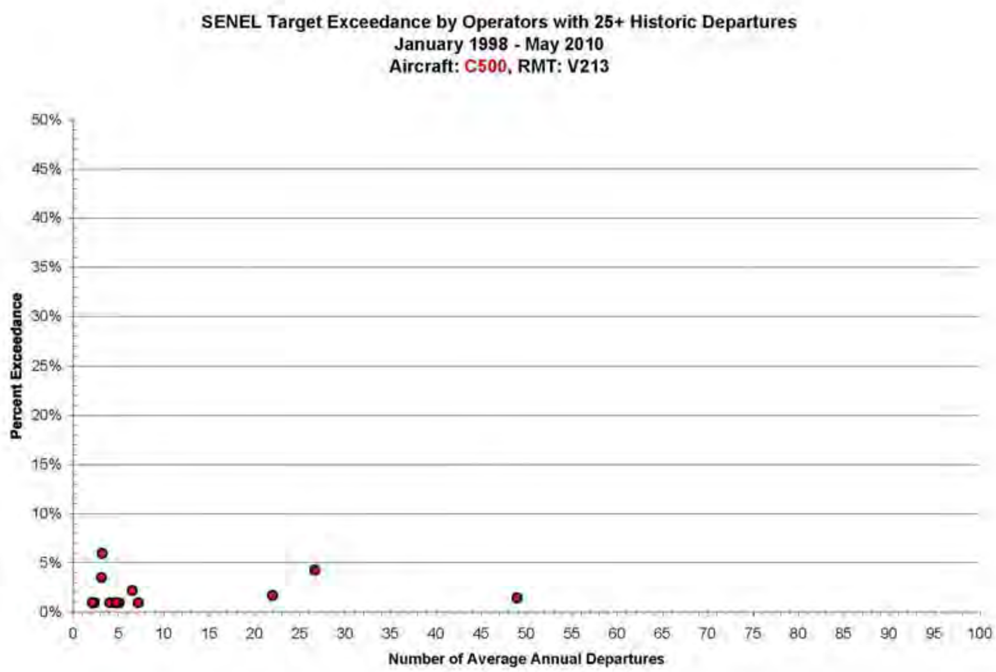

SENEL Target Exceedance by Operators with 25+ Historic Departures
January 1998 - July 2008
Aircraft: A3, RMT: V213
Percent Exceedance
Number of Average Annual Departures
0%
5%
10%
15%
20%
25%
30%
35%
40%
45%
50%
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100

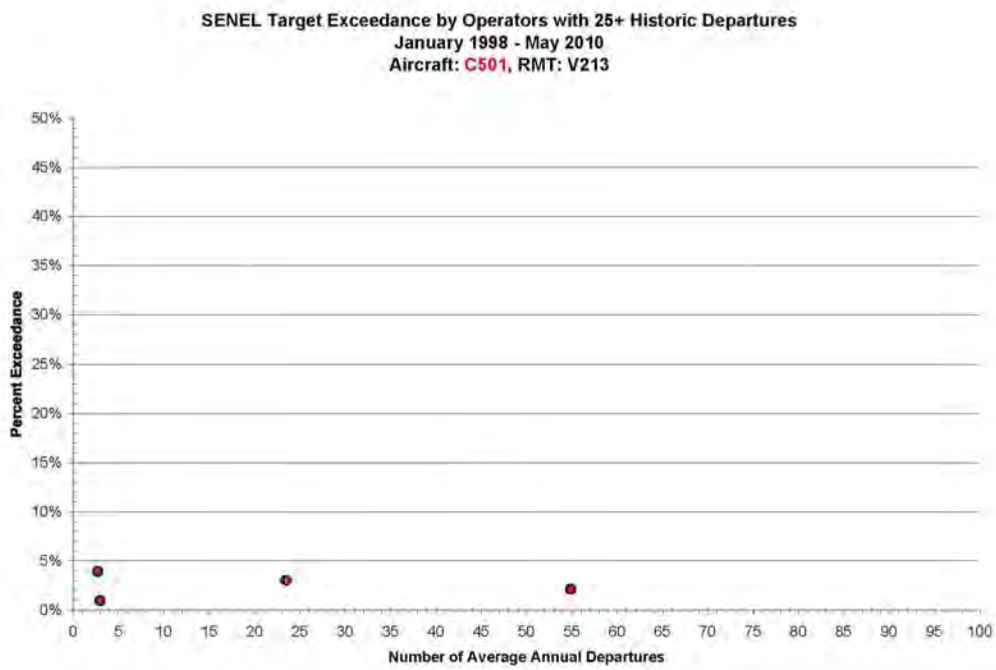

SENEL Target Exceedance by Operators with 25+ Historic Departures
January 1998 - May 2010
Aircraft: ASTR, RMT: V213
Percent Exceedance
Number of Average Annual Departures
0%
5%
10%
15%
20%
25%
30%
35%
40%
45%
50%
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100

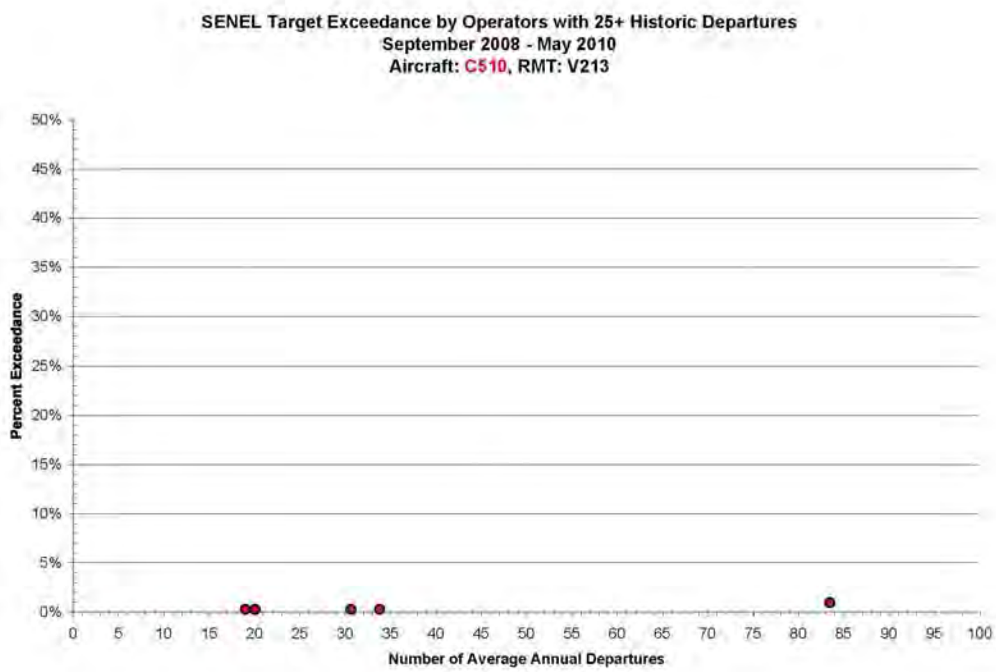

SENEL Target Exceedance by Operators with 25+ Historic Departures
January 1998 - April 2010
Aircraft: B272, RMT: V213
Percent Exceedance
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Number of Average Annual Departures

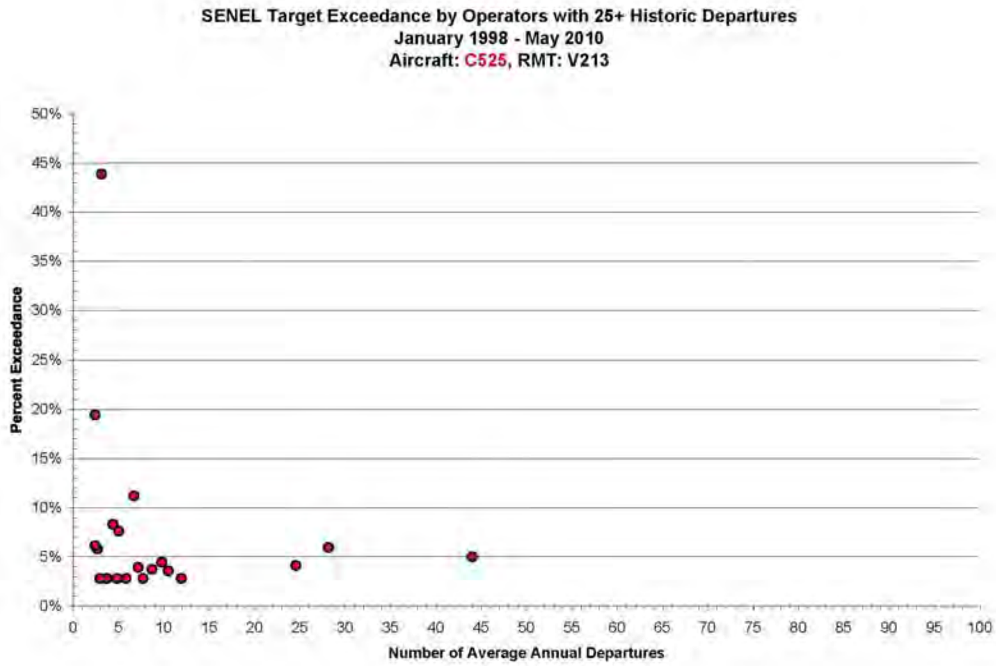

SENEL Target Exceedance by Operators with 25+ Historic Departures
July 2000 - May 2010
Aircraft: B737, RMT: V213
Percent Exceedance
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Number of Average Annual Departures

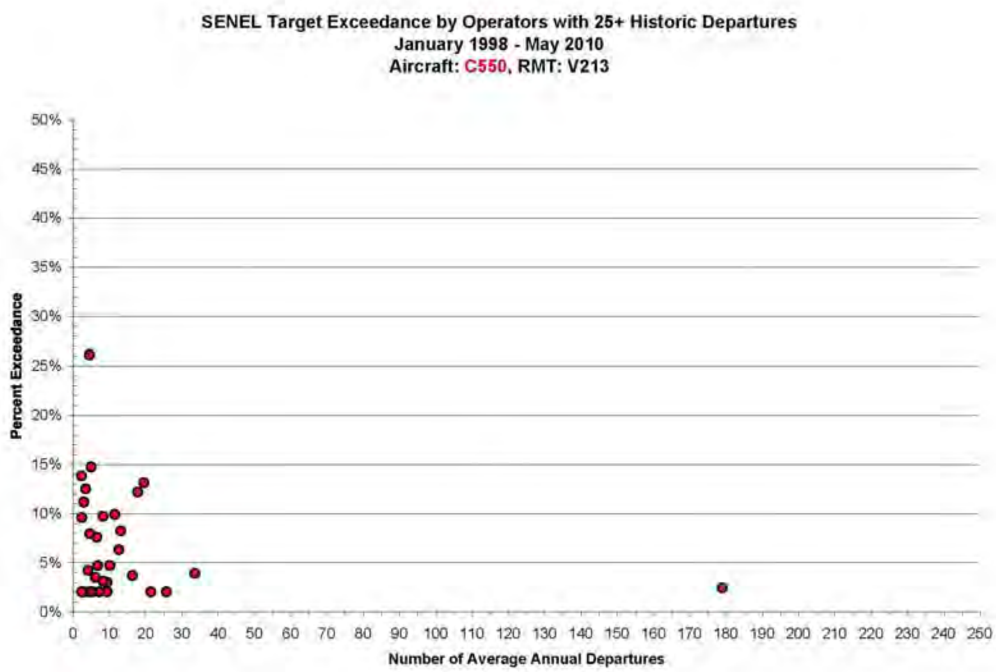

SENEL Target Exceedance by Operators with 25+ Historic Departures
January 1998 - May 2010
Aircraft: BE40, RMT: V213
Percent Exceedance
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
Number of Average Annual Departures

