Chapter 7
Noise

This chapter summarizes information that was included in the *Draft ESPR* for noise conditions at Hanscom Field for year 2000 and the 2005 and 2015 scenarios and provides responses to scoping elements identified in the MEPA Certificate related to past noise trends, including changes in EXP, changes in the noise model that was used for the *Draft ESPR* analysis, and changes in Time-Above (TA) computations and Sound Exposure Level (SEL) distributions. This chapter also presents the current status of the Hanscom Noise Workgroup recommendations; the recent recommendation for the use of L_{max} 90 dBA weighted noise contour; estimation of Day-Night Sound Level (DNL) and TA values for additional noise sensitive receptors including locations in the Minute Man National Historical Park; and, recommendations for additional noise monitoring and environmentally beneficial measures.

Summary of the *Draft ESPR*

The *Draft ESPR* described the noise conditions at Hanscom Field for 2000 and for the forecast 2005 and 2015 scenarios. The *Draft ESPR* used a broad array of metrics to describe conditions including: Day-Night Sound Level (DNL), Time Above a decibel threshold (TA), Total Noise Exposure (EXP) and Distribution of Sound Exposure Levels (SEL). In general, noise levels at Hanscom Field have been increasing over the last several years, due primarily to increases in general aviation jet activity. This has been partially offset by technological trends toward quieter and better performing aircraft. This trend would continue with the addition of more jet activity in the High Growth forecasts for both 2005 and 2015, although the total population exposed to high noise levels at Hanscom Field remains low. Specific findings are outlined below:

- Comparison of year 2000 DNL noise contours to 1995 contours shows that noise levels have increased in Concord and Lexington, but decreased in Bedford and Lincoln. This is largely due to overall higher activity levels by general aviation (GA) jets, combined with lower use of Runway 5-23 (the shorter runway) by larger aircraft.

- Total population exposed to Day-Night Sound Level (DNL) greater than 65 dB has decreased from 29 in 1995 to 26 in 2000, all of which resides in Bedford. The total population in the four towns exposed to DNL values of 55 dB or greater in 2000 is estimated to be 2,848.

- Comparison of predicted noise levels at permanent noise monitoring sites shows good agreement at the sites closest to the airport, and less agreement at the more distant sites dominated by community (i.e., non-aviation) noise.

- The 2015 High Growth Scenario represents the worst noise condition of the four alternatives analyzed. Forecast noise levels for the 2015 High Growth Scenario show increases in DNL of as much as 4 dB at permanent noise monitoring locations. The total estimated population within the DNL 65 dB contour would increase from 26 in 2000 to 47-103 in 2005 and 53-202 in 2015.

Past Noise Trends

This section responds to scoping elements identified in the MEPA Certificate related to past noise trends. This includes changes in EXP, which Massport uses to track noise exposure around Hanscom Field, a discussion of changes in the Integrated Noise Model (INM), and changes in TA computations and SEL distributions.

EXP

The EXP metric indicates estimated changes in total noise exposure caused by changes in fleet activity (aircraft mix and number of operations), approximating expected resultant changes in DNL without the need to prepare noise contours. Massport has used EXP to track noise exposure around Hanscom Field since 1981. Table 7-1 below presents a historic comparison of EXP values from 1987 through 2000. A discussion of noise model differences is presented in the following section.

Table 7-1 Historic Trends in EXP

Year	Civilian Aircraft Departure EXP	Noise Model
1987	112.0	INM Version 3.9
1988	112.4	
1989	111.6	
1990	110.8	
1991	110.7	
1992	111.4	
1993	110.6	
1994	111.4	
1995	111.6	
1996	112.0	INM Version 5.1
1997	112.3	
1998	113.1	
1999	113.0	
2000	112.3	INM Version 6.0c

Noise Model Differences

All noise calculations in the *Draft ESPR* were prepared with the INM version 6.0c, which was the most current version available. Version 5.0 was used for the noise calculations in the *1995 GEIR*, the most current model version available at the time of that document. Prior analyses of EXP were prepared with previous versions: Version 3.9 was used from 1987 through 1996, and Version 5.1 was used from 1996 through 1999. Some of the major differences between these versions of the model are summarized below:

- The FAA released version 3.9 in May of 1987.

- The FAA released version 3.10 in June of 1992. Version 3.10 included updated noise and performance data for all aircraft included in the previous database, and included eighteen new aircraft types. There were no computational changes between Versions 3.9 and 3.10. Massport continued to use INM 3.9 for consistency with prior calculations of EXP.

- Version 4.11 was released in December of 1993. This version of the model included noise calculation improvements, an expanded database, and incorporated algorithms that alter aircraft performance assumptions depending on user-defined temperature and airport elevation parameters. Massport continued to use INM 3.9 for consistency with prior calculations of EXP.

- Version 5.0 was released in August 1995. Major enhancements included: a new graphics user interface, new data preparation and data input aids, new graphics and plotting capabilities, and improved and faster noise calculation algorithms. Massport upgraded to this version for noise calculations in the *1995 GEIR*.

- Version 5.1 was released in February 1997. Major improvements included incorporation of parts of the preprocessor program and access to NOISEMAP (USAF) data. Massport upgraded to this version for new calculations of EXP beginning with 1996.

- Version 5.2 was released in May 1998. Three new aircraft were added to the database and twenty new substitution aircraft were added. Data for four aircraft were modified to correct various problems. Massport continued to use INM 5.1 for consistency with prior calculations of EXP.

- Version 6.0 was released in October 1999. This was the first release in a new series of the INM. It included one new aircraft type and many algorithm improvements, including the ability to take atmospheric absorption into account. It utilized a new version of the contour plotting program, NMPlot, and added several new options to the model. Massport continued to use INM 5.1 for consistency with prior calculations of EXP.

