

MEMORANDUM

VIA FORUM

Date: September 6, 2007

To: BOS/TAC Members

From: Stephen Smith [ORIGINAL SIGNED] – Project Consultant

Subject: BOSTON OVERFLIGHT NOISE STUDY, COMPARATIVE ANALYSIS: 2005 AND 2006

The goal of this analysis was to determine if any aspect of the following data for 2006 could suggest modifications to the assumptions derived from the 2005 data, which will be used to define Existing Conditions for Phase 2:

1. Average annual day operations
2. Annual runway use
3. Comparison of day and night annual operations
4. Comparison of runway configuration use
5. Runway 27 Noise Abatement Departure Procedure (NADP) compliance

The methodology used to analyze these data is described below. The results were tabulated and illustrated to better present the findings. In summary, no aspect of the 2006 data that would justify modifications to the 2005 baseline data was identified.

## **Introduction and Methodology**

Each of the components addressed in this analysis affects the noise environment surrounding the Airport. The modeled noise levels produced to depict the changes in the noise environment surrounding the Airport were not affected by the components in a uniform manner. For example, a slight change in temperature has a negligible effect on the annual average noise exposure contour. However, an increase in nighttime (11 p.m. [2200 hours] –to 7 a.m. [0700 hours]) operations could affect the shape and size of the annual average noise exposure contour. Therefore, each component addressed below does not contribute to the noise environment in the same manner, but all are important to obtain an accurate depiction of the noise levels surrounding the Airport.

Note that Runway 14-32 became operational in December 2006; therefore, the data for that month were not included in the analysis. The annual operational data are, therefore, presented as average annual day (AAD) data so that they can be compared year to year.

Weather data used for baseline noise modeling are 10-year averages of measured temperature, humidity, and barometric pressure data. Because a long-term average was used, a discussion of annual weather for 2005 compared to 2006 is not relevant to this analysis.

The Environment Data Report (EDR) for 2005 and the Logan Airport Noise and Operations Management System (ANOMS) flight track data for 2006 were the primary sources of data for this analysis. The data were used as-is; there were unknown aircraft types and runway designations in the data for 2006, which led to some level of uncertainty in the analysis. This uncertainty is addressed below where applicable.

## 1. Average Annual Day Operations

Total numbers of average annual day (AAD) operations by aircraft category are listed in **Table 1**. AAD operations are presented because data were excluded for December 2006.

**Table 1**

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Total Average Annual Day Operations

Aircraft Category	2005	2006
Heavy Jet	60	42
Light Jet	538	511
Regional Jet/Corporate Jet/Propeller	522	564
Total	1,120	1,117

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Sources: Appendix H from the Environmental Data Reports and ANOMS data for Boston-Logan International Airport.  
Prepared by: Wyle Laboratories, 2007

The operations are listed by the following aircraft categories: heavy jet, light jet, and regional jet / corporate jet / propeller. These categories were selected based on a combination of the data available in the EDR and the ANOMS database. These categories also provide consistency with INM aircraft categories for varying aircraft types.

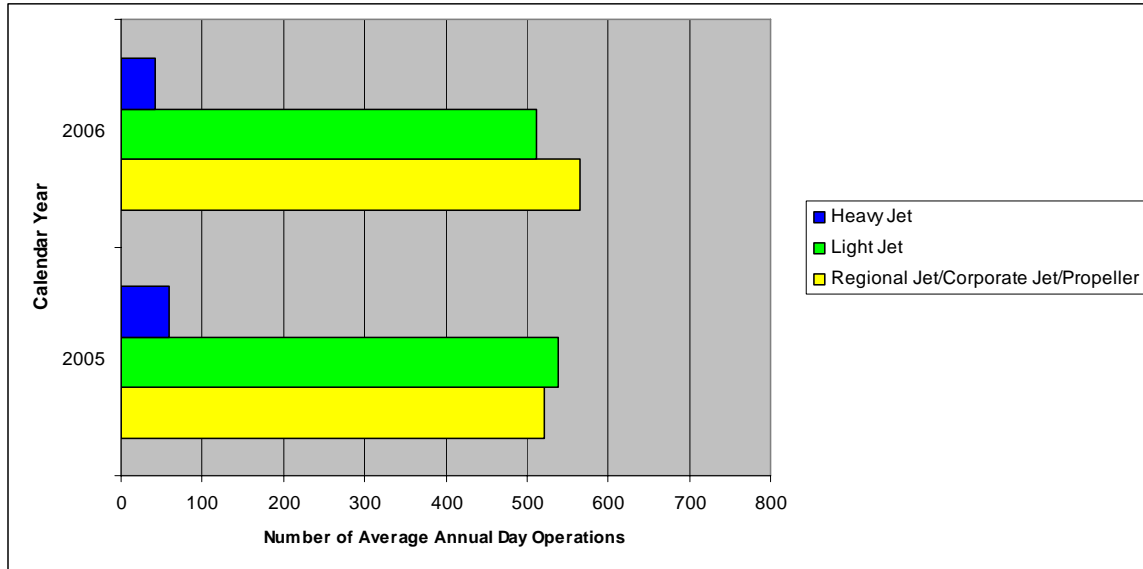
Please note that the AAD number of operations for 2006 were derived from data for January 1 through November 30, 2006; therefore, the totals were divided by 334 days to determine the AAD totals.

