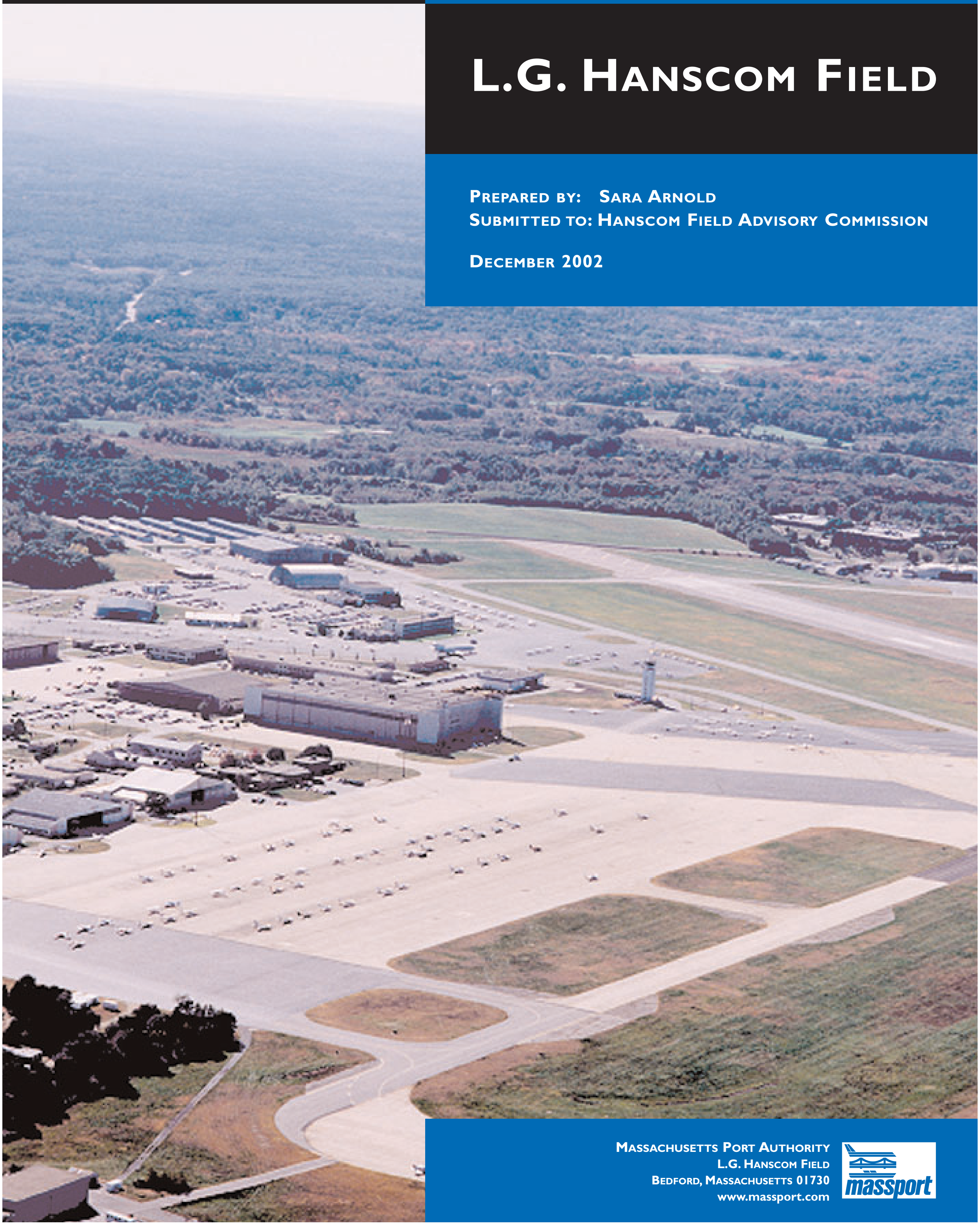
2001

Noise Exposure Levels at

L.G. Hanscom Field



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INTRODUCTION -- L. G. HANSCOM FIELD

L. G. Hanscom Field is a general aviation airport, located northwest of Boston, Massachusetts and geographically bounded by Bedford, Concord, Lexington and Lincoln. Although the land was purchased by the state for development of an airfield, the original runways and facilities were constructed in 1941 by the military in support of America's war effort, and the Army Air Corps leased the land for advanced pilot training.

In the 1950s, the Massachusetts Port Authority (Massport) was granted control of the land by the state legislature. Massport managed the civil terminal area while the Air Force leased and operated the airfield for continued use by military and civilian aircraft. In 1974, the Air Force canceled its lease, and Massport was granted control of the airport's operation and maintenance. While the Air Force continues to own land adjacent to the airfield, military aircraft operations represent less than one percent of the activity.

Consistent with its role for the past two decades, Hanscom Field functions as a general aviation reliever airport for Logan International Airport, while providing limited commercial service. It contributes to the regional transportation system in two ways:

1. It eases Logan congestion by handling approximately 200,000 general aviation aircraft operations per year. These include private, pilot training, business, charter, cargo, and air taxi operations, all of which serve the diverse flying needs of corporations, research and development firms, and educational institutions, as well as individuals and small businesses.

2. It provides the traveling public with an alternative airport by offering limited commercial service to select markets. Consistent with Massport's 1980 Regulations, commuter activity has been periodically available at Hanscom in aircraft with no more than 60 seats. After seven years without commuter service, Shuttle America began serving Hanscom in September 1999. In 2001, it carried 134,337 passengers on 6414 flights, which represented three percent of the total activity.

The total number of Hanscom operations has fluctuated over the years. Prior to 1970, operations steadily increased, with FAA tower counts peaking at over 300,000 in 1970. After declines in activity during the 1970s, the FAA tower counts ranged from just under 214,000 to almost 250,000 in the 1980s. The depressed economy in the early 1990s caused activity to drop to fewer than 200,000 operations by 1993, and they remained below 200,000 until 2000. Hanscom experienced 205,436 operations in 2001, a 3.3 percent decrease as compared to 2000.

The airport is seen as a regional economic asset, which plays a vital role in the Massachusetts economy and in the regional transportation system. Both the residential and aviation communities take great interest in the planning and operation of the airport. The annual noise report is one tool used by Massport to report on the activity at Hanscom.

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 (for the previous year's data), making this the twentieth Hanscom noise report. It compares 2001 activity data with data for the previous study years (1978, 1981, and 1983 through 2000). Until 1987, 1978 was used as the base year for evaluating changes in noise exposure. The base year was changed to 1987 when the noise and performance data used to calculate noise exposure at Hanscom Field was updated. A summary explaining the change is included in Chapter 2, while a detailed explanation of the change is included in the 1988 annual report (available through Massport). Chapter 2 of this report also describes the process used to continue using 1987 noise exposure as the base year despite the further update of the noise and performance data that was incorporated in 1996.

In response to input from aviation and residential representatives, the most recent annual reports have focused on the noise impact of civilian aircraft departures, including single engine piston aircraft. There is supplemental information on total numbers of operations, fleet mix, 11 p.m. to 7 a.m. activity, the effect of military operations, and arrival noise levels. EXP, a metric that estimates cumulative noise exposure at Hanscom, is used as a screening procedure to evaluate changes in the overall noise level. This report also includes seven years of data from the permanent noise monitoring system that was installed in the early to mid-1990s.

Massport's data management system compiles information from a number of sources and develops the operations and noise data discussed in this report. Results of this evaluation show the following:

1. For activity between 7 a.m. and 11 p.m., 2001 Federal Aviation Administration (FAA) Tower counts, including all arrivals and departures for both civilian and military aircraft, show 205,436 operations. This is a decrease of 3.3 percent as compared to 2000.

2. The civilian portion of the FAA tower counts, which dominates the total activity, decreased 3.3 percent in 2001 as compared to 2000. This is primarily attributable to the six percent decrease in single engine piston aircraft operations, which represent 77 percent of the activity. There were also decreases in twin-engine piston and helicopter operations. At the same time there was a 12.9 percent increase in jet activity and a 5.7 percent increase in turboprop operations. Both the decrease in activity by the smaller

aircraft and the increase in the jets reflect the effects of the September 11, 2001 terrorist attacks.

3. Military flights, which represent less than one percent of the total activity, decreased 2.7 percent in 2001 as compared to 2000.

4. Non-single engine piston (non-SEP) civilian aircraft averaged 68.04 daily departures in 2001, the highest of all the study years. This was an increase of 6.7 percent as compared to 2000. The increase included more business jet operations, which represented 9.5 percent of the activity in 2000 and 11.1 percent of the aircraft activity in 2001.

5. Operations by single engine piston aircraft in 2001 were below levels experienced through the 1980s and below most levels experienced during the 1990s and 2000s.

6. Use of the airfield between 11 p.m. and 7 a.m. decreased almost 13 percent from 1,918 operations in 2000 to 1,674 operations in 2001. Jets (48.3 percent) and helicopters (25.8 percent) dominated these aircraft arrivals and departures. A nighttime field use fee was instituted in 1980 to discourage use of the field during these noise sensitive hours; the fee doubles after five operations in a calendar year; and the fee is adjusted each July 1 based on the Consumer Price Index. Of the 600 civilian aircraft that were subject to the fee, 30 conducted more than five operations. There were 523 exempt operations, of which 88 percent were medical flights.

7. Using EXP Version 5.1, the 2001 departure noise exposure for civilian aircraft was 112.5 decibels (dB), a decrease of 0.9 dB as compared to 2000 and 0.4 dB above the 1987 base year. 2001 is one of five study years that experienced civilian departure aircraft noise levels greater than the base year. The highest civilian departure EXP was in 2000, with 1.3 dB above the base year. The lowest civilian departure EXP was in 1993, with 1.4 dB below the base year. In 2001, civilian aircraft contributed 89 percent to the total noise exposure. Military aircraft, which conducted less than one percent of the activity, contributed 11 percent to the noise levels.

8. This report includes a seven-year comparison of noise levels recorded at six noise-monitoring sites located in the communities and on the airfield. 1995 was the first year that data was collected consistently from all six sites. The reported noise levels include civilian and military aircraft noise as well as community noise. When comparing 2000 to 2001, the monitors show decreases at four of the sites and increases of less than 1.0 dB at the other two locations.

9. The 1978 *Hanscom Field Master Plan and Environmental Impact Statement* (The Master Plan) and the *General Rules and Regulations for Lawrence G. Hanscom Field*, effective 1980, include the policies and regulations that guide Massport as it operates

Hanscom Field. In addition, Massport staff work closely with the Hanscom Field Advisory Commission (HFAC) and the Hanscom Area Towns Committee (HATS), as well as other concerned parties, in an effort 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.

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

This report has been prepared by Massport to present data on the year 2001 operations at Hanscom Field and to evaluate their effect on the noise environment around the airport. Consistent with previous annual reports, this report includes an 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. Information from previous years is included to show trends in aviation activity. Along with informing the public of Hanscom's operations and noise exposure, the annual reports respond to questions and ideas raised at meetings with the 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 Historic Park, as well as Massport.

This chapter 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 and Hanson Inc. (HMMH), noise consultants for Massport. 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 HMMH reports and includes some background information written by HMMH.

Each year, Massport has a noise consultant review the noise data and report. Acentech Inc. reviewed the data and report in 2001.

2.1 The Use of Ldn to Evaluate Noise Exposure

The primary purpose of the first noise report was to evaluate the effectiveness of the noise rules that Massport had implemented in 1980, by determining changes in the noise environment between 1978 and 1981. The most frequently used measure to characterize noise exposure around an airport is referred to as the Day-Night Average Sound Level (Ldn or DNL), which uses contours on a map to connect points of equal noise exposure. Creating Ldn 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.

Ldn is used widely throughout the United States, and is discussed in more depth in Appendix A. Appendix A also includes maps from previous studies showing the 1978, 1987, 1995 and 2000 Ldn contours and 2000 Time Above contours for Hanscom. The 1978 contours were developed in 1981 using the computerized Integrated Noise Model Version 3.8 (INM 3.8); the 1987 contours were developed in 1988 using INM 3.9; the 1995 contours were developed in 1996 using INM 5.0; and the 2000 contours were developed in 2002 using INM 6.0c. The contours include the effects of civil and military aircraft as well as touch-and-goes, a procedure used by flight schools to train students to land and depart.