- Version 6.0a was released in May 2000. This was the first minor release in the INM6 series; it added noise and performance data for the Airbus 340 and Embraer 120. Massport continued to use INM 5.1 for consistency with prior calculations of EXP.

- Version 6.0b was released in January 2001. This second minor release of the INM6 series contains noise and performance data for the Airbus 330, Boeing 737-700, the Cessna Citation 550 Bravo and several Cessna piston engine aircraft. Massport continued to use INM 5.1 for consistency with prior calculations of EXP.

- Version 6.0c was released in September 2001; this version contains new noise and performance data for the A319-121 and A320-232; the Boeing 717-200, 777-300, and 767-400; the Cessna Citation X; and the Gulfstream GII, GIII, GIV, and GV. Massport upgraded to this version for noise calculations in the current ESPR and for new calculations of EXP.

In summary, the most significant differences between Versions 5.1 and 6.0c that could affect noise predictions at Hanscom are: the introduction of new propagation algorithms to take atmospheric effects (temperature and relative humidity) into account; and an update to the database with new noise and performance profiles for the Gulfstream II and III aircraft.

DNL Contours and TA Computations

The *Draft ESPR* compared DNL Contours for 1995 and 2000 operations. As discussed in the *Draft ESPR*, the major differences in contours were due to: changes in runway use assignments (based on Massport's more precise method of data collection for runway use), increased operations by jet aircraft, and new noise and performance data for the Gulfstream II and III.

Table 7-2 includes TA65 dBA predictions at those noise-sensitive sites that were common to both the *1995 GEIR* and the *Draft ESPR*. These locations are illustrated in Figure 7-1. The *1995 GEIR* did not include the TA55 dBA values, which were added to the *Draft ESPR* in response to recommendations from the Noise Workgroup. There was an overlap of only a few noise-sensitive sites for TA65 dBA for each of the two

studies because the current ESPR focused more on historic resources than on residential neighborhoods featured in the earlier GEIR. The table includes values calculated in 1995 for 1995 levels, as well as predictions for 2000 with 1% and 3% growth scenarios; note that predictions for the *1995 GEIR* were made with INM 5.0.

Table 7-2 Comparison of TA65 Computations, in minutes, at Noise Sensitive Receptors

Label	Name	Address	Town	1995*	2000 1% Growth*	2000 3% Growth*	2000	2005 Mod.	2005 High	2015 Mod.	2015 High
N35	Daniel Brooks House	Brooks Rd.	Lincoln	21	22	24	4.3	5.0	5.6	6.0	7.0
S14	Diamond Middle School	99 Hancock St.	Lexington	0	0	0	5.7	7.4	9.1	8.7	11.5
S15	Estabrook School	117 Grove St.	Lexington	6	6	7	2.0	2.8	3.6	3.5	4.9

* *Hanscom Field GEIR Update 1995, Baseline and Analysis, Report EOEA #5484/8696*

For the three sites that appear in both analyses, comparisons of predictions in 1995 and 2000 show the following:

- **Daniel Brooks House, Lincoln:** The TA 65 at this site is less in 2000 than 1995 (4.3 minutes versus 21 minutes) because of the same issues related to changes in DNL, namely that 2000 contours assume less use of Runway 05/23.

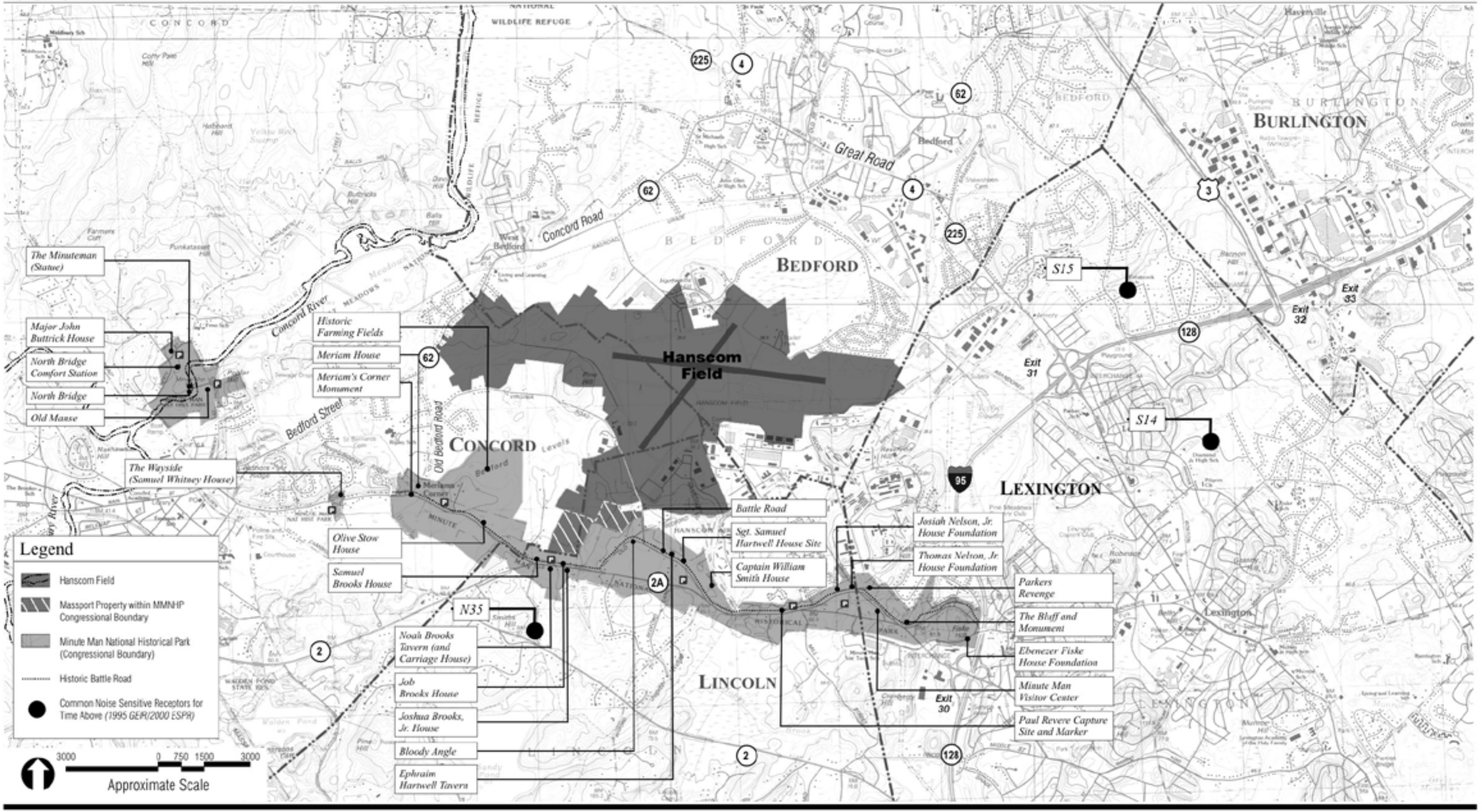
- **Diamond Middle School, Lexington:** This site shows greater Time Above 65 dBA in 2000 than 1995, 5.7 minutes per day in 2000 versus 0 minutes in 1995. Again, this is most likely due to the same factors driving DNL contours: higher use of Runway 11-29, and more jet operations.

