

NOISE EFFECTS OF CONCORDE OPERATIONS AT
JOHN F. KENNEDY INTERNATIONAL AIRPORT
NOVEMBER 1977 THROUGH NOVEMBER 1978

OFFICE OF NOISE ABATEMENT AND CONTROL
U.S. ENVIRONMENTAL PROTECTION AGENCY

April 1979

Contents

Background	1
Purpose of this Publication	2
Introduction	3
Concorde Noise Levels	4
Concorde and Subsonic Aircraft Noise Levels	6
Noise Exposure Due to Concorde Operations	8
Community Response (Complaints)	14
Applications for the JFK Noise Monitoring Data	16
Conclusions	18
References	20

Abstract

The FAA measured the noise at several communities in the vicinity of JFK International Airport due to the operations of Concorde and subsonic aircraft. The FAA reports are factual and valuable but do not provide much discussion of the effects (current or potential) of Concorde noise on the public. This report presents the results of an analysis by the EPA of the FAA noise data which leads to interpretations of the effects of Concorde operations on the public that are different in significant respect from what might be assumed from a cursory reading of the FAA reports.

The EPA analysis of the noise levels shows that Concorde arrival noise was as much as 6 dB noisier than expected from FAR 36 test results and that Concorde operations alone establish a noise floor which under some projected numbers of operations exceed EPA goals for noise exposure. The significance of the noise floor is that regardless of whatever noise control is implemented in the future in regard to subsonic aircraft, the noise exposure will not decrease below the limiting levels set by Concordes. If there were 32 Concorde operations per day at JFK, for instance, only 7,000 people out of 188,000 exposed to Ldn 65 (NEF 30) would receive any relief even if the subsonic fleet were significantly silenced after 1985.

The EPA analysis of the record of complaints shows that there were about 100 times more complaints per Concorde operation than there were per subsonic operation.

Background

Route - proving flights of Concorde supersonic transports (SSTs) between London and Paris and New York City's John F. Kennedy International Airport (JFK) were conducted in October 1977 by British Airways (BA) and Air France (AF). Commercial operations were initiated in November 1977. The Federal Aviation Administration (FAA) set-up a noise monitoring system in the vicinity of JFK in time to record and report the results of the route-proving flights (Ref. 1).

The FAA continued monitoring the commercial operations and issued a report each month for November 1977 through October 1978 (Ref. 2). The reports contained listings of the types of aircraft and number of operations conducted at JFK, the noise levels at various sites in terms of several descriptors for all Concorde and a few subsonic aircraft operations, and a record of complaints of Concorde and subsonic aircraft noise levels. Also included in the monthly reports are information on separate monitoring programs for structural vibrations and sonic booms.

A summary report of the monitoring was issued by the FAA in January 1979 (Ref. 3) which included the results of additional noise monitoring conducted in November 1978.

Purpose of this Publication

The FAA monthly reports contain a great deal of data which is presented with little discussion or analysis. The Environmental Protection Agency (EPA), believing that the FAA reports are a valuable source of information for determining the noise effects of Concorde, examined the reports in detail. The purpose of this document, therefore, is to present the results of the EPA analysis with emphasis on the following questions:

- (1) What are the average single event noise levels that have been produced at specific communities in the vicinity of JFK due to Concorde and subsonic aircraft operations?
- (2) What are the differences in single event noise levels between Concorde operated by British Airways and Air France, and between Concorde and subsonic aircraft?
- (3) What are the noise exposure (multiple event) levels at the specific communities due to Concorde operations alone? What would be the exposure levels due to various projected operational rates?
- (4) How do the complaints of Concorde and subsonic aircraft operations compare?
- (5) Can the JFK noise monitoring data be applied to predict noise levels due to Concorde operations at other airports?

Introduction

The FAA recorded noise levels during the monitoring program at many sites which are identified by the town or village in which the measuring and recording equipment were located. However, only five of the sites were used consistently to acquire enough data for satisfactory analysis; Belle Harbor, Howard Beach, Rockaway Park, Cedarhurst, and Laurelton. The FAA reports identify the aircraft noise levels at each monitoring site in terms of: runway identification number; departures or arrivals; Concordes BA or AF; and subsonic aircraft by several types such as B707, DC-8, B747, B727, DC-9, etc.

This report has organized the FAA noise data into the following categories:

- (1) Departures at Belle Harbor, Howard Beach and Rockaway Park.
- (2) Arrivals at Cedarhurst, Howard Beach, Rockaway Park and Laurelton.
- (3) SST aircraft as Concordes (BA), Concordes (AF), and Concordes (All).
- (4) Subsonic aircraft (B707/DC-8 only).

The FAA reported the single event noise levels in terms of several descriptors but the only one presented here is the A-weighted level designated in the following as dBA. However, estimates are also provided here of multiple event noise exposure levels in terms of the day-night average sound level designated in the following as Ldn. Detailed discussions of the above two single and multiple event noise descriptors are given in the EPA "Levels Document" (Ref. 4).

In the following, the noise levels represent the average of all commercial operations where the averaging is done on a logarithmic basis, which is common when the quantities to be averaged are in decibel or decibel-like units.

Concorde Noise Levels

The average single event noise levels at the five monitored sites due to Concorde operations are shown in the bar charts of Figure 1. Concordes operated by British Airways (BA) and Air France (AF) are identified separately. The levels represent the average dBA resulting from Concorde operations for the thirteen months from November 1977 through November 1978. The purpose of showing the BA and AF levels separately is to determine if one operator produces significantly lower levels than the other which might be attributed to more effective noise abatement flight procedures.

For the three departure sites, Figure 1 shows that BA was lower at Belle Harbor by 1.9 dB and AF was lower at Howard Beach and Rockaway Park by 0.8 dB. Since each operator was lower than the other by less than three decibels, neither operator has a significantly more effective noise abatement departure procedure than the other.

For the four arrival sites, Figure 1 shows that BA was lower at Howard Beach by 2.1 dB and AF was lower at Cedarhurst, Rockaway Park, and Laurelton by 1.4, 0.3, 3.8 dB respectively. Since each operator was lower than other by less than 3 dB at Howard Beach, Cedarhurst, and Rockaway Park, neither operator has demonstrated a significantly more effective noise abatement arrival procedure than the other at those sites. However, at Laurelton, AF averaged nearly four decibels lower than BA which cannot be dismissed as an insignificant difference.

In summary, comparing the noise levels produced by BA and AF Concorde, there is no evidence that one operator has more effective noise abatement departure procedures than the other. However, there is some indication that the AF arrival procedures are capable of producing nearly four decibels less noise than those of BA which is a difference important enough to merit more investigation. Both operators should be requested to evaluate and compare arrival procedures to determine if those of AF are superior for noise abatement. If the results show that AF's arrival procedures are capable of being quieter than those of BA, then both airlines should be requested to implement those procedures consistently.

Concorde and Subsonic Aircraft Noise Levels

The noise levels due to Concorde and B707/DC-8 subsonic aircraft operations for the five monitored sites are shown in Figure 2. In this case, the Concorde levels are identified as Concorde (All), which is the average of the Concorde (BA) and the Concorde (AF) levels. Just as for Figure 1, the levels shown in the bar-charts of Figure 2 represent the average single event noise levels of all Concorde and B707/DC-8 operations for the thirteen months from November 1977 through November 1978.

