

B A C K G R O N D R E P O R T
O N C O N C O R D E
F L I G H T O P E R A T I O N S

R E V I S E D

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I. BACKGROUND

On February 4, 1976, Secretary of Transportation Coleman announced his decision to allow British Airways and Air France to conduct limited scheduled Concorde flights into Dulles International Airport and John F. Kennedy International Airport (JFK) for a trial period not to exceed 16 months. Service began at Dulles on May 24, 1976. The 16-month trial period ended on September 24, 1977. A ban on Concorde operations by the Port Authority of New York and New Jersey delayed the beginning of the trial period at JFK until November 22, 1977. The ban was challenged in court by British Airways and Air France; and, on September 29, 1977, the U.S. Court of Appeals (Second Circuit) ordered the Port Authority to allow Concorde operations at JFK.

On September 23, 1977, Secretary of Transportation Adams directed the Federal Aviation Administration (FAA) to amend the operations specifications of British Airways and Air France to allow limited Concorde operations to continue at Dulles and JFK indefinitely and to allow operations at 11 other airports, including the Seattle-Tacoma International Airport (SeaTac).

This report discusses the predicted impact of one Concorde flight per day on SeaTac and its environs, the recent court case involving landing rights for Concorde at JFK which attempts to delineate the role of airport proprietors in airport noise abatement, and current FAA noise regulations for subsonic aircraft and proposed regulations for supersonic jets.

II. SUMMARY

The FAA and the Environmental Protection Agency (EPA) have written a Draft Environmental Impact Statement (DEIS) and a supplemental EIS (SDEIS) estimating the impact of Concorde operations at 13 airports including SeaTac. The estimates for SeaTac are based on the impact of one Concorde flight (two operations) per day in 1987. According to those documents, two Concorde operations a day would have two effects on SeaTac in terms of noise impact. First, an additional 1,000 people would be included within that area considered to be most severely impacted by aircraft noise. Second, people currently residing in areas which are rarely exposed to aircraft noise, if at all, would be affected by Concorde noise.

The Port of Seattle, in letters to the FAA commenting on the SDEIS and proposed noise regulations for supersonic jets, has indicated that the addition of Concorde operations would have a serious effect on its SeaTac Communities Plan which was developed to reduce the impact of airport noise on nearby communities. One of the noise remedy programs included in the Communities Plan is to acquire outright much of the property within the area most severely impacted by aircraft noise. In those letters, the Port stated that the inclusion of 1,000 additional people (300 houses) within that area would increase the cost of property acquisition by \$10-15 million.

Proposed federal noise regulations for supersonic jets would allow all current generation Concorde (those with flight time before January 1, 1980) to generate noise at their current levels indefinitely. Second generation Concorde (first flight time after January 1, 1980) would have to meet more stringent noise requirements. The noise remedy programs in the Communities Plan were originally developed under the assumption that all aircraft operations at SeaTac would meet these more stringent noise requirements by 1985.

However, the airport proprietor does not have to rely on federal regulations alone to control airport noise. The recent court case involving landing rights for Concorde at JFK stated that an airport proprietor may establish regulations for controlling airport noise as long as those regulations are reasonable, nonarbitrary and nondiscriminatory.

If, however, nondiscriminatory means that the same noise rules must be applied to supersonic and subsonic aircraft, many noise regulations, if they took effect immediately, would affect not only the Concorde but many of the older and noisier subsonic jets as well. Under current federal regulations, these older subsonic jets do not have to meet the more stringent noise requirements until 1985.

III. IMPACT OF CONCORDE OPERATIONS AT SEATAC

The Final Environmental Impact Statement (FEIS)², estimating the impact of Concorde operations at Dulles and JFK, and the Draft Environmental Impact Statement (DEIS)³ and its supplement (SDEIS)⁴, estimating the impact of Concorde operations at 13 airports including JFK and Dulles, use two types of noise indices: a cumulative noise index, and single event noise indices.

Cumulative Noise

The Noise Exposure Forecast (NEF) is a measure of the cumulative noise from airport operations to which communities around the airport are exposed. The NEF analysis involves construction of contours which link together points of equal cumulative noise exposure. The area inside the contour is exposed to more noise, and the area outside the contour is exposed to less noise than the area at the contour.

There is some disagreement as to what cumulative noise levels are acceptable. However, Secretary Coleman, in his decision to allow Concorde operations at Dulles and JFK,⁵ reported the following as being generally accepted:

- Less than NEF 30 Essentially no complaints; noise may interfere with community activities.
- NEF 30 to NEF 40 Individuals may complain; group action possible.

Greater than NEF 40 Repeated vigorous complaints expected;
group action probable.

NEF 45 Threshold of possible hearing loss.