- **Estabrook Elementary School, Lexington:** This site shows a decrease from estimated TA 65 dBA of 6 minutes in 1995 to 2 minutes in 2000. This is most likely due to runway use assumptions, specifically that fewer departures use Runway 11 (departures to the east, over Estabrook School) in the 2000 case as compared with 1995.

SEL Distributions

Figure 7-2 presents a distribution of operations by Sound Exposure Level (SEL) for historical data: 1987, 1990, 1995, and 2000. Data were derived from Massport's Annual Noise Reports for 1987 and 1990, and from the *1995 GEIR* for 1995. This presentation was recommended by the Hanscom Noise Workgroup, and was included in the *Draft ESPR* for 2000 and all forecast scenarios. The figure shows that operations by the noisiest aircraft types (SEL greater than 105 dBA) have decreased over time, while operations by relatively quieter aircraft types have increased during that same period.

5796_noise_sensitive_receptors.cdr



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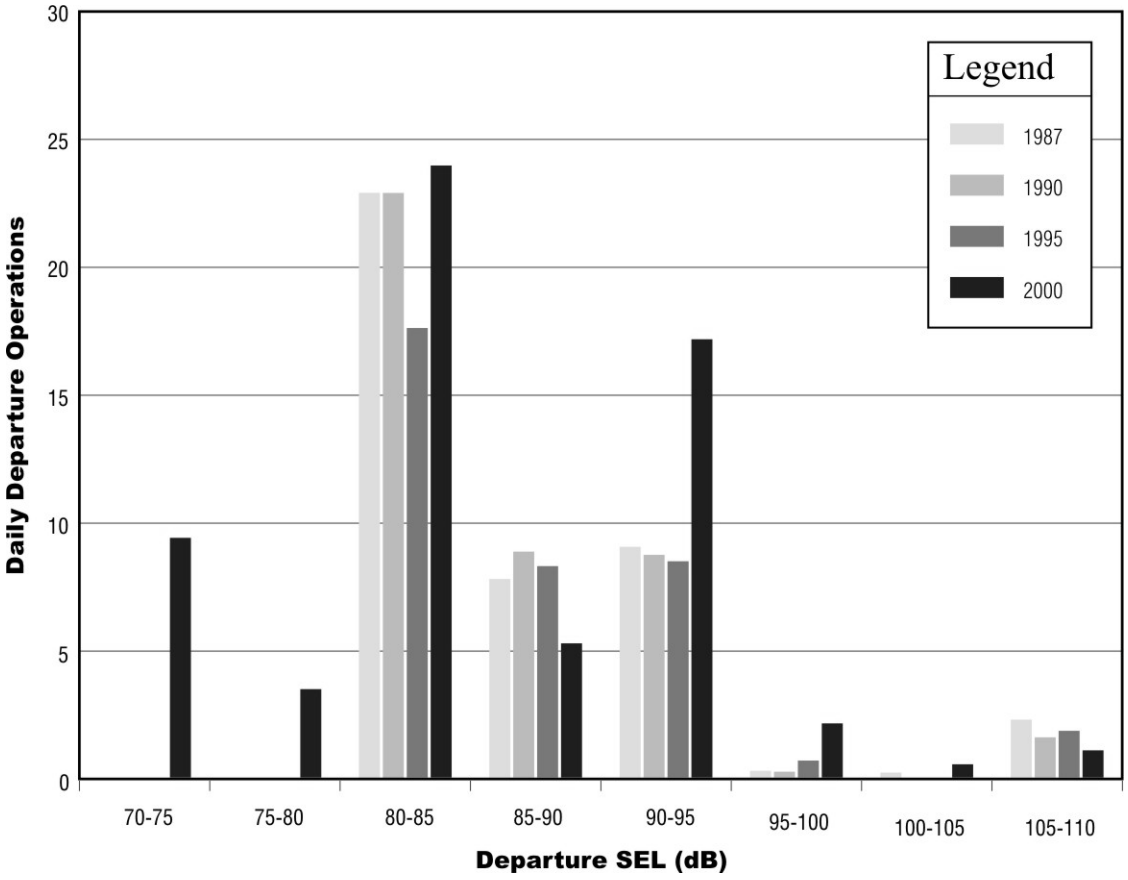
Base Map: MA USGS Maps;
MA GIS website, 1996