The ANOMS data for 2006 include numerous flight operations for which the aircraft types do not comply with standard aircraft identifiers or were missing from the data. In addition, on some days, the ANOMS was malfunctioning and data were, therefore, missing from the database. Therefore, as many aircraft types are unknown, the AAD operations for each aircraft category are approximations. The operations by unknown aircraft types were included in the Regional Jet/Corporate Jet/Propeller category because, in general, unknown aircraft found in ANOMS data typically belong in this category (which includes charter and unscheduled aircraft operations). The total AAD operations data for 2006 include all known and unknown aircraft types. However, because the ANOMS was not functioning on some days, there was some loss of operational data for all aircraft types that is not accounted for in Table 1.

**Exhibit 1** illustrates the data provided in Table 1 for 2005 and 2006. Three fewer AAD operations were conducted in 2006 than in 2005.

**Exhibit 1**

Total Average Annual Day Operations in 2005 and 2006



Sources: Appendix H from the Environmental Data Reports and ANOMS data for Boston Logan International Airport.  
Prepared by: Wyle Laboratories, 2007

## 2. Annual Runway Use

Annual runway use for 2005 and 2006 is shown in **Table 2** and **Table 3**, for arrivals and departures, respectively. Arrivals and departures are shown for daytime and nighttime hours. Daytime hours are defined as those between 7 a.m. (0700 hours) and 11 p.m. (2200 hours) and nighttime hours are defined as those between 11 p.m. (2200 hours) and 7 a.m. (0700 hours). **Exhibit 2** and **Exhibit 3** illustrate the same runway use data for 2005 and 2006.

Runway use in 2006 was very similar to runway use in 2005. The largest difference in arrival runway use relates to the use of Runway 4R. The data also show a change in the use of Runway 22R for departures.

Differences in runway use from 2005 and 2006 are due in part to runway improvement projects. According to the Massachusetts Port Authority (Massport), Runway 4L-22R was resurfaced in 2005 and was closed during some nighttime hours. In 2006, Runway 4R-22L was resurfaced, which led to closures during nighttimes, weekends, and some weekdays. According to Massport, the construction of Runway 14-32 was scheduled to coincide with other projects, and because of its location relative to the other runways, did not cause substantial runway closures.

Please note that the ANOMS data for 2006 includes an unknown-runway category, which was accounted for in the tables.

### 3. Comparison of Day and Night Annual Operations

**Table 4** presents a comparison of arrivals and departures by time of day for 2005 and 2006. **Exhibit 4** is a further illustration of the data.

The only notable difference between the data for the two years is that five more nighttime arrivals were recorded in 2005 than in 2006. Nighttime departures were the same in both years.

**Table 2**

Annual Runway Operations – Arrivals

Runway	2005		2006	
	Day	Night	Day	Night
4L	10.7%	3.3	10.6%	3.7%
4R	32.5	25.3	29.2	27.1
9	0.0	0.0	0.0	0.0
15L	0.1	0.0	0.1	0.0
15R	1.4	1.2	1.5	1.1
22L	12.0	16.2	13.5	16.4
22R	0.4	0.1	0.6	0.2
27	28.4	24.4	29.8	25.0
33L	14.2	29.4	13.8	25.9
33R	0.3	0.0	0.5	0.1
Unknown	0.0	0.0	0.4	0.5
Total	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

Sources: Appendix H from the Environmental Data Report and ANOMS data for 2006 for Boston-Logan International Airport  
 Prepared by: Wyle Laboratories, 2007