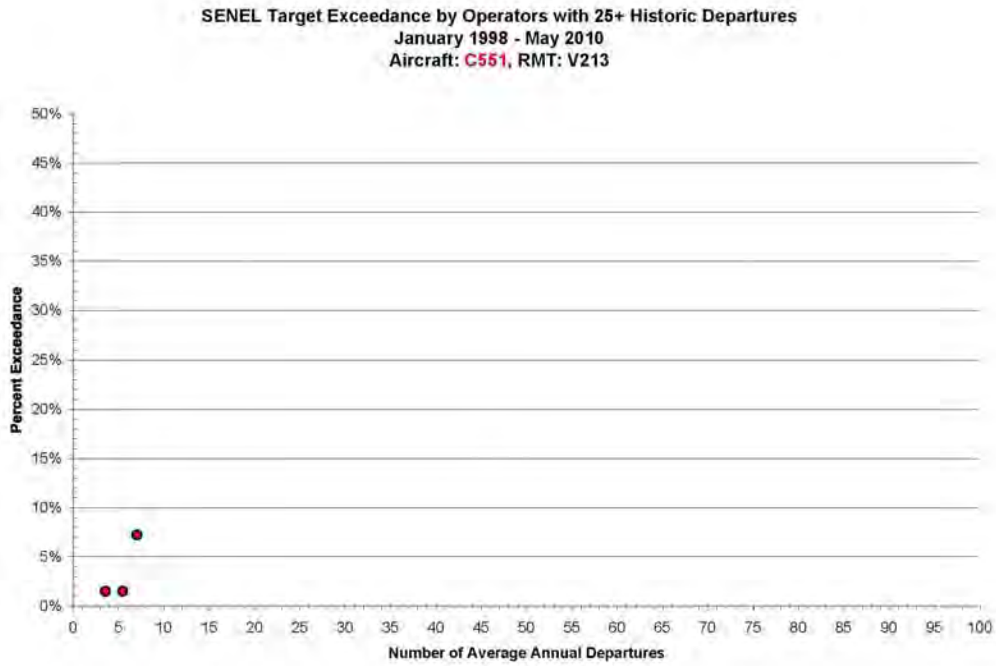

SENEL Target Exceedance by Operators with 25+ Historic Departures
January 1998 - May 2010
Aircraft: C500, RMT: V213
Percent Exceedance
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
Number of Average Annual Departures

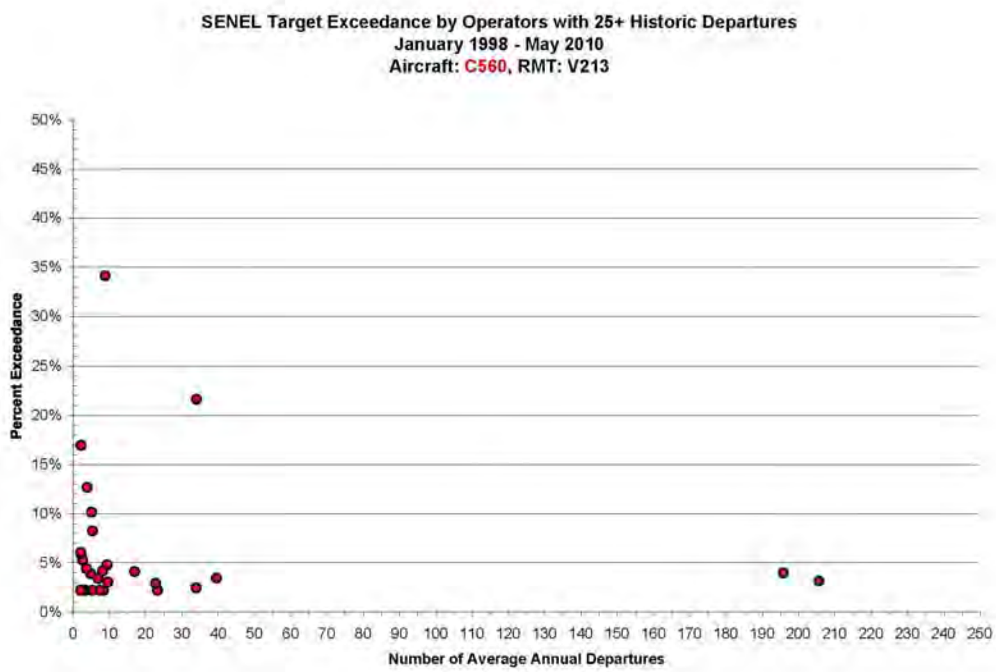

SENEL Target Exceedance by Operators with 25+ Historic Departures
January 1998 - May 2010
Aircraft: C501, RMT: V213
Percent Exceedance
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
Number of Average Annual Departures

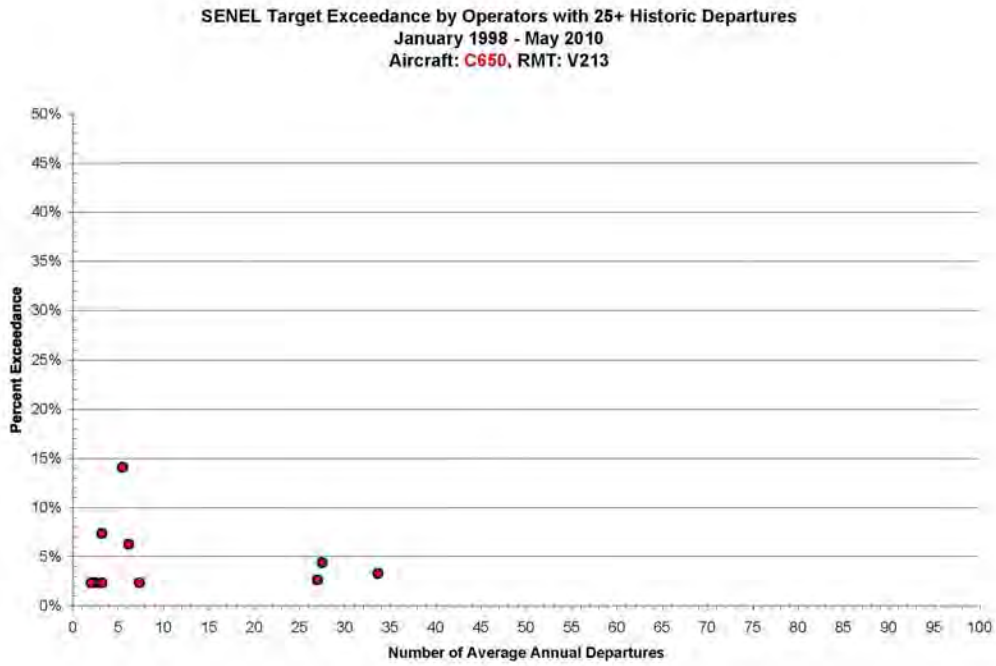

SENEL Target Exceedance by Operators with 25+ Historic Departures
September 2008 - May 2010
Aircraft: C510, RMT: V213
Percent Exceedance
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
Number of Average Annual Departures

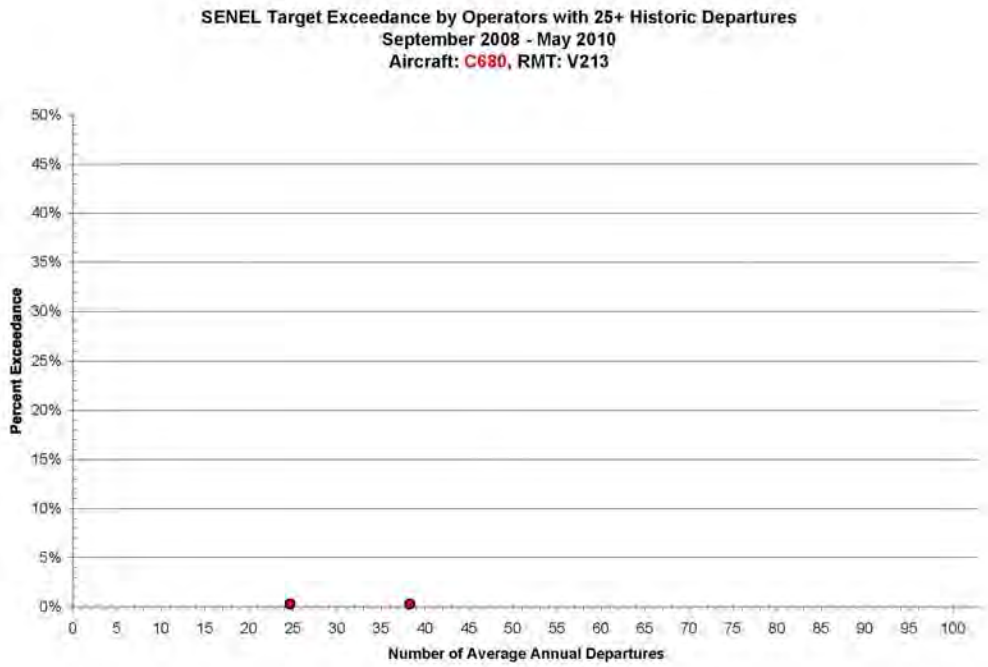

SENEL Target Exceedance by Operators with 25+ Historic Departures
January 1998 - May 2010
Aircraft: C525, RMT: V213
Percent Exceedance
Number of Average Annual Departures

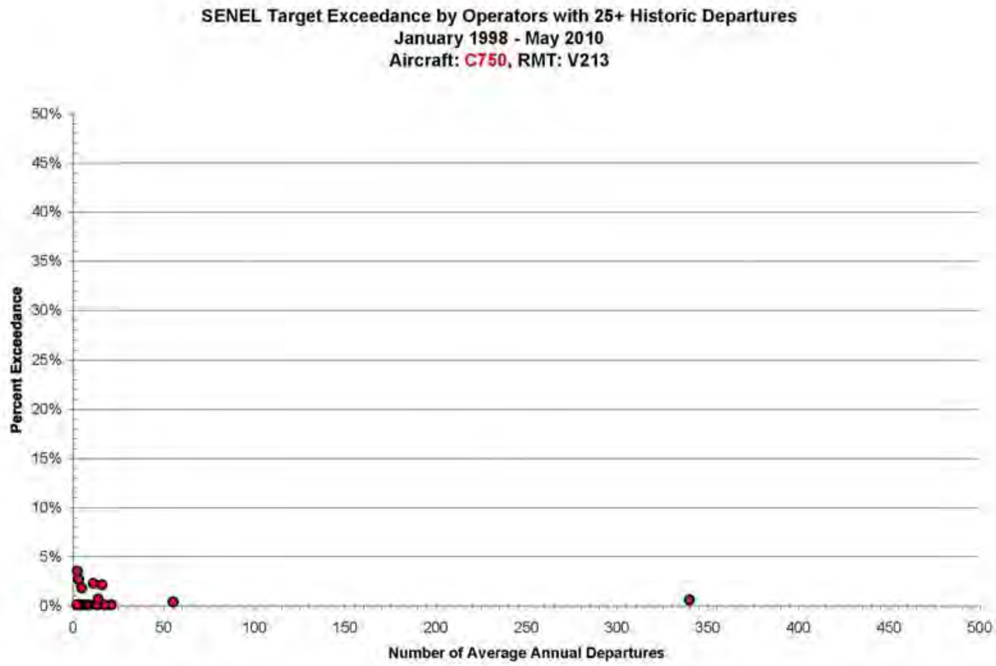

SENEL Target Exceedance by Operators with 25+ Historic Departures
January 1998 - May 2010
Aircraft: C550, RMT: V213
Percent Exceedance
Number of Average Annual Departures

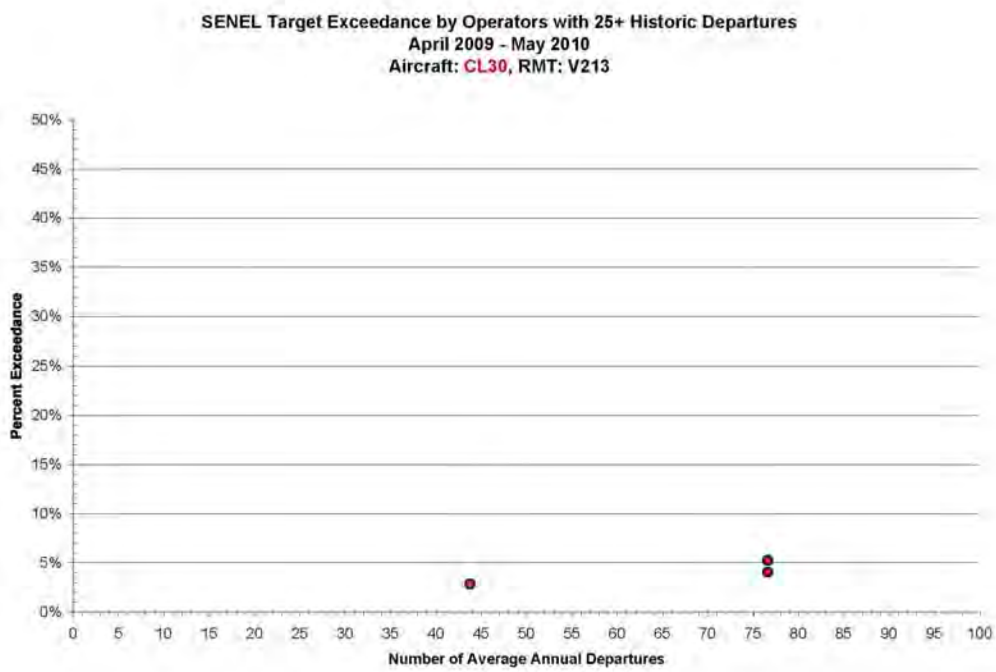

SENEL Target Exceedance by Operators with 25+ Historic Departures
January 1998 - May 2010
Aircraft: C551, RMT: V213
Percent Exceedance
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Number of Average Annual Departures