The DEIS estimates the NEF 30 and NEF 40 contours for SeaTac for 1978 baseline (no Concorde operations), 1987 baseline, and 1987 baseline plus Concorde (one flight per day). The 1987 baseline condition assumes that all aircraft meet the Stage 2 Federal Aviation Regulations Part 36 (FAR 36) noise requirements. (FAR 36 regulations establish three stages of sound levels for subsonic aircraft with specified limits. Older aircraft of older design must meet Stage 1 limits; newer production models of older design aircraft and current design aircraft must meet Stage 2 limits; and new design aircraft must meet Stage 3 limits.) The 1987 baseline plus Concorde condition assumes all aircraft except the Concorde meet the FAR 36 requirements. The Concorde is assumed to generate noise at the Stage 1 level. The decrease in the area within the NEF 30 and NEF 40 contours between 1978 baseline and 1987 baseline, then, is largely attributable to the FAR 36 requirements (Table I).

By way of clarifying the information in Table I, it should be noted that the area within the NEF 30 contour includes the area within the NEF 40 contour, i.e., the area within the NEF 30 contour is that area exposed to cumulative noise of NEF 30 and greater. Thus, the total increase in area affected by the addition of one Concorde flight per day (two operations) at NEF 30 or greater is two square miles. There is no increase in total area within the NEF 40 contour. But, the impact of one Concorde flight is not only to increase the size of the area within the NEF 30 contour, but also to change the shape of the contours, due in part to different flight patterns. Thus, when a Concorde flight is added, more airport property and water area is included between the NEF 30 and NEF 40 contours and less airport property is included within the NEF 40 contour. When airport property and water area are excluded from the analysis, then, the total increase in area within the NEF 30 contour is still two square miles. However, one square mile is between the NEF 30 and NEF 40 contours and one square mile is within the NEF 40 contour.

Table II shows that the extension of the NEF 30 contour in the baseline plus Concorde condition will result in 1,000 additional people being contained within that contour. It also shows that 1,000 people who are between the NEF 30 and NEF 40 contours without Concorde operations will be contained within the NEF 40 contour in the baseline plus Concorde condition.

The increase of one square mile of nonairport property and 1,000 people within the NEF 40 contour could have significant implications for the SeaTac Communities Plan adopted by the Port of Seattle and King County. The Plan included several noise remedy programs to be applied to a 44 square mile area around the airport. These programs are summarized as follows:

1. Outright acquisition of areas permanently exposed to cumulative noise of NEF 40 or greater, where permanent is defined as remaining at NEF 40 or higher throughout the 20-year planning period of the Plan--1973 to 1993. (The actual measure used by the Port is Adjusted Noise Exposure, or ANE, because the boundaries of the 44 square mile area included in the Plan do not conform to the NEF contours. However, at any one point, ANE 40 equals NEF 40.)

Table I

Summary of Areas Contained Within NEF Contours for
Seattle-Tacoma International Airport

(all areas expressed in terms of square statute miles)

Case Description	NEF Value	Total Area	Impact Area				
			Total*	Residential	Parks & Rec.	Commercial	Industrial
1978 Base	30	33-34	28-29	17-18	3-4	3-4	3-4
	40	5-6	2-3	1-2	1-2	0-1	0-1
1987 Base	30	23-24	20-21	13-14	2-3	2-3	1-2
	40	3-4	0-1	0-1	0-1	0-1	0-1
1987 Base + Concorde**	30	25-26	22-23	14-15	2-3	2-3	2-3
	40	3-4	1-2	0-1	0-1	0-1	0-1

* Excludes airport property and water area contained within the NEF contour.

** Baseline mix modified to accommodate added Concorde operations.

Table II

Summary of Population Contained Within NEF Contours at
Seattle-Tacoma International Airport

(all population figures expressed in terms of thousands of people)

Case Description	Number of People Contained Within Contour			
	NEF 30		NEF 40	
	1978 ¹	1987 ¹	1978 ¹	1987 ¹
1978 Base	101	-	8	-
1987 Base	71	71	1	1
1987 Base + Concorde ²	72	72	2	2

¹Forecast Population.

²Base aircraft mix modified to accommodate added Concorde operations.

2. A purchase guarantee of noise-impacted private properties, if so desired by the affected property owner, in areas exposed to sustained noise levels of NEF 40 or greater. A sustained exposure level is one that is expected to fall below NEF 40 at some point during the planning period.
3. Cost-shared acoustic insulation programs for areas between the NEF 35 and NEF 40 contours.

The Port, in letters to the FAA⁶, has indicated that these programs were developed on the assumption that all aircraft operating at SeaTac would meet Stage 2 noise levels by 1985. The Port also indicated that the inclusion of an additional 1,000 people (300 houses) in the property acquisition area (permanent NEF 40 or greater) as a result of Concorde operations, would increase the cost of this program by \$10-15 million.

