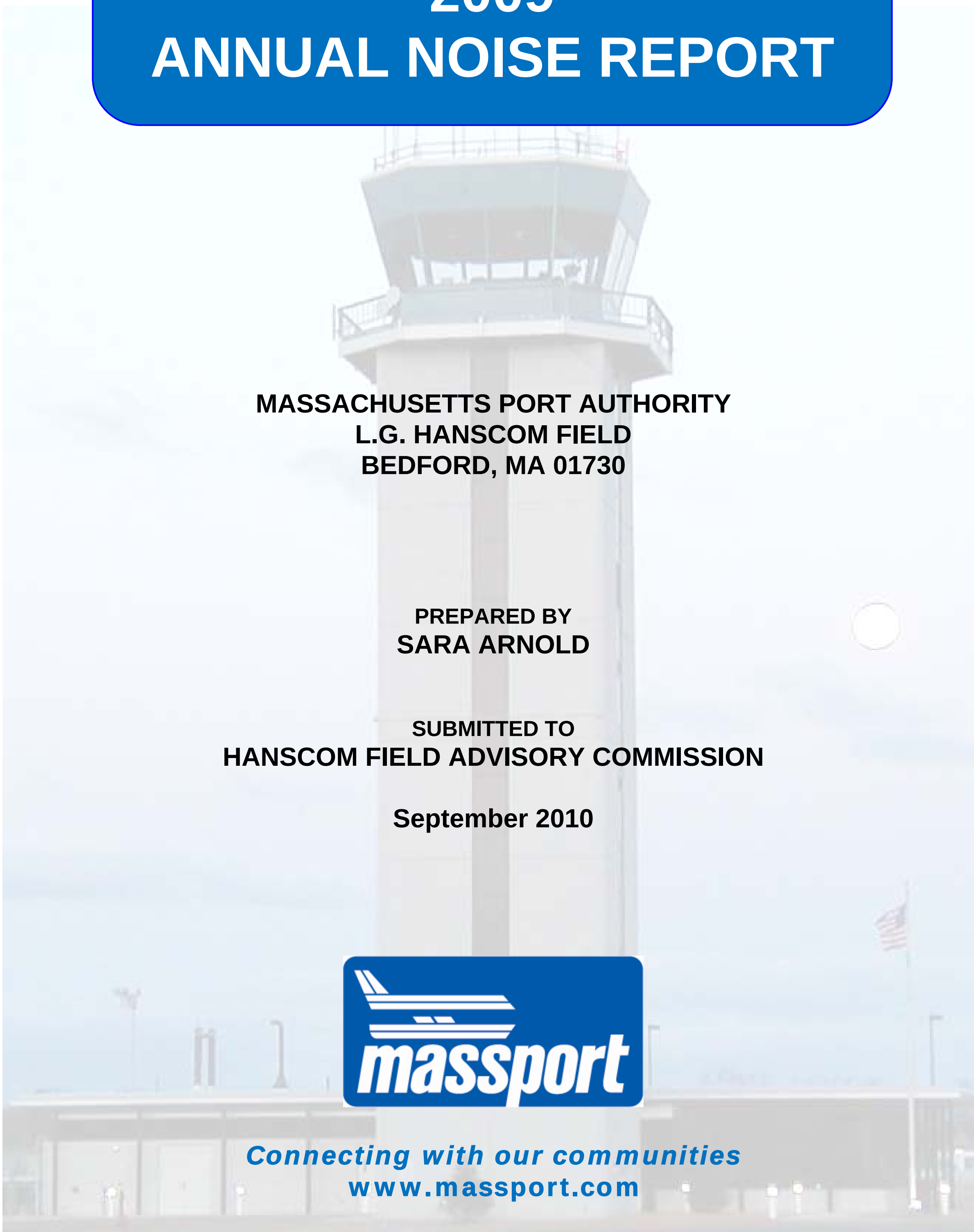
L.G. HANSCOM FIELD 2009 ANNUAL NOISE REPORT



MASSACHUSETTS PORT AUTHORITY
L.G. HANSCOM FIELD
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SUBMITTED TO
HANSCOM FIELD ADVISORY COMMISSION

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INTRODUCTION

Each year, the Massachusetts Port Authority prepares a noise report for L.G. Hanscom Field, a tool used by Massport to report on aircraft activity and the noise environment at the airport. It includes a historical perspective on why and how noise impact reports have been presented since 1982, and continues with data on the numbers and types of operations and overall noise exposure for the most recent calendar year. This report has been prepared to present data on Hanscom Field's 2009 operations. Comparable data from previous study years (1978, 1981, and 1983 through 2008) demonstrate trends in aviation activity and noise levels.

The Massachusetts Port Authority

The Massachusetts Port Authority (Massport) operates Boston Logan International Airport, L.G. Hanscom Field, Worcester Regional Airport, and the Port of Boston. Massport is a financially self-sustaining public authority whose premier transportation facilities generate close to $9 billion every year and enhance and enable economic growth and vitality in New England. Massport is committed to providing safe, secure and efficient transportation facilities that afford travelers and businesses the freedom to travel and conduct business throughout the world while enabling Massachusetts and New England to compete successfully in the global marketplace.

L. G. Hanscom Field

In 1941, the Commonwealth of Massachusetts purchased land northwest of Boston for the proposed Boston Auxiliary Airport, and the U.S. Civil Aeronautics Administration oversaw construction of the original runways and facilities. The completed facility was immediately leased by the Army Air Corps for advanced pilot training in support of America's war effort. In 1943, the new airport, geographically bounded by Bedford, Concord, Lexington and Lincoln, was officially dedicated as Laurence G. Hanscom Field.

In 1956, the Massachusetts legislature created the Massachusetts Port Authority and gave it control of Hanscom Field. In 1959, Massport began managing the civil terminal area while the U.S. Air Force leased and operated the airfield for continued use by military and civilian aircraft. In 1974, the Air Force canceled its lease of the airfield, and Massport became responsible for operating and maintaining the airport. The Air Force continued to use its own property and to lease various parcels of land that were owned by Massport, all of which abutted the airfield.

Hanscom Air Force Base (HAFB) has become an important research and development facility in Massachusetts. Although military operations at Hanscom have dropped to less than one percent of the aircraft activity, the airfield continues to be a valuable resource for the Base.

Today, L. G. Hanscom Field plays an important role in New England's regional aviation system by serving as a premier general aviation (GA) reliever for Logan International Airport. Hanscom helps ease congestion at Logan by accommodating private, pilot training, business, charter, cargo, air taxi, medical, and military aircraft activity all of which serve the diverse flying needs of government entities, corporations and businesses, research and development firms, and educational institutions, as well as individuals. This full service GA facility serves as a vital link to domestic and international destinations for local companies. Additionally, commercial service to select markets has been periodically available at Hanscom in aircraft with no more than 60 seats, consistent with Massport's 1980 *General Rules and Regulations for Lawrence G. Hanscom Field*.

On-going improvements of infrastructure and procedures ensure that Hanscom is a well-equipped, safe, and secure facility for serving the diverse needs of its users, while standing ready to support the future economic growth of the region. Massport recognizes the interest that the residential and aviation communities have in its planning and operation of the airport and has a long history of sharing information with interested parties. Massport is committed to continuing its relationship with the Hanscom Field Advisory Commission (HFAC), a committee consisting of representatives from the surrounding communities, area-wide organizations, airport users, and Ex Officio members from the FAA, Hanscom Air Force Base, and Minute Man National Historical Park. The annual noise report is presented to HFAC each year.

CHAPTER 1 SUMMARY

The first noise report for L.G. Hanscom Field was prepared in 1982, and it compared data for 1978 and 1981. Annual updates were started in 1984 (based on the previous year's data), making this the twenty-eighth Hanscom noise report. Starting with the first report, 1978 has been used as the base year for evaluating changes in noise exposure. Chapters 2 and 6 review how this has been done, despite updates in the noise and performance data used to calculate noise exposure at Hanscom Field. This compilation of data provides a long term historical perspective on the airport's aircraft activity.

The annual reports focus on the noise generated by civilian aircraft departures, including single engine piston aircraft. This approach was an outgrowth of input from aviation and residential representatives as the early noise reports were being developed. EXP, a metric that estimates cumulative noise exposure at Hanscom, is used as the screening tool to evaluate the changes in noise levels. This report presents the supporting data for calculating EXP, including total numbers of operations and fleet mix by time of day. It also discusses noise levels for military operations and arrival noise levels, and it includes data from the permanent noise monitoring system for 1995, 2000, and 2005 through 2009.

Massport's data management systems compile information from a number of sources and include estimates and formulas to develop the operations and noise data discussed in this report. Results of this evaluation show the following:

1. The 2009 Federal Aviation Administration (FAA) Tower count, which includes all arrivals and departures for both civilian and military aircraft activity between 7 a.m. and 11 p.m., shows 149,911 operations, 9.6 percent less than in 2008.

2. While military flights represented less than one percent of the total activity, they contributed 38 percent of the total departure noise exposure. Tower counts indicate that military operations decreased 17.8 percent in 2009, as compared to 2008.

3. The civilian portion of the FAA tower counts, which has consistently represented approximately 99 percent of the total activity during the study years, decreased 9.6 percent as compared to 2008. Data indicate decreases in all of the non-helicopter civilian aircraft categories. Civilian activity contributed 62 percent of the departure noise exposure.

4. The estimated 146.2 average daily single engine piston (SEP) operations, including touch and goes, represented 71.2 percent of the 2009 operations and indicate an 8.0 percent decrease in SEP activity as compared to 2008.

5. Non-single engine piston (non-SEP) civilian aircraft, which dominate changes in civilian noise levels, averaged 56.5 daily departures in 2009. This represented a decrease of 12.0 percent, as compared to 2008.

6. Business jet activity, which represented 17.0 percent of the total activity, decreased 16.9 percent in 2009 and contributed 80.9 percent of the civilian departure noise. Despite the decrease in Stage 2 jet operations (the noisiest civilian aircraft) from 11 percent of the jet fleet in 2000 to 1.7 percent in 2009, Stage 2 jets contributed over 21.7 percent of the civilian jet departure noise in 2009.

7. Turboprop operations, which represented 3.7 percent of the total 2009 activity, decreased 18.8 percent. Boston-Maine, which used turboprops for its commuter airline service, conducted 104 operations during the first two months of 2008 and then discontinued its service. The non-commuter turboprop operations decreased 17.5 percent in 2009, as compared to 2008.

8. Use of the airfield between 11 p.m. and 7 a.m. decreased from 1,910 arrivals and departures in 2008 to 1,735 arrivals and departures in 2009. Jets (62 percent) and helicopters (24 percent) dominated this nighttime activity. A nighttime field use fee was instituted in 1980 to discourage use of the field during these hours. Of the 575 different aircraft that were subject to the fee, 49 conducted more than five operations. There were 514 operations exempt from the fee, of which 95.5 percent were medical flights. Helicopters were used for the majority of the medical flights.

9. Using EXP Version 6.1, the 2009 departure noise exposure for civilian aircraft was 109.2 decibels (dB), 1.0 dB less than 2008. Civilian departure EXP levels since 1978 indicate that noise exposure in 2009 is the lowest of all the study years to-date.

10. This report includes a comparison of 1995, 2000, and 2005 through 2009 noise levels recorded at six noise-monitoring sites located in the communities and on the airfield. The reported noise levels include civilian and military aircraft noise as well as community noise. In late 2006, Massport began transitioning to a new monitoring system. Hardware upgrades, upgrade-related downloading issues, and equipment problems resulted in some gaps in available data, particularly at the two on-airport sites. Additionally, one off-airport site was hit by a truck in April 2009 and was out of commission for the rest of the year while efforts were made to find a new location. Changes in noise levels at the sites, based on available data, range from a 0.9 dB increase to a 1.9 dB decrease when comparing 2009 to 2008.

11. In addition to the data analyses, this report discusses policies that have impacted noise levels at Hanscom during the study years. The 1978 *Hanscom Field Master Plan and Environmental Impact Statement* (The Master Plan) and the 1980 *General Rules and Regulations for Lawrence G. Hanscom Field* include the policies and regulations that continue to guide Massport as it operates Hanscom Field. Since the adoption of these documents, Massport has worked closely with the HFAC and the Hanscom Area Towns Committee (HATS), as well as other interested parties, to balance its commitment to regional transportation and the business community with the need to recognize and minimize the airport's impact on the surrounding communities. Concepts for a new initiative to reduce touch and go traffic over Minute Man National Historical Park were identified in 2009.

CHAPTER 2 HISTORICAL PERSPECTIVE ON THE ANNUAL REPORT AND THE EVALUATION OF NOISE

This chapter of the report discusses the development of measures used to evaluate noise exposure at Hanscom. Each step was discussed with the HFAC, and the current approach was adopted through general consensus at the HFAC meetings.

The first noise report was prepared in 1982 by Harris Miller Miller & Hanson Inc. (HMMH), noise consultants for Massport, to evaluate the effectiveness of the noise rules that Massport had implemented in 1980. The firm continued to prepare noise reports until 1987, when Massport assumed the responsibility. In preparing the annual document, Massport utilizes the basic approach and format of the original HMMH reports and includes some background information written by HMMH. Each year, Massport has a noise consultant review the noise data and annual report. HMMH reviewed the data and report for 2009.

2.1 The Use of Contours to Evaluate Noise Exposure

The most frequently used measure to characterize noise exposure around an airport is referred to as the Day-Night Average Sound Level (DNL or Ldn), which is most commonly depicted by using contours on a map to connect points of equal noise exposure. Creating DNL contours requires detailed knowledge of the fleet of aircraft using the airport, the types of aircraft engines, the climb performance characteristics, information on the frequency of runway use, and the flight paths of the aircraft as they depart and approach the field. These data are entered into a computer noise model to produce the contours.

DNL is used widely throughout the United States and is the metric used by the FAA for assessing noise impacts. DNL is discussed in more depth in Appendix A. Appendix A also includes maps from previous studies showing the 1978, 1987, 1995, 2000, and 2005 DNL contours for Hanscom. The 1978 contours were developed in 1981 using the computerized modeling program called Noisemap; the 1987 contours were developed in 1988 using the Integrated Noise Model (INM) 3.9; the 1995 contours were developed in 1996 using INM 5.0; the 2000 contours were developed in 2002 using INM 6.0c; and the 2005 contours were developed in 2006 using INM 6.1. The contours include the effects of civil and military aircraft as well as touch-and-goes. Touch and goes are a procedure used by flight schools to train students to land and depart.

Time Above is another metric sometimes used to describe the noise experience by reporting the amount of time that noise levels exceed a given threshold. Time Above is described in Appendix A, which includes the 2000 and 2005 Time Above contours.

2.2 Developing EXP to Evaluate Changes in Noise Exposure

In addition to creating DNL contours, HMMH used the 1982 report to define a screening procedure, or metric, that could be used to routinely evaluate the effect of changes in the aircraft fleet mix and numbers of operations. A database management system was developed to calculate the metric (called EXP), which has been used since 1982 as a first-round screening procedure.

Although EXP does not show how noise levels change in specific communities, it does provide a tool for distinguishing civilian noise from military noise while indicating <u>changes</u> in the total noise exposure and expected changes in DNL. This is accomplished by having EXP use the same FAA noise data for the aircraft types, and the same manner of logarithmically summing noise used in calculating DNL, as discussed in Appendix A. This includes applying a "noise penalty" of 10 decibels for each 10 p.m. to 7 a.m. aircraft event to account for its more intrusive nature.

Each aircraft type is assigned to a group, with each group characterized by a similarity of size, the number and type of engine(s), climb performance, and ultimately, noise level characteristics.

Using FAA noise and performance data, arrival and departure Sound Exposure Levels (SEL) are assigned to each group. The SELs used for EXP are in A-weighted decibels and represent the amount of noise generated 15,000 feet from start of take-off roll. There is additional discussion of SEL in Appendix A.

The total departure noise exposure on an average day is calculated for each group by

1. Logarithmically multiplying the representative SEL for the group by the average number of daily departures by those aircraft, applying the "noise penalty" to 10 p.m. to 7 a.m. operations, and creating a "partial" departure EXP; and
2. Logarithmically adding all "partial" EXPs for the entire fleet to obtain a single number estimate of departure noise exposure.

2.3 The Significance of Changes in EXP

Because EXP applies the same methodology used for calculating DNL, it continues to be used as a first round procedure to estimate changes in noise levels at Hanscom. In the mid-1980s, HFAC and Massport discussed the significance of changes in EXP, and it was agreed that an increase of 1.5 dB above the 1978 base year noise level would indicate the need for further study.

Although civilian departure EXP has never exceeded the 1978 EXP by 1.5 dB, Massport completed a Generic Environmental Impact Report (GEIR) based on 1985 data, an update of the GEIR based on 1995 data, an Environmental Status and Planning Report (ESPR) based on 2000 data, and an ESPR update based on 2005 data. The GEIRs and ESPRs include noise contours and additional noise metrics, providing comprehensive analyses of noise impacts. Furthermore, it is anticipated that updates of the ESPR, with detailed noise analyses, will continue to be produced.

It is increasingly complex to compare current noise levels to noise levels from 25 years ago because the FAA routinely updates the Integrated Noise Model, which is the basis of calculating EXP. However, EXP still allows for an annual evaluation of <u>changes</u> in the noise level from one year to the next and identifies <u>trends</u> in those changes.

2.4 Upgrading EXP Calculations

Until 1987, the EXP calculations relied primarily on SELs from the U.S Air Force's Noisemap noise and performance database, which was available in 1982 when EXP was developed. In 1987, the FAA released a revised and expanded set of noise and performance data (Version 3.9) for the Integrated Noise Model (INM), and Massport moved from using Noisemap to the INM.

The FAA continues to support a process of updating its aircraft noise and performance data for modeling aircraft noise using the INM. As a result, Massport has periodically upgraded the SEL values used in EXP. From 1987 through 1995, EXP Version 3.9 (EXP 3.9) was used. EXP

Version 5.1 (EXP 5.1) was used starting in 1996. EXP Version 6.0c (EXP 6.0c) was introduced in the 2002 report for the years starting in 2000, and EXP Version 6.1 (EXP 6.1) was introduced in the 2005 report. The numbers in each version link to the INM version that was used.

2.5 EXP Focus: With Single Engine Piston (SEP) vs. Without SEP, With Military Aircraft vs. Without Military Aircraft, Departure EXP vs. Arrival EXP

When EXP was first developed, it was calculated for civilian and military non-SEP aircraft departures with the capability of using either subgroup for comparisons. SEP operations were excluded from the data for reasons discussed in detail in early reports. When residents became interested in the effect of the noise generated by these small aircraft, a method for estimating their usage was developed for future use and was applied to all the study years retroactively.

In 1988, HFAC members discussed the need to focus on one number when comparing EXP from one year to the next. It was agreed that the emphasis should be on civilian aircraft, and the civilian component should include the estimated SEP operations. It was also agreed that Massport would begin to track arrival EXP. However, the focus on departures would still be used as the best representation of the noise impact because changes in departure EXP more closely reflect changes in DNL than changes in arrival or total EXP.

2.6 The Report on 2009 Noise Exposure

This report incorporates the results of the agreed-upon methodology for evaluating the noise impact, as it applies to 2009 Hanscom operations. It includes operational data for the study years (1978, 1981 and 1983 through 2009) and analyzes the change in noise exposure since 1978. It focuses on the effect of civilian aircraft departures, including SEP, with supplementary information on FAA tower counts, 11 p.m. to 7 a.m. operations, the impact of military activity, and arrival EXP.

In addition to being considered a good indicator of changes in DNL and changes in the general level of total noise exposure generated by the airport, it also provides a historical perspective, because comparative data are available for most years since 1978. Data from the permanent noise monitoring system became available during the 1990s, providing information on the measured noise experience at six locations.

Methods of data collection for determining operations and noise exposure are reviewed in Chapter 3 of this report. A discussion of the 7 a.m. to 11 p.m. operational levels for 2009 is presented in Chapter 4. Chapter 5 focuses on operations conducted between 11 p.m. and 7 a.m. when a nighttime field use fee is in effect. Chapter 6 presents noise exposure levels (using the EXP noise metric), and Chapter 7 discusses the permanent noise monitoring system and the data generated by the system. Massport policies that address aircraft noise are reviewed in Chapter 8.

CHAPTER 3 DATA COLLECTION FOR DETERMINING OPERATIONS AND NOISE EXPOSURE

Hanscom Field serves various categories of civilian and military aircraft, and data are compiled to track their noise impact. Massport's data management system uses a set of files of aircraft operational information and estimates to summarize activity levels, identify aircraft operations subject to nighttime field use fees, and compute estimates of resulting noise exposure. Because the Hanscom FAA control tower is only open from 7 a.m. to 11 p.m., and because the tower does not have a written record for every operation, input to the files used to develop operations and noise data come from several sources, as follows:

1. FAA Flight Strips: used to record non-SEP Instrument Flight Rule (IFR) departures from Hanscom between 7 a.m. and 10 p.m. and all IFR arrivals and departures between 10 p.m. and 11 p.m.