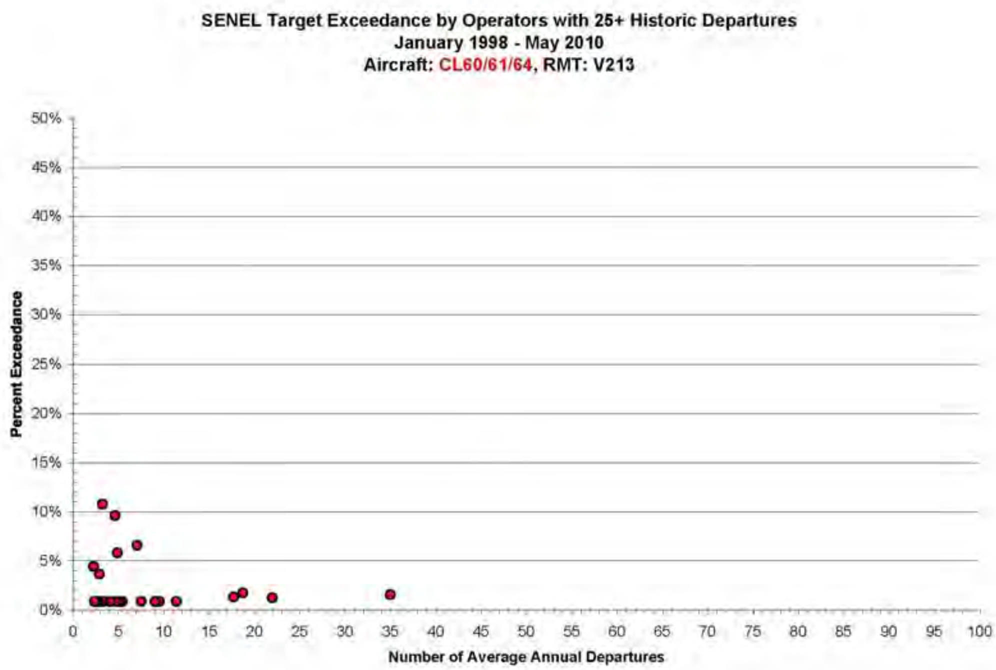

SENEL Target Exceedance by Operators with 25+ Historic Departures
January 1998 - May 2010
Aircraft: C560, RMT: V213
Percent Exceedance
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230
240
250
Number of Average Annual Departures

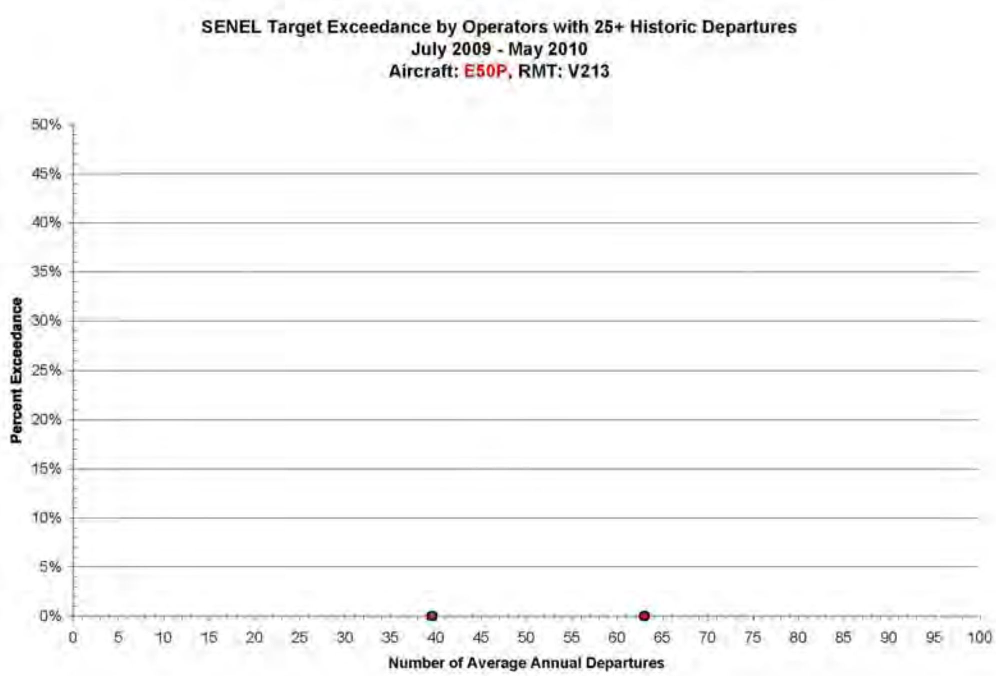

SENEL Target Exceedance by Operators with 25+ Historic Departures
January 1998 - May 2010
Aircraft: C650, RMT: V213
Percent Exceedance
Number of Average Annual Departures

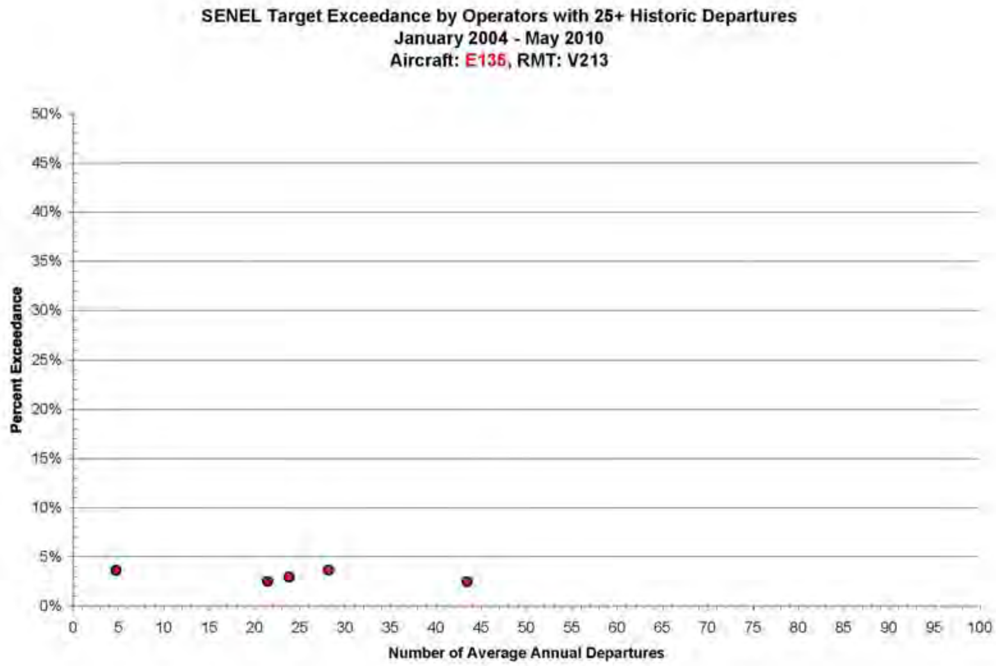

SENEL Target Exceedance by Operators with 25+ Historic Departures
September 2008 - May 2010
Aircraft: C680, RMT: V213
Percent Exceedance
Number of Average Annual Departures

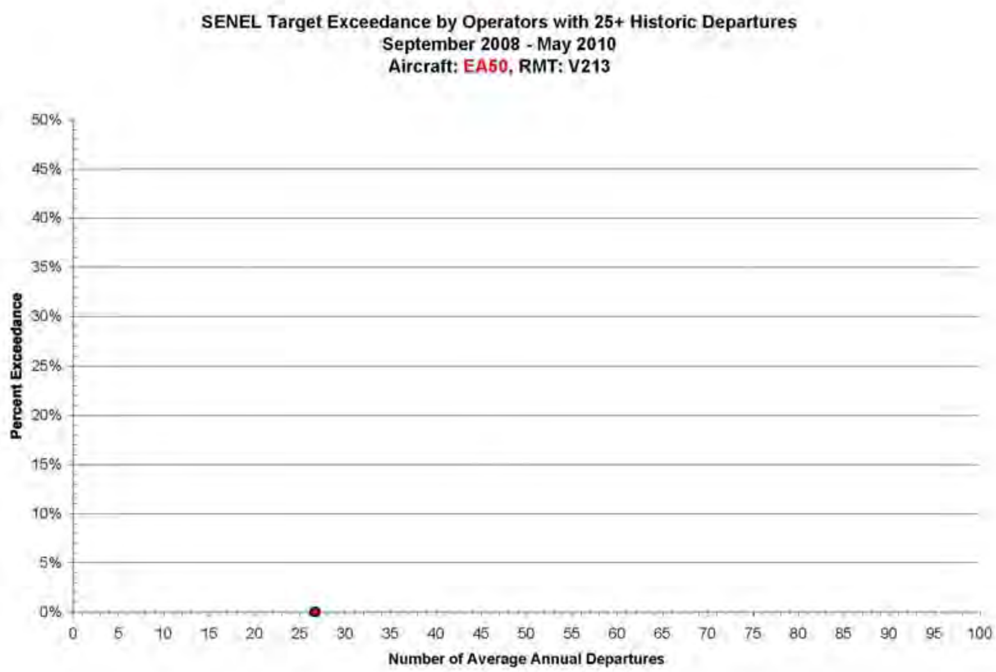

SENEL Target Exceedance by Operators with 25+ Historic Departures
January 1998 - May 2010
Aircraft: C750, RMT: V213
Percent Exceedance
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
0
50
100
150
200
250
300
350
400
450
500
Number of Average Annual Departures

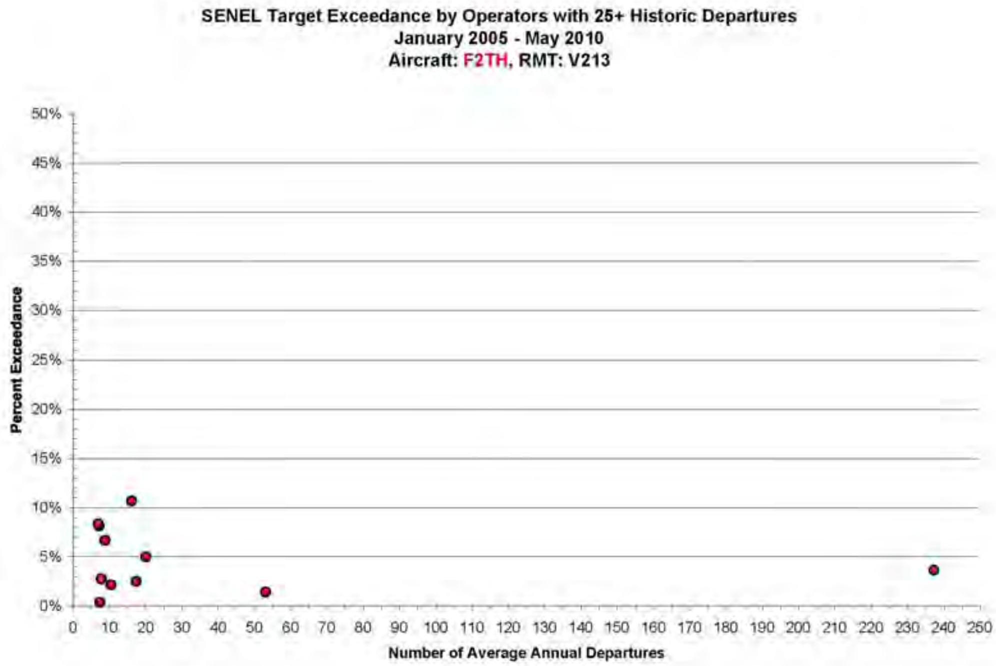

SENEL Target Exceedance by Operators with 25+ Historic Departures
April 2009 - May 2010
Aircraft: CL30, RMT: V213
Percent Exceedance
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Number of Average Annual Departures

