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REVIEW AND ANALYSIS OF PRESENT AND PLANNED FAA NOISE REGULATORY ACTIONS AND THEIR CONSEQUENCES REGARDING AIRCRAFT AND AIRPORT OPERATIONS

ENVIRONMENTAL PROTECTION AGENCY
AIRCRAFT/AIRPORT NOISE STUDY REPORT

27 JULY 1973

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WILLIAM C. SPERRY, TASK GROUP CHAIRMAN

This document is the result of an extensive task force effort to gather all available data pertinent to the subject discussed herein. It represents the interpretation of such data by the task group chairman responsible for this specific report. It does not necessarily reflect the official views of EPA and does not constitute a standard, specification, or regulation.

PREFACE

The Noise Control Act of 1972 (Public Law 92-574) directs the Environmental Protection Agency (EPA) to study the adequacy of current and planned regulatory action taken by the Federal Aviation Administration (FAA) in the exercise of FAA authority to abate and control aircraft/airport noise. The study is to be conducted in consultation with appropriate Federal, state and local agencies and interested persons. Further, this study is to include consideration of additional Federal and state authorities and measures available to airports and local governments in controlling aircraft noise. The resulting report is to be submitted to Congress on or before July 27, 1973.

The governing provision of the 1972 Act states:

> "Sec. 7(a). The Administrator, after consultation with appropriate Federal, state, and local agencies and interested persons, shall conduct a study of the (1) adequacy of Federal Aviation Administration flight and operational noise controls; (2) adequacy of noise emission standards on new and existing aircraft, together with recommendations on the retrofitting and phaseout of existing aircraft; (3) implications of identifying and achieving levels of cumulative noise exposure around airports; and (4) additional measures available to airport operators and local governments to control aircraft noise. He shall report on such study to the Committee on Interstate and Foreign Commerce of the House of Representatives and the Committees on Commerce and Public Works of the Senate within nine months after the date of the enactment of this act."

Under Section 7(b) of the Act, not earlier than the date of submission of the report to Congress, the Environmental Protection Agency is to:

> "Submit to the Federal Aviation Administration proposed regulations to provide such control and abatement of aircraft noise and sonic boom (including control and abatement through the exercise of any of the FAA's regulatory authority over air commerce or transportation or over aircraft or airport operations) as EPA determines is necessary to protect the public health and welfare."

The study to develop the Section 7(a) report was carried out through a participatory and consultive process involving a task force. That task force was made up of six task groups. The functions of these six task groups were to:

1. Consider legal and institutional aspects of aircraft and airport noise and the apportionment of authority between Federal, state, and local governments.

2. Consider aircraft and airport operations including monitoring, enforcement, safety, and costs.

3. Consider the characterization of the impact of airport community noise and to develop a cumulative noise exposure measure.

4. Identify noise source abatement technology, including retrofit, and to conduct cost analyses.

5. Review and analyze present and planned FAA noise regulatory actions and their consequences regarding aircraft and airport operations.

6. Consider military aircraft and airport noise and opportunities for reduction of such noise without inhibition of military missions.

The membership of the task force was enlisted by sending letters of invitation to a sampling of organizations intended to constitute a representation of the various sectors of interest. These organizations included other Federal agencies, organizations representing state and local governments, environmental and consumer action groups, professional societies, pilots, air traffic controllers, airport proprietors, airlines, users of general aviation aircraft, and aircraft manufacturers. In addition to the invitation letters, a press release was distributed concerning the study, and additional persons or organizations expressing interest were included into the task force. Written inputs from others, including all citizen noise complaint letters received over the period of the study, were called to the attention of appropriate task group leaders and placed in the public master file for reference.

This report presents the results of the Task Group 5 effort devoted to the investigation of existing and proposed regulatory actions. It also provides a basis for proposing additional regulations as required by Section 7(b) of Public Law 92-574.

The membership of Task Group 5 was made up of representatives of the Federal Government, airport operators, airlines, airframe manufacturers, general aviation, and environmental groups. The task group met six times in Washington, D. C., during the period February 15, 1973 to June 22, 1973. The members presented information pertinent to the problem of airport noise, presented comments on information supplied by other members, generally discussed the problem and possible solutions, and reviewed and commented on draft reports. EPA requested that all data submitted be

in writing; all documents received are listed under References and Bibliography and are available for inspection in the Airport/Aircraft Study files.

Reference to a specific item in the listing is made by providing the page number and the group acquisition number of the item being referenced. For example, Reference 4.1-56 refers to the document numbered 56 on page 4.1 of the References. Position papers of the task group participants are included in Appendix A and the list of participants is provided as Appendix B.

The conclusions and recommendations of this report are the responsibility of the Chairman and staff and are based on the information supplied by task group participants and other sources and on consideration of protection to the public health and welfare. The difficult and controversial subjects of the task group assignment precluded complete agreement among task group members. EPA sincerely appreciates the wholehearted efforts that the task group members have put forth, without which this report could not have been prepared.

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SECTION 1

INTRODUCTION AND BACKGROUND

The results of the Task Group 2 and 4 studies clearly indicate that the current technology is exceptionally comprehensive and capable of being translated into feasible hardware and flight procedures that would significantly decrease aircraft noise exposure. However, the available technology will not be thoroughly implemented by the manufacturers and operators until they have the necessary incentives. Noise control has been applied over the past 10 years, but essentially only to the extent of preventing the escalation of noise. Much more is needed and can be obtained by hardware and flight operating procedures that are safe and technically practical, and may well be economically reasonable if the costs are shared equitably by the responsible members of the aviation community, the flying public, the noise exposed public, and the general taxpayer. All of these elements will benefit in various ways from a less noisy civil aviation system, and likewise, will suffer from a severely limited one.

Regulations are probably the most effective and reliable technique for exploiting the state of the art of noise control at the source (engine and airframe design and modification), at the path (flight operating procedures), and at the receiver (airport operating procedures; curfews, restrictions, compatible land use, etc.). However, to reach an optimum balance of noise control and civil aeronautics viability, the regulations must be wisely constructed and enforced.

The purpose of this report is to examine the existing and proposed Federal Aviation Administration (FAA) regulations and to consider their effectiveness in furnishing protection to the public health and welfare and to consider whether they adequately exploit the available technology. This report begins with a review of the legislative history of noise control and briefly identifies the regulatory status of the FAA and relevant noise control actions of several state and local authorities.

The relationships between technology, health and welfare, and regulations are discussed in Section 2. The results of Task Group 3 (10.4-427) are introduced in a qualitative manner and are shown to be necessary in the development of a practical concept for optimizing costs in the protection of the public health and welfare from aircraft noise and sonic boom.

The FAA regulatory and proposed actions are reviewed in considerable depth in Section 3, and various noise control actions of state and local authorities and the industry are reviewed in Section 4. The actions are examined in respect to their effectiveness; whether the existing regulations should be modified and whether the proposed actions should be implemented in some form.

A three part plan for the development and implementation of aircraft noise regulations is presented in Section 5. The plan is designed to permit EPA, FAA, and the airport authorities to work together in a manner that optimally utilizes their special interests and expertise. The objective is to provide incentive to implement all noise control options to the maximum extent feasible and to control the residual noise by compatible land use measures.

General recommendations are presented in Section 6 for immediate and future FAA and other Federal action. Detailed regulatory proposals will be prepared for the FAA after completion of the report.

LEGISLATIVE EVOLUTION AND DEVELOPMENT

PUBLIC LAW 85-726

The Federal Aviation Act of 1958 (Public Law 85-726) created "...a Federal Aviation Agency, to provide for the regulation and promotion of civil aviation in such manner as to best foster its development and safety, and to provide for the safe and efficient use of the airspace by both civil and military aircraft, and for other purposes." The FAA, therefore, was created to ensure that civil aviation would be a viable and safe national asset. The Act did not recognize that civil aviation could have any detrimental effects on the public except to be unsafe or uneconomical.

VOLUNTARY ACTIONS

Serious consideration by the aviation community was not given to the control of aircraft noise by regulation until the rapid growth of air commerce in the early 1960's significantly increased community noise exposure near major airports. Tolerance of the noise was strained to the point that large segments of the public objected to the expansion of existing airports or the development of new airports. The aviation community was concerned that aircraft noise, unless it was reduced or effectively controlled, would seriously inhibit the development of new airports necessary to provide badly needed capacity and that air commerce would not realize its full potential of public and private service.

In October 1965, at the request of the President, the Office of Science and Technology sponsored a symposium on the aircraft noise problem, the results of which are presented in Reference 12.1-249. This reference source is commonly referred to as the "Green Book." In his transportation message of March 2, 1966, the President directed that a concerted effort be undertaken by the Federal Government to combat the growing problem of jet aircraft noise in the vicinity of airports. In response, the Office of Science and Technology, in cooperation with the FAA, the National Aeronautics and Space Administration, and the Department of Housing and Urban Development, initiated an Aircraft Noise Alleviation Program. The program was based on implementing specific recommendations contained in the Green Book.

Three governmental committees were established to provide guidance, industry advice, and the means of ensuring interagency cooperation and coordination:

1. The Policy Committee, composed of participating Federal agency and department heads.
2. The Program Evaluation and Development Committee (PEDC), composed of working level members of organizations represented on the Policy Committee, representatives of various aircraft industry organizations, and individual aircraft noise experts participating in an advisory capacity.

3. The Management Committee, composed of working level representatives of participating Federal agencies responsible for the day-to-day conduct and coordination of the program.

One of the recommendations of the Green Book that was emphasized and expanded by the PEDC in Reference 12.1-106 was that certification of aircraft for noise was critical to the solution of the problem. This view was endorsed by the London Conference (12.1-250), and appropriate legislation (which ultimately led to Public Law 90-411) was introduced by the Administration to grant FAA such authority. In September 1966, the FAA Associate Administrator for Development forwarded to industry for comment a concept of noise certification (8.4-251), commonly known as the "Blatt letter." As a result of industry comments on the Blatt letter, and efforts of ad hoc working groups, the concept was refined through a series of drafts, the last of which (sixth revision) was drafted in February 1968, (8.5-252).

In May 1967, a series of tripartite meetings was initiated between representatives of the United States, the United Kingdom, and France in an attempt to define a mutually acceptable noise certification concept for subsonic aircraft. The goal was to develop a plan of international agreement which could result in the adoption of an essentially identical aircraft noise certification rule in the three countries. The objective included eventual International Civil Aviation Organization (ICAO) adoption and international acceptance. In December 1967, ICAO (12.1-253) indicated its interest in establishing international standards for aircraft noise certification and directed aircraft manufacturing nations to keep ICAO informed as to their progress in developing noise standards.

In October 1967, discussions by the Director of the FAA Office of Noise Abatement (8.5-254) on the advantages and disadvantages of a number of noise certification concepts were forwarded to industry for comment. Industry responded (13.1-255) with a number of suggestions and, as a result, an informal government/industry task force was established to further explore the problems and to recommend the most practical concept of a noise certification rule.

Tripartite discussions in May 1968, developed a concept that adopted effective perceived noise level (EPNL) in units of EPNdB as the measure of subjective response. Also, three points of measurement (approach, takeoff and sideline) were established at which specified noise limits should be met.

In a July 1968 briefing, industry proposed a variation of the same three-point concept and made a strong recommendation for using maximum Perceived Noise Level (PNL) in units of PNdB as the measure of subjective response. After considering and modifying the industry proposals, the FAA issued a Notice of Proposed Rule Making (NPRM) 69-1 (14.2-256) to fulfill the requirements established by the then recently passed Public Law 90-411. The plan of the NPRM was basically that of the tripartite agreement, with modifications to incorporate certain parts of industry proposals or to accommodate valid objections.

PUBLIC LAW 90-411

Public Law 90-411, issued in July 1968, was the first Federal Legislative action directed to the control of aircraft noise and sonic boom. It was generated as the result of pressures on the Administration and Congress by the public who sought relief from noise exposure, and by the industry, who were concerned that their growth potential might be limited. Concurrent with the development of Public Law 90-411, the aviation community (international government and industry without the participation of environmental groups) worked toward developing safe and economical noise control technology and complementary regulatory procedures. Public Law 90-411 required the FAA to prescribe and amend such regulations as the FAA may find necessary to "afford present and future relief and protection to the public from unnecessary aircraft noise and sonic boom." The only constraints on the FAA were that the regulations must be safe, be economical, and be based upon available technology and FAA was the sole judge on whether aircraft noise and sonic boom was unnecessary. Public Law 90-411 did not provide any real environmental incentives or criteria. The only incentive was economical in the sense defined by PL 85-726, that is, "the promotion, encouragement, and the development of civil aeronautics," and if noise interfered with this, then it must be controlled and regulated.

PUBLIC LAW 91-190

The National Environmental Policy Act of 1969 (Public Law 91-190) established a national policy to "...encourage productive and enjoyable harmony between man and his environment; to promote effort which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man;...". While noise was not specifically mentioned, PL 91-190 established the Council of Environmental Quality (CEQ), which chose to consider noise an influence on the quality of the environment.

PUBLIC LAW 91-258

The Airport and Airway Development and Revenue Act of 1970 was signed into law on 21 May 1970, implementing the first stage of a proposed 10-year program to expand, modernize, and improve aviation facilities throughout the United States in order to meet the forecasted growth of aviation in the next decade. To provide funds for the program, the revenue part of the Act provides for user charges to be collected from aircraft owners, operators, and passengers.

Airport sponsors must meet certain requirements not part of past programs. These include consideration of the environmental impact of the airport on the community, provisions for adequate housing for persons being displaced by the acquisition of land for the airport, and an opportunity for a public hearing. Concerning the latter, requests involving location of an airport, an airport runway, or runway extension will not be approved until the sponsoring public agency certifies that economic, social, and environmental considerations have been publically reviewed.

The Act also provides for airport certification. The FAA is authorized to issue operating certificates to airports served by air carriers certificated by the Civil Aeronautics Board (CAB). Operators of such airports must obtain operating certificates.

PUBLIC LAW 91-604

The Noise Pollution and Abatement Act of 1970 (Title IV of Public Law 91-604) directed that "The Administrator shall establish within the Environmental Protection Agency on Office of Noise Abatement and Control, and shall carry out through such

Office a full and complete investigation and study of noise and its effect on the public health and welfare in order to (1) identify and classify causes and sources of noise and (2) determine -- "...(D) effects of sporadic extreme noise (such as jet near airports) as compared with constant noise;...(F) effect of sonic booms on property (including values);...". Title IV specifically recognizes aircraft noise and sonic boom as a possible public nuisance that may have a detrimental psychological and physiological effect on the public health and welfare.

PUBLIC LAW 92-574

The Noise Control Act of 1972 (Public Law 92-574) "...declares that it is the policy of the United States to promote an environment for all Americans free from noise that jeopardizes their health and welfare." Section 7 of PL 92-574 is devoted entirely to aircraft noise and sonic boom and supersedes PL 90-411 by amending Section 611 of the Federal Aviation Act of 1958 to include the concept of "health and welfare" and to define the responsibilities of and interrelationships between the FAA and EPA. Specifically, PL 92-574 requires that "In order to afford present and future relief and protection to the public health and welfare from aircraft noise and sonic boom, the FAA, after consultation ... with EPA, ... shall prescribe and amend such regulations as the FAA may find necessary to provide for the control and abatement of aircraft noise and sonic boom,...". The regulatory instructions of PL 90-411 are compared with those of PL 92-574 in Figure 1-1, and it is significant that the latter contains the phrase "health and welfare" and does not contain the word "unnecessary." The full text of Section 611 of the Federal Aviation Act of 1958 is given in Figure 1-2.

In prescribing and amending standards and regulations, PL 92-574 requires that the FAA shall consider whether any proposed standard or regulation is:

- Consistent with the highest degree of safety in air commerce or air transportation in the public interest;
- Economically reasonable;

- Technologically practicable; and
- Appropriate for the particular type of aircraft, aircraft engine, appliance, or certificate to which it will apply.

The above specifications that must be considered by the FAA in prescribing aircraft noise and sonic boom regulations are identical to those contained in PL 90-411 and form constraints on the regulatory procedures. However, PL 92-574 has introduced a fifth constraint-protection to the public health and welfare.

PUBLIC LAW 90-411

IN ORDER TO AFFORD PRESENT AND FUTURE RELIEF AND PROTECTION TO THE PUBLIC FROM *UNNECESSARY* AIRCRAFT NOISE AND SONIC BOOM, THE FAA SHALL PRESCRIBE AND AMEND SUCH REGULATIONS AS THEY MAY FIND NECESSARY TO PROVIDE FOR THE CONTROL AND ABATEMENT OF AIRCRAFT NOISE AND SONIC BOOM.

PUBLIC LAW 92-574 (SUPERSEDES PL 90-411)

IN ORDER TO AFFORD PRESENT AND FUTURE RELIEF AND PROTECTION TO THE PUBLIC *HEALTH AND WELFARE* FROM AIRCRAFT NOISE AND SONIC BOOM, THE FAA, *AFTER CONSULTATION WITH EPA*, SHALL PRESCRIBE AND AMEND SUCH REGULATIONS AS THEY MAY FIND NECESSARY TO PROVIDE FOR THE CONTROL AND ABATEMENT OF AIRCRAFT NOISE AND SONIC BOOM.

Figure 1-1. Regulatory Instructions Comparison

REGULATORY STATUS OF THE FAA

Based upon the authority and requirements set forth in PL 90-411 and PL 92-574, the FAA has developed and issued regulations, standards, orders, and advisory circulars in its efforts to abate and control aircraft noise and sonic boom.

In the process of prescribing a regulation, the actual issuance of the regulation is preceded by a Notice of Proposed Rule Making (NPRM), or when more preliminary in nature, an Advance Notice of Proposed Rulemaking (ANPRM). In either case, the public notice is usually preceded by developmental work documented in a project report.

Section 611: Control And Abatement of Aircraft Noise and Sonic Boom

(a) For purpose of this section:
(1) The term "FAA" means the Administrator of the Federal Aviation Administration.
(2) The term "EPA" means the Administrator of the Environmental Protection Agency.

(b)(1) In order to afford present and future relief and protection to the public health and welfare from aircraft noise and sonic boom, the FAA, after consultation with the Secretary of Transportation and with EPA, shall prescribe and amend standards for the measurement of aircraft noise and sonic boom and shall prescribe and amend such regulations as the FAA may find necessary to provide for the control and abatement of aircraft noise and sonic boom, including the application of such standards and regulations in the issuance, amendment, modification, suspension, or revocation of any certificate authorized by this title. No exemption with respect to any standard or regulation under this section may be granted under any provision of this Act unless the FAA shall have consulted with EPA before such exemption is granted, except that if the FAA determines that safety in air commerce or air transportation requires that such an exemption be granted before EPA can be consulted, the FAA shall consult with EPA as soon as practicable after the exemption is granted.

(2) The FAA shall not issue an original type certificate under section 601(a) of this Act for any aircraft for which substantial noise abatement can be achieved by prescribing standards and regulations in accordance with this section, unless he shall have prescribed standards and regulations in accordance with this section which apply to such aircraft and which protect the public from aircraft noise and sonic boom, consistent with the considerations listed in subsection (d).

(c)(1) Not earlier than the date of submission of the report required by section 7(a) of the Noise Control Act of 1972, EPA shall submit to the FAA proposed regulations to provide such control and abatement of aircraft noise and sonic boom (including control and abatement through the exercise of any of the FAA's regulatory authority over air commerce or transportation or over aircraft or airport operations) as EPA determines is necessary to protect the public health and welfare. The FAA shall consider such proposed regulations submitted by EPA under this paragraph and shall, within thirty days of the date of its submission to the FAA, publish the proposed regulations in a notice of proposed rulemaking. Within sixty days after such publication, the FAA shall commence a hearing at which interested persons shall be afforded an opportunity for oral (as well as written) presentations of data, views, and arguments. Within a reasonable time after the conclusion of such hearing and after consultation with EPA, the FAA shall-

(A) in accordance with subsection (b), prescribe regulations (i) substantially as they were submitted by EPA, or (ii) which are a modification of the proposed regulations submitted by EPA, or

(B) publish in the Federal Register a notice that it is not prescribing any regulation in response to EPA's submission of proposed regulations, together with a detailed explanation providing reasons for the decision not to prescribe such regulations.

(2) If EPA has reason to believe that the FAA's action with respect to a regulation proposed by EPA under paragraph (1)(A)(ii) or (1)(B) of this subsection does not protect the public health and welfare from aircraft noise or sonic boom, consistent with the considerations listed in subsection (d) of this section, EPA shall consult with the FAA and may request the FAA to review, and report to EPA on, the advisability of prescribing the regulation originally proposed by EPA. Any such request shall be published in the Federal Register and shall include a detailed statement of the information on which it is based. The FAA shall complete the review requested and shall report to EPA within such time as EPA specifies in the request, but such time specified may not be less than ninety days from the date the request was made. The FAA's report shall be accompanied by a detailed statement of the FAA's findings and the reasons for the FAA's conclusions; shall identify any statement filed pursuant to section 102(2)(C) of the National Environmental Policy Act of 1969 with respect to such action of the FAA under paragraph (1) of this subsection; and shall specify whether (and where) such statements are available for public inspection. The FAA's report shall be published in the Federal Register, except in a case in which EPA's request proposed specific action to be taken by the FAA, and the FAA's report indicates such action will be taken.

(3) If, in the case of a matter described in paragraph (2) of this subsection with respect to which no statement is required to be filed under such section 102(2)(C), the report of the FAA indicates that the proposed regulations originally submitted by EPA should not be made, then EPA may request the FAA to file a supplemental report, which shall be published in the Federal Register within such a period as EPA may specify (but such time specified shall not be less than ninety days from the date the request was made), and which shall contain a comparison of (A) the environmental effects (including those which cannot be avoided) of the action actually taken by the FAA in response to EPA's proposed regulations, and (B) EPA's proposed regulations.