Single Event Noise Indices

There are two measures of single event noise (noise generated by one aircraft operation) used in the DEIS. One is the effective perceived noise level (EPNL) measure in effective perceived noise decibels (EPNdB), and the other is the single event noise contour or "footprint."

Because some frequencies are perceived as being louder than others, even though the physical intensities of the sounds are the same, the EPNL applies differential weightings to physical intensities of sounds at different frequencies in order to equate them in terms of perceived noisiness. The EPNL also applies a weighting for time duration of the event. An increase of 10 EPNdB represents a doubling of perceived noisiness.

The FAR 36 regulations require that aircraft noise be measured at three places: one for takeoff, one for approach, and one as a sideline measure. Below, Concorde is compared to four other aircraft at these FAR 36 measuring points:

	<u>Concorde</u>	<u>B/707-300</u>	<u>DC-8-61</u>	<u>B/747-200</u>	<u>DC-10-30</u>
	(measurements in EPNdB)				
Takeoff	119.5	116	116	107	104
Sideline	112.0	102	102	98	97
Approach	116.5	118	117	107	108

Boeing 707's and DC-8's are among the loudest aircraft now landing at SeaTac. The newer B/747's, including the B/747-200 and the DC-10's, are among the quietest. It can be seen that the Concorde is over 25 percent noisier than the B/707 and DC-8 on takeoff, twice as loud at the sideline measuring point, and somewhat

quieter on approach. This is an important point because many noise regulations which affect the Concorde will also affect the B/707's and DC-8's, which currently represent about 15 percent of aircraft operations at SeaTac. However, under FAR 36, these aircraft will have to meet Stage 2 noise limits by 1985 or be replaced by aircraft which do comply. This is not true of Concorde.

The single event noise contour, or footprint, is an imaginary line that connects points of equal aircraft noise level (EPNL). Points inside the contour are impacted by an EPNL greater than that of points on the contour (see Appendix 1). The exact size and shape of the contour, for any one type of aircraft, will vary depending on the approach and takeoff procedures that are assumed. On approach, the Concorde EIS's assume a three percent glide slope for all aircraft. On takeoff, a noise abatement procedure is assumed for Concorde, while takeoff procedures recommended in FAA Advisory Circular 91-39 are assumed for subsonic aircraft.^{8, 9} Below, the footprint for the Concorde, utilizing a noise abatement takeoff, is compared to the Concorde and four subsonic jets, utilizing the AC 91-39 takeoff procedures.

	<u>Concorde Full Power</u>	<u>Concorde Noise Abatement</u>	<u>B/707-320</u>	<u>DC-8-61</u>	<u>B/747-200</u>	<u>DC-10-30</u>
	(measurements in square miles)					
<u>Approach</u>						
110 EPNdB	1.29	1.29	.616	.821	.168	.128
100 EPNdB	11.10	11.10	2.470	3.620	.586	.288
<u>Takeoff</u>						
110 EPNdB	8.16	9.30	1.970	2.260	.594	.287
100 EPNdB	54.30	47.60	7.490	11.600	2.910	.967

Advisory Circular 91-39 recommends that a power reduction not be taken until an aircraft reaches an altitude of 1,500 feet. However, because the Concorde is noisier on takeoff than subsonic aircraft, a power reduction is made at an altitude of 500 feet. A three percent climb gradient is maintained between an altitude of 500 feet and 1,000 feet where full climb power is re-established. The effect of this noise abatement procedure is to extend the size of the 110 EPNdB contour somewhat as a result of the lower climb gradient. However, the area within the 100 EPNdB contour is reduced.

Notice that even utilizing a noise abatement takeoff procedure the area encompassed within the 100 EPNdB Concorde footprint is larger than the area contained within the NEF 30 contour for the 1987 baseline condition. "Thus, there will be people residing outside the cumulative noise contour who will be adversely impacted by Concorde operations."¹⁰

The FEIS includes a table of comparative noise levels which help to convey the intensity and relative magnitudes of single noise events.¹¹ These noise events have been measured in A-weighted decibels (dBA). The dBA measurement weights physical intensities for different frequencies as does the EPNdB. However, unlike the EPNdB, the dBA does not include an additional weighting for the time duration of the event. Thus, there is not a linear relationship between dBA and EPNL.

TABLE III
COMPARATIVE NOISE LEVELS

<u>Noise Event</u>	<u>dBA</u>
Rustling leaves	20
Soft whispers at five feet	34
Window air conditioner	55
Conversational speech	60
Typing pool (nine typewriters)	65
Ringling alarm clock (at two feet)	80
Printing press plant	86
Heavy city traffic	92
Home lawn mower	98
Banging of steel plate	104
Air hammer	115

Unfortunately, there is no information which allows a comparison between NEF contours and single event noise contours. The FEIS does include, however, a comparison between the Aircraft Sound Description System (ASDS) and approximate NEF equivalents.¹² The ASDS describes exposure to aircraft sound in terms of the amount of time during the day that sound levels exceed 85 dBA. The 85 dBA threshold was chosen because indoor sleep interference occurs at approximately 70-75 dBA. With a 15-20 dBA acoustic reduction from housing structures, sleep interference is unlikely to occur unless the outdoor noise levels exceed 85 dBA. The indoor speech interference threshold, at a separation of eight feet, is about 65 dBA. With an acoustic reduction of 15-20 dBA, indoor speech interference will generally not occur unless the outdoor sound level exceeds 85 dBA.