The levels for B707 and DC-8 subsonic aircraft were combined and identified as B707/DC-8 because they are very similar aircraft powered by the same type of engines. Those two aircraft were chosen for comparison with Concordes in preference to other subsonic-types because they constitute nearly half of all of the subsonic aircraft measured by the FAA during the course of the monitoring period. Furthermore the B707/DC-8 aircraft are in widespread use and are among the noisiest of the subsonic air carrier fleet.

The purpose of comparing Concorde (All) and B707/DC-8 noise levels is to determine if the differences are as expected from a knowledge of the Federal Aviation Regulations Part 36 (FAR 36) noise certification tests (Ref. 5). Those tests are made to certify noise levels of aircraft and are conducted under specified operating conditions that are not necessarily duplicated in commercial service. The differences expected from FAR 36 are that Concordes would be about 8 dB noisier than B707/DC-8 aircraft for departures, while for arrivals, the noise levels

for Concordes would be about the same or slightly less than for B707/DC-8 aircraft (Ref. 6 and 7).

For the three departure sites, Figure 2 shows that Concorde (All) was noisier than B707/DC-8 by 8.0 dB at Belle Harbor, by 6.0 dB at Howard Beach, and by 2.9 dB at Rockaway Park. All of the exceedances are as expected or less which indicates that departure flight procedures may be accomplishing some noise reduction, perhaps as much as five decibels at Rockaway Park.

For the four arrival sites, Figure 2 shows that Concorde (All) was noisier than B707/DC-8 by 0.9 dB at Cedarhurst, by 3.9 dB at Howard Beach, by 0.1 dB at Rockaway Park, and by 6.1 dB at Laurelton. Therefore, at three of the four arrival sites, Concorde noise was greater than expected from FAR 36 tests.

In summary, comparing the noise levels produced by Concordes and B707/DC-8 aircraft, the monitored results indicate that:

- (1) On departure, Concordes can be as noisy as expected (about 8 dB greater than B707/DC-8) but can be quieter by as much as 5 dB, possibly as a result of conducting noise abatement flight procedures.
- (2) On arrival, Concordes can be as noisy as expected (about the same as B707/DC-8) but as much as 6 dB noisier, possibly as a result of not conducting noise abatement flight procedures.

Noise Exposure Due To Concorde Operations

The average noise levels of Concorde operating singly are discussed in the foregoing and shown in Figures 1 and 2. However, the daily cumulative noise exposure due to multiple events of Concorde is a meaningful measure of the effect of Concorde noise on the population of the monitored communities. The measure of noise exposure chosen for this analysis is the day-night average sound level, Ldn and the projected numbers of daily operations chosen are as follows:

- (1) 4 (current),
- (2) 14 (British/French market estimate, Refs. 6 and 8),
- (3) 32 (FAA lower limit, Ref. 6), and
- (4) 50 (FAA upper limit, Ref. 6).

The predicted noise exposure levels due to Concorde operating at the five selected sites are shown in Figure 3 and Table 1. The noise exposure levels are based upon the average single event levels for Concorde (All) shown in Figure 2. Each site is assumed to be exposed to the noise of Concorde operating with the summer-time percent runway use indicated in Figure 3, taken from the FAA August report (Ref.1). Also included for each site is the special case of 50 operations per day and 100 percent runway use. The bar-charts of Figure 3, therefore, represent envelopes where the lower bar at each site represents the noise exposure due to the current number of operations of Concorde and summer-time runway use, and the upper bar represents the noise exposure due to the maximum number of Concorde operations projected by the FAA operating from one runway exclusively.

Since 50 operations per day may seem unreasonable in view of the promulgation of the SST rule (Ref.5), the following explanation for including them is presented. The FAA points out in the Environmental Impactment Statement (EIS) (Ref.6) that their projections of 32 to 50 operations per day are based upon an assumed first generation fleet of 30 to 40 Concorde operating at 13 airports within the United States even though the SST rule limits the U.S. Concorde fleet to only 16. Although 32 operations per day can be conducted at JFK by 16 Concorde, and 50 per day may be conducted under the most favorable conditions, it is unlikely that the number of daily operations will exceed the British and French market estimate of 14, providing the U.S. Concorde fleet remains limited to the original 16.

Nevertheless, the EIS identifies a specific number of Concorde operations at each of the 13 U.S. airports, and 50 is the upper limit number assigned to JFK. The "Probable Noise Impact" for JFK is determined in the EIS for 50 operations per day (25 departures and arrivals each) in terms of the increase in population within specific noise exposure contours. Furthermore, the FAA has stated that it would not be necessary to prepare another EIS relative to Concorde operations at any of the 13 airports provided the number of operations does not exceed those assigned in the EIS.

In view of the above, it is reasonable to predict the noise exposure at the monitored sites for the maximum number of operations considered by the FAA. In the event that the market demand for Concorde increases, renewed pressure from the Concorde operators and developers to relax the 16 aircraft limit may be expected. The full range of predicted community noise exposures at each site shown in Figure 3, based upon the FAA noise monitoring program, provides

additional insight on the probable noise impact beyond that contained in the EIS. The results of the JFK monitoring program, as well as the EIS, furnish background for determining whether amendments to the SST rule should be permitted, in the event that they are requested.

The maximum noise exposure (top bar) for each site shown in Figure 3 assumes that all Concorde operations at JFK occur on a single runway which, of course, is not likely on a permanent basis due to weather variations, runway maintenance, accidents, etc. However, it is possible that 100 percent runway utilization may occur for a significant length of time (from several days to several weeks) which may be enough to cause a noticeable degradation in community noise environment during that period.

Also, it must be emphasized that the noise exposure levels of Figure 3 represent noise floors due to the predicted number of Concorde operations and runway use. Regardless of whatever noise control is implemented in the future in regard to subsonic aircraft (such as retrofit or design of the source, noise abatement flight procedures, and operational restrictions) the noise exposure will not decrease below the noise floors set by Concordes.

The implications of the Concorde floor can be illustrated in terms of land areas and people by analyzing the two examples of Concorde operations at JFK given in the EIS (Ref. 6). The first example considers 8 Concorde operations per day mixed with the 1978 subsonic air carrier fleet, many of which do not comply with the FAR 36 noise level requirements. The second example considers 32 Concorde operations per day mixed with an assumed 1978 subsonic air carrier fleet, all of which comply with at least the 1969 requirements of FAR 36.

In the first case, 185 square miles and 487,000 people are exposed to Ldn 65 dB or greater due to the combined operations of subsonics and Concorde. If only subsonics were operating, the land area and population would be 175 square miles and 485,000 people, respectively. And, if only Concorde were operating, about 29 square miles and 85,000 people would be exposed which is the noise floor in terms of area and people due to 8 Concorde operations per day alone.

In the second case, 90 square miles and 188,000 people are exposed to Ldn 65 dB or greater due to the combined operations of subsonics and Concorde. If only subsonics were operating, the land area and population would be 45.5 square miles and 164,000 people, respectively. And, if only Concorde were operating, about 64 square miles and 181,000 people would be exposed which is the noise floor in terms of area and people due to 32 Concorde operations per day alone.

For the first example, the addition of only 8 Concorde operations per day to a relatively noisy subsonic fleet adds 10 square miles and 2,000 people to the Ldn 65 dB exposure. Although that increase may appear modest, the relatively few daily Concorde operations would insure that at least 29 square miles and 85,000 people would be exposed to Ldn 65 dB or greater, even if the subsonic fleet was substantially silenced or rerouted.

The second example shows that the addition of 32 Concorde operations per day to relatively quiet subsonic fleet adds 44.5 square miles and 24,000 people to the Ldn 65 dB exposure. What is more significant, however, is that regardless of how much noise abatement is applied in the future to the subsonics, at most only 7,000 out of 188,000, people would be relieved from the Ldn 65 dB or greater noise exposure.