(d) In prescribing and amending standards and regulations under this section, the FAA shall-
(1) consider relevant available data relating to aircraft noise and sonic boom, including the results of research, development, testing, and evaluation activities conducted pursuant to this Act and the Department of Transportation Act;
(2) consult with such Federal, State, and interstate agencies as he deems appropriate;
(3) consider whether any proposed standard or regulation is consistent with the highest degree of safety in air commerce or air transportation in the public interest;
(4) consider whether any proposed standard or regulation is economically reasonable, technologically practicable, and appropriate for the particular type of aircraft, aircraft engine, appliance, or certificate to which it will apply; and
(5) consider the extent to which such standard or regulation will contribute to carrying out the purposes of this section.

(e) In any action to amend, modify, suspend, or revoke a certificate in which violation of aircraft noise or sonic boom standards or regulations is at issue, the certificate holder shall have the same notice and appeal rights as are contained in section 609, and in any appeal to the National Transportation Safety Board, the Board may amend, modify, or reverse the order of the FAA if it finds that control or abatement of aircraft noise or sonic boom and the public health and welfare do not require the affirmation of such order, or that such order is not consistent with safety in air commerce or air transportation.

Figure 1-2. Section 611 of the Federal Aviation Act of 1958 as Amended by PL 92-574.

As of this writing, the FAA has issued two noise source control regulations:*

1. "Federal Aviation Regulation (FAR) Part 36: Noise Standards: Aircraft type Certification" became effective 1 December 1969.

2. "Federal Aviation Regulation (FAR) Part 91.55: General Operating and Flight Rules: Civil Aircraft Sonic Boom" became effective 27 April 1973.

In addition to these two regulations, the FAA has issued two NPRMs and three ANPRMs that have not yet resulted in regulations as proposed. The notices, the general titles, and the dates of issue are:

1. ANPRM 70-33; Civil Supersonic Aircraft Noise Type Certification Standards, 4 August 1970.

2. ANPRM 70-44; Civil Airplane Noise Reduction Retrofit Requirements, 30 October 1970.

3. NPRM 71-26; Noise Type Certification and Acoustical Change Approvals, 13 September 1971.

4. NPRM 72-19; Newly Produced Airplanes of Older Type Design; Proposed Application of Noise Standards, 7 July 1972.

5. ANPRM 73-3; Civil Airplane Fleet Noise (FNL) Requirements, 24 January 1973.

The FAA has also developed at least three project reports preliminary to the issuance of notice of proposed rulemaking. These project reports constitute part of current FAA developments. Draft version titles and dates for these project reports are:

1. "Amendment to Federal Aviation Regulations to Provide for a Takeoff Noise Control Operating Rule," 21 November 1972.

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* An additional FAA regulation, FAR Part 91.87, concerning minimum altitudes and preferential runways, relates to aircraft noise control. Discussion of this regulation is included in the report of Task Group 2 (10.4-426).

2. "Noise Certification Rule for Quiet Short Haul Category Aircraft," 29 December 1972.

3. "Propeller Driven Aircraft Noise Type Certification Standards," 22 January 1973.

In addition, the FAA has implemented what is commonly known as the "Keep-'em-High" program. In this program, procedures for controlling the arrival and departure of high performance aircraft are designed to reduce noise exposure levels in addition to reducing the time that IFR aircraft are exposed to VFR aircraft at lower altitudes. The FAA issued an Advisory Circular (AC 90-59) in February 1972 making reference to an FAA Order (7110.22A) relating to the air traffic controllers handling of the high performance aircraft. Also, AC 91-36 encourages pilots operating fixed and rotary wing aircraft under Visual Flight Rules (VFR), to fly at not less than 2000 feet above the surface over noise sensitive areas. Both of these Advisory Circulars are discussed in the report of Task Group 2 (10.4-426).

In an attempt to derive an airport sound descriptor, the FAA has developed a Draft Order (3 August 1972) entitled "Aircraft Sound Description System." This draft order "states policy and establishes the procedures and guidance for the calculation and dissemination of aircraft sound data."

All of the preceding regulations, notices, project reports, and the Draft Order are described in detail and reviewed in depth in Section 3.

NOISE CONTROL ACTIONS OF OTHERS

Effective aircraft noise control actions in the form of regulations, rules, resolutions, specifications and standards by organizations other than the FAA are notably few. Most of those that have been promulgated have been developed in conjunction with the FAA.

The first significant action, in the form of a rule, was established in 1957 by the Port Authority of New York and New Jersey and specified a maximum noise level at specific locations for takeoff operations at the three major airports in the New York City area. A discussion of this action is presented in the Task Group 1 report (10.4-425).

The most noteworthy airport noise regulation imposed by a state government is that developed and brought into effect on December 1, 1972 by the State of California (15.1-34).* This regulation accomplishes its ends by controlling and reducing noise exposure levels, in addition to single event noise levels, in the communities in the vicinity of the airport. This is accomplished principally through enforcement by the county in which the airport resides and placement of a large portion of the implementation upon the airport proprietor. Recently announced resolutions by the Los Angeles International Airport Board of Commissions (15.2-265) to establish a five-point noise abatement program with airport management enforced regulations and penalties stems directly from the authority and responsibility established under the state aeronautical laws.

Other California airports may be expected to follow the lead provided by Los Angeles International (15.1-64) and the California law relating to aircraft noise is being given consideration by other states.

Another noise control area in which there has been potentially effective rules established is in the area of control of aircraft operating procedures; especially noteworthy are those endorsed and promulgated by the National Business Aircraft Association (NBAA) and the Air Transport Association (ATA) (13.1-150 and 188 and 13.1-266, respectively). Both procedures were developed in conjunction and with the support of the FAA. However, these rules are self-imposed, unenforced, bear no real and direct penalties, and are not endorsed by all of the group membership.

Similar operating rules adopted by the California intrastate aircraft carriers (4.1-267, 268) in response to requirements under the state noise laws are probably more effective because of the airport monitoring and the potential penalties for violations.

Special aircraft operating rules that have been jointly developed by the airlines and the airports for specific situations have also been promulgated and are in effect on a self-imposed basis (4.1-269, 270).

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* This statute may be in danger of discontinuation because of the recent U.S. Supreme Court ruling in the case of City of Burbank vs Lockheed Air Terminal, Inc. This issue is thoroughly discussed in Task Group 1 Report (Reference 10.4-425).

The preceding specific citations are not to be construed as being either complete or even possibly the best examples; however, they do serve to illustrate the general types of noise control actions being taken by organizations other than the FAA and provide a framework for some of the review, analysis and recommendations in the other sections of this report.

SECTION 2

TECHNOLOGY, HEALTH AND WELFARE, AND REGULATIONS

NOISE CONTROL OPTIONS

The abatement of aircraft noise is accomplished by exercising one or more of the control options identified in Figure 2-1. In general, for new designs of any product, the most sensible and preferred approach for noise abatement is to attempt to control the source to the extent that it will be acceptable in any environment. Path and receiver control options should always remain the second and third choices, respectively. For the existing aviation system, however, the older equipment has only minor application of source control technology and the newer equipment, while having substantially more, does not have enough to yield noise levels acceptable in all environments in which they operate. Technology capability for complete control of all aircraft noise at the source is not yet available and lies somewhere in the future, perhaps the far distant future. The solution, therefore, is to implement the source, path, and receiver control options concurrently, each to the extent feasible, and, finally, to contain the remainder of the noise within noise compatible boundaries. Figure 2-1 is intended to represent a flow diagram of the four options capable of independent, but concurrent, implementation.

SOURCE CONTROLS

Source control options are the result of the scientific and engineering capability of the airframe and engine manufacturers and those shown in Figure 2-1 are intended to be significant examples of current technology and not necessarily a complete list. The null or "do nothing case" is included as a baseline for economic evaluations, assuming that even if no source control option is utilized, costs would still accrue as a result of public hostility being translated into higher airport fees, curfews, restrictions, etc. The fleet replacement case is included as the upper boundary for

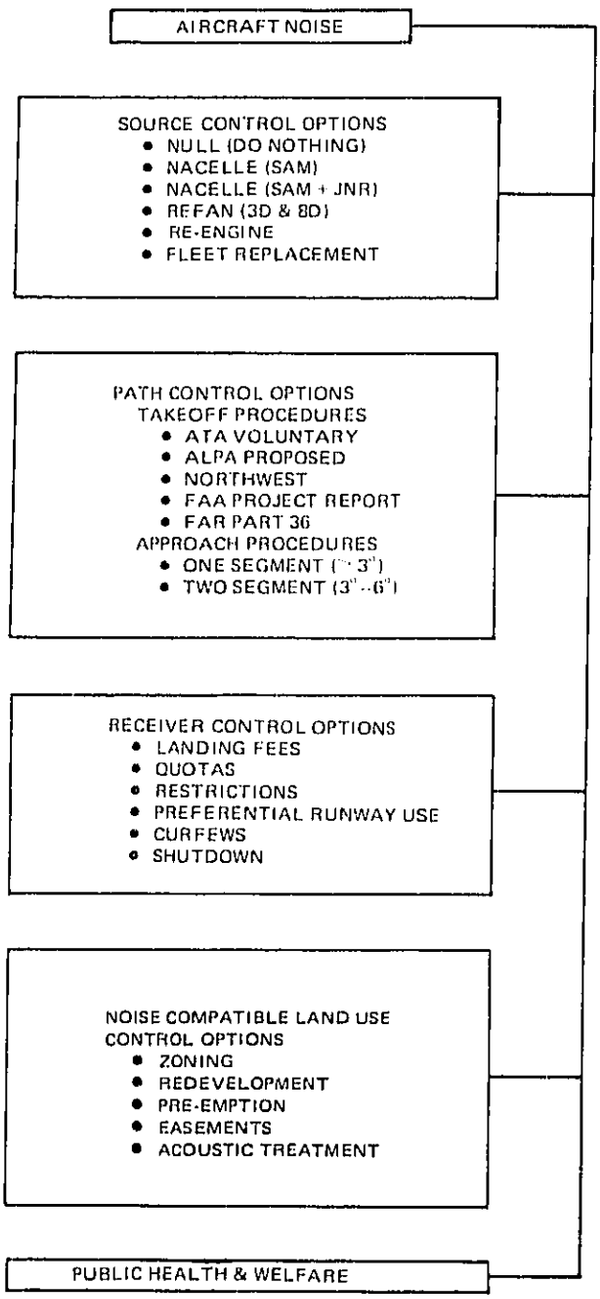

Figure 2-1. Typical Aircraft Noise Control Options.

economic evaluations of current technology by assuming that replacing all turbojet and low-bypass ratio turbofan propelled aircraft by the latest technology high-bypass turbofan propelled aircraft would be more costly than any of the intermediate source control options. Also the fleet replacement option can be considered to represent future technology applied to aircraft not yet designed and would include such design features as higher thrust/weight ratios than those of present conventional aircraft.

The nacelle (SAM) and (SAM + JNR) options represent the nacelle retrofit technology with "sound absorption material" and "sound absorption material plus jet noise reducer," respectively, developed for FAA by Boeing and McDonnell Douglas. The refan options represent the modified fan engine and nacelle technology under development for NASA by Pratt and Whitney, Boeing, and McDonnell Douglas and are intended to include both the JT3D and JT8D engines for consideration, both of which are assumed to include SAM. The re-engine options represent the "quiet engine" technology developed for NASA by General Electric both with and without the SAM developed by Boeing. The NASA "quiet engine" is not considered seriously for retrofit but should be considered available technology for future aircraft. Also the re-engine options are intended to include the replacement of turbojet with turbofan engines, especially for the business jet category.

PATH CONTROLS

Path control options are dependent to a great extent upon aircraft operator (airlines and general aviation) and pilot willingness to fully exploit all available operational capability of their aircraft. The options shown in Figure 2-1 are examples of current technology and not necessarily a complete list. However, the responsibility for implementing these options must be shared by the Federal Government (FAA) because of its authority over and control of approach and departure rates, patterns, and guidance and surveillance equipment. Some of the more sophisticated path control options would require the installation of new electronic guidance equipment at the airports (Government responsibility) and compatible equipment in the aircraft (operator responsibility) because the highest degree of safety must be maintained.

RECEIVER CONTROLS

The receiver control options are generally the responsibility of the airport operator with some exceptions that are shared with, or can be overruled by, the Federal Government (e.g., preferential runway use, bilateral agreements, interstate commerce requirements). It is apparent that the airport operator, if sufficiently motivated and with adequate legal authority, has the tools to control the noise to any required level.

LAND USE CONTROLS

The noise compatible land use control options shown in Figure 2-1 are far easier exercised in the development of new airports than as remedial measures for existing noise impacted airport communities. For the latter case, the costs for land use control alone are so high that maximum effort must be devoted to implementing the source, path, and receiver control options. The responsibility for exercising land use control options are shared by the airport operators and the Federal, state, and local governments depending upon the size of the noise impacted areas and the political jurisdictions that control its welfare.

PUBLIC HEALTH AND WELFARE

The flow diagram of Figure 2-1 represents four sets of control options protecting the public health and welfare from aircraft noise. The extent to which the control options must be utilized is dependent upon the meaning and quantification of public health and welfare. Until the advent of Public Law 92-574, the motivation for exploiting the technology control options (source and path) was limited by the constraints on the FAA noise abatement regulatory procedures delineated in Public Law 90-411. That is, in prescribing and amending standards and regulations, the FAA shall consider whether any proposed standard or regulation is consistent with the highest degree of safety and whether any proposed standard or regulation is economically reasonable, technologically practicable, and appropriate for the particular type of aircraft to which they apply. The Noise Control Act of 1972 (PL 92-574), however,

has added an additional constraint: protection to the public health and welfare. This additional constraint has not yet been officially quantified and, consequently, is difficult to apply to final judgments and evaluations of the adequacy of the FAA flight and operational noise controls and adequacy of noise emission standards on new and existing aircraft.

Although the former constraints were essentially safety, economics, and technology, some degree of public health and welfare has been considered. The basic noise evaluation measure, Effective Perceived Noise Level (EPNL) in units of EPNdB was developed after extensive experimentation and analysis was devoted to psychoacoustic effects of noise on human beings (e.g., loudness, annoyance, intrusiveness). The widely used noise exposure measure, Noise Exposure Forecast (NEF), is another example of psychoacoustic consideration. Physiological effects of noise on human beings and other ecological systems, such as temporary and permanent threshold shift (hearing loss), cardiovascular damage, fetal impairment, must now be considered. And the functional degradation effects of noise (speech interference, signal masking, etc.) must also be examined. Detailed investigations are being conducted under the sponsorship of EPA, and the concept of public health and welfare will ultimately be quantified. Also, the Task Group 3 report (10.4-427) contains recommendations specifically for use in this report.

Several definitions and quotations useful for a qualitative understanding of public health and welfare follow.

1. "In law, the suspect is innocent until his guilt has been proven beyond a reasonable doubt. In the protection of human health, such absolute proof often comes late. To wait for it is to invite disaster, or at least to suffer unnecessarily through long periods of time." W. H. Stewart, Noise as a Public Health Hazard, Proceedings of the Conference, ASHA Report No. 4, February 1969.

2. "Health. A state of physical, mental, and social well being, and not merely the absence of disease or infirmity." The Noise Around Us, Findings and

Recommendations, Report of the Panel on Noise Abatement, U.S. Department of Commerce Publication, September 1970. (Note: this is the World Health Organization definition.)

3. "All language referring to effects on welfare includes, but is not limited to, effects on soils, water, crops, vegetation, man-made materials, animals, wildlife, weather, visibility, and climate, damage to and deterioration of property, and hazards to transportation as well as effects on economic values and on personal comfort and well-being." Clean Air Act of 1970, PL 91-604, Title IV - Noise Pollution.

4. "Public health and welfare includes not only all direct effects upon human health but also any effects upon personal comfort and well being, and upon economic values, materials and property, animals, wildlife and any other ecological components." Noise Program Work Plans, EPA Office of Noise Abatement and Control, 10 November 1972.

Two important points must be clearly understood. First, the FAA regulations have two sets of constraints, the first one pertaining to safety, economics, and technology and the second pertaining to protection of the public health and welfare. The point is that the second set of constraints does not necessarily override the first. The second point is that aviation is a national asset and that ill conceived regulations, purportedly designed to protect the public health and welfare, might actually endanger the public welfare if they would result in destroying, seriously crippling, or severely limiting the viability of the national aviation system. On the other hand, well conceived regulations, while protecting the public health and welfare directly, might actually accelerate the development of aviation by minimizing public hostility.

Possible effects of noise on human beings and other ecological systems that must be considered in developing a quantitative measure defining protection to the public health and welfare from aircraft noise and sonic boom are listed in Figure 2-2. This is not meant to be an all-inclusive list nor is it intended to imply that all of the items are significantly affected by the levels of noise exposure found in typical noise

- PSYCHOLOGICAL
  - LOUDNESS
  - ANNOYANCE
  - INTRUSIVENESS
  - FRUSTRATION
- PHYSIOLOGICAL
  - HEARING LOSS
  - NERVOUSNESS
  - ETC.
- FUNCTIONAL INTERFERENCE
  - SPEECH
  - SIGNALING
  - SLEEP
- ECOLOGICAL DEGRADATION
  - SOIL
  - WATER
  - CROPS
  - ANIMALS
  - ETC.
- FINANCIAL LOSS
  - PROPERTY
  - INCOME
  - ETC.

Figure 2-2. Considerations in Defining Protection to Public Health and Welfare

impacted communities. Figure 2-2 is simply an itemized listing of some of the characteristics affecting the quality of life that could conceivably be influenced by aircraft noise and sonic boom exposure.

The results of the Task Group 3 study (10.4-427) include the development of a cumulative noise exposure measure called day-night average sound level (Ldn). The measure has been defined for that study as the average A-weighted sound level during a 24-hour time period with a 10 dB penalty applied to nightime (2200-0700 hours) sound levels. Included in the Task Group 3 study is an analysis of the effects of noise on people which was performed in direct response to the requirements of the aircraft/airport noise study. Concurrent with this analysis, the EPA prepared a general document of criteria (10.5-459) for the effects of noise on people as required by Section 5(a) (1) of the Noise Control Act. In addition, as required by Section 5(a) (2) of the Noise Control Act, the EPA is preparing a document "... on the levels on environmental noise, the attainment and maintenance of which, in defined areas under various conditions, are requisite to protect the public health and welfare with an adequate margin of safety."

Cumulative noise exposure levels such as the Ldn are believed to be the best available means of identifying the impact of noise around airports. Cumulative noise exposure levels can also serve as the basis for generally applicable environmental standards designed to control the noise exposure of members of the general population, as well as the most critically exposed individuals, to levels that will protect their health and welfare with an adequate margin of safety. With regard to "welfare" effects, however, there is a wide range of degree of human response to noise; and thus there may be a range of such levels taking this into account.

The establishment of limiting values for cumulative noise exposure will be influenced by the Task Group 3 study, the criteria document, and the environmental level document. The values also must be contingent on an appropriate balance between acceptable noise levels and varying economic capability and sociological effects among communities. The values may be represented by a curve such as shown qualitatively in Figure 2-3. The horizontal scale represents levels such as Ldn and the vertical scale represents the percentage of people affected by one or more of the noise degradation effects such as listed in Figure 2-2. Ultimately, recommendations will be provided for specific values such as defined by point A in Figure 2-3. The noise control options listed in Figure 2-1 cannot be properly exercised until a set of numbers such as represented by point A are chosen.