2.2 The Development of EXP to Evaluate Noise Exposure

In addition to creating Ldn contours, HMMH used the 1982 report to define a screening procedure, or metric, that could be used readily to evaluate the effect of changes in the fleet mix and number 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 and for indicating changes in the total noise exposure, which reflect expected changes in Ldn. 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 Ldn. This includes the weighting of 10 p.m. to 7 a.m. aircraft events as if they were ten decibels louder than comparable daytime events to account for their more intrusive nature.

Each aircraft model 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, an arrival and a departure Sound Exposure Level (SEL) are assigned to each group. The SELs used for EXP 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 departures by those aircraft, weighting the 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.

Appendix A describes the EXP methodology in more depth.

2.3 The Significance of a 1.5 Decibel Change in EXP

Periodically EXP has been reviewed to validate its continued use as an estimate of corresponding changes in Ldn, and it has been concluded that changes in EXP and contour values show good agreement. Thus, EXP 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 EXP has never exceeded 1.5 dB above 1978, Massport completed a Generic Environmental Impact Report (GEIR) in 1988, which included noise analyses. An update of the GEIR was completed in 1997, and a further update, entitled Environmental Status and Planning Report (ESPR) based on 2000 data is scheduled for completion in early 2003. The original GEIR and the updates include noise contours and additional noise metrics, providing comprehensive analyses of noise impacts.

2.4 Upgrading EXP Calculations

Until 1987, the EXP calculations used SELs based on FAA noise and performance data (Version 3.8) that were available in 1982 when EXP was developed. At that time, the FAA had not yet developed noise and performance data for some aircraft types, so HMMH worked with the FAA and with major airport users to develop appropriate SELs for those types regularly using Hanscom. In 1987, the FAA released a revised and expanded set of noise and performance data (Version 3.9) for aircraft noise modeling, and to this day, the FAA supports a continual process of updating its aircraft noise and performance data.

The FAA upgrades have resulted in periodically upgrading the SEL values used in EXP. Massport and the HFAC decided that a change to using EXP Version 3.9 (EXP 3.9) should be started in 1987. This meant that EXP could use FAA certified noise and performance data to compute all the SEL values for Hanscom aircraft rather than having some SEL values developed by the noise consultant. Use of EXP Version 5.1 (EXP 5.1) was started in 1996 to ensure use of current noise and performance data and to allow for comparisons with Ldn contours, which always use the must currently available data. There is a detailed explanation of these changes in the reports 1988 Noise Exposure Levels at L. G. Hanscom Field and 1996 Noise Exposure

Levels at L. G. Hanscom Field, available through Massport. Chapter 6 in this report summarizes the changes and discusses their impacts on EXP.

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 comparison. SEP operations were excluded from the data for reasons discussed in the early reports. When residents became interested in the noise impact of these small aircraft, a method for estimating their usage was developed and applied to all the study years.

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 since Massport does not have jurisdiction over military operations, 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, although the focus on departures would still be used as the best representation of the noise impact since changes in departure EXP more closely reflect changes in Ldn than do changes in arrival EXP.

2.6 The Report on 2001 Noise Exposure

This report incorporates the results of the agreed upon methodology for evaluating the noise impact, as it applies to 2001 Hanscom operations. It focuses on the effect of civilian aircraft departures, including SEP, with supplementary information on total numbers of operations, the impact of military activity, 11 p.m. to 7 a.m. operations, and arrival EXP. It includes operational data for the study years (1978, 1981 and 1983 through 2001) and evaluates the change in noise exposure since 1978. EXP is still considered a good indicator of changes in Ldn and changes in the general level of total noise exposure generated by the airport. Furthermore, it provides an historical perspective, since comparative data are available for most years since 1978. Data from the permanent noise monitoring system became available during the 1990s, providing additional information on the measured noise experience at six locations.

Methods of data collection for determining operations and noise exposure are reviewed in Chapter 3. A discussion of the 7 a.m. to 11 p.m. operational levels for 2001 are presented in Chapter 4, while 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 the noise impacts that concern the surrounding communities, 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 Bedford 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 Bedford 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 previous inclusion of overflights and the current exclusion of operations between 11 p.m. and 7 a.m. when the FAA tower is closed.

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 VFR operations by civilian non-SEP aircraft types 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 counted.

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 + formulas to estimate 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 2001 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. Because the Tower is not open from 11 p.m. to 7 a.m., the counts do not include operations conducted between those hours. Including night (11 p.m. to 7 a.m.) operations would increase the total by less than one percent. Night activity is discussed in Chapter 5.

Table 4.1 presents the Hanscom Tower counts since 1978, showing 205,436 operations for 2001. This represents a 3.3 percent decrease in activity as compared to 2000. This was the second year since 1992 that activity exceeded 200,000 annual operations. Prior to the 1990s, it is necessary to go back to 1962 to find levels 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
1978	235,750	1990	232,678
1979	225,805	1991	213,637
1980	218,502	1992	203,755
1981	213,698	1993	196,138
1982	215,984	1994	187,550
1983	219,466	1995	190,282
1984	229,130	1996	179,497
1985	247,434	1997	188,087
1986	232,110	1998	183,185
1987	239,154	1999	197,302
1988	228,725	2000	212,371
1989	238,340	2001	205,436

The tower counts in **Table 4.1** have been plotted in **Figure 4.1** to illustrate the annual fluctuations since 1978, including the high of 247,434 operations in 1985 and the 1996 low of 179,497 operations. In 1970, Hanscom experienced its peak activity level with FAA logs recording over 300,000 operations.

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

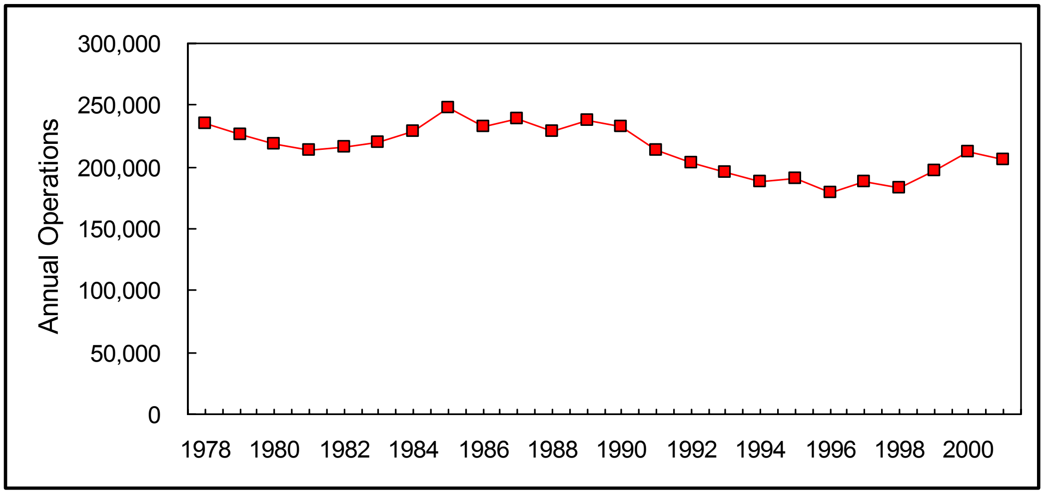


Table 4.2 shows a summary of the estimated average daily departures by aircraft other than SEP. These departures have been separated by day and night hours for both civilian and military aircraft and are listed month-by-month to show seasonal variations in activity. Night hours are defined as 10 p.m. to 7 a.m., consistent with the night definition used in noise exposure calculations for Ldn and EXP, as discussed in Appendix A.

TABLE 4.2 2001 Monthly Average Daily Departures by non-Single Engine Piston Aircraft

	CIVILIAN			MILITARY			CIVILIAN & MILITARY		
	DAY	NIGHT	TOTAL	DAY	NIGHT	TOTAL	DAY	NIGHT	TOTAL
Jan	60.74	2.41	63.15	0.81	0.03	0.84	61.55	2.44	63.99
Feb	63.78	2.74	66.52	0.82	0.00	0.82	64.60	2.74	67.34
Mar	60.36	2.36	62.72	1.18	0.00	1.18	61.54	2.36	63.90
Apr	61.13	2.90	64.03	2.26	0.00	2.26	63.39	2.90	66.29
May	60.91	2.55	63.46	2.34	0.00	2.34	63.25	2.55	65.80
Jun	62.58	2.97	65.55	1.73	0.00	1.73	64.31	2.97	67.28
Jul	51.97	2.04	54.01	2.18	0.00	2.18	54.15	2.04	56.19
Aug	60.65	2.50	63.15	1.73	0.00	1.73	62.38	2.50	64.88
Sep	52.09	2.58	54.67	0.87	0.00	0.87	52.96	2.58	55.54
Oct	78.91	4.04	82.95	1.65	0.00	1.65	80.56	4.04	84.60
Nov	75.75	3.47	79.22	1.89	0.06	1.95	77.64	3.53	81.17
Dec	69.99	2.73	72.72	1.00	0.00	1.00	70.99	2.73	73.72
2001	65.27	2.77	68.04	1.56	0.00	1.56	66.83	2.77	69.60

These data show that, in 2001, almost 98 percent of the estimated departures in multi-engine aircraft and helicopters (i.e. non-SEP aircraft) were civilian operations. Military departures have never represented more than eight percent of the non-SEP departures in any study year to-date. The busiest month for civilian non-SEP activity was October, with an average of 82.95 daily departures, while the low occurred in July with only 54.01 civilian non-SEP departures. It is reasonable to assume that the high was influenced by the events on September 11. Operations were curtailed for four days immediately following the terrorist attacks that day. Subsequently there were shifts in aviation usage that resulted in an increase in business aircraft activity, which was particularly evident in October but continued in November and December.

Military activity peaked in May with 2.34 departures. The lowest military level was in February with 0.82 departures. Total civilian and military activity levels peaked in October, when there were 84.60 average daily departures for non-SEP activity, reflecting the civilian dominance of aircraft operations. The slowest month was September, with 55.54 civilian and military average daily departures. September combines the second slowest month for non-SEP civilian operations with the third slowest month for military activity.

Figure 4.2 shows a plot of the data in **Table 4.2**. It demonstrates the monthly variability of non-SEP departures, including the October high and the July low, and the influence of September 11 events on non-SEP activity during the last quarter of the year.

FIGURE 4.2 Monthly Variations in Activity by Multi-engine Aircraft & Helicopters, 2001

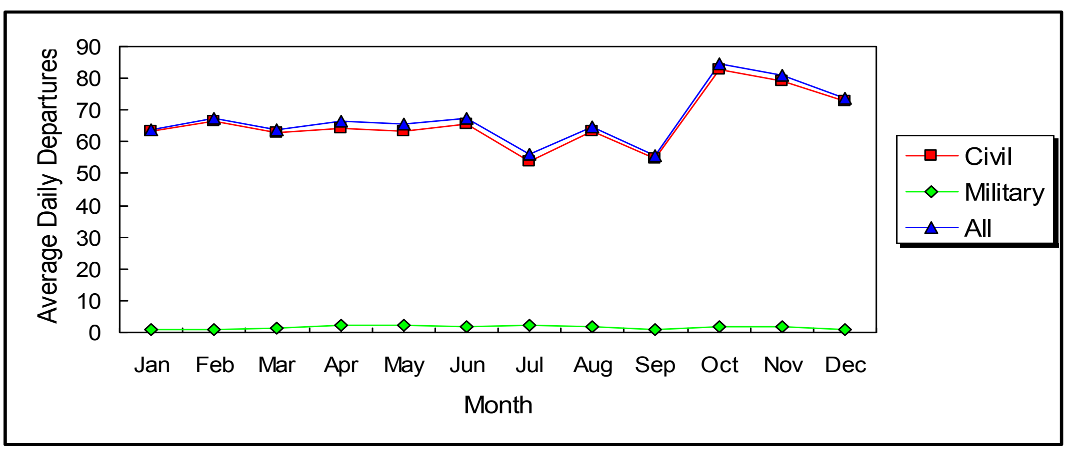


Table 4.3 shows the comparison of the 2001 data for non-SEP activity to previous study year totals. The 68.04 civilian average daily departures is the highest of all the study years and is 6.7 percent greater than the 2000 civilian average daily departures. The military activity, which averaged 1.56 daily departures in 2001, is 10.6 percent greater than in 2000 but is below the 2.13 military average for the study years.