There are three values of Ldn that are significant to the EPA as national goals (Ref. 9):

- (1) "Reduce environmental noise exposure of the population to an Ldn value no more than 75 dB immediately, utilizing all available tools, except in those isolated cases where this would impose severe hardship."
- (2) "Through vigorous regulatory and planning actions, reduce environmental noise exposure levels to Ldn 65 dB or lower, and concurrently reduce noise annoyance and related activity interference caused by intrusive noises."
- (3) "In planning future programs concerned with or affecting environmental noise exposure, to the extent possible, aim for environmental noise levels that do not exceed an Ldn of 55 dB. This will ensure protection of the public health and welfare from all adverse effects of noise based upon present knowledge."

Examining Figure 3 and Table 1, it is seen that for the current departure and arrival operations (4 operations per day, 2 each departures and arrivals), the noise exposure floor established by Concorde operations is less than Ldn 55 dB. Thus the EPA lower goal is not exceeded, at least not solely by Concordes. For the British and French market estimate of 14 operations per day, the Ldn 55 dB goal is exceeded for departures at Belle Harbor and Rockaway Park, and exceeded for arrivals at Cedarhurst and Howard Beach. For the FAA lower limit of 32 operations per day, the Ldn 55 dB goal is exceeded at all sites for departures and exceeded for arrivals at Cedarhurst and Howard Beach. For the FAA upper limit of 50 operations per day and normal runway use, the Ldn 55 dB goal is exceeded at all sites for departures and exceeded at all sites except Rockaway Park for

arrivals. For the special case of 50 operations per day and 100 percent runway use, the Ldn 65 dB goal is exceeded at Rockaway Park for departures and at Howard Beach for arrivals.

In summary, Concorde operations at JFK at the current rate of 4 per day do not impose an environmental degradation that violates the EPA lower limit goal of Ldn 55 dB. However, increasing Concorde operations to the extent of the British and French market estimate of 14 per day and to the FAA lower limit projection of 32 per day would prevent achieving the EPA lower goal at all communities except Laurelton. In fact, for 32 operations per day, the noise exposure at Belle Harbor and Rockaway Park would exceed Ldn 60 dB. For the FAA upper limit projection of 50 operations per day and normal runway use, the EPA lower goal would be exceeded at all communities, and Ldn 60 dB would be exceeded at all communities except Laurelton. For the worst case of 50 operations per day and 100 percent runway use, Ldn 60 dB would be exceeded at all communities, Ldn 65 dB would be exceeded at Howard Beach and Rockaway Park, and Ldn 70 dB would be exceeded at Howard Beach.

Community Response (Complaints)

Figure 4 shows the monthly record of complaints received from all communities of Concorde and of all subsonic aircraft operations. The maximum number of Concorde complaints were received in the months of May through August, and of subsonic complaints in the months of May through September. The maximum number of complaints per month was 657 for Concordes in May and 1,674 for subsonics in August which is about 2.5 times as many complaints of subsonic aircraft as there were of Concordes on the basis of the maximum month for each.

The fact that complaints of subsonic aircraft exceed those of Concordes is expected, considering that the number of operations of subsonic aircraft far exceed those of Concordes. The operational comparisons are shown in Figure 5 which gives the monthly record of operations of Concordes and of all subsonics. The maximum number of operations of Concordes and subsonics occurred in the months of May through October. The maximum number of operations per month was 155 for Concordes in October and 31,230 for subsonics in July which is about 200 subsonic operations for every Concorde operation on the basis of the maximum month for each.

Table 2 lists the 13-months total of complaints and operations of Concordes and of all subsonics. For the thirteen months, there were 2.35 times as many complaints of Concordes as there were of subsonics but 234 subsonic operations for every Concorde operation. The result is a complaint density of 232 complaints per 100 operations for Concordes compared to 2.33 for the subsonics which translates to about 100 times as many complaints per operation of Concordes as there were per operation of subsonic aircraft.

In summary, while it is true that complaints of Concorde were less than half of those of all subsonic aircraft, when the numbers of operations of the aircraft were considered, the complaints of Concorde exceeded by about 100 times the complaints of subsonic aircraft. That result is unexpected considering that the Concorde complaints were based upon about four operations per day (two each departures and arrivals) which produced a noise exposure contribution less than Ldn 55 dB. That fact leads to concern for the extent of community response if Concorde operations ever reach the British and French market estimate of 14 per day or the FAA projections of 32 or 50 per day.

Applications for the JFK Noise Monitoring Data

Monitoring of aircraft noise in the vicinity of a specific airport and the subsequent analysis should include as objectives: (1) providing information for quantifying the noise exposure due to present and projected operations; (2) determining the need for and extent of noise abatement; and (3) developing operational methods for reducing noise exposure. However, in addition to the site specific information, there is a potential for acquiring data useful for translation to aircraft operations at other sites and other airports. In the case of the FAA monitoring program at JFK, it is the differences in noise levels between Concorde and B707/DC-8 aircraft which may be the data useful for application to other airports that may have Concorde operations in the future.

The reason that the actual levels of Concorde noise measured at the JFK monitoring sites have no real significance for airports other than JFK is because of lack of supporting data (distance to aircraft, thrust setting, aircraft weight, engine type, etc.). However, the differences in noise levels between Concordes and subsonic airplanes are meaningful because the JFK results can be applied to other airports where Concordes and subsonic aircraft would use the same runways and produce nearly the same flight tracks.

For example, Concordes departing from JFK averaged 3 to 8 dB noisier than B707/DC-8 subsonics, depending upon the effectiveness of the Concorde noise abatement procedures. Therefore, at another airport, the same range of differences would be expected to hold. For the case of Concordes arriving at JFK, the measured levels indicated that the best to be expected is that Concordes would

be about as noisy as the B707/DC-8 subsonics. However, at some sites, Concorde operations were as much as 6 dB noisier than subsonic operations, possibly as a result of not conducting noise abatement arrival procedures. Therefore, at another airport, Concordes might be expected to be about as noisy as B707/DC-8 subsonics provided rather strict arrival procedures were maintained.

All that is necessary, therefore, for another airport to predict the range of approximate noise levels of Concorde operations, is a knowledge of the noise produced by B707/DC-8 subsonic aircraft at that airport and the differences measured at JFK. The assumption, of course, is that the Concordes would use the same runways and produce approximately the same flight tracks as the subsonic aircraft.

The same reasoning may not be valid in regard to complaints. If another airport has a record of complaint density for subsonic aircraft (complaints per 100 operations), the complaint density of Concorde operations cannot necessarily be predicted from a knowledge of the relative density of complaints at JFK. Nevertheless, the results of the analysis of complaints at JFK may be of some use as background information.

Conclusions

The noise monitoring program conducted by the FAA at JFK has provided the data necessary for determining the noise exposure of present Concorde operations at selected sites at JFK and for estimating the effects of projected Concorde operations at those sites and other airports. The data should be particularly useful to airport operators in deciding the number of Concorde operations they can tolerate or whether they want Concordes at all.