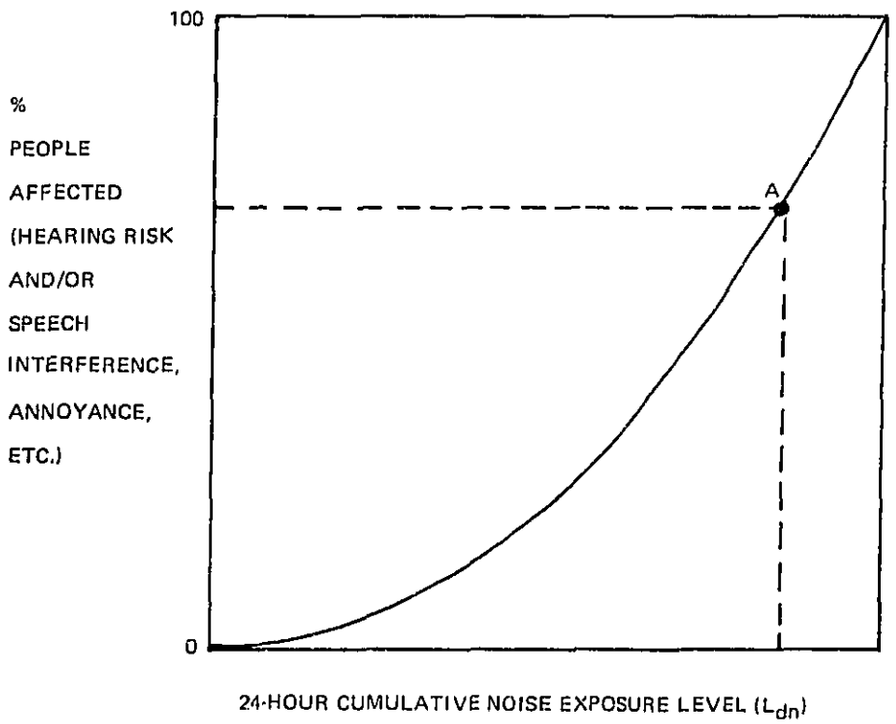

Figure 2-3. Generalized Curve for Determining Limiting Cumulative Noise Level For the Protection of Public Health and Welfare

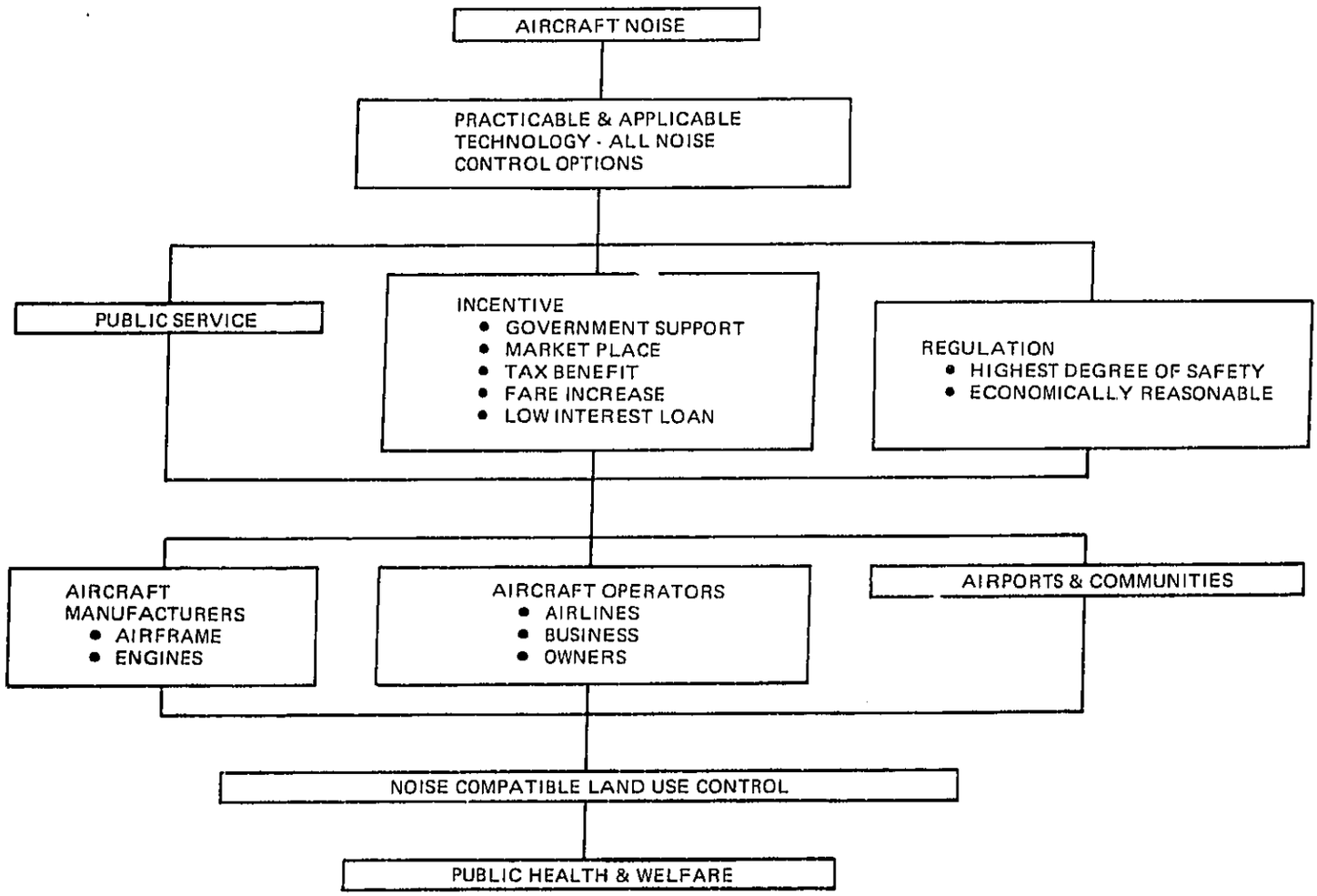

Figure 2-4. Exploitation of Source Control Options.

METHODS OF EXPLOITING TECHNOLOGY

The following discussion is based upon the assumption that a decision will be made by an appropriate Federal Government body supported by the scientific community on the choice of point A in Figure 2-3.

The flow diagram in Figure 2-4 represents public health and welfare protected from aircraft noise and sonic boom by all four of the noise control options shown in Figure 2-1. The methods for exploiting the noise control options are designated as public service, incentives, and regulations, all of which are applicable to manufacturers of the airframe and engines, the operators of airlines and business and other general aviation aircraft, and also to the airport operators and political jurisdictions of the airport neighborhood communities.

Public service as a method for exploiting noise control is meant to imply that the corporate management must accept the concept that the aviation community is not exempt from providing environmental protection and must be willing to volunteer effort to that end. Also public service is meant to imply that communities, citizens groups, environmentalists, and individuals must accept that aviation is a national asset and that their welfare may be dependent upon, to a considerable extent, a viable national aviation system.

Incentive as a method for exploiting noise control includes the usual ideas of competition, tax relief, fare increases, low interest loans, etc., which may be dependent upon some sort of government support, generally of an implicit nature. The term "Government Support" as used in Figure 2-4, however, is meant to imply more direct or explicit assistance, such as the design, development, and installation of guidance, surveillance and navigational equipment necessary to safely implement noise abatement operating procedures. Also, the Government should maintain a continuing high level support for noise abatement research and development.

Regulation as a technique for exploiting noise control possibilities is probably the most effective of the three presented in Figure 2-4. They must, however, be care-

fully developed to assure that the control options conform to the highest degree of safety and are economically reasonable in both installation and application.

After all the practicable and applicable noise control options have been adequately exploited, and if the noise exposure at any airport neighborhood community exceeds the level designated as the limit for protection to the public health and welfare (point A in Figure 2-3), then the only recourse is to exercise noise-compatible land use control measures. For new airport developments, the costs of land use control only may be reasonable, but for some existing noise impacted airport communities, the costs may be astronomical unless the source, path, and receiver control options are exploited to the optimum.

Figure 2-5 represents an airport surrounded by noise exposure contours intended to represent the extremes of noise control, that is, do nothing and maximum feasible. The interior area represents the residue of noise exposure that must be controlled in order to protect the public health and welfare. Obviously, the ideal case would be for the inner contour to lie within the airport boundary, thus representing optimum noise compatible land use control.

Figure 2-6 presents a qualitative example of the need to fully exercise the source, path, and receiver control options in order to minimize the cost (to the entire aviation community, the airport neighborhood communities, and the general tax payer) that would accrue in providing protection to the public health and welfare from aircraft noise. The land use curve represents the costs for the null case, in which the source and path (technology) noise control options were not exercised and the protection to the public health and welfare was accomplished solely by land use control. While it is possible for 100 percent of the area to be protected, or controlled, by noise compatible land use, the ultimate costs would be high. The technology curve represents the other extreme, where no effort was made to implement land use control, and protection is accomplished solely by the technology control options. Initially, technology is very effective; considerable noise impact area reduction is accomplished at low cost compared to land use control. Ultimately, however, the technology costs become excessive and the technology options never do achieve the objective of 100 percent protection.

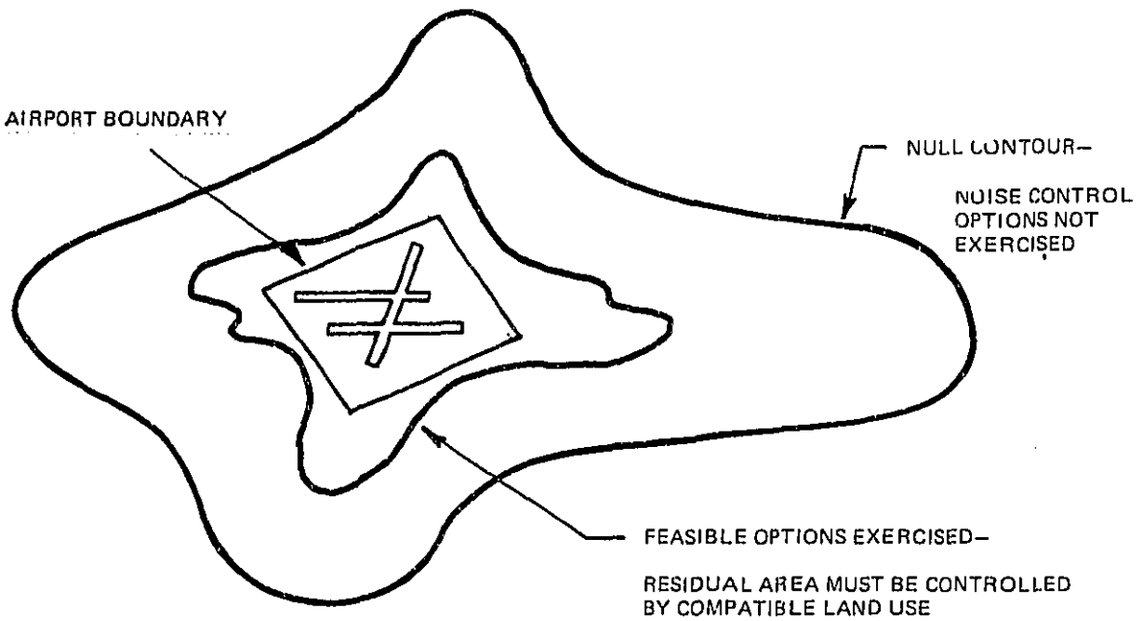

Figure 2-5. Noise Exposure Contours for Levels Representing Various Options

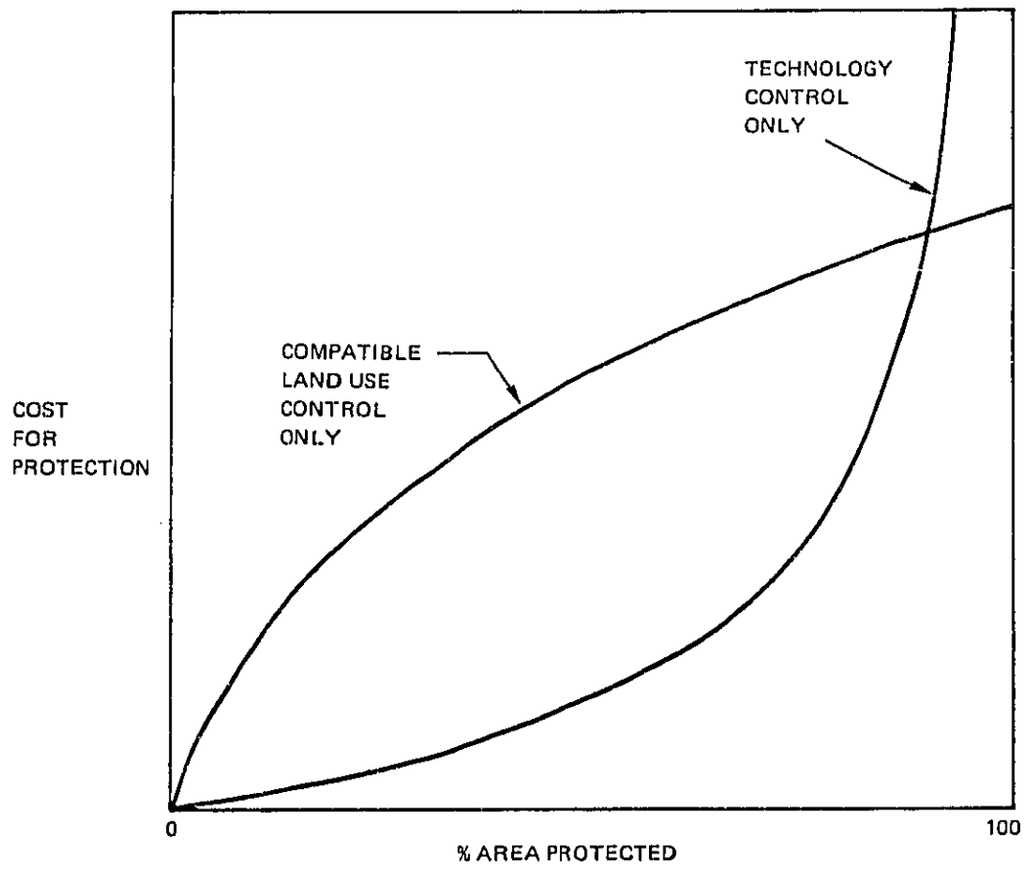

Figure 2-6. Qualitative Cost Comparison Between Technology & Land Use Noise Control

The solution to the problem is to determine, by cost-effectiveness studies, the optimum balance of costs for protection among the various options. Section 4 of the TASK GROUP 4 report (10.4-428) includes an example of such studies.

REGULATIONS

The concept of protection to the public health and welfare is capable of broad interpretation, depending upon the interests of the public and the specific threat against their health and welfare. The necessity for public protection is clearly obvious for such potential hazards as explosives, nuclear fuel, poisons, and high-speed transportation, which, if uncontrolled, can have an immediate and cataclysmic effect upon the public. For these potential hazards, there are Federal, state, and local regulations designed for public protection, and there is general acceptance of their need.

There is, however, controversy, even for the most fearful hazards, as to the extent of protection the regulations must require. Assuming these potential hazards (explosions, radiation, etc.), in a controlled form, are necessary and beneficial to the public, the controversy is not simply a conflict between good and evil. Instead, the issue is usually between segments of the public without a vested interest in the source of the hazard who want 100 percent protection and other segments of the public with a vested interest in the source but who cannot afford the cost of absolute safety. In general, 100 percent safety or protection is an unreachable goal, and the issues must be resolved by regulations that provide protection to the public to a degree at least commensurate with their other environmental influences.

In the case of degrading environmental influences that are not usually considered fearful hazards, the controversies over the stringency of regulations, or even whether regulations are necessary, are more complex and less easily reconciled. The fact that a degrading environmental influence does not cause immediate noticeable and irreversible damage, does not mean that it is not a health hazard after long exposure. On the contrary, degrading environmental influences may be more of an ultimate threat to the public health and welfare than the more obvious hazards because they tend to be overlooked or neglected, and hence, not adequately controlled or regulated.

Aircraft noise, at the least, is a degrading environmental influence and PL 92-574 requires that regulations be prescribed for its control. But the breadth and strictness of these regulations will be governed by judgments of the extent to which aircraft noise is capable of being a hazard to the public health and welfare. How should this judgment be made? How much protection is necessary? Segments of the public without a vested interest in aviation want maximum regulatory protection while other segments of the public with a vested interest want considerably less. The decision must and will be made by the Government. But which Agency, EPA or FAA, should have the major responsibility for the health and welfare aspects of aircraft noise regulations?

The Environmental Protection Agency has sole responsibility for the control of all noise sources except aircraft, and has begun extensive effort on the determination of the effects of noise from all sources on man and other ecological systems. These EPA studies will be comprehensive and will ultimately consider all possible health and welfare effects (psychological, physiological, functional, etc.) such as indicated in Figure 2-2. Although aircraft have noise signatures composed of unique spectral, temporal, and frequency and amplitude modulation characteristics compared with other noise sources, they are not a truly independent source in most airport neighborhood communities. In many cases, aircraft are the major sources of noise, but their environmental effects must be considered along with those of other kinds of sources and the evaluation measures must be capable of application to all. No other Government agency has the responsibility for, nor is attempting the development of, criteria and evaluation measures applicable to all noise sources.

The Air Force, FAA, and NASA have been responsible for the development of most of the existing information on human response to aircraft noise. Other segments of the aviation community, mostly the airframe and engine manufacturers, have made substantial contributions as well. This work has been invaluable and more extensive than that produced by all other sections of the national economy combined. However, the effort by the aviation community has been devoted principally to psychological and sociometric studies, and it appears that the aviation community is convinced that air-

craft noise exposure is basically an annoyance phenomenon. This supposition may be true, but it is necessary that, in order to protect the public health and welfare, thorough investigations of other effects (such as shown in Figure 2-2) must be conducted, criteria must be established, and evaluation measures must be developed that are suitable for all noise sources, either singly or combined. Noise must be investigated as to its capability of being an authentic health hazard, both for short and long term exposures.

SECTION 3

REVIEW OF FAA REGULATORY STATUS

The Federal Aviation Act of 1958 created the FAA for the promotion, encouragement, and development of civil aeronautics and to ensure that civil aeronautics would be a safe and viable national asset. Although subsequent legislation dealt with environmental quality and noise, it was not until PL 92-574 that the FAA had any really definite guidelines for noise control that would indicate that the original purpose of PL 85-726 would not be compromised by noise control actions. Despite the lack of criteria, the FAA has devoted substantial effort to the necessary technological, economic, and legal background support required to prescribe regulations that prevent the escalation of aircraft noise and sonic boom. In addition, the FAA has other proposed regulatory actions that, if properly implemented, will make a significant contribution to the reduction of aircraft noise exposure in the airport neighborhood communities.

REGULATIONS

NOISE STANDARDS: AIRCRAFT TYPE CERTIFICATION — FAR PART 36

FAR Part 36, effective on 1 December 1969 as a new part to the Federal Aviation Regulations, was based upon NPRM 69-1, issued on 3 January 1969. FAR Part 36 prescribes noise standards for the issue of type certificates, and changes to those certificates, for subsonic transport category airplanes, and for subsonic turbojet powered airplanes regardless of category. This regulation initiated the noise abatement regulatory program of the FAA under the statutory authority of PL 90-411.

FAR Part 36 makes a significant contribution in the form of three appendixes that have come to be used as standards or recommended practices in the measurement and

evaluation of aircraft noise. Appendix A of FAR Part 36 prescribes the conditions under which noise type certification tests must be conducted and the measurement procedures that must be used to measure the noise made by the aircraft for which the test is conducted. Appendix B prescribes the procedures that must be used to determine the noise evaluation quantity designated as effective perceived noise level (EPNL). Appendix C of FAR Part 36 provides the noise levels, noise measuring points, and airplane test conditions for which compliance must be shown with noise levels measured and evaluated as prescribed, respectively, by Appendixes A and B.

A qualification or limitation statement is included in FAR Part 36: "...the noise levels in this part have been determined to be as low as is economically reasonable, technologically practicable, and appropriate to the type of aircraft to which they apply. No determination is made, under this part, that these noise levels are or should be acceptable or unacceptable for the operation at, into, or out of, any airport." The statement, therefore, implies that the regulatory constraints of PL 90-411 were maintained in the development of FAR Part 36, to protect the aircraft industry without consideration of the airport operator. In addition, the preamble states: "Under the... statutory constraints, socially acceptable noise levels can only be required insofar as they involve economically reasonable burdens on the aircraft industry and are technologically practicable." This statement clearly supports the previous contention that the FAA interpretation of PL 90-411 is that "economically reasonable" applies to the industrial segment of the aviation community and not the airport operator who must, apparently, fend for himself. As final support for this contention, the preamble states "...the actual noise generated at a given airport in operation is not a question for type certification, but involves the right of airport proprietors to limit the permissible levels of noise that can be created by aircraft using the airport. If further noise reduction must be achieved at a given airport, the judicial decisions and legislative history of Public Law 90-411 have made it clear that this is a matter for the airport proprietor."

Regardless of whether the FAA feels more responsibility for protecting the aircraft industry than satisfying the airport in promulgating noise regulations, the purpose of FAR Part 36 as stated in the preamble ("... the purpose of this rule is to prevent, at the earliest possible date, any escalation of aircraft noise,...) is worthy and results to date indicate success. Also, the preamble states: "Further noise reduction will be required as the technology of noise abatement progresses." FAR Part 36 is a major regulatory achievement that is flexible and capable of being adjusted to conform to any statutory requirements. It is an excellent first step.

CIVIL AIRCRAFT SONIC BOOM — FAR Part 91.55

Part 91.55, issued on 23 March 1973 as a new section to Part 91 of the Federal Aviation Regulations, was based upon NPRM 70-16, issued on 10 April 1970. The purpose of this rule is to afford the public protection from civil aircraft sonic boom by prohibiting supersonic flights of civil aircraft, except under terms of an authorization to exceed the speed of sound (Mach 1.0).

The rule is explicit and should be effective in protecting the public health and welfare from routine sonic boom exposure. Civil aircraft, however, may obtain authorization to operate at a true flight Mach number greater than unity over a designated test area, for limited special test purposes including:

- Compliance with airworthiness requirements.
- Determining sonic boom characteristics.
- Determining conditions under which speeds greater than a true flight Mach number of unity will not cause a measurable sonic boom overpressure to reach the surface.

Authorization for a flight outside of a designated test area at supersonic speeds may be made if the applicant can show conservatively that the flight will not cause a measurable sonic boom overpressure to reach the surface.

NOTICES AND ADVANCE NOTICES

CIVIL SUPERSONIC AIRCRAFT NOISE TYPE CERTIFICATION STANDARDS — ANPRM 70-33

This advance notice, issued on 4 August 1970, announces that the FAA is considering rule making to establish noise standards for the type certification of civil supersonic aircraft. The stated reason for an advance notice is that it would be helpful to invite early public participation in the identification and selection of tentative alternate courses of action. The preamble to FAR Part 36 (which is currently limited to the noise type certification of subsonic airplanes) stated that additional rule making concerning the noise type certification of supersonic airplanes would be proposed. This advance notice is the first step in implementing this objective.

The notice solicits public comment on a number of issues and problems and does not include suggestions or recommendations although the claim is made that much research has been done, that is: "It should be noted that much research has been done within the Office of the Secretary of Transportation and the Federal Aviation Administration to identify the best possible regulatory approach to the type certification of supersonic aircraft, and to insure that this new generation of aircraft is developed in a manner that is compatible with the total environmental objectives of the Department."