Table IV compares the time sound levels are in excess of 85 dBA with the time in excess of other sound levels and with approximate NEF equivalents.

TABLE IV

<u>Equivalent NEF</u>	<u>Time in Excess of 85 dBA (Min/Day)</u>	<u>90 dBA</u>	<u>95 dBA</u>	<u>100 dBA</u>
20-32	0- 2	0- 2	0- 1	0 -0.4
32-37	2-15	2- 8	1- 4	0.4-0.8
37-40	15-30	8-14	4- 7	0.7-1.0
40-42	30-45	14-20	7-11	0.9-1.1
42-43	45-60	20-25	11-15	1.1-1.4

This table indicates that residents between the NEF 20-32 contours will be exposed to sound levels exceeding 85 dBA for approximately 0-2 minutes a day.

IV. FEDERAL AIRCRAFT NOISE REGULATIONS

The FAA, in consultation with the EPA, has authority under the Federal Aviation Act (Sec. 611), as amended by the Noise Control Act of 1972, to regulate aircraft for the purpose of noise abatement (49 USC 1431).

In 1969, the FAA promulgated the first noise rule for large transport category subsonic airplanes and subsonic turbojets (14 CFR 36). This rule has since been amended and a noise rule for supersonic jets (SST's) has been proposed (42 FR 55176).

Regulations for Subsonic Aircraft

The FAA's noise regulations for the large transport category of subsonic aircraft and subsonic turbojets provide for three stages of aircraft noise levels (14 CFR 36.1) with specified limits (14 CFR 36.5). Stage 1 noise levels, measured at specified points for takeoff, sideline and approach according to the requirements of FAR Part 36, Appendix C, have no upper limits and are the loudest of the three noise level stages. Stage 3 noise levels (those levels at or below the Stage 3 noise limits) are the quietest.

Aircraft are classified under each of the noise level stages according to the date of application for a type certificate (14 CFR 36.201) and date of first flight time (14 CFR 36.161). Basically, aircraft classified under Stage 1 are older aircraft of older type design (first flight time before December 31, 1974). Aircraft required to comply with Stage 2 noise limits are newer aircraft of older type design and current technology aircraft (type certificate application made after January 1, 1967 or December 1, 1969 depending on engine bypass ratio). New technology aircraft (type certificate application made after November 5, 1975) are required to comply with Stage 3 noise limits.

A 1977 amendment to the Federal Aviation Regulations (14 CFR 91.301) established a phased-in compliance schedule under which all domestic U.S. commercial subsonic jets weighing 75,000 pounds or more must be modified to meet Stage 2 noise limits by 1985 or be replaced by aircraft that do meet the Stage 2 limits.

At the end of 1975, about 77 percent of the U.S. air carrier fleet (accounting for about 80 percent of scheduled air carrier operations) was operating at Stage 1 noise levels.¹³ While this percentage has declined as a result of voluntary noise abatement efforts by air carriers and the 1977 retrofit requirement, Stage 1 aircraft still make up a large share of the U.S. fleet.

Proposed Regulations for Supersonic Aircraft

There is currently no noise rule for supersonic aircraft. However, the FAA, in consultation with the EPA, has proposed the following noise regulations for SST's:

1. Any Concorde (the only SST for which application for a U.S. type certificate has been made) with flight time before January 1, 1980, would have to achieve the lowest noise levels that are technologically practicable.
2. Concordes without flight time before January 1, 1980 would have to comply with Stage 2 noise limits in order to operate in the U.S.
3. No design change that would increase the noise of the Concorde would be allowed.
4. SST's that do not comply with Stage 2 noise limits could not schedule operations at U.S. airports between 10 p.m. and 7 a.m. local time.

There will be at least nine, and possibly 16, Concordes with flight time before January 1, 1980. Under the proposed regulations, these aircraft will be able to generate noise at their current levels. The noise levels of the Concorde are compared below with the Stage 2 noise limits for a similar size aircraft (approximately 400,000 pounds)¹⁴:

	<u>Concorde</u>	<u>Stage 2</u>
Takeoff	119.5	105.5
Sideline	112.0	107.5
Approach	116.5	107.5

As can be seen, the Concorde is over twice as noisy on takeoff as would be the case if it were required to comply with Stage 2 noise limits.