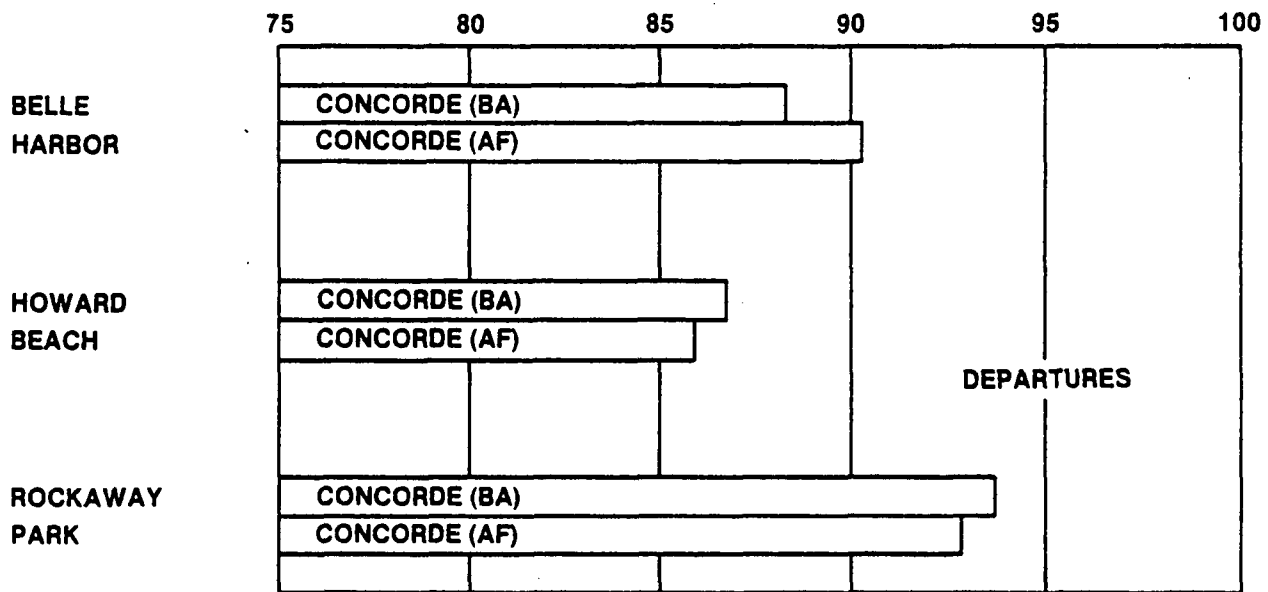
Specific conclusions are as follows:

- (1) Concorde departures can be about 8 dB noisier than B707/DC-8 departures, which was as expected from FAR 36 test results, but noise abatement procedures possibly can reduce the exceedance to about 3 dB.
- (2) Concorde arrivals can be about as noisy as B707/DC-8 arrivals, which was as expected, but unfortunately can be as much as 6 dB noisier, possibly as a result of not conducting noise abatement flight procedures.
- (3) Air France's arrival procedures may be capable of producing nearly four decibels less noise than those of British Airways.
- (4) Concorde operations establish a noise floor which under some projected numbers of operations will exceed EPA goals. Regardless of whatever noise control is implemented in the future for subsonic aircraft (retrofit or design at the source, noise abatement flight procedures, etc.) the noise exposure will not decrease below the floor set by Concordes.

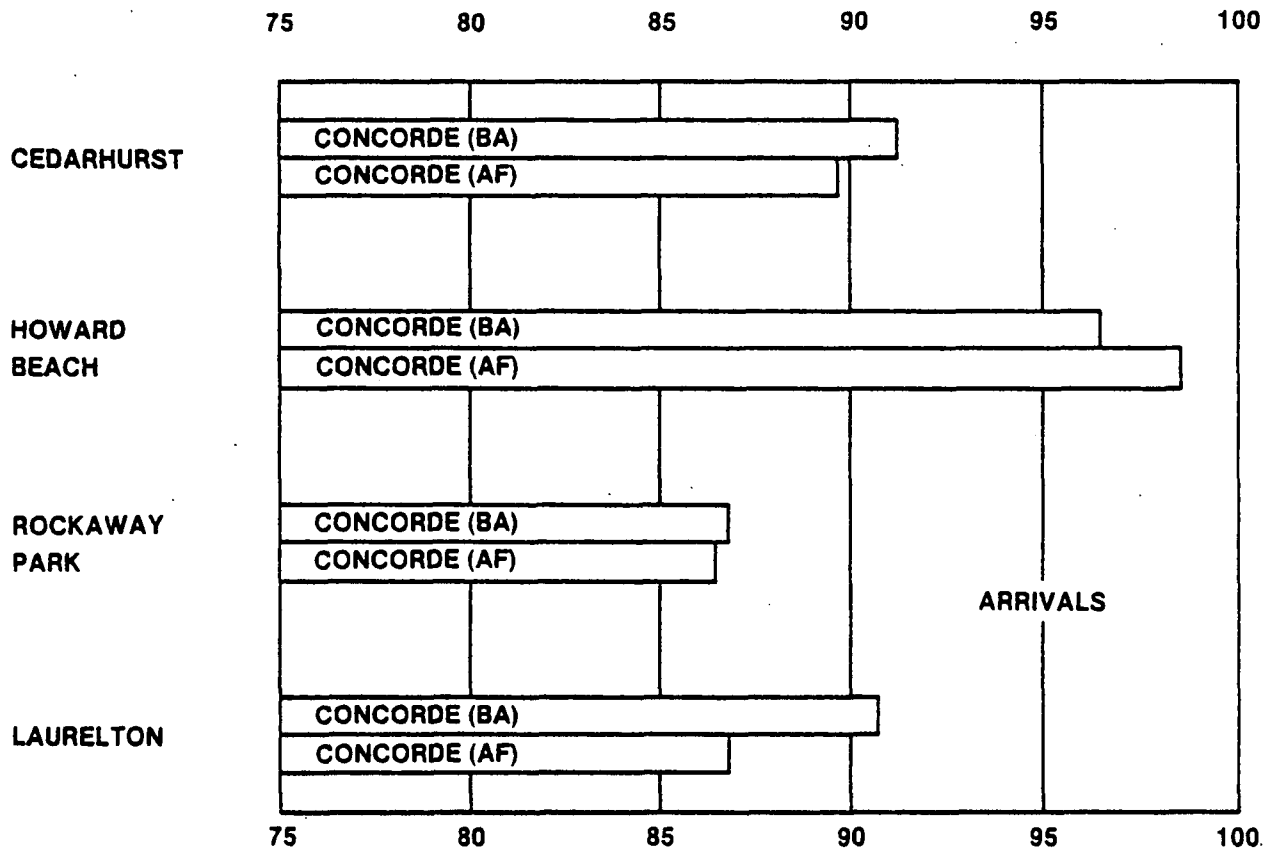
- (5) In terms of future expectations at JFK in reducing noise exposures due to the introduction of Stages 2 and 3 and even lower noise level aircraft as replacements for current Stage 1 aircraft, the operation of even a small number of Concorde will to a large extent vitiate these expectations.
- (6) The EPA goal of Ldn 55 dB is not exceeded at any monitoring site solely by the present Concorde operations of 4 per day. However, that goal would be exceeded solely by Concorde operations at four sites by the British and French market estimate of 14 per day and by the FAA lower projection of 32 per day, and at all five sites by the FAA upper projection of 50 per day.
- (7) Ldn 60 dB would be exceeded solely by Concorde operations at two sites by the FAA lower projection of 32 per day, at four sites by the FAA upper projection or 50 per day and normal runway use, and at all five sites by 50 operations per day and 100 percent runway use. In fact for the latter projection, Ldn 65 dB would be exceeded at two sites and Ldn 70 dB exceeded at one site.
- (8) Although the total number of Concorde complaints was less than half of those of subsonics, Concorde complaints per operation were about 100 times those of subsonics. That result is surprising considering that the four Concorde operations per day do not exceed the EPA lower goal of Ldn 55 dB.