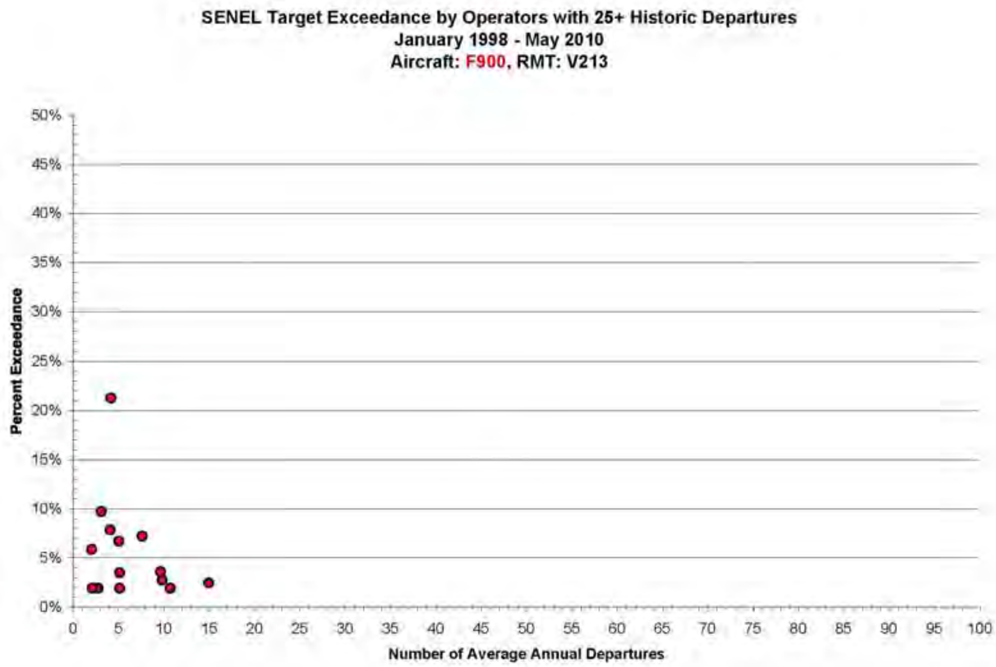

SENEL Target Exceedance by Operators with 25+ Historic Departures
January 1998 - May 2010
Aircraft: CL60/61/64, RMT: V213
Percent Exceedance
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
Number of Average Annual Departures

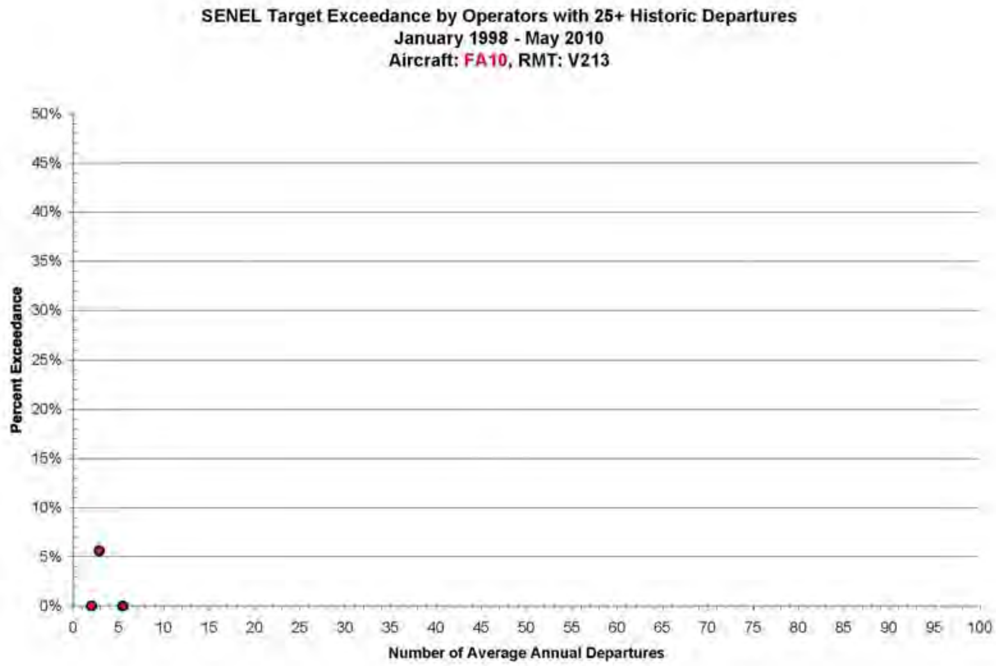

SENEL Target Exceedance by Operators with 25+ Historic Departures
July 2009 - May 2010
Aircraft: E50P, RMT: V213
Percent Exceedance
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
Number of Average Annual Departures

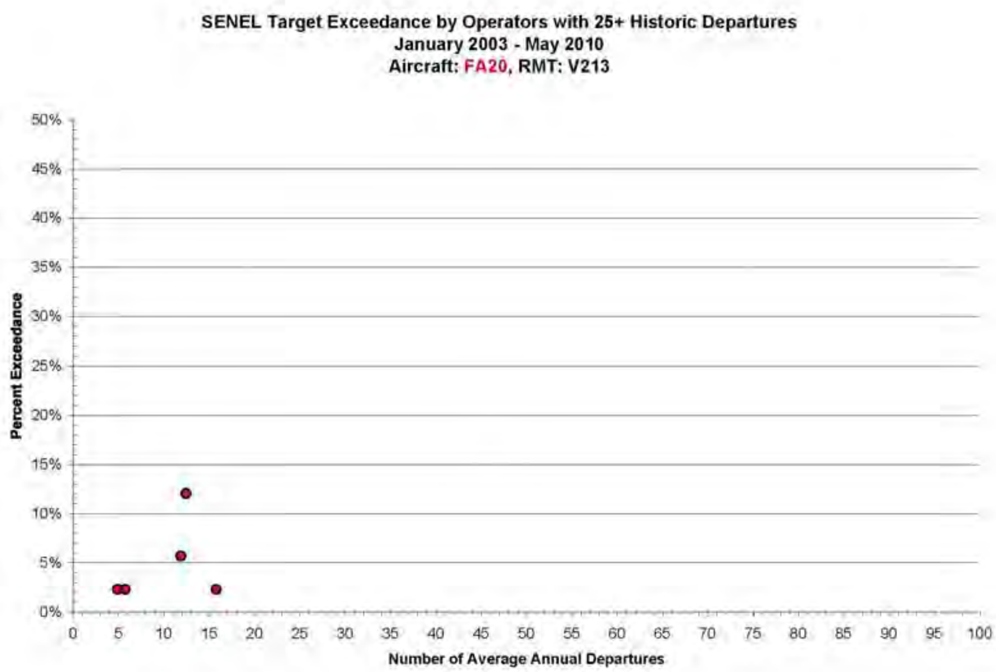

SENEL Target Exceedance by Operators with 25+ Historic Departures
January 2004 - May 2010
Aircraft: E135, RMT: V213
Percent Exceedance
Number of Average Annual Departures

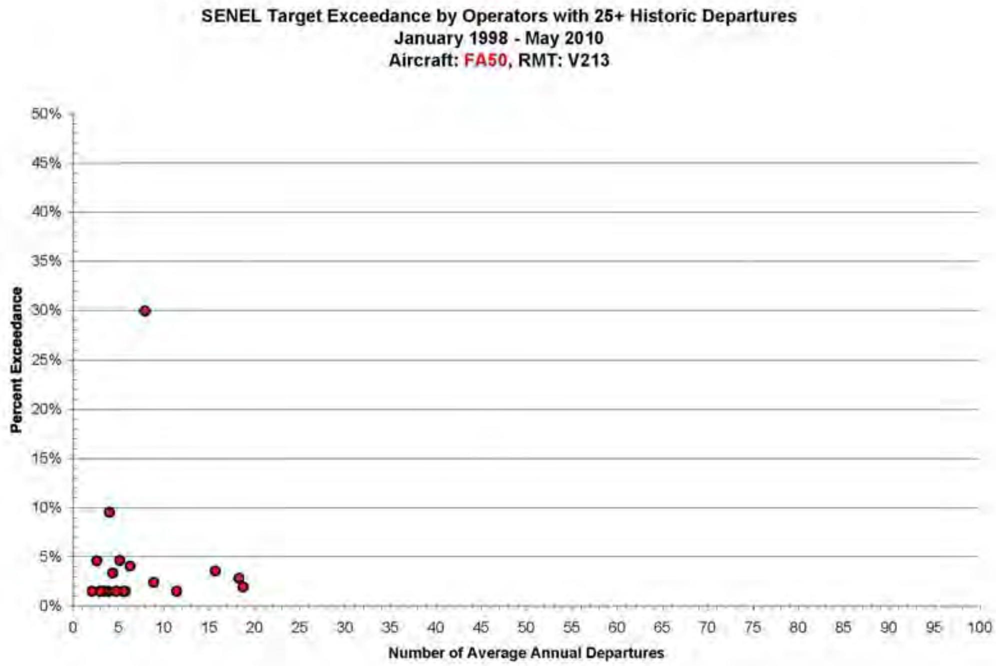

SENEL Target Exceedance by Operators with 25+ Historic Departures
September 2008 - May 2010
Aircraft: EA50, RMT: V213
Percent Exceedance
Number of Average Annual Departures

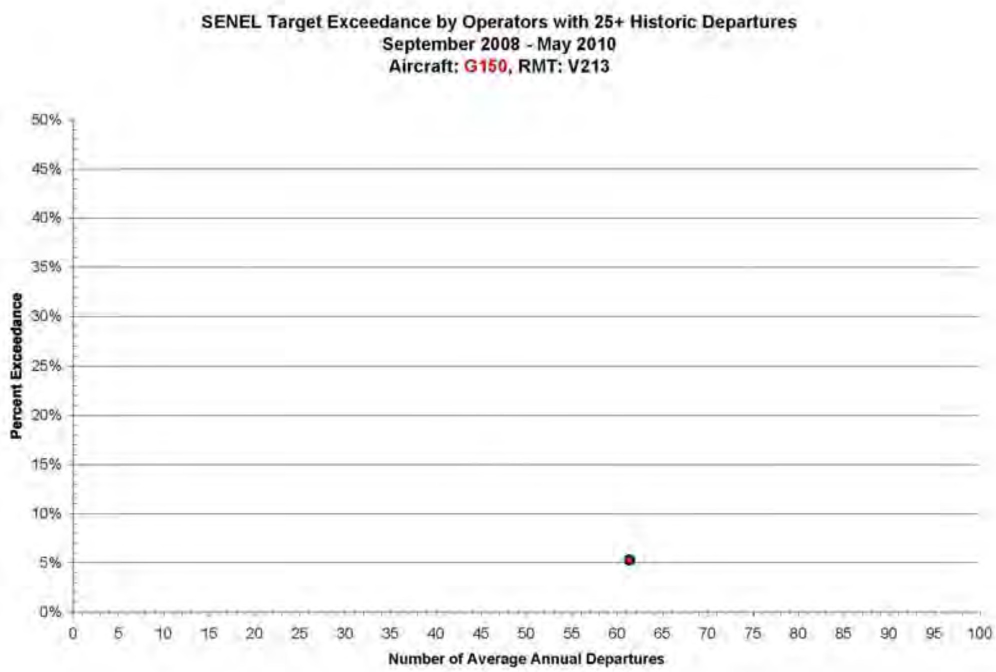

SENEL Target Exceedance by Operators with 25+ Historic Departures
January 2005 - May 2010
Aircraft: F2TH, RMT: V213
Percent Exceedance
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250
Number of Average Annual Departures