2000 Hanscom Field Final ESPR
Bedford, Concord, Lexington and Lincoln, Massachusetts

Noise Sensitive Receptors:
MMNHP and Common *1995 GEIR/2000 ESPR* Locations Figure 7-1

Figure 7-2 Distribution of Daily Departure SELs (Excluding Single Engine Prop)



Noise Workgroup Recommendations

Following the filing of the *1995 GEIR* in 1997, the Massachusetts Secretary of Environmental Affairs (EOEA) asked Massport to organize and meet with a community- and aviation-based workgroup for six months. The committee, known as the Hanscom Field Noise Workgroup, met for a period of two years, and published its findings in a report entitled "Report of the Hanscom Field Noise Workgroup," dated September 22, 1999. Their report summarizes the series of meetings by the committee and its two task groups, one devoted to abatement and mitigation, the other to metrics and modeling. Together, the two task groups developed a comprehensive list of recommendations.

In establishing the scope of work for the *Draft ESPR*, the Secretary included the Noise Workgroup recommendations that were practical and generally consistent with previous work at Hanscom Field. The *Draft ESPR* discussed recommendations of the Noise Workgroup Metrics Subcommittee. Those recommendations, which were included in the *Draft ESPR*, are summarized in Table 7-3. The Noise Abatement Subcommittee also made noise abatement recommendations, which are presented in Chapter 12 - Mitigation.

Table 7-3 Hanscom Noise Work Group Recommendations for ESPR Scope

Number	Description	Status
M1	*The workgroup should continue in existence and make additional suggestions for changes to the ESPR.*	The Noise Workgroup contributed substantially to the development of the current scope of work that led to this document. Massport will continue to work with the Noise Workgroup on future ESPRs.
M2	*The ESPR should include Time-Above (TA) contours and their areas.*	Included as Figures 7-11 and 7-12 and Figures 7-19 to 7-26 of the *Draft ESPR*.
M3	*The ESPR should show Single Event Level Distributions.*	Included as Figures 7-13 and 7-14 of the *Draft ESPR*.
M4	*The next GEIR [ESPR] should include a linear dimensionless metric to show exposure to noise energy.*	Not included. No such metric is used regularly in the evaluation of aircraft or other environmental noise.
M5	*Future GEIRs should include discussion of impacts with reference to the EPA level of 55 dB DNL and avoid the implication that DNL less than 65 (the Federal Aviation Administration mitigation threshold) has no impact.*	Included. Chapter 7 - Noise of the *Draft ESPR* provided information for both 55 and 65 dB DNL.
M6	*Future GEIRs should include three Community Summary Metrics - Loud Event Count, Area of 55 dB DNL contour, and Area of the 30-minute TA 55 dBA contour.*	Included. Figures 27 of the *Draft ESPR* and Figure 7-2 of the *Final ESPR* present SEL distributions; Table 7-16 provided area estimates and Table 7-17 of the *Draft ESPR* provided population estimates within the current and forecasted 55 dB DNL contour; Figure 7-12 and Figures 7-23 to 7-16 of the *Draft ESPR* include the area of the 30-minute TA 55 dBA contour.
M7.	*Documentation should include a detailed list of assumptions and model parameters used in the noise modeling.*	Included in Chapter 7 - Noise of the *Draft ESPR* and further explained as part of this *Final ESPR*.
M8	*The ESPR should include a section discussing the estimated variation in Integrated Noise Model (INM) results due to different modeling assumptions, and Massport should adopt the standard practice of reporting "error bands." The ESPR should also include a comparison of measured and modeled results and an explanation of the differences.*	Not included. The real goal of the noise analyses in the ESPR is intended to evaluate the range of alternative growth scenarios, which is accomplished by comparing and explaining noise predictions under different fleet and airport development assumptions.
M9	*Future ESPRs should explain expected short-term variations in noise from long-term averages.*	Included in Chapter 7 - Noise of the *Draft ESPR*.
M10	*The ESPR should document how changes in the INM data [base] affect predicted noise exposure.*	Included in Chapter 7 - Noise of the *Draft ESPR* and further explained as part of this *Final ESPR*.
M11 and M12	*Three of the six permanent noise monitoring sites should be relocated and more sites should be added to the system.*	Not included. Massport and the workgroup should address these issues outside the scope of the ESPR.
M13 and M14	*A procedure or system should be developed to correlate noise events with flight data and complaints, and the noise data should be stored in a publicly accessed location such as a web site.*	Not included. This requires installation of a new noise and operations monitoring system, which Massport is considering installing at a future date.

Review of the L_{max} 90 dBA Weighted Noise Contour

The *Draft ESPR* used a broad array of metrics to describe conditions including DNL, TA, EXP, and Distribution of Sound Exposure Levels. An additional metric - the L_{max} 90 dBA contour - was proposed during the *Draft ESPR* public participation process following the release of the *Draft ESPR*. The Secretary's certificate stated: "… if the FESPR does not adopt the L_{max} 90 dBA weighted noise contour as recommended by the Noise Workgroup, it should provide the rationale in detail, as well as whether another contour exists that would meet its goals."

Massport respectfully points out that the Noise Workgroup never recommended use of the L_{max} 90 dBA contour at any time during its two years of deliberations and meetings. The notion of using the L_{max} 90 dBA contour was presented for the first time as a comment at the public meeting held by the Secretary of Environmental Affairs on November 19, 2002 on the *Draft ESPR*. This observation notwithstanding, Massport produced examples of the L_{max} 90 dBA contour as requested in the Certificate which confirm that the metric has no use as a means of evaluating alternatives or informing decision-makers or the public as to potential changes in the noise environment at Hanscom or at any other airport.