References

1. "Concorde Monitoring, John F. Kennedy International Airport, Route-Proving Flights", U.S. Department of Transportation, Federal Aviation Administration, October 1977.
2. "Concorde Monitoring, John F. Kennedy International Airport", U.S. Department of Transportation, Federal Aviation Administration, November 1977 through October 1978.
3. "Concorde Monitoring Summary Report, John F. Kennedy International Airport", U.S. Department of Transportation, Federal Aviation Administration, November 1977 - November 1978.
4. "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety", U.S. Environmental Protection Agency, 550/9-74-004, March 1974.
5. "Noise Standards: Aircraft Type and Airworthiness Certification", Federal Aviation Regulations Part 36, Amendment 36-10, "Civil Supersonic Airplanes, Noise and Sonic Boom Requirements", 43 FR 28406, 29 June 1978.
6. "Final Environmental Impact Statement: Noise Regulation and Type Certification Alternatives for Civil Supersonic Aircraft", Federal Aviation Administration, June 1978.
7. "Measured or Estimated (Uncertificated) Airplane Noise Levels", Federal Aviation Administration Advisory Circular; AC No: 36-2A, 6 February 1978.
8. "Oral Testimony by Concorde Spokesman", Hearing before the U.S. Federal Aviation Administration, Washington, D.C., 15 December 1977.
9. "Toward a National Strategy for Noise Control", U.S. Environmental Protection Agency, April 1977.



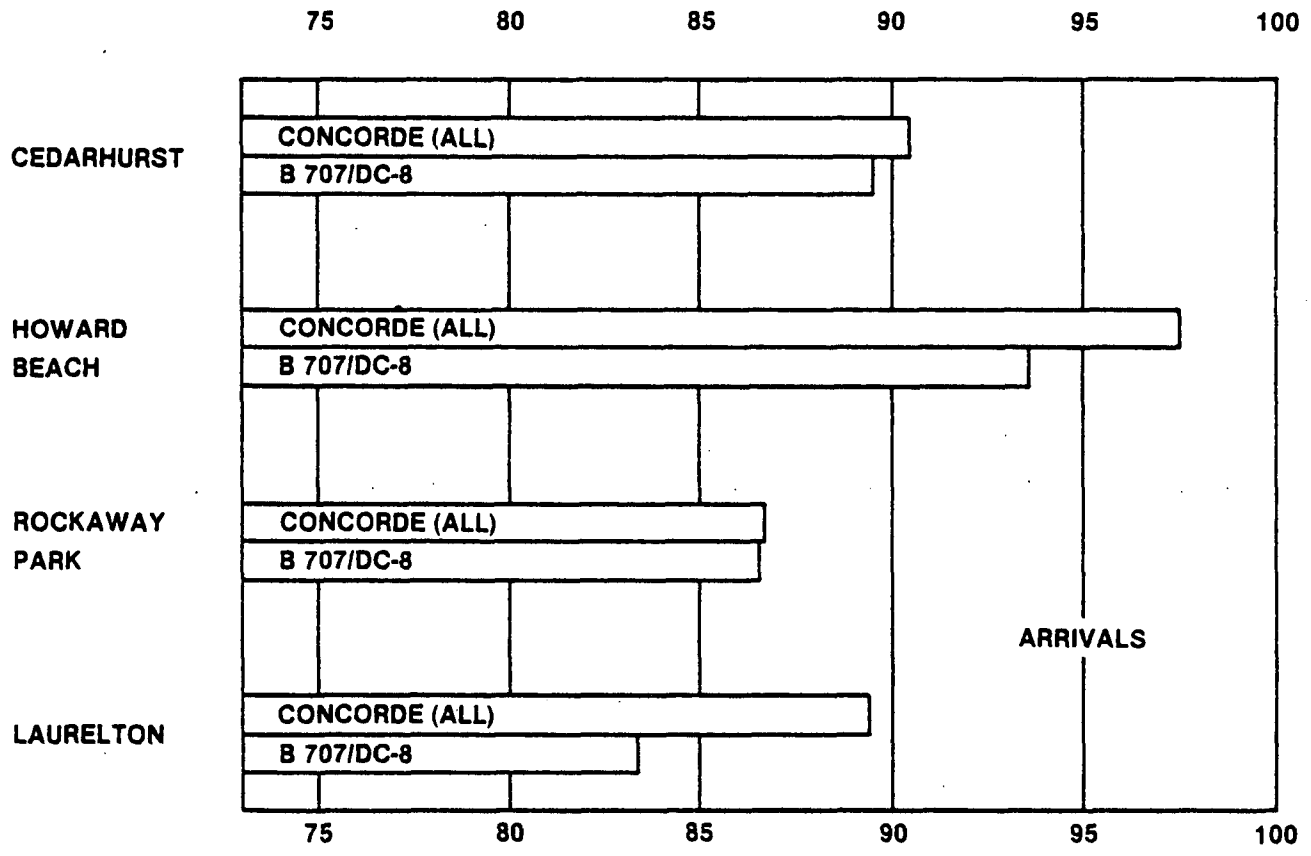
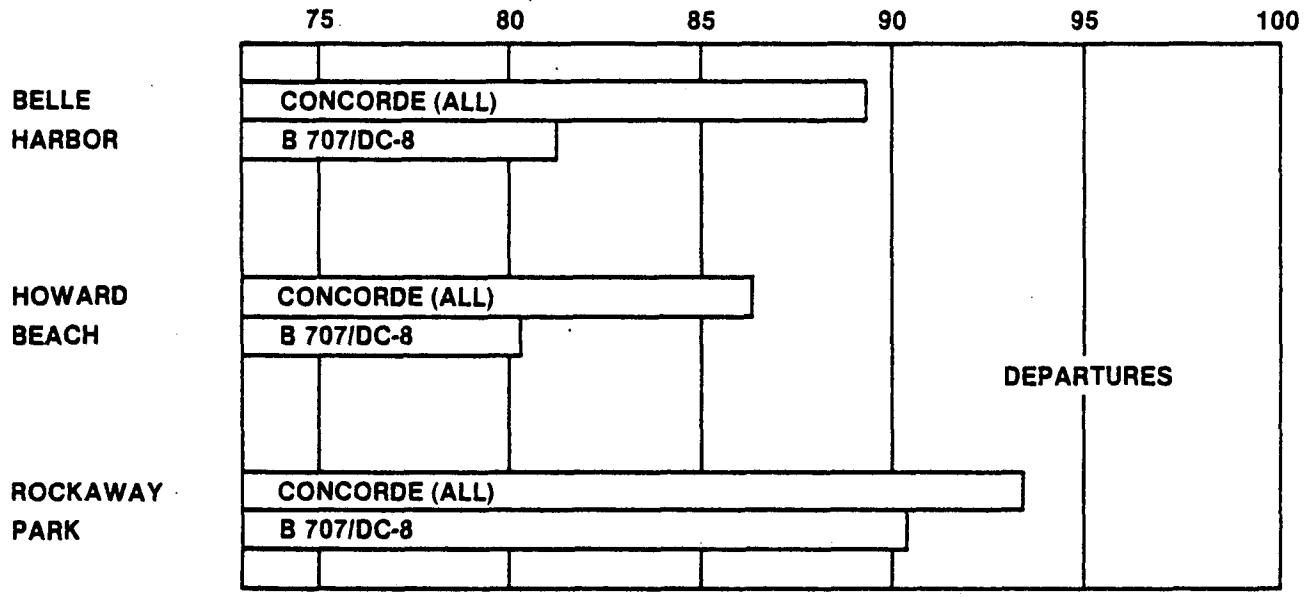
DEPARTURES