TABLE 4.3 Annual Average Daily Departures by Aircraft other than Single Engine Piston

	CIVILIAN			MILITARY			CIVILIAN & MILITARY		
	DAY	NIGHT	TOTAL	DAY	NIGHT	TOTAL	DAY	NIGHT	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

Figure 4.3 plots the annual non-SEP departure activity for the study years from 1978 to 2001, demonstrating the fluctuations that have been experienced over the past 23 years. It shows that after decreases in non-SEP activity starting in 1989 and continuing in the early 1990s, the levels remained stable through 1997. It also shows that the 1998 non-SEP departures returned to a level comparable to those experienced in the late 1980s; the 2000 non-SEP departures increased to 63.74 departures primarily due to the reintroduction of commuter service in late 1999; and the 2001 levels rose to 68.04 with the influence of the September 11 events.

FIGURE 4.3 Annual Variations in Average Daily Departures by Aircraft other than SEP

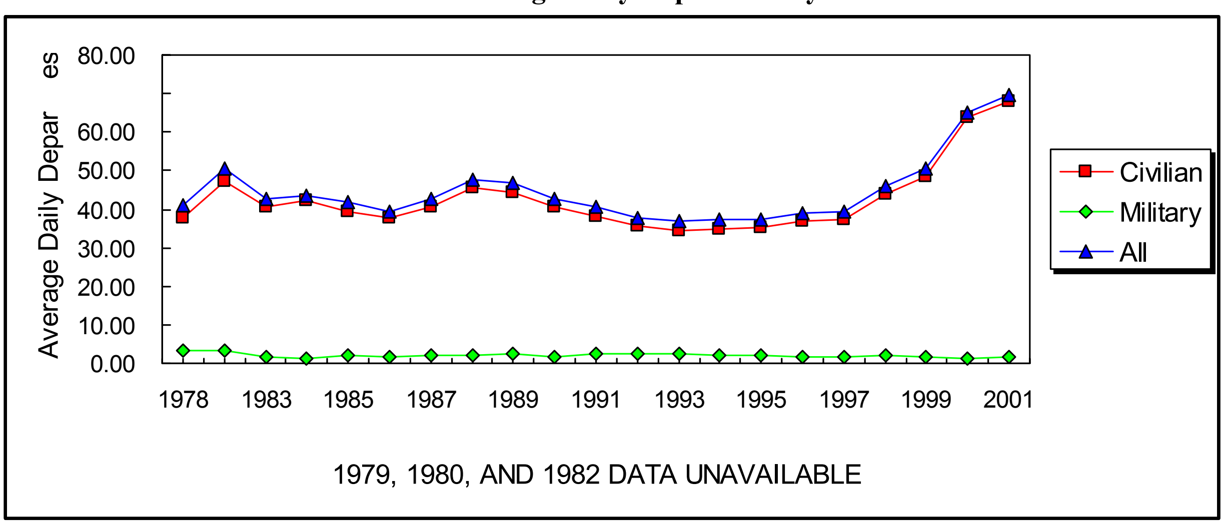


Table 4.4 shows the estimated SEP aircraft activity between 7 a.m. and 11 p.m. for the study years starting in 1978. The 213.7 average daily departures in 2001 is almost six percent less than in 2000. The study year with the lowest level of estimated average daily SEP departures was 1998 with 206.2 average SEP departures. The highest study year for SEP activity was 1985 with 297.3 estimated 7 a.m. to 11 p.m. average daily departures.

TABLE 4.4 Estimated Average Daily Departures*, 7 a.m.-11 p.m. by Single Engine Piston Aircraft for Study Years

Year	SEP Departures	Year	SEP Departures
1978	282.0	1992	240.2
1981	242.6	1993	231.1
1983	258.0	1994	219.8
1984	270.4	1995	223.0
1985	297.3	1996	207.2
1986	278.4	1997	218.9
1987	284.2	1998	206.2
1988	264.9	1999	221.6
1989	280.1	2000	227.0
1990	276.0	2001	213.7
1991	251.1		

*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).

Use of small aircraft, which dominate Hanscom's activity, was particularly impacted by the depressed economy in the early 1990s, and activity by this category of aircraft has not recovered. Furthermore, the restrictions on Visual Flight Rule activity that were in place in 2001 between September 11 and November 28 had a further impact on the use of these aircraft. Activity by these planes had been increasing prior to September 11, but there was a net decline for the year because of the restrictions.

The estimate for SEP operations includes touch-and-go, or "local," activity, which peaked in 1978 when the FAA logged 94,641 touch-and-goes. This is the pattern used to practice landing and departing, mostly 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. The reason the touch-and-go operations are included in the estimates for single engine piston aircraft activity is because since 1980 touch-and-goes have not been allowed in aircraft over 12,500 pounds at Hanscom, and they are mostly conducted by flight schools, which use SEP aircraft.

The FAA tallies "local" operations and military activity as separate categories in its monthly counts. Starting in 1987, this information has been combined with the data collected in the 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 4.5**.

TABLE 4.5 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

Decreases in all categories of civilian operations except turboprops and jets caused the 3.3 percent decline in activity. The largest single impact on this resulted from the six percent decline in SEP operations. **Table 4.5** shows that over 35 percent of the SEP 2001 activity consisted of touch-and-goes (local). It is estimated that an additional 41 percent of the SEP activity was conducted by single engine pistons that were not conducting touch-and-goes, indicating that 77 percent of the operations were by single engine piston aircraft.

Estimated helicopter activity, which represented 2.7 percent of the aircraft operations, declined 20.5 percent, and twin-engine piston operations, which represent 2.4 percent of the activity, declined 4.7 percent as compared to 2000. Consistent with the decline in SEP activity, these decreases resulted from the post September 11 VFR restrictions. Military activity, which accounted for less than one percent of the operations, declined almost 2.7 percent as compared to 2001.

Civilian jet aircraft activity, accounting for 11.1 percent of the 2001 operations as compared to 9.5 percent in 2000, increased 12.9 percent as compared to 2000. It is generally accepted that the fluctuations in business jet operations are directly related to the economic health of the area. With the softening economy in 2001, a decrease in business jet use might have been expected;

and in fact, there was a one percent decrease in this activity between January and August. This trend was altered by the September 11 events. Between October and December 2001 business jet operations increased 50.7 percent as compared to October through December 2000. After September 11 many businesses expanded the number of employees eligible to use their company jets and other businesses decided to use private jets rather than commercial airlines. The level of jet activity is particularly relevant because jets dominate the noise exposure.

Unlike the other categories of civilian aircraft, September 11 events appeared to have little or no effect on turboprop operations, which represented 6.6 percent of the activity. Use of turboprops increased 7.3 percent prior to September and despite suffering during September, this activity recovered in subsequent months, ending the year with an increase of 5.7 percent. Since pilots of turboprop aircraft are generally qualified to fly IFR, the VFR restrictions had a limited impact but there wasn't the post September 11 surge in their use seen by business jets. The latter may be attributed to a national decline in the ownership and use of turboprops by businesses.

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, although the FAA control tower is closed from 11 p.m. to 7 a.m. Since aircraft using the airport during these hours communicate with Boston approach, the Bedford tower does not have flight strips, and this activity is not included in the tower counts.

In the summer of 1980, an 11 p.m. to 7 a.m. field use fee was instituted to help reduce noise exposure by encouraging use of the field before 11 p.m. or after 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.

The growth in the number of nighttime operations in 1987 and 1988 caused concern for community members of the HFAC, resulting in a review of the nighttime field use fee. In 1989, the Massport Board voted to increase the fees reflecting the Consumer Price Index (CPI) increase between 1980 and 1989 and to institute an annual CPI increase.

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. In 1990, nighttime activity decreased and subsequently remained below 1,000 annual operations through 1995. This was a likely reflection of the depressed economy and the increase in the fees. Since 1996 the night operations have again exceeded 1,000, partially due to night activity by the medical evacuation helicopter that transports critically ill or injured patients. This helicopter service moved to Hanscom in October 1995 and now conducts over 400 night operations annually. Night operations decreased 13 percent from 1,918 in 2000 to 1,674 in 2001.

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	1992	702
1982	532	1993	689
1983	640	1994	735
1984	759	1995	919
1985	442	1996	1159
1986	466	1997	1495
1987	850	1998	1390
1988	1098	1999	1622
1989	1053	2000	1918
1990	773	2001	1674
1991	797		

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

The data in **Table 5.1** are plotted in **Figure 5.1,** illustrating the fluctuations in 11 p.m. to 7 a.m. activity. It demonstrates that 1988, 1989, and 1996 through 2001 are the eight years when there were more than 1,000 nighttime operations.

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

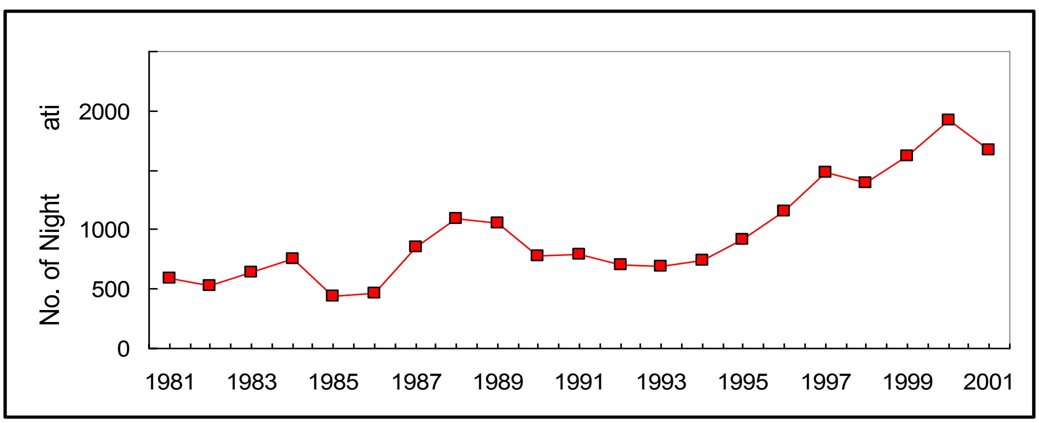


Table 5.2 provides an overview of the 2001 11 p.m. to 7 a.m. operations by aircraft type, arrivals and departures, and significant flight times. It also shows a breakdown of the number of operations by fee amount levied for each type of aircraft. The fee column headings show two

dollar-amounts. The lesser amount was charged from January through June and the greater amount was charged after the July 1 CPI adjustment. Those aircraft being charged $84/$86 or $612/$630 conducted more than five operations in the calendar year.

TABLE 5.2 Breakdown of 2001 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	$42/ $43	$84/ $86	$306/ $315	$612/ $630	Exempt	
Jets	471	337	197	228	383	12	13	690	73	20	808
Singles	112	49	76	25	60	135	0	0	0	26	161
Twins	54	29	22	31	30	70	4	0	0	9	83
Turbos	129	61	77	41	72	90	8	36	7	49	190
Helis	237	195	81	6	345	13	0	0	0	419	432
TOTAL	1003	671	453	331	890	320	25	726	80	523	1674

Of the 1674 night operations, 523 were exempt. Almost 88 percent of the exemptions were medical flights, which were dominated by the medical evacuation service based at Hanscom. Exemptions also included military, Federal Aviation Administration, and Civil Air Patrol operations, as well as Hanscom 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 600 different civilian aircraft that were subject to the nighttime fee. Of those, 30 conducted more than five nighttime operations.

Of the 1,674 11 p.m. to 7 a.m. operations, 60 percent were arrivals and 40 percent were departures. Almost 20 percent of these operations occurred between 6 a.m. and 7 a.m. while 27 percent were between 11 p.m. and midnight. The remaining 53 percent were between midnight and 6 a.m.

Jets conducted the largest number of night operations by a single group, representing 48.3 percent of the activity. Helicopters represented 25.8 percent, turboprops 11.4 percent, single engine pistons 9.6 percent, and twin engine pistons 5.0 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 aircraft noise on an average day for the aircraft that used Hanscom. The estimate is made at a point on the ground representing some of the airport's closest residential neighborhoods (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 account for their greater intrusive quality.

6.1 2001 EXP Version 5.1 (EXP 5.1)

Noise exposure, represented by the EXP metric, is calculated monthly and annually. **Table 6.1** presents the monthly departure EXP 5.1 values, including the effects of SEP aircraft, for 2001. Those portions of the noise attributable to civilian and military aircraft are separated in the table to show the relative contributions of each. The distinction is important because military aircraft are exempt from the noise abatement measures that are applicable to civilian aircraft, so have some of the highest SEL values as compared to the other aircraft that use the field. Although they represented less than one percent of the activity in 2001, they contributed 11 percent of the total noise energy.