    Pilots fly using either IFR or Visual Flight Rule (VFR) procedures. When flying IFR, a flight plan is filed with the FAA, resulting in a flight strip identifying the aircraft type and time of the operation at the origin and destination FAA towers. When there is VFR weather, pilots may choose to fly without filing a flight plan. The majority of jets fly IFR, regardless of the weather. Many turboprops and twins also fly IFR.

2. FAA Monthly Tower Reports: used to provide the number of aircraft operations at Hanscom Field between 7 a.m. and 11 p.m.

    The Hanscom FAA tower personnel maintain a count of all aircraft that operate at Hanscom when the tower is open. This includes VFR and IFR arrivals and departures. Prior to 1993, it also included aircraft that flew through the Hanscom air space but did not use the airport (overflights). The FAA tower count is traditionally used to quantify the activity level for the airport, despite the exclusion of operations between 11 p.m. and 7 a.m. when the FAA tower is closed and the previous inclusion of overflights.

3. Estimates of Civilian VFR non-SEP Aircraft: used to supplement IFR activity by civilian twin-engine pistons (twins), turboprops (turbos), and helicopters between 7 a.m. and 10 p.m.

    Pilots of some turboprops and twin-engine aircraft and most helicopters fly VFR. They communicate with the FAA tower, and the tower tallies the operation, although there is no written record of the aircraft type or specific time of the operation. Estimates are incorporated into the database programs to provide a reasonable representation of the noise generated by civilian non-SEP VFR operations between 7 a.m. and 10 p.m.

4. An Estimate of Civilian SEP Activity between 7 a.m. and 10 p.m.

The number of civilian SEP aircraft operations is estimated by subtracting the civilian IFR and estimated flights for jets, helicopters, twins, and turbos from the Tower counts for non-military operations. Prior to 1993, the FAA Tower counts included all communications with aircraft that flew through the Hanscom air space, whether or not they used Hanscom, making the estimated number of SEP operations derived by this method conservatively high. Starting in 1993, the approximations are closer to the actual number of arrivals and departures since overflights are no longer included.

5. Nighttime Field Use Logs: Massport records all operations between the hours of 11:00 p.m. and 7:00 a.m. when the FAA tower is closed.

Table 3.1 summarizes the sources of data used to track operational activity by aircraft type, as discussed above.

TABLE 3.1 Data Sources for Civilian Aircraft

	7 a.m.-10 p.m.	**10 p.m.-11 p.m.**	**11 p.m.-7 a.m.**
DEPARTURES: Non-SEP	FAA flight strips + an estimate for civilian VFR turbos, twins & helicopters	FAA flight strips	Massport records
SEP	FAA count for non-military operations minus civilian non-SEP IFR & estimated VFR activity	FAA flight strips	Massport records
ARRIVALS:	Difference between total departures & 10 p.m.-7 a.m. arrivals	FAA flight strips	Massport records

CHAPTER 4 2009 OPERATIONS, 7 a.m.-11 p.m.

As discussed in Chapter 3, the FAA tower counts are traditionally used to report the official number of operations for an airport. At Hanscom, they include military operations and, until 1993, an unidentified percentage of overflights. During the study years, the Tower has not been open from 11 p.m. to 7 a.m., so those counts do not include operations conducted between those hours. Including night (11 p.m. to 7 a.m.) operations would increase the total by approximately one percent. Night activity is discussed in Chapter 5.

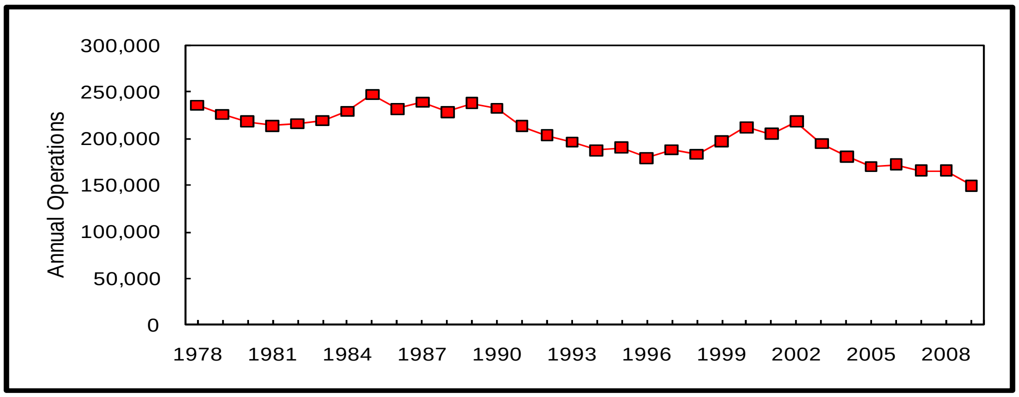
Table 4.1 presents the Hanscom Tower counts since 1978, showing 149,911 operations for 2009, the lowest of all the study years. This is 9.6 percent less than 2008. For thirty years prior to 1993, the Tower counts consistently exceeded 200,000, and in 1970 they peaked at more than 300,000. They also exceeded 200,000 from 2000 through 2002. However, from 1993 through 1999, and again from 2003 through 2009, tower counts have remained below 200,000.

TABLE 4.1 Annual FAA Tower Counts for 7 a.m. to 11 p.m. Since 1978

Year	Tower Count	Year	Tower Count	Year	Tower Count	Year	Tower Count
1978	235,750	1986	232,110	1994	187,550	2002	218,248
1979	225,805	1987	239,154	1995	190,282	2003	194,885
1980	218,502	1988	228,725	1996	179,497	2004	180,804
1981	213,698	1989	238,340	1997	188,087	2005	169,955
1982	215,984	1990	232,678	1998	183,185	2006	172,457
1983	219,466	1991	213,637	1999	197,302	2007	165,907
1984	229,130	1992	203,755	2000	212,371	2008	165,889
1985	247,434	1993	196,138	2001	205,436	2009	149,911

The tower counts in **Table 4.1** have been plotted in **Figure 4.1** to illustrate the annual fluctuations and overall decline since 1978, including the high of 247,434 operations in 1985 and the current 2009 low. Decreases in SEP operations have been the predominant influence on Hanscom's general decline in activity.

FIGURE 4.1 Annual FAA Tower Counts for 7 a.m. to 11 p.m. Since 1978



The FAA maintains separate tallies for "local" (i.e. touch-and-go) operations and military activity in its daily counts. A touch-and-go is the pattern used to practice landing and departing, most frequently conducted by the flight schools. The aircraft is brought in for a landing, continues on the runway for a departure, circles the field and repeats the procedure without stopping. The FAA tower tallies each touch-and-go as two operations, since there is an arrival and a departure.

Starting in 1987, Massport has combined the FAA tower counts with the data collected in Hanscom's database system in order to estimate the breakdown of 7 a.m. to 11 p.m. civilian activity by aircraft type for both IFR and VFR operations, as shown in **Table 4.2**.

TABLE 4.2 Annual Estimated Operations by Aircraft Type, 7 a.m.-11 p.m.

	CIVILIAN						MILITARY	TOTAL
	Local	Singles	Twin Piston	Turbo	Jet	Heli		
1987	72,999	134,461	5,309	6,443	10,034	7,294	2,613	239,153
1988	66,669	127,233	5,968	8,800	10,216	7,258	2,581	228,725
1989	72,067	132,368	5,697	8,767	9,656	7,294	2,491	238,340
1990	76,732	124,756	5,658	7,582	8,630	7,262	2,058	232,678
1991	80,805	102,478	5,476	6,666	8,368	6,942	2,902	213,637
1992	83,427	92,328	4,940	5,579	8,105	6,834	2,542	203,755
1993	85,872	82,756	4,489	4,571	8,838	6,811	2,801	196,138
1994	86,287	74,294	4,581	4,223	9,345	6,819	2,001	187,550
1995	86,048	76,685	4,589	3,997	9,592	6,804	2,567	190,282
1996	76,735	74,872	4,536	4,250	10,390	6,915	1,799	179,497
1997	76,217	83,515	4,157	3,733	11,248	6,912	2,305	188,087
1998	68,506	81,976	5,797	4,524	13,583	6,878	1,921	183,185
1999	73,483	88,137	5,426	5,697	16,108	6,885	1,566	197,302
2000	75,676	90,323	5,097	12,848	20,226	6,914	1,287	212,371
2001	72,605	84,803	4,858	13,580	22,839	5,499	1,252	205,436
2002	76,849	82,282	5,295	14,598	30,788	7,012	1,424	218,248
2003	71,696	70,912	4,750	9,057	30,352	6,978	1,142	194,887
2004	60,794	63,755	4,818	10,155	33,021	7,066	1,195	180,804
2005	58,535	57,894	4,265	9,008	32,345	7,004	904	169,955
2006	59,222	58,198	4,352	8,828	33,251	7,014	1,592	172,457
2007	56,731	51,776	4,196	10,355	34,522	6,889	1,438	165,907
2008	65,906	50,063	3,988	6,881	30,656	6,805	1,590	165,889
2009	60,263	46,478	3,963	5,588	25,482	6,830	1,307	149,911

Comparing 2009 to 2008, the FAA tower count for military operations, which represented 0.9 percent of the activity in 2009, decreased 17.8 percent. The civilian component, 99.1 percent of the 2009 operations, shows a decrease of 9.6 percent. All categories of civilian aircraft activity declined or remained stable.

The level of jet activity is particularly relevant because jets dominate the civilian noise exposure. Business jet use has traditionally been impacted by the economic health of the area, as illustrated in **Table 4.2**. Jet activity levels declined during the slow economic years around 1990. This was followed by a steady increase starting in the mid-1990s through 2000 when the economy was recovering and then flourishing. As the economy slumped in 2001, the year started with a decline in jet operations.

The events of September 11, 2001 (9/11) created a new factor that impacted aircraft activity, particularly business jet activity levels. Despite the economic downturn, there was a surge in business jet use after 9/11 as businesses began reevaluating the use of commercial airlines for their travel needs. This resulted in a net increase in business jet use in 2001 and an additional 34 percent increase in 2002. Jet use continued to climb from 30,788 in 2002 to 34,522 in 2007, when jets represented 21.0 percent of Hanscom's total activity.

The economic recession that hit in 2008 caused business jet activity levels to decrease 11.2 percent in 2008 and 16.9 percent in 2009, and business jet use dropped to 17.0 percent of the total 2009 activity. While the number of jet operations in 2009 is the lowest of the post 9/11 years, it has not returned to pre-9/11 levels.

There was also a decrease in turboprop activity in 2008 and 2009, partially caused by the termination of Hanscom's only airline service in February 2008; the airline conducted 104 turboprop operations in 2008. Turboprop operations represented 3.7 percent of the 2009 total activity and decreased 18.8 percent as compared to 2008. Non-commuter airline turboprop activity decreased 17.5 percent.

Twin pistons and helicopters are the other non-SEP civilian aircraft that are tracked by Massport. Estimated twin piston aircraft activity in 2009 decreased 0.6 percent as compared to 2008, and represented 2.6 percent of the operations. Because of the way helicopter operations are estimated, their activity levels generally remain stable one year to the next.

SEP aircraft have always dominated aircraft activity at Hanscom. SEP operations include touch-and-go, or "local," activity, which peaked in 1978 when the FAA logged 94,641 touch-and-goes. Touch-and-go operations are included in Massport's estimates for single engine piston aircraft activity for two reasons: 1) since 1980, touch-and-goes have not been allowed in aircraft over 12,500 pounds at Hanscom, and 2) they are mostly conducted by the Hanscom flight schools using SEP aircraft. In recent years, touch-and-go operations have represented 50 to 60 percent of the SEP activity.

In 2009, estimated SEP activity, including touch-and-goes, represented 71.2 percent of the operations and decreased 8.0 percent as compared to 2008. **Table 4.3** shows the estimated average daily departures for SEP aircraft between 7 a.m. and 11 p.m. for the study years. The 146.2 average daily departures make 2009 the lowest of all the study years. The highest study year for SEP activity was 1985, with 297.3 estimated 7 a.m. to 11 p.m. average daily departures.

TABLE 4.3 Estimated Average Daily Departures*, 7 a.m.-11 p.m. by Single Engine Piston Aircraft for Study Years

Year	SEP Departures	Year	SEP Departures	Year	SEP Departures	Year	SEP Departures
1978	282.0	1989	280.1	1997	218.9	2005	159.6
1981	242.6	1990	276.0	1998	206.2	2006	160.8
1983	258.0	1991	251.1	1999	221.6	2007	148.6
1984	270.4	1992	240.2	2000	227.0	2008	158.4
1985	297.3	1993	231.1	2001	213.7	2009	146.2
1986	278.4	1994	219.8	2002	219.8		
1987	284.2	1995	223.0	2003	195.5		
1988	264.9	1996	207.2	2004	170.2		

*Estimated Average Daily Departures = Total Annual Operations from FAA tower counts divided by two, minus the daily departures of aircraft other than single engine piston aircraft divided by 365 days (366 in a leap year).

While the use of small aircraft continues to dominate Hanscom's GA activity, it has suffered from a number of regional and national events over the past 20 years. In the early and mid-1990s, there was a decline in the manufacturing of these aircraft coupled with a depressed economy. Piston aircraft operations experienced another setback at Hanscom after 9/11. The FAA's temporary restrictions on VFR activity in urban areas, including Boston and thus Hanscom Field, caused many of the Hanscom-based piston aircraft pilots to move permanently to other airports.

The SEP decline at Hanscom reflects national trends. The *2005 Environmental Status and Planning Report* (ESPR) for Hanscom reported the following: "Since 1990, GA aircraft operations at Hanscom Field fell by 2.2 percent annually, compared to a national decline of 1.1 percent per year."

The ESPR also reported that "…since 2002, both Hanscom Field and the U.S. have seen a sharp decline in general aviation operations. Over the past five years, GA operations have faced rising operating costs including escalating fuel prices, increased insurance premiums, and new security-related expenses. In addition, economic growth has been moderate and the number of private GA and student pilots continues to fall."

While the tower counts, along with the influence of the SEP operations on those counts, provide one perspective on Hanscom's activity levels, it is the non-SEP operations, particularly the jets, that are the driving force behind changes in noise levels. **Table 4.4** shows a summary of the 2009 estimated average daily departures by non-SEP aircraft. These non-SEP departures have been separated by day and 10 p.m. to 7 a.m. hours, which are the blocks of time used in noise exposure calculations for DNL and EXP, both of which are discussed in Appendix A. The average daily departures are for the identified and estimated civilian aircraft and the identified military aircraft. They are listed month-by-month to show seasonal variations in activity.

TABLE 4.4 2009 Monthly Average Daily Departures by Non-Single Engine Piston Aircraft

	CIVILIAN			MILITARY			CIVILIAN & MILITARY		
	DAY	10pm-7am	TOTAL	DAY	10pm-7am	TOTAL	DAY	10pm-7am	TOTAL
Jan	46.69	2.29	48.98	0.45	0.00	0.45	47.14	2.29	49.43
Feb	52.12	2.21	54.33	0.79	0.00	0.79	52.91	2.21	55.12
Mar	53.69	2.39	56.08	0.81	0.00	0.81	54.50	2.39	56.89
Apr	54.23	2.80	57.03	1.10	0.00	1.10	55.33	2.80	58.13
May	55.56	3.03	58.59	1.19	0.00	1.19	56.75	3.03	59.78
Jun	58.90	3.14	62.04	1.87	0.00	1.87	60.77	3.14	63.91
Jul	52.72	2.13	54.85	0.81	0.00	0.81	53.53	2.13	55.66
Aug	51.49	2.39	53.88	0.81	0.09	0.90	52.30	2.48	54.78
Sep	53.50	2.77	56.27	0.77	0.03	0.80	54.27	2.80	57.07
Oct	59.33	2.77	62.10	0.71	0.00	0.71	60.04	2.77	62.81
Nov	57.83	2.63	60.46	1.00	0.00	1.00	58.83	2.63	61.46
Dec	51.07	2.32	53.39	0.52	0.00	0.52	51.59	2.32	53.91
2009	**53.92**	**2.57**	**56.49**	**0.90**	**0.02**	**0.92**	**54.82**	**2.59**	**57.41**

The data show that the busiest month for civilian non-SEP activity was October, which averaged 62.10 daily departures, while the low occurred in January with 48.98 daily civilian non-SEP departures. The civilian non-SEP activity averaged 56.49 daily departures during the year. The identified military operations peaked in June with 1.87 average daily departures. The lowest military level was in January, with 0.45 average daily departures. Military non-SEP activity averaged 0.92 daily departures in 2009.

Figure 4.2 shows a plot of the data in **Table 4.4**, demonstrating the monthly variability of non-SEP departures for both civilian and military activity. It is difficult to distinguish the civilian levels from the total for civilian and military activity because of the civilian aircraft dominance. The combined civilian and military level peaked in June, with 63.91 average daily departures. The slowest month was January, with 49.43 average daily departures. Civilian and military non-SEP activity averaged 57.41 departures during the year.

FIGURE 4.2 Monthly Average Daily Departures by Non-SEP Aircraft, 2009

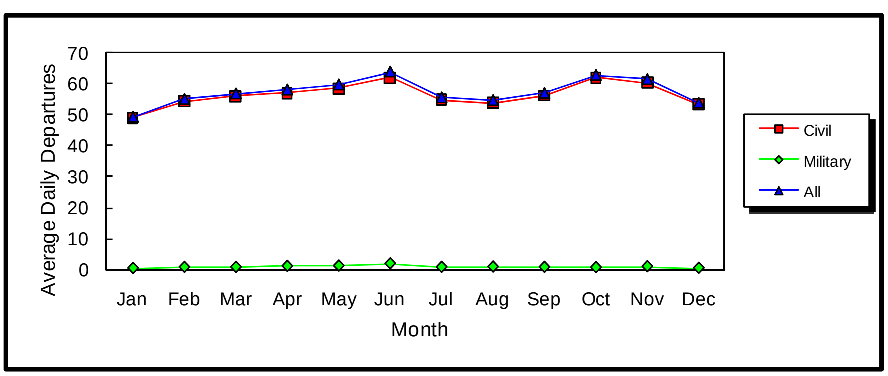


Figure 4.2 reflects the influence of the seasons on non-SEP activity, showing peak activity levels during the spring and fall and a decline during the summer. The spring and fall peaks are common, although this is in contrast to the 2008 experience when there was a decline in the summer without a fall recovery, an influence of the late 2008 downturn in the economy.

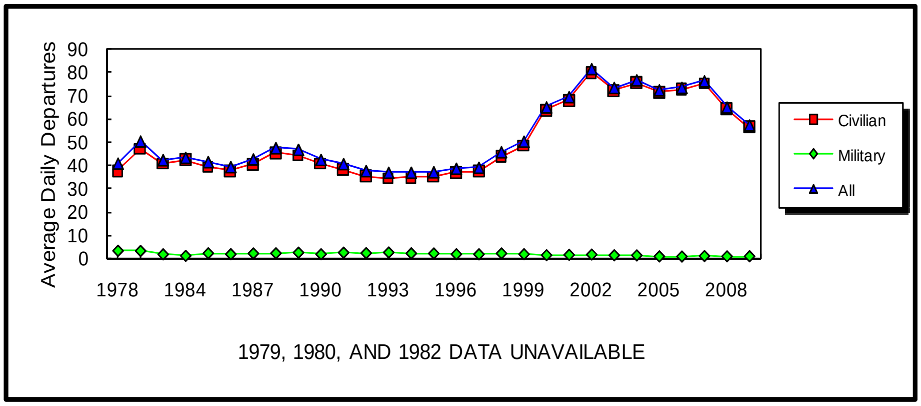
Table 4.5 shows the comparison of the 2009 data for non-SEP activity to previous study year totals. The 56.49 average daily civilian departures are 12.0 percent less than in 2008 and are less than all the years since 1999. Non-SEP civilian activity peaked in 2002 with 79.96 average daily departures.