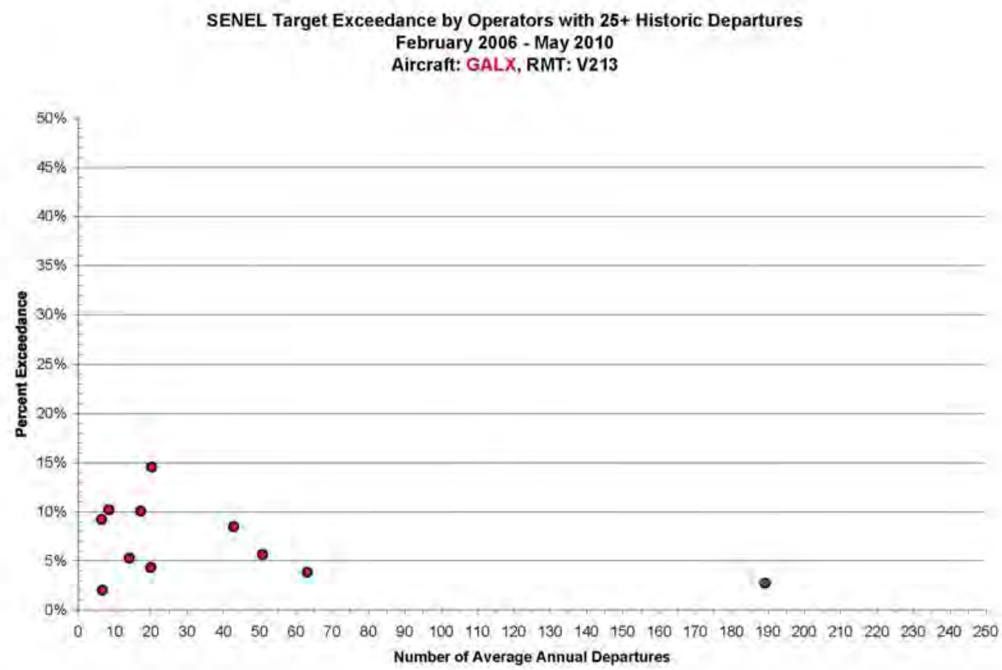

SENEL Target Exceedance by Operators with 25+ Historic Departures
January 1998 - May 2010
Aircraft: F900, RMT: V213
Percent Exceedance
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
Number of Average Annual Departures

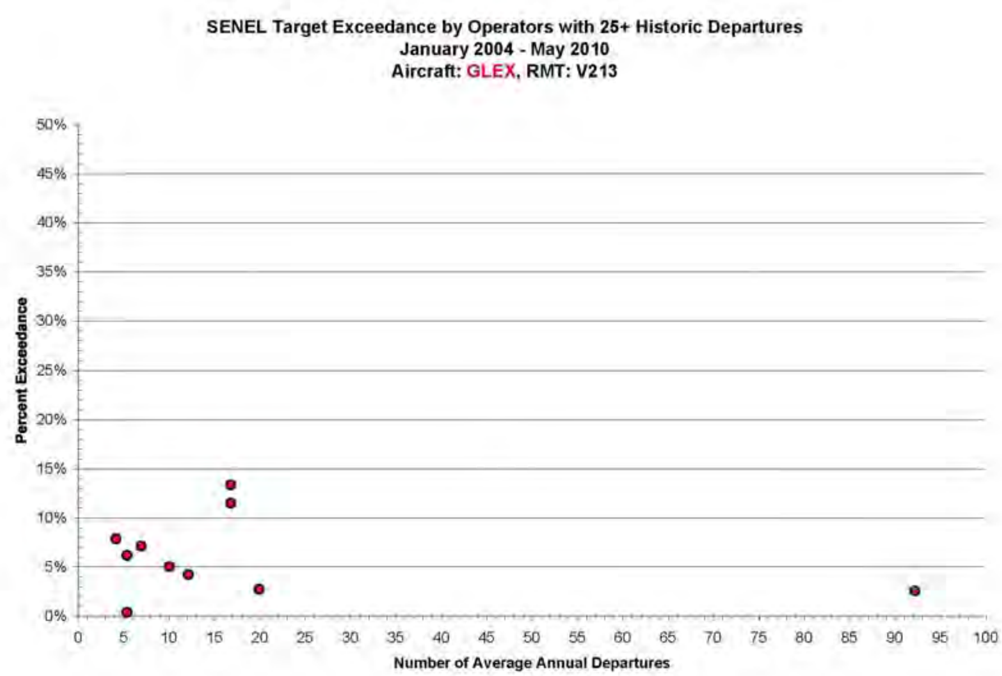

SENEL Target Exceedance by Operators with 25+ Historic Departures
January 1998 - May 2010
Aircraft: FA10, RMT: V213
Percent Exceedance
Number of Average Annual Departures

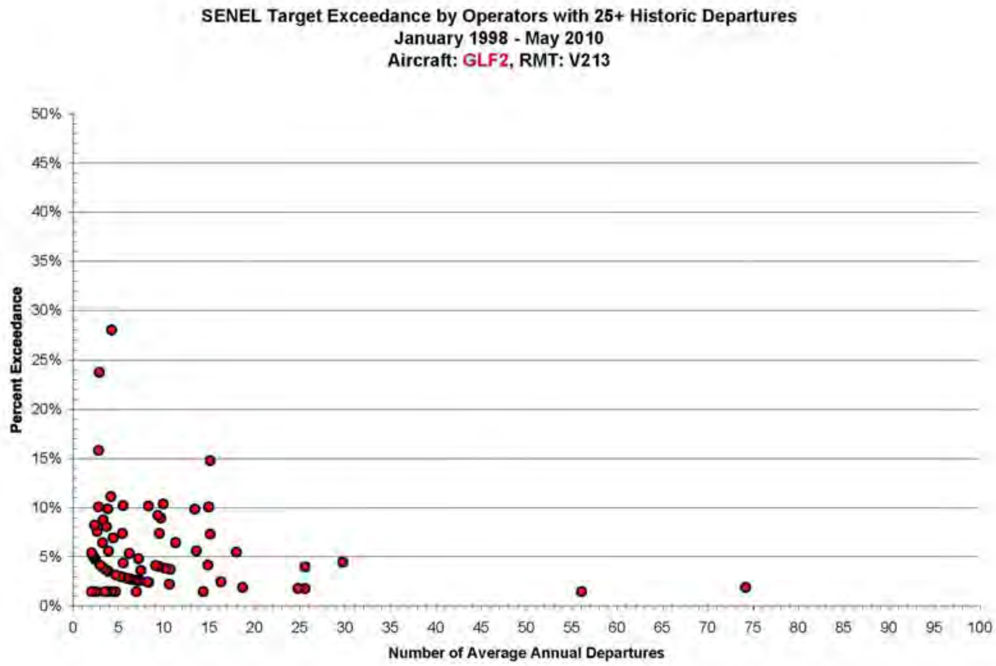

SENEL Target Exceedance by Operators with 25+ Historic Departures
January 2003 - May 2010
Aircraft: FA20, RMT: V213
Percent Exceedance
Number of Average Annual Departures

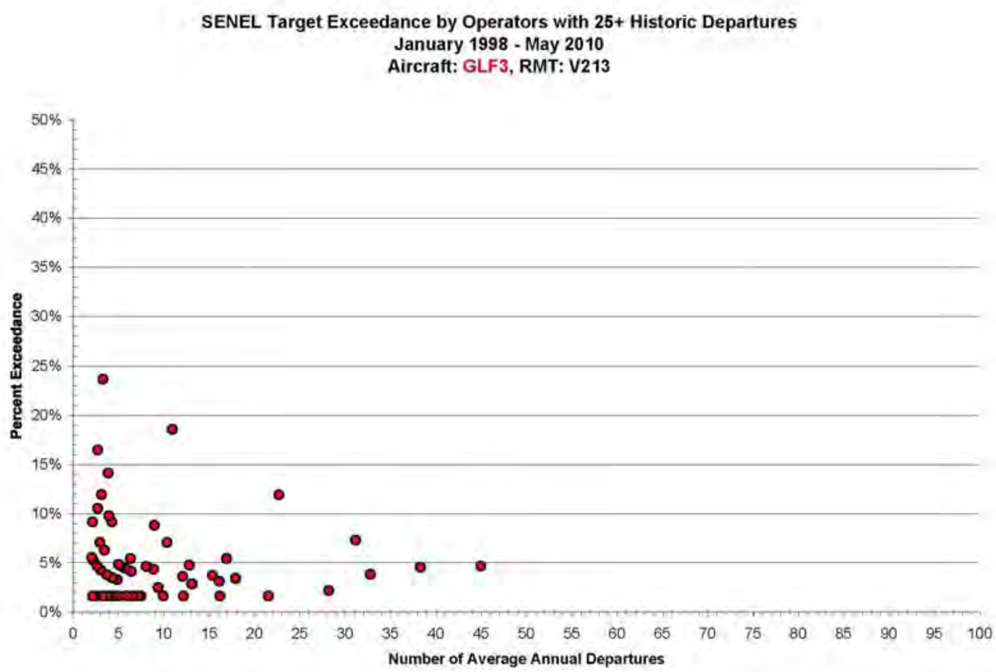

SENEL Target Exceedance by Operators with 25+ Historic Departures
January 1998 - May 2010
Aircraft: FA50, RMT: V213
Percent Exceedance
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
Number of Average Annual Departures

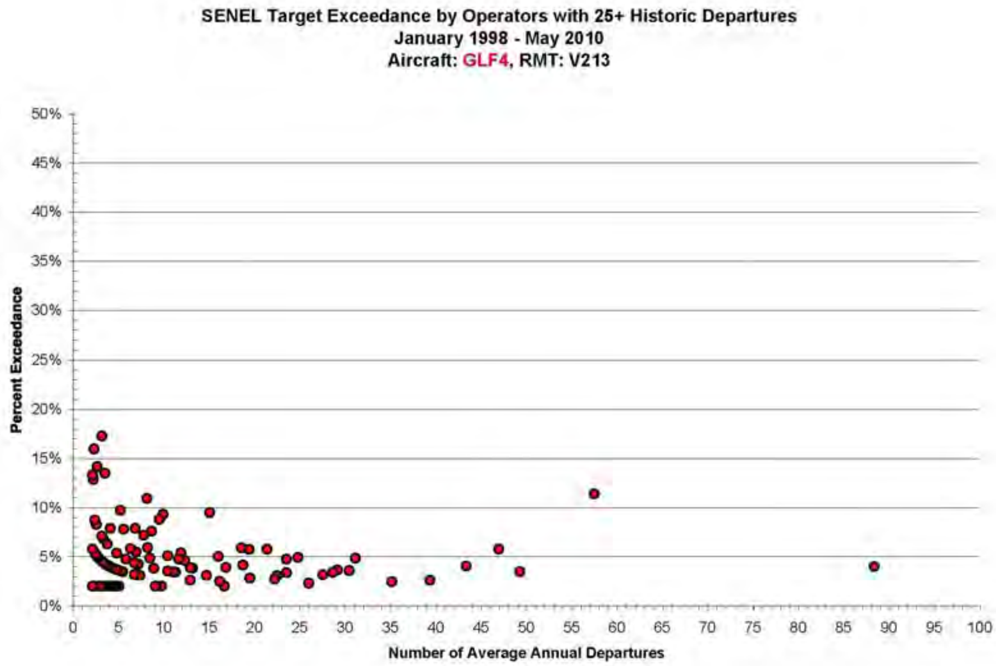

SENEL Target Exceedance by Operators with 25+ Historic Departures
September 2008 - May 2010
Aircraft: G150, RMT: V213
Percent Exceedance
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
Number of Average Annual Departures

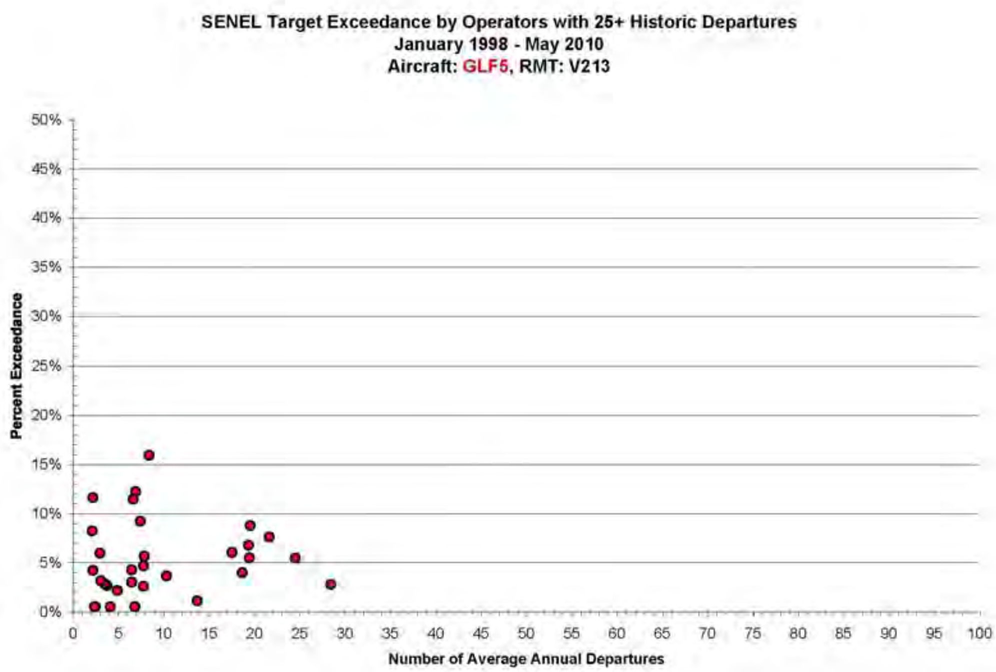

SENEL Target Exceedance by Operators with 25+ Historic Departures
February 2006 - May 2010
Aircraft: GALX, RMT: V213
Percent Exceedance
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250
Number of Average Annual Departures