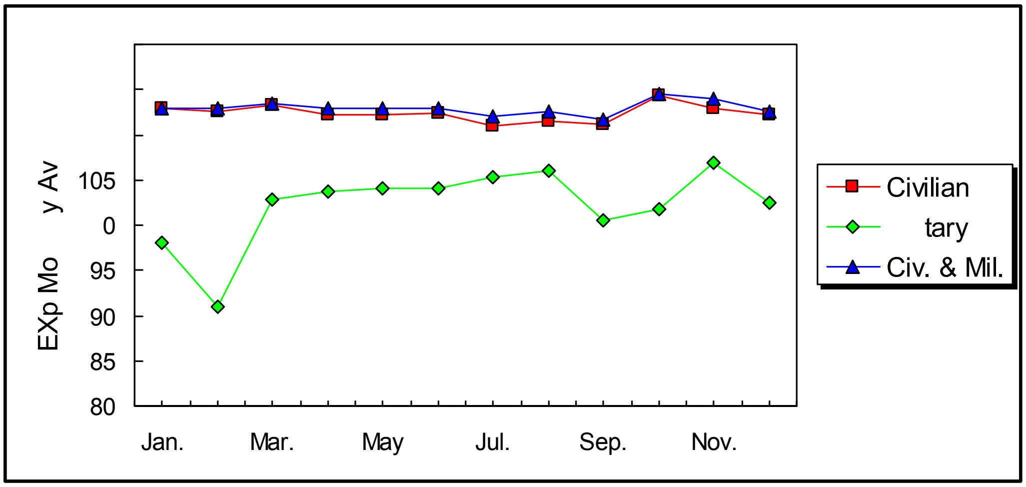
TABLE 6.1 Monthly Variations in Departure Noise Exposure 5.1 for 2001

Month	EXP 5.1 with SEP AIRCRAFT		
	Civilian	Military	Civilian & Military
Jan.	112.9	98.1	113.0
Feb.	112.5	90.9	112.9
Mar.	113.2	102.9	113.5
Apr.	112.3	103.7	112.9
May	112.3	104.1	112.9
Jun.	112.4	104.0	113.0
Jul.	110.9	105.3	112.0
Aug.	111.5	106.0	112.6
Sep.	111.2	100.6	111.6
Oct.	114.3	101.8	114.6
Nov.	112.9	106.9	113.9
Dec.	112.2	102.4	112.6
2001	112.5	103.3	113.0

Civilian departure EXP 5.1 for 2001 was 112.5 dB and fluctuated between a low of 110.9 dB in July to a high of 114.3 dB in October. These correlate with the highs and lows for civilian non-SEP activity shown in **Table 4.2**. Military EXP totaled 103.3 dB and ranged from a high of 106.9 dB in November, to a low of 90.9 dB in February. The highest total EXP during the year was reached in October when the civilian portion combined with the military portion to total 114.6 dB. September experienced the lowest total noise exposure, 111.6 dB, with the civilian portion at its second lowest and military EXP at its third lowest levels for the year.

The data from **Table 6.1** are plotted in **Figure 6.1.** **Figure 6.1** demonstrates that military noise levels had greater monthly variation than the civilian portions**.** **Figure 6.1** also shows that civilian aircraft were the dominant noise source throughout 2001.

FIGURE 6.1 EXP 5.1--2001 Monthly Averages in Departure Noise Exposure



Appendix B shows a detailed table of 2001 EXP 5.1. It includes the average daily departures and arrivals and 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 Ldn than do changes in arrival EXP, so the HFAC focuses on civilian departure EXP for primary comparative purposes. However, arrival EXP is being calculated and is included in Appendix B.

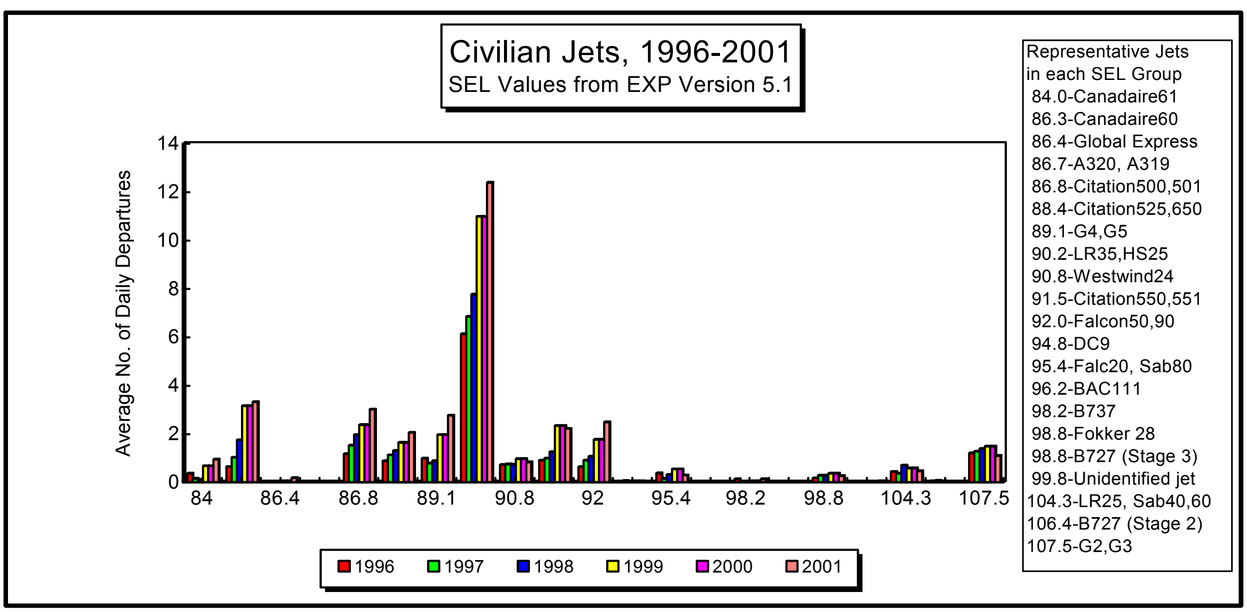
EXP 5.1 results show that in 2001, civilian aircraft generated approximately 89 percent of the total departure noise energy at Hanscom Field. **Table 6.2** presents the contribution to the 2001 civilian departure EXP by several aircraft categories, illustrating the effect of civilian jets. Civilian jets comprise 11 percent of the civilian operations. They have the highest partial EXP, and consequently represent over 91 percent of the civilian noise energy. This is due to the relatively high SEL values assigned to them. Single engine piston aircraft contribute 4.9 percent of the 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, which comprise almost 77 percent of the civilian activity.

TABLE 6.2 Contribution to Civilian Departure EXP for 2001 Operations

Aircraft Category	Partial EXP Contribution to Civilian Departure Noise Exposure
Jets	112.1
Turboprops	92.2
Helicopters	96.3
Twin Engine Pistons	91.4
Single Engine Pistons	99.4
TOTAL CIVILIAN EXP	112.5

Since civilian departure EXP is heavily 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. Using data from Appendix B and comparable data for 2000, **Figure 6.2** demonstrates that out of the 10 civilian jet noise groups that experienced increases in average daily departures in 2001, nine were less than one daily departure; there were decreases. of less than one daily departure in eight of the groups; and three groups remained stable. The groups where there were decreases included Group 5 and Group 7, both of which have SELs greater than 104 dB and represent the noisiest civilian aircraft that operate at Hanscom.

FIGURE 6.2 Average Daily Jet Departures by SEL Groups, 1996-2001



6.2 EXP Comparisons for Study Years, 1978-2001

The importance of EXP is not in its specific value but rather in the change in EXP from one year to the next. As discussed in Chapter 2, Section 2.4, EXP 5.1 has been applied to seven study years--1987, and 1996 through 2001. **Table 6.3** shows both departure and arrival EXP 5.1 for the civilian and military components as well as the totals for those years. Departure EXP for the civilian component is highlighted to indicate its role as the primary focus for comparing EXP, as discussed in Chapter 2. Civilian departure EXP 5.1 decreased 0.9 dB between 2000 and 2001.

TABLE 6.3 EXP 5.1 Annual Comparisons

			DEPARTURE EXP	ARRIVAL EXP
CIVILIAN COMPONENT, WITH SINGLES				
	Base Year	1987	112.1	105.9
		1996	112.0	105.7
		1997	112.3	106.3
		1998	113.1	106.5
		1999	113.0	107.7
		2000	113.4	107.8
		2001	112.5	107.1
MILITARY COMPONENT				
	Base Year	1987	103.1	103.0
		1996	105.5	103.0
		1997	104.7	103.5
		1998	106.4	104.8
		1999	105.6	105.9
		2000	104.5	102.6
		2001	103.3	102.2
TOTAL EXP (INCLUDING MILITARY AND SINGLES)				
	Base Year	1987	112.6	113.8
		1996	112.8	107.6
		1997	113.0	108.1
		1998	113.9	108.8
		1999	113.7	109.6
		2000	114.0	108.9
		2001	113.0	108.3

Other study years are not included in **Table 6.3** because a different version of EXP was used to calculate noise exposure for those years. It is important to have a mechanism to evaluate changes between study years, even when different versions of EXP have been used, in order to demonstrate EXP fluctuations and allow for a comparison of the current year EXP to the base year EXP.

Table 6.4 provides data that help demonstrate how changes in EXP can still be evaluated despite the use of different versions to do the calculations. It shows civilian departure EXP for 1987 through 2001 as well as for the original 1978 base year. The 1978 and 1987 EXP 3.8 for civilian aircraft departures was 112.5 dB. The resulting zero in the "Difference" column indicates equal civilian departure noise exposure, and this equal noise exposure allowed 1987 to replace 1978 as the base year. EXP Version 3.9 for 1987 civilian departures was 112.0 dB. From 1988 to 1995, EXP 3.9 results were compared to the 1987 EXP 3.9 level, with the difference from the base year indicating the change from year-to-year.

TABLE 6.4 Civilian Departure EXP Comparisons Using Different EXP Versions

		Annual EXP	Base Year EXP	Difference
Version 3.8	**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**	**Current 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**	**Current 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

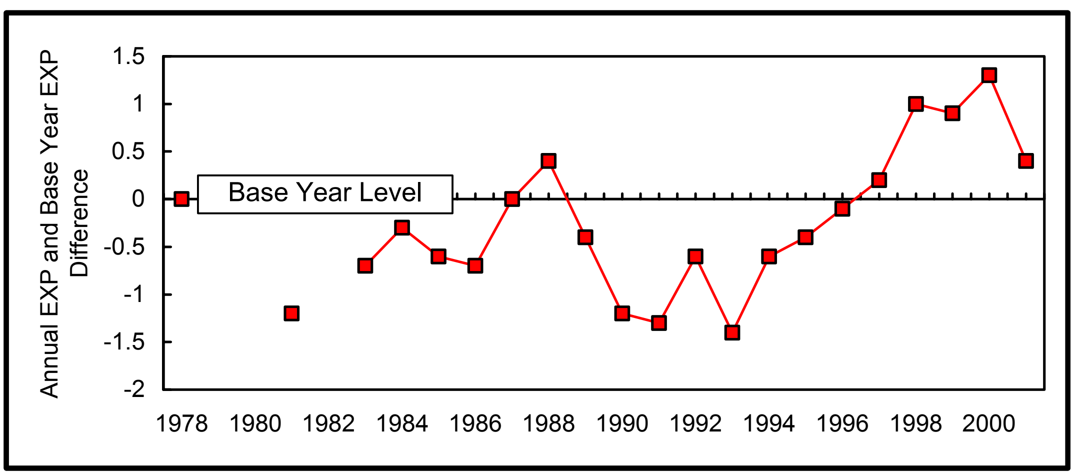
The transition to EXP 5.1 was not facilitated by equal noise exposure in 1987 and 1996, so the 1987 base year was recalculated using EXP 5.1. **Table 6.4** shows the civilian departure EXP 5.1 for 1987 is 112.1 dB, which has been used as the base for comparative purposes since 1996.

It should be noted that EXP is a tool to indicate changes that may be significant, and it is best to avoid trying to analyze changes of relative insignificance. For example, if EXP 3.9 is used to calculate 1996 noise exposure, there is no difference between 1995 and 1996, while there is a decrease of 0.1 dB when EXP 5.1 is used to compare noise exposure for 1995 and 1996. Whether EXP increased 0.1 dB, decreased 0.1 dB or remained equal is not statistically significant, and trying to analyze changes of this small magnitude is generally difficult and non-productive.