The Boeing Commercial Airplane Group, as well as others, at the fourth meeting of Task Group 5 indicated that:

1. The noise levels specified in the current FAR Part 36 (1 December 1969) would be appropriate for application to any future SST designs.
2. The three-point measurement concept used in the current FAR Part 36 should be maintained.
3. The terminal operating characteristics of a supersonic type aircraft are, and probably will be, significantly different from conventional, subsonic aircraft characteristics. Due to this essentially different design feature, the noise regulations would require greater flexibility than the current rules allow in the takeoff and landing procedures.

In view of (3), above, they also suggested that the noise standards for the supersonic transport type aircraft be a separate section of the Federal Aviation Regulations.

Boeing also suggested, in Reference 3.5-178, that "An aircraft whose application for certification predates the creation of certification standards should be certified at its initial production noise level, but only after demonstrating that it incorporates the full noise reduction technology that was economically reasonable and appropriate at the time of its proposed certification."

The Anglo-French Concorde is the only supersonic transport for which there is an FAA application for certification at this time and it was submitted prior to the establishment of noise certification standards for new aircraft.

CIVIL AIRPLANE NOISE REDUCTION RETROFIT REQUIREMENTS — ANPRM 70-44

This advance notice, issued on 30 October 1970, announces that the FAA is considering rule making to establish noise reduction requirements that would involve modification (retrofit) of currently type certificated subsonic turbofan engine powered airplanes, regardless of category, as a condition to further operation of these airplanes. Two reasons are given for the need for noise reduction retrofit:

1. "The first reason is the obvious public need for relief. It was the noise of current fleet of aircraft that, in large part, led to the enactment of Public Law 90-411 and with respect to which the public need for protection is clearly the most urgent. The near-total noise saturation of hundreds of airport neighborhoods has been well documented and needs no further elaboration other than to restate the FAA's commitments to using every legal regulatory technique at its disposal to reduce the noise impact of aircraft through source noise reduction."

2. "The second reason for an agressive noise reduction retrofit program is that the noise of the current fleet of aircraft is a deterrent to the development of new airports, the extension of existing runways, and the continued full use of the airport system in the United States. The airport system is a vital

national asset and its health directly affects the health of the entire air transportation system. The FAA, therefore, regards an effective noise reduction retrofit regulatory program as being necessary in the broad public and national interest not only because of the relief it will bring to airport neighbors under Public Law 90-411 and the National Environmental Policy Act of 1969, but also because aircraft noise reduction retrofit is directly related to the further promotion, encouragement, and development of civil aeronautics."

The above quoted reasons clearly indicate FAA awareness that the public needs protection from noise and that the growth of aviation will be inhibited unless noise reduction is accomplished. Furthermore, the FAA believes that current technology is available for a feasible retrofit program: "In summary, research and development done to date has demonstrated that the basic concepts of noise suppression of turbofan engines are valid acoustically, and that materials and fabrication technologies may be developed to translate these concepts into hardware that could provide economically reasonable and technologically practicable means of significantly reducing the noise generated by certain currently certificated turbofan powered airplanes."

NOISE TYPE CERTIFICATION AND ACOUSTICAL CHANGE APPROVALS — NPRM 71-26

This notice, issued on 13 September 1971, announces that the FAA proposes to amend FAR Part 36 to require altitude and temperature accountability for the test conditions, to strengthen the test conditions for acoustical change approvals, and to make miscellaneous amendments to the appendixes. This proposed regulation would correct the following deficiencies in FAR Part 36:

- FAR Part 36 now permits compliance to be shown for one specific sea level condition only, without altitude and temperature accountability. This permits the airplane to be approved on the basis that it meets the noise levels of Appendix C of FAR Part 36 under a specific reference day sea level condition even though compliance with those noise limits may not be achievable under other conditions of altitude and temperature.

- The absence of temperature and altitude accountability permits approval of an acoustical change upon a showing that the aircraft after a change in type design is no noisier than the aircraft prior to the change under a specific reference day sea level condition, even though such a showing has not been made throughout the altitude and temperature conditions approved for the aircraft.
- Miscellaneous features in the appendixes tend to be confusing and misleading without specific interpretations by the certificating authorities.

NEWLY PRODUCED AIRPLANES OF OLDER TYPE DESIGN, PROPOSED APPLICATION OF NOISE STANDARDS — NPRM 72-19.

This notice, issued on 7 July 1972, announced that the FAA proposed to issue regulations requiring new production turbojet and transport category airplanes to comply with the noise standards of Appendix C of FAR Part 36, irrespective of type certification date.

FAR Part 36 currently applies specific noise standards only to airplanes type certificated on or after the 1 December 1969 effective date. The only current regulatory impact of Part 36 on airplanes type certificated prior to that date (and do not meet the specified noise limits) is the acoustical change provision, which prohibits changing the type design of those airplanes so as to result in further escalation of noise.

This proposed regulation would establish dates by which new production airplanes of older type designs must comply with Appendix C of FAR Part 36. The stated purpose is: "... to address the separate question whether the older generation of airplane types would continue to be manufactured, and added to the fleet, with noise levels higher than required for new type designs under Part 36."

Subsequently, the responses to the notice have been received and analyzed by the FAA. A draft of the proposed regulation has been prepared and has been received by the EPA for review and comment. The draft regulation (8.4-424) amends FAR Part 21 and 36 and establishes dates by which subsonic transport category or subsonic

turbojet powered airplanes (that have not had any flight time before these dates) must comply with the requirements of FAR Part 36. The dates are stated to be:

> " (1) December 1, 1973, for airplanes with maximum weights greater than 75,000 lbs., except for airplanes that are powered by Pratt and Whitney Turbo Wasp JT3D series engines;
>
> (2) December 31, 1974, for airplanes with maximum weights greater than 75,000 lbs and that are powered by Pratt and Whitney Turbo Wasp JT3D series engines; and
>
> (3) December 31, 1974, for airplanes with maximum weights of 75,000 lbs. and less."

CIVIL AIRPLANE FLEET NOISE LEVEL (FNL) REQUIREMENTS — ANPRM 73-3.

This advance notice, issued on 24 January 1973, announces that the FAA is considering proposing the adoption of regulations that would prevent escalation of fleet noise levels (FNL), would require a reduction in FNL on or before 1 July 1976, and would require airplanes to comply with FAR Part 36 on or after 1 July 1978. The proposal would apply to aircraft operated in interstate commerce by air carriers, supplemental air carriers, and commercial and air taxi operators operating turbojet powered airplanes with maximum weights of 75,000 pounds or greater. The proposal would not apply to airplanes engaged in foreign air commerce and airplanes operated in overseas air commerce.

The major elements of the FNL concept are:

1. Determining the noise levels for each airplane in the fleet.
2. Determining the total number of operations (takeoffs and landings), for each airplane type for a representative 90-day period.
3. Calculating a fleet noise level based on a mean logarithmic equation.
4. Establishing a precise limit on fleet noise levels.

Beginning on its effective date, the impact of the rule would be to immediately "freeze", and prevent any further escalation of, the FNLs that are now being generated

and to achieve a positive FNL reduction on and after 1 July 1976. This would be done by:

1. Requiring each operator to submit the data information necessary to establish the FNLs actually generated by the operator during a representative 90 consecutive days during the 12 months preceding the date of the rule.

2. The FAA determination of the initial FNLs.

3. Requiring that the initial FNLs not be exceeded.

Beginning on 1 July 1976, the rule would require that the FNLs originally established for each operator be reduced to a level that is halfway between the original level and the level that would exist if each airplane covered by this proposal was type certificated under FAR Part 36.

Beginning on 1 July 1978, the FNL concept would expire. In its place, the regulation would require each operator to restrict all of his operations covered by this proposal to airplanes type certificated under Part 36, Appendix C.

This advance notice was published after consideration of comments received in response to ANPRM 70-44, Civil Airplane Noise Reduction Retrofit Requirements. The responses to that advance notice were categorized in three basic groups:

1. City and State governmental authorities

2. Foreign states and manufacturers

3. Domestic industry groups and associations.

The members of the first group almost unanimously support the early implementation of retrofit requirements. However, the FAA states: "...the responses do not address the technological practicability or economic reasonableness of early implementation."

The members of the foreign group expressed the opinion that any retrofit requirements should be developed in the international forum. The advance notice 73-3 states: "The FAA supports the concept that it is desirable to obtain uniformity of regulatory action through the ICAO procedure, and, ... is working in support of that international

effort. Accordingly, this FNL proposal would supplement the establishment of international standards, while providing early relief to the public from aircraft noise generated by interstate operators."

The members of domestic industry groups were divided on the question of retrofit. The United Automobile Workers of America, the Air Line Pilots Association, the American Association of Airport Executives, the Airport Operators' Council International, the National Association of State Aviation Officials, and the National Academy of Sciences all endorsed the early initiation of an aircraft acoustical retrofit requirement. Their position, essentially, is that existing studies are adequate to establish technical and economic feasibility and that noise reduction would be meaningful to airport neighbors.

However, the Aerospace Industries Association and the Air Transport Association express the opposing opinion that adequate information is not available to proceed with an acoustic retrofit program. Additionally, they argue that regulations should not be promulgated until the term "meaningful relief" is defined, until complete acoustical modifications are available for each airplane type, and until specific financing means are resolved.

PROJECT REPORTS AND ADVISORY MATERIALS

This section concerns FAA project reports and draft FAA orders informally issued to the aviation community or issued formally to EPA as part of the consultative process. These materials are preliminary documents developed preparatory to the announcement of notices or advanced notices of proposed rule making and do not necessarily constitute or represent FAA policy. Some of the material discussed here may have been superseded by subsequent drafts, reports, or proposals and should not be assumed to represent current FAA work. This section is presented only to provide information on possible directions of future regulatory actions or ideas under preliminary consideration.

AMENDMENT TO FEDERAL AVIATION REGULATION TO PROVIDE FOR A TAKEOFF NOISE CONTROL OPERATING RULE (21 NOV 1972): PROJECT REPORT.

The objective of this project report (14.1-320) was stated to be "to provide information for the development of a Notice of Proposed Rule Making to amend the Federal Aviation Regulations to include takeoff noise control operating procedures for civil transport category and civil turbojet powered airplanes."

The background section of this project report provides a synopsis of the efforts (since 1960) by both the air transport industry and Federal agencies (FAA and NASA) to define a takeoff procedure that would simultaneously:

1. Provide a uniform procedure which would reduce the cockpit departure workload and enhance safety during this key phase of flight.
2. Produce uniformly "controlled and/or reduced noise levels" (underscoring added).

The concluding section of the background material states, "The FAA's past issuances of guidance/criteria documents, noise abatement rules, and the endorsement of the airlines' recent recommended takeoff procedures have not to date effected the goals desired. It is therefore deemed appropriate and warranted in further fulfilling our response to P.L. 90-411 in the control of aircraft noise that a Notice of Proposed Rule Making prescribing an operational noise control procedure be developed." Thus it appears that the FAA objective in making a rule on takeoff procedure may be directed principally toward control in order to ensure safe and constant results while achieving some noise relief along the takeoff flight path.

A constant and simple takeoff operating procedure on a system-wide basis may very well be justified for safety and economic considerations. However, maximum relief of community noise problems requires a high degree of flexibility and variation from one airport to another and is often different between runways at the same airport. The proposed rule is therefore not optimum from a noise standpoint for all airports.

NOISE CERTIFICATION RULE FOR QUIET SHORT HAUL CATEGORY AIRCRAFT, 29 DEC 1972: PROJECT REPORT.

This project report (14.2-323) had been under internal review and revision within the DOT/FAA since December 1970. From the front cover of the draft version it appears that the report is subject to internal review and revision at least annually.

The latest revision (29 December 1972) changed the scope of the category of aircraft to be covered from the Short Takeoff and Landing (STOL) (e.g. Ref 8.2-100) to a much broader category designated Quiet Short Haul (QSH). The QSH category includes not only the STOL but the Reduced Takeoff and Landing (RTOL) and the Vertical Takeoff and Landing (VTOL) types of aircraft. This includes fixed and rotary wing aircraft with stage lengths under 500 miles.

The background and historical sections of the project report takes cognizance of the impact on noise rulemaking by the National Environmental Policy Act of 1969, the Airport and Airway Development Act of 1970, as well as the Noise Control Act of 1972 (PL 92-574). In spite of the recognition of these Acts, in a section devoted to a discussion of alternative methods of providing QSH noise certification, the project report states: "Noise exposure certification--This method would control QSH noise by means of a noise measuring system concept tailored perhaps to specific land uses and/or existing ground noise environment. This would essentially constitute a certification of the airport, heliport or STOLport with respect to maximum allowable noise source and path options. The chief problem here is that the Federal Government does not fully have the authority, and perhaps should not, to exercise absolute control over local airport operations."

The stated objective of the project "is to establish the foundation for a rule limiting the maximum noise emission for the types of aircraft commonly designated as Quiet Short Haul. The rule should be effected as soon as practicable because of the prospect of this class of aircraft developing into a fast-expanding segment of local and regional commercial short haul air transportation. It is therefore urgent that noise reduction concepts are instilled as quickly as possible in the design and development of this class of aircraft. In this way, quiet short haul aircraft will be more

compatible with the communities they are intended to serve and this mode of transportation will be better able to fulfill the promise of its future role."

In addition to the wide variety of aircraft with the inherent wide variety of possible "configurations, combination of propulsion systems, and operational capabilities," the project appears to be faced with an equally wide variety of possible terminal facilities and attendant variable noise sensitivities.

The project report (14.2-323) includes a list that illustrates the wide variation in aircraft types considered to be included in the QSH category. For convenience, this list has been extracted and is as follows:

"(a) Turboprop Aircraft

(1) Deflected slipstream

(2) Tilt-wing

(3) Nonpowered lift CTOL

(b) Rotary Wing Aircraft

(1) Conventional Helicopters

(2) Advanced helicopters, i.e., compound type with slowed, stopped, trailing, stowed or other variable geometry rotors.

(c) Turbofan and Jet Flap Aircraft

(1) Fully internal flow

(2) Internally blown flap

(3) Externally blown flap

(4) Augmentor wing

(5) Overwing blown flap

(d) Lift Pod Aircraft

(1) High bypass ratio, high thrust/weight turbofans, either concentric or turbotip drive, in wing or fuselage lift pods or swingout/stowed within fuselage; separate cruise propulsion turbofans.

(c) Fan-In-Wing Aircraft

(1) Turbotip lift fans powered by turbojets or low bypass turbofans which also afford cruise propulsion."

The project report review also states that the subject types of aircraft are not covered under the current FAR Part 36 "Noise Standards: Aircraft Type Certification;" inasmuch as the Part 36 rule was directed toward a wide variety of Conventional Takeoff and Landing (CTOL) aircraft, the operational characteristics, thrust modes, environments, and economics of which are substantially dissimilar from the envisioned QSH type of aircraft. Thus a regulation "tailored" to and clearly appropriate to the type (as required by law) should be considered.

One of the project report conclusions is stated to be "since the QSH system development is in such a state of flux during its present embryonic stage, it is concluded that the issuance of an ANPRM on QSH noise would best suit the FAA's purposes in establishing a firm structure upon which to base specific QSH noise standards. Reliable specific data on various QSH aircraft noise characteristics and economics are urgently needed to construct an effective and viable QSH noise rule."

Other conclusions are stated to be:

"1. Second generation QSH aircraft should be no noisier than first generation of STOL aircraft.

2. Noise regulations should be developed with a view to the impact of environmental provisions of the Environmental Policy Act, the Airport and Airways Act and the Noise Control Act of 1972.

3. Most noise certification concepts lack the capability of matching aircraft noise to airport, heliport or STOLports. The potential for this matching exists through the new environmental legislation.

4. Enroute noise for quiet short haul routes should be given regulatory consideration.

5. The aircraft industry repeatedly stresses caution both in the premature issuance of a QSH noise rule and in regulatory noise limits which inhibit the development of the many types and sizes of QSH aircraft now in view. On the other hand, the Rule's entire objective would be negated if the FAA were to structure the regulation so as to permit a wide spectrum of noise emissions from all possible types of QSH aircraft. Further, it would seem that the noise sensitive task of establishing new metropolitan heliports and STOLports together with the demands of new environmental laws, would require QSH aircraft to accede to even more of an economic sacrifice in the cause of noise reduction than has been the case for CTOL aircraft."

The project report makes only one recommendation; that is, prepare an ANPRM. According to the recommendation, the ANPRM should serve three functions:

1. Provide emphasis of the FAA intent to require standards of maximum noise for QSH type aircraft.

2. Provide notice of intention to follow the general philosophy of the present subsonic noise regulations.

3. Solicit specific information from all segments of interested aviation sources, municipal, local, state, Federal and public entities and individuals on the specifics of R/V/STOL designs, physical and operational characteristics, environmental impacts, economic limitations, evolutionary development and alternatives.

The project report further provides a list of 19 specific areas of inquiry and, for convenience, all nineteen have been extracted and are listed below.

"(1) How best to envelop the class of aircraft known as QSH for noise certification purposes.

(2) The extent to which the class of QSH aircraft should be divided into subclasses, i.e., rotary wing, VTOL, STOL, RTOL, etc. for the purpose of establishing noise limits and measurement procedures.

(3) The extent to which the class of QSH aircraft should be further categorized for purposes of assessing the economic impact and technological feasibility of noise regulations.

(4) The extent to which noise level characteristics of present day and future types of QSH aircraft and their propulsion system can be predicted.

(5) The extent to which present conventional noise reduction techniques can be incorporated in the various types of QSH aircraft now envisioned.

(6) Specification of noise measurement points for certification purposes to ensure that noise information recorded in the flight manual will have maximum utility for long-range land use planning and future airport development.

(7) The variation in noise characteristics and operating economics associated with the various types of STOL aircraft now envisioned.

(8) How best to regulate noise for QSH aircraft (amend Part 36, promulgate new Part, etc.).

(9) The minimum time for compliance with a QSH noise rule.

(10) The expected market range for various classes of QSH aircraft if the development of metropolitan heliports and STOLports is not impeded by non-technological factors.

(11) An equitable method of establishing a relationship between maximum noise certification levels for QSH aircraft and economic and technological feasibility.

(12) The quantitative benefits associated with QSH operation from metropolitan airports, heliports and STOLports with relatively high background noise levels and with nonresidential nighttime communities.

(13) The extent and effect on total operating economics of larger classes of QSH aircraft foreseeably designed for both QSH and CTOL route structures.

(14) The economic penalties associated with minimum and maximum levels of noise reduction for various classes of QSH aircraft.

(15) The limitations on the utilization of the V/STOL aircraft's capability of high maneuverability by reason of airline practice due to passenger comfort, pilot acceptance, navigational equipment safety margins and operating economics.

(16) The need for enroute QSH noise restrictions.

(17) The alternative methods of QSH noise regulation.

(18) The development and placement of economic incentives in the Rule for reducing the noise of future QSH aircraft.

(19) The applicability of subjective noise rating concepts to rotary wing, RTOL, STOL and VTOL aircraft (ASDS, CNR, etc.)."

PROPELLER DRIVEN AIRCRAFT NOISE TYPE CERTIFICATION STANDARDS (NOTICE OF PROPOSED RULE MAKING): 22 JAN 1973: PROJECT REPORT.

The stated objective of the subject project "is to support a Notice of Proposed Rule Making to amend Part 36 to provide type certification standards for propeller driven aircraft (other than transport category already covered under Part 36)."

The proposed standards are stated to have been "designed to halt the escalation of noise from propeller aircraft and to ensure that new designs are substantially quieter."

The project report (14.1-322) does take cognizance of and references the Noise Control Act of 1972 (PL 92-574).

The proposed standards are stated to be applicable "to propeller driven aircraft normally certificated for airworthiness under FAR 23, including normal, utility and

acrobatic aircraft having a maximum certificated takeoff weight not exceeding 12,500 pounds (5,700 kg.). Within this range are included single and multi-engined aircraft equipped with various types of powerplants and that derive the major portion of their propulsive thrust by means of a propeller. Standards herein relating to noise certification for these propeller driven airplanes apply to all affected types of basically new design or modification to existing designs for which a type certificate is required. These standards will not be made retroactive to the extent of requiring modification of individual airplanes already in service but will embrace continued production of earlier types. It is proposed that all aircraft produced after 1 year following the issuance date of this FAR will meet a basic noise limit; whereas, after 31 December 1975, all original type certificates will meet a lower level. Original type certificates granted through December 1975 will also conform to the basic limit.

"It is noted that the noise produced by a light airplane belonging to a given basic model can, in some cases, be influenced to a significant degree by the installation of approved alternative equipment or by the incorporation of subsequent modifications, with particular reference to propeller and engine exhaust system. Therefore, the provision of FAR 36, covering the incorporation of acoustically significant changes, shall apply."

A particular guideline applied to this project led to recommending deviations from standards previously established under Part 36. The guideline was stated to be, "Any noise certification scheme for such aircraft should be as simple as possible, in consonance with the ability to produce consistent and reproducible results over the range of ambient test conditions likely to be encountered in practice."

The significant deviations are noted to include:

- The basic unit of noise measurement is based upon an A-weighted network (dBA) as opposed to the previously established Effective Perceived Noise Level (EPNdB).

- The noise is measured at a single point under the aircraft, which shall fly at constant altitude and power setting as opposed to the previously established three points of noise measurements (takeoff, approach and sideline), with the aircraft operating in the appropriate (takeoff or landing) mode.