**Table 3**

Annual Runway Operations - Departures

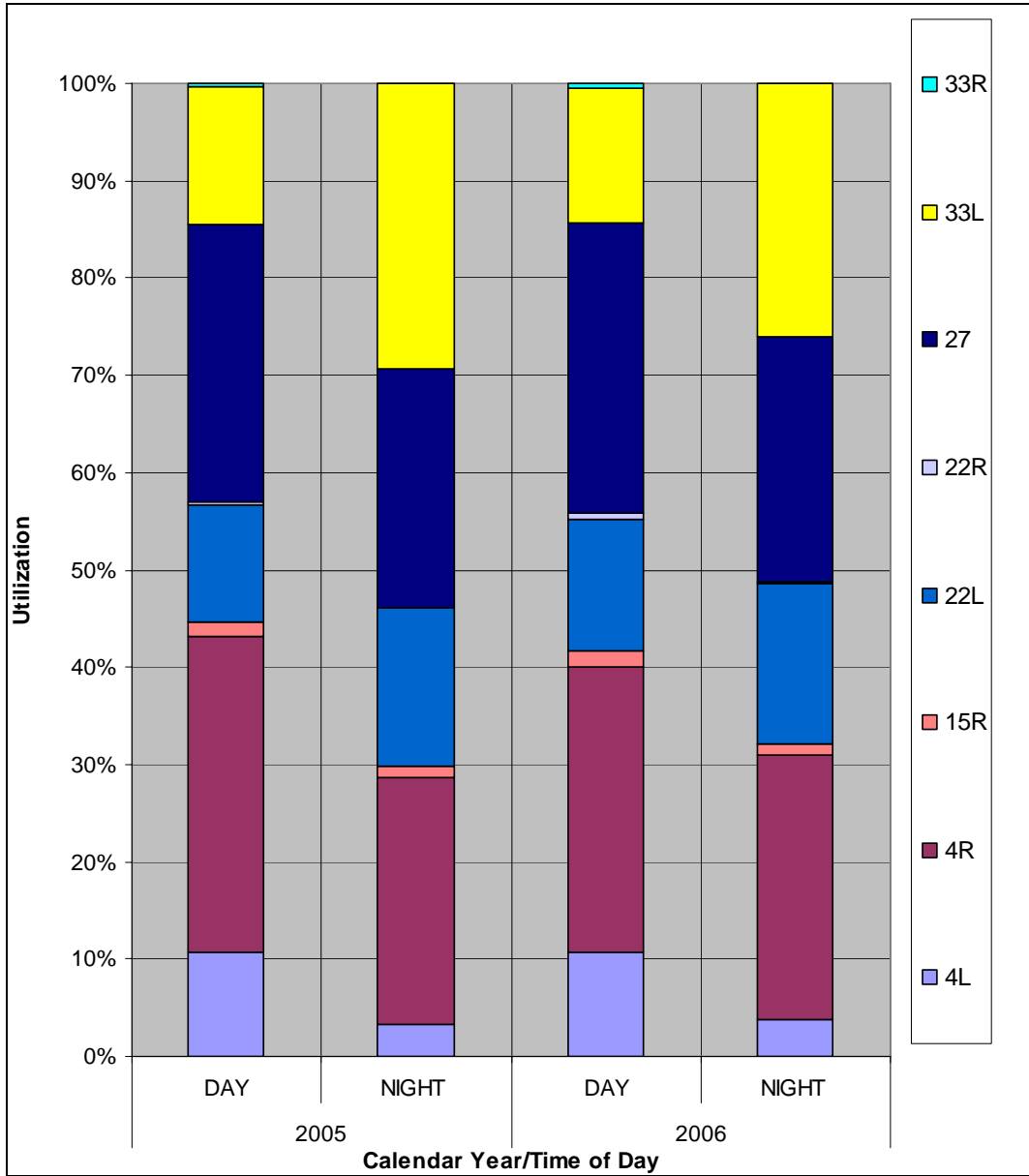
Runway	2005		2006	
	Day	Night	Day	Night
4L	2.9%	0.6%	2.3%	0.5%
4R	4.7	3.5	4.2	3.5
9	31.8	25.6	29.4	26.5
15L	0.2	0.1	0.3	0.1
15R	8.0	17.0	4.9	8.0
22L	1.6	1.3	1.2	0.9
22R	30.2	28.6	36.4	37.2
27	13.0	16.1	14.7	17.4
33L	7.5	7.3	6.0	5.4
33R	0.0	0.0	0.1	0.0
Unknown	0.0	0.0	0.7	0.4
Total	100.0%	100.0%	100.0%	100.0%

Note: Columns may not add to totals shown because of rounding.

Sources: Appendix H from the Environmental Data Report and ANOMS data for 2006 for Boston-Logan International Airport  
 Prepared by: Wyle Laboratories, 2007