ARRIVALS

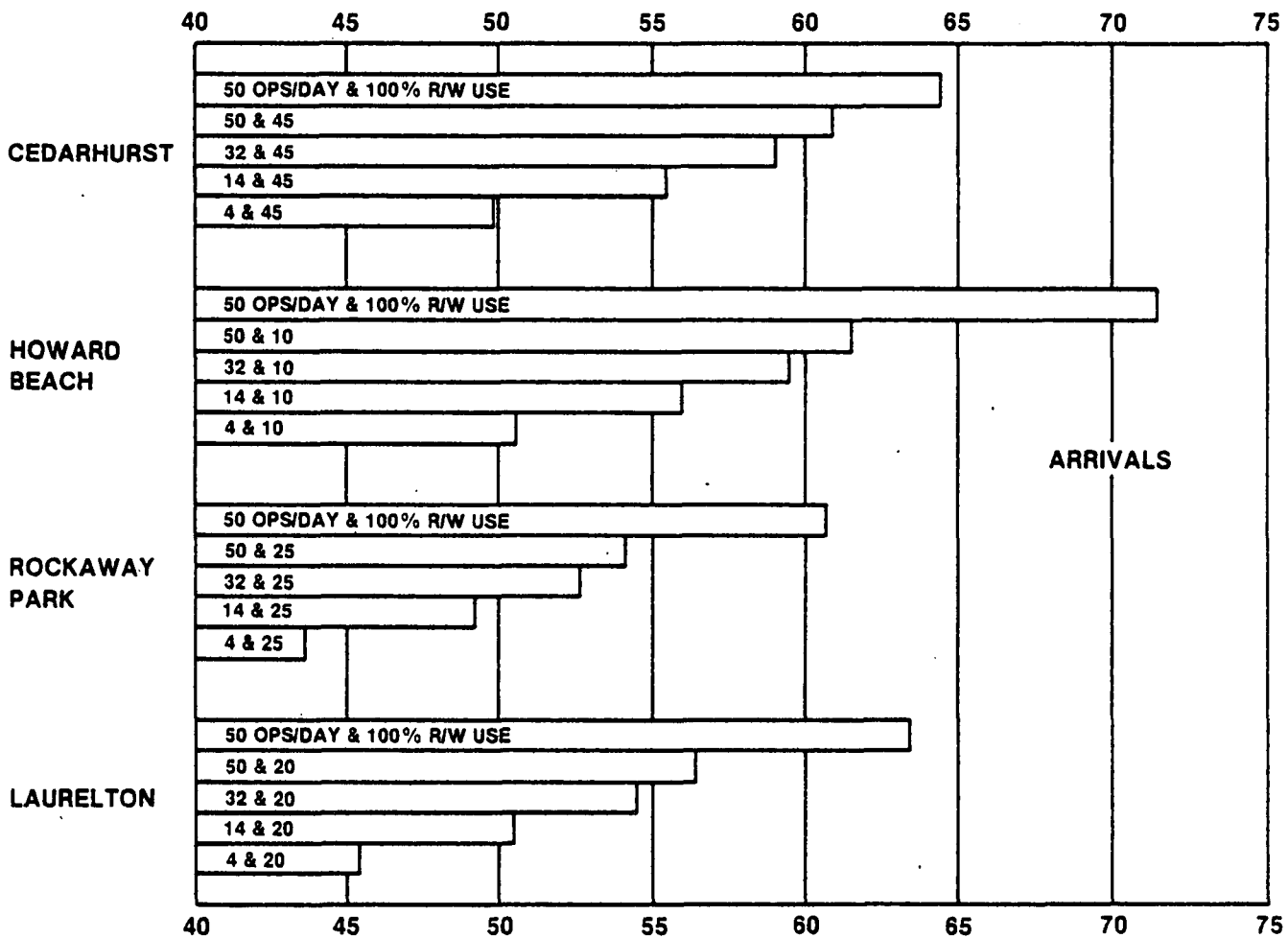
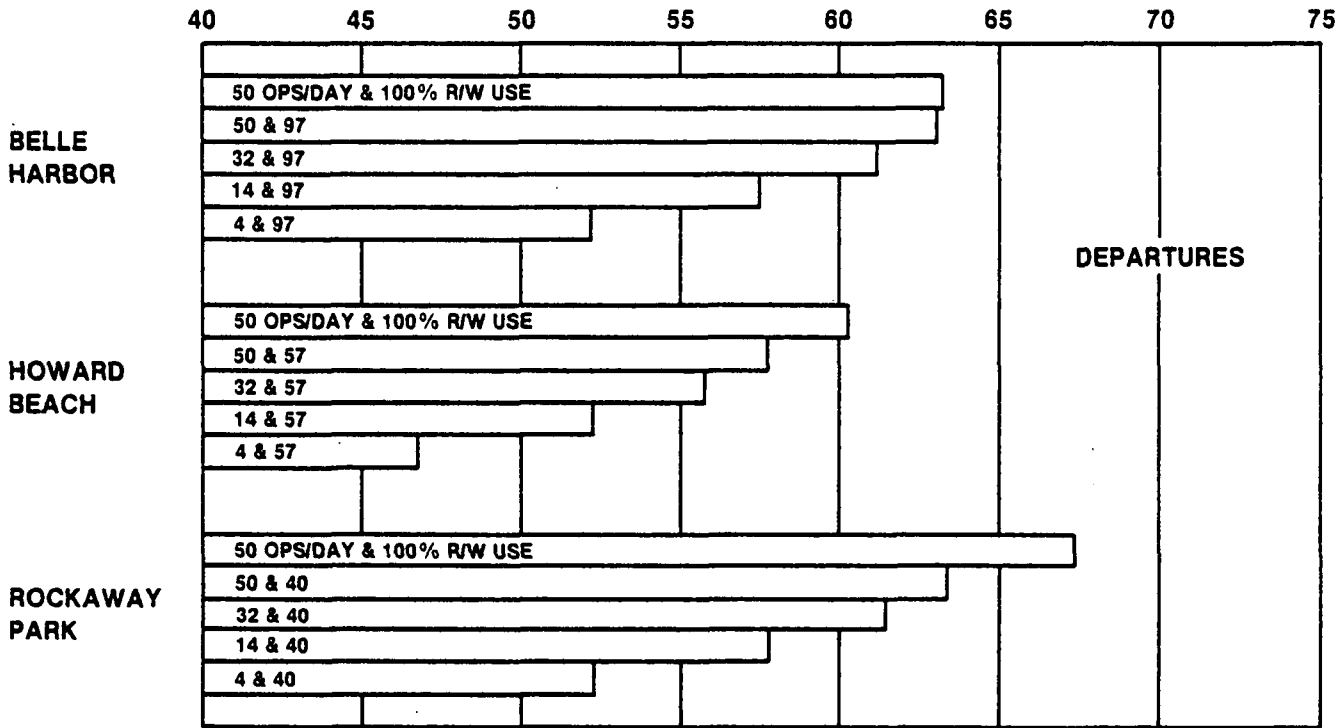
A-WEIGHTED NOISE LEVEL, dBA, dB

FIGURE 1. AVERAGE NOISE LEVELS FOR CONCORDE (BA) AND CONCORDE (AF).