SENEL Target Exceedance by Operators with 25+ Historic Departures
January 2004 - May 2010
Aircraft: GLEX, RMT: V213
Percent Exceedance
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
Number of Average Annual Departures


SENEL Target Exceedance by Operators with 25+ Historic Departures
January 1998 - May 2010
Aircraft: GLF2, RMT: V213
Percent Exceedance
Number of Average Annual Departures


SENEL Target Exceedance by Operators with 25+ Historic Departures
January 1998 - May 2010
Aircraft: GLF3, RMT: V213
Percent Exceedance
Number of Average Annual Departures


SENEL Target Exceedance by Operators with 25+ Historic Departures
January 1998 - May 2010
Aircraft: GLF4, RMT: V213
Percent Exceedance
0%
5%
10%
15%
20%
25%
30%
35%
40%
45%
50%
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
Number of Average Annual Departures


SENEL Target Exceedance by Operators with 25+ Historic Departures
January 1998 - May 2010
Aircraft: GLF5, RMT: V213
Percent Exceedance
0%
5%
10%
15%
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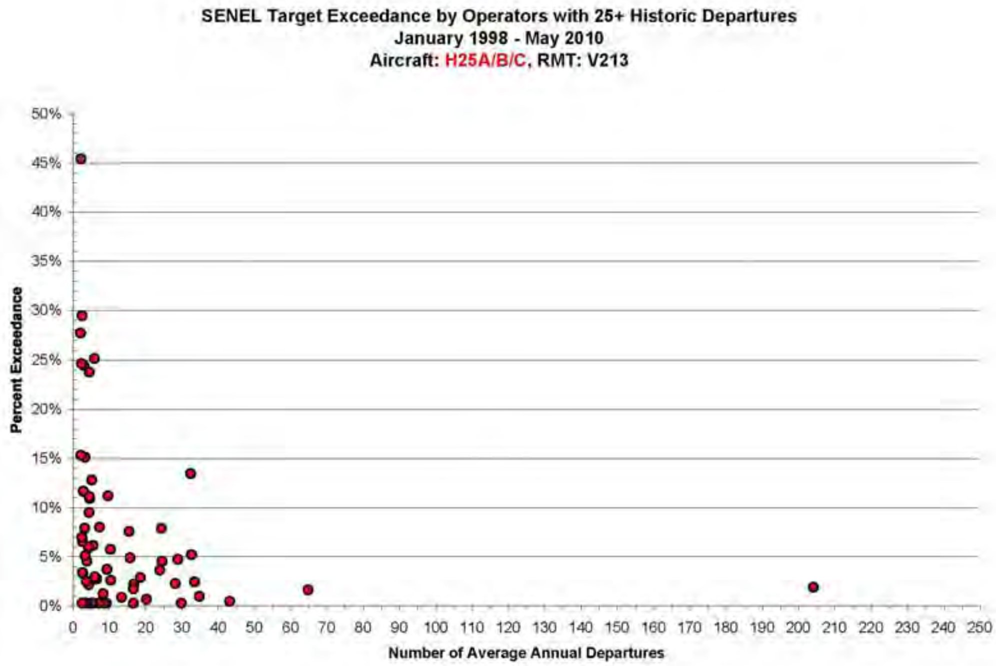
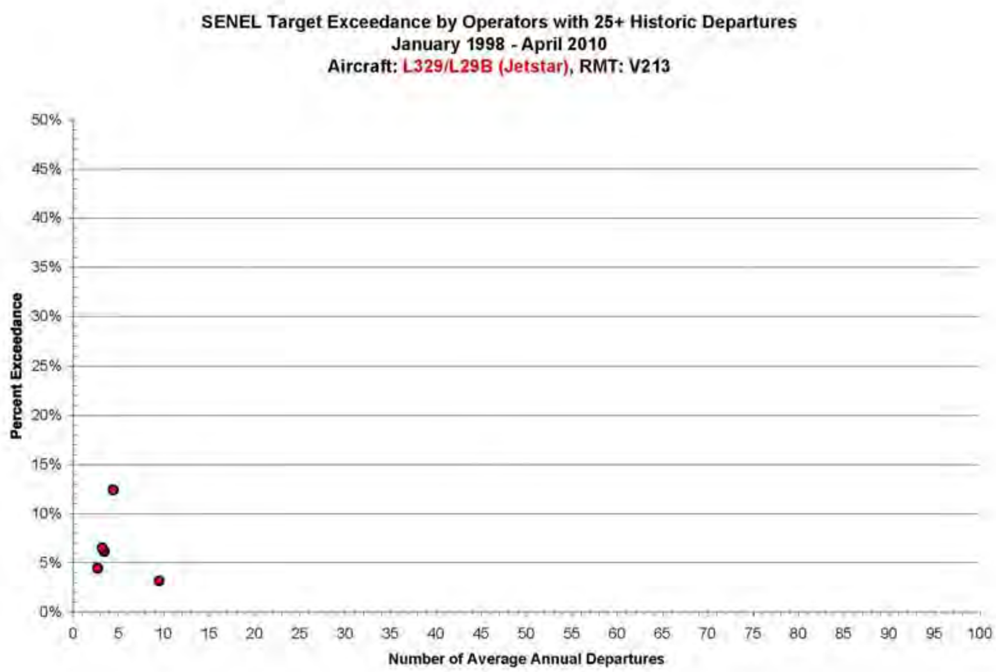
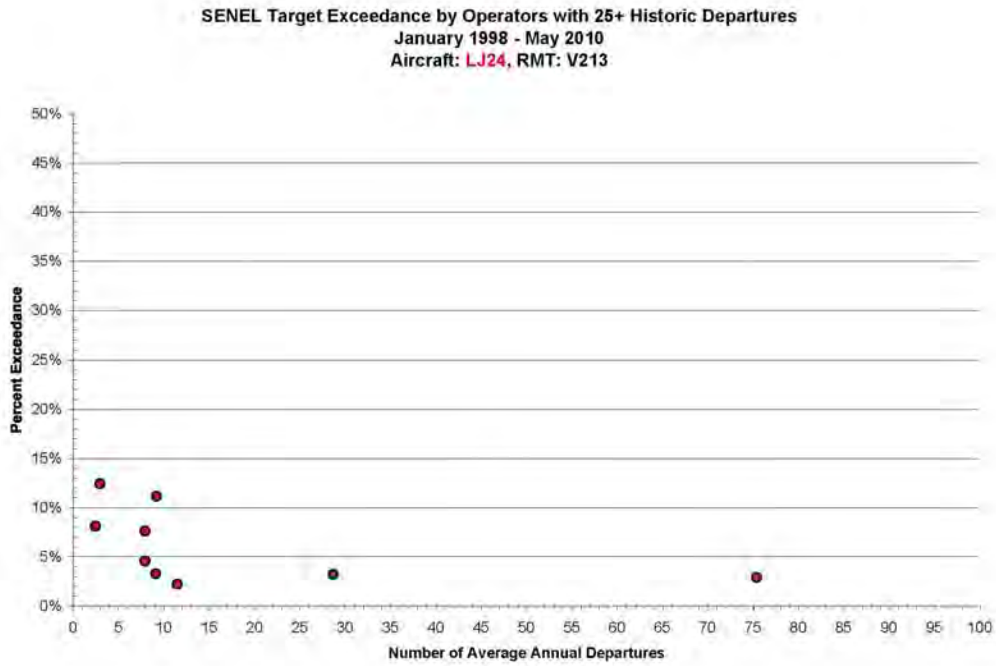
25%
30%
35%
40%
45%
50%
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
Number of Average Annual Departures


SENEL Target Exceedance by Operators with 25+ Historic Departures
January 1998 - May 2010
Aircraft: H25A/B/C, RMT: V213
Percent Exceedance
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250
Number of Average Annual Departures


SENEL Target Exceedance by Operators with 25+ Historic Departures
January 1998 - April 2010
Aircraft: L329/L29B (Jetstar), RMT: V213
Percent Exceedance
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
Number of Average Annual Departures


SENEL Target Exceedance by Operators with 25+ Historic Departures
January 1998 - May 2010
Aircraft: LJ24, RMT: V213
Percent Exceedance
Number of Average Annual Departures
0%
5%
10%
15%
20%
25%
30%
35%
40%
45%
50%
0
5
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15
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45
50
55
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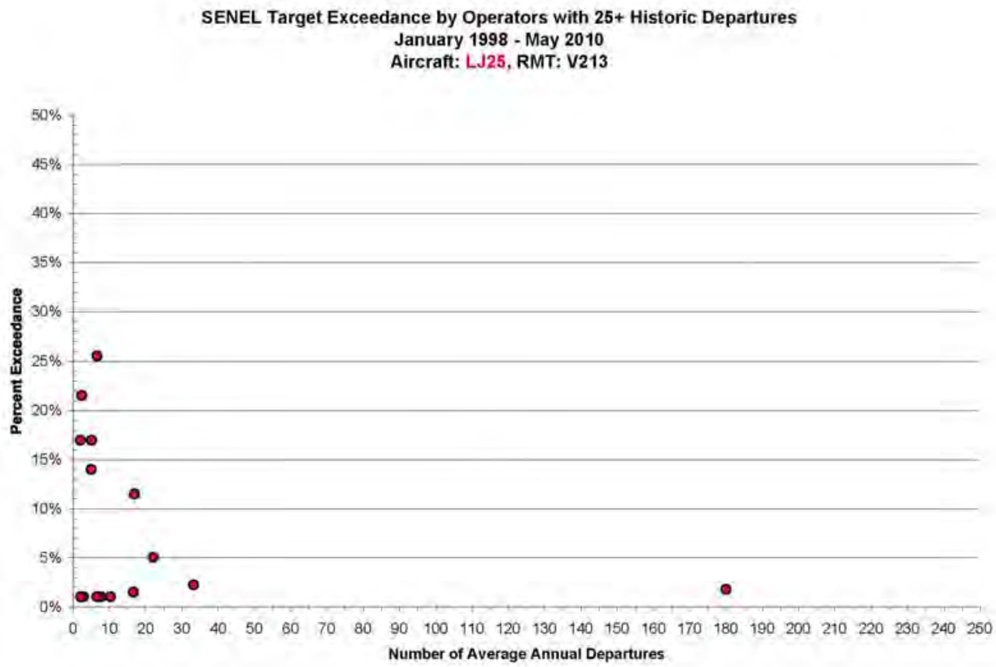
75
80
85
90
95
100