**Exhibit 2**

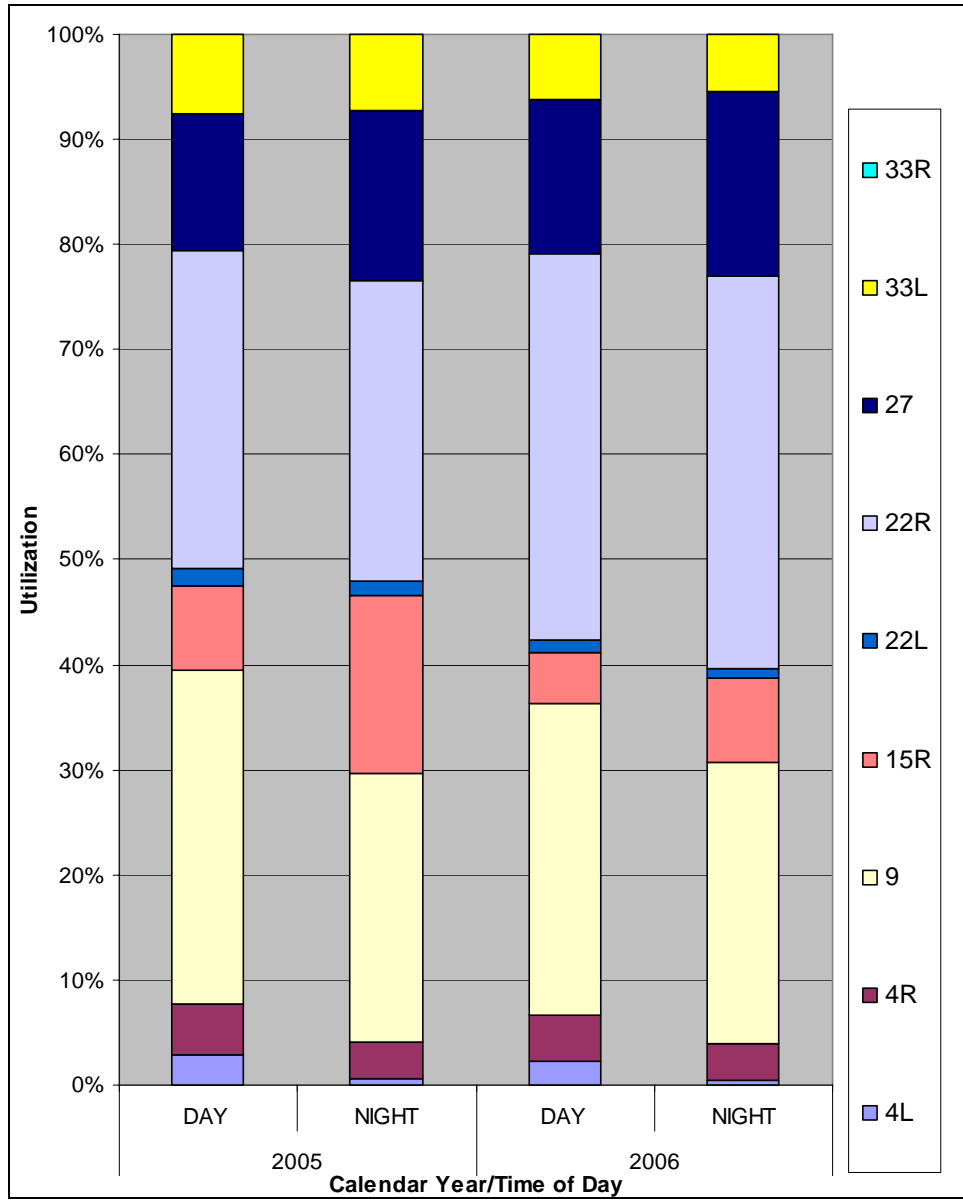
**Annual Runway Use – Arrivals**



Source: Table 2: Annual Runway Use-Arrivals  
 Prepared by: Wyle Laboratories, 2007

**Exhibit 3**

Annual Runway Use - Departures



Source: Table 3: Annual Runway Use-Departures  
 Prepared by: Wyle Laboratories, 2007

**Table 4**

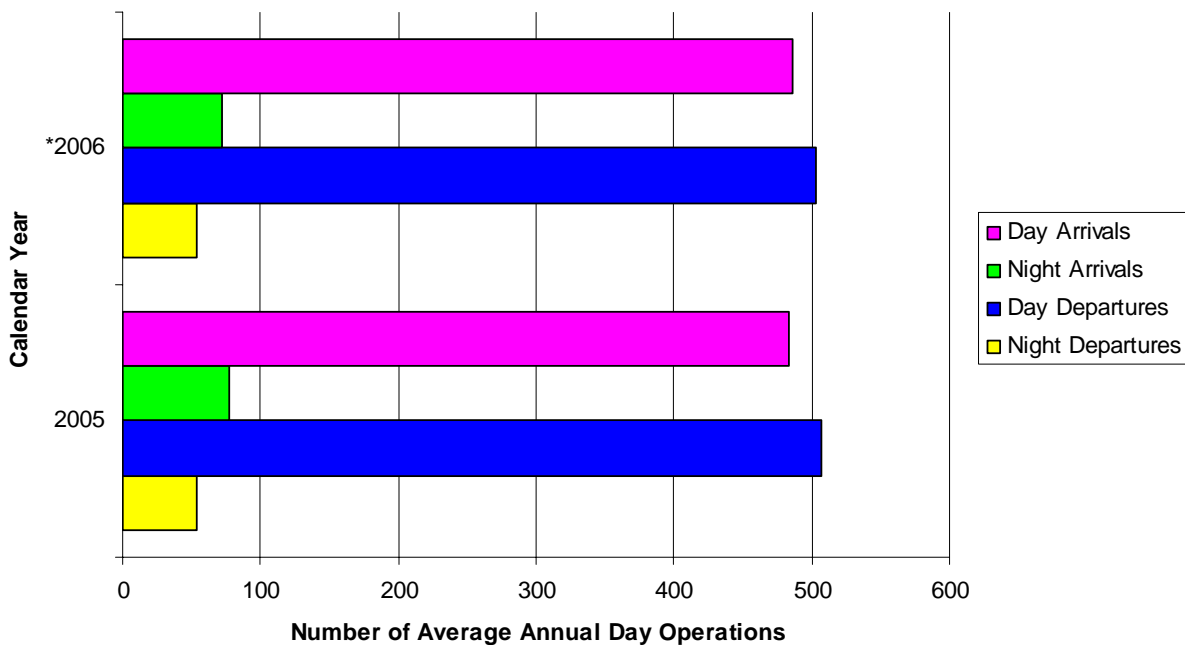
Comparison of Average Annual Day/Night Operations