The project report states that, "The basic approach taken in setting noise limits for general aviation propeller driven aircraft was to establish noise limits as a function of aircraft gross weight, using as a guide the current noise levels, limits previously established by Switzerland and Germany, and an estimate of reductions that are technically feasible and economically reasonable. These basic limits would apply for "standard" performance aircraft, having a "standard" power loading (W/HP). Correction factors, based on power loading, would be allowed to credit higher performance aircraft for their abilities to climb faster and to fly the pattern at a lower percent power."

The proposed noise limits are shown in Figure 3-1. As shown, the proposed standard noise levels, as in the original Part 36, are a function of aircraft weight. The allowable corrections are based upon the aircraft power loading (W/HP) and the correction to the measured value is proposed to be limited to minus 5 dB, initially, and minus 3 dB at a future date.

This report appears to be well developed, consistent with other similar standards for this type aircraft and capable of providing a noise limit with probable future reduction of noise generated by this type aircraft. Deviation from previously established standards under FAR, Part 36 appears to be unwarranted, except on the basis of simplicity and the economics resulting from the simpler measurements and procedures. The adoption of these simple standards to this type aircraft should in no way effect a change in those already established for turbojet powered transport category aircraft.

AIRCRAFT SOUND DESCRIPTION SYSTEM (DRAFT Order 7040, 3 AUG 1972):

This draft order "states policy and establishes procedures and guidance for the calculation and dissemination of aircraft sound data." In addition, it is intended to cancel Order 7040.1, 27 October 1965, Technical Report: "Land Use Planning Relating to Aircraft Noise."

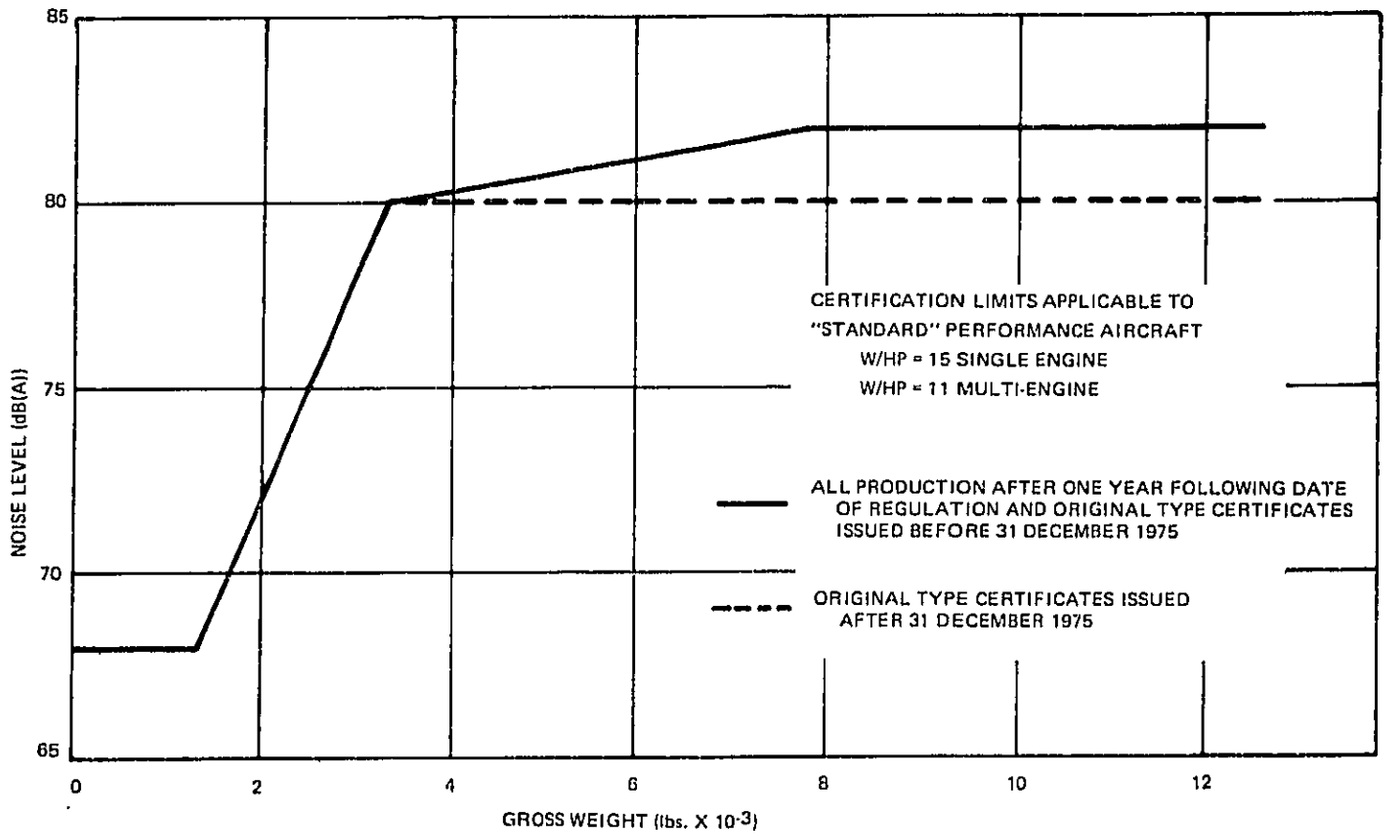

Figure 3-1. Proposed Noise Limits for Propeller Driven Aircraft

The background section of this draft order states, "the Federal Aviation Administration does not have authority to promulgate or enforce aircraft sound standards in the vicinity of airports. However, by virtue of the authority described in Paragraph 1 of this order, it does seek to promote, encourage and support, to the extent practicable, sound abatement plans and compatible land use planning and control by the responsible local and state authorities where the legal authority and responsibility rests."

The authorities cited in the above paragraph include:

- Public Law 90-411, Section 611 (a), an amendment to title VI of the Federal Aviation Act.
- The National Environmental Policy Act of 1969 (PL 91-190) together with Executive Order 11514.
- The Airport and Airway Development Act of 1970 (PL 91-258).

The draft order further states that, "the techniques for measuring and describing the physical characteristics of sound are highly developed and extensively used by members of the scientific community. However, methods for quantifying and describing sound exposure had not been developed that are readily understandable and generally usable."

The Aircraft Sound Description System (ASDS) developed by the FAA Office of Environmental Quality is intended to provide a "readily understandable and generally usable" sound descriptor. The draft order was not officially distributed but has been given wide unofficial distribution as witnessed, for example, by the resolution passed by the Board of Airport Commissioners of the Los Angeles International Airport (1.1-278). This resolution states:

"WHEREAS, by Draft Order No. 7040, dated August 3, 1972, the Department of Transportation, Federal Aviation Administration, distributed a proposed aircraft sound description system (ASDS); and

"WHEREAS, said Draft Order contains proposed procedures and guidance for the calculation and dissemination of aircraft sound data; and

"WHEREAS, it is in the best interest of the City of Los Angeles, the Department of Airports, and of airport operators generally that a national system of sound measurement be adopted for use by airport operators;

"NOW, THEREFORE, BE IT RESOLVED that the Board of Airport Commissioners of the City of Los Angeles approves the adoption of said aircraft sound description system and respectfully memorializes the Department of Transportation, the Federal Aviation Administration to expedite the proceedings necessary to adopt said system and to order the same at the earliest possible date."

The Draft Order was a preliminary document requiring considerable rework, as indicated in Reference (8.3-149), before official dissemination. However, it does present a totally new concept, and preliminary documents are legitimate media for their introduction. It is important that such preliminary documents are not represented as the result of final deliberations, nor assumed as such (1.1-278), until they are officially issued.

Subsequent to the draft order, the FAA has issued a report (8.4-286) which presents the ASDS concept in a far more readable form and which obviously has received the benefit of much more attention. However, it must be understood that the report is still not official because a disclaimer states "This document is issued under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its contents or use thereof." The following analysis, therefore, is also presented in the interest of information exchange with the intent to illuminate any weaknesses in the ASDS concept before it should be issued as an official FAA order. It is very important that new concepts proposed to replace existing ones be thoroughly examined as to their adequacy before precipitous decisions are made for their official use.

It may be more feasible to modify an existing concept for noise exposure, in order to improve its relevancy or correct its deficiencies, than to develop a totally new concept which must be time-tested for adequacy. The delay involved and resultant confusion would be detrimental to the development of a coordinated aircraft noise abatement program unless the new concept has such outstanding advantages as to offset any setback in affording "... present and future relief and protection to the public health and welfare from aircraft noise...".

ASDS Format

The FAA report describing the background and application of the ASDS (8.4-286) presents the concept in the following two forms:

1. Curves called sound contours defining the areas on the ground plane estimated to receive a level of noise of 85dB(A) or greater corresponding to types of aircraft and operating conditions. The results can be displayed as (a) a grid map containing a tabular printout giving the time in seconds that each 500 foot by 500 foot block on the ground plane is exposed to a level of noise of 85dB(A) or greater or (b) curves of time zones with identified ranges of exposure times (e.g., 0-5 minutes, 5-10 minutes, 10-15 minutes, etc.) to a level of noise of 85dB(A) or greater.

2. A quantification of airport noise for all or part of an airport neighborhood called situation index (SI) in units of acre minutes. The results can be presented as (a) a single number representing the summation of the number of minutes that each acre on the ground plane is exposed to a level of noise of 85dB(A) or greater or (b) a chart (histogram) that indicates the amount of acreage exposed to a level of noise of 85dB(A) or greater from different aircraft types.

Basic Input to ASDS

The primary element in the ASDS consists of single-event equal noise level contours of 85dB(A) assigned to various classes and operational modes of aircraft. The FAA report does not furnish any information or background detail on the construction of these contours and simply states "the appropriate sound contour data is selected from Section II of this instruction (to be provided in subsequent developments of an applications manual for the ASDS)."

The usual procedure for calculating noise level contours is dependent (as a minimum) upon the following three relationships:

1. A set of takeoff profiles and takeoff roll distances identified for each class of aircraft (e.g., four, three, and two jet engines) and takeoff weight or stage length. Also, one or more approach profiles and distances to touchdown.

2. The variation in noise level at a reference distance (e.g., dBA or EPNL at 200 feet) with engine power setting (e.g., engine pressure ratio, fan speed, or thrust).

3. The variation in noise level with slant range at closest point of approach for each power setting of interest (e.g., takeoff, cutback, and approach).

The preceding relationships represent extremely comprehensive sets of data that, because of the flexibility in aircraft operational procedures, are impossible to predict for each specific aircraft. The usual procedure, therefore, is to assume relationships for each type or class of aircraft that are meant to be representative of average performance, both for noise level and aircraft operations. These relationships (or even more sophisticated ones) are fundamental to all cumulative noise exposure concepts and the ASDS is no exception.

The ways in which the ASDS differ from other concepts begin after the inclusion of the contour data in the methodology, and the adequacy or validity of the ASDS will be analyzed accordingly in the following discussions. Nevertheless, it must be emphasized that the ASDS concept, no matter how attractive, can be invalidated in application by improper basic input. A set of contours (without published backup support) provided for use in ASDS computations is simply not sufficient for all those concerned (aviation community, environmentalists, land use planners, etc.) to make valid judgments on the results of any particular application.

Finally, with respect to basic input data, since all cumulative noise exposure concepts require essentially the same basic input including measurements, any flaws or weaknesses in such are not remedied by the development of a totally new concept. The sensible approach, of course, is to continue to improve the data acquisition, reduction, and computational procedures, including all the influential variables, to the extent commensurate with the accuracy of the measured data.

Basic Premise, Threshold Level, and Event Times

The basic premise of the ASDS concept "...is to state exposure to aircraft s' .nd in terms of the amount of time that sound levels exceed a preselected threshold value." The threshold value selected is 85dB(A) which corresponds roughly to the 100 EPNdB level used in the original draft order (8.3-149). In conjunction with the threshold value, and necessary to the premise, is an assumption of the length of time (duration) the noise of a single event aircraft flyover exceeds a level of 85dB(A). The ASDS concept assumes 15 seconds for takeoff events and 10 seconds for landing events. There are fallacies, however, in the choices of numerical values for level and time as well as in the basic premise.

The choice of 85dB(A) is poor on two counts. First, a single number is not sufficient to provide information for such purposes as noise compatible land use planning. A premise based upon time that sound levels exceed threshold values would have more validity if several threshold values were used. Second, a level of 85dB(A) is too high (except possibly as the highest level of several threshold values) to be of much use in evaluating noise exposure. The explanation provided in the ASDS report for the choice of 85dB(A) as the threshold is quite lengthy but apparently considerable weight was given to the assumptions "...that, under reasonable operating conditions, an 85dB(A) noise level corresponded approximately with both the altitude and lateral boundaries of airport traffic areas." The assumption may be correct, but threshold levels should be chosen to correspond with airport community noise impact areas which may extend beyond "airport traffic areas".

The term "threshold level" is used rather loosely in the ASDS which is a cumulative noise exposure concept where the cumulation is in minutes of noise exposure above a selected level (called threshold). Wherever land areas under consideration in the ASDS are assigned minutes of exposure, they are exposed to noise levels greater than 85dB(A), perhaps substantially greater. Only where the minutes of exposure are equal to zero would 85dB(A) exist, and for that case only can 85dB(A) be considered to have significance as a true threshold. The point is, minutes of noise exposure must not be assumed or implied to mean minutes of exposure to only 85dB(A).

To illustrate that 85dB(A) is too high a value to be of much use, an example will be constructed which can be compared with equivalent values for noise exposure forecast (NEF), the California measure (15.1-34) of community noise exposure level (CNEL), and the slightly modified version of both of them developed by Task Group 3 of this study (10.4-427) called day-night noise exposure level (Ldn). Consider a position on the ground exposed to a number of aircraft flyover events each having a maximum value of 85dB(A). In terms of ASDS, this ground position would be exposed to zero minutes of 85dB(A) and all positions nearer the aircraft would be exposed to a finite number of minutes of levels greater than 85dB(A). For the example, assume that 85dB(A) is equivalent to 100 EPNdB and that there are 240 flyover events per day (0700 to 2200) and 24 events per night (2200 to 0700). The compared noise exposure results are approximately as follows: 40 NEF, 75 CNEL, 75 Ldn, and zero minutes above 85dB(A) for the ASDS. The position on the ground for this example is the outermost or least exposed position considered by the ASDS; the emphasis would be placed

on positions exposed to finite numbers of minutes of noise greater than 85dB(A). Therefore, the areas examined by the ASDS for an 85dB(A) "threshold" would be interpreted by means of the other measures as areas of extreme annoyance, perhaps hearing risk, and clearly unacceptable for proposed housing sites (10.4-427, 10.4-428, 12.2-442). No such interpretations would be available for the ASDS results in terms of minutes of exposure.

The choice of 15 seconds for takeoff events and 10 seconds for landing events appears to be too low based upon duration time measurements (8.6-443) for effective perceived noise level (EPNL). However, this point is not obvious and further study is required to make a conclusive judgment because the duration times for noise levels in units of EPNdB are not necessarily closely related to the event times for noise levels in units of dB(A) as used in the ASDS. The explanation provided in the ASDS report does not conclusively support the choices of event times for takeoff and landing of 15 and 10 seconds, respectively.

Linear Summation of Events

The ASDS is influenced equally by acres per event and the number of events per day in the sense that if one is halved and the other doubled, the number of acre-minutes remains the same. In all of the international procedures for predicting aircraft noise exposure, developed by acoustical experts throughout the world, the effect of number of operations is included as some form of logarithmic relation and not linear. There are differences of opinion as to the particular logarithmic form that is most appropriate (e.g., whether 10 log or 15 log) but there is no justification whatever for the assumption of a linear relationship. The ASDS would penalize aircraft traffic growth far more than is realistic: doubling the number of operations would double the number of acre-minutes. On the other hand, for the concepts that incorporate numbers of operations logarithmically (e.g., NEF, CNEL, and Ldn), doubling the number of operations would increase the result by only three units, which is reasonable and much less severe.

The aviation community expects to grow in numbers of aircraft and operations and also in the production of noise controlled aircraft. The ASDS could indicate, erroneously, that the benefits gained from quieter aircraft (e.g., DC-10, L1011, 747, and noise retrofit) are offset by an increase in numbers of operations. The lack of subjective interpretations for the ASDS, such as annoyance, will not prevent the making of such evaluations. It should be expected that the ASDS acre-minutes predicted for an airport vicinity in 1980 that are less than, equal to, or greater than those

predicted for the same airport in 1972 will be judged to mean less, equal, or greater annoyance, respectively.

Conclusions of ASDS Analysis

The basic premise for the ASDS is unusual, to say the least, because no consideration is given in the ASDS to any upper limit above the threshold. For example, exposure to 300 minutes of noise varying between 85 and 110 dB(A) would certainly be expected to have greater impact on public health and welfare than would the same time exposure to noise varying between 85 and 90 dB(A). There is no mechanism in the ASDS by which the true levels of noise are identified except in the special case of a single event contour. Furthermore, the report (8.4-286) provides no information on guidelines, meaning, or interpretations of the ASDS results with respect to the effects of the time exposure of noise on people. Is 300 minutes of exposure to 85dB(A) or greater at one location just as bad as 300 minutes at another? Is 150 minutes of exposure half as bad as 300 minutes, or is 150 minutes of exposure even necessarily better than 300 minutes? Is it even certain that 10000 acre minutes represents less noise impact than 15000 acre minutes? The ASDS concept does not provide answers to these types of questions, consequently, without recommendations for the meaning or interpretation of the values, it is difficult to understand how the ASDS can be used for such purposes as environmental impact statements (1.2-422, 1.2-434), noise compatible land use planning, the evaluation of noise control measures, and noise certification of airports.

SECTION 4

REVIEW OF NOISE CONTROL ACTIONS OF OTHERS

STATE AND LOCAL

STATE OF CALIFORNIA

On November 10, 1970 the California State Aeronautics Board adopted airport noise standards which became effective as State Department of Aeronautics Regulations on December 1, 1972. The regulations are contained in Subchapter 6, Title 4 of the State Administrative Code (15.1-34).

The regulations were "designed to cause the airport proprietor, aircraft operator, local governments, pilots, and the department to work cooperatively to diminish noise. The regulations accomplish these ends by controlling and reducing the noise in communities in the vicinity of airports."

The regulations are applicable to all existing and future airports in California required to operate under a valid permit issued by the State Aeronautics Department.

With the exception of the specification of a Single Event Noise Exposure Level (SENEL), the regulation is concerned with noise exposure, which combines measures of noise and time at specific locations. That is, the regulation is primarily concerned with the totality of the aircraft noise at a particular location without specific regard for or an assessment of a particular event, source, or operation.

The enforcement of the California state regulations is delegated to the county in which the airport is located. Review of data and findings are maintained at the state level. Implementation, beyond that of the enforcing county, is the responsibility of the airport proprietors, except for complying with the SENEL, which is the responsibility of the aircraft operator.

The regulation specifies (but does not limit) the methods of controlling and reducing the noise impact to the following:

"(a) Encouraging use of the airport by aircraft classes with lower noise level characteristics and discouraging use by higher noise level aircraft classes;

(b) Encouraging approach and departure flight paths and procedures to minimize the noise in residential areas;

(c) Planning runway utilization schedules to take into account adjacent residential areas, noise characteristics of aircraft and noise sensitive time periods;

(d) Reduction of the flight frequency, particularly in the most noise sensitive time periods and by the noisier aircraft;

(e) Employing shielding for advantage, using natural terrain, buildings, et cetera; and

(f) Development of a compatible land use within the noise impact boundary.

Preference shall be given to actions which reduce the impact of airport noise on existing communities. Land use conversion involving existing residential communities shall normally be considered the least desirable action for achieving compliance with these regulations."

LOS ANGELES INTERNATIONAL AIRPORT

The management of Los Angeles International Airport have taken actions in order to alleviate their noise problem. The Board of Airport Commissioners has recently adopted a five point noise abatement program. The program includes:

1. A preferential runway use program that allows preferential treatment of aircraft certificated under FAR Part 36, Appendix C.

2. Planning of landing fees giving preferential treatment to aircraft certificated under FAR Part 36 and fees somewhat proportional to type noise levels.

3. A fleet noise rule making reference to FAR Part 36 noise levels. A stated goal of 40 percent of all aircraft using the airport being in compliance by July 1, 1977, and a rule of 100 percent compliance by December 31, 1979. The rule will stand as a regulation at the airport "unless and until a more stringent rule is adopted by the Federal Government, or by any one or more of its agencies authorized to do so."

4. Establishment of an airport Noise Reduction Enforcement Division with the staff and equipment required to measure aircraft noise to ensure compliance with standards fixed by FAR Part 36.

5. Revocation of airline operating permits when carriers are shown to be repeatedly in violation of the preferential use runway program.

The regulations in the cited resolution of the Board of Commissioners of the Los Angeles International Airport (15.2-265) reflect the use of some of the noise control options available to the airport operator when implemented in conformance with FAA approved procedures. The use of these options is undoubtedly related to the California airport noise regulation (15.1-34).

INDUSTRY NOISE CONTROL ACTIONS

Other options that appear to be available for use in rulemaking are those which would tend to regulate, control, or standardize certain aircraft operational alternatives such as two-segment approaches, reduced thrust takeoffs, and landings without the use of thrust reversers. Controls placed upon flight operations invariably involve the safety of the particular aircraft and often other aircraft in "the system"; therefore, the successful development and application of aircraft operational noise rules often require the combined efforts of the FAA, the aircraft manufacturer, the airlines, and the flight crews.