V. BRITISH AIRWAYS AND AIR FRANCE VS. PORT
AUTHORITY OF NEW YORK AND NEW JERSEY

U.S. courts have ruled fairly consistently that although the federal government has exclusive statutory responsibility for aircraft noise abatement through regulation of flight operations and aircraft design, airport proprietors have some authority to control airport noise. Actions an airport proprietor might take in regulating airport noise include controlling the type of aircraft which uses its airport and imposing curfews or other use restrictions as long as these regulations are not unjustly discriminatory and do not impose an undue burden on commerce.

This section will outline the two decisions of the U.S. Court of Appeals, Second Circuit, which for the the purpose of this section will be known as Concorde I and Concorde II, concerning the ban on Concorde flights into JFK.^{15, 16} These are the only cases which have been brought to court in which an airport proprietor has attempted to exercise its regulatory authority by banning Concorde flight operations at its airport. In its two decisions, the U.S. Court of Appeals, Second Circuit, made an effort to delineate the role of the airport proprietor in airport noise abatement.

Background

On February 4, 1976, British Airways and Air France were given approval by the Secretary of Transportation to schedule limited flights into JFK. Although the Port Authority had a longstanding noise regulation banning jet aircraft exceeding 112 PNdB, which the Concorde could meet, a temporary ban was imposed on Concorde operations pending development of a noise regulation applicable to supersonic jet aircraft.

Of particular concern to the Port Authority was the fact that the noise generated by the Concorde has a larger low-frequency component than that generated by subsonic jets. Low frequency sound travels more readily through the atmosphere and through structures, producing greater structural vibration or "house rattle" than does the higher frequency sound generated by subsonic jets. Because of these characteristics of low frequency sound, the Port Authority felt justified in imposing a temporary ban in order to study the monitoring reports from Concorde operations at Dulles and to develop a "rattle index."

The Port Authority hired a consultant to study the problem of structural vibration. He was able to develop a "rattle index" relating the amount of structural vibration to type of aircraft, but he was unable to solve the additivity problem. That is, is an aircraft with a noise level of 110 PNdB and rattle index of 3 noisier than an aircraft with a noise level of 111 PNdB and rattle index of 1? The Port Authority did not appropriate additional funds to study the additivity problem.

During the course of the Port's study, British Airways and Air France furnished the Port Authority with evidence that the Concorde, using certain noise abatement approach and takeoff procedures, could operate at noise levels even further below the 112 PNdB level than previously estimated.

The Decision

On May 11, 1977, the U.S. District Court ruled that the Port Authority's ban on Concorde operations was illegal. The court ruled that the authority of the federal government preempts that of the airport proprietor in the area of noise and noise abatement regulation. Thus, the Port Authority's ban "must give way under the Supremacy Clause of the Constitution." ¹⁷

In June of 1977, the U.S. Court of Appeals, Second Circuit, in Concorde I, reversed that decision. The court ruled that the legislative history of the amendment to the Federal Aviation Act of 1958, directing the FAA to establish aircraft noise regulations (Sec. 611(b)(1) indicates that Congress intended the airport proprietor to continue in the responsibility of protecting the local population from airport noise, while the FAA assumed the responsibility of controlling aircraft noise through control of flights and flight operations. The Court also ruled that the Port Authority was not prohibited, under the Commerce Clause of the Constitution, from banning Concorde. The Court stated:

It is clear to us that the Port Authority is vested only with the power to promulgate reasonable, non-arbitrary and nondiscriminatory regulations that establish acceptable noise levels for the airport and its immediate environs. Any other conduct by an airport proprietor would frustrate the statutory scheme and unconstitutionally burden the commerce Congress sought to foster.

Because the argument that the Port Authority's delay (13 months from the time of the request for landing rights) was discriminatory was raised for the first time during the appeal, the Appeals Court directed the District Court to hold an evidentiary hearing.

The District Court ruled that the Port Authority's delay (by then 17 months) was unreasonable and discriminatory.¹⁸ The District Court also ruled that the delay was an impingement on commerce, an undue interference with Congressional objectives and that the Port Authority abdicated its authority as an airport proprietor and forfeited its privilege to establish noise regulations for Concorde.

The U.S. Court of Appeals, Second Circuit, in Concorde II, affirmed the decision, with modification, on September 29, 1977. The Court enjoined "further prohibition of Concorde operations at Kennedy Airport until the Port Authority promulgates a reasonable, nonarbitrary and nondiscriminatory noise regulation that all aircraft are afforded an equal opportunity to meet." The Court clearly indicated that the Port Authority had not forfeited its privilege to establish a noise regulation applicable to Concorde.

Summary

The U.S. Court of Appeals, Second Circuit, in its two decisions, attempted to delineate the role of the airport proprietor in the area of airport noise abatement.