Operation Type	2005	*2006
Day Arrivals	483	487
Night Arrivals	77	72
Total Arrivals	560	559
Day Departures	506	504
Night Departures	54	54
Total Departures	560	558
Total Operations	1,120	1,117

Sources: Environmental Data Report and ESPR for Boston-Logan International Airport; ANOMS data for 2006 are for the month of January through November  
 Prepared by: Wyle Laboratories, 2007

**Exhibit 4**

Comparison of Day-Night Average Annual Day Operations for 2005 and 2006



Source: See Table 4.  
 Prepared by: Wyle Laboratories, 2007

#### 4. Comparison of Runway Configuration Use

The Airport Traffic Control Tower (ATCT) uses many different runway configurations, each consisting of the use of specific combinations of arrival and departure runways during the same time period. The configurations can change several times a day, and those used between midnight (0000)

and 6:00 a.m. (0600)—the "late-night" timeframe—are different from those used during all other hours. The BOS ATCT keeps a log of the runway use configurations in Microsoft Excel, which includes date, beginning and ending times of use, and arrival and departure runways used within the configuration. This log, provided by Massport, covers the period from the beginning of 2000 through the end of 2006. The log does not detail the numbers of operations occurring during the use of each runway configuration, only the amount of time each configuration was in use.

The log data were analyzed to determine, for each year, the percentage of time during which unique configurations were in use (computed from the number of minutes per year each configuration was used). Many runway use configurations listed in the log were seldom used; therefore, only the 10 most frequently used configurations are shown on **Exhibit 5** and **Exhibit 6**. The results of the analysis are presented separately for 6:00 a.m. through midnight and midnight through 6:00 a.m. on Exhibit 5 and Exhibit 6, respectively.