The takeoff operational procedures developed and promulgated by the Air Transport Association of America (ATA) and the National Business Aircraft Association, Incorporated (NBAA) are contained in References 13.1-150, 188 and 266. These procedures were developed with the assistance of the FAA. The ATA procedure has been in effect since 1 August 1972; however, the FAA Project Report relating to the Noise Control Operating Rule for Takeoff (Reference 14.1-320) dated 21 November 1972 indicates that "the endorsement of the airlines' recent recommended takeoff procedure have not to date effected the goals desired." The project report does not explain which goals or how the failure manifests itself. In any case, the ATA Flight Operations Committee efforts, as well as those made by the staff of NBAA, are representative of the noise control actions which have been, and are continuing to be, taken by the air transport industry. These are voluntary actions resulting in self-imposed rules.

Inasmuch as there appears to be no comprehensive effort devoted to monitoring and assessing the results, the degree to which the effort is effective, in terms of actual reduced noise levels or exposure, is not known at this time.

Noise control operating procedures taken by another segment of the air transport industry, the intrastate carriers operating in the State of California, are reported in References 4.1-267 and 4.1-268. These actions appear to be developed on a case-by-case basis in cooperation with the California airport operators in response to the previously cited state airport regulations. These actions, as well as those proposed or taken by ALPA, ATA and NBAA have been thoroughly reviewed in the report of Task Group 2 (10.4-426).

SECTION 5

SUMMARY AND CONCLUSIONS

The Noise Control Act of 1972 (Public Law 92-574) amends the Federal Aviation Act of 1958 to include the concept of "health and welfare" and to define the responsibilities of and interrelationships between the Federal Aviation Administration (FAA) and the Environmental Protection Agency (EPA) in the control and abatement of aircraft noise and sonic boom. Specifically, PL 92-574 requires that, in order to afford present and future relief and protection to the public health and welfare from aircraft noise and sonic boom, the FAA, after consultation with EPA, shall prescribe and amend such regulations as the FAA may find necessary to provide for the control and abatement of aircraft noise and sonic boom.

In prescribing and amending regulations, PL 92-574 requires that FAA shall consider whether any regulation is:

1. Consistent with the highest degree of safety.
2. Economically reasonable.
3. Technologically practicable.
4. Appropriate to the type.

The above considerations form a set of constraints oriented to safety, economics, and technology. However, PL 92-574 has introduced a fifth constraint: protection to the public health and welfare.

The abatement of aircraft noise is accomplished by exercising, to the extent feasible, the noise control options available to the aircraft manufacturers and operators, the airport operators, and the public authorities in the airport neighborhood communities. Finally, the remainder of the noise must be contained within noise compatible boundaries.

Regulations are the most effective technique for exploiting available noise control technology and, if properly constructed and implemented, can provide the incentive to ensure continuing effort directed to technological advancements.

THREE PART REGULATORY PLAN

Public Law 92-574 (superseding PL 90-411) amends the Federal Aviation Act of 1958 to include the concept of health and welfare. The full text of the amendment is given in Figure 1-2. In effect, a fifth regulatory constraint has been added as discussed in Section I and shown in Figure 1-1. The FAA has the authority to prescribe aircraft noise regulations and is well qualified to develop them effectively within the original four constraints. The fifth constraint (health and welfare) is the responsibility of both FAA and EPA; but EPA has the capability, by virtue of broader noise control responsibility and greater objectivity, for coping more effectively with that constraint. In fact, no member of the aviation community, by virtue of its vested interests, should be put in the position of having major responsibility for the possible limitation of the growth of aviation. A perplexing question, therefore arises. That is, how can EPA and FAA most effectively work together and reconcile any differences in interpretation of what constitutes protection to the public health and welfare? A solution to this problem is presented in the following three part plan.

REGULATIONS PRESCRIBED AND ENFORCED BY FAA

The FAA shall continue to prescribe and enforce aircraft noise regulations for the aircraft manufacturers and operators, considering the principal regulatory constraints to be safety, economics, and technology. The purpose or objective for the FAA in prescribing regulations shall be as stated in PL 92-574; that is, "In order to afford present and future relief and protection to the public health and welfare from aircraft noise and sonic boom...". The FAA shall be considered to have the best expertise in prescribing regulations within the constraints and, although EPA shall be consulted for advice and recommendations, the FAA shall have the responsibility and authority for their content and enforcement.

The noise control regulations prescribed by the FAA for the aircraft manufacturers and operators shall be expected to reflect the latest state of the art of safe and economical technology and shall be expected to effect a decrease in noise exposure, but not necessarily to the extent of full protection to the public health and welfare. Noise regulations that pertain to source emissions or flight procedures of specific types of aircraft cannot be expected to take into consideration such unknowns as the quantity of these aircraft that eventually will be produced or where they will be operated. Consequently, unless single event noise criteria is available for defining protection to the public health and welfare, source emissions or flight procedures regulations can be developed only on the basis of safety, economics, and technology. The regulations shall be of the "umbrella" type in the sense that those regulated can all comply by use of available technology but some may be capable of achieving lower noise levels than others by virture of their greater technological capability. An airworthiness or operation certificate shall be contingent upon compliance with the noise control regulations.

REGULATIONS PROPOSED BY EPA

EPA shall, when necessary, present to the FAA recommendations for noise control regulations that EPA determines to be needed to increase the protection to the public health and welfare. The recommendations shall be in the form of proposed regulations containing the substance of noise control actions but that may not have been thoroughly analyzed regarding safety, economics, and technology. The FAA shall have the authority to reject the EPA proposals on the basis that the constraints of safety, economics, and technology have been violated.

If, however, EPA has reason to believe that FAA rejection of the proposed regulations is unwarranted, EPA shall consult with the FAA and may request the FAA to review their decision. Any such request shall be published in the Federal Register in accordance with the detailed illumination procedure required by PL 92-574 (see Figure 1-2).

AIRPORT REGULATIONS (PERMITS) PRESCRIBED AND ENFORCED BY FAA OR EPA

EPA shall have the authority and responsibility to develop criteria and noise evaluation methodology sufficient to establish noise exposure criteria such as represented by point A in Figure 2-3. That numerical level shall establish the meaning of protection to the public health and welfare based upon the current state of the art of determining the effects of noise on man and other ecological systems and shall consider that 100 percent protection is unreasonable. As studies continue over the years, this number may be lowered, particularly if evidence should indicate that noise is a hazard to health in ways not apparent initially.

The criteria establishing protection to the public health and welfare shall represent a level (or dose) of cumulative noise exposure over a 24-hour period that, if exceeded for a specified period of years, would constitute lack of protection or eventually may be classed as a hazard, depending upon length of exposure. A point to be emphasized, however, is that mere exceedance of this number only indicates that the noise exposure is a degrading environmental influence and not a cause of immediate noticeable irreversible damage.

All airport operators shall be required to predict their aircraft operations for a typical 24-hour day and to construct noise exposure contours for prescribed numerical levels in conformance with a methodology specified by EPA. The land area within the contours for each airport neighborhood shall be examined for noise-compatible usage based upon a definition determined by EPA with advice and recommendations from other interested Federal, State, and local agencies. Wherever land areas are considered to be incompatible with the noise exposure, the airport operator shall be required to begin to restrict the aircraft operations by all regulatory means at his disposal (curfews, quotas, weight and type limitations, preferential runway use, landing fees, etc.). The restrictions shall be in effect until all land areas within specified contours are noise-compatible. Full compliance with land use compatibility shall be specified in a reasonable time period, permitting the aircraft operators and manufactuers to implement the current and near future source and path noise control technology and permitting land areas within these contours to be converted by the

appropriate authorities (airport operators, and/or Federal, State, and local governments) to noise compatible use (insulated buildings, manufacturing, recreation, etc.).

SUMMARY OF THREE-PART PLAN

The three part regulatory procedure discussed presents a logical plan for controlling aircraft noise exposure to levels that afford protection to the public health and welfare. The procedures would permit the FAA to exercise their considerable expertise in safety, economics, and technology without conflicting influences resulting from their need to interpret the meaning of protection to health and welfare. EPA would have extensive consultations with FAA and would, on occasion, propose new or modified regulations. In general, however, EPA would recognize and defer to the FAA expert judgment but would have available, in the case of serious disagreements, the public dissemination procedure specified in PL 92-574. The controls on noise exposure, to the extent of protection of the public health and welfare, would be implemented at the airport by the airport authorities, because the airport neighborhood is where the environmental degradation exists and where the ultimate controls should be. The airport authorities would impose restrictions on the aircraft operators as needed to ensure that the airport neighborhood communities are noise-compatible. The restrictions would provide incentive for the aircraft operators to conduct thorough investigations and consider maximum utilization of the available source and path noise control options. The fact that an aircraft manufacturer or operator has barely complied with an FAA "umbrella type" regulation would not ensure the acceptance of a particular airplane at all airports. The airport restrictions would, therefore, encourage the aircraft operators and manufacturers to satisfy the FAA regulations by full utilization of available technology and not merely comply with specified limits.

The airport permit plan is similar in concept to the plan incorporated in the airport noise standards of the State of California, which became effective as State Department of Aeronautics Regulations on 1 December 1972. Many of the technical and functional details that have been worked out for the State of California would be applicable here.

SECTION 6

RECOMMENDATIONS

The FAA, since the advent of FAR Part 36, has been concerned with the development of a considerable number of noise control regulatory actions. As discussed in Section V-3, there are two regulations, two NPRMs, three ANPRMs, and three project reports. The two regulations, FAR Part 36 for subsonic transports and turbojets and FAR Part 91.55 for sonic boom, effectively prevent the escalation of source noise and sonic boom from civil aircraft. Considering the recent rapid growth of civil aircraft (size and thrust, as well as quantity), holding the line on source noise is a noteworthy achievement. Furthermore, the remaining eight proposed regulatory actions, if implemented with only relatively slight modifications, would continue to limit and taken together effect significant reduction in noise exposure by 1980. The land areas within the noise exposure contours representing protection to the public health and welfare, such as shown in Figure 2-5, would experience substantial shrinkage, thus minimizing the residual land areas requiring noise-compatible usage.

In addition, there are other potential noise control actions not necessarily explored in depth by the FAA, such as discussed in detail in the report of Task Group 2, that would further reduce substantially the noise exposure areas.

IMMEDIATE FAA REGULATORY ACTION

ANPRM 70-33: SUPERSONIC AIRCRAFT NOISE

The noise problems relating to supersonic transports can be identified with current and future types of these aircraft. For the current types (Concorde and TU-144), some models exist, others are in production, and additional models including growth versions may be produced. The future types are defined as those that have no applications for type certificates and may not have been designed nor even thought of.

Many manufacturing members of the aviation community believe that the basic differences in the design characteristics of subsonic and supersonic aircraft preclude the use of noise standards applicable to both types of aircraft. Even though supersonic transports will share the same airports with subsonic transports that will have complied with the FAR Part 36 noise standards current at that time, they believe that separate noise regulations should be developed for supersonic transports permitting them to exceed the required levels for the subsonic aircraft. Unless this is done, they maintain, the development of supersonic transport aircraft will be severely inhibited. In support of this position, the International Civil Aviation Organization (ICAO) recommended (CAN 3, Agenda Item 3) Ref. 8.4-185 that future supersonic transport airplanes be designed to minimize the noise levels below the approach path, below the takeoff path, and to the side of the airplane during takeoff climb. Annex 16 noise certification standards for subsonic turbojet airplanes (which are practically the same as FAR 36), current at the time the application for certificate of airworthiness for the prototype was accepted, should serve only as a general guideline.

The ICAO recommendations, however, do not appear to be compatible with the requirements of PL 92-574. On the one hand, it is not unreasonable to allow limited numbers of existing supersonic aircraft (or whose construction is committed) to share airports with subsonic aircraft providing they comply with the airport "permit" requirements. On the other hand, it is not reasonable to issue a noise "carte blanche" to the manufacturers allowing them freedom to design future aircraft with the degree of noise source control they think best.

In consideration of the above discussion and the requirements of PL 92-574, it is recommended that existing SST aircraft types (Concorde and TU-144) be regulated to noise levels as low as they are capable of achieving through available technology or operational controls. Future SST aircraft types should be regulated to noise levels no higher than the original FAR 36 levels. As more advanced noise control technology becomes available, limits should be reduced accordingly.

Existing SST aircraft cannot comply with Part 36, but if the airport permit plan discussed in Section 5 is implemented, the noise exposure will be maintained within

compatible land use boundaries. Some airports might be able to accept numerous SST aircraft operations per day without jeopardizing public health and welfare, while other airports might be forced to limit them to a very few per day or none at all.

NPRM 72-19: NEWLY PRODUCED AIRPLANES OF OLDER TYPE DESIGNS

The FAA has received and analyzed responses to this notice and has drafted a regulation providing changes to FAR Parts 21 and 36. A regulation, prescribed in accordance with the draft, should control the noise of new production subsonic transport category or subsonic turbojet powered airplanes to FAR 36 levels (which levels are commensurate with current technology capability). It is recommended, therefore, that a regulation be expedited in accordance with the FAA draft.

ANPRM 70 - 44 and ANPRM 73 - 3: CIVIL AIRPLANE NOISE REDUCTION RETROFIT AND FLEET NOISE REQUIREMENTS

Two advance notices of proposed regulations have been issued having essentially the same objective -- retrofit of currently type-certificated subsonic turbofan powered aircraft. The earlier "straight retrofit" notice merely discusses the need for noise reduction and emphasizes that current technology is available for a feasible retrofit program. The later notice on fleet noise level (FNL) was published after consideration of comments received in response to the earlier notice and presents a detailed methodology and implementation procedure that permits and encourages other alternatives as well as retrofit. The FNL proposal is well developed and could be converted to a regulation in a short time, while the straight retrofit proposal might require considerable additional development before it could be structured as a regulation.

Most of the members of Task Group 5 indicated that the FNL concept was preferable to a straight retrofit rule but that the FNL proposal as written should be modified with respect to some of the details. The most common objection was that the proposed formula for calculating FNL, using a logarithmic summation, does not give sufficient incentive to airlines to acquire aircraft having noise levels significantly below the FAR Part 36 Appendix C levels. For example, sufficient credit would not

be given to airlines that purchase new widebody aircraft. This objection does not appear to be compatible with PL 92-574 requiring protection to the public health and welfare. Noise exposure reduction cannot be accomplished by adding numbers of lesser noise sources. The major noise sources must be reduced first, then the minor sources become important. Merely purchasing and using widebody aircraft will have no significant effect on the overall community noise exposure unless the noisy narrow-body aircraft are retrofitted or replaced. The logarithmic summation procedure is much more representative of the physical and subjective characteristics of noise than is a linear summation procedure.

The point raised on incentives to acquire aircraft having noise levels lower than the criteria of FAR Part 36 is, however, a good one. The way to accomplish this is to have the FNL regulation continue, and not terminate in 1978, with a number of goals (or "gates" as one manufacturer suggests) that decrease in time, reflecting or exploiting technology advancements. The first gate would be the original value of the fleet noise level for each air carrier, which would establish his upper limit and which he would not be permitted to exceed. The second gate would occur on 1 July 1976 where the FNL originally established for each operator would be required to be reduced to a level that is halfway to the FAR Part 36 level applicable to his fleet.

The third gate would occur on 1 July 1978, when all of the aircraft for each operator would be required to comply with the FAR Part 36 Appendix C levels. At the third gate, the FNL for each operator would be somewhat below the FAR 36 levels applicable to his fleet, because many of his aircraft individually would have levels below the criteria, and none would be above. Also, the third gate would represent the situation to be expected if a straight retrofit rule were prescribed. The fourth, and all future gates, would be dependent upon future technological developments. For example, a fourth gate specified for 1980 might require FNL values to be five EPNdB below the values for the third gate to exploit the refan technology if available.

The concept and structure of the FNL proposal appears adequate to effectively exploit the current technology (nacelle retrofit) and to allow and encourage the near

future technology (refan retrofit) to contribute as it becomes operable, and to encourage the phaseout of existing aircraft by the introduction of new wide-body and other quiet aircraft. In addition, the FNL concept would periodically provide a great deal of useful information to the Government on air carrier fleet size, mix, and utilization. However, there are several features in the proposal that weaken its effectiveness and should be removed. There are several features that would add strength if included.

In consideration of the preceding discussion and of the requirements of PL 92-574, the Task Group 5 report recommendation is that the FNL proposal (ANPRM 73-3) be prescribed as a regulation with the following exceptions:

1. Omit exemption for airplanes engaged in foreign air commerce except supersonic transports,
2. Omit exemption for airplanes engaged in overseas air commerce,
3. Omit expiration date of 1 July 1978 and continue the FNL concept indefinitely to permit the implementation of technological advancements (e.g., refan) as they become available,
4. Include airplanes engaged in intrastate air commerce,
5. Include FNL requirements for sideline noise as well as takeoff and approach.

A fleet noise level rule would be superior to and obviate the need for a straight retrofit rule such as considered in ANPRM 70-44.

PROJECT REPORT: TAKEOFF OPERATING RULE

Noise abatement takeoff operating procedures have two important requirements. First, they must be safe, standardized, and capable of being included in routine operation at any airport. Second, they must be capable of effecting significant noise reduction for critical noise impact areas. Unfortunately, no single takeoff procedure is capable of providing the necessary noise relief for all airport neighborhood communities. Consequently, more than one departure procedure should be considered for standardization, so that each airport can decide which procedure and runway combination best protects the public health and welfare of their neighborhood communities.

Individual airports, or runways of the airports, can be placed into three main categories regarding community noise exposure:

1. Sideline noise sensitive,
2. Near downrange noise sensitive,
3. Far downrange noise sensitive.

Consequently, three standardized noise abatement takeoff operating procedures should be developed so that all airport neighborhood communities can be assured of the minimum noise exposure that available safe flight operational procedures can bring. Various flight operational procedures are discussed in detail in the Task Group 2 report, and specific regulations in the form of project reports will be proposed, subsequent to this report, to the FAA, for noise abatement takeoff procedures. However, in brief, a sideline noise sensitive departure procedure would require a reduced-thrust takeoff. A near downrange noise sensitive departure procedure would require a steep initial climb and sharp thrust cutback (a cutback such as detailed in FAR Part 36 Appendix C). A far downrange noise sensitive departure procedure would be as presented in the FAA Project Report discussed in Section 3 of this report.

It is recommended that the FAA proceed with all actions necessary to bring into effect the proposed turbojet powered takeoff operating rule as provided in the project report. The proposed rule is not optimum from a noise standpoint for all airports, but it does assure minimal noise in areas at relatively long distances from the airport, and, in general, some relief resulting from non-standardized departure procedures. Therefore, it is also recommended that the FAA continue to develop additional departure flight control rules that will provide minimum noise exposure for all airport communities while maintaining safe individual aircraft and system operations.

PROJECT REPORT: PROPELLER DRIVEN AIRCRAFT

The project report represents the basis for a rule that will halt the escalation of noise generated by propeller driven aircraft. However, for noise type-certification purposes, the public health and welfare would be better protected if the FAR 36 noise

evaluation measure, Effective Perceived Noise Level (EPNL) in units of EPNdB, were specified instead of the A-weighted network in units of dBA and if three noise certification points were required instead of one.

In consideration of the preceding discussion and the requirements of PL 92-574, it is recommended that the project report be developed as soon as possible into a regulation including the EPNL evaluation measure and a three-point measurement system similar to FAR 36, but with levels and distances chosen to fully exploit the availability of current source and flight path noise control technology for propeller driven aircraft.

ADDITIONAL FAA REGULATORY ACTION

FAR PART 36

This rule, applying to subsonic transport category airplanes and for subsonic turbojet powered airplanes regardless of category, has been in effect for over 3 years. The levels of Appendix C provide an "umbrella" for aircraft propelled by the new high-bypass ratio engine in the sense that the noise from such aircraft can be controlled to levels considerably below that criteria. Consideration should be given to lowering the criteria levels for all new aircraft. However, the existing criteria levels are reasonable (in the technologically practicable sense) for aircraft that are propelled by the existing low-bypass ratio engines and that cannot comply, except with the aid of some sort of retrofit modification.

It is recommended that the criteria levels for Appendix C remain in effect as an "umbrella" for the existing low-and high-bypass ratio fleet. However, future FAR 36 category aircraft should be regulated by the FAA to levels of Appendix C minus five to ten. Consideration must be given for the approach condition to ensure that such levels are not lower than can be achieved by available technology for control of the airframe aerodynamic noise.

It would be appropriate to include in the revised regulations the "Acoustical Change" adjustments proposed in NPRM 71-26 as determined necessary to make the rule clearer and more effective.

PROJECT REPORT: QUIET SHORT HAUL AIRCRAFT

The current effort to gather all possible types and varieties of R/S/VTOL aircraft (with their attendant variability in propulsion and lift systems, types of terminal facilities, probable route structures and economies) into one noise envelope appears to be impractical. This is especially true if the rule is to be established in time to properly influence design, development, and introduction of a truly quiet short haul aircraft system.

It is recommended that the regulatory process be initiated to provide a noise rule for short haul aircraft that would require only a simple modification to FAR Part 36. The three-point measurement concept and Appendixes A and B are recommended for short haul aircraft. Only criteria levels and locations of measuring points need be modified to reflect the lower noise levels required for city and suburban center operations and for comparatively low altitude cruise paths.

MISCELLANEOUS FEDERAL ACTION

The three-part regulatory plan presented in Section 5 introduces the airport permit concept in which the controls on noise exposure, to the extent of protection of the public health and welfare, would be implemented at the airport. Such a permit can be incorporated in an airport certificate issued by the FAA under Title VI of the Federal Aviation Act of 1958. An alternative method of implementing airport noise standards would be to transfer this authority to EPA.