TABLE 4.5 Annual Average Daily Departures by Non-SEP Aircraft for Study Years

	CIVILIAN			MILITARY			CIVILIAN & MILITARY		
	DAY	10pm-7am	TOTAL	DAY	10pm-7am	TOTAL	DAY	10pm-7am	TOTAL
1978	35.55	2.11	37.66	3.32	0.03	3.35	38.87	2.14	41.01
1981	45.77	1.44	47.25	3.24	0.04	3.28	49.01	1.48	50.49
1983	39.82	0.91	40.73	1.76	0.01	1.77	41.58	0.92	42.50
1984	40.63	1.72	42.35	1.12	0.01	1.13	41.75	1.73	43.48
1985	38.68	0.73	39.41	2.22	0.04	2.26	40.90	0.77	41.67
1986	37.02	0.67	37.70	1.81	0.03	1.84	38.83	0.69	39.52
1987	39.61	1.00	40.61	2.13	0.04	2.17	41.75	1.04	42.79
1988	43.67	1.73	45.40	2.15	0.08	2.23	45.82	1.83	47.65
1989	42.72	1.71	44.43	2.45	0.08	2.53	45.17	1.78	46.95
1990	39.61	1.16	40.77	1.77	0.06	1.83	41.38	1.22	42.60
1991	37.27	1.00	38.27	2.39	0.13	2.52	39.66	1.13	40.79
1992	34.48	1.03	35.51	2.24	0.06	2.30	36.72	1.09	37.81
1993	33.55	0.90	34.45	2.49	0.11	2.60	36.04	1.02	37.06
1994	33.99	0.92	34.91	2.12	0.08	2.20	36.10	1.01	37.11
1995	34.01	1.15	35.16	2.06	0.10	2.16	36.07	1.24	37.31
1996	35.25	1.70	36.95	1.74	0.09	1.83	36.99	1.79	38.78
1997	35.38	2.04	37.42	1.75	0.04	1.79	37.12	2.08	39.20
1998	41.71	2.05	43.76	2.08	0.11	2.19	43.79	2.16	45.95
1999	46.31	2.27	48.58	1.81	0.04	1.85	48.12	2.31	50.43
2000	60.83	2.91	63.74	1.35	0.06	1.41	62.18	2.97	65.15
2001	65.27	2.77	68.04	1.56	0.00	1.56	66.83	2.77	69.60
2002	76.50	3.46	79.96	1.66	0.03	1.69	78.16	3.49	81.65
2003	69.18	3.00	72.18	1.34	0.02	1.36	70.52	3.02	73.54
2004	72.01	3.47	75.48	1.30	0.01	1.31	73.31	3.48	76.79
2005	68.32	3.32	71.64	0.85	0.02	0.87	69.17	3.34	72.51
2006	68.52	4.24	72.76	0.80	0.02	0.82	69.32	4.26	73.58
2007	71.06	4.28	75.34	1.01	0.02	1.03	72.07	4.30	76.37
2008	61.00	3.19	64.19	0.89	0.02	0.91	61.89	3.21	65.10
2009	53.92	2.57	56.49	0.90	0.02	0.92	54.82	2.59	57.41

Figure 4.3 plots the annual non-SEP departure activity for the study years from 1978 through 2009, demonstrating the dominance of the civilian activity over the past 30 years. It shows that the non-SEP activity levels remained relatively stable between 1978 and 1998 and then increased to a peak in 2002 with 81.65 average daily civilian and military departures.

FIGURE 4.3 Annual Variations in Average Daily Departures by Non-SEP Aircraft



Business jet and turboprop operations caused the post 1998 non-SEP increases. There were more than 60 average daily non-SEP departures annually between 2000, the first full year after commuter service was re-introduced at Hanscom in turboprop aircraft, and 2008, when the commuter service was terminated. The peak year, 2002, was influenced by a 50 percent increase in jet activity during the first twelve months after the events of September 11, 2001, plus it was in 2002 that Hanscom experienced its highest number of commuter operations in turboprops.

The 2009 decrease in non-SEP activity, as compared to 2008, resulted primarily from an economic recession that especially impacted business jet use. Although SEP activity in 2009 was the lowest since 1999, it was greater than all years prior to 2000. The lack of a commuter airline at the airport and an anticipated slow economic recovery will impact the speed at which the non-SEP activity will recover.

CHAPTER 5 11 P.M. to 7 A.M. OPERATIONS

Hanscom Field is a public facility and is open for use 24 hours a day. However, aircraft using the airport between 11 p.m. and 7 a.m. communicate with the FAA's Boston approach control facility because the Hanscom FAA control tower is closed. Therefore, this activity is not included in the Hanscom FAA tower counts discussed in Chapter 4.

In the summer of 1980, Massport instituted an 11 p.m. to 7 a.m. airfield use fee to help minimize noise exposure by discouraging use of the field between 11 p.m. and 7 a.m. The fee is based on aircraft weight and doubles for aircraft that conduct more than five night operations in a calendar year. From 1980 until 1989 the fees were $20 for aircraft weighing 12,500 pounds or less and $150 for aircraft weighing more than 12,500 pounds.

In 1988, there was a review of the nighttime field use fee. In 1989, the Massport Board voted to increase the fees to reflect the Consumer Price Index (CPI) increase between 1980 and 1989 and to institute an annual CPI increase, effective each July 1. In 2009, there was no CPI increase so the 2009 fees remained at $52 and $382 throughout the year.

Records for activity between 11 p.m. and 7 a.m. were not maintained prior to the institution of the night field use fee. **Table 5.1** shows the history of these operations starting with 1981, the first full year they were logged. Activity levels fluctuated in the early 1980s and then increased to just over 1,000 in 1988 and 1989. In 1990, nighttime activity decreased and subsequently remained below 1,000 annual operations through 1995, a likely reflection of the depressed economy and the fee increases.

TABLE 5.1 11 p.m. to 7 a.m. Operations Since Nighttime Fee was Instituted

Year	11 p.m.-7 a.m.	Year	11 p.m.-7 a.m.
1981	585	1996	1,159
1982	532	1997	1,495
1983	640	1998	1,390
1984	759	1999	1,622
1985	442	2000	1,918
1986	466	2001	1,674
1987	850	2002	2,170
1988	1,098	2003	1,743
1989	1,053	2004	2,006
1990	773	2005	1,894
1991	797	2006	2,324
1992	702	2007	2,284
1993	689	2008	1,910
1994	735	2009	1,735
1995	919		

NOTE: The above totals include aircraft operations that are exempt from the fee, with the exception of some missing exemption figures in 1983 and 1984 and possibly in 1981 and 1982. Since exemptions for other years in the 1980s represented a small number of nighttime operations, the totals in the table area assumed to closely reflect the number of night operations for each year.

Since 1996, the number of 11 p.m. to 7 a.m. operations has consistently exceeded 1,000, partially due to night activity by a medical evacuation service, which transports critically ill or injured patients. This service moved to Hanscom in October 1995 and in 2009 conducted just over 400 night helicopter operations, a five percent decrease as compared to 2008. Total night operations decreased from 1,910 in 2008 to 1,735 in 2009. The greatest decrease was in nighttime jet operations, the aircraft that generate the highest noise levels. There were fewer turboprop and helicopter operations, but in terms of numbers of operations, these decreases were relatively small and were comparable to increases in single and twin engine pistons.

The data in **Table 5.1** are plotted in **Figure 5.1,** illustrating the fluctuations in 11 p.m. to 7 a.m. activity. They demonstrate that there has been a general upward trend that became more pronounced after 1995. Since 1999 there have been fluctuations between a low of 1,622 in 1999 to a high of 2,324 in 2006. Four of those years exceeded 2,000 operations.

FIGURE 5.1 Annual 11 p.m. to 7 a.m. Operations since Nighttime Fee was Instituted

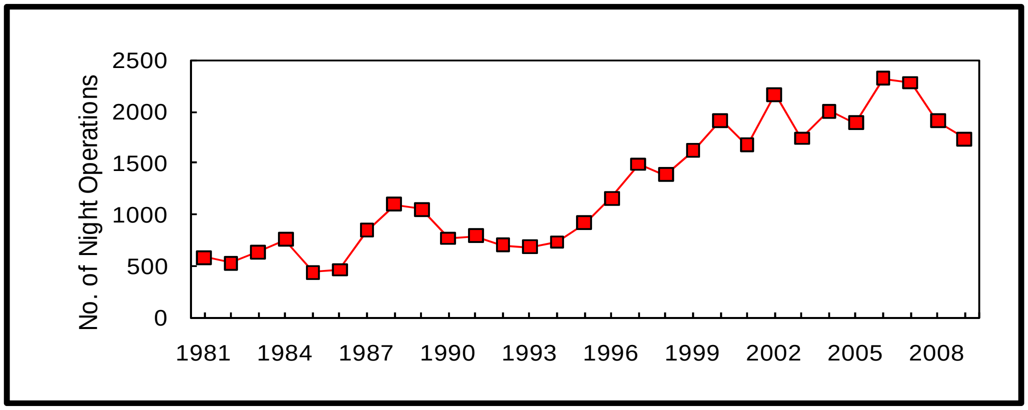


Table 5.2 provides an overview of the 2009 11 p.m. to 7 a.m. operations by aircraft type, arrivals and departures, and significant flight times. It also shows a breakdown of the number of operations by fee amount levied for each category of aircraft. Those aircraft being charged $104 or $764 conducted more than five operations in the calendar year.

TABLE 5.2 Breakdown of 2009 11 p.m. to 7 a.m. Operations

TYPE			TIME OF OPERATION			FEE DISTRIBUTION					TOTAL
	Arr.	Dep.	11PM to 12 AM	6 to 7 AM	Other	$52	$104	$382	$764	Exempt	
Jets	629	446	293	225	557	39	12	753	177	94	1,075
Singles	61	45	41	32	33	84	16	0	0	6	106
Twins	23	21	13	12	19	39	5	0	0	0	44
Turbos	48	44	22	29	41	89	1	0	0	2	92
Helis	224	194	90	36	292	6	0	0	0	412	418
TOTAL	985	750	459	334	942	257	34	753	177	514	1,735

Of the 1,735 night operations, 514 were exempt. Medical flights, dominated by the medical evacuation service based at Hanscom, represented 95.1 percent of the exemptions. Exemptions also included military and Civil Air Patrol operations, as well as operations by Hanscom-based aircraft that used the airport between 11 p.m. and 7 a.m. due to unavoidable circumstances, such as weather, mechanical, or FAA delays. There were 597 different aircraft that were subject to the nighttime fee. Of those, 49, or 8.5 percent, conducted more than five nighttime operations that were subject to the fee.

Almost 57 percent of the 11 p.m. to 7 a.m. operations were arrivals; 43 percent were departures. Over 19 percent of the night operations occurred between 6 a.m. and 7 a.m. while almost 27 percent were between 11 p.m. and midnight. The remaining 54 percent were between midnight and 6 a.m.

Jets conducted the largest number of night operations by a single aircraft category, representing 62 percent of the activity. Helicopters represented 24 percent, turboprops five percent, single engine pistons six percent, and twin engine pistons almost three percent of the night activity.

CHAPTER 6 NOISE EXPOSURE LEVELS

As discussed in Chapter 2, the 1982 HMMH noise study defined a screening metric, referred to as EXP, to use in evaluating changes in noise exposure without resorting to complex noise exposure contours for each application. It is the logarithmic sum, in decibels (dB), of the total aircraft noise on an average day for the aircraft that used Hanscom. The estimate is made for a point on the ground 15,000 feet from brake release for departures. A “noise penalty” of 10 dB is applied to operations between 10 p.m. and 7 a.m. to be consistent with the development of DNL noise contours.

6.1 2009 EXP Version 6.1

Noise exposure, represented by the EXP metric, is calculated monthly and annually at Hanscom. As discussed in Section 2.4, EXP version 6.1 (EXP 6.1) is currently being used to calculate noise exposure.

Table 6.1 presents the monthly departure EXP 6.1 values, including the effects of SEP aircraft, for 2009. Those portions of the noise attributable to civilian and military aircraft are separated in the table to show the relative contributions of each.

TABLE 6.1 2009 Monthly Variations in Departure EXP 6.1

Month	EXP 6.1c with SEP AIRCRAFT		
	Civilian	Military	Civilian & Military
Jan.	108.2	102.6	109.2
Feb.	108.1	97.5	108.5
Mar.	110.6	105.3	111.7
Apr.	110.5	109.4	113.0
May	109.9	105.4	111.2
Jun.	109.1	110.2	112.7
Jul.	109.1	107.5	111.4
Aug.	108.4	112.7	114.0
Sep.	108.9	107.1	111.1
Oct.	109.0	93.6	109.1
Nov.	108.9	103.8	110.1
Dec.	109.0	102.5	109.9
2009	**109.2**	**107.2**	**111.3**

Civilian departure EXP for 2009 was 109.2 dB, 62 percent of Hanscom's total (civilian and military) departure noise energy. It fluctuated between a low of 108.1 dB in February and a high of 110.6 dB in March. The low and high in EXP levels frequently do not correlate with the low and high for non-SEP activity levels. Although non-SEP activity dominates noise exposure, the high for civilian non-SEP activity, as seen in **Table 4.4**, occurred in October, while March had the highest noise exposure. The low for non-SEP aircraft activity was January, while the low for noise exposure was in February. This lack of correlation is because EXP factors in the fleet mix and the nighttime "noise penalty", not just the numbers of operations.

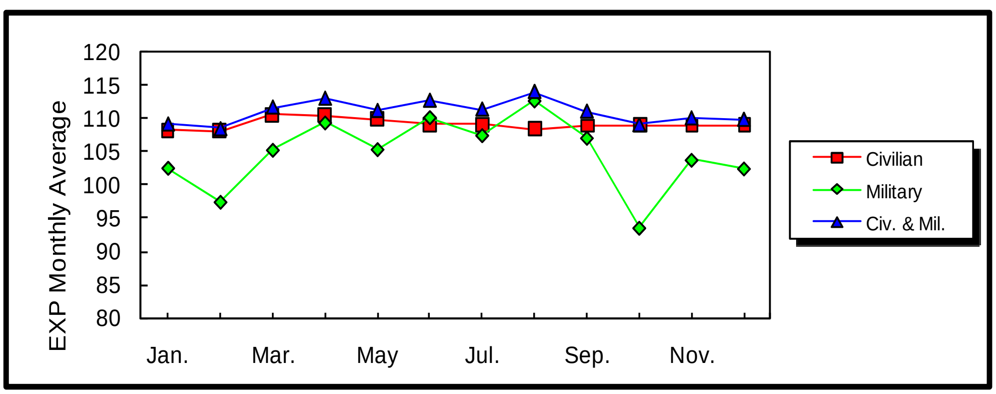
Military EXP shows more variation in departure noise levels than the civilian portion. This reflects the high noise levels of many military aircraft; a few operations by a particularly noisy aircraft can cause EXP to increase significantly. Military aircraft are exempt from the noise abatement measures that are applicable to civilian aircraft and have some of the highest SEL values as compared to the civilian aircraft that use the airport.

Military departure EXP totaled 107.2 dB in 2009, with its lowest level in October and its highest level in August. The August high reflects activity by a variety of military aircraft, from the C5, which is the largest aircraft in the military fleet, to an older model Sabreliner business jet, to a number of fighter jets. Fighter jets have the highest SEL of all the aircraft types in EXP.

In 2009, military aircraft generated 38 percent of Hanscom's total noise energy despite representing slightly less than one percent of the aircraft activity. Military activity has consistently represented less than two percent of the activity during the study years, while its contribution to the noise energy has averaged 24 percent and has ranged from 11 percent to 47 percent.

The departure EXP 6.1 data from **Table 6.1** are plotted in **Figure 6.1,** which demonstrates that military noise levels vary more than the civilian portions. The highest total (civilian and military) EXP during the year was 114.0 dB in August, when the military level exceeded the civilian portion. February experienced the lowest civilian departure EXP and the second lowest military departure EXP, resulting in the lowest total departure noise exposure, 108.5 dB.

FIGURE 6.1 2009 Monthly Averages in Departure Noise Exposure EXP 6.1



Appendix B shows a detailed table of 2009 EXP 6.1. It includes the average daily departures and arrivals as well as the departure and arrival SELs for each civilian and military aircraft group. The aircraft types listed for each group are representative of those included in the group, and the partial EXP specifies the noise impact for that group of aircraft. As explained in Chapter 2, changes in departure EXP more closely reflect changes in DNL than do changes in arrival EXP, so this report focuses on civilian departure EXP for primary comparative purposes. However, arrival EXP is being calculated and is included in Appendix B.

Table 6.2 presents the decibel contribution of several aircraft categories to civilian departure EXP 6.1, illustrating the effect of civilian jets. Although civilian jets comprised 17.0 percent of the civilian operations, they had the highest partial departure EXP and represented 80.9 percent of the civilian departure noise energy. This reflects the relatively high SEL values assigned to them. By contrast, single engine piston aircraft comprised 71.2 percent of the civilian activity but contributed only 12.9 percent of the civilian departure noise energy. They have a relatively low SEL but have the second highest partial EXP because of the large number of operations by these aircraft.

TABLE 6.2 Contributions to Civilian Departure EXP for 2009 Operations

Aircraft Category	Partial EXP 6.1 Contribution to Civilian Departure Noise Exposure
Jets	108.3 dB
Turboprops	88.7 dB
Helicopters	95.1 dB
Twin Engine Pistons	90.9 dB
Single Engine Pistons	100.3 dB
TOTAL CIVILIAN EXP	109.2 dB

6.2 EXP Comparisons for Study Years, 1978-2009

Over the past 25 years, Massport has incorporated periodic upgrades of the noise and performance data used to produce EXP. Because the importance of EXP is not in its specific value, but rather in the change in EXP from one year to the next, methods have been developed to incorporate the upgrades while presenting a reasonable representation of the changes in noise levels since 1978.

Table 6.3 shows civilian departure EXP for the study years from 1978 through 2001. It also identifies the different EXP versions that were used and the changes in EXP for each year as compared to the base year. Between 1978 and 1987, Noisemap was used to calculate the SEL values for EXP. The results for the first year and the last year of that timeframe showed 112.5 dB for civilian aircraft departures. The resulting zero in the “Difference from Base Year” column indicates equal civilian departure noise exposure, and this equal noise exposure allowed 1987 to serve as an alternate base year for future comparisons. Applying EXP Version 3.9 to 1987 data showed EXP for civilian departures was 112.0 dB. From 1988 to 1995, EXP 3.9 was calculated, and the difference from 112.0 dB indicated the year-to-year difference from the base year.

TABLE 6.3 Civilian Departure EXP Comparisons, 1978-2001

		Annual EXP	Base Year EXP	Difference from Base Year
Noisemap	**1978**	**112.5**	**Original Base Year**	
	1981	**111.3**	112.5	-1.2
	1983	**111.8**	112.5	-0.7
	1984	**112.2**	112.5	-0.3
	1985	**111.9**	112.5	-0.6
	1986	**111.8**	112.5	-0.7
	1987	**112.5**	**112.5**	0.0
Version 3.9	**1987**	**112.0**	**Alternate Base Year**	
	1988	**112.4**	112.0	0.4
	1989	**111.6**	112.0	-0.4
	1990	**110.8**	112.0	-1.2
	1991	**110.7**	112.0	-1.3
	1992	**111.4**	112.0	-0.6
	1993	**110.6**	112.0	-1.4
	1994	**111.4**	112.0	-0.6
	1995	**111.6**	112.0	-0.4
Version 5.1	**1987**	**112.1**	**Alternate Base Year**	
	1996	**112.0**	112.1	-0.1
	1997	**112.3**	112.1	0.2
	1998	**113.1**	112.1	1.0
	1999	**113.0**	112.1	0.9
	2000	**113.4**	112.1	1.3
	2001	**112.5**	112.1	0.4

The 1996 transition to EXP 5.1 was facilitated by calculating the 1987 data using EXP 5.1. **Table 6.3** shows the civilian departure EXP 5.1 for 1987 was 112.1 dB, and from 1996 to 2001 the differences between EXP 5.1 for those years and EXP 5.1 for 1987 were calculated. Because 1987 noise levels had been determined to be equal to 1978 using Noisemap, this allowed for a continued ability to represent the annual change in EXP as compared to 1978.

Past methodologies were not practical for the transition to EXP 6.0c that occurred in 2000. EXP 5.1 was applied to the data for 2000 and 2001 but neither equaled EXP 5.1 in 1987, and there was a risk in assuming that EXP 6.0c SELs, which were developed for 2000 flying procedures and aircraft, could be accurately applied to 15 year old data. Consequently, it was determined that EXP 5.1 and prior versions would illustrate the changes from 1978 to 2001 while future versions would illustrate changes from 2000 forward.

EXP 6.0c was used to track changes in noise between 2000 and 2005, as seen in **Table 6.4**. EXP 6.1 was introduced starting in 2005, and **Table 6.4** shows civilian departure EXP 6.1 for the year 2000, as well as for the years 2005 through 2009. As discussed in *2005 Noise Exposure Levels at L.G. Hanscom Field*, the differences in SEL levels for civilian aircraft groups between EXP version 6.0c and 6.1 were minimal. As a result, the annual civilian departure EXP was not affected by the version that was used. This is demonstrated in **Table 6.4** by the equal EXP level for 2000, using Versions 6.0c and 6.1 for both years, and again for 2005, using Versions 6.0c and 6.1 for both years. Consequently, it is reasonable to compare the results of either version to the other for the civilian component without further adjustments.