A-WEIGHTED NOISE LEVEL, dBA, dB

FIGURE 2. AVERAGE NOISE LEVELS FOR CONCORDE (ALL) AND B707/DC-8.



DAY-NIGHT AVERAGE SOUND LEVEL, Ldn, dB

FIGURE 3. PREDICTED NOISE EXPOSURE DUE TO CONCORDES ONLY.

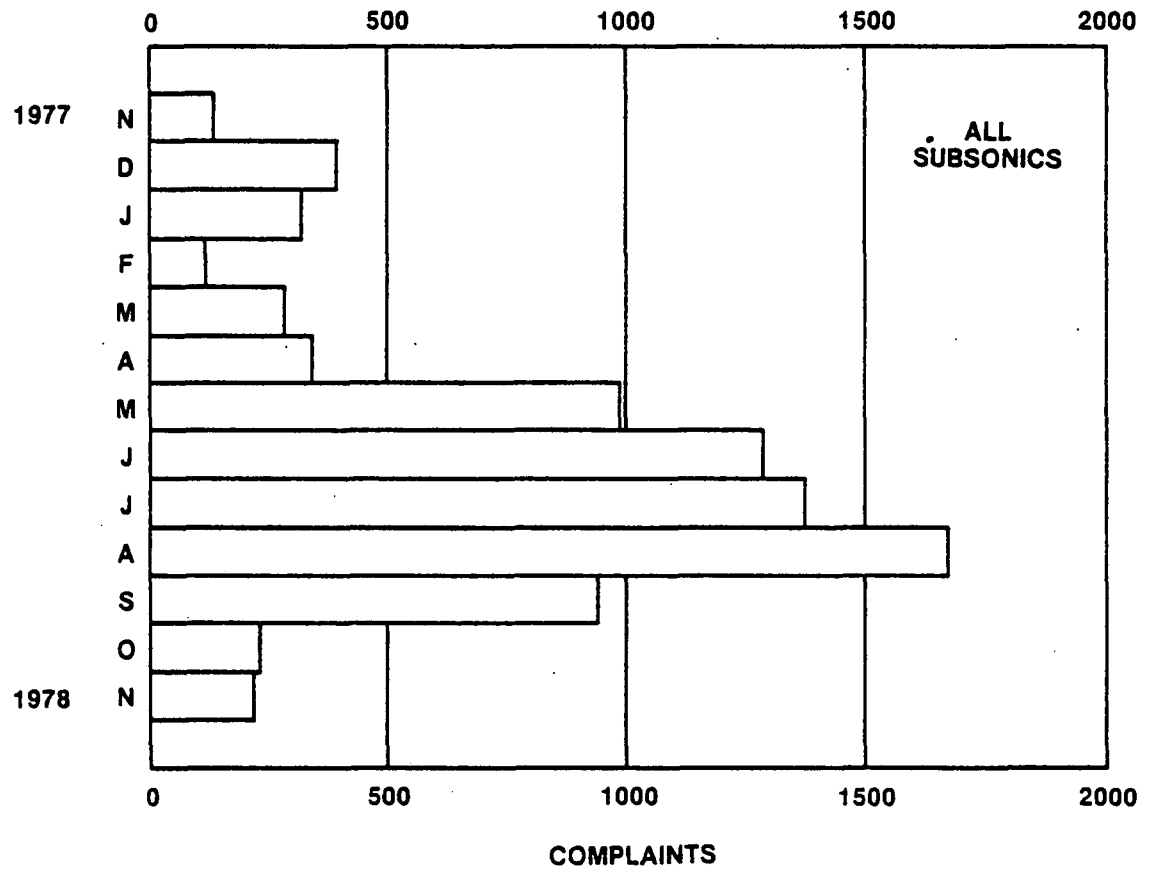
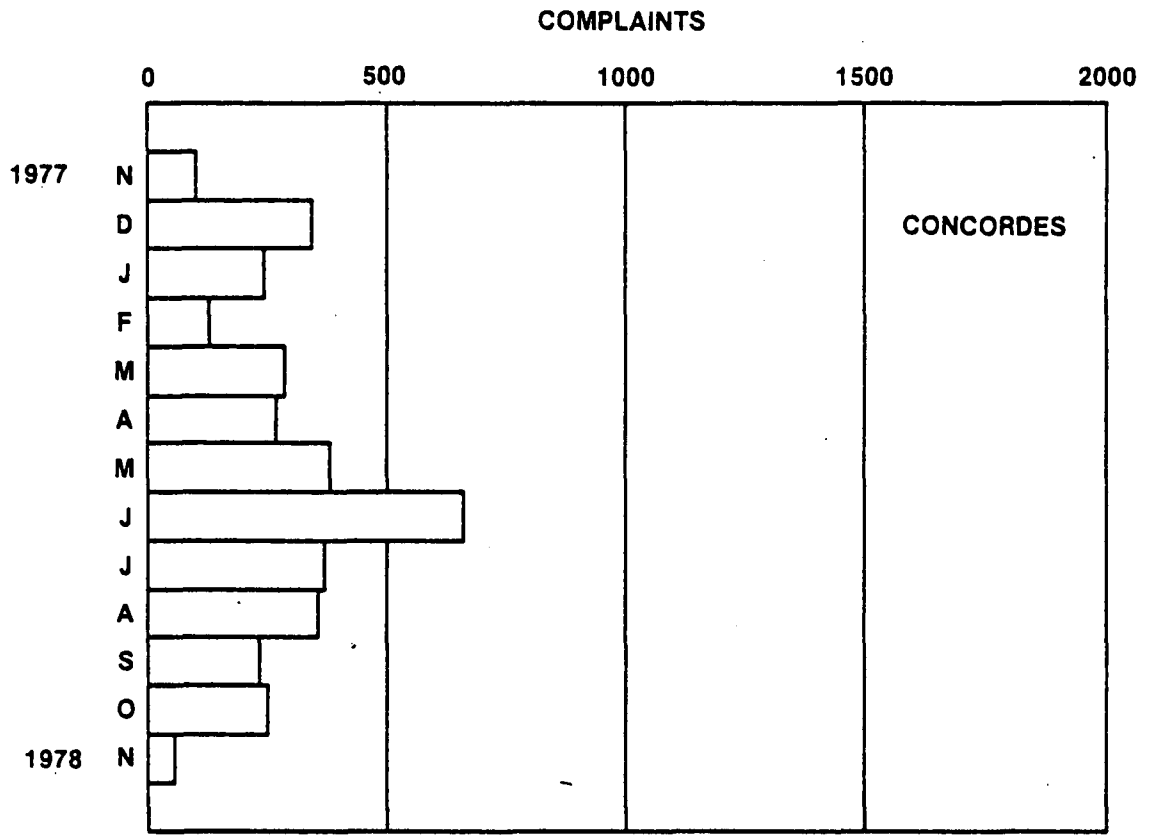