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344	"Supporting Information for the Adopted Noise Regulations for California Airports," Final Report to the California Department of Aeronautics, Report No. WCR 70-3(R), Wyle Laboratories, 29 Jan '71.
397	John S. Moore, Ltr: "Comments on Aircraft/Airport Noise Study Task Force", Illinois Environmental Protection Agency, 20 June 1973.
351	B. J. Lockheed, Ltr: "Comments on Chapter 3: Operations Analysis Task Group 2," City of Los Angeles, Dept. of Airports, 8 May 1973.
245	M. Mergell; Ltr: "City of Inglewood's Support of EPA Aircraft/Airport Noise Study Task Force," City of Inglewood, 26 March 1973.
382	M. S. Spelman, Ltr. "Comments on Possible Aircraft Jet Engine Noise Research," Malcolm S. Spelman Associates, Aviation Consultants to Nassau County, N.Y., 4 May '73.
383	[illegible] Diamond, Ltr. "Participation in EPA Task Force", Department of Environmental Conservation, State of New York, 25 April 1973.

MASTER FILE NO.	BIBLIOGRAPHIC CITATION
444	John S. Moore; "Position Statement for Illinois Environmental Protection Agency", State of Illinois, July 1973.

APPENDIX A

POSITION PAPERS

OF

TASK GROUP MEMBERS

Note: Throughout the development of this report, and especially during the review of the two published drafts, the chairman and staff continually solicited two types of information from the task group memberships. First, written comments and critiques, as well as additional data, were requested of all and submitted by most active participants. This information has been helpful in the refinement of this final report. All of the submissions, comments and critiques are contained in the list of references and bibliography, and a copy of each is preserved and maintained, available to the public, in the task group master file. Second, position papers in which the members, representing their various interests, would state their position relative to the issues, independent of the conclusions and recommendations stated in this report, were solicited. Those position papers are included in this appendix.

AEROSPACE INDUSTRIES ASSOCIATION OF AMERICA, INC.

1725 DE SALES STREET, N.W., WASHINGTON, D.C. 20036 TEL. 347-2315

July 2, 1973

Dr. Alvin F. Meyer
Deputy Assistant Administrator for
Noise Control Program
Environmental Protection Agency
1921 Jefferson Davis Highway
Room 1115
Arlington, Virginia 20460

Dear Dr. Meyer:

At the invitation of the Administrator, Environmental Protection Agency, several AIA member companies participated in your Aircraft/Airport Noise Study. A study task force, divided into six study groups, has assisted in developing respective parts of the report required by the Noise Control Act of 1972. Because of the pace of task group activities and broad scope of information and data being assembled, it was not possible for AIA to develop and submit positions as the study progressed.

We are deeply concerned over the conduct of the study and desire to provide the following comments on this matter:

a. The total subject of aircraft noise control, including standards, retrofit or phaseout of existing aircraft, cumulative noise exposure, operating procedures and definition of health and welfare is exceedingly complex and involved. We are concerned that the five month period available did not allow sufficient time for EPA to assemble a team, let contracts, and accomplish the work necessary to complete the study in a entirely satisfactory manner. Furthermore, this short time made it impossible for the task group members to adequately analyze the findings of the contractors or comment on the work to date in any detail.

b. Because of the diverse backgrounds, expertise and interests of the task group members, little attempt was made to determine consensus or majority opinions on the multitude of questions discussed in the meetings. Many of the conclusions and recommendations developed by Task Group Chairmen were in fact not even covered in the meetings. Consequently, the final reports should not be represented as the conclusions and recommendations of the task groups. They are, more realistically, the opinions and individual views of the Task Group Chairmen

which in some important instances do not reflect the arguments and facts presented by the members.

c. The AIA supports efforts to review the existing noise standards for new aircraft designs and to strengthen them. The successful introduction of resulting quieter aircraft into the fleet is critically dependent on Federal action to insure that these aircraft once certificated as complying with the applicable standards shall have the right to operate at all airports, where they meet airworthiness requirements. It is essential that airport operators be preempted from prescribing restrictions which would prevent such certificated aircraft from operating at their airports. The necessity for federal preemptions does not conflict with the use of noise abatement operating procedures. However, it is essential that the operational procedures and required aircraft equipment be FAA prescribed for reasons of safety of operation, pilot training and equipment interchangeability. Any other course which permits individual airport authorities to specify unique requirements will lead to chaos and will be counterproductive to the intent of Public Law 92-574.

d. In general, we find that the cost analysis approach taken by EPA was inadequate. For example, the cost analysis on curfews would suggest that night time curfews offer a very efficient means of reducing noise exposure areas on per dollar cost basis. In fact, the adverse economic impact resulting from disruption to overseas travel and from aircraft being other than where needed for the following day's flights would be severe and was not properly considered. Another example is in the case of land use studies where more factual data is needed in place of oversimplified extrapolations. We are convinced that the economic analyses must be completely re-examined before any meaningful conclusions can be drawn.

e. While AIA is not in a position to disagree with the general approach taken to rate noise exposure using the dBA unit, we strongly question the selection of the specific values of 80 for hearing damage and 60 as the ultimate goal for annoyance or disturbance criteria in the L_{dn} scale. The data presented does not adequately substantiate the selection of these levels. The implication and impact of these limits is far reaching. Such limits require substantiation prior to their selection.

f. The FAA noise regulatory actions recommended by the Task Group Chairmen contain a number of elements with which AIA is not in agreement. These disagreements will be discussed at the time issue of subsequent regulatory notices.

The AIA recognizes the extent of the noise problem and the need for progress in alleviating its impact on the environment. We agree that regulations and procedures relating to operations and compatible land use are necessary to assist in reducing noise exposure. We also agree with the need for continued research to reduce noise at the source and provide operating procedures to reduce noise exposure for airport neighbors. We concur with the need to provide financing for research, equipment development, implementation of noise control measures, and land acquisition.

In closing, we do want to commend the EPA Task Group Chairmen for their diligent efforts under difficult circumstances. We urge your consideration of our concerns discussed above.

This letter revises AIA letter of May 25, 1973 to you. It is submitted in request to your appeal at the EPA hearings on June 20, 1973 at the Department of Commerce Auditorium, Washington, D. C. for all previous submittals made to EPA on the study subject be reviewed and revised not later than July 2, 1973. As reflected in our statement at the hearing on June 20, 1973, it is requested that this statement be included in the record of all study groups.

Very truly yours,

AEROSPACE TECHNICAL COUNCIL

Gene I. Martin
Associate Director
Civil Aircraft Technical Requirements

GIM:ssf

cc: John Schettino - EPA
EPA Task Group Chairmen (6)

AOCI POSITION ON THE REPORT OF EPA TASK GROUP NO. 5

Task Group No. 5 was directed to examine existing FAR's which affect aircraft noise and to make recommendations concerning their adequacy as well as proposing new regulations. In the process of performing this function, it became apparent that the direction which the final report would take had for all practical purposes been established before the very first meeting. It can only be suggested that EPA had a particular "game plan" which it intended to take, and the function of the Task Group would be to provide such data as would substantiate it. Opposing views were heard courteously, but it was made clear that the EPA staff and its paid consultant were the only ones with the responsibility to write the report. Consensus was not only not required but no votes were ever taken.

The basic recommendation of the report of Task Group No. 5 consists of acknowledging that noise reduction should be accomplished by three elements of the aviation system: the FAA, the airplane operator and the airport operator.

The FAA, it was recommended, should issue regulations which require the retrofitting of existing noisy aircraft. Airplane operators would, by operational procedures, further reduce noise levels employing such means as thrust cutback, two-segment approaches, turns, flap management and so on. The airport operator would then be faced with the problem of ensuring that those individuals who had not received sufficient relief as a result of technological and operational changes would either be compensated

for their property by purchase or condemnation or, in the event this was impractical or financially infeasible, equivalent noise reductions would be instituted by the airport operator at the airport level. He would, for example, limit numbers of operations, establish curfews and discriminate in his landing fee structure.

The Task Group 5 report went on to assert that administratively EPA would determine the maximum permissible level to which individuals in the community should be exposed so that contours around the airport might be drawn within which residential life would eventually be prohibited.

All attempts to convince the EPA staff that the power of the airport operator was limited and it was politically and socially impractical to condemn residential property on which people resided, were to no avail. It was also pointed out that recommendations for rezoning of property from residential to commercial were equally either outside the authority of the airport operator or were probably unconstitutional.

At least, however, the report does indicate that aircraft technology for noise reductions is available and operational procedures, which reduce noise, should be implemented.

What is, however, unclear is whether in the event the FAA should find it "economically unreasonable" to require retrofit, the airport operator would then be faced with the requirement to "sterilize" the huge, noise-affected area that would result. Evidently, "economic unreasonableness", in the eyes of EPA only applies to the airlines and not to the airport operator.

The report criticizes FAA's Draft Order of August 1972 on the "Aircraft Sound Description System", concluding that the concept is based on two false premises -- the use of a linear rather than logarithmic relationship for number of operations and the assumption of an arbitrary constant duration time.

As a matter of record, some members of AOCI have endorsed the ASDS concept. One airport board has adopted a resolution urging its early adoption, and another has used it in an Environmental Impact Statement.

Airport Noise Certification

The authority of FAA to certificate an airport for noise does not imply that there are no limitations upon this authority. Although, for example, pilots are licensed, it would exceed the intent of FAA's licensing authority if the pilot were required to fly noise abatement procedures as a condition for licensing or renewal. An airport might, if it were certificated, be required to specify the location of maintenance run-up areas to prevent intrusion upon the adjacent community, or construct devices, if such were feasible, to shield the community from ground noise. However, to require the imposition of curfews or to limit the number and type of runway operations goes beyond the intent of rule and is probably unconstitutional under Burbank.

Until retrofit is accomplished, noise certification serves no purpose in that the extent of any noise contour can only be determined by actual measurement and an accurate determination

of the number and types of airplanes by runway. Consequently, the airport would play a passive role for six or seven years until aircraft are retrofitted. If would be more appropriate to wait until the airlines have done their part.

Additionally, the restrictions which EPA envisions the airport operator would impose upon the airlines, after certification, are probably illegal under Burbank.

Finally, the airport would merely transmit FAA directives to the airlines and act as an intermediary. Certification without authority is a burden and is unnecessary.

-:-

Telegrams: Britair Weybridge Telex Cablegrams: Britair Weybridge

British Aircraft Corporation Limited

COMMERCIAL AIRCRAFT DIVISION

Tel. Extn.
Our Ref.
Your Ref.

BROOKLANDS ROAD WEYBRIDGE SURREY

Telephone Weybridge 45522

Telex : 27111

Mr. William C. Sperry,
Chairman (Task Group 4 and 5),
Aircraft/Airport Noise Report Group,
Environmental Protection Agency

17th May 1973
Ref: MGW/css/127

Regulation of Concorde Noise

Dear Sir:

You informed the Concorde Manufacturers on May 16th 1973 that the Environmental Protection Agency would welcome the receipt of a statement relating to Concorde Noise for consideration by the Task Groups of which you are Chairman, and you further stated that such a statement would be referred to in the onward reporting by these Task Groups if received in due time.

In consequence, we enclose herewith a document entitled "Recommendation of the Manufacturers to the Environmental Protection Agency related to the Regulation of Concorde Noise" reference MGW/css/126, dated 17th May 1973, which is submitted on behalf of the four Concorde Manufacturers.

Yours faithfully,

M. G. Wilde
Concorde Project Director
British Aircraft Corporation (CAD)

Telegrams: Britair Weybridge Telex Cablegrams: Britair Weybridge

British Aircraft Corporation Limited

COMMERCIAL AIRCRAFT DIVISION

BROOKLANDS ROAD WEYBRIDGE SURREY

Telephone Weybridge 45522

Telex : 27111

Tel. Extn.

Our Ref. MGW/css/126

Your Ref.

May 17, 1973

Recommendation of the Concorde Manufacturers to the Environmental Protection Agency Related to the Regulation of Concorde Noise

The four companies who are jointly involved in the design and manufacturer of the Concorde supersonic aircraft (the British Aircraft Corporation, Rolls-Royce, Societe Nationale d'Etudes et de Construction de Moteurs d'Aviation and Societe Nationale Industrielle Aerospatiale), supported by the British and French Governments, believe that this advanced form of transportation will be of great benefit to the whole community by enhancing worldwide communications, fostering international commerce and encouraging economic growth. In addition they believe it will give vital and new impetus to the future development of the air transport industry.

Whilst the challenge of providing such a revolution in air transportation was recognized as requiring extreme endeavours in the areas of airframe aerodynamics, powerplant design, structural efficiency and many others, the manufacturers and the Governments have been conscious of the acute need not to worsen the airport environment. In consequence, from the inception of the programme, noise control has been a key objective.

A series of detailed reports entitled "Concorde Airport Noise and Silencing Programme" have been submitted to the Environmental Protection Agency (Refs. 1, 2, 3 and 4) which cover the large amount of research and development which has been undertaken with the objective of achieving noise levels at entry into service directly comparable with the many long-range subsonic jets, which are expected to remain in service for many years to come.

Despite the inherent difficulties in this area, arising fundamentally from the need to employ high thrust engines using the straight jet engine cycle in combination with a small span, slender wing configuration, these objectives will

be achieved by the use of completely novel silencing means in the nozzle technology and in the engine aerodynamics and control systems. The development of these silencing means has required the deployment of a very significant proportion of the total project manpower and funds.

Whilst the manufacturers will have reduced the noise levels of Concorde at entry into service so as to achieve noise parity with the contemporary straight jet and low by-pass fan jet long-range subsonic aircraft, they cannot, using currently available technology, match the noise performance of the latest high by-passed engined subsonic aircraft. The requirements for supersonic flight are such that it is not technologically practical to utilise the large diameter high by-pass ratio fan engines which enable new subsonic aircraft to achieve the noise levels set by FAR Part 36 Annex C.

Since Concorde will be used predominantly on international routes and will represent only a very small proportion of such total operations, we recommend that Concorde be regulated to noise levels as low as are capable of being achieved by best effort available through technology or operational controls, in accordance with the recent I.C.A.O. Committee on Aircraft Noise (CAN 3) recommendation.

Mr. M. G. Wilde	Dr. P. H. Calder
for and on behalf of BRITISH AIRCRAFT CORPORATION LTD. and SOCIETE NATIONALE INDUSTRIELLE AEROSPATIALE	for and on behalf of ROLLS-ROYCE (1971) LIMITED and SOCIETE NATIONALE D'ETUDES ET DE CONSTRUCTION DE MOTEURS D'AVIATION

Ref. 1 - Concorde Airport Noise and Silencing Programme, (DO/JAH/LG/8904), October 1972.
Ref. 2 - Annex 1, Test Facilities, (DO/JAH/DW/8964), October, 1972.
Ref. 3 - Annex 2, Manufacturers Further Studies of Noise Reduction, (DO/JAH/LG/9198), 20th February 1973.
Ref. 4 - Annex 3, The Economic Aspects of Silencing Concorde, (DO/JAH/LG/9239), January 1973.

BOEING COMMERCIAL AIRPLANE COMPANY
P.O. Box 3707 Seattle, Washington 98124

June 29, 1973
6-7270-1-445

Mr. William C. Sperry
Office of Noise Abatement and Control
Environmental Protection Agency
Washington, D. C. 20460

Subject: Boeing Commercial Airplane Company Position on Task Group 5, "Review and Analysis of Present and Planned FAA Noise Regulatory Actions and Their Consequences Regarding Aircraft and Airport Operations"

References:
1) Boeing Letter 6-7270-1-442, V. L. Blumenthal to R. L. Hurlburt.
2) Boeing Letter 6-7270-1-443, V. L. Blumenthal to H. E. von Gierke.
3) Boeing Letter 6-7270-1-444, V. L. Blumenthal to W. C. Sperry.

Dear Mr. Sperry:

In response to the request made by Mr. John Schettino in his letter of June 25, 1973, the Boeing Commercial Airplane Company wishes to include only this letter in the final report of Task Group 5. References 1, 2, and 3 contain our position letters for Task Groups 2, 3, and 4.

In some of the Task Group draft reports it clearly states that the conclusions and recommendations are the responsibility of the chairman. We endorse this position and agree with it completely as being the only reasonable and fair manner in which such reports could be written. Because of the variety of opinions espoused in the Group discussions, and because generally no formal attempt was made to obtain a consensus, we would suggest that any inference of unanimity of opinion be expurgated.

The Boeing Company recognizes the need for effective control and reduction of aircraft noise emissions, as evidenced by our own 15 year-long research and development programs aimed at producing quieter aircraft. We support these actions

which would result in meaningful subjective noise reductions for affected communities. However, we also recognize that the vitality of our national air transportation system provides substantial benefits, both tangible and intangible, to the entire country, local communities, and indeed even to those nearby residents most exposed to aircraft noise. Consequently, any noise regulatory scheme must be carefully structured to avoid impairing the national framework of air commerce.

Further, particular noise control regulations will be viable only if they equitably balance the interests of all affected parties and allocate the burdens, both financial and functional, among all groups. A combination of available noise control methods seems most likely to accomplish this goal. The degree to which any particular option is utilized must be founded on a comprehensive cost/benefit analysis designed to ascertain the most efficient combinations.

Boeing now has configurations that comply with FAR Part 36 Appendix C noise levels for all production models. Costs and schedule availability for these options are in reference 3. Retrofit with these options is not recommended, however, unless it can be shown that significant benefit to the community will result. Currently there is no clear justification for retrofitting those aircraft that are already close to FAR-36 noise levels.

The following comments reflect our thoughts on the major items discussed in the report:

1) The Boeing Company believes that the control of aircraft noise is best accomplished on a nation-wide basis. We believe that local authorities should be able to control aircraft noise emissions only by techniques which clearly do not disrupt or impede the free flow of air commerce. We therefore recommend that Federal guidelines for local noise control be established in order to preserve the viability of our national air transportation system.

2) We recommend accelerated government funding of noise source reduction research and development programs. Such programs are essential if source control technology is to progress beyond its current infancy and is to contribute to future noise abatement reduction.

3) Boeing believes it is appropriate to assess the feasibility of a 5 to 10 EPNdB reduction in the FAR 36 Appendix C aircraft noise certification standards, provided that such a reduction is clearly applied only to aircraft of new type design, not all new aircraft.

We have appreciated the opportunity to participate in the Task Group's efforts and we hope these comments will be helpful to you in completing the report to Congress.

Very truly yours,

BOEING COMMERCIAL
AIRPLANE COMPANY

V. L. Blumenthal
Director, Noise and Emission
Abatement Programs

General Aviation
Manufacturers Association

Suite 1215
1025 Connecticut Ave., N.W.
Washington, D. C. 20036
(202) 296-8848

GENERAL AVIATION MANUFACTURERS ASSOCIATION POSITIONS ON THE ISSUES CONTAINED IN THE REPORT

ON

REVIEW AND ANALYSIS OF PRESENT AND PLANNED FAA NOISE REGULATORY ACTIONS AND THEIR CONSEQUENCES REGARDING AIRCRAFT AND AIRPORT OPERATIONS

FOR

ENVIRONMENTAL PROTECTION AGENCY
AIRCRAFT/AIRPORT NOISE REPORT STUDY

TASK GROUP 5

June 20, 1973

(Revised 7/24/73)

The General Aviaiton Manufacturers ..ation has been pleased to contribute to the work of Task Group 5. Specific comments on the recommendations are as follows:

1. The proposal to expedite enactment of FAA NPRM 72-19 concerning Newly Produced Airplanes of Older Type Design is not acceptable unless the final rule is substantially changed with respect to the effective date for the small turbine powered airplanes. As proposed, the rule is economically unreasonable. The expenditure of large sums of development monies would not necessarily guarantee the achievement of FAR 36 noise levels by the proposed effectivity date of July 1, 1974.

Generalized design criteria, applicable to any class of engine, which can, with precision, be used to reduce noise levels to specified differences of equivalent perceived noise do not exist today. Evidence of this is ample. The government is currently funding a number of programs to investigate the technological feasibility of several types of noise suppression. These programs are funded simply because the detail design parameters are not known at this time. As the precise technology to design specific sound suppressors to regulation specified levels of equivalent perceived noise is not available, we feel that the proposed requirement is not technologically achievable by July 1, 1974.

A considerable amount of monies and work has been expended by GAMA members, other industry associations, manufacturers, and the government in an attempt to understand the causes of aircraft engine noise and its control. Most of this effort has been directed toward the T2, T3, and T4 class of engines. Little has been directed toward the T1 class. It is now well known that certain classes of noise attenuation devices are wave length dependent. Hence, it is not possible to scale down attenuation devices and technology derived from the large engines and apply them to the small engines. More effort needs to be directed to the solution of noise suppression for the T1 class of engines.

In light of the above rationale and in line with historically demonstrated technological progress that the normal cycle for development of new engine-airframe combinations is approximately six years, we believe the implementation of FAR 36 standards to newly produced aircraft of older type design should be delayed till July 1, 1975 at the earliest.

2. Project Report - Propeller Driven Aircraft

The soon to be proposed amendment to FAR 36 to cover propeller driven aircraft, as proposed by the FAA using the A-weighted network in units

of dBA and the single measuring point, should be retained. The changes proposed, to measure the noise level in EPNdB and to use the measuring points, are unsupported. The adoption of these changes will effectively throw out the work of the noise experts from the certifying agencies in twelve countries, who, while recognizing the shortcomings of dBA, determined that there is no better unit of measurement for propeller driven aircraft. Further, these experts determined that the 1,000 feet flyover, with single point measuring, will ensure that community noise levels are lowered. The fact that test costs are lowered for all concerned (government, manufacturers and operators) is an added bonus.