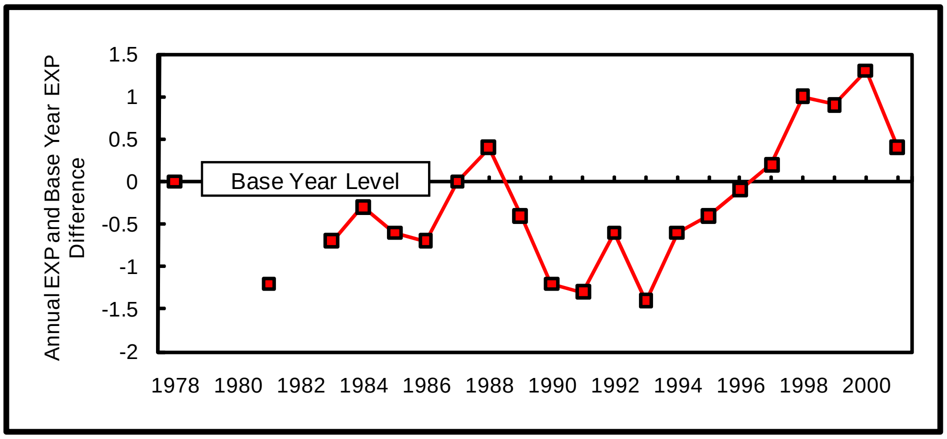
TABLE 6.4 Civilian Departure EXP Comparisons, 2000-2009

		Annual EXP	Difference from 2000	Difference from 2001	Difference from Previous Year
Version 5.1	**2000**	**113.4**			
	2001	112.5	-0.9	n/a	-0.9
Version 6.0c	**2000**	**112.3**			
	2001	111.6	-0.7	n/a	-0.7
	2002	112.4	0.1	0.8	0.8
	2003	111.9	-0.4	0.3	-0.5
	2004	111.9	-0.4	0.3	0.0
	2005	111.4	-0.9	-0.2	-0.5
Version 6.1	2000	112.3			
	2005	111.4	-0.9	-0.2	-0.5
	2006	111.0	-1.3	-0.6	-0.4
	2007	111.3	-1.0	-0.3	0.3
	2008	110.2	-2.1	-1.4	-1.1
	2009	109.2	-3.1	-2.4	-1.0

Because the upgrades in FAA noise data that are used to generate EXP make it difficult to make a direct comparison of current noise levels to the 1978 noise experience, it has been determined that identifying a range to represent the increase or decrease in civilian departure EXP is a reasonable alternative. **Table 6.3** shows a 0.4 dB increase in noise between 1978 and 2001, and **Table 6.4** shows a 2.4 dB decrease in noise between 2001 and 2009, indicating that civilian departure EXP for 2009 is 2.0 dB less than 1978. Alternatively, **Table 6.3** shows a 1.3 dB increase in noise between 1978 and 2000, and **Table 6.4** shows a 3.1 dB decrease between 2000 and 2009, indicating that civilian departure EXP for 2009 is 1.8 dB less than 1978. In other words, 2009 civilian departure EXP ranges from 1.8 to 2.0 dB less than the noise exposure in 1978. A comparison of 2009 civilian departure EXP with previous study years indicates that 2009 experienced the lowest noise level of all the study years. The next lowest was 1993 with 1.4 dB below 1978.

The EXP differences from the base year for the study years 1978 through 2001 shown in **Table 6.3** are plotted in **Figure 6.2** to demonstrate the way EXP changed through 2001. **Figure 6.2** illustrates a decrease in civilian departure EXP between 1978 and 1981, a subsequent general upward trend through 1988, a decline in the early 1990s, and a consistent increase from 1993 through 1998. From 1998 to 2001, EXP fluctuated at levels between 0.4 dB and 1.3 dB above the 1978 base year. **Figure 6.2** also demonstrates that until 2001, 2000 was the study year with the highest civilian departure EXP, while 1993 was the lowest of those study years.

FIGURE 6.2 Differences Between Civilian Departure EXP for Study Years 1978-2001



Note: 1979, 1980 and 1982 data unavailable

The EXP differences from 2000 for the study years 2001 through 2009, as shown in **Table 6.4,** are plotted in **Figure 6.3** to demonstrate the way EXP has changed since 2000. As in **Figure 6.2, Figure 6.3** illustrates the decrease in EXP between 2000 and 2001. It also shows an increase in 2002, when 2002 exceeded 2000 by a tenth of a decibel, making it the study year with the highest civilian departure EXP to-date. This was followed by a general decrease in civilian departure noise exposure, including a 1.0 dB decrease between 2008 and 2009.

FIGURE 6.3 Differences Between Civilian Departure EXP for Study Years 2000-2009

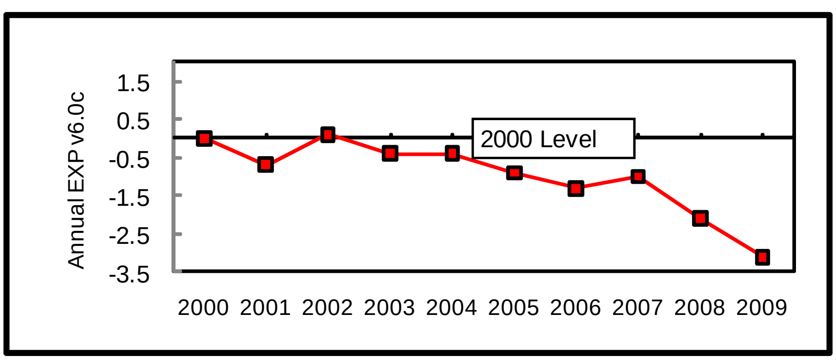


Table 6.5 looks at the six years for which EXP 6.1 was used to calculate EXP. It shows the civilian and military components as well as the total noise exposure for both departures and arrivals. Although all of this data is tracked, the noise report has never tried to analyze annual changes in EXP for military aircraft, arrivals, or total activity. Rather, it focuses on changes in the civilian portion for departures, which is highlighted in the table.

TABLE 6.5 EXP 6.1 Values for 2000 and 2005 through 2009

		DEPARTURE EXP	ARRIVAL EXP
		Version 6.1	
CIVILIAN COMPONENT, WITH SINGLES			
	2000	112.3 dB	109.1 dB
	2005	111.4 dB	108.8 dB
	2006	111.0 dB	109.1 dB
	2007	111.3 dB	109.3 dB
	2008	110.2 dB	108.4 dB
	2009	109.2 dB	107.9 dB
MILITARY COMPONENT			
	2000	106.8 dB	99.0 dB
	2005	108.4 dB	94.5 dB
	2006	107.1 dB	94.2 dB
	2007	109.9 dB	96.2 dB
	2008	106.1 dB	95.1 dB
	2009	107.2 dB	96.0 dB
TOTAL EXP (INCLUDING MILITARY AND SINGLES)			
	2000	113.4 dB	109.5 dB
	2005	113.2 dB	109.0 dB
	2006	112.5 dB	109.2 dB
	2007	113.6 dB	109.5 dB
	2008	111.6 dB	108.6 dB
	2009	111.3 dB	108.2 dB

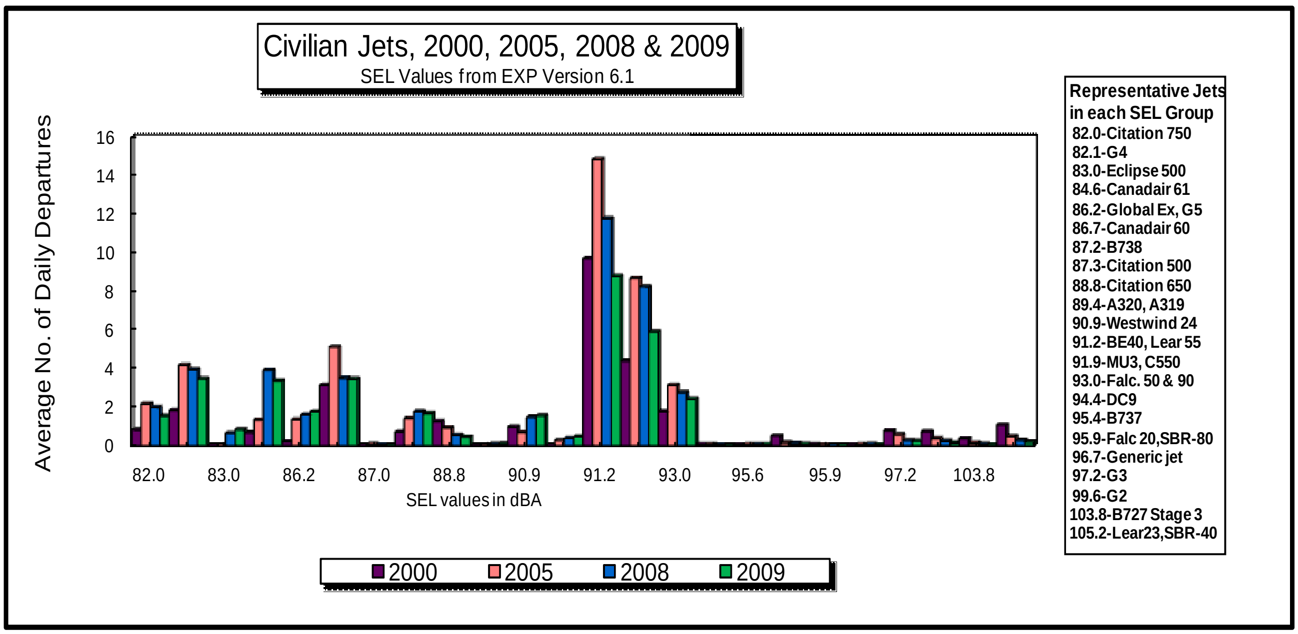
6.3 Analysis of Changes in Annual EXP for Study Years, 1978-2009

The fluctuations in civilian EXP over the past 28 years demonstrate three major influences on noise exposure: 1) the number of jet operations, since jets dominate the noise exposure, as discussed in Section 6.1; 2) whether the jet operations operated between 10:00 p.m. and 7:00 a.m. when the “noise penalty” is applied, as discussed in the introduction of this chapter and in

Appendix A; and 3) the amount of noise energy generated by each jet operation, which is reflected in the SEL assigned each jet type, as discussed in Appendix A.

Because civilian departure EXP is dominated by jet activity, it is useful to look at the number of operations conducted at Hanscom Field by the jets in each SEL group, and to see how they compare to previous years. **Figure 6.4** shows the level of activity for each jet SEL group for 2000, 2005, 2008 and 2009. It demonstrates that most of the jet operations occurred in aircraft with SELs of less than 94 dB. Included in these aircraft are the Very Light Jets, small, relatively inexpensive aircraft with some of the smallest noise footprints of all the jets that use Hanscom. **Figure 6.4** also demonstrates that in recent years there have been decreases in operations by jets in the groups with SELs exceeding 94 dB.

FIGURE 6.4 Average Daily Jet Departures by SEL Groups, 2000, 2005, 2008 & 2009



The noise energy levels of the Hanscom fleet have been influenced by federal and Massport regulations directed at reducing noise exposure for residents both nationally and around Hanscom. The FAA first issued noise standards for civil aircraft in 1969, when regulations established that minimum noise performance levels must be demonstrated for new turbojet and transport category large airplane designs. In 1977, more stringent standards were adopted, and Stage 1, 2, and 3 classifications were introduced. Stage 1 airplanes do not meet either the 1969 or 1977 standards. Stage 2 airplanes meet the 1969 standards but do not meet the 1977 standards. Stage 3 airplanes meet the 1977 standards.

Over the years, the FAA also adopted regulations that phased out the use of Stage 1 and 2 aircraft weighing more than 75,000 pounds. However, most jets using Hanscom weigh less than 75,000 pounds, so the impact was minimal.

In 1980, Massport adopted rules to address some of the noise issues being discussed with the communities around Hanscom. These rules included a phase out of Stage 1 civilian jet operations in aircraft over 12,500 pounds, a fee to discourage 11 p.m. to 7 a.m. activity, and restrictions on touch and go operations. **Figure 6.2** clearly demonstrates the initial impact of these rules. The 1981 civilian departure EXP decreased 1.2 dB as compared to 1978, the only previous study year. This initial decrease was followed by an upward trend in civilian departure EXP caused by an overall increase in jet activity resulting from a strong economy. As discussed earlier, by 1987 the noise exposure equaled 1978, and the 1988 exposure exceeded the base year for the first time.

Between 1988 and 1993, the slow economy resulted in an overall decrease in civilian departure EXP that was influenced by a decline in business jet operations, including fewer Stage 2 jets. In 1993, when civilian departure EXP dropped to the lowest level of all the 1978 to 1993 study years, there were increases in business jet activity as compared to 1992, but Stage 2 jet operations decreased.

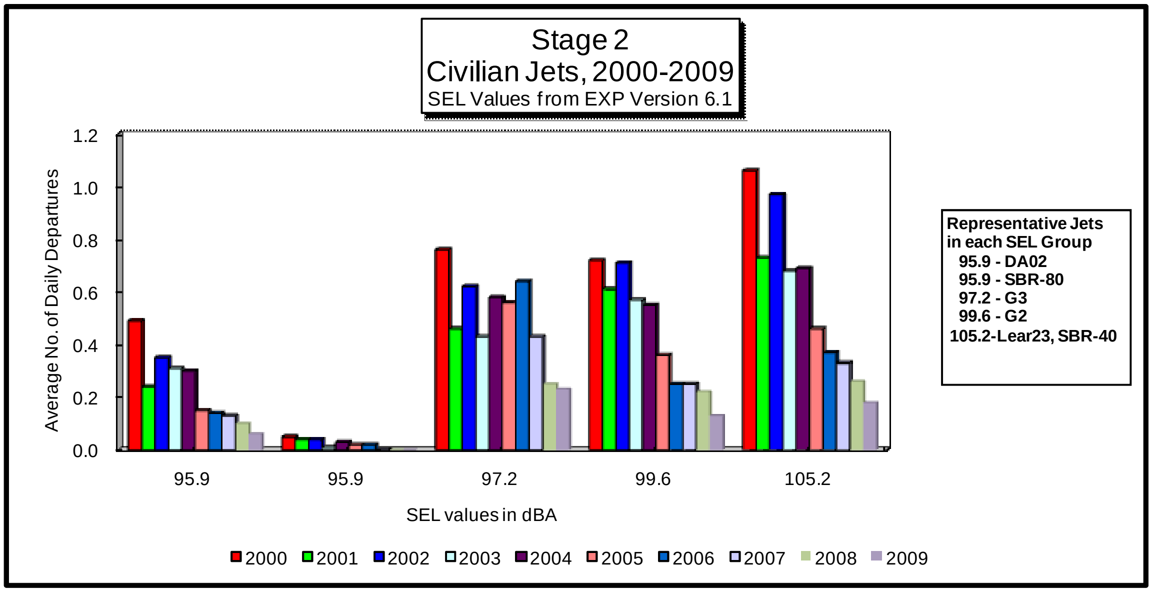
From 1993 through 2000, EXP for civilian departures showed an upward trend caused by annual increases in business jet operations. In most years, that included more Stage 2 jet activity and more jet activity between 10:00 p.m. and 7:00 a.m. Although the number of Stage 2 jet operations was increasing, the percentage of Stage 2 jets began to decrease during these years. In 1995, Stage 2 jets represented 18 percent of the jet fleet. By 2000, Stage 2 jet activity had dropped to 11 percent of the jet operations.

Starting in 2000, natural attrition of Stage 2 aircraft translated into an overall decline in EXP. The turnover from Stage 2 to Stage 3 aircraft helped counteract the noise generated by the overall increases in business jet activity. However, there were two years (2002 and 2007) when civilian departure EXP increased as compared to the previous year's noise level.

- In 2002, there were increases, as compared to 2001, in both Stage 2 and Stage 3 jet activity during the daytime hours and between 10 p.m. and 7 a.m. when the nighttime noise penalty is applied in the noise calculations. These increases reflected a reaction to the events of September 11, 2001 that resulted in many businesses turning to private aircraft rather than flying commercially. Thus, 2002 EXP increased as compared to 2001 and became the study year with the highest noise level to-date.
- In 2007, Stage 3 jet operations increased while Stage 2 jet activity decreased during the nighttime and daytime hours. As a result, 2007 was the first year that an increase in noise level was driven by increases in Stage 3 jet operations, which occurred during both the daytime and nighttime hours. This experience provides a window to the future. Assuming current trends continue, changes in noise levels at Hanscom will increasingly reflect increases and decreases in the noisiest Stage 3 jet activity levels, coupled with the fluctuations in jet activity during the nighttime hours.

Although total jet activity increased 26 percent between 2000 and 2009, Stage 2 jets decreased over 80 percent, and in 2009, they represented only 1.7 percent of the jet fleet. **Figure 6.5** illustrates the 2000 through 2009 activity levels for the Stage 2 EXP jet groups. There were decreases by all groups of Stage 2 aircraft in 2009 as compared to 2000. Group 38, which only represents the Sabreliner 80, has not had any operations since 2006. All other Stage 2 groups experienced decreases when comparing 2009 with 2008.

FIGURE 6.5 Stage 2 Jet Activity, 2000-2009



In 2009, Stage 2 jets comprised 17.6 percent of the total civilian noise energy for departures and 21.7 percent of the civilian jet noise energy for departures. It is reasonable to assume that Stage 2 jets will eventually become obsolete, but a mandatory federal phase out of Stage 2 jets that weigh less than 75,000 pounds would facilitate more rapid noise reduction at airports nationally. Massport's support of such a phase out is discussed in Chapter 8.

As discussed in Chapter 4, an important influence on jet activity levels is the economy. Predictably, the positive economic trends of the mid to late 1980s and again in the mid to late 1990s and into 2000 resulted in increased business jet activity at Hanscom Field. Helping counteract the noise generated by the increases in jet operations in the 1980s was the phase out of most Stage 1 jets at Hanscom Field, and in the 1990s there was some turnover from Stage 2 to Stage 3 jets as businesses upgraded their equipment. For jets over 75,000 pounds, the upgrades were required nationally by the year 2000. To meet this mandate, some aircraft operators upgraded to new Stage 3 aircraft while others installed hushkits that reduced the noise footprint of a non-Stage 3 aircraft and brought it below the Stage 3 noise threshold.

The Boeing 727 (B727), the noisiest Stage 3 Hanscom aircraft, has a higher SEL than most of the Stage 2 aircraft that use Hanscom. This is because the noise threshold for meeting the Stage 3 standard increases with an aircraft's weight, and the Boeing 727 is a heavy aircraft. The Boeing 727 was originally a Stage 2 aircraft, but in the United States, these aircraft have been retrofitted to meet Stage 3 standards. Their activity levels decreased in 2008 and 2009. Increases or decreases in these aircraft operations have an influence on changes in EXP equal to those operations conducted by Stage 2 aircraft.

The events of September 11, 2001 (9/11) resulted in a surge in business jet operations despite the slow economy at the time. Between 2002 and 2008, the business jet activity has fluctuated between 30,000 and 34,600 annual operations. Despite the 16.9 percent decrease in Hanscom's jet traffic in 2009, as compared to 2008, the jet operations remained above pre-9/11 activity levels. Massport believes that the decline in business jet use is a temporary reaction to the economic conditions and that the demand for business jet travel will return to previous levels in the near future.

CHAPTER 7 NOISE MONITORING SYSTEM

In the late 1980s, Massport and the surrounding communities agreed that a permanent noise monitoring system (NMS) could contribute to a more complete picture of the noise environment around the airport by adding data to the existing EXP metric. EXP looks at total noise on an average day, with a focus on civilian departure EXP, and doesn't consider runway use, for example. In the early 1990s, five noise monitors were installed on and around the airport. A sixth monitor was installed in late 1994. Data for all the monitor sites became available in 1995.

Given the age of Massport's original noise monitoring system and the advancement of technology in this field, in 2004, Massport decided to upgrade its system. Massport requested proposals and subsequently selected Rannoch Corporation, now Era Corporation, to replace the system's microphones and software. Hanscom staff members began experiencing the benefits of the new system in 2007 and have been able to provide callers with more information about disturbing flights than had been available in the past. An interactive website is being developed.

The data from the monitors shown in this report are Day-Night Average Sound Levels (DNL) in A-weighted decibels, both of which are described in Appendix A. These are actual measured levels, so they include military and civilian aircraft as well as community noise.