SENEL Target Exceedance by Operators with 25+ Historic Departures
January 1998 - May 2010
Aircraft: LJ25, RMT: V213
Percent Exceedance
Number of Average Annual Departures
0%
5%
10%
15%
20%
25%
30%
35%
40%
45%
50%
0
10
20
30
40
50
60
70
80
90
100
110
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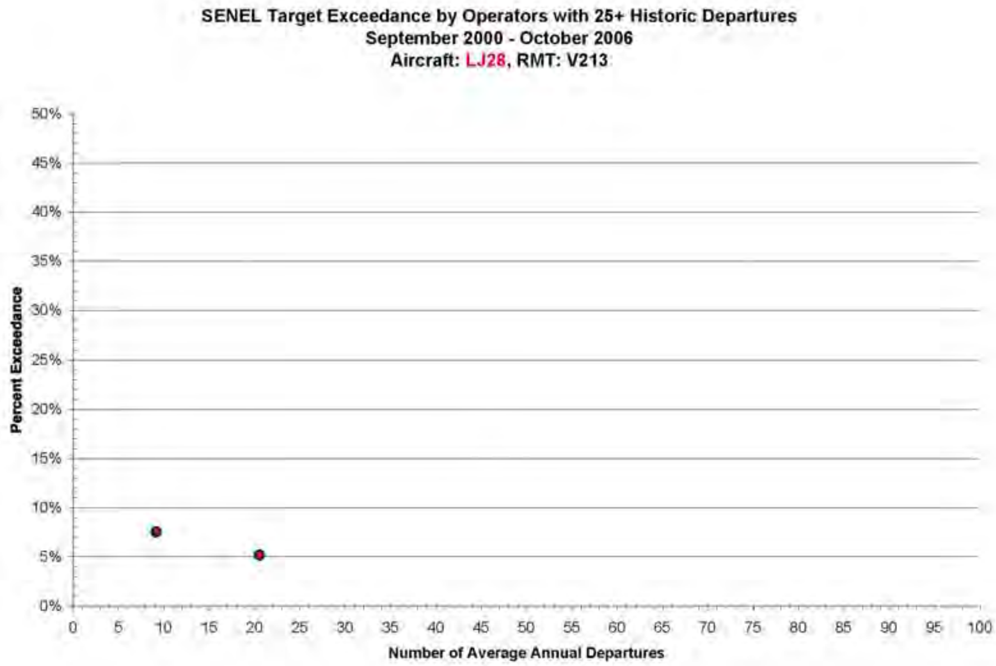
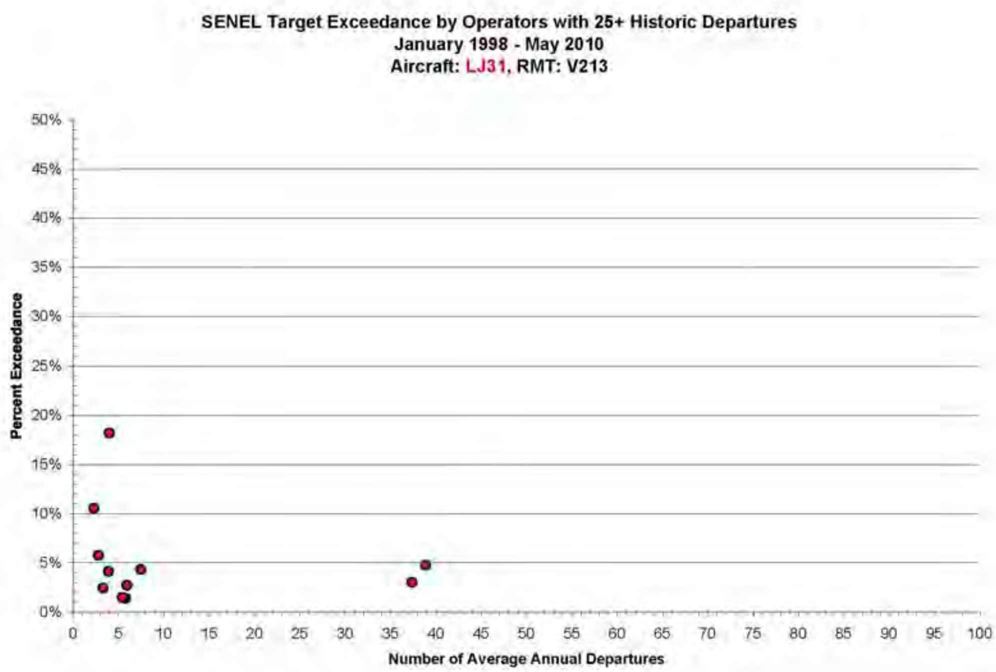
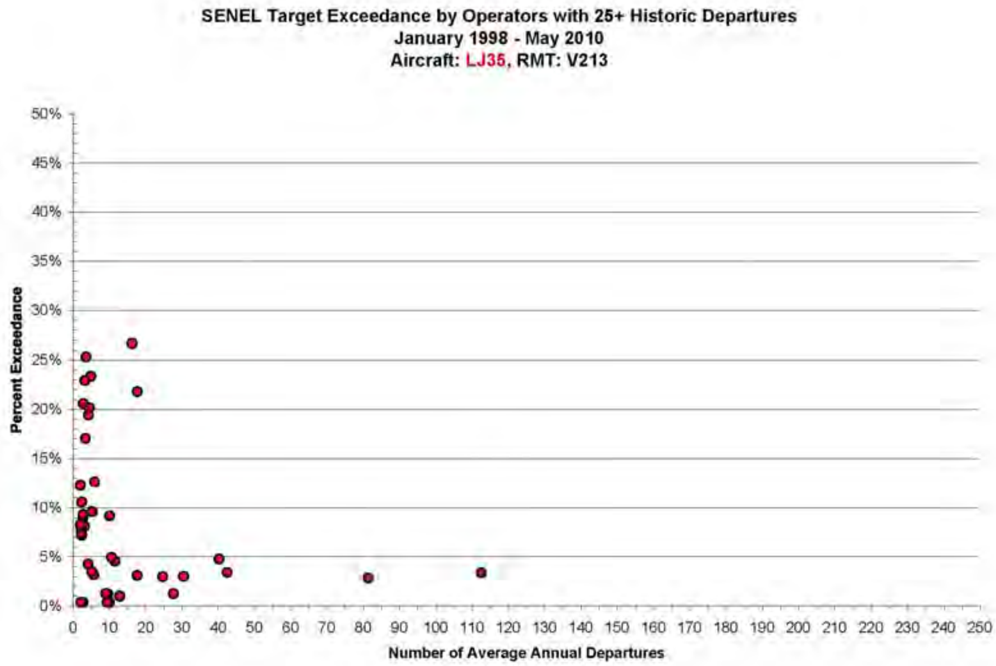
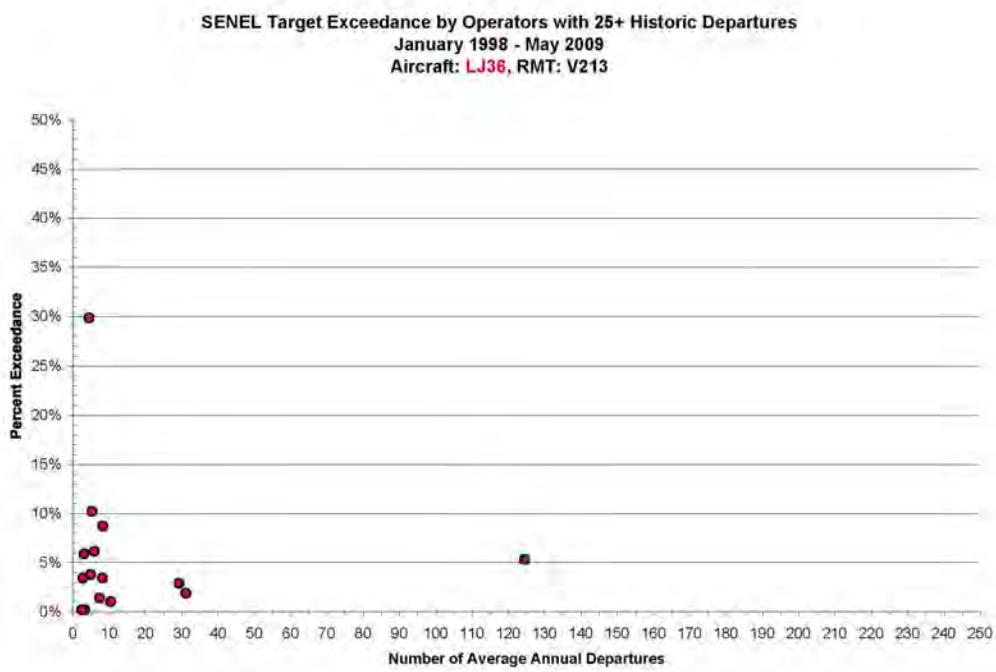
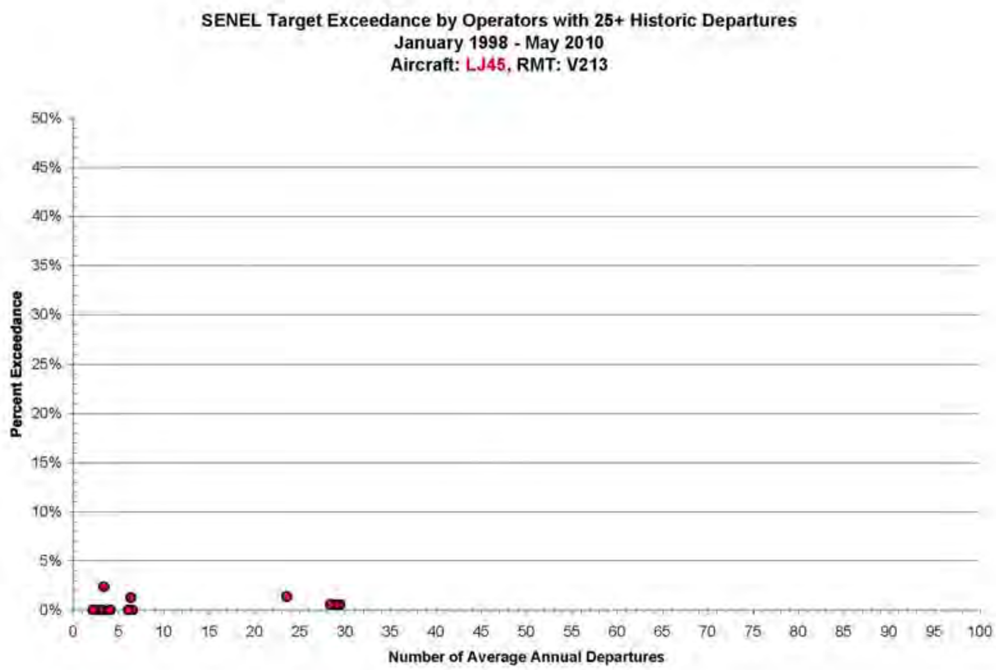
210
220
230
240
250

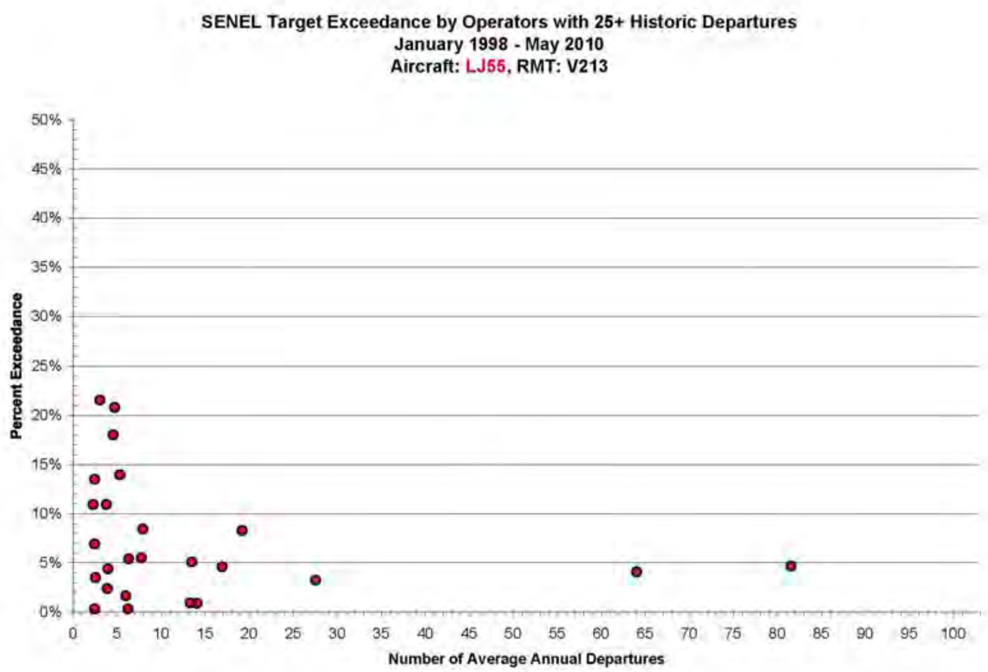

SENEL Target Exceedance by Operators with 25+ Historic Departures
September 2000 - October 2006
Aircraft: LJ28, RMT: V213
Percent Exceedance
0% 5% 10% 15% 20% 25% 30% 35% 40% 45% 50%
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
Number of Average Annual Departures