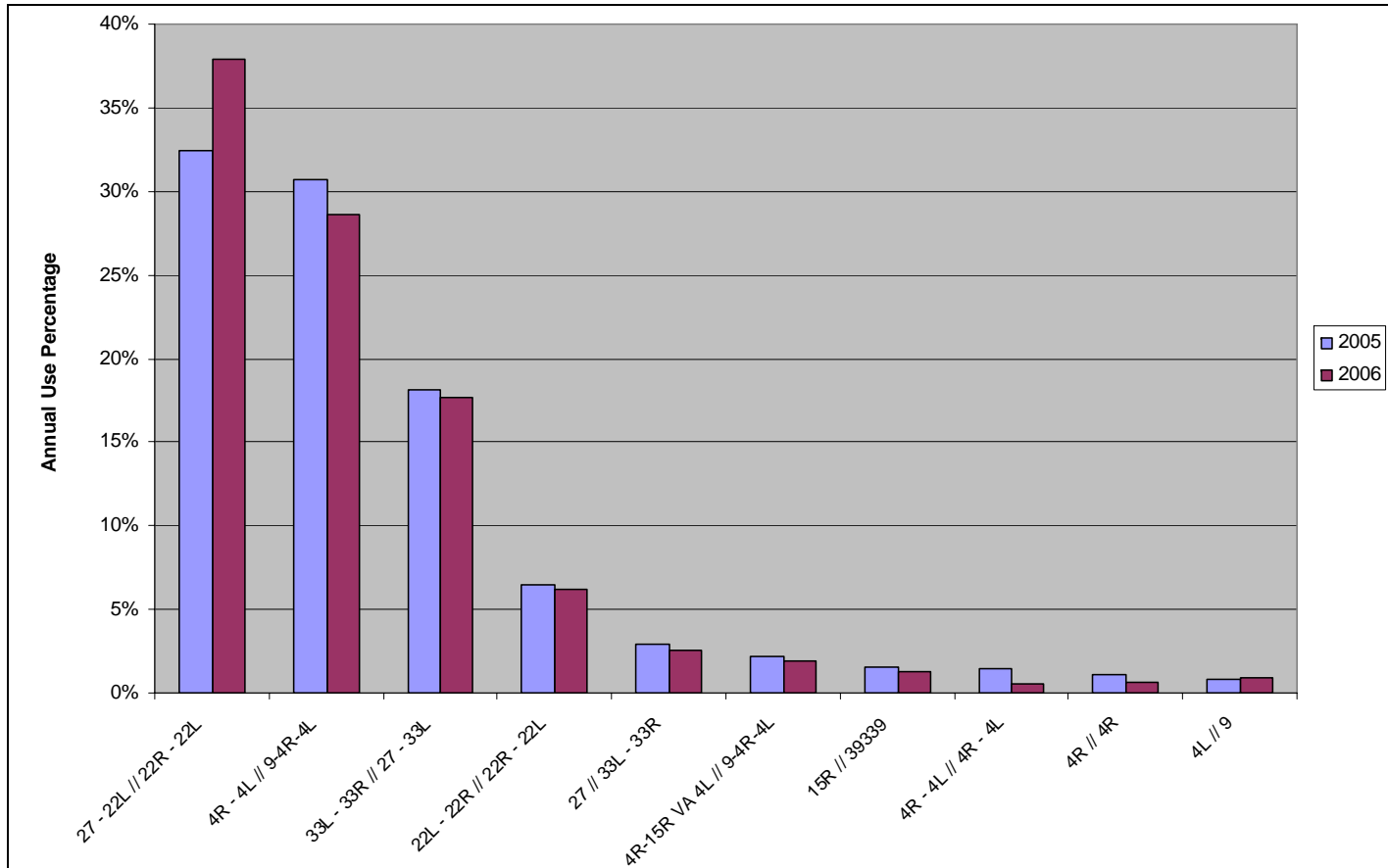
The configuration designations are shown on Exhibit 5 and Exhibit 6 on the X-axes (arrival runway(s) followed by "/" followed by departure runway(s)). The Y-axes show the percentage of time (computed from minutes per year data) each configuration was used during each year. For example, the overall most-often used daytime configuration was arrivals to Runways 27 and 22L and departures from Runways 22R and 22L: in 2005, this configuration was used 32.5 percent of daytime hours and in 2006, the configuration was used 37.9 percent of daytime hours. The use of the other daytime configurations was more consistent in 2005 and 2006. The most frequently used late-night configuration was arrivals to Runway 33L and departures from Runway 15R; this configuration was used 35.5 percent of late-night hours in 2005 and 43.3 percent of late-night hours in 2006.

Runway use configuration percentage differences from year to year resulted, in part, from the following properties of the log data: (1) some runways were used in more than one configuration—therefore, the runway use charts show different results; (2) the log specifies configurations used by time period and does not include the number of operations—therefore, the percentages shown in the exhibits are based on *time* while the runway use charts are based on *operations*.

Overall, the use of runway configurations in 2005 and 2006 was relatively consistent. From a noise modeling perspective, it is unlikely that the differences in runway configuration use would have a substantial effect on modeled noise levels for 2005 compared to 2006.

**Exhibit 5**

Runway Configuration Use (6:00 a.m. to –Midnight)