Because noise monitoring equipment upgrades were installed in November 2006, there is no noise monitoring data for that month. Between 2007 and 2009, the monitors at sites 31 and 32 had complex challenges associated with wireless downloading from the new equipment, and a defect was discovered in the monitor at site 32. While these problems resulted in the loss of data, both sites were generating reliable data by the middle of 2009.

In April of 2009, the Site 34 monitor on DeAngelo Drive in Bedford was hit by a vehicle, which caused substantial damage. Because a tree that had grown near the site could potentially contaminate data and because there had been similar incidents in prior years, Massport determined that a new location needed to be identified for installing a replacement. This led to a review of possible locations, which included discussions with Bedford representatives and taking noise measurements and analyzing flight tracks at numerous alternative sites. It was determined that DeAngelo Drive was the best acoustical location, which led to selecting a site that was close to the old site but away from trees and set back from the road. This work was completed in 2010.

Table 7.1 shows the readings at the six sites for 1995 and 2000 as well as for 2005 through 2009. Footnotes identify the number of months included in the data. Appendix C shows the readings for those years by month. Appendix C also includes a map showing the locations for the monitors. Data for the years not included in this report can be found in previous annual noise reports, available in Massport's offices.

TABLE 7.1 Measured DNL Levels—1995, 2000 and 2005 Through 2009

Site No.	1995	2000		2005	2006*	2007	2008	2009
31	67.2	66.5	Switch from every five year data to annual data	68.3	66.1	64.9 #	65.9 #	64.0 #
32	66.7	64.5		64.1	63.9	63.3 #	62.8 +	63.7 ++
33	57.1	55.7		56.1	56.1	56.9	56.0	56.1
34	60.1	59.7		60.6	60.5	61.8	62.2	60.6 ##
35	60.5	60.2		59.2	59.4	60.3	59.8	60.0
36	62.4	62.8		62.3	62.3	63.3	62.7	62.0

* Eleven month average: All but November data, when new monitors were being installed, tested and adjusted.
# Six month average: 2007 data from Jan-May and Nov; 2008 data from Jan-Jun; 2009 data from Jul-Dec; missing data damaged/lost due to downloading challenges using wireless communications.
+ Two month average: data from Jan and Nov.; other data lost/damaged due to downloading challenges or contaminated by faulty monitor.
++ Eight month average: May-Dec data; other data contaminated by faulty monitor
Three month average: Jan-Mar data; monitor hit by truck in April; not replaced until 2010

A comparison of the 2008 and 2009 annual DNL values at the off-airfield sites shows decreases of 1.6 dB, and 0.7 dB at Sites 34 (Bedford) and 36 (Concord) respectively. There was an increase of 0.1 dB at Site 33 in Lincoln and an increase of 0.2 dB at Site 35 in Lexington.

The available data for Site 31 included six months in both 2008 and 2009, although it was for the first six months in 2008 and the last six months in 2009. Business jet activity decreased significantly in 2008, but not until the second half of the year, and the recovery did not resume in earnest until early 2010. The 1.9 dB decrease in DNL at Site 31 is consistent with the 23 percent decline in business jet use between the first half of 2008 and the second half of 2009.

The available data for Site 32 includes only two months in 2008 as compared to eight months in 2009, making it inappropriate to assume that a comparison reflects the change in the two years. The average for the two months in 2008 is 62.8 dB. The average for the eight months in 2009 is 63.7 dB.

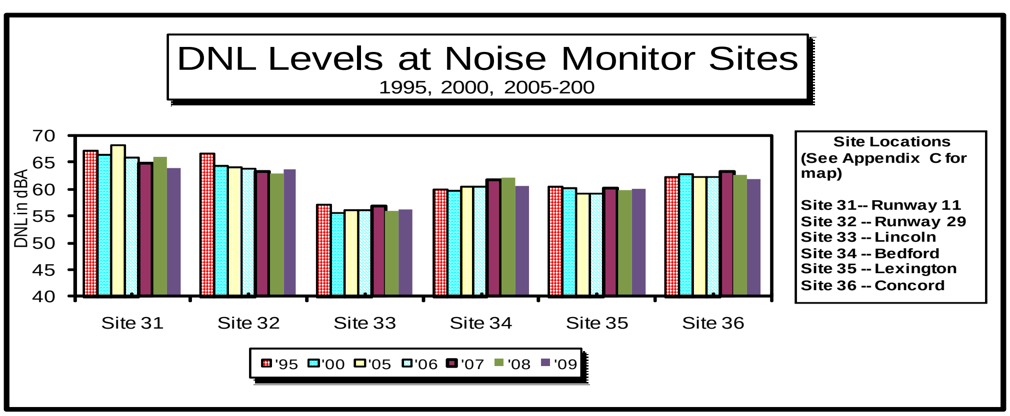
The measured changes must be looked at carefully for both aviation and non-aviation influences. Aviation influences include the noise levels generated by specific aircraft and runway use, which determines which monitors are impacted by a particular flight.

Military aircraft activity can cause particularly high readings because of the high noise levels of some military aircraft, such as fighter jets. Some months are influenced by military events that result in increased military activity at Hanscom: an Air Force Air Show generated high noise levels in June of 1995; in October of 1995, there was a test of navigational equipment, which required a military KC135 (Boeing 707 equivalent) to conduct multiple low approaches over the airport; fighter jets operated out of Hanscom in order to conduct fly-overs at sports events, including Red Sox games in April 2005, October 2005, April 2006, October 2007, and April 2008, and Patriots games in January 2007 and January 2008; there were fighter jets to celebrate Independence Day in July 2007. This military activity is known to have contributed to the monitor readings in those years but is only partially reflected in military EXP because only the military IFR events are accounted for in the computer modeling.

Readings may also reflect non-aviation noise sources. In 1995, Sites 31 and 32 experienced noise from the use of tree removal equipment. Construction noise influenced readings at Site 31 in 2005 and at Site 36 in 2007. Site 36 is also influenced by noise from the near-by wastewater treatment facility, which produces background noises that contribute to the readings. As a result, Site 36 consistently shows the highest recorded levels at an off-airport location. There are plans to move this monitor to a new location.

The data in **Table 7.1** are plotted in **Figure 7.1**, which demonstrates the fluctuations in measured noise at the six sites for 1995, 2000 and 2005 through 2009. Sites 31 and 32 consistently have the highest readings because they are located on the airport at the ends of Runway 11/29. They are the least likely to be influenced by consistent community noise and therefore are likely to have the closest correlation to noise levels shown in noise contours.

FIGURE 7.1 Measured DNL Values—1995, 2000, and 2005 through 2009



Note: 2006 includes 11 months of data at all sites; 2007 includes six months of data at Sites 31 and 32; 2008 includes six months of data at Site 31 and two months of data at Site 32; 2009 includes six months of data at Site 31, eight months of data at Site 32, and three months of data at Site 34.

CHAPTER 8 NOISE ABATEMENT POLICIES

Massport operates Hanscom as a safe and secure, well-equipped, modern airport that serves the diverse needs of its users and accomplishes its role in the regional transportation system, while being sensitive to the concerns of the surrounding communities. Massport encourages meaningful public participation and expends considerable resources in an attempt to strengthen its relationship with its neighbors. Towards this effort, Massport strives to disseminate accurate information on a timely basis, mitigates environmental impacts whenever and wherever possible, and prepares in-depth environmental studies and/or analyses during its planning and project review processes.

In 2009, Massport began a new initiative to reduce noise over the Minute Man National Historical Park. Most touch and go operations circle to the south of the airport, potentially taking the aircraft over areas of the Battle Road Trail that are used by the Park for outdoor programs and interpretive talks. In a partnership with the Park, the FAA, the flight schools and Hanscom pilots, it was determined that small aircraft could increase the use of a tight touch and go pattern that keeps the aircraft over the airfield rather than over sensitive park areas. Massport developed an extensive outreach program for implementation in 2010.

This touch and go initiative is the latest of many efforts to minimize aircraft noise that began over 30 years ago. In 1978, the Massport Board adopted the *Hanscom Field Master Plan and Environmental Impact Statement* (The Master Plan). This official policy statement regarding the future development and management of Hanscom Field was developed by Massport staff in conjunction with the Governor's Hanscom Field Task Force. The Task Force, which represented neighboring towns, airport users, state legislators, public interest groups and other stakeholders, was established to ensure that all concerns were considered in a plan that would guide Massport's operation and maintenance of the airport.

The plan's 12 policy statements fall under four broad categories, as follows:

Growth:

1. The character of the airport
2. Airport activity and runway facilities
3. Certified passenger air carrier operations
4. Passenger commuter operations
5. Cargo operations
6. Airport improvements
7. Aircraft noise

Land use:

1. Aviation related land use
2. Other Massport properties

Ground access:

1. Ground access

Planning process:

1. Hanscom Field Advisory Committee
2. Airport System Planning

One outgrowth of The Master Plan was the formation of the HFAC. Another was the Massport Board's adoption of the 1980 *General Rules and Regulations for Lawrence G. Hanscom Field*, which was designed to address noise issues. The rules for Hanscom included phasing out the use of most Stage 1 aircraft, limiting touch-and-go operations to aircraft under 12,500 pounds, limiting touch-and-go activity to the hours of 7 a.m. to 11 p.m., limiting commercial air carrier passenger service to aircraft with no more than 60 seats, and establishing the nighttime field use fee. It also provided parameters for the use of Ground Power Units and updated the definition of commuter aircraft that had been referenced in The Master Plan.

The Master Plan and the 1980 Rules (available in Massport offices) continue to guide Massport for Hanscom related decisions. Massport continues its diligent enforcement of the rules, while actively sharing data, plans, and policies with the aviation and residential communities. Massport staff members participate at all HFAC meetings and attend Hanscom Area Towns Committee (HATS) meetings, as well as other forums where their presence is requested or seems warranted.

Massport has also completed a series of environmental studies, which inform staff in planning Hanscom's future and provide the communities with extensive data related to the airport, as follows: a Generic Environmental Impact Report (GEIR) based on 1985 activity levels, a GEIR Update based on 1995 activity levels, an Environmental Status and Planning Report (ESPR) based on 2000 activity levels, and an ESPR based on 2005 activity levels. The Secretary of Environmental Affairs found all of these documents to adequately comply with the Massachusetts Environmental Policy Act (MEPA).

The GEIR/ESPR documents include a comprehensive analysis of base year noise levels and look at potential future noise levels assuming a series of future scenarios. These reports are available for review in the Massport offices and in the libraries of the four contiguous towns.

From 1998 through 2000, Massport staff worked closely with the Noise Working Group, an outgrowth of the then current GEIR Update. The group, which included aviation and residential community members, formed two subgroups, one to develop noise abatement/mitigation recommendations and the other to review and recommend metrics to be used to describe the Hanscom Field noise environment. The recommendations were submitted to Massport in late 2000.

In 2001, Massport began taking steps to implement most of the recommendations that were directed to Massport.[1] **Table 6.4** in this report is an example of a metric requested by the Noise Working Group, and the ESPRs respond to some of the other metric requests. Implementation of the upgraded noise monitoring system, as discussed in Chapter 7, is expected to facilitate the adoption of some additional Noise Working Group requests.

While Massport began actively encouraging quiet flying techniques in the 1980s, the Noise Working Group's initiatives resulted in a more robust noise abatement awareness program. In 2001, Massport distributed "Fly Friendly" videos to all Hanscom pilots, flight schools, and Fixed Base Operators (FBOs)[2]. Massport is now asking all pilots who receive a Hanscom ID badge to watch a video about quiet flying techniques. In 2009, 99 percent of those pilots watched the video. The quiet flying techniques are also described on Massport's website, on posters that are prominently displayed by the flight schools and the FBOs, and on handouts that are available for pilots to include with their airport flight materials. Airfield signage also promotes quiet flying.

On another front, Massport is an active participant in Sound Initiative, an organization spearheaded by general aviation airports that support federal legislation to phase out Stage 2 aircraft operations in the United States. By early 2007, both the Senate Commerce Committee and the US House of Representatives' Transportation and Infrastructure Committee had responded to Sound Initiative's urgings and approved amendments to the 2007 FAA reauthorization bill that would phase-out non-Stage 3 aircraft by 2012. Unfortunately, the reauthorization bill was stalled in Congress and the FAA has been operating under temporary budget extensions since October 2007. Although it is anticipated that the reauthorization bill will eventually be passed, the phase-out deadline may be extended.

Massport's operation of Hanscom Field assists Massport in meeting its responsibilities to the regional transportation system, to the business community and to the economic viability of the region. At the same time, Massport recognizes the issues that are raised by the surrounding communities and strives to work through HFAC to find mutually acceptable mechanisms to minimize and/or mitigate those issues.

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1 Some of the recommendations were directed to Hanscom Air Force Base, the Noise Working Group, or the FAA.

2 A full-service FBO is a company that handles a range of needs for based and transient aircraft, their operators and their passengers. These include cleaning, maintaining, fueling, and parking/hangaring aircraft, providing flight planning services for the pilots, and arranging for the specific needs of those flying.

APPENDIX A [1]

Noise Terminology Used at Hanscom Field

DNL Noise Contour Maps

Time Above Contour Maps

[1] Excerpts from: *2000 L.G. Hanscom Field Environmental Status and Planning Report* and *Draft 2005 L.G. Hanscom Field Environmental Status and Planning Report*

Noise Terminology

Noise, often defined as unwanted sound, is one of the most common environmental issues associated with aircraft operations. Aircraft are not the only sources of noise in an urban or suburban environment where interstate and local roadway traffic, rail, industrial, and neighborhood sources also intrude on the everyday quality of life. Nevertheless, aircraft are readily identified by their noise and are typically singled out for special attention and criticism. Consequently, aircraft noise problems often dominate analyses of environmental impacts. To help understand and interpret these impacts, it is important to be familiar with the various metrics that are used to describe the noise from an aircraft and from the collection of noise events that comprise an airport noise environment. This introductory section describes those commonly used noise metrics, in increasing complexity. They include the:

- Decibel (dB)
- A-weighted decibel, or sound level (dBA)
- Sound Exposure Level (SEL)
- Equivalent Sound Level (L_{eq})
- Day-Night Sound Level (DNL)
- Time Above (TA)

The Decibel, dB

Sound is a physical phenomenon consisting of minute vibrations that travel through a medium, such as air, and are sensed by the human ear. Whether that sound is interpreted as pleasant (music, for example) or unpleasant (aircraft noise, for example) depends largely on the listener's current activity, experience, and attitude toward the source of that sound. It is often true that one person's music is another person's noise.

The loudest sounds the human ear can comfortably hear have one trillion (1,000,000,000,000) times the acoustic energy of sounds the ear can barely detect. Because of this vast range, any attempt to represent the intensity of sound using a linear scale becomes unwieldy. As a result, a logarithmic unit called the decibel (dB) is used to represent the intensity of sound. This representation is called a sound pressure level.

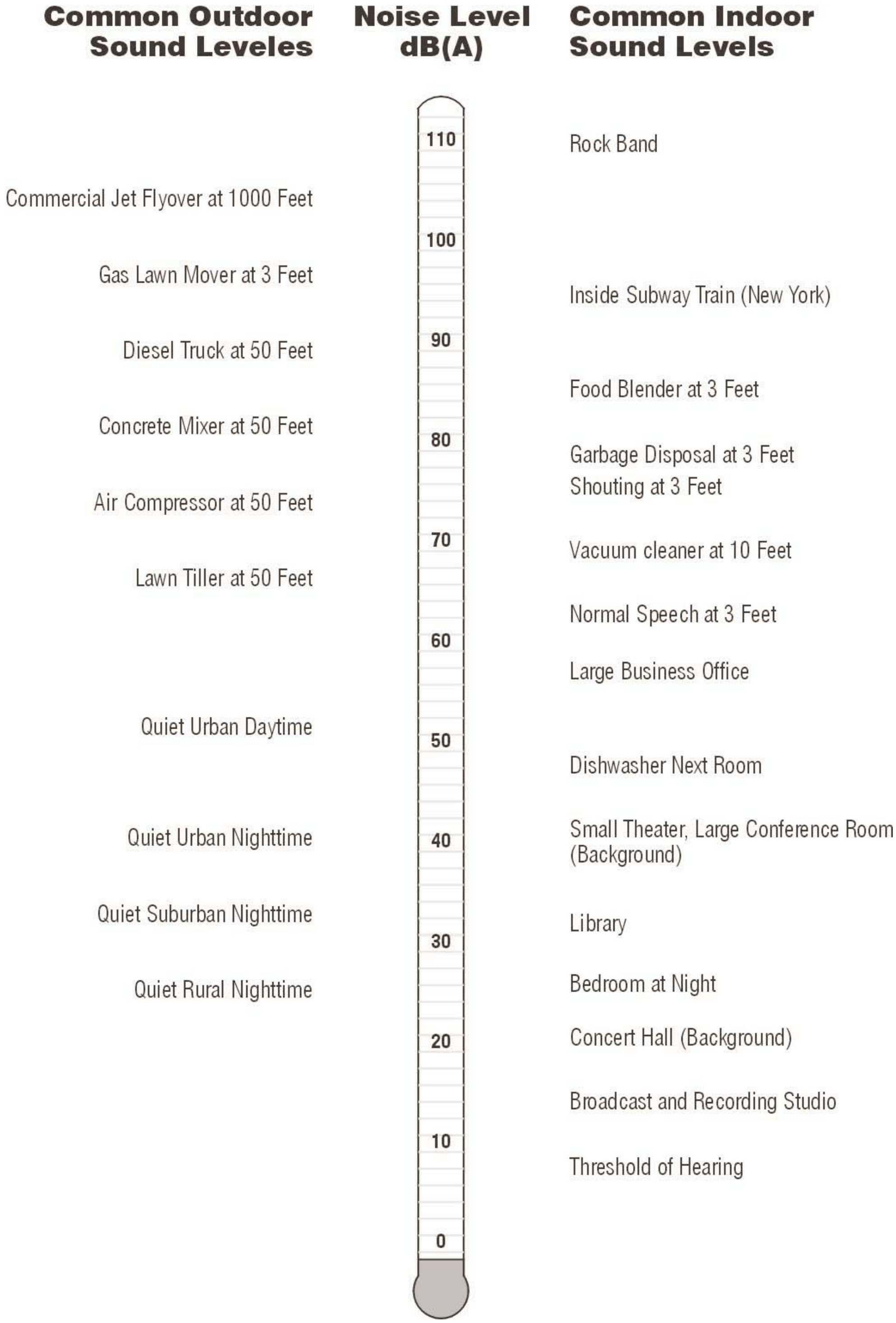
A sound pressure level of less than 10 dB is approximately the threshold of human hearing and is barely audible under extremely quiet conditions. Normal conversational speech has a sound pressure level of approximately 60 to 65 dB. Sound pressure levels above 120 dB begin to be felt inside the human ear as discomfort and eventually pain at still higher levels.

A-weighted Sound Level, dBA

Additionally, not all sound pressures are heard equally well by the human ear. Some tones are easier to detect than others and are perceived as being louder or noisier. Thus, in measuring community noise, frequency dependence is taken into account by adjusting the very high and very low frequencies to approximate the human ear's reduced sensitivity to those frequencies. This adjustment is called "A-weighting" and is commonly used in measurements of environmental noise.

Figure 7-1 shows A-weighted sound levels for some common sounds. In this document, all sound pressure levels are A-weighted and, as is customary, are referred to simply as "sound levels," where the adjective "A-

Figure 7-1 Common A-weighted Sound Levels

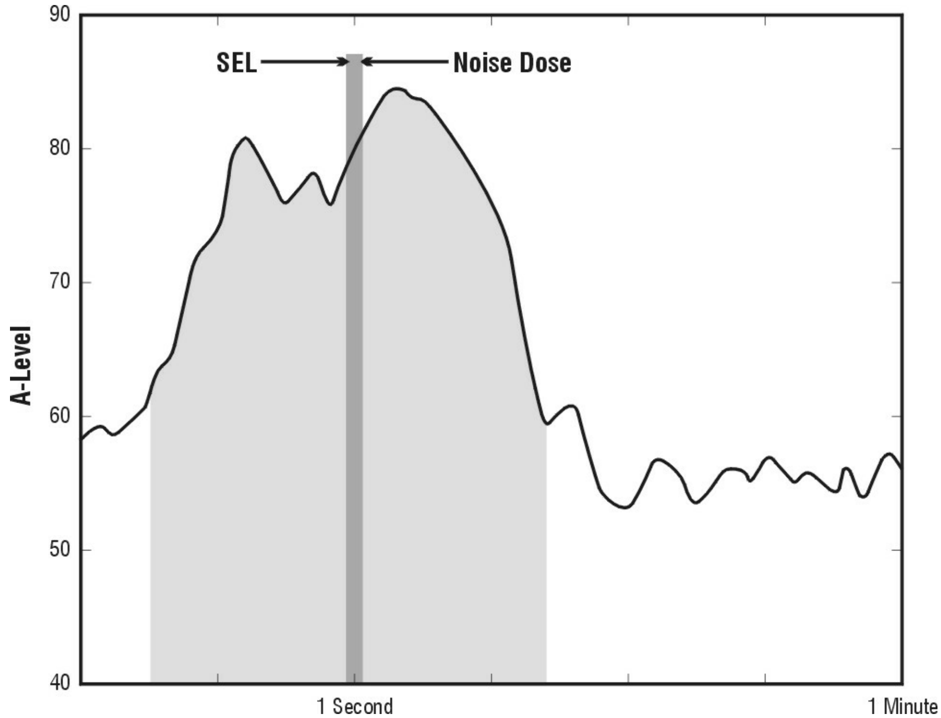


weighted" has been omitted. Sound levels are designated in terms of A-weighted decibels, abbreviated dBA. With A-weighting, a noise source having a higher sound level than another is generally perceived as louder. Also, the minimum change in sound level that people can detect outside of a laboratory environment is on the order of 3 dB. A change in sound level of 10 dB is usually perceived by the average person as a doubling (or halving) of the sound's loudness, and this relationship holds true for loud sounds as well as for quieter sounds.