- The L_{max} 90 dBA contour encompasses the area exposed to 90 dBA or higher for any period time during an average day, regardless of how high the noise level gets, how long the noise lasts, or how frequently the noise occurs. This is because the contour size is determined by the loudest aircraft type in the fleet on any given flight track. As long as that aircraft type remains in the fleet, the contour will not change. Whether that aircraft operates once per year or a thousand times per year, the contour will not change. Whether there were ten thousand new operations per year by an aircraft making far less noise than the loudest one, the contour will not change. Thus, the overall noise environment can transform dramatically, but the L_{max} 90 dBA contour will not account for or reflect any of it. (All of the other metrics used in the *Draft ESPR* and this *Final ESPR* do reflect such changes.)

- There is no scientific basis for using the L_{max} 90 dBA contour to meaningfully describe or evaluate a noise environment. Accordingly, it is not used by any other airport to evaluate noise impacts, nor is it recognized as a standard by any state or federal agency responsible for assessing aircraft noise.

To illustrate these points, Figure 7-3 presents a comparison between the Lmax 90 contour for the year-2000 scenario and for the 2015 High Growth scenario, and, as seen, there is no difference between the two. This is because these contours are driven by the noise levels of the loudest aircraft in the fleet mix - in this case the Gulfstream II and military jet operations - and not by the number of operations by those aircraft types. Until the noisiest aircraft types are removed entirely from the fleet, the Lmax 90 dBA contours will not change. The same would be true for any of the other scenarios in this document. Yet, DNL and TA contours, by comparison, do account for the other aircraft types and their numbers of operations, all of which contribute to the surrounding noise environment and, thus, are much more appropriate for assessing differences among scenarios.

Operations

The *Draft ESPR* included data that described the forecasts for 2005 and 2015 Moderate and High Growth scenarios. Table 7-4 summarizes the average daily operations for the four forecast scenarios and includes the number of operations for helicopter and all groups in the 2015 Moderate Growth Scenario, in accordance with the MEPA Certificate. (This table was previously included as Table 7-15 in the *Draft ESPR*.)

Table 7-4 Forecast Average Daily Operations

Group	Departures		Arrivals		Total
	Day*	Night**	Day*	Night**	
2005 Moderate Growth					
Stage 2 Jets	2.5	0.2	2.4	0.3	5.4
Stage 3 Jets	36.2	2.8	35.8	3.2	77.9
Turbo Prop	31.3	0.4	31.3	0.4	63.3
Piston	234.9	0.8	234.7	0.7	471.1
Military	0.1	0.0	0.1	0.0	0.2
Helicopters	9.9	0.6	9.9	0.6	20.9
All Groups	314.8	4.7	314.2	5.2	639.0
2005 High Growth					
Stage 2 Jets	3.2	0.2	3.1	0.3	6.8
Stage 3 Jets	53.0	4.0	51.4	5.8	114.2
Turbo Prop	32.2	0.4	32.3	0.4	65.4
Piston	236.2	0.6	236.0	0.7	473.5
Military	0.1	0.0	0.1	0.0	0.2
Helicopters	9.9	0.6	9.9	0.6	21.0
All Groups	334.6	5.8	332.7	7.9	681.1
2015 Moderate Growth Scenario					
Stage 2 Jets	1.2	0.1	1.2	0.1	2.6
Stage 3 Jets	50.0	3.5	49.2	4.4	107.0
Turbo Prop	40.3	0.4	39.5	1.3	81.4
Piston	269.8	0.6	269.6	0.8	540.9
Military	0.2	0.0	0.2	0.0	0.3
Helicopters	10.0	0.6	10.0	0.6	21.2
All Groups	371.5	5.2	369.6	7.2	753.5

Table 7-4 Forecast Average Daily Operations (cont.)

Group	Departures		Arrivals		Total
	Day	Night	Day	Night	
2015 High Growth					
Stage 2 Jets	1.8	0.1	1.7	0.2	3.8
Stage 3 Jets	80.5	6.3	77.4	9.6	173.8
Turbo Prop	42.1	0.5	41.2	1.3	85.1
Piston	267.0	0.6	266.9	0.8	535.3
Military	0.2	0.0	0.2	0.0	0.5
Helicopters	10.1	0.6	10.1	0.6	21.5
All Groups	401.8	8.1	397.5	12.5	819.9

* 7 a.m. to 10 p.m.

** 10 p.m. to 7 a.m.

Noise-Sensitive Locations

Following publication of the *Draft ESPR*, Massport met with representatives from the National Park Service at Minute Man National Historical Park to discuss issues related to noise at Minute Man National Historical Park. As a result of these discussions, Massport and the National Park Service together identified a number of additional noise-sensitive sites for evaluation. Table 7-5 includes 25 sites that reflect these noise-sensitive locations in Minute Man National Historical Park. These locations are illustrated in Figure 7-1. The locations of several sites that were included in the *Draft ESPR* were refined for this additional analysis based on information that was received from the National Park Service. All of these sites are exposed to less than 65 dB DNL in Year 2000 and, in fact, are below 55 dB DNL in Year 2000.

For the future scenarios, with the exception of those listed below, all locations within the Park are exposed to levels below 55 dB DNL. The sites listed below are exposed to levels between 55 and 60 dB DNL:

- Job Brooks House, Joshua Brooks House and Noah Brooks Tavern in Lincoln and the historic farming fields in Concord for the 2005 and 2015 scenarios
- The Wayside and Meriam House in Concord for the 2005 High Growth and the 2015 Moderate and High Growth scenarios
- Samuel Brooks House in Lincoln and Meriam's Corner in Concord for the 2005 High Growth and the 2015 High Growth scenarios

None of the of the 5.5-mile Historic Battle Road is located within the 65 dB DNL contour for year 2000 or any of the future scenarios. None of the Historic Battle Road is in the 55 dB DNL contour in year 2000. Forecast scenarios suggest that none of the Historic Battle Road would be exposed to 55 dB DNL under the 2005 Moderate Growth Scenario and approximately two-thirds of a mile would be exposed to 55 dB DNL under the 2015 High Growth Scenario. Additional information about the historic resources in the Minute Man National Historical Park is included in Chapter 10 - Cultural and Historical resources, which also discusses potential effects on conservation and recreational lands.