FIGURE 4. COMPLAINTS FROM ALL COMMUNITIES

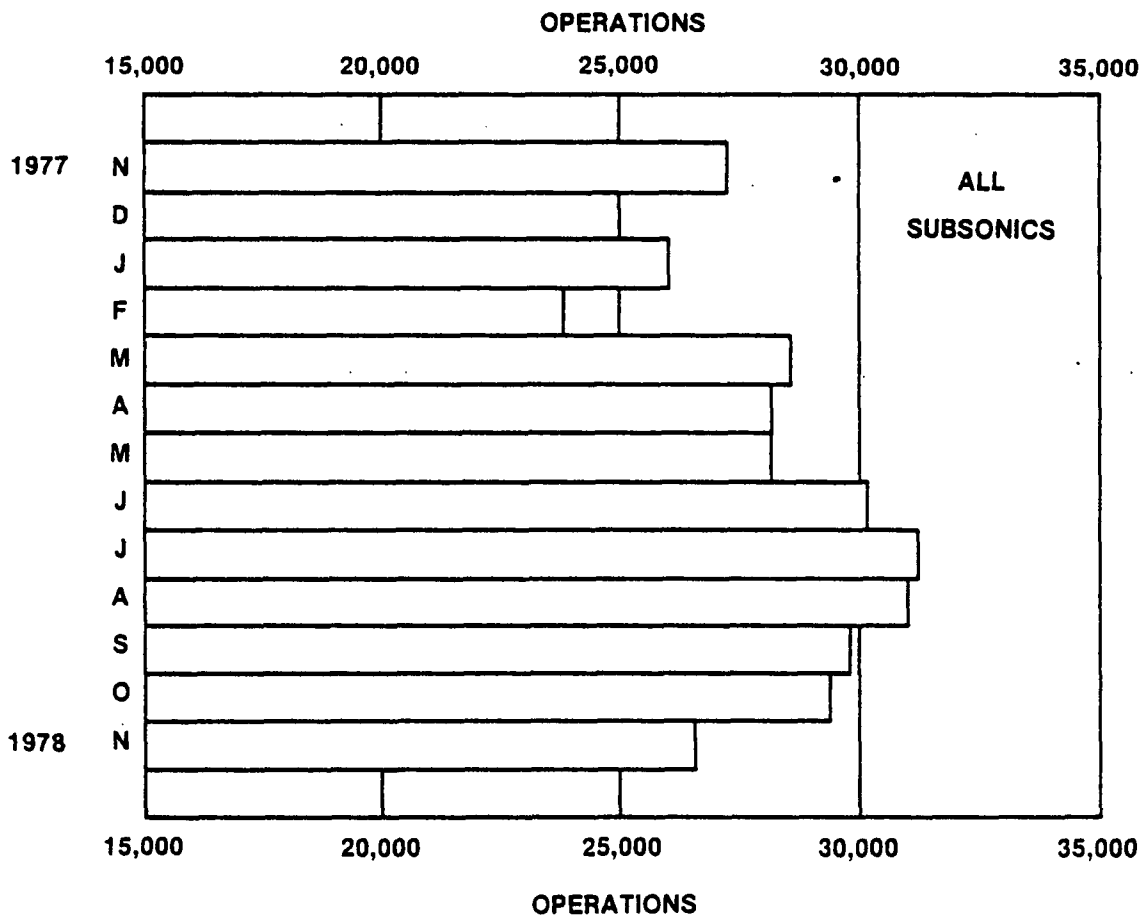
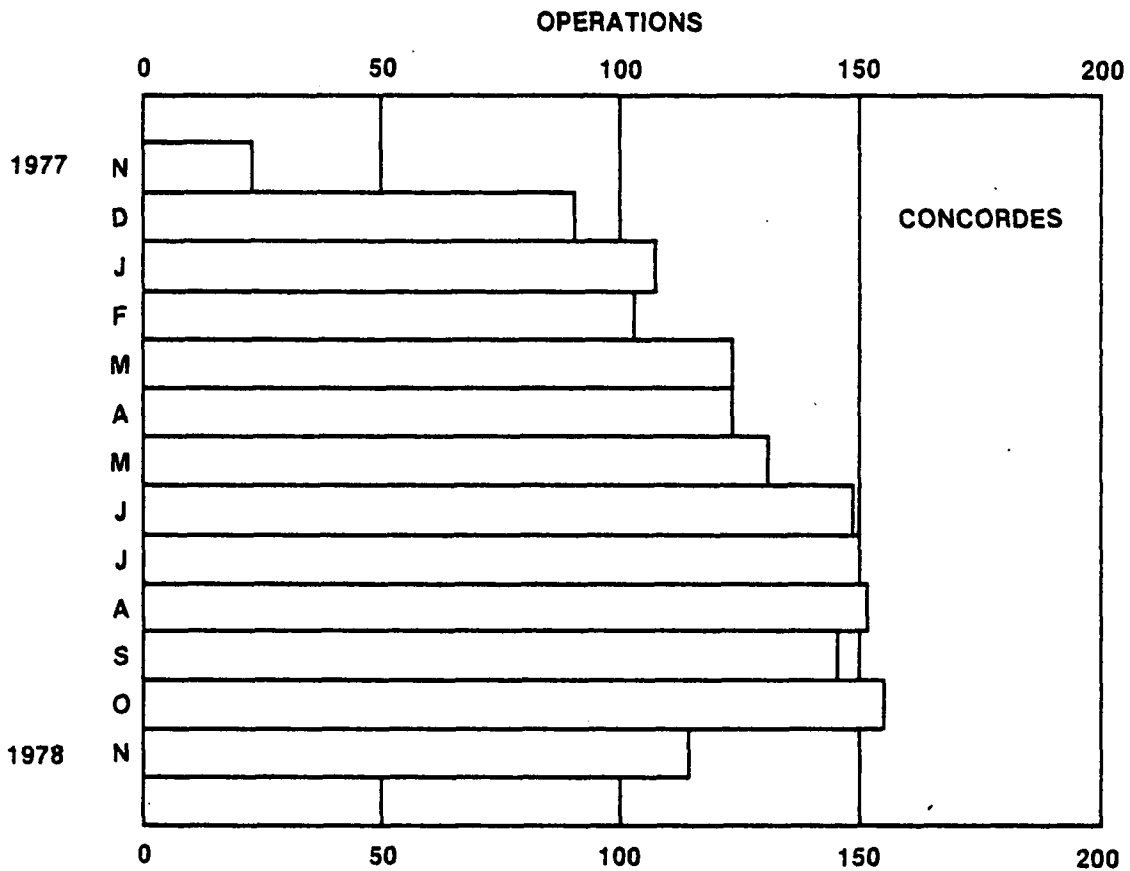


FIGURE 5. DEPARTURES AND ARRIVALS.

DAY-NIGHT AVERAGE SOUND LEVEL, Ldn, dB										
	4 OPS DAY		14 OPS DAY		32 OPS DAY		50 OPS DAY		*50 OPS DAY	
	DEP	ARR	DEP	ARR	DEP	ARR	DEP	ARR	DEP	ARR
BELLE HARBOR	52.1	NA	57.5	NA	61.1	NA	63.0	NA	63.2	NA
HOWARD BEACH	46.8	50.5	52.2	56.0	55.8	59.5	57.7	61.5	60.2	71.5
ROCKAWAY PARK	52.3	43.7	57.8	49.1	61.4	52.7	63.0	54.7	67.3	60.7
CEDARHURST	NA	49.9	NA	55.4	NA	59.0	NA	60.9	NA	64.4
LAURELTON	NA	45.4	NA	50.5	NA	54.5	NA	56.4	NA	63.4

* 100% RUNWAY USE

N/A NOT APPLICABLE



EXCEEDS Ldn 55 dB



EXCEEDS Ldn 65 dB

TABLE 1. PREDICTED NOISE EXPOSURE DUE TO CONCORDES ONLY

	CONCORDES	ALL SUBSONICS	RATIO
TOTAL COMPLAINTS	3,620	8,500	2.35
TOTAL OPERATIONS	1,560	365,000	234
COMPLAINTS PER 100 OPERATIONS	232	2.33	99.6

TABLE 2. COMPLAINTS FROM 13-MONTHS OF OPERATIONS