Sound Exposure Level, SEL

A further complexity in judging the impact of a sound is how long it lasts. Long duration noises are more annoying than short ones. The period over which a noise is heard is accounted for in noise measurements and analyses by integrating sound pressures over time. In the case of an individual aircraft flyover, this can be thought of as accounting for the increasing noise of the airplane as it approaches, reaches a maximum, and then falls away to blend into the background (see Figure 7-2). The total noise dose, or exposure, resulting from the time-varying sound is normalized to a one-second duration so that exposures of different durations can be compared on an equal basis. This time-integrated level is known as the Sound Exposure Level (SEL), measured in A-weighted decibels.

Figure 7-2 Illustration of Sound Exposure Level



Because aircraft noise events last longer than one second, the time-integrated SEL always has a value greater in magnitude than the maximum sound level of the event – usually about 7 to 10 dB higher for most airport environments. SELs are used in this study as a means of comparing the noise of several significant aircraft types; they are also highly correlated with sleep disturbance, an impact that is discussed in Appendix G.

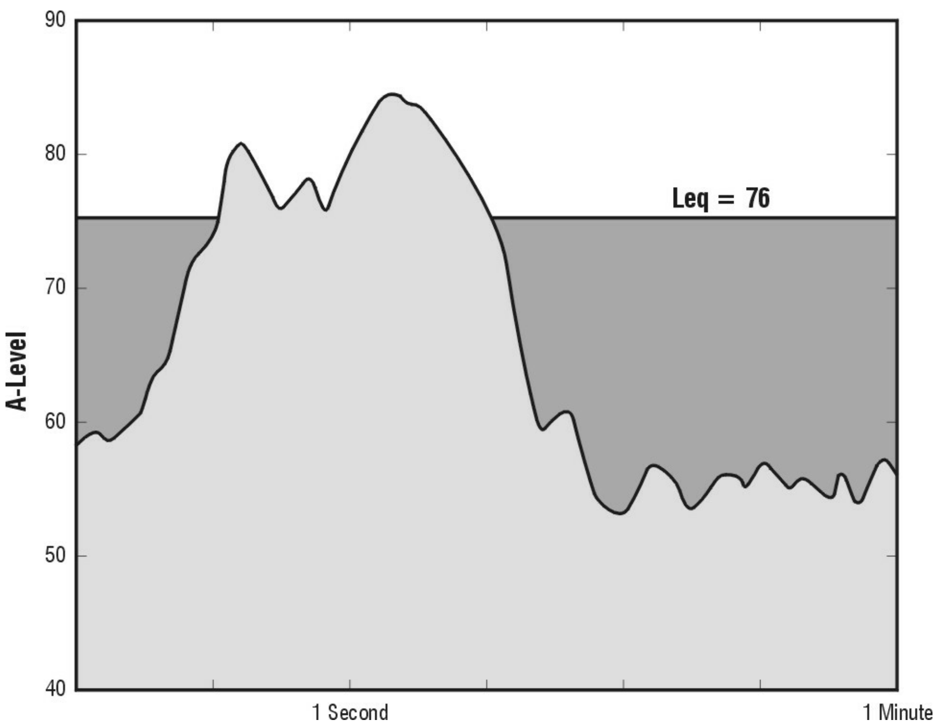
The remaining noise metrics discussed in this section refer to the accumulation of exposure caused by multiple noise events over time. While such metrics are often viewed as downplaying the importance of individual aircraft operations, they are extremely good indicators of community annoyance with complex noise environments, and they have become widely accepted as the most appropriate means of evaluating land use planning decisions.

Equivalent Sound Level, L_{eq}

The most basic measure of cumulative exposure is the Equivalent Sound Level (L_{eq}). It is a measure of exposure resulting from the accumulation of A-weighted sound levels over a particular period (as opposed to an event) of interest such as an hour, an eight-hour school day, nighttime, a single 24-hour period, or an average 24-hour period. Because the length of the period can differ, the applicable period should always be identified or clearly understood when discussing the metric. Such durations are often identified through a subscript, for example $L_{eq}(8)$ or $L_{eq}(24)$.

Conceptually, the L_{eq} may be thought of as the constant sound level occurring over the designated period of interest and having as much sound energy as that created by the actual rising and falling sound pressures from multiple noise sources as they become more or less pronounced. This is illustrated in Figure 7-3 for the same representative one-minute of exposure shown earlier in Figure 7-2. Both the dark and light gray shaded areas have a one-minute L_{eq} value of 76 dBA. It is important to recognize, however, that the two representations of exposure (the constant one and the time-varying one) would sound very different from each other were they to occur in real life.

Figure 7-3 Illustration of Equivalent Sound Level



Often the L_{eq} is referred to misleadingly as an "average" sound level. This is not true in the traditional sense of the term average. Because decibels are logarithmic quantities, loud events dominate the calculation of the L_{eq}. For example, if an aircraft produced a constant sound level of 85 dBA for 30 seconds of a minute then immediately disappear, leaving only ambient noise sources to produce a level of 45 dBA for the remaining 30 seconds, the L_{eq} for the full minute would be 82 dBA – just 3 dBA below the maximum caused by the aircraft, not the 65 dBA suggested by normal averaging. More typical timeframes of interest are daytime, nighttime, and annual average 24-hour exposure levels, but all of these same principles of combining sound levels apply to those periods as well. Loud noise events occurring during any timeframe are going to have the greatest influence on the overall exposure for the period.

The Day-Night Sound Level, DNL

The most widely used cumulative noise metric is a variant of the 24-hour L_{eq} known as the Day-Night Sound Level, or DNL, a measure of noise exposure that is highly correlated with community annoyance. The long-term (yearly) average DNL is also associated with a variety of land use guidelines that suggest where incompatibilities are expected to exist between the noise environment and various human activities. Because of these strengths, the metric is required to be used on airport noise studies funded by the Federal Aviation Administration (FAA).

In simple terms, DNL is the equivalent sound level for a 24-hour period, modified so that noises occurring at night (defined specifically as 10:00 p.m. to 7:00 a.m.) are artificially increased by 10 dB. This "penalty" reflects the added intrusiveness of nighttime noise events as community activity subsides and ambient noise levels get quieter. The penalty is mathematically equivalent to multiplying the number of nighttime noise events by a factor of ten.

The U.S. Environmental Protection Agency (EPA) identified DNL as the most appropriate means of evaluating airport noise based on the following considerations[1]:

- The measure should be applicable to the evaluation of pervasive long-term noise in various defined areas and under various conditions over long periods of time.

- The measure should correlate well with known effects of the noise environment and on individuals and the public.

- The measure should be simple, practical and accurate. In principal, it should be useful for planning as well as for enforcement or monitoring purposes.

- The required measurement equipment, with standard characteristics, should be commercially available.

- The measure should be closely related to existing methods currently in use.

- The single measure of noise at a given location should be predictable, within an acceptable tolerance, from knowledge of the physical events producing the noise.

- The measure should lend itself to small, simple monitors, which can be left unattended in public areas for long periods of time.

Despite these origins, the lay public often criticizes the use of DNL as not accurately representing community annoyance and land use compatibility with aircraft noise. Much of that criticism stems from a lack of understanding of the measurement or calculation of DNL. One frequent criticism is based on the feeling that people react more to single noise events than to "meaningless" time-average sound levels. In fact, DNL takes into account both the noise levels of all individual events occurring during a 24-hour period and the number of times those events occur. The logarithmic nature of the decibel causes noise levels of the loudest events to control the 24-hour average, just as they were shown to do in the previous discussion of shorter-term L_{eq}s.

Most federal agencies dealing with noise have formally adopted DNL, though they also encourage the use of supplemental noise metrics to aid the public in understanding the complex noise environment of an airport. For example, Massport frequently uses the Sound Exposure Level, maximum sound level, or times above threshold sound levels to help describe the environments around Hanscom Field and Logan International Airport. Even so, the Federal Interagency Committee on Noise (FICON), comprised of member agencies such as the FAA, Department of Defense (DoD), U.S. EPA, Department of Housing and Urban Development (HUD), National Aeronautics and Space Administration (NASA), Council on Environmental Quality (CEQ), and the Department of Veterans Affairs, reaffirmed the appropriateness of DNL in 1992. The FICON summary report stated, "There are no new descriptors or metrics of sufficient scientific standing to substitute for the present DNL cumulative noise exposure metric".[2] The Federal Interagency Committee on Aviation Noise (FICAN) recently supported the use of supplemental metrics in its statement that "supplemental metrics provide valuable information that is not easily captured by DNL".[3]

DNL can be measured or estimated. Measurements are practical only for obtaining DNL values for a relatively limited number of points, and, except in the case of a permanently installed noise monitoring system, only for relatively short time periods. Most airport noise studies are based on computer-generated DNL estimates, depicted in terms of equal-exposure noise contours, much as topographic maps have contours of equal elevation.

Time Above a Threshold, TA

Because analyses of decibels are complex and often unfamiliar to the public, the FAA has developed a supplemental noise metric that is non-logarithmic: the amount of time (in minutes or seconds) that the noise source of interest exceeds a given A-weighted sound level threshold. Every time a noise event goes above a given threshold, the number of seconds is accumulated and added to any previous periods that the noise exceeded the threshold. These time-above-thresholds, or Time Above (TA), are usually reported for a 24-hour period.

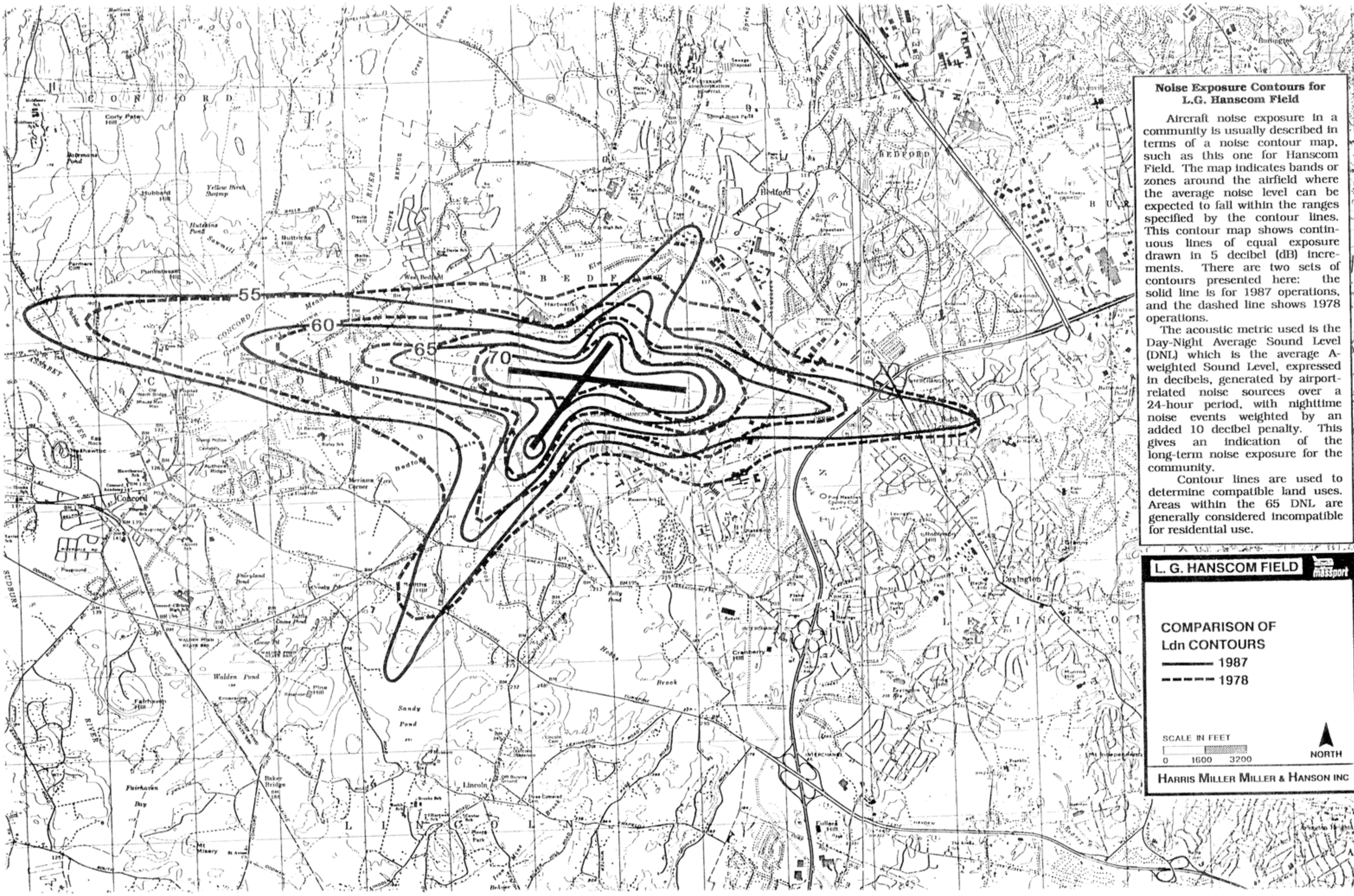
Note that TA does not tell the loudness of the various noise events. Just as a single value of the A-weighted sound level ignores the dimension of time, so the TA ignores the dimension of loudness. Nevertheless, TA can be helpful in better understanding a noise environment.

Noise Exposure Contours for L.G. Hanscom Field

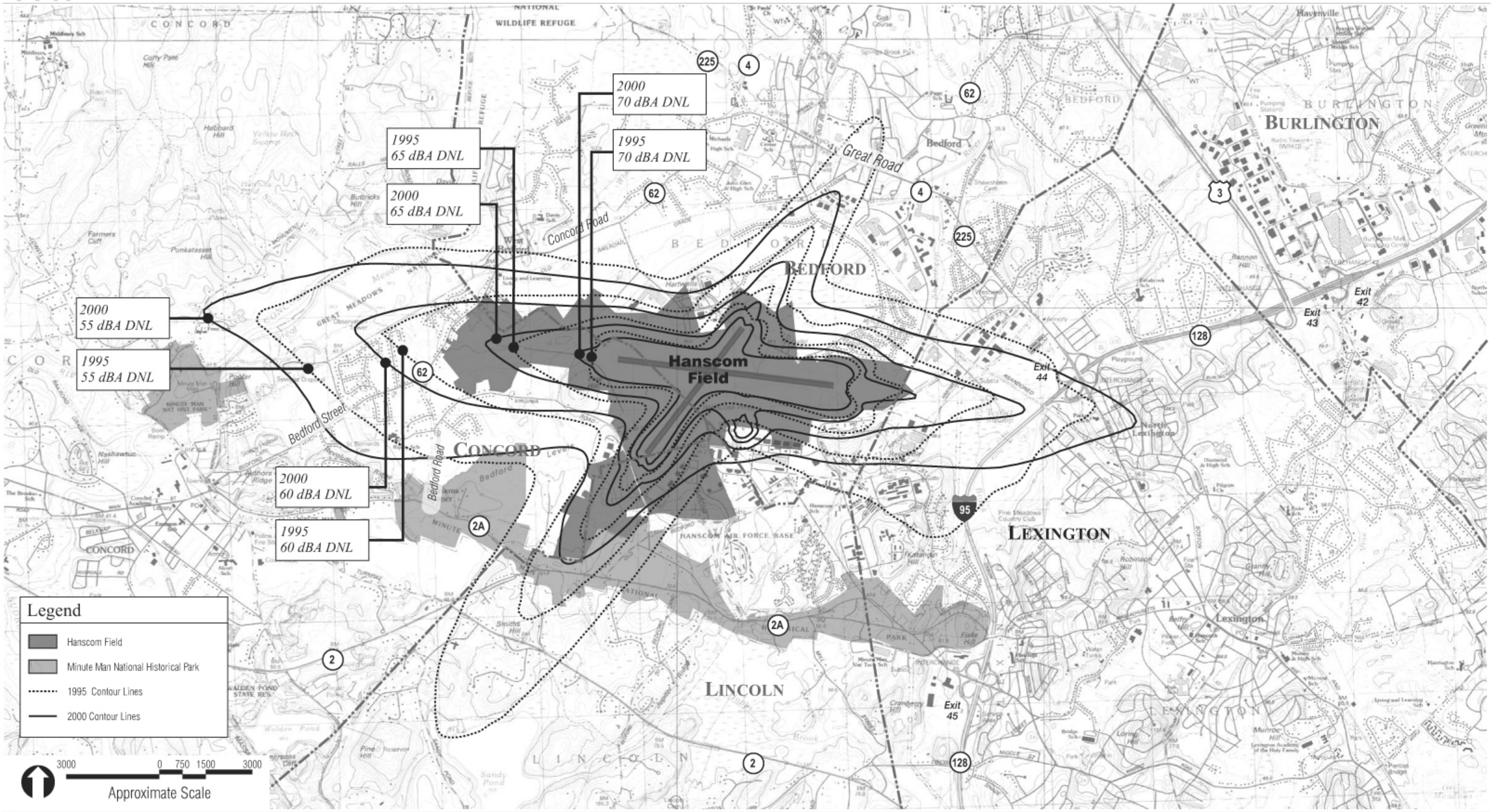
Aircraft noise exposure in a community is usually described in terms of a noise contour map, such as this one for Hanscom Field. The map indicates bands or zones around the airfield where the average noise level can be expected to fall within the ranges specified by the contour lines. This contour map shows continuous lines of equal exposure drawn in 5 decibel (dB) increments. There are two sets of contours presented here: the solid line is for 1987 operations, and the dashed line shows 1978 operations.

The acoustic metric used is the Day-Night Average Sound Level (DNL) which is the average A-weighted Sound Level, expressed in decibels, generated by airport-related noise sources over a 24-hour period, with nighttime noise events weighted by an added 10 decibel penalty. This gives an indication of the long-term noise exposure for the community.

Contour lines are used to determine compatible land uses. Areas within the 65 DNL are generally considered incompatible for residential use.