The task of protecting the local population from airport noise has traditionally fallen to the agency, usually of local government, that owns and operates the airfield. The federal government, under its authority to manage navigable airspace, has exclusive authority to regulate aircraft noise through regulation of flight operations (including landings and takeoffs) and aircraft design. Congress has consistently reaffirmed its commitment to this division of power.

However, the authority of the airport proprietor to establish noise regulations is limited in three ways. The regulations must be reasonable, nonarbitrary and nondiscriminatory.

FOOTNOTES

1. SeaTac Communities Plan, Sec. 6.6.
2. Concorde Supersonic Transport Aircraft Final Environmental Impact Statement (FEIS), U.S. Department of Transportation (Sept. 1975).
3. Draft Environmental Impact Statement (DEIS): Noise Regulation and Type Certificate Alternatives for Civil Supersonic Aircraft, U.S. Department of Transportation (April 1977).
4. Supplemental Draft Environmental Impact Statement (Supplemental DEIS): Noise Regulation and Type Certificate Alternatives for Civil Supersonic Aircraft, U.S. Department of Transportation (Oct. 1977).
5. The Secretary's Decision on Concorde Supersonic Transport, U.S. Department of Transportation (Feb. 4, 1976) p. 48.
6. Letters from Donald Shay, Director of Aviation, SeaTac International Airport, to Federal Aviation Administration, Dec. 19, 1977.
7. DEIS, op. cit., p. 20.
8. Ibid., p. 27.
9. FEIS, op. cit., pp. X-43.
10. Supplemental DEIS, op. cit., p. 30.
11. FEIS, op. cit., pp. VI-46.
12. Ibid., pp. VI-45.
13. Aviation Noise Abatement Policy, U.S. Department of Transportation (Nov. 1976) p. 36.
14. Advisory Circular No. 36-2, U.S. Department of Transportation, p. 3.
15. British Airways Board and Compagnie Nationale v. Port Authority of New York and New Jersey, 558 F. 2d 75 (1977) [Concorde I].
16. British Airways Board and Compagnie Nationale v. Port Authority of New York and New Jersey, 564 F. 2d 1002 (Sept. 29, 1977) [Concorde II].
17. British Airways Board and Compagnie Nationale v. Port Authority of New York and New Jersey, 431 F. Supp. 1216 (1977).
18. British Airways Board and Compagnie Nationale v. Port Authority of New York and New Jersey, 437 F. Supp. 804 (1977).