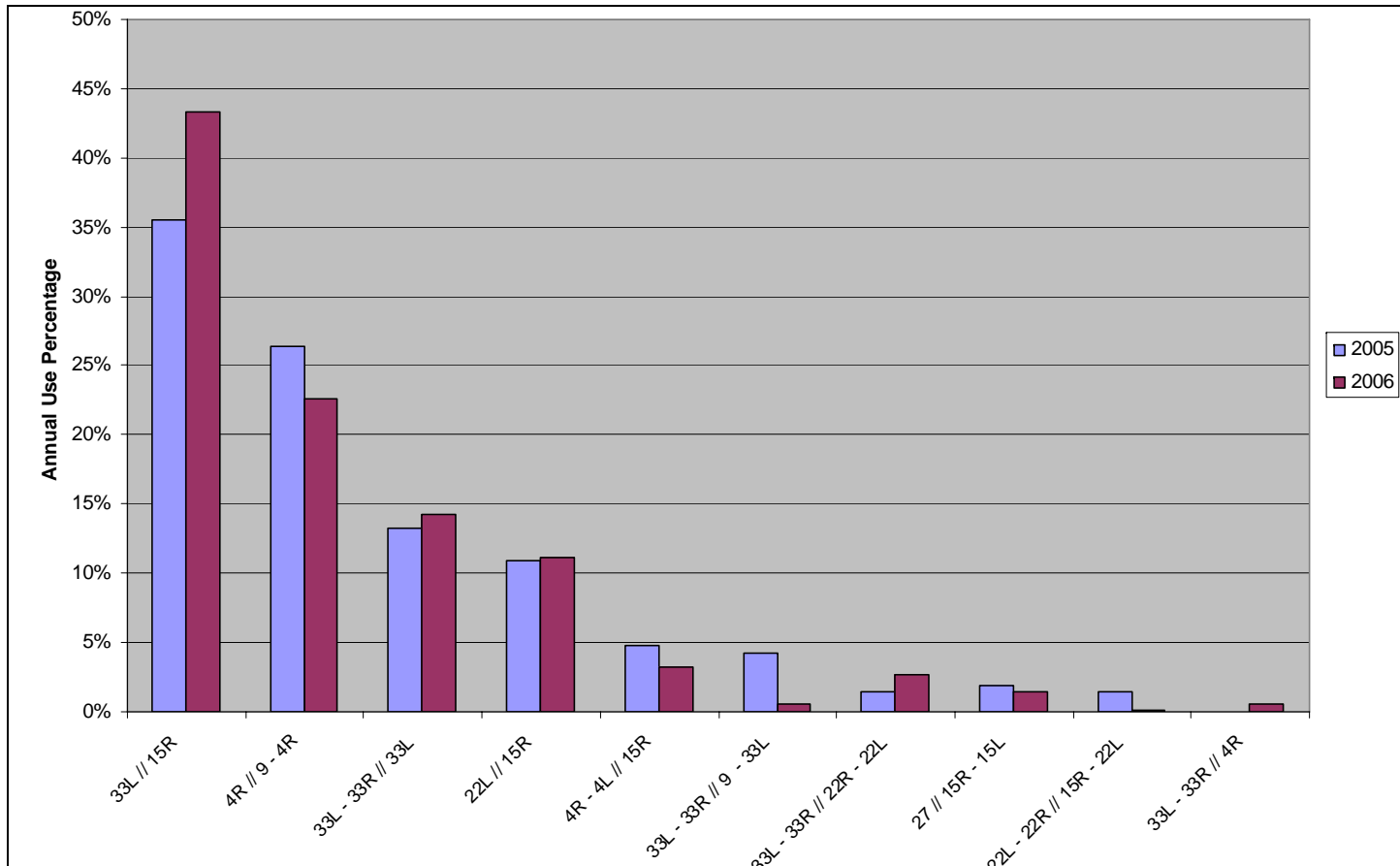


Source: BOS ATCT Runway Configuration Log, "RWCONF\_2000\_2006.xls" (MassPort, June 2007)  
Prepared by: Wyle Laboratories, 2007



**Exhibit 6**

**Runway Configuration Use (Midnight to 6:00 a.m.)**



Source: BOS ATCT Runway Configuration Log, "RWCONF\_2000\_2006.xls" (MassPort, June 2007)  
Prepared by: Wyle Laboratories, 2007



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## 5. Runway 27 Noise Abatement Departure Procedure Compliance

An additional concern regarding noise modeling for the baseline year (2005) is the compliance of flight operations with the published Runway 27 Noise Abatement Departure Procedure. This FAA procedure sets up a series of five gates, labeled A through E on **Exhibit 7**. The procedure dictates that aircraft departing from Runway 27 proceed to the GARVE "Fly-By" navigational aid, and then change heading to fly through the corridor that intersects each of the gates (corridor is shown as a roughly triangular section on Exhibit 7). This procedure has been in effect for several years. According to Massport, the location of GARVE was changed in early 2006.

Massport tracks the use of this procedure and keeps a record of monthly compliance. Compliance is determined for each gate; a flight track can either be inside the corridor (i.e., in compliance), or west or east of the corridor (i.e., not in compliance). The percentage of tracks inside the corridor for each gate is shown in **Table 5** as an average of the monthly percentages for each year. The average percentage of flights inside the corridor and standard deviation (based on monthly percentages) are shown for 2005 and 2006. The percentages are higher for the farther-away gates mainly because they are wider and the pilots have more time to get the aircraft on course. It is more difficult for a pilot to fly through a close-in gate during the initial stages of climb-out.

The data show that compliance with the NADP was higher in 2006 than in 2005. The average improvement ranged from 1.1 percent to 2.8 percent. The increase in compliance was likely a result of the relocation of the GARVE navigational aid in early 2006. Please note that this improvement is, in most cases, within the standard deviation of the monthly averages for each year.