8793_2000_1995_ldn_contours.cdr



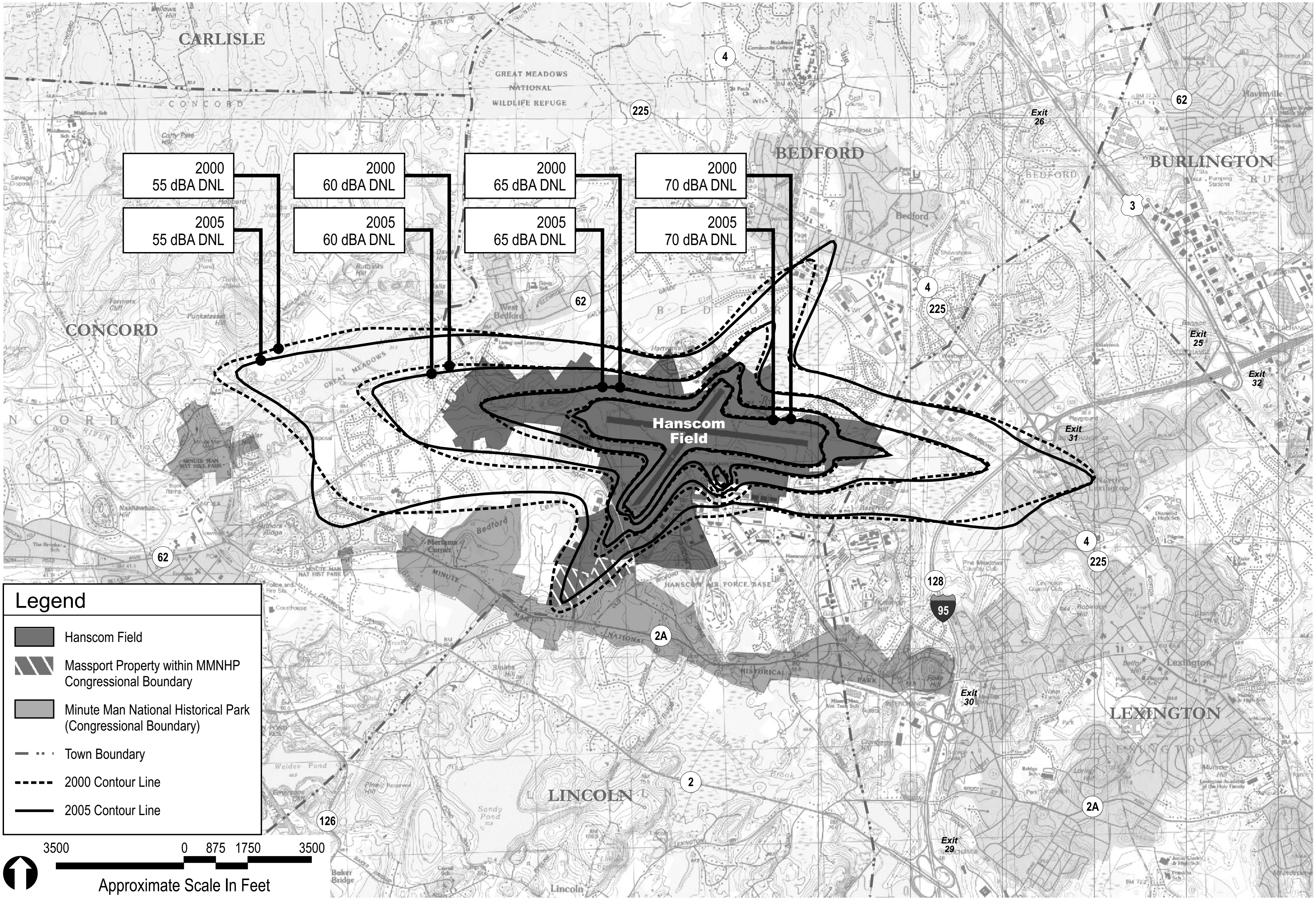
massport

RIZZO ASSOCIATES
A TETRA TECH COMPANY

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

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

2000/1995 DNL Contours Figure 7-8



2005 Hanscom Field DRAFT ESPR

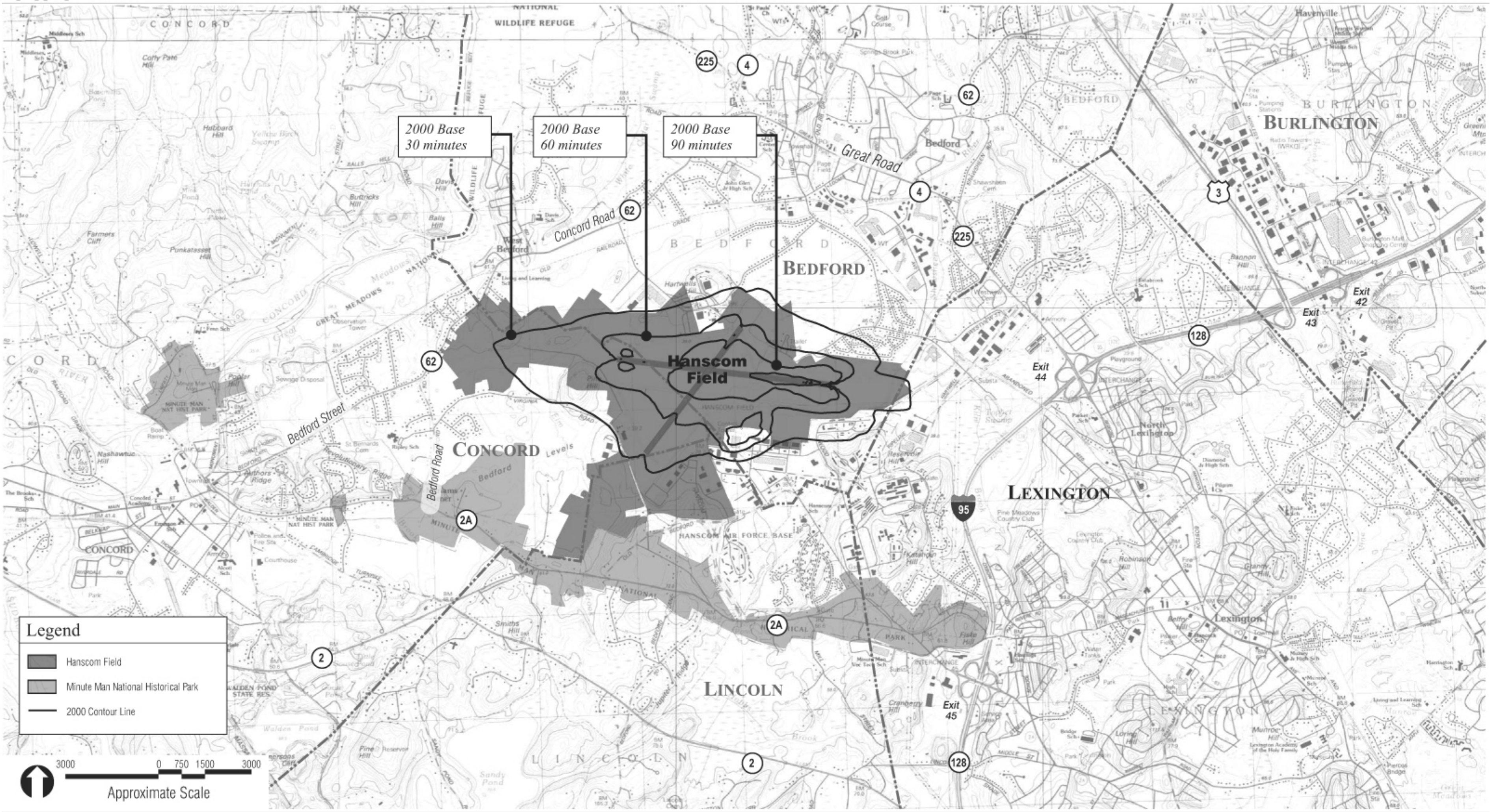
Bedford, Concord, Lexington and Lincoln, Massachusetts

Base Map: MA USGS
Topographic Maps from CD
Source: HMMH

Comparison of 2000 and 2005 DNL Contours

Figure 7-9

8793_2000_ta_65dba_contours



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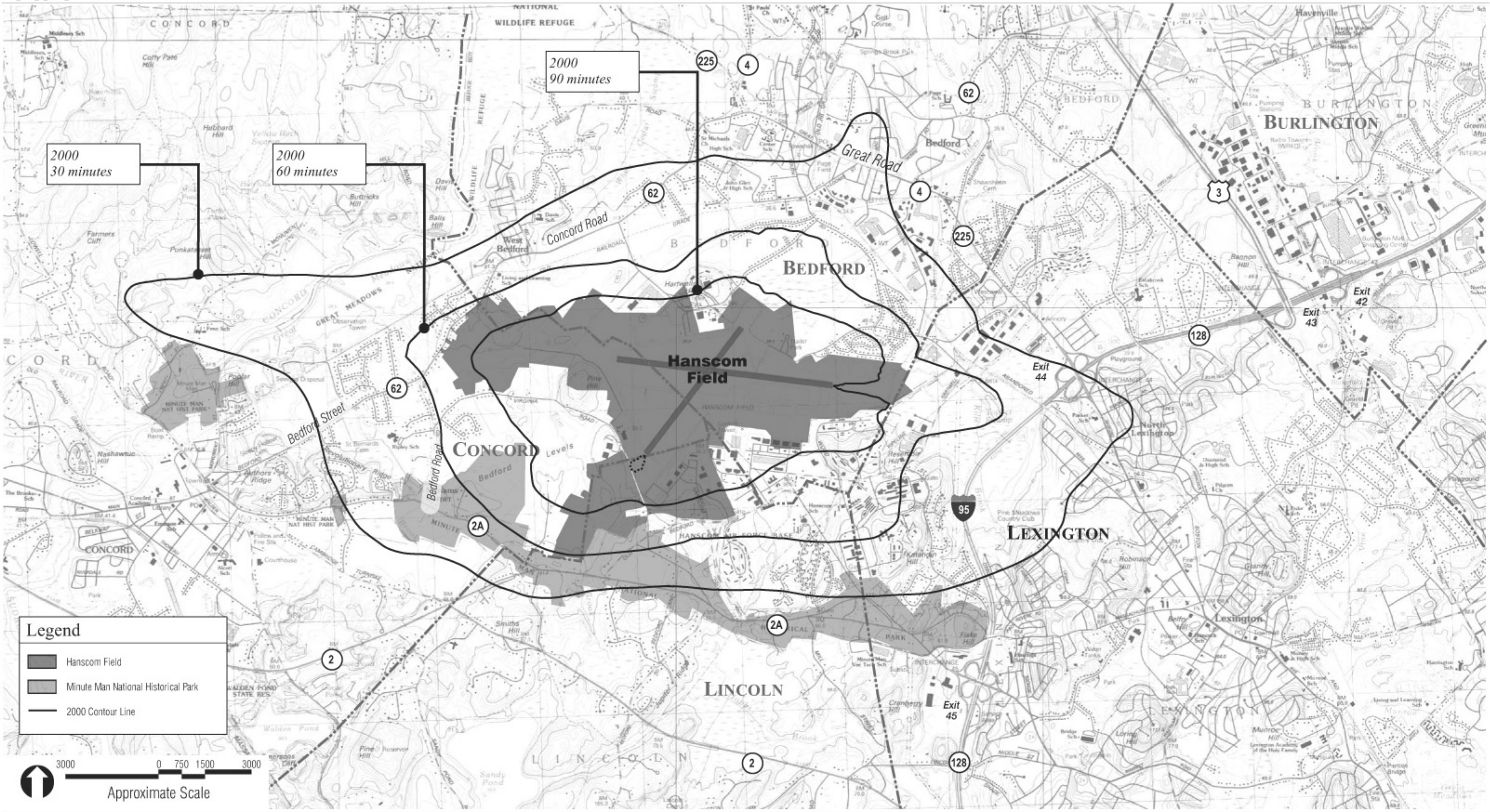
Base Map: MA USGS Maps;
MA GIS website, 1996

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

2000 Time Above 65 dBA
Contours

Figure 7-11

8793_2000_ta_55dba_contours.cdr



massport

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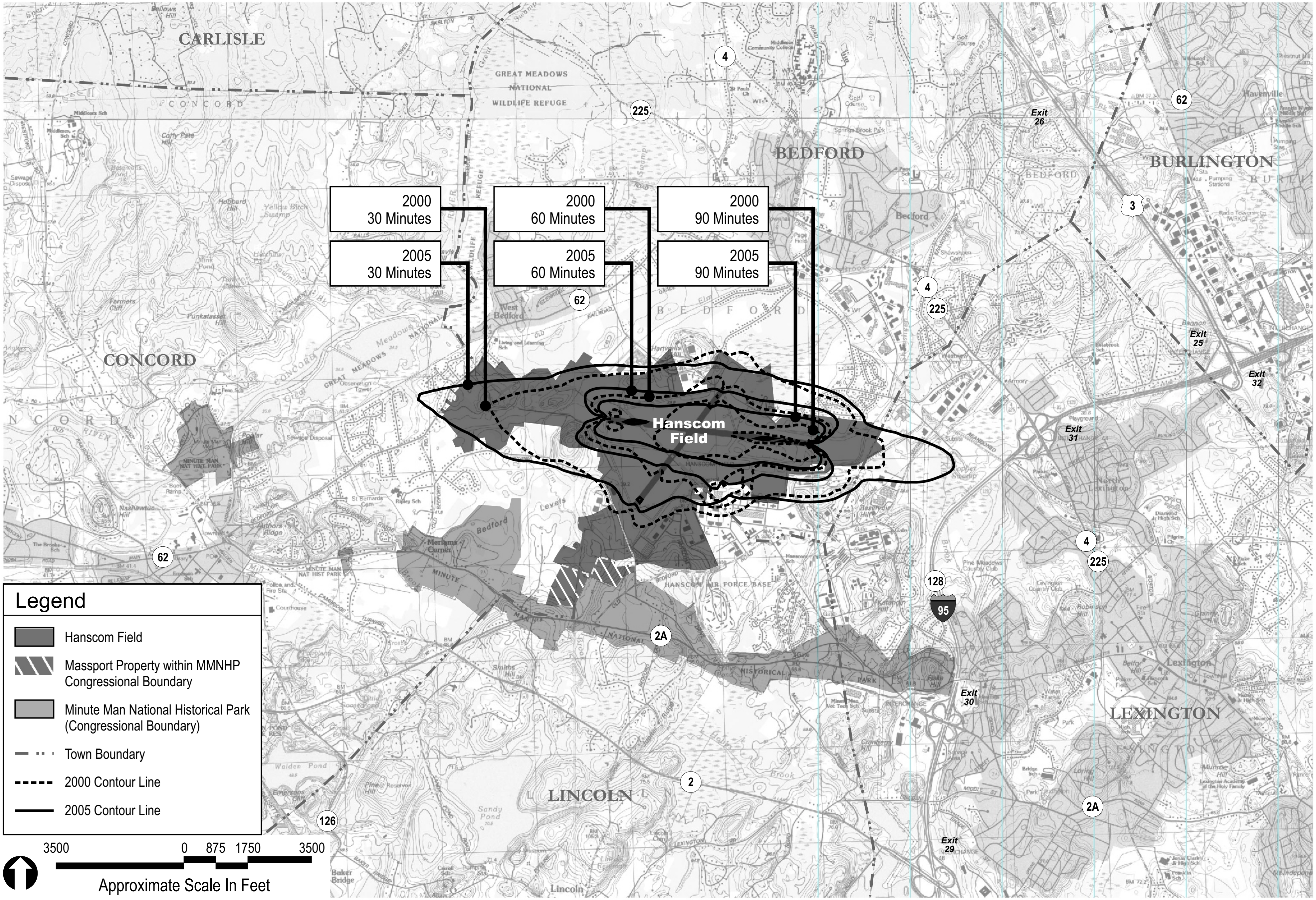
Base Map: MA USGS Maps;
MA GIS website, 1996

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

2000 Time Above 55 dBA Contours

Figure 7-12

Z:\project\12700000\12700496\12700496_figures_despr\chapter_07\12700496_ta_65_dba.cdr



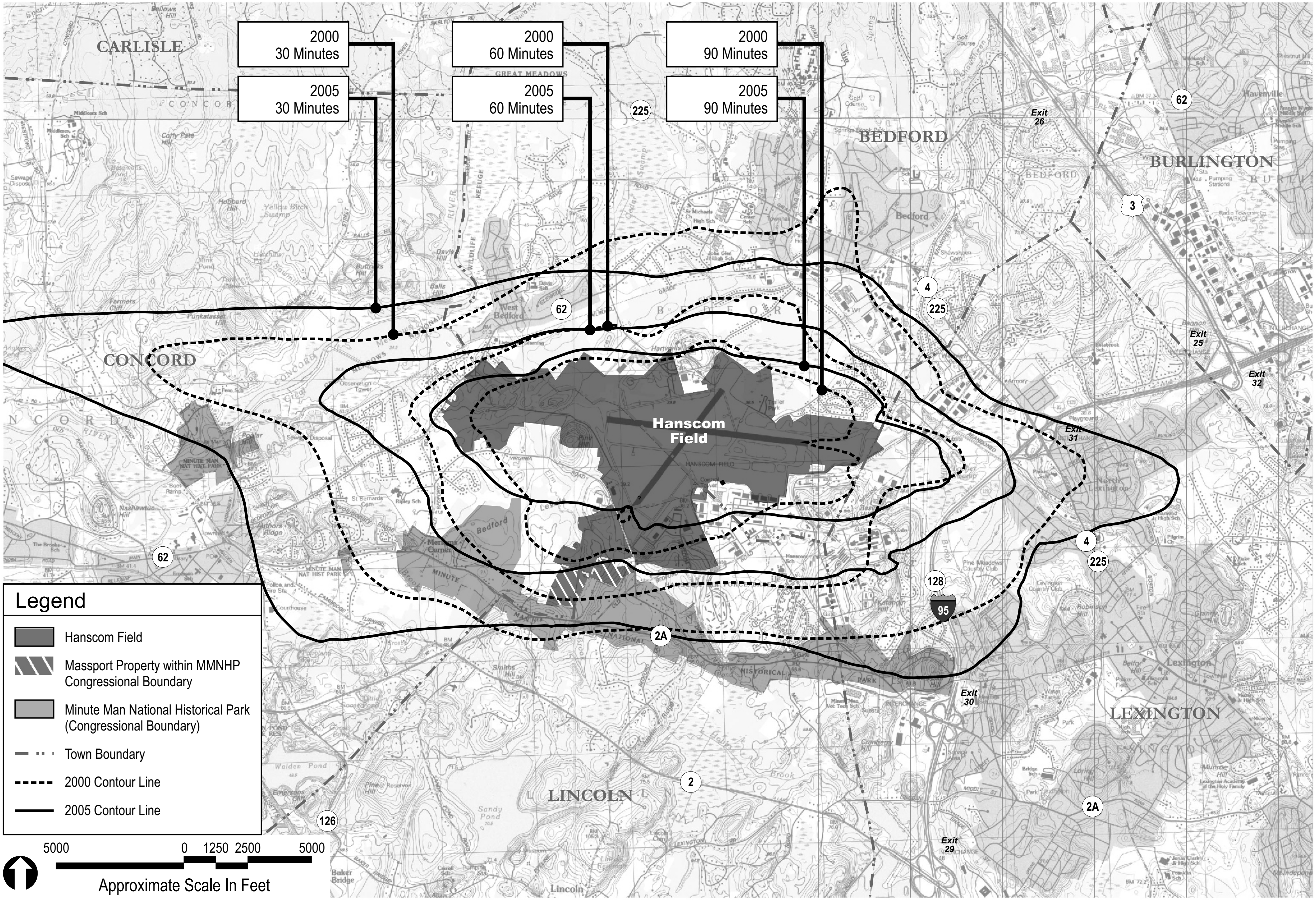
2005 Hanscom Field DRAFT ESPR
Bedford, Concord, Lexington and Lincoln, Massachusetts

Base Map: MA USGS
Topographic Maps from CD
Source: HMMH

2005
Time Above 65 dBA Contours

Figure 7-12

Z:\project\12700000\12700496\12700496_figures_despr\chapter_07\12700496_ta_55_dba.cdr