110 EPNdB SINGLE EVENT CONTOURS FOR CONCORDE AND B/747-200B

CONCORDE NOISE ABATEMENT TAKEOFF

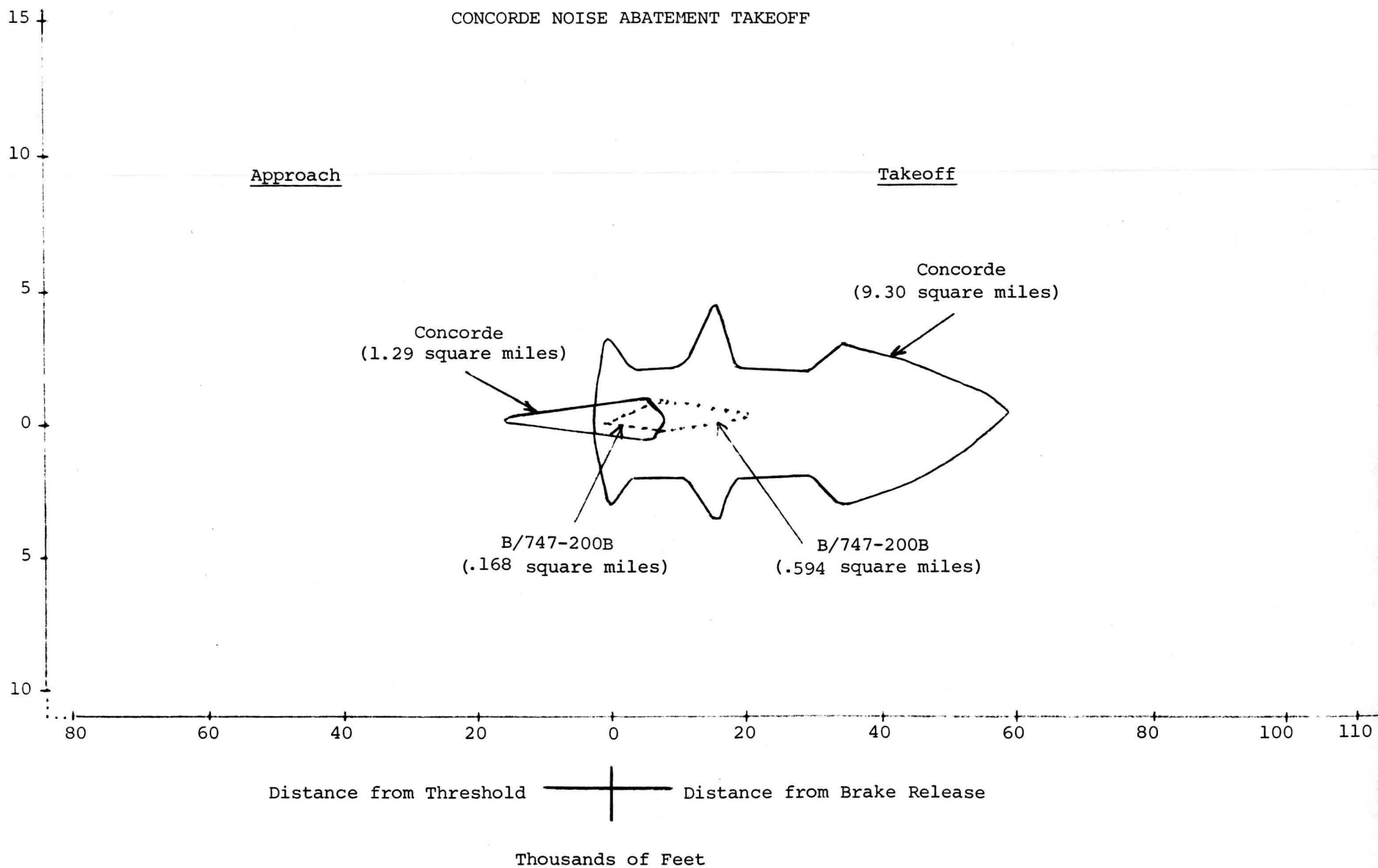


FIGURE 1

100 EPNdB SINGLE EVENT CONTOURS FOR CONCORDE AND B/747-200B