## Conclusion

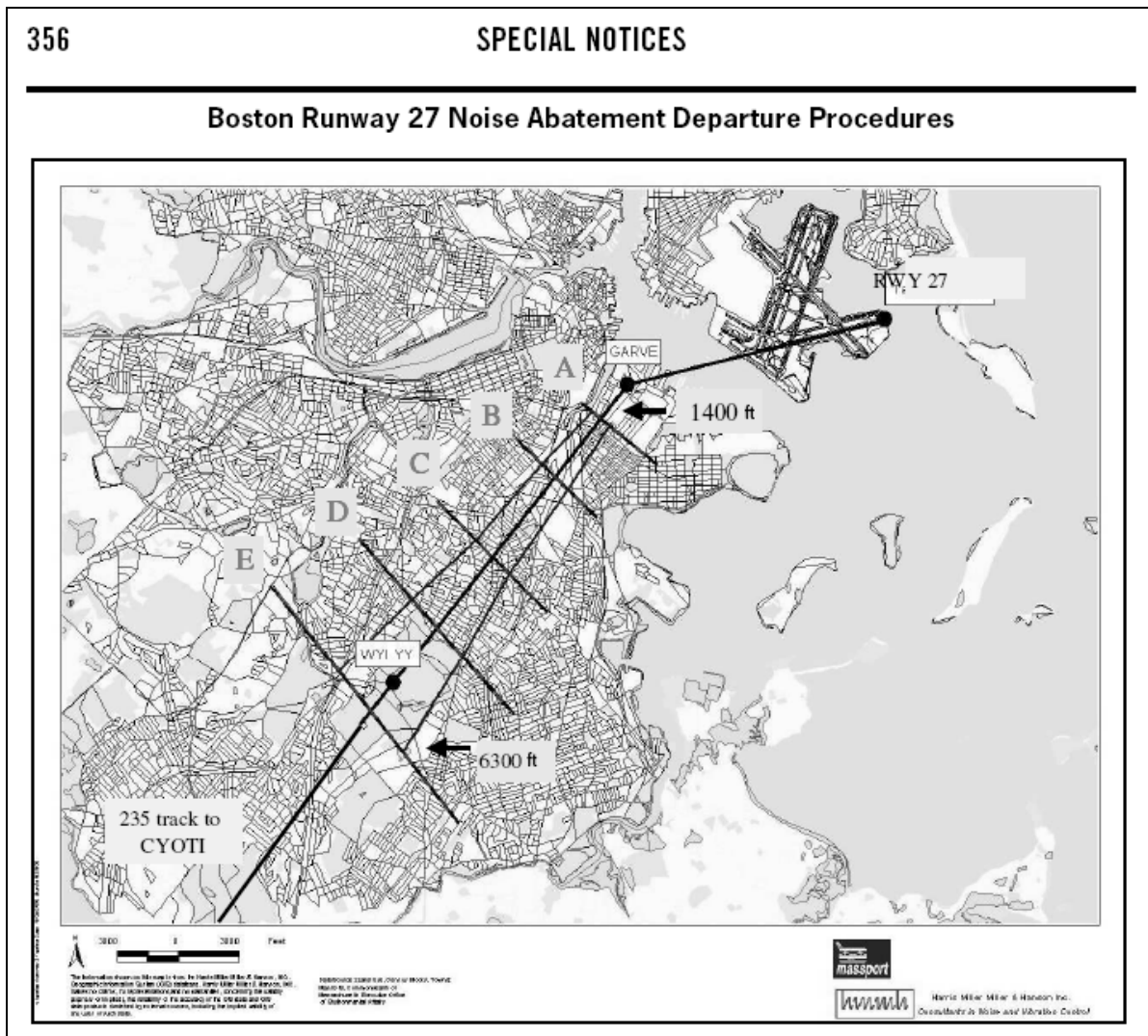
The following data were included in the analysis: average annual day operations, annual runway use, comparison of day and night annual operations, comparison of runway configuration use, and Runway 27 NADP compliance.

Based on the cursory review of the data, 2005 appears to be a suitable representation of existing conditions prior to Runway 14/32 opening for noise analysis purposes. The analyses of runway use, runway configurations, and Runway 27 NADP compliance did not show any substantial differences between the two years that would appear to have an effect on modeled noise levels.

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**Exhibit 7**

Published Runway 27 NADP



Source: [http://www.faa.gov/airports\\_airtraffic/airports/regional\\_guidance/new\\_england/environmental/logan\\_documents](http://www.faa.gov/airports_airtraffic/airports/regional_guidance/new_england/environmental/logan_documents), August 31, 2007  
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**Table 5**

**Runway 27 – Percentage of Departures Inside Corridor**

Year	Statistic	Gate A	Gate B	Gate C	Gate D	Gate E
2005	Monthly Average	60.4%	70.2%	84.4%	91.6%	87.5%
	Standard Deviation	2.4%	2.3%	2.4%	2.2%	2.8%
2006	Monthly Average	63.2%	72.5%	85.6%	92.7%	89.6%
	Standard Deviation	1.8%	1.6%	1.7%	1.3%	1.9%
	Change in Average Percentage	+2.8%	+2.3%	+1.2%	+1.1%	+2.1%

Source: Runway 27 Analysis - Percentage of Departures Inside and Outside of Corridor, March 19, 2007 (Massport 2007)  
Prepared by: Wyle Laboratories, 2007

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