Table 7-5 Year 2000 and Forecast Day-Night Sound Level, DNL, in decibels at MMNHP Sites

Name	Town	Year 2000	2005 Moderate	2005 High	2015 Moderate	2015 High
Battle Road Unit						
Bloody Angle	Concord	51.4	52.1	52.6	52.5	53.5
Historic Farming Fields	Concord	53.4	54.7	55.7	55.3	57.0
Meriam's Corner Monument	Concord	52.2	53.7	54.8	54.4	56.2
Meriam House	Concord	52.7	54.1	55.2	54.9	56.7
Olive Stow House	Concord	50.5	51.5	52.3	52.1	53.5
The Bluff and Monument	Lexington	44.9	45.8	46.5	46.4	47.6
Ebenezer Fiske House Foundation	Lexington	46.4	47.2	48.0	47.6	48.9
Minute Man Visitor Center	Lexington	45.3	46.1	46.7	46.6	47.7
Parkers Revenge	Lexington	46.6	47.3	47.9	47.8	48.8
Job Brooks House	Lincoln	54.5	55.1	55.8	55.4	56.7
Joshua Brooks, Jr. House	Lincoln	54.0	54.6	55.4	55.0	56.2
Noah Brooks Tavern (and Carriage House)	Lincoln	54.2	54.9	55.6	55.2	56.4
Samuel Brooks House	Lincoln	53.1	53.8	54.6	54.2	55.5
Ephraim Hartwell Tavern	Lincoln	48.3	48.9	49.3	49.5	50.2
Sgt. Samuel Hartwell House Site	Lincoln	47.7	48.3	48.7	48.9	49.6
Josiah Nelson, Jr. House Foundation	Lincoln	46.8	47.5	48.0	48.0	48.9
Thomas Nelson, Jr. House Foundation	Lincoln	46.9	47.5	48.1	48.1	49.0
Paul Revere Capture Site and Marker	Lincoln	45.5	46.1	46.6	46.6	47.4
Captain William Smith House	Lincoln	45.6	46.3	46.7	46.8	47.7
North Bridge Unit						
Major John Buttrick House	Concord	51.9	52.6	53.6	52.6	54.3
The Minuteman (Statue)	Concord	50.8	51.5	52.6	51.6	53.4
North Bridge	Concord	50.9	51.7	52.7	51.8	53.5
North Bridge Comfort Station	Concord	51.4	52.1	53.1	52.1	53.8
Old Manse	Concord	51.4	52.1	53.2	52.3	54.0
Wayside Unit						
The Wayside (Samuel Whitney House)	Concord	52.6	54.0	55.1	54.7	56.5

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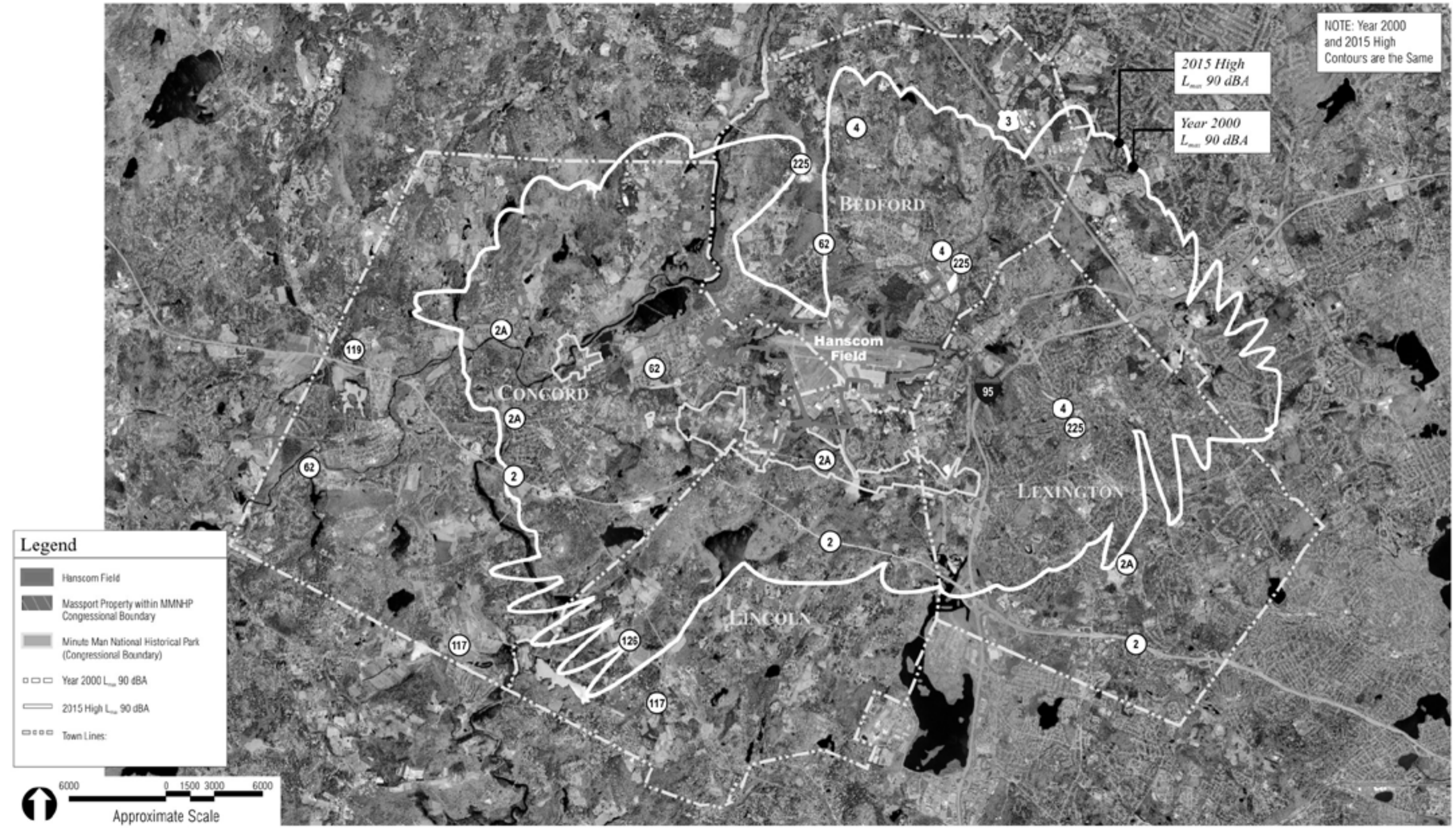