6.3 Analysis of Changes in Annual EXP for Study Years, 1978-2001

The EXP differences for all the study years since 1978, shown in **Table 6.4**, are plotted in **Figure 6.3** to provide a visual picture of the way EXP has changed for each study year since 1978. **Figure 6.3** 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. In the last three years it has fluctuated at levels above the 1997 base year. It also demonstrates that 2000 is the study year with the highest civilian departure EXP, that the 1993 level was the lowest of all the study years, and that the 2001 level is 0.4 dB above the base year EXP 5.1.

FIGURE 6.3 Differences Between Base Year EXP and Civilian Departure EXP for Study Years



Note: 1979, 1980 and 1982 data unavailable

As discussed in Section 6.1, jets dominate the noise exposure. It follows that the specific noise levels of the particular jet aircraft using Hanscom Field significantly influence the fluctuations demonstrated in **Figure 6.3**. The FAA first issued noise standards for civil aircraft in 1969, when regulations established that minimum noise performance levels 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.

In 1980, Massport adopted rules to address some of the noise issues discussed with the aviation and residential communities. The impact of these is discussed in depth in the 1982 HMMH noise report (available in Massport offices). These rules phased out most Stage 1 civilian jet operations and established a fee to discourage nighttime activity. With these rules in place, 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. By 1987, the noise exposure equaled 1978, and the 1988 exposure exceeded the base year for the first time.

After 1988, there were three years of annual decreases in civilian departure EXP primarily due to a decline in business jet operations, including fewer Stage 2 jets. In 1992, civilian departure EXP increased, despite decreases in operations, including a three percent reduction in business jet activity. The EXP increase resulted from more Stage 2 jet operations. In 1993, civilian departure EXP dropped to the lowest level of all the study years. More than compensating for the eight percent increase in business jet activity were the decreases in day and nighttime operations by the older model Stage 2 jets.

From 1994 through 1998 there was an upward trend in civilian departure EXP caused by annual increases in business jets. In most years that included more Stage 2 jet activity and more jet activity between 10:00 p.m. and 7:00 a.m. In 1999, EXP remained stable, decreasing an insignificant 0.1 dB as compared to 1998. In 2000, EXP increased 0.4 dB primarily due to increases in Stage 3 jet activity.

In 2001, EXP decreased 0.9 dB despite increases in jet activity. The decrease reflects the decline in 10 p.m. to 7 a.m. operations, which are weighted for their more intrusive nature, and the decrease in Stage 2 operations both during the day and nighttime hours.

The fluctuations in civilian EXP over the past 20 years demonstrate three major influences on noise exposure: the number of jet operations, the noise energy generated by those jets, and whether they operate between 10:00 p.m. and 7:00 a.m. when the "noise penalty" is applied. Those factors have historically been impacted by the economy and regulations. In 2001, there was the additional influence of the September 11 events.

With the positive economic trends of the mid to late 80s and again in the mid to late 90s and into 2000, business jet activity increased at Hanscom Field. This continued in 2001 due to the surge in their activity after September 11. Helping counteract the increases in jet operations was the phase out of most Stage 1 jets at Hanscom Field in the 1980s and some turnover from Stage 2 to Stage 3 jets in the 1990s as businesses upgraded their equipment. The latter was influenced by the national requirement that jets over 75,000 pounds meet Stage 3 certification levels by the year 2000, although most jets that use Hanscom weigh less than 75,000 pounds.

Of particular importance in the near future will be whether the turnover to Stage 3 aircraft will be significant enough to counteract any increases in business jet activity that may occur. Furthermore, it is unclear whether the surge seen in the use of business jets after September 11 is a new trend that will thrive or whether it will subside, with at least some business travelers returning to commercial airlines.

CHAPTER 7 NOISE MONITORING SYSTEM

In the late 1980s, Massport and the surrounding communities agreed that a permanent noise monitoring system could add valuable data to the existing method of calculating the annual EXP, providing a more complete picture of the noise environment at the airport. In the early 1990s, five noise monitors were installed on and around Hanscom Field. A sixth monitor was installed in late 1994. Data for all of the sites are available starting in 1995.

Table 7.1 shows the readings at the six sites for 1995 through 2001. Appendix C shows the readings for the sites, by month and year for 1999 through 2001. It also includes a map showing the locations for the monitors. The data shown are Day Night Noise Levels (Ldn) 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.

TABLE 7.1 Measured Ldn Levels--1995 Through 2001

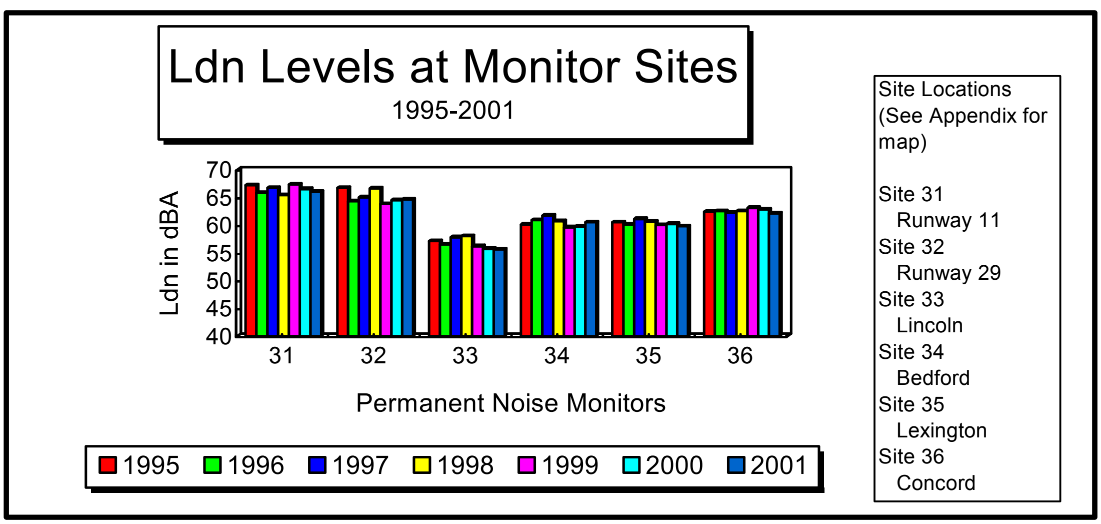
Site Number	1995	1996	1997	1998	1999	2000	2001
31	67.2	65.8	66.7	65.4	67.3	66.5	66.0
32	66.7	64.3	65.0	66.6	63.8	64.5	64.6
33	57.1	56.5	57.8	58.0	56.2	55.7	55.6
34	60.1	60.9	61.7	60.7	59.6	59.7	60.5
35	60.5	60.1	61.1	60.6	60.0	60.2	59.8
36	62.4	62.5	62.2	62.5	63.1	62.8	62.1

A comparison of the annual Ldn values for 2000 and 2001 shows decreases at four of the six sites and increases of less than 1.0 dB at the other two sites. The measured changes must be looked at carefully for both aviation and non-aviation influences.

In June of 1995, June of 1997, and August of 1998 there were Air Force Air Shows that generated high noise levels. Also, in October of 1995 and August 1998 there was a test of navigational equipment, which required a military KC135 (Boeing 707 equivalent) to conduct low approaches over the airport. These military events are known to have contributed to the readings in those years but are only partially reflected in military EXP because only the IFR events are entered into the calculations. Readings may also reflect community events near the sites. For example, Site 36 is located near the Concord wastewater treatment plant, which produces background noises that contribute to the readings. As a result, Site 36 consistently shows the highest recorded levels at an off-airport site. Sites 31 and 32 have higher readings than Site 36 since they are located on the airport at the ends of Runway 11/29.

The data in **Table 7.1** are plotted in **Figure 7.1**. It demonstrates the fluctuations in measured noise at the six sites over the past seven years.

FIGURE 7.1 Measured Ldn Values--1995 Through 2001



CHAPTER 8 NOISE ABATEMENT POLICIES

Massport strives to find the balance between operating a safe, high quality, viable airport and being sensitive to the concerns of the surrounding communities. This is a difficult task since many residents would prefer aircraft did not fly over their homes, but operating an airport inherently means that aircraft will be using the field.

In 1978, the Massport Board adopted the *Hanscom Field Master Plan and Environmental Impact Statement* (The Master Plan). This included a series of policies that were developed by Massport staff in conjunction with the Governor's Hanscom Field Task Force and members of the public.

The plan's 12 policy statements fell 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

Outgrowths of The Master Plan were the formation of the HFAC and the adoption of the 1980 Rules adopted to address noise issues. The rules included the phase out of some of the most noisy planes that were using the field, 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., and the development of the nighttime field use fee, as discussed in Chapter 5. 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, such as collection of the nighttime field use fee, as well as actively sharing data, plans and positions with the aviation and residential communities. Massport staff participate at all Hanscom Field Advisory Commission meetings and attend Hanscom Area Towns Committee (HATS) meetings, as well as other forums where their presence is requested or seems warranted.

In 1997, Massport completed a Generic Environmental Impact Report (GEIR) Update to reflect changes in environmental effects since the first GEIR was completed in 1988. The Secretary of Environmental Affairs found the update to adequately comply with the Massachusetts Environmental Policy Act and the Scope that had been issued for the study. The GEIR Update includes an analysis of 1995 noise levels.

In 1998 and 2000, Massport staff worked closely with the Noise Working Group, an outgrowth of the GEIR Update. The group, which included aviation and residential community members, formed two subgroups, one to develop noise abatement and 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 1999. In 2000, Massport began taking steps to incorporate many of the recommendations. This included developing a noise abatement program for encouraging pilots to use noise abatement procedures.

A second update to the GEIR, now called the Environmental Status and Planning Report, is being prepared in 2002, using 2000 for its base point and looking at growth scenarios for 2005 and 2015[1]. This is providing another opportunity to analyze noise impacts in depth and to incorporate additional recommendations submitted by the Noise Working Group. All of these reports are available for review in the Massport offices and the libraries of the four contiguous towns.

Massport's operation of Hanscom Field continues to reflect its responsibility to the regional aviation system and to the business community. At the same time, Massport recognizes the noise impacts and strives to work with the surrounding communities to help them understand the importance of the airport as a resource while finding mutually acceptable mechanisms to minimize the issues that are of concern.

[1] The 2000 draft ESPR was filed with the Massachusetts Policy Act (MEPA) office on July 31, 2002. The final ESPR will be filed with MEPA in 2003.

APPENDIX A

Noise Terminology Used

at

Hanscom Field (1) and Ldn Noise Contour Maps

(1) Excerpt from: 2000 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.