2005 Hanscom Field DRAFT ESPR

Bedford, Concord, Lexington and Lincoln, Massachusetts

Base Map: MA USGS
Topographic Maps from CD
Source: HMMH

2005
Time Above 55 dBA Contours

Figure 7-13

APPENDIX B

2009 Average Daily Operations and

Noise Exposure by Aircraft Type

Average Daily Departures, Arrivals, and EXP6.1 for 2009

AVERAGE DAILY DEPARTURES, ARRIVALS, AND EXP 6.1 FOR 2009

Aircraft Group	Representative Types	Reference Dep. SEL: 15,000 ft. from Brake Release (in dB)	DEPARTURES Day	DEPARTURES Night 10pm-7am	DEPARTURES Total	DEPARTURES Partial EXP 6.1	Reference Arr. SEL: 8,000 ft from Landing Threshold (in dB)	ARRIVALS Day	ARRIVALS Night 10pm-7am	ARRIVALS Total	ARRIVALS Partial EXP 6.1
1	C500, C501	87.3	1.60	0.05	1.65	90.4	83.0	1.59	0.06	1.65	86.3
2	MU3, C550, C560	91.9	5.61	0.28	5.89	101.1	84.5	5.41	0.47	5.88	94.6
2M	T47 (MILITARY)	91.9	0.01	0.00	0.01	73.3	84.5	0.01	0.00	0.01	65.9
3	BE40, LR35, LR55, DA10 &200	91.2	8.37	0.40	8.77	102.1	85.6	8.28	0.50	8.78	96.8
	H25-700 & 800, N265-65										
3M	C-21 (MILITARY)	91.2	0.17	0.00	0.17	83.6	85.6	0.17	0.00	0.17	78.0
4	DA02	95.9	0.06	0.00	0.06	86.4	96.1	0.06	0.00	0.06	85.5
4M	HU25	95.9	0.00	0.00	0.00	0.0	96.1	0.00	0.00	0.00	0.0
5	LR23, 24, 25, N265-40 & 60, H25-40(	105.2	0.16	0.02	0.18	100.4	97.5	0.17	0.02	0.19	93.1
5M	T- 37, 38, & 39 (MILITARY)	105.2	0.02	0.00	0.02	88.6	97.5	0.02	0.00	0.02	86.0
6	BAC-111	97.3	0.00	0.00	0.00	0.0	97.1	0.00	0.00	0.00	0.0
7	G3	97.2	0.21	0.02	0.23	92.6	90.6	0.19	0.03	0.22	87.5
7M	C20	97.2	0.04	0.00	0.04	83.0	90.6	0.04	0.00	0.04	76.4
8	G4	82.1	3.24	0.22	3.46	89.5	86.1	3.14	0.33	3.47	94.1
8M	C20B, G4 (MILITARY)	82.1	0.00	0.00	0.00	56.5	86.1	0.00	0.00	0.00	60.5
9	CL60, DA2000, GALX	86.7	3.31	0.14	3.45	93.4	85.0	3.25	0.20	3.45	92.2
10	CL61 & 64, CARJ	84.7	3.19	0.16	3.35	91.5	86.0	3.06	0.28	3.34	93.7
11	UNKNOWN/MISC JETS (G.A.)	96.7	0.02	0.01	0.03	89.4	99.1	0.02	0.02	0.04	92.9
11M	UNKNOWN/MISC JETS (MIL)	100.4	0.00	0.00	0.00	74.8	89.0	0.00	0.00	0.00	63.4
12	C140 (MILITARY) Obsolete		0.00	0.00	0.00	0.0		0.00	0.00	0.00	0.0
13	C141 (MILITARY)	104.4	0.00	0.00	0.00	0.0	108.2	0.00	0.00	0.00	0.0
14	DC-9	94.4	0.01	0.00	0.01	82.6	91.1	0.01	0.00	0.01	77.2
14M	C9, T-43 (MILITARY)	99.5	0.01	0.00	0.01	79.9	92.2	0.01	0.00	0.01	72.6
15	B707 Obsolete	0.0	0.00	0.00	0.00	0.0	0.0	0.00	0.00	0.00	0.0
15M	C-5A, KC-135, C137 (MIL)	103.6	0.10	0.00	0.10	95.6	99.8	0.10	0.02	0.12	94.4
16	Acft moved to alt. Groups		0.00	0.00	0.00	0.0	0.0	0.00	0.00	0.00	0.0
17	HELICOPTERS (G.A.)	83.4	9.38	0.53	9.91	95.1	87.9	9.29	0.62	9.91	99.8
17M	HELICOPTERS (MILITARY)	80.8	0.09	0.00	0.09	70.4	89.4	0.09	0.00	0.09	79.0
18	G159, CV60 - HVY TURBOS	89.9	0.00	0.00	0.00	0.0	94.6	0.00	0.00	0.00	0.0
18M	C130 - HVY TURBOS (MILITARY)	93.1	0.13	0.00	0.13	84.2	93.5	0.07	0.00	0.07	84.6
19	BE20,30 - TURBOS	81.9	4.01	0.05	4.06	88.5	91.1	3.97	0.09	4.06	98.0
19M	C12, T44, C26 - TURBOS (MIL)	81.9	0.23	0.00	0.23	76.1	91.1	0.23	0.01	0.24	86.0
20	TWIN PISTON - BE56, C310 (G.A.)	82.6	5.35	0.14	5.49	90.9	83.7	5.40	0.08	5.48	91.7
20M	TWIN PISTON - C45,T42 (MIL)	82.6	0.00	0.00	0.00	0.0	83.7	0.00	0.00	0.00	0.0
21	SINGLES - INC. LOCALS (G.A.)	78.5	149.14	0.27	149.41	100.3	79.4	148.95	0.45	149.40	101.3
21M	SINGLES (MILITARY)	78.5	0.00	0.00	0.00	0.0	79.4	0.00	0.00	0.00	0.0
22	WW24, WW25	90.9	1.50	0.04	1.54	93.7	82.5	1.48	0.06	1.54	85.6
23	FK28-Moved to Unidentified		0.00	0.00	0.00	0.0		0.00	0.00	0.00	0.0
24	A-4,6, F-14,15,16,18 (MIL)	117.0	0.07	0.00	0.07	106.7	93.2	0.07	0.00	0.07	82.9
25	C650	88.8	0.41	0.02	0.43	86.8	82.5	0.41	0.02	0.43	80.3
26	DA50, DA90	93.0	2.30	0.10	2.40	98.3	87.4	2.26	0.14	2.40	93.1
27	CV58 - TURBO	81.9	0.00	0.00	0.00	0.0	91.5	0.00	0.00	0.00	0.0
28	DC3, CV24 - HVY TWIN PISTONS	94.7	0.00	0.00	0.00	0.0	95.6	0.00	0.00	0.00	0.0
28M	DC3 - HVY TWIN PISTONS (MIL)	94.7	0.00	0.00	0.00	0.0	95.6	0.00	0.00	0.00	0.0
29	AC6T, BE90, PA31T - TURBOS	75.3	0.62	0.02	0.64	74.6	81.9	0.64	0.01	0.65	80.6
30	SF34 - TURBO	77.4	0.00	0.00	0.00	0.0	84.0	0.00	0.00	0.00	0.0
31	B727 (STAGE 2) Obsolete		0.00	0.00	0.00	0.0		0.00	0.00	0.00	0.0
32	B727 (STAGE 3)	103.8	0.01	0.01	0.02	94.6	94.7	0.02	0.01	0.03	84.6
33	BEST, ND26 - TURBOS	83.0	0.00	0.00	0.00	0.0	85.3	0.00	0.00	0.00	0.0
34	B737	95.6	0.02	0.02	0.04	89.4	91.8	0.01	0.05	0.06	88.8
35	DH8	70.3	0.07	0.00	0.07	60.4	81.1	0.07	0.01	0.08	72.1
36	A320, A319	89.5	0.08	0.01	0.09	82.3	91.1	0.05	0.04	0.09	87.5
37	GLEX, G5	86.2	1.62	0.12	1.74	90.8	86.5	1.66	0.10	1.76	90.7
37M	C37, G5	86.2	0.01	0.00	0.01	67.6	86.5	0.01	0.00	0.01	67.9
38	SBR1-80	95.9	0.00	0.00	0.00	70.3	96.0	0.00	0.00	0.00	70.4
39	G2	99.6	0.13	0.00	0.13	91.5	92.3	0.13	0.01	0.14	84.9
40	C750	82.0	1.48	0.04	1.52	84.8	89.1	1.45	0.08	1.53	92.6
41	B738	91.1	0.35	0.10	0.45	92.6	92.4	0.35	0.10	0.45	93.8
42	B757	87.0	0.01	0.00	0.01	66.2	91.0	0.01	0.00	0.01	70.2
43	EA50, C510	83.0	0.79	0.03	0.82	83.6	87.4	0.76	0.06	0.82	88.8
TOTALS											
	CIVILIAN W/O SINGLES		53.92	2.57	56.49	108.6		53.14	3.41	64.29	106.8
	CIVILIAN W/SINGLES		203.06	2.84	205.90	109.2		202.10	3.86	205.96	107.9
	MILITARY		0.90	0.02	0.92	107.2		0.88	0.03	0.91	96.3
	TOTAL W/O SINGLES		54.82	2.59	57.41	111.0		54.03	3.44	57.47	107.2
	TOTAL W/SINGLES		203.96	2.84	206.80	111.3		202.98	3.90	206.88	108.2

APPENDIX C

1995, 2000, and 2005 through 2009 Measured DNL (dBA)

at

Hanscom Noise Monitoring Sites

Hanscom Measured DNL (dBA)

RMS ID	Location	Jan '95	Feb '95	Mar '95	Apr '95	May '95	un '95**	Jul '95	Aug '95	Sep '95	Oct '95***	Nov '95	Dec '95	**1995**
31	Concord Localizer*	66.1	67.8	66.6	67.3	64.8	73.3	63.5	63.7	65.5	66.7	67.0	65.2	67.2
32	Bedford Localizer	66.0	n/a	n/a	62.2	62.2	73.9	64.7	63.4	64.3	64.4	69.8	62.2	66.7
33	Lincoln--Brooks Rd	n/a	54.9	55.9	56.6	56.8	58.6	57.1	59.2	58.4	56.8	56.7	53.5	57.1
34	Bedford--DeAngelo	57.6	57.3	58.1	58.1	56.7	59.3	59.6	61.4	63.0	63.0	61.8	58.5	60.1
35	Lexington--Preston	58.3	58.4	60.0	62.4	59.8	64.6	57.3	59.7	59.8	61.0	60.9	59.4	60.5
36	Concord Wastewater	62.5	61.0	62.5	62.7	62.3	64.1	61.7	62.6	62.0	62.3	63.5	60.9	62.4

* Site 31: Helicopter removal of felled trees impacted noise levels in Feb 1995

** All Sites: Hanscom Air Force Air Show, June 9-11

*** All Sites: Air Force used KC135 (B707) for testing October 12-13; aircraft performed many flyovers.

RMS ID	Location	Jan '00	Feb '00	Mar '00	Apr '00	May '00	Jun '00	Jul '00	Aug '00	Sep '00	Oct '00	Nov '00	Dec '00	**2000**
31	Concord Localizer	67.6	65.9	66.3	66.0	66.8	65.5	65.8	65.9	66.8	67.9	66.9	65.2	66.5
32	Bedford Localizer	62.5	62.9	64.5	63.8	66.5	63.0	62.6	64.8	63.9	66.0	66.6	64.4	64.5
33	Lincoln--Brooks Rd	54.6	54.9	56.1	56.4	56.2	57.8	55.8	56.0	55.7	54.7	54.8	54.6	55.7
34	Bedford--DeAngelo	58.8	58.7	59.7	60.4	59.8	60.3	60.4	60.2	59.8	59.9	59.9	58.6	59.7
35	Lexington--Preston	59.7	59.3	60.5	60.6	60.1	59.4	58.8	60.2	60.7	61.1	61.1	60.7	60.2
36	Concord Wastewater	63.3	63.3	63.6	63.3	63.1	63.3	62.2	61.8	62.5	62.8	62.3	62.1	62.8

Switching from every five year data to annual data

RMS ID	Location	Jan '05	Feb '05	Mar '05*	Apr '05**	May '05	Jun '05	Jul '05	Aug '05	Sep '05	Oct '05***	Nov '05***	Dec '05***	**2005**
31	Concord Localizer	65.7	63.5	64.3	68.4	66.2	64.9	63.1	67.2	67.0	70.7	70.4	73.6	68.3
32	Bedford Localizer	63.8	60.9	64.4	65.4	64.9	66.4	61.9	62.2	64.4	64.1	62.9	62.9	64.1
33	Lincoln--Brooks Rd	53.6	53.3	54.2	55.2	56.9	55.0	55.5	60.2	57.9	55.8	56.0	54.2	56.1
34	Bedford--DeAngelo	59.5	59.4	58.8	60.2	62.1	59.8	60.3	62.3	60.6	61.2	62.4	58.7	60.6
35	Lexington--Preston	58.7	57.3	58.5	59.0	57.9	59.1	57.8	60.4	59.9	60.6	60.2	60.5	59.2
36	Concord Wastewater	61.7	61.9	62.6	64.0	62.2	61.6	60.1	62.0	61.6	63.0	62.3	63.2	62.3

* Site 35: Not operational March 4-16 due to power issues

** All sites: Military aircraft operated for Red Sox Opening Day

*** Site 31: Construction noise (demolition and reconstruction) from Hartwell Rd., Bedford, impacted noise levels.

RMS ID	Location	Jan '06*	Feb '06	Mar '06	Apr '06**	May '06	Jun '06	Jul '06	Aug '06	Sep '06	Oct '06	Nov '06***	Dec '06	**2006**
31	Concord Localizer	63.9	63.3	65.9	65.7	65.1	66.0	64.6	65.4	65.2	64.5	n/a	72.0	66.1
32	Bedford Localizer	62.5	63.2	63.3	63.2	64.3	62.9	62.7	63.3	62.6	64.2	n/a	67.7	63.9
33	Lincoln--Brooks Rd	55.0	54.7	54.4	55.3	55.4	55.4	56.8	59.8	56.6	55.6	n/a	55.3	56.1
34	Bedford--DeAngelo	59.7	59.5	60.4	60.0	59.8	61.1	62.6	61.2	60.5	61.0	n/a	60.3	60.5
35	Lexington--Preston	58.6	59.2	59.0	59.3	61.5	59.0	58.8	59.9	59.0	59.0	n/a	59.7	59.4
36	Concord Wastewater	63.0	63.0	62.6	61.2	62.4	63.1	62.1	61.8	61.7	61.5	n/a	63.1	62.3

* Site 36: Not operational January 25-31 for mechanical reasons.

** Site 31: Not operational April 15-30 for mechanical reasons.

*** All Sites: New monitors being installed, tested and adjusted; no data collection.

RMS ID	Description	Jan '07	Feb '07	Mar '07	Apr '07	May '07	Jun '07	Jul '07	Aug '07	Sep '07	Oct '07	Nov '07	Dec '07	**2007**
31	Concord Localizer*	68.5	69.4	66.8	66.9	67.0	n/a	n/a	n/a	n/a	n/a	65.9	n/a	64.9
32	Bedford Localizer*	66.9	68.6	66.5	64.3	63.7	n/a	n/a	n/a	n/a	n/a	63.7	n/a	63.3
33	Lincoln--Brooks Rd	55.1	54.8	57.2	56.2	57.6	56.2	57.2	58.4	55.4	59.5	57.0	55.1	56.9
34	Bedford--DeAngelo	61.4	59.2	61.4	61.4	61.5	62.0	61.6	62.6	62.3	61.5	64.9	60.3	61.8
35	Lexington--Preston	59.0	59.5	61.2	60.4	60.8	59.2	59.6	59.6	62.0	60.4	60.8	60.5	60.3
36	Concord Wastewater**	62.7	62.7	64.5	66.0	66.7	62.9	61.2	62.6	60.0	62.1	60.1	58.8	63.3

* Sites 31 & 32: Downloading issues Jun-Oct and Dec that resulted in lost data.

** Site 36: Excavation/construction conducted in proximity of monitor between March and May

RMS ID	Description	Jan '08	Feb '08	Mar '08	Apr '08	May '08	Jun '08	Jul '08	Aug '08	Sep '08	Oct '08	Nov '08	Dec '08	**2008**
31	Concord Localizer*	64.8	66.1	66.3	65.2	64.9	67.5	n/a	n/a	n/a	n/a	n/a	n/a	65.9
32	Bedford Localizer**	62.3	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	63.3	n/a	62.8
33	Lincoln--Brooks Rd	54.0	56.5	56.6	56.0	56.1	55.6	57.5	56.9	55.7	56.0	54.7	55.9	56.0
34	Bedford--DeAngelo	59.6	61.1	62.3	61.5	62.7	62.5	62.6	62.0	62.6	63.1	63.1	61.8	62.2
35	Lexington--Preston	59.6	60.4	59.8	59.8	59.2	61.3	63.4	57.7	59.7	60.2	60.0	59.4	59.8
36	Concord Wastewater***	60.6	62.2	63.0	63.3	63.1	61.7	61.5	61.7	67.1	62.2	61.1	63.2	62.7

* Site 31: Downloading issues Jul-Dec that resulted in lost data.

** Site 32: Downloading issues and malfunctioning monitor that resulted in lost or contaminated/unusable data.

***Site 36: no data 6/23-6/30 due to a communication problem; brush cutting performed near Site 36 for a few days in Sept

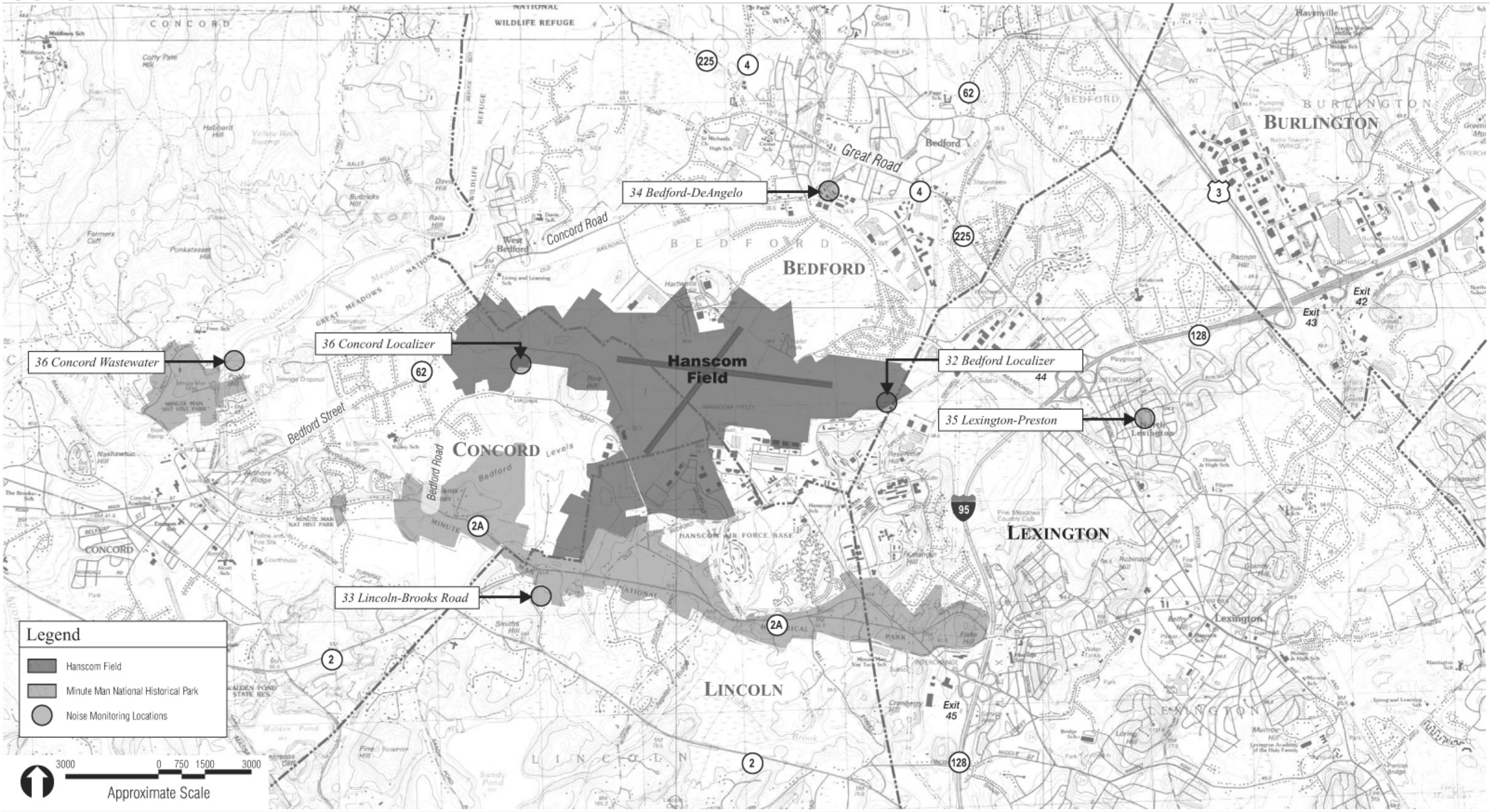
RMS ID	Description	Jan '09	Feb '09	Mar '09	Apr '09	May '09	Jun '09	Jul '09	Aug '09	Sep '09	Oct '09	Nov '09	Dec '09	**2009**
31	Concord Localizer*	n/a	n/a	n/a	n/a	n/a	n/a	65.7	67.4	63.2	64.0	63.1	62.9	64.0
32	Bedford Localizer**	n/a	n/a	n/a	n/a	64.0	64.1	64.5	65.0	63.1	62.0	62.4	63.4	63.7
33	Lincoln--Brooks Rd	54.2	55.2	55.0	56.1	56.4	57.0	58.9	56.8	56.1	54.9	55.1	54.8	56.1
34	Bedford--DeAngelo***	59.6	60.6	61.5	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	60.6
35	Lexington--Preston	58.5	58.9	59.0	60.2	59.4	58.0	60.5	62.2	59.8	60.4	60.9	60.2	60.0
36	Concord Wastewater	60.4	61.7	61.7	62.5	61.9	61.6	62.9	64.5	61.6	61.7	61.0	61.0	62.0

* Downloading issues with wireless equipment, Jan-Jun

** Data contamination, Jan-Apr.

*** Monitor equipment hit by a truck in April; site evaluation needed before reinstalling Bedford site.

8793_noise_monitoring_locations.cdr



massport

RIZZO ASSOCIATES
A TETRA TECH COMPANY

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

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

Noise Monitoring Locations

Figure 7-9