Note: Year 2000 and 2015 High Growth contours are the same. Massport does not believe that L_{max} 90 is an appropriate noise metric for the following reasons:

- L_{max} 90 is driven by the noise levels of the loudest aircraft in the fleet.
- Until the noisiest aircraft types are removed entirely from the fleet, the L_{max} 90 dBA contours will not change
- L_{max} 90 is not a regulatory- or industry-accepted metric for evaluating aircraft-generated noise impacts.

Base Map: PhotoMapper 2000
Source: HMMH

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2000 Hanscom Field Final ESPR
Bedford, Concord, Lexington and Lincoln, Massachusetts

L_{max} 90 dBA Contours:
2000 vs. 2015
High Growth Scenario

Figure 7-3

Table 7-6 includes TA65 calculations for 25 sites in Minute Man National Historical Park. The *Draft ESPR* had included data for four of these sites. Current TA65 values at the Minute Man National Historical Park are less than eight minutes per day at all sites except the Historic Farming Fields which is twelve minutes a day. These are times when aircraft noise may cause speech disruption or require use of a raised voice. These sites are expected to experience TA65 for the future scenarios, ranging from one to 14 minutes for the 2005 Moderate Growth scenario and 1 to 22 minutes per day for the 2015 High Growth scenario.

TA55 calculations are presented in Table 7-7. Available research data suggest that *noticeability* of aircraft occurs at the point at which aircraft noise equals or exceeds the ambient levels. Given that daytime ambient levels in many areas in the Minute Man National Historical Park range from mid-40s to mid 50s dBA, the TA 55 data suggest that these are times when park visitors could notice aircraft.

Monitoring and Environmentally Beneficial Measures

MEPA requested additional information and evaluation of run-up procedures and the noise and operations monitoring system at Hanscom Field. This section also discusses environmentally beneficial measures.

Run-up Procedures

Massport has a well-defined aircraft engine maintenance run-up procedure for Hanscom Field. Aircraft are directed to the "Run-up Pad" located due south of Runway 11-29, west of the intersection with Runway 05-23. At the Run-up Pad, aircraft are directed to maintain a west heading when conducting run-ups; there is a short "blast fence" on the east side of the pad which deflects jet exhaust, propwash, and debris. Furthermore, Massport discourages operators from conducting nighttime run-ups.

After Shuttle America began performing regular aircraft maintenance at Hanscom Field, there were times when nighttime run-ups occurred for maintenance purposes. After receiving multiple complaints, mostly from residents in newly constructed homes along Virginia Road, Massport re-located those nighttime run-ups to the east end of the East Ramp, away from this newly constructed residential community. Shuttle America has since relocated its aircraft maintenance activities to its facility in Fort Wayne, Indiana, significantly reducing nighttime maintenance run-ups at Hanscom.

Massport will continue to direct operators to the run-up pad during the day, and to the East Ramp at night. The optimal orientation for run-ups at the East Ramp is a magnetic heading of approximately 230 degrees, aligned with Runway 05-23, whenever feasible based on wind conditions. This heading will minimize sound levels at homes north of the approach end of Runway 11-29, while providing a substantial reduction in sound levels at the newly constructed homes along Virginia Road, relative to levels during run-ups conducted at the run-up pad. This heading is desirable for use regardless of aircraft type, though jet aircraft are likely to be more sensitive to crosswind conditions and may not be able to use the preferred heading as often as propeller aircraft can.

Massport has additional ground noise procedures in effect minimizing the use of Auxiliary Power Units (APUs) and Ground Power Units (GPUs). On-board APUs and GPUs provide electricity, heat and air conditioning to an aircraft when its engines are off. At Hanscom Field, APU and GPU use is prohibited outside of hangars between 11:00 p.m. and 7:00 a.m. unless part of takeoff procedures or necessary maintenance procedures. Between 7:00 a.m. and 11:00 p.m., the use of APUs is limited to 30 minutes.