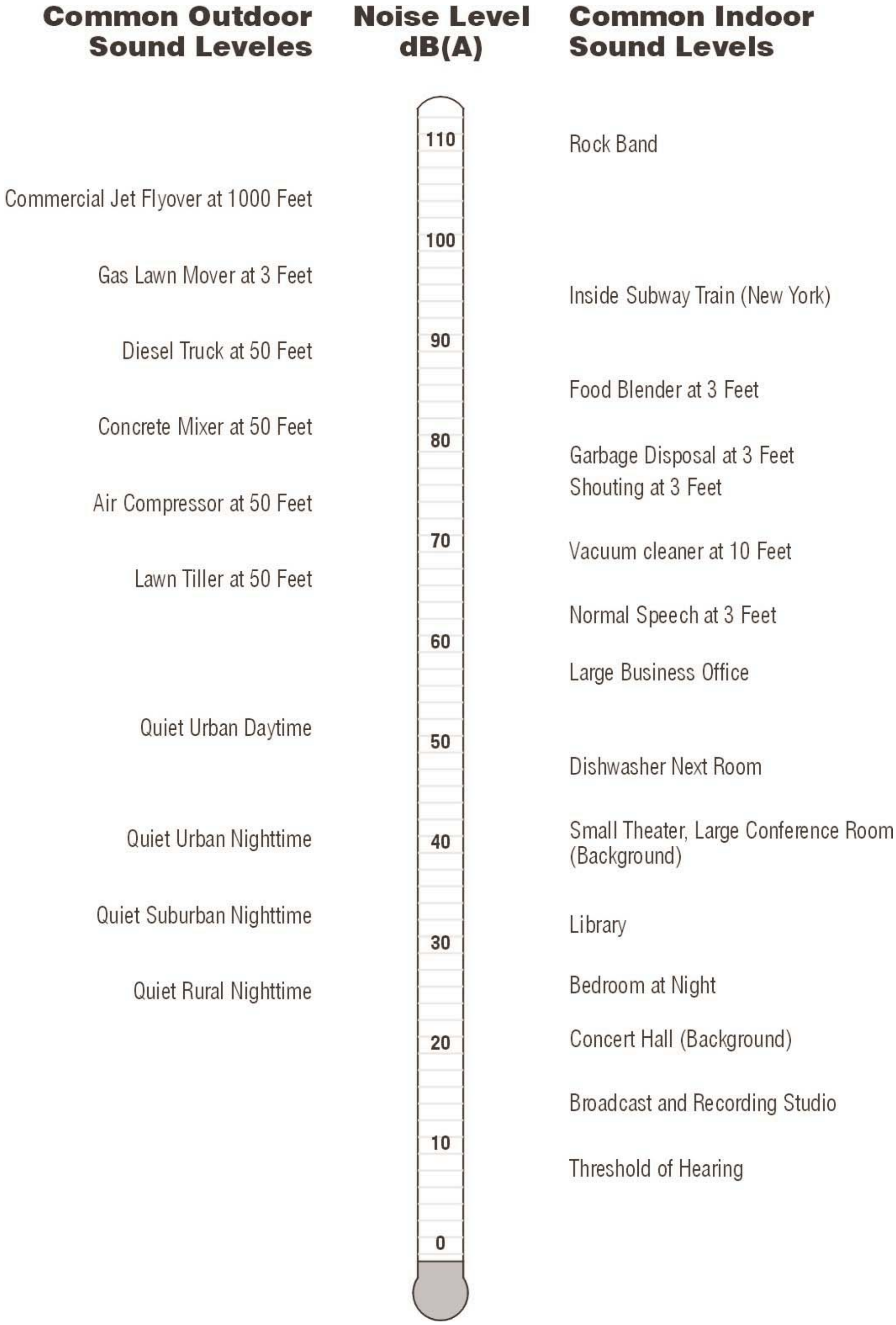
A sound pressure level of less than 10 dB is approximately the threshold of human hearing and is barely audible under extremely quiet conditions. Normal conversational speech has a sound pressure level of approximately 60 to 65 dB. Sound pressure levels above 120 dB begin to be felt inside the human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

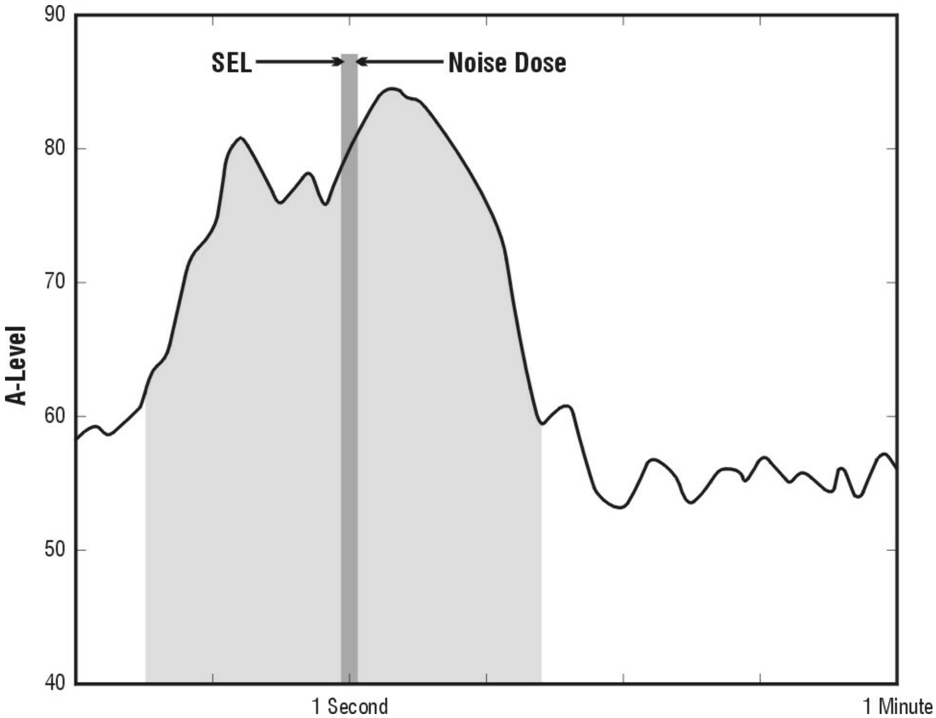


weighted" has been omitted. Sound levels are designated in terms of A-weighted decibels, abbreviated dBA. With A-weighting, a noise source having a higher sound level than another is generally perceived as louder. Also, the minimum change in sound level that people can detect outside of a laboratory 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.

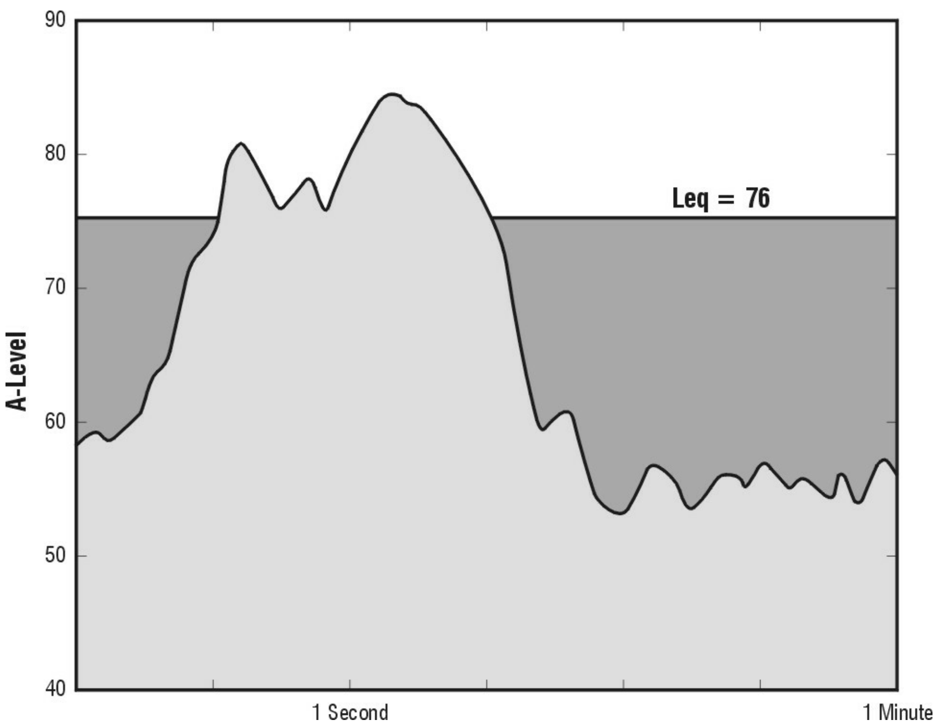
The remaining noise metrics discussed in this section refer to the accumulation of exposure caused by multiple noise events over time. While such metrics are often viewed as downplaying the importance of individual aircraft operations, they are extremely good indicators of community annoyance with complex 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.

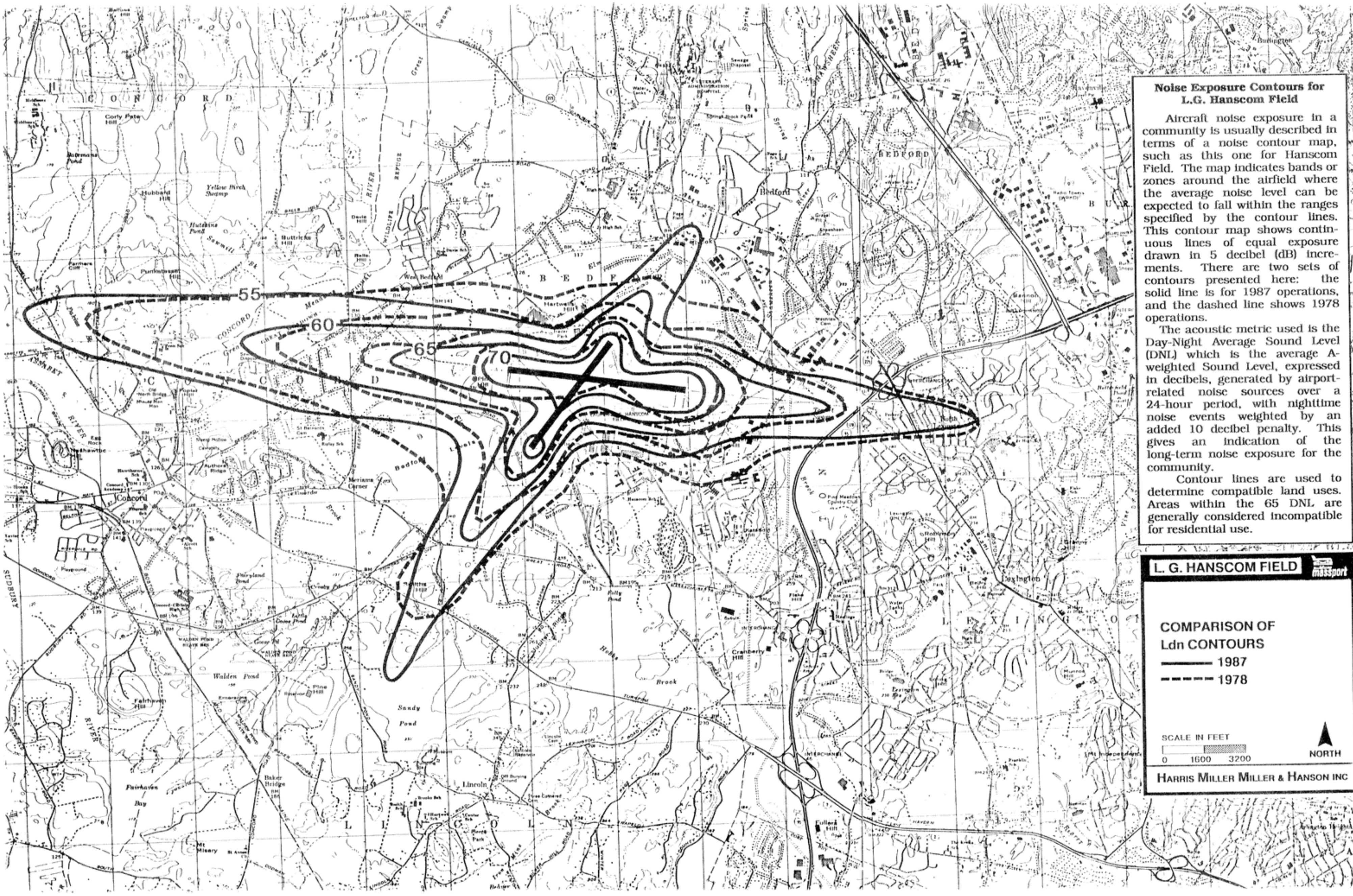
Most federal agencies dealing with noise have formally adopted DNL, though they also encourage the use of supplemental noise metrics to aid the public in understanding the complex noise environment of an airport. For example, Massport frequently uses the Sound Exposure Level, maximum sound level, or 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.