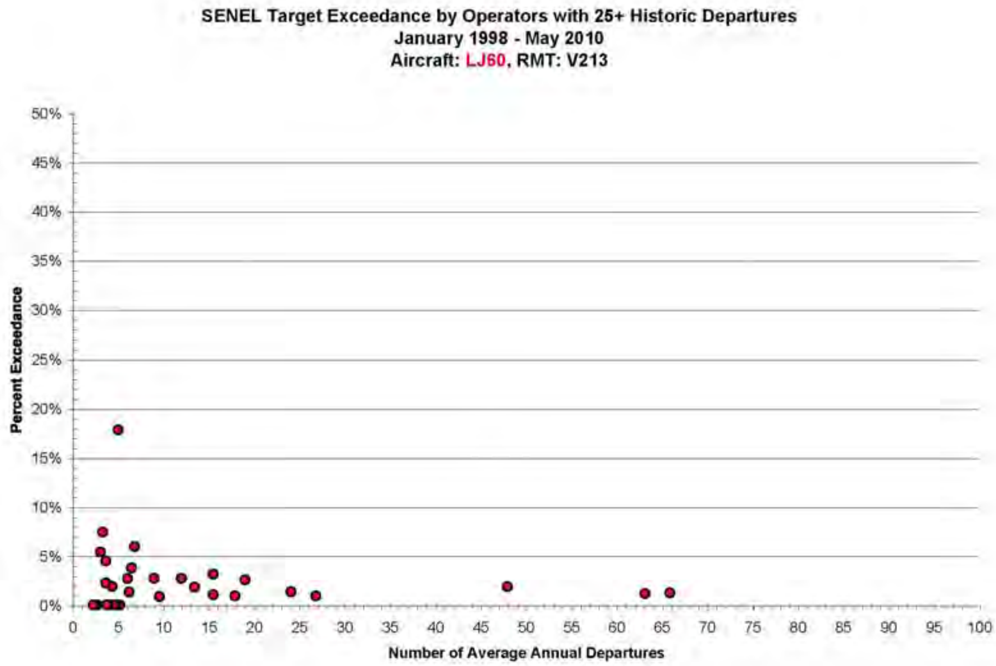

SENEL Target Exceedance by Operators with 25+ Historic Departures
January 1998 - May 2010
Aircraft: LJ31, RMT: V213
Percent Exceedance
0% 5% 10% 15% 20% 25% 30% 35% 40% 45% 50%
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
Number of Average Annual Departures

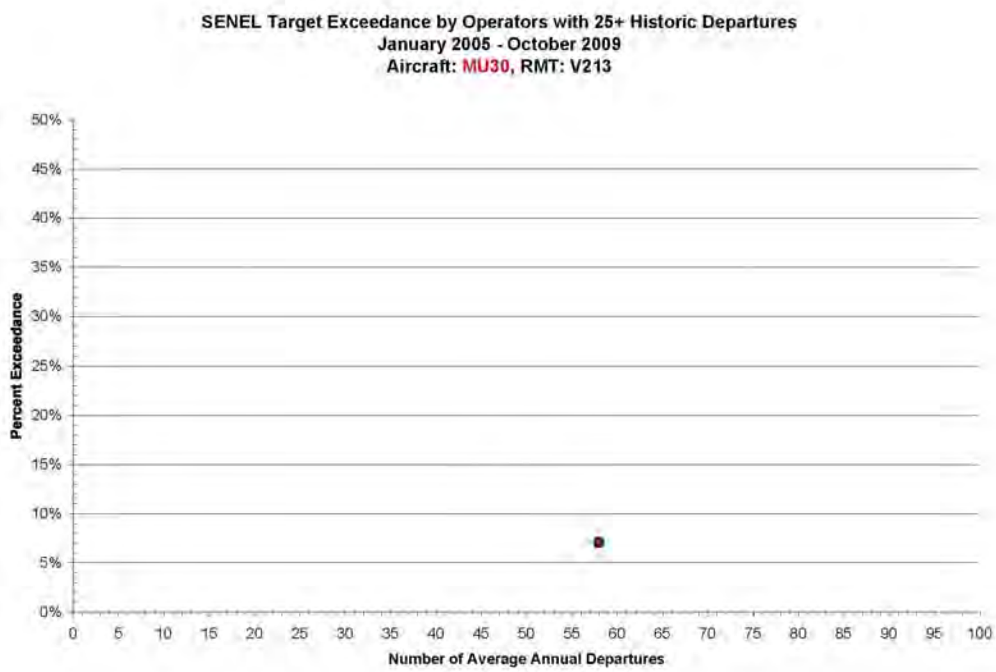

SENEL Target Exceedance by Operators with 25+ Historic Departures
January 1998 - May 2010
Aircraft: LJ35, RMT: V213
Percent Exceedance
Number of Average Annual Departures

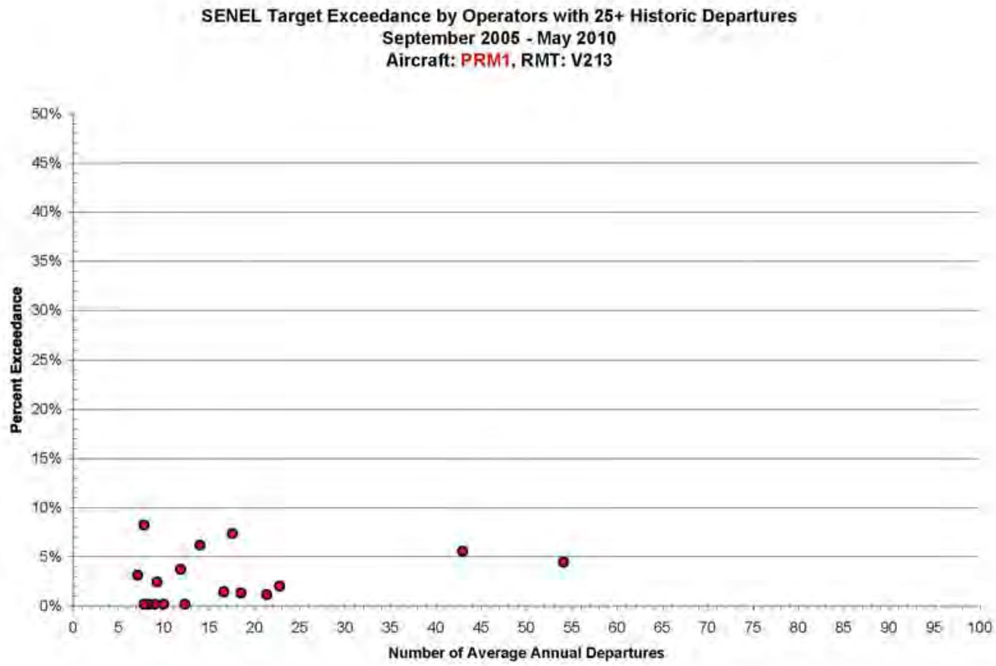

SENEL Target Exceedance by Operators with 25+ Historic Departures
January 1998 - May 2009
Aircraft: LJ36, RMT: V213
Percent Exceedance
Number of Average Annual Departures

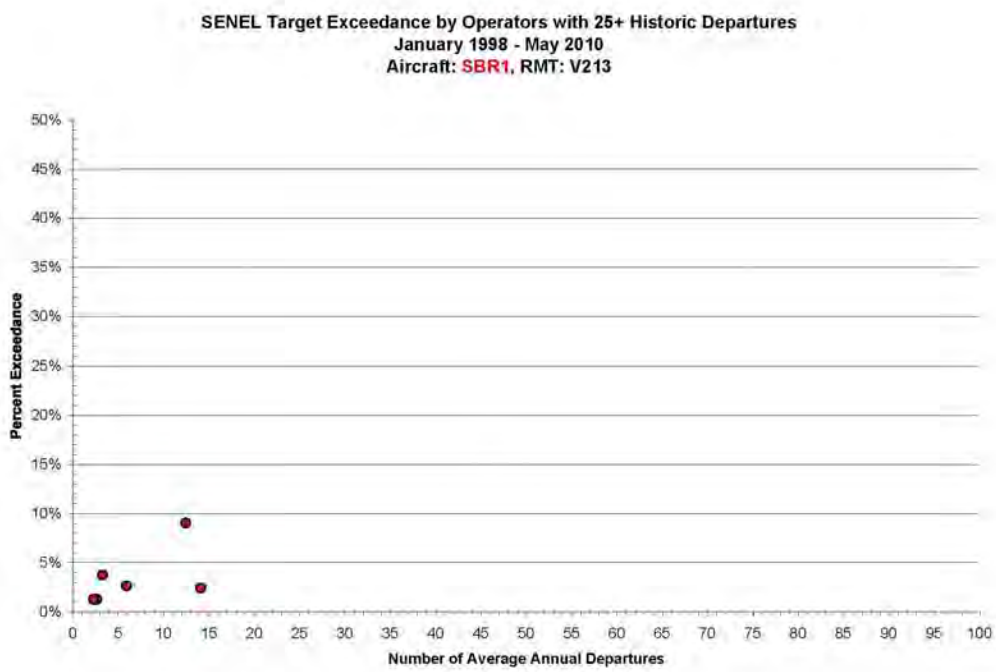

SENEL Target Exceedance by Operators with 25+ Historic Departures
January 1998 - May 2010
Aircraft: LJ45, RMT: V213
Percent Exceedance
0%
5%
10%
15%
20%
25%
30%
35%
40%
45%
50%
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
Number of Average Annual Departures

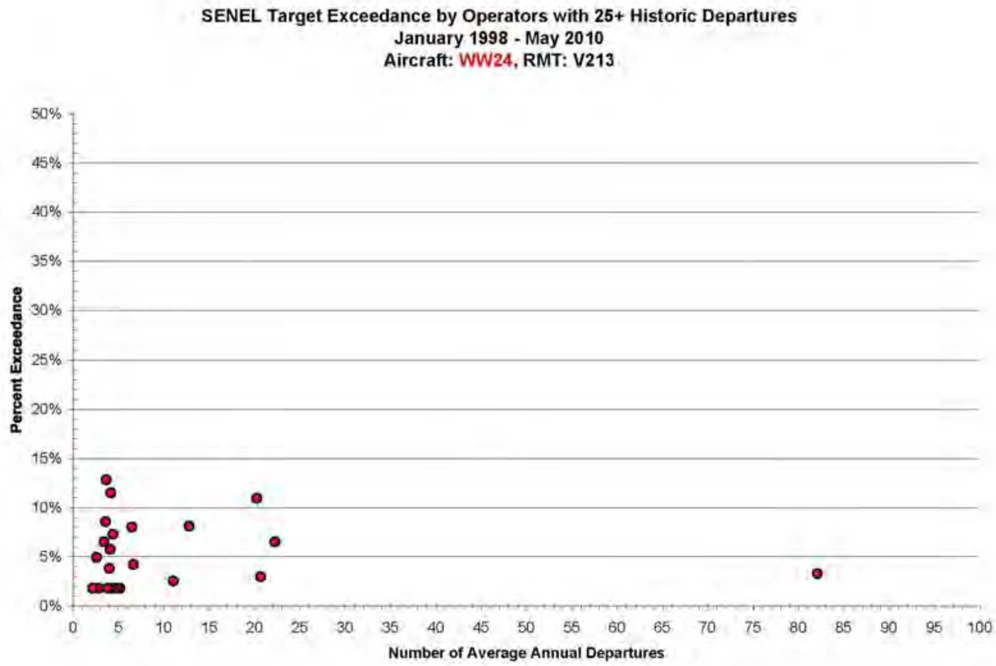

SENEL Target Exceedance by Operators with 25+ Historic Departures
January 1998 - May 2010
Aircraft: LJ55, RMT: V213
Percent Exceedance
0%
5%
10%
15%
20%
25%
30%
35%
40%
45%
50%
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
Number of Average Annual Departures


SENEL Target Exceedance by Operators with 25+ Historic Departures
January 1998 - May 2010
Aircraft: LJ60, RMT: V213
Percent Exceedance
Number of Average Annual Departures


SENEL Target Exceedance by Operators with 25+ Historic Departures
January 2005 - October 2009
Aircraft: MU30, RMT: V213
Percent Exceedance
Number of Average Annual Departures


SENEL Target Exceedance by Operators with 25+ Historic Departures
September 2005 - May 2010
Aircraft: PRM1, RMT: V213
Percent Exceedance
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
Number of Average Annual Departures


SENEL Target Exceedance by Operators with 25+ Historic Departures
January 1998 - May 2010
Aircraft: SBR1, RMT: V213
Percent Exceedance
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
Number of Average Annual Departures


SENEL Target Exceedance by Operators with 25+ Historic Departures
January 1998 - May 2010
Aircraft: WW24, RMT: V213
Percent Exceedance
0%
5%
10%
15%
20%
25%
30%
35%
40%
45%
50%
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Number of Average Annual Departures

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