When operationally feasible, the use of GPUs is preferred over APUs. Although the noise levels produced by GPUs are not insignificant (they are similar to an idling diesel truck), they are considerably lower than

Table 7-6 Year 2000 and Forecast Time Above (TA) 65 dB, in minutes, at MMNHP Sites

Name	Town	Year 2000	2005 Moderate	2005 High	2015 Moderate	2015 High
Battle Road Unit						
Bloody Angle	Concord	7.1	7.9	8.5	9.0	10.0
Historic Farming Fields	Concord	11.8	14.1	16.4	16.9	21.5
Meriam's Corner Monument	Concord	6.5	8.1	9.5	9.6	12.4
Meriam House	Concord	7.2	9.0	10.6	10.7	14.0
Olive Stow House	Concord	6.2	7.1	8.0	8.1	9.8
The Bluff and Monument	Lexington	1.4	1.7	2.0	1.9	2.4
Ebenezer Fiske House Foundation	Lexington	1.7	2.1	2.5	2.5	3.3
Minute Man Visitor Center	Lexington	1.6	1.9	2.1	2.0	2.4
Parkers Revenge	Lexington	2.3	2.6	2.8	2.8	3.1
Job Brooks, Jr. House	Lincoln	7.7	8.7	9.4	9.9	11.2
Joshua Brooks House	Lincoln	7.1	8.0	8.7	9.2	10.5
Noah Brooks Tavern (and Carriage House)	Lincoln	7.5	8.5	9.2	9.7	11.1
Samuel Brooks House	Lincoln	7.2	8.2	9.0	9.4	10.8
Ephraim Hartwell Tavern	Lincoln	3.3	3.8	4.1	4.2	4.8
Sgt. Samuel Hartwell House Site	Lincoln	2.5	2.8	3.1	3.1	3.5
Josiah Nelson, Jr. House Foundation	Lincoln	2.3	2.5	2.7	2.6	3.0
Thomas Nelson, Jr. House Foundation	Lincoln	2.3	2.6	2.8	2.7	3.1
Paul Revere Capture Site and Marker	Lincoln	1.4	1.6	1.7	1.6	1.8
Captain William Smith House	Lincoln	1.0	1.1	1.2	1.2	1.3
North Bridge Unit						
Major John Buttrick House	Concord	5.6	7.1	8.8	8.4	11.7
The Minuteman (Statue)	Concord	4.3	5.6	7.2	6.9	10.1
North Bridge	Concord	4.4	5.8	7.4	7.1	10.4
North Bridge Comfort Station	Concord	5.2	6.6	8.2	7.8	11.0
Old Manse	Concord	4.7	6.2	8.0	7.7	11.3
Wayside Unit						
The Wayside (Samuel Whitney House)	Concord	5.1	6.7	8.2	8.1	11.2

Table 7-7 2000 and Forecast Time Above (TA) 55 dB, in minutes, at MMNHP Sites the

Name	Town	Year 2000	2005 Moderate	2005 High	2015 Moderate	2015 High
Battle Road Unit						
Bloody Angle	Concord	64.9	74.6	78.6	88.0	95.0
Historic Farming Fields	Concord	75.3	86.9	95.8	103.7	120.4
Meriam's Corner Monument	Concord	44.9	53.8	61.0	64.7	78.6
Meriam House	Concord	49.4	58.9	66.5	70.8	85.3
Olive Stow House	Concord	53.2	62.2	68.3	74.1	86.1
The Bluff and Monument	Lexington	14.5	17.0	19.2	19.7	23.7
Ebenezer Fiske House Foundation	Lexington	10.4	12.9	14.9	15.1	18.9
Minute Man Visitor Center	Lexington	18.9	21.4	23.6	24.7	28.7
Parkers Revenge	Lexington	29.9	32.9	35.5	38.2	42.7
Job Brooks House	Lincoln	47.1	53.6	57.1	63.0	69.5
Joshua Brooks, Jr. House	Lincoln	43.9	49.9	53.2	58.6	64.5
Noah Brooks Tavern (and Carriage House)	Lincoln	44.3	50.3	53.9	59.2	65.8
Samuel Brooks House	Lincoln	46.8	53.4	57.6	63.1	71.0
Ephraim Hartwell Tavern	Lincoln	47.0	53.7	56.0	62.7	66.4
Sgt. Samuel Hartwell House Site	Lincoln	41.9	47.6	49.5	55.3	58.1
Josiah Nelson, Jr. House Foundation	Lincoln	31.8	34.9	37.3	40.4	44.5
Thomas Nelson, Jr. House Foundation	Lincoln	32.0	35.2	37.7	40.8	45.2
Paul Revere Capture Site and Marker	Lincoln	15.9	18.3	19.6	20.6	22.7
Captain William Smith House	Lincoln	28.9	31.9	33.4	36.6	38.6
North Bridge Unit						
Major John Buttrick House	Concord	26.4	34.3	41.2	41.8	54.7
The Minuteman (Statue)	Concord	21.3	29.1	35.2	35.5	47.3
North Bridge	Concord	21.5	29.4	35.6	35.9	47.9
North Bridge Comfort Station	Concord	24.8	33.0	39.8	40.3	53.0
Old Manse	Concord	22.0	30.2	36.6	37.0	49.3
Wayside Unit						
The Wayside (Samuel Whitney House)	Concord	29.9	37.9	44.0	46.1	58.2

noise levels produced by a typical APU. In addition, GPUs generally are more fuel efficient than APUs and less expensive to run from a maintenance standpoint. Reduction of APU use may also have the benefit of reducing emissions. It should be noted that it is not feasible to completely eliminate APU use because APUs may be needed to start the aircraft main engines, and maintenance requiring operation of the APU may sometimes need to be performed at locations where alternative power is not readily available.

Noise and Operations Monitoring System

Massport is focusing on a "fly friendly" program to establish an atmosphere at Hanscom Field that encourages quiet flying techniques. In addition, there is particular emphasis on discouraging 11 p.m. to 7 a.m. aircraft activity, which is generally considered the most intrusive type of activity. Measure M13 of the Noise Workgroup recommended that a procedure or system be developed to correlate noise events with flight data and complaints (see Table 7-3). When Massport is in a position to upgrade its noise monitoring system, which currently does not make these correlations, there may be opportunities to enhance the system. However, the majority of Hanscom traffic operates under Visual Flight Rule (VFR) conditions, in which case only minimal flight data may be available for correlation.