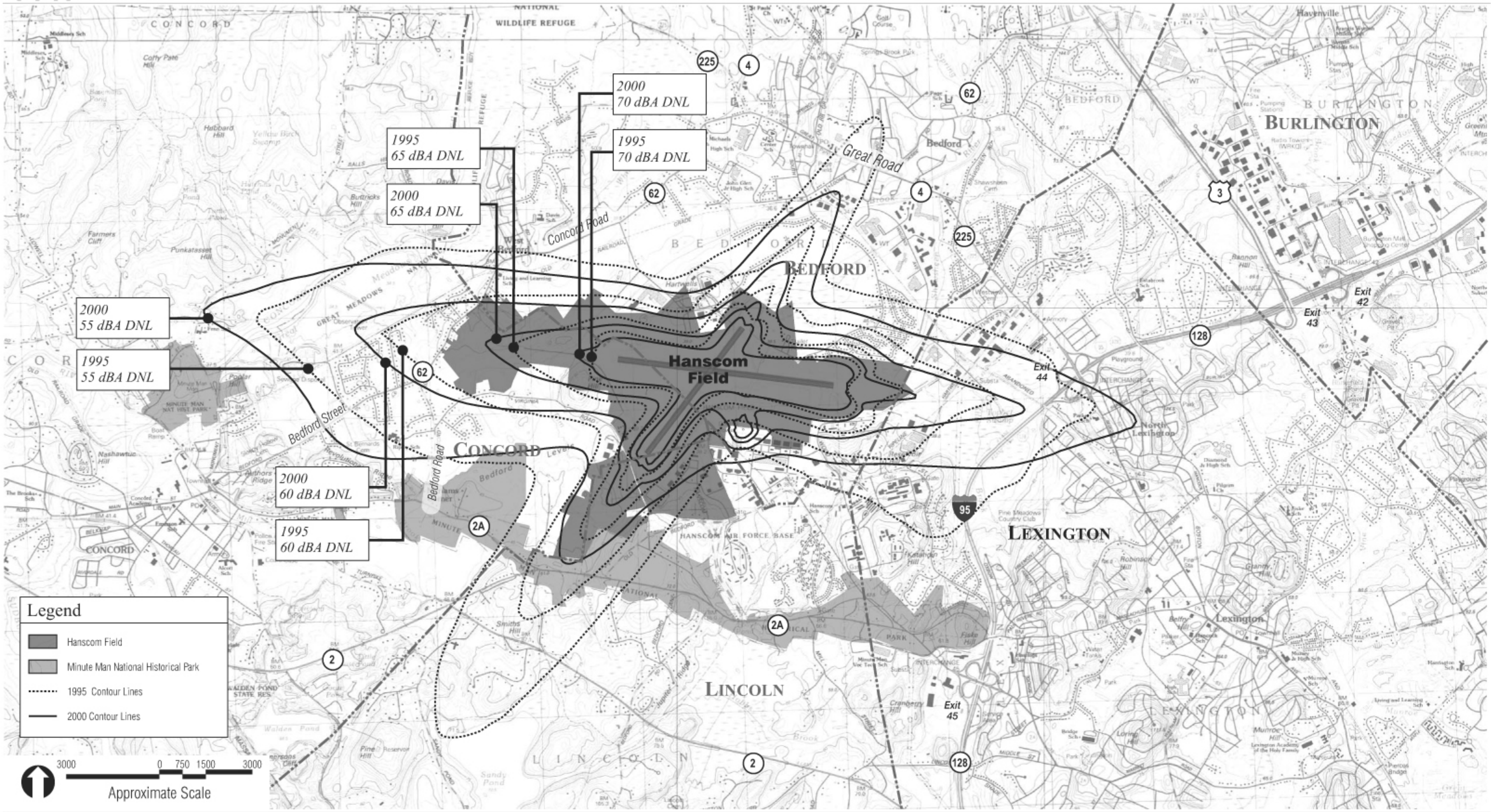
Noise Exposure Contours for L.G. Hanscom Field

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

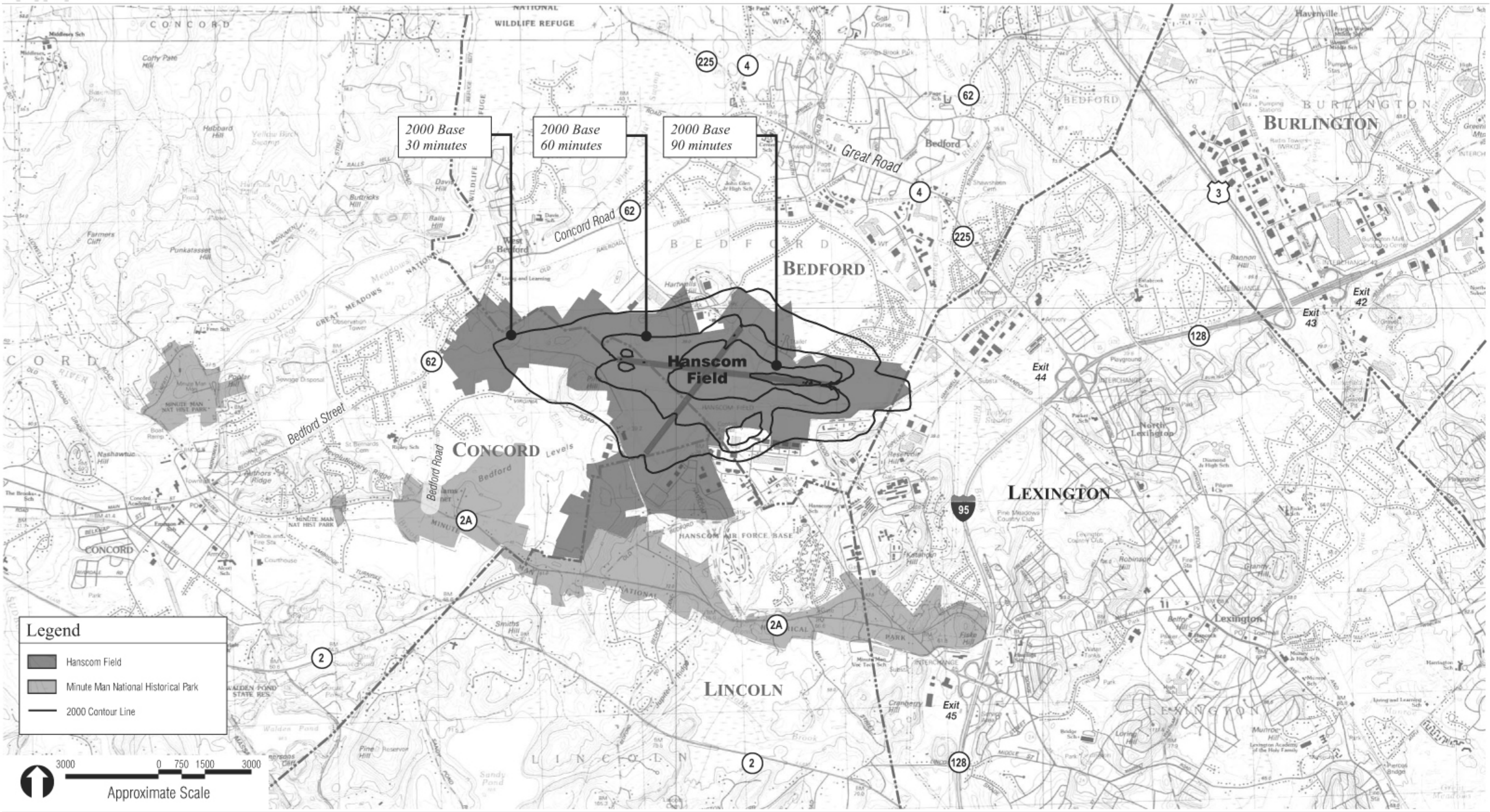
RIZZO ASSOCIATES
A TETRA TECH COMPANY

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

8793_2000_ta_65dba_contours



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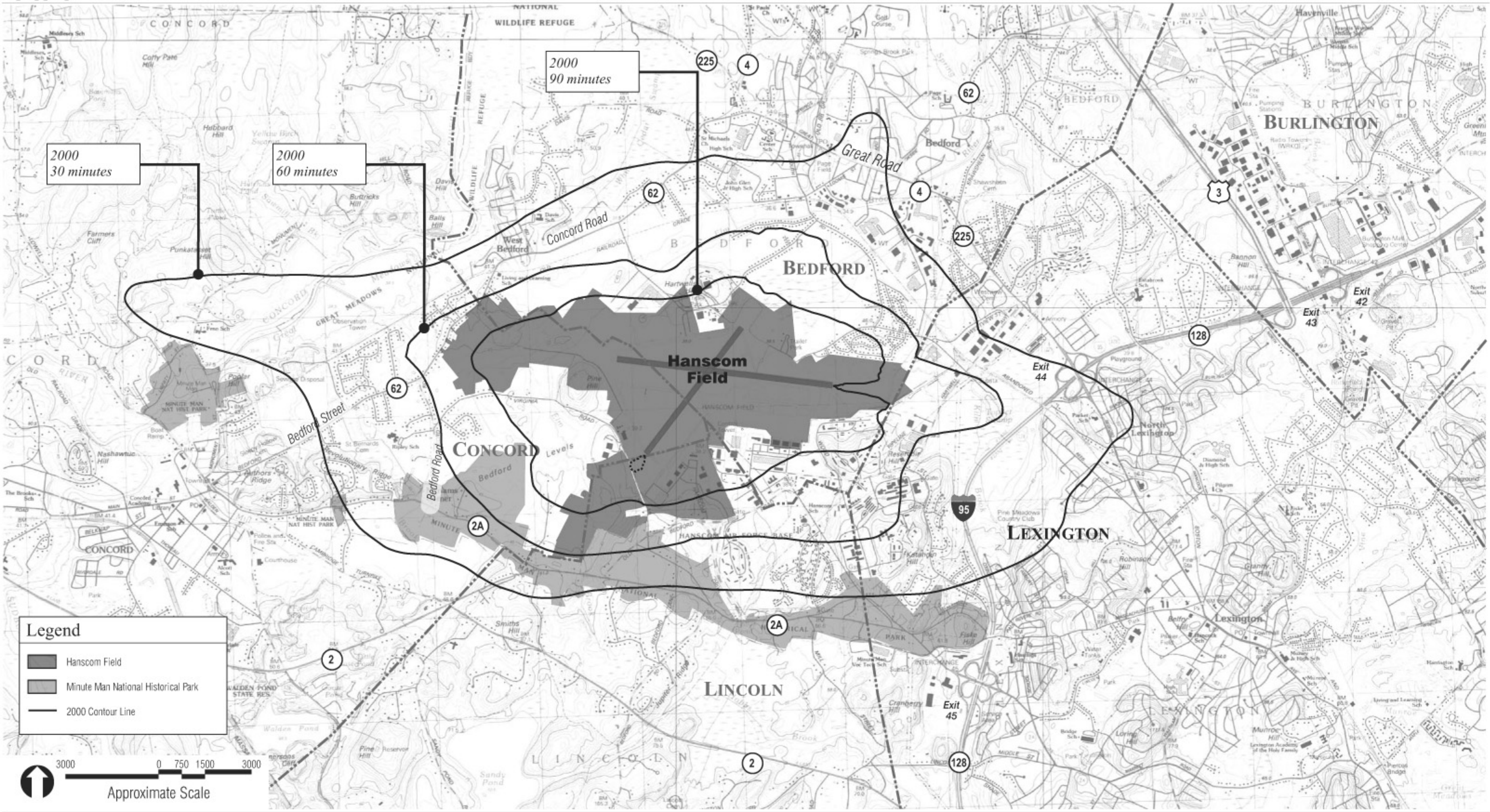
Base Map: MA USGS Maps;
MA GIS website, 1996

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



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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