CONCORDE NOISE ABATEMENT TAKEOFF

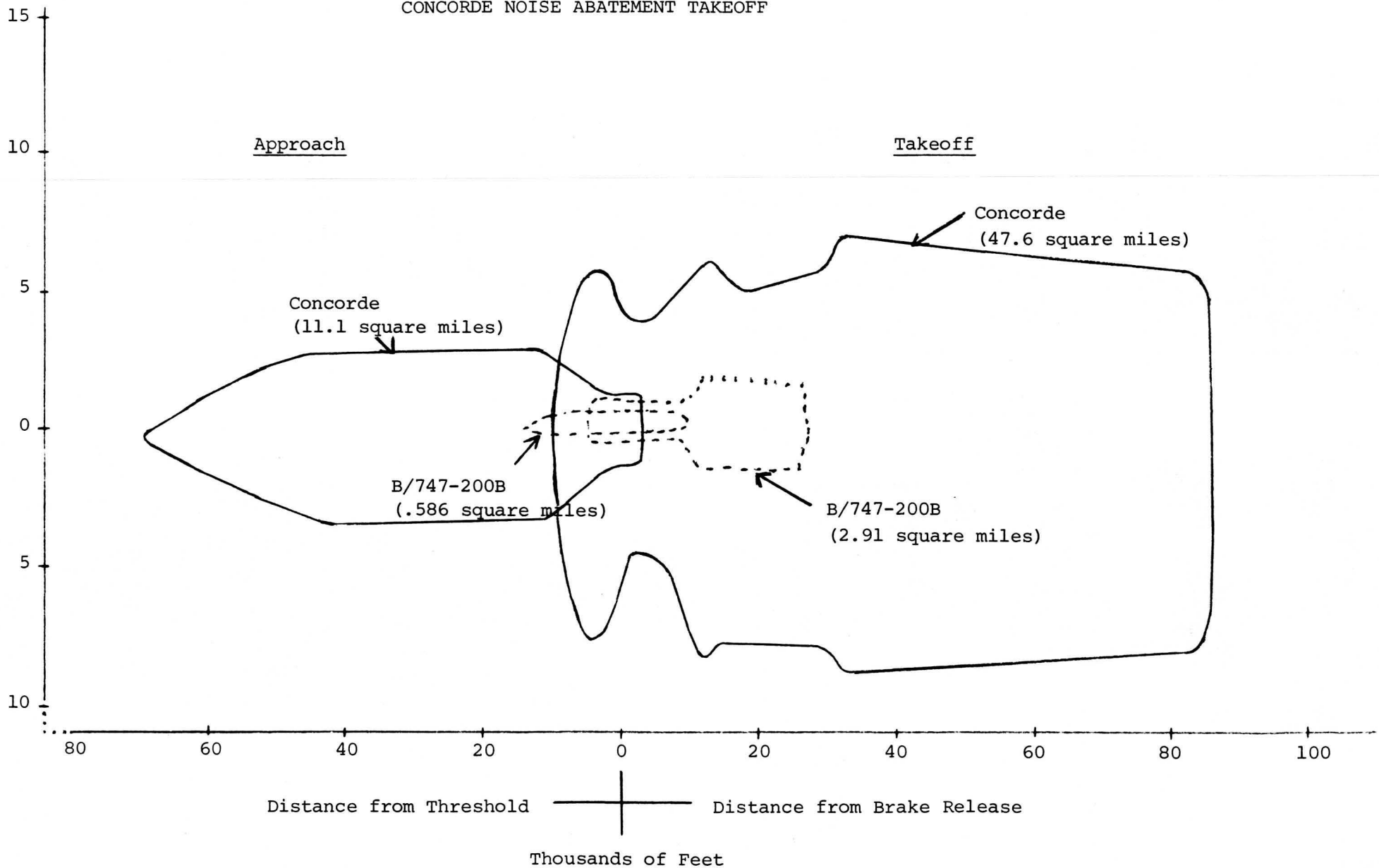


FIGURE 2

CONCORDE 100 AND 110 EPNdB SINGLE EVENT CONTOURS (FULL POWER TAKEOFF)

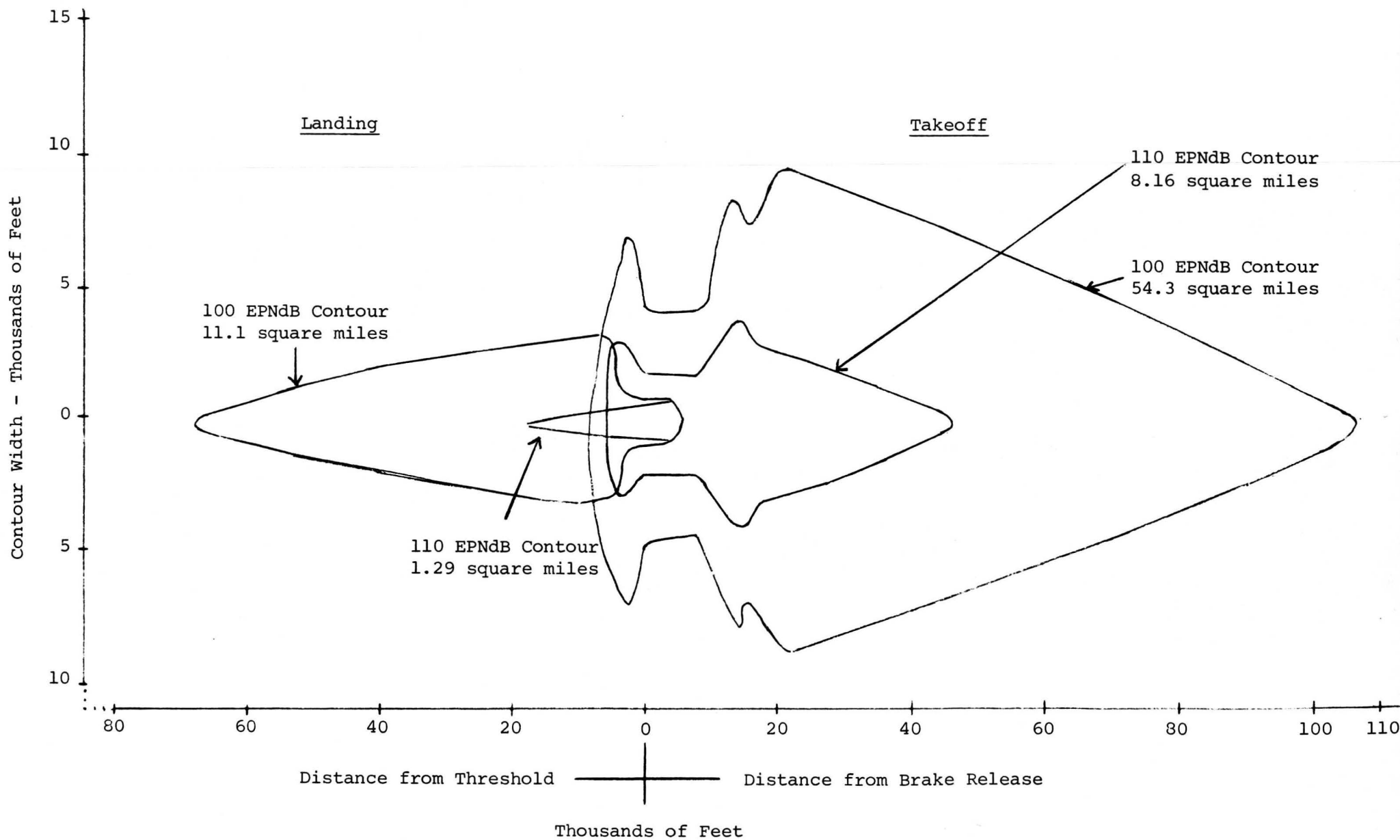


FIGURE 3