APPENDIX B

2001 Average Daily Operations and

Noise Exposure by Aircraft Type

Aircraft Group	Types	Reference Dep. SEL: 15,000 ft. from Brake Release (in dB)	DEPARTURES Day	Night 10pm-7am	Total	Partial EXP 5.1	Reference Arr. SEL: 15,000 ft from Brake Release (in dB)	ARRIVALS Day	Night 10pm-7am	Total	Partial EXP 5.1
1	C500, C501, C560	86.8	2.84	0.16	3.00	93.3	83.1	2.80	0.20	3.00	89.9
2A	MU3, C550, C551	91.5	2.13	0.07	2.20	96.0	84.5	2.10	0.11	2.21	89.6
2B	T47 (MILITARY)	91.5	0.00	0.00	0.00	0.0	84.5	0.00	0.00	0.00	0.0
3A	BE40, LR35, LR55, DA10,50,90,200 HS25-400, 600, 700, 800, WW24,N265-65	90.2	11.83	0.54	12.37	102.6	85.5	11.72	0.69	12.41	98.2
3B	C-21 (MILITARY)	90.2	0.15	0.00	0.15	82.0	85.5	0.15	0.00	0.15	77.3
4A	DA02, N265-80	95.4	0.27	0.01	0.28	91.1	95.9	0.27	0.01	0.28	91.6
4B	HU25	95.4	0.00	0.00	0.00	0.0	95.9	0.00	0.00	0.00	0.0
5A	LR23, 24, 25, 28, N265-40,-60, AC2	104.3	0.42	0.03	0.45	102.9	97.4	0.44	0.02	0.46	95.5
5B	T-39 (MILITARY)	104.3	0.03	0.00	0.03	89.1	97.4	0.03	0.00	0.03	82.2
6	BAC-111	96.2	0.00	0.00	0.00	0.0	97.0	0.00	0.00	0.00	0.0
7A	G2, G3	107.5	1.02	0.06	1.08	109.6	94.9	0.99	0.09	1.08	97.7
7B	C20	107.5	0.03	0.00	0.03	92.3	94.9	0.03	0.00	0.03	79.7
8	G4	89.1	2.58	0.17	2.75	95.4	86.3	2.52	0.23	2.75	93.1
9	CL60	86.3	3.10	0.20	3.30	93.4	84.9	3.04	0.26	3.30	92.4
10	CL61	84.0	0.87	0.06	0.93	85.7	85.8	0.85	0.08	0.93	88.0
11A	UNKNOWN/MISC JETS (G.A.)	99.8	0.04	0.00	0.04	85.8	89.8	0.04	0.00	0.04	75.8
11B	UNKNOWN/MISC JETS (MIL)	99.8	0.04	0.00	0.04	85.8	89.8	0.04	0.00	0.04	75.8
12	C140 (MILITARY)	95.5	0.00	0.00	0.00	0.0	95.5	0.00	0.00	0.00	0.0
13	C141 (MILITARY)	103.3	0.04	0.00	0.04	89.3	108.0	0.04	0.01	0.05	99.5
14A	DC-9	94.8	0.01	0.01	0.02	85.2	91.0	0.02	0.00	0.02	74.0
14B	C9, T-43 (MILITARY)	94.8	0.09	0.00	0.09	84.3	91.0	0.09	0.00	0.09	80.5
15A	B707	102.6	0.00	0.00	0.00	0.0	104.7	0.00	0.00	0.00	0.0
15B	C-5A, KC-135, C137 (MIL)	112.0	0.02	0.00	0.02	95.0	112.1	0.02	0.00	0.02	95.1
16	T-33,37,38, A-10, F111 (MIL)	104.3	0.02	0.00	0.02	87.3	97.4	0.02	0.00	0.02	80.4
17A	HELICOPTERS (G.A.)	84.6	9.63	0.53	10.16	96.3	84.6	9.51	0.65	10.16	96.6
17B	HELICOPTERS (MILITARY)	84.6	0.21	0.00	0.21	77.8	84.6	0.21	0.00	0.21	77.8
18A	G159, CV60 - HVY TURBOS	94.2	0.00	0.00	0.00	0.0	95.5	0.00	0.00	0.00	0.0
18B	C130 - HVY TURBOS (MILITARY)	94.2	0.22	0.00	0.22	87.6	95.5	0.22	0.00	0.22	88.9
19A	BE20,30 - TURBOS	82.8	6.68	0.12	6.80	91.8	81.7	6.65	0.15	6.80	90.8
19B	C12, T44, C26 - TURBOS (MIL)	82.8	0.60	0.00	0.60	80.6	81.7	0.59	0.01	0.60	80.1
20A	TWIN ENGINE PISTON (G.A.)	82.2	6.62	0.17	6.79	91.4	83.6	6.56	0.23	6.79	93.1
20B	TWIN ENGINE PISTON (MIL)	82.2	0.00	0.00	0.00	0.0	83.6	0.00	0.00	0.00	0.0
21	SINGLES - INC. LOCALS (G.A.)	76.1	213.74	0.13	213.87	99.4	75.8	213.35	0.54	213.89	99.2
22	WW24, WW25	90.8	0.78	0.04	0.82	91.5	82.3	0.79	0.02	0.81	82.3
23	FK28	98.8	0.00	0.00	0.00	0.0	95.5	0.00	0.00	0.00	0.0
24	A-4,6, F-14,15,16,18 (MIL)	110.7	0.11	0.00	0.11	101.1	101.5	0.10	0.01	0.11	94.5
25	C525, C650	88.4	1.96	0.08	2.04	92.8	82.4	1.98	0.07	2.05	86.7
26	DA50, DA90	92.0	2.36	0.11	2.47	97.4	87.3	2.38	0.10	2.48	92.6
27	CV58 - TURBO	81.5	0.01	0.00	0.01	61.5	91.2	0.01	0.00	0.01	71.2
28	DC3, CV24 - HVY TWIN PISTONS	94.2	0.00	0.00	0.00	0.0	95.5	0.00	0.00	0.00	0.0
29	AC6T, BE90, PA31T - TURBOS	74.9	2.96	0.10	3.06	80.9	81.7	2.92	0.15	3.07	88.2
30	SF34 - TURBO	76.9	0.03	0.00	0.03	61.7	83.8	0.03	0.00	0.03	68.6
31	B727 (STAGE 2)	106.4	0.00	0.00	0.00	0.0	95.4	0.00	0.00	0.00	0.0
32	B727 (STAGE 3)	98.8	0.15	0.10	0.25	99.4	94.2	0.14	0.12	0.26	95.5
33	BEST, ND26 - TURBOS	82.8	0.01	0.00	0.01	62.8	85.2	0.01	0.00	0.01	65.2
34	B737	98.2	0.09	0.03	0.12	94.1	91.3	0.09	0.04	0.13	88.2
35	DH8	74.9	8.72	0.17	8.89	85.1	85.1	8.52	0.36	8.88	95.9
36	A320, A319	86.7	0.00	0.00	0.00	0.0	91.5	0.00	0.00	0.00	0.0
37	GLEX	86.4	0.16	0.01	0.17	80.5	88.8	0.16	0.01	0.17	82.9
TOTALS											
	CIVILIAN W/O SINGLES		65.27	2.77	68.04	112.3		64.54	3.59	68.13	106.3
	CIVILIAN W/SINGLES		279.01	2.90	281.91	112.5		277.89	4.13	282.02	107.1
	MILITARY		1.56	0.00	1.56	103.3		1.54	0.03	1.57	102.2
	TOTAL W/O SINGLES		66.83	2.77	69.60	112.8		66.08	3.62	69.70	107.7
	TOTAL W/SINGLES		280.57	2.90	283.47	113.0		279.43	4.16	283.59	108.3

APPENDIX C

1999 through 2001 Measured Ldn (dBA)

at

Hanscom Noise Monitoring Sites

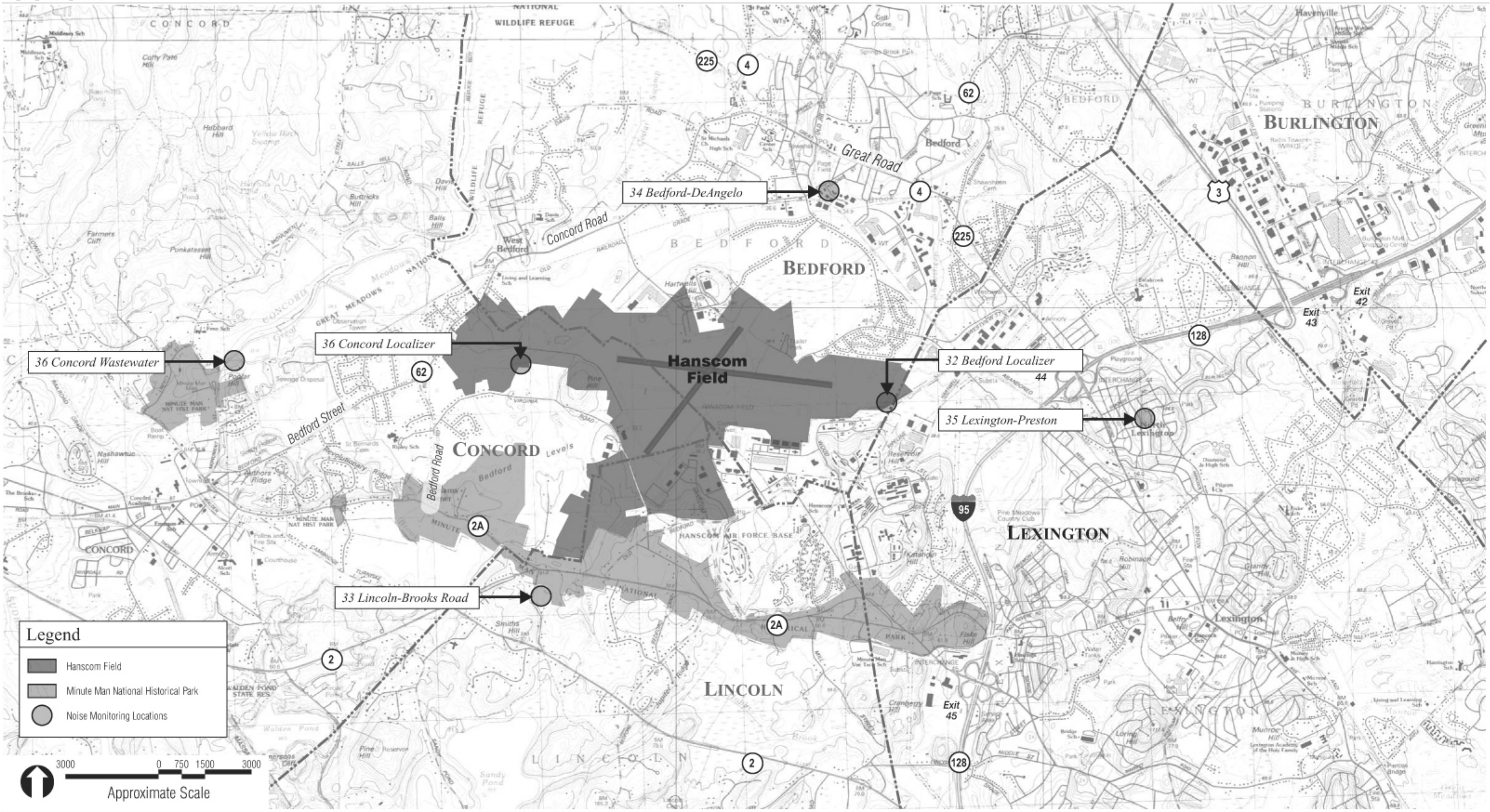
Hanscom Sites
Noise Summary
Measured Ldn (dBA)

RMS ID	Location Description	Jan'99	Feb '99	Mar '99	Apr '99	May '99	Jun '99	Jul '99	Aug '99	Sep '99	Oct '99	Nov '99	Dec '99	**1999**
Month														
31	Concord Localizer	65.4	66.0	68.6	67.1	65.3	65.5	65.0	66.5	67.8	70.1	68.9	67.7	67.3
32	Bedford Localizer	62.9	62.5	64.9	63.9	62.8	63.6	64.5	63.3	63.6	63.5	64.9	63.6	63.8
33	Lincoln--Brooks Rd	54.7	55.2	56.4	55.8	55.9	56.3	56.1	57.8	57.5	56.7	55.9	55.0	56.2
34	Bedford--DeAngelo	58.5	58.4	59.4	59.1	59.4	60.2	60.2	61.6	59.5	59.8	59.7	58.7	59.6
35	Lexington--Preston	59.3	59.3	60.1	60.4	59.4	58.3	59.3	59.9	59.8	60.9	61.4	60.7	60.0
36	Concord Wastewater	61.3	62.4	62.6	62.1	62.0	62.0	63.0	63.5	64.1	64.3	64.2	64.2	63.1

RMS ID	Location Description	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**
Month														
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

RMS ID	Location Description	Jan '01	Feb '01	Mar '01	Apr '01	May '01	Jun '01	Jul '01	Aug '01	Sep '01	Oct '01	Nov '01	Dec '01	**YTD 2001**
Month														
31	Concord Localizer	65.4	65.3	66.7	66.9	64.5	65.6	66.5	65.1	64.4	66.8	67.7	66.2	66.0
32	Bedford Localizer	63.0	64.2	65.3	66.5	64.4	63.6	62.5	65.2	63.8	63.9	66.4	64.3	64.6
33	Lincoln--Brooks Rd	52.9	53.2	54.3	55.9	57.5	56.7	56.2	58.1	55.5	54.0	54.4	54.6	55.6
34	Bedford--DeAngelo	57.8	58.1	58.0	60.5	60.3	60.8	60.4	61.5	60.8	60.5	61.4	62.8	60.5
35	Lexington--Preston	59.8	60.2	60.6	60.0	59.9	59.1	59.0	58.9	59.0	60.1	60.5	59.8	59.8
36	Concord Wastewater	59.8	61.6	62.2	63.4	61.6	62.0	61.7	62.1	61.9	62.1	62.1	63.7	62.1

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