The subject of standardization with the measurement units and measurement points for turbojet aircraft was thoroughly discussed in ICAO and discarded on the grounds that this technique is better suited to piston engine powered aircraft, is understood by more people concerned with noise, and is directly measurable with instruments economically available to the broad range of airports and communities most likely affected by this class of aircraft. Further, dBA is the standard measurement unit for almost all other noise sources and is the unit of measurement to determine Ldn measurements recommended by Task Group 3.

It should be noted that the FAA project report, in effect, adopts the ICAO recommendations which will be universally applied by all countries who have large populations of propeller driven general aviation aircraft. Approximately 25 percent of the aircraft manufactured by U.S. manufacturers are exported. Currently, about 85 percent of the world's general aviation fleeet is of U.S. manufacture. It is, therefore, vital that the U.S. noise requirements and measurement procedures remain compatible with the requirements and procedures used by, or soon to be used by, our world markets.

GENERAL ELECTRIC
COMPANY
CINCINNATI, OHIO 45215

AIRCRAFT ENGINE GROUP

22 May 1973

Dr. Alvin Meyer
Environmental Protection Agency
401 M Street, N. W.
Washington, D. C.

Dear Dr. Meyer:

In reference to discussions at the meetings of the EPA Aircraft/Airport Noise Study Task Force, the views of the Aircraft Engine Group of General Electric on aircraft noise regulations can be briefly summarized as follows:

1. FAR 36 (as issued on 23 November 1969) has been effective in stimulating noise reductions. For example, new wide-bodied aircraft have been certified at or below Appendix C levels.

2. We suggest the promulgation of the subsonic CTOL Fleet Noise Rule we proposed in our comments on ANPRM 73-3, sent to the FAA Rules Docket on 12 March 1973, rather than a series of separate, incomplete and possibly conflicting regulations. For example, we favor regulations which would require all newly-produced aircraft to comply with FAR 36 at reasonable dates, depending on the aircraft type. The suggested Fleet Noise Rule would accomplish this. We do not favor regulations which would require all of the current fleet of older types of aircraft now in service to be retrofitted with nacelle acoustic treatment or refanned engines. The suggested Fleet Noise Rule would promote some retrofit of some aircraft types, depending on the particular airline operator's constraints.

   A proper Fleet Noise Rule would allow an airline a decreasing "noise quota" with time, out into the 1980 period. We believe that such a method would offer the airline operators maximum flexibility to control noise through a combination of off-loading, operating procedures, retrofit and fleet replacement in the most economic and practical way for each airline and aircraft type. It is important to note in this connection that most airline fleets use a mixture of two, three, and four engine aircraft across a wide range of different stage lengths and numbers of operations.

We suggest promulgation of an FAA regulation of the generic type of the Fleet Noise Level (FNL) proposed by FAA in ANPRM 73-3, but with important modifications proposed by General Electric, as follows:

a. The noise measure in such a rule should be weighted to give considerable incentive to airlines to acquire aircraft having noise levels significantly below Appendix C levels. This was not the case with the noise measure proposed in ANPRM 73-3.

b. Rather than the interim nature of the FNL rule of ANPRM 73-3, which would terminate in 1978, we suggest a rule with a number of "gates" at specified times, requiring aircraft "on-the-average" to get half-way-down to FAR 36 by some date, down to FAR 36 by a later date, and down to levels below FAR 36 by some still later date. The noise levels shown on the attached figure are suggested as typical certification levels for new aircraft in the late 1970's, based on our views of possible noise reduction, available technology and economic reasonableness, over the wide range of aircraft types covered. The suggested approach noise levels are for the flap settings used in normal operating practice, rather than the maximum flap settings as required currently in FAR 36. The use of normal flap settings is a worthwhile noise abatement operating procedure in itself.

It should be noted that separate certification rules will be required for supersonic transport aircraft and for quiet short-haul aircraft, due to the different characteristics of these aircraft types.

It is also suggested that FAR 36 be modified to encourage the use of two-segment approach procedures, by specification of an additional special reference point, such as a 3 1/2nm approach point, and maximum allowable noise levels at this point. If this method were used, the FAR 36 tradeoff provisions should be maintained at the normal three reference points only.

3. EPA has proposed airport regulations as such. The cognizant authority for such regulations should be a Federal agency, in order to assure that this vital and integral part of the national transportation system is not adversely compromised by local piece-meal actions. Therefore, such definitive Federal pre-emption of airport noise

regulations should be a part of the proposed action in order to afford equitable treatment for all airport users, including airlines. Appropriate FAA noise source control and aircraft path control regulations should separately provide final "design requirements" for manufacturers, as FAR 36 has done in the past.

4. An increased level of aircraft noise reduction research and development is needed in the following areas:

   a. Development of noise technology for advanced CTOL engine/aircraft systems which emphasize reduction of the economic penalties of lower noise, i.e., lower cost, weight and performance losses.

   b. Identification of improved measures of airport community noise annoyance for aircraft operations making noise equal to or less than required by FAR 36.

   c. Determination of aircraft-alone noise levels and identification of means to control this noise source.

General Electric has been active in aircraft noise reduction since the middle 1950's, in both the civil and military aircraft areas. Substantial progress has been made, as evinced by the civil fleet introduction of the new wide-bodied aircraft, which are much quieter than their predecessors. We believe that Federal aircraft noise regulations and additional research and development of the types suggested above will achieve further reductions in airport community noise exposure.

Very truly yours,

J N Krebs

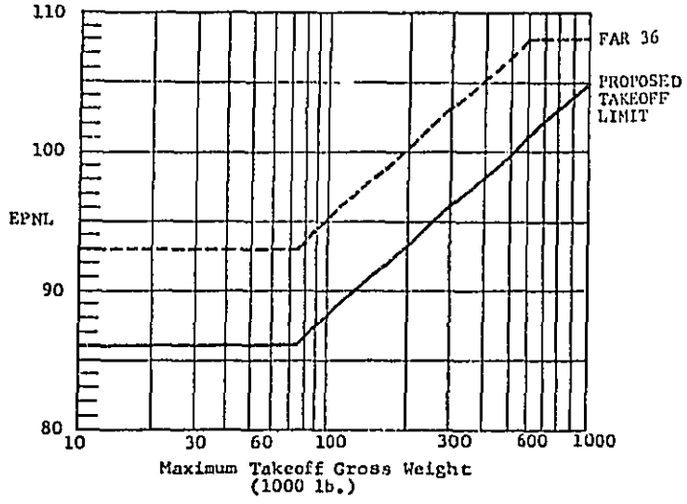
J. N. Krebs

attach.

CERTIFICATION LEVELS FOR NEW AIRCRAFT IN THE LATE 1970's TIME PERIOD

TAKEOFF

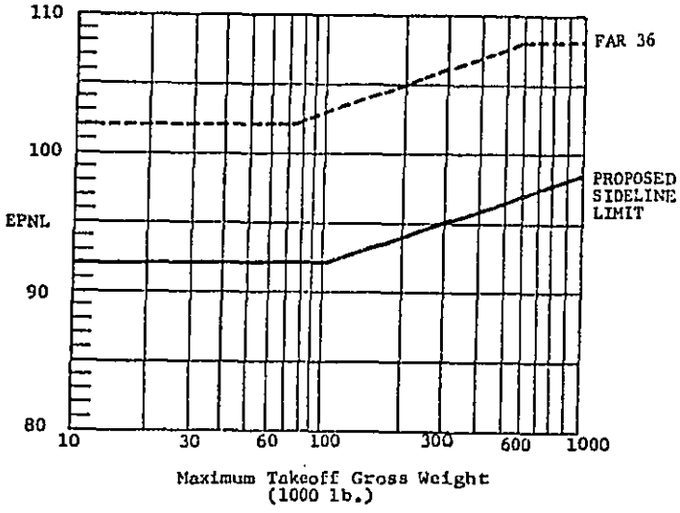
3.5 N. Mi. from Brake Release



SIDELINE

0.35 N. Mi. (4 Engine A/C)

0.25 N. Mi (Less than 4 Engines)

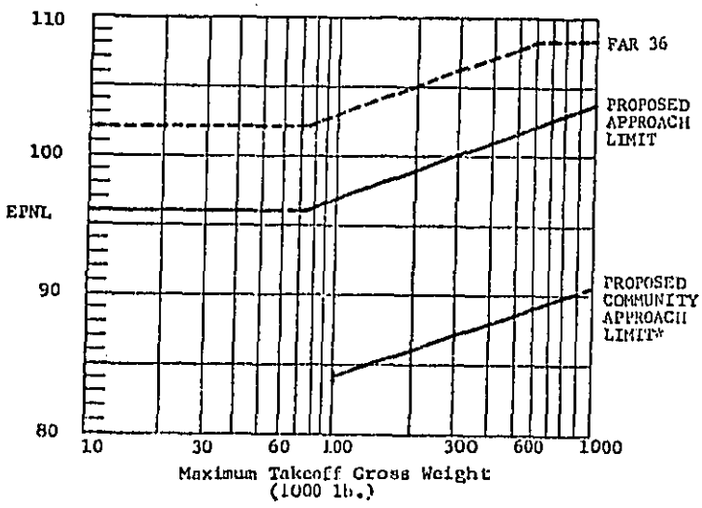


APPROACH

1.0 N. Mi. from Threshold

COMMUNITY APPROACH

3.5 N. Mi. from Threshold



*Based on 6°/3° Two-Segment Approach with 600 ft. Intercept

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
WASHINGTON, D. C. 20410

ASSISTANT SECRETARY FOR
COMMUNITY PLANNING AND MANAGEMENT

JUN 1 1973

Mr. William C. Sperry
Chairman, Task Group 5
Aircraft/Airport Noise Report Study
Environmental Protection Agency
Washington, D. C. 20460

Dear Mr. Sperry:

My staff has reviewed the draft Task Group report on "Noise Regulatory Actions by the Federal Aviation Administration", and believe it to contain a good statement on the status and potential benefits of such regulatory actions.

In terms of the substantive recommendations in Section V of the draft, we would endorse the recommendation that airport operators exercise their authority to regulate aircraft operations to reduce noise in residential areas. The requirement that airport operators predict operations and noise exposure to determine compatibility of the adjacent land uses and then take actions to achieve a larger measure of compatibility is an important element in the total program to reduce airport-community conflicts. Decisions on runway alignment, airport expansion and volume and type of aircraft use are as essential to ameliorating and preventing noise conflicts as are the control of noise at the source and the control and guidance of land use development the airport environs.

We would also support the role of the Environmental Protection Agency as the lead agency implementing the airport permit plan concept under the authority of PL 92-574. We will be happy to provide whatever assistance we can to the EPA in this effort.

Sincerely yours,

Clifford W. Graves
Acting Assistant Secretary

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
WASHINGTON, D. C. 20410

ASSISTANT SECRETARY FOR
COMMUNITY PLANNING AND MANAGEMENT

JUN 29 1973

Mr. John C. Schettino
Director, Aircraft/Airport Noise Study
Office of Noise Abatement and Control
Environmental Protection Agency
Washington, D. C. 20460

Dear Mr. Schettino:

We would like to take this opportunity to express our general satisfaction with the work of EPA Task Force which was organized to provide recommendations for dealing with the aircraft/airport noise problems. Unfortunately, we were able to provide only limited assistance to three of the Task Groups due to staff shortages and other pressing assignments; however, I am enclosing our general observations and position on many of the preliminary recommendations of the Task Force.

We will continue to support the activities of the Environmental Protection Agency in the aircraft/airport noise program, and will be happy to provide whatever assistance we can to the EPA in this effort.

Sincerely,

Clifford W. Graves
Acting Assistant Secretary

Enclosure

Department of Housing and Urban Development

Comments on

RECOMMENDATIONS ON THE EPA TASK FORCE ON AIRCRAFT/AIRPORT NOISE PROBLEMS

A. HUD's ROLE IN NOISE ABATEMENT

It has long been HUD's policy to encourage the creation and maintenance of a quiet environment. To further this goal, HUD issued, on August 4, 1971, a policy Circular on "Noise Abatement and Control: Departmental Policy, Implementation Responsibilities and Standards." This policy was promulgated after several years of development, in an effort to fulfill the Department's mandate to "provide a decent home and a suitable living environment for every American family". With the issuance of this policy, HUD stated its conviction that "noise is a major source of environmental pollution which represents a threat to the serenity and quality of life in population centers." The policy formalized and expanded existing FHA noise regulations which had been in effect for many years, and drew upon the work of several other agencies and groups and on a long standing and developing body of knowledge in the area.

The policy establishes noise exposure policies and standards to be observed in the approval or disapproval of all HUD projects; it supersedes those portions of existing program regulations and guidance documents which have less demanding noise exposure requirements. Further, it is HUD's general policy to foster the creation of controls and standards for community noise abatement and control by general purpose agencies of State and local governments. HUD also requires that noise exposures and sources of noise be given adequate consideration as an integral part of urban environments in connection with all HUD programs which provide financial support to planning. The policy emphasizes the importance of compatible land use planning in relation to airports, other general modes of transportation, and other sources of high noise, and supports the use of planning funds to explore ways of reducing environmental noise to acceptable exposures by use of appropriate methods. Reconnaissance studies, and, where justifiable, studies in depth for noise control and abatement will be considered allowable costs.

Because HUD's noise standards are technically specific in nature, the Department has published "Noise Assessment Guidelines", a manual to provide HUD's personnel and the general public with a practical methodology for preliminary evaluation of noise levels at given project sites. An important facet of the Department's noise control activities is a continuing program of sponsored research into various aspects of the cause and effects of environmental noise. Typical of these is a series of Metropolitan Aircraft Noise Abatement Policy Studies, funded jointly by HUD and the Department of Transportation. This work was summarized and

extended in the form of a guideline manual, to help localities plan community growth in the vicinity of airports. The manual discusses the costs, benefits and limitations of alternative methods of noise alleviation such as compatible land use development, zoning, and noise attenuation measures in building construction. Applicable to all type of airports, it will be used to develop procedures for dealing with a variety of local airport noise situations. It also contains relevant information on Federal and State programs to assist in achieving compatible airport-community development. The manual entitled "Aircraft Noise Impact: Planning Guidelines for Local Agencies," is now in printing by the Government Printing Office and will be given wide distribution.

B. HUD's POSITION ON ISSUES RELATED TO THE WORK OF THE TASK FORCE

1. Cumulative Noise Exposure

We believe that there is an urgent need to standardize a measure of noise exposure as a prerequisite to promulgating a national set of noise exposure standards and implementing procedures. We, therefore, strongly support the activities of Task Group 3. The lack of what might be called a "perfect" index of measure is no excuse for inaction on the growing problems of noise abatement and control. Our major concern is that any proposed aircraft noise assessment method be compatible with those now in use by this Department in implementing the HUD noise policy, i.e., Composite Noise Rating (CNR) or Noise Exposure Forecast (NEF).

We are in agreement with the long term goal of Ldn of 60 (NEF 25) recommended in the Task Group report, though we feel that further clarification is needed. Current HUD policy is to discourage residential development beyond 30 NEF (though some discretion is applied in certain cases where noise exposures lie between NEF 30 and 40). The NEF 30 value corresponds roughly to an Ldn of 65. Thus, the current allowable noise exposure for HUD assisted new residential construction is marginally higher than the long term goal recommended by the Task Group. However, we fully hope and anticipate that the EPA, with the cooperation of other Federal agencies and industry groups, will be successful in reducing noise through source and operational controls, so that noise reduction from these activities will bring current residential construction satisfying existing HUD criteria well within the long term objective (Ldn of 60). It is important to emphasize that since new construction represents the long term establishment of a given land use to a particular area, implementation of long term goals requires immediate action of the type HUD has been actively pursuing in the last two years.

We assume that the immediate goal of Ldn (45 NEF) of 80 is to be implemented through source and operations controls, building modifications, and where necessary, condemnation and relocation, and is to be applied to existing residential units. We fully support such a recommendation providing adequate relocation resources are available at a price the displacees can afford (pursuant to provisions of the Uniform Relocation Act).

We are concerned, however, that noise levels less than Ldn 80 may also constitute risks to health resulting from sleep interference, unless airports have stringent restrictions on night-time operations. The problem is exacerbated with windows open, as they must be in the summer months in many areas when adequate alternative ventilation is not available.

We support recommendation concerning a standardized computer program for calculating cumulative noise exposure. Further, there should be a standardized definition of data input requirements and a central data center which can generate contours of cumulative noise exposure for use by Federal, State and local agencies in making land use decisions.

2. Airport Noise Regulation

We would endorse the recommendations that airport operators exercise their authority to regulate aircraft operations to reduce noise in residential areas. The requirement that airport operators predict operations and noise exposure to determine compatibility of airport operations with the adjacent land uses and then take actions to achieve a larger measure of compatibility through reduction in the noise effective size of the airport is an important element in the total program to reduce airport-community conflicts. Decisions on runway alignment, airport expansion and volume and type of aircraft use are as essential to ameliorating and preventing noise conflicts as are the control of noise at the source and the control and guidance of land use development in the airport environs.

It is understood that the FAA has the authority for requiring airport certification under existing legislation. That agency should therefore be encouraged to take the necessary action to meet the EPA compliance schedule.

3. Continuing Program for Noise Abatement

We would concur in the need for a continuing Federal Program to assist in implementing a comprehensive national aircraft/airport noise abatement program. We would be happy to participate in those aspects of the program which are of interest and concern to the Department.

C. OTHER RELATED ISSUES

There are other problems that need to addressed to further goals of the aircraft/airport noise abatement program; some of these are:

1 National Airport System Planning

A National Airport System Plan appears to offer a key to the problem of location and expansion of airports in the Nation, and a meaningful document can lessen the potentially adverse impacts of such development. The long range plan could identify the projected kinds and volume of operations at specific classes of airports so that there would not continue to be the many surprises which appear to develop fairly regularly following the creation of an airport or changes in operations at existing airports. Communities in the airport environs would then have an explicit idea of the kinds of airport development expected and could plan accordingly. The National Airports System Plan should have a rational national focus and not be only a compilation of airport projects conceived solely by state and local authorities.

2. Modification of Airport and Airway Development Act (AADA)

We believe that the AADA can be strengthened to insure a greater measure of compatibility between airports and their surrounding areas, as follows:

a) Aircraft noise is not specifically addressed in the law. In view of the growing concern with environmental quality and the impact of the airport development program, noise merits specific recognition. The law does not now support the acquisition of land to be exposed to severe levels of noise;consideration should therefore be given to modifying the statute to allow the acquisition of such land, by easement or fee simple, as part of the airport development project costs. Inclusion of such a provision to cover areas of very severe noise exposure is both desirable and necessary to any meaningful solution to the noise problem.

b) The rules promulgated by the FAA for implementing the Planning Grant Program under the AADA are not consistent with Section II of the Act. Airport systems planning should be an integral part of multi-modal transportation planning for the metropolitan area, and should be handled by the appropriate public comprehensive planning agency. Environmental considerations and airport location should be a significant part of the systems planning process rather than a token after-the-fact issue in airport master planning.

POSITION STATEMENT

Illinois Environmental Protection Agency
Division of Noise Pollution Control
Springfield, Illinois

Subject: Environmental Protection Agency Airport/Aircraft Noise Study

In reviewing the preliminary proposed findings and recommendations for the airport/aircraft noise study which this office received from The Counsel of State Governments on May 24, 1973 the following comments are submitted and reflect the position of this office.

The Illinois Environmental Protection Agency believes aircraft/airport noise may be reduced by applying the following control strategies:

1. The implementation of noise reduction technology at the source as soon as possible in conjunction with,

2. Operational limitations or procedures, and

3. Land use control and incompatable land use conversion or protection.

We believe that these control strategies can be best implemented by the combined efforts of the various levels of government.

Thus, the Illinois Environmental Protection Agency is in general agreement with the preliminary findings and recommendations of the Counsel of State Governments, which were submitted to the Task Force. If the findings and recommendations are followed, adverse aircraft and airport noise should be effectively reduced.

In addition to the recommendations and findings of the Counsel of State Governments, the Illinois Environmental Protection Agency would like to recommend the following:

To effectively reduce airport noise, a tremendous amount of time and effort will be required by the Federal Government to implement the noise certification and to reduce the amount of incompatable land uses near airports. Since States can more accurately assess their particular needs, States should be given primary responsibility both for the development of airport noise certifications, subject to federal approval, and for the development of adequate land use controls. The effect of this recommendation would be to reduce the administrative burden on the Federal Government and to more effectively achieve relief from airport noise.

John S. Moore
Manager
Division of Noise Pollution Control

LOCKHEED-CALIFORNIA COMPANY
A DIVISION OF LOCKHEED AIRCRAFT CORPORATION
BURBANK, CALIFORNIA 91503

April 25, 1973

Mr. W. C. Sperry
Chairman, Task Groups 4 & 5
Aircraft/Airport Noise Study Task Force
Office of Noise Abatement and Control
Washington, D.C. 20460

Dear Bill:

As part of the Lockheed effort in support of the EPA Aircraft/Airport Noise Task Force, we some time ago asked Rolls-Royce to provide their evaluation of the potential for further engine noise reduction. I feel that consideration of the Rolls-Royce input by EPA is appropriate both because of the pre-eminence of Rolls-Royce in aircraft engine noise technology and because Rolls-Royce engines power a growing proportion of the U.S. air transport fleet.

The attached statement was prepared by Mike Smith, Manager of the Rolls-Royce Noise Department, and approved for submission to EPA by Mr. E. M. Eltis, Director of Engineering, RB.211 Programme. I hope you will find it useful.

Sincerely,

H. Drell

H. Drell
Flight Sciences Division
Commercial Engineering

HD:JRT:jg
Attach.

16 April 1973

CONSIDERATIONS RELEVANT TO QUIETENING OF AIRCRAFT NOISE

IN THE IMMEDIATE FUTURE

The noise environment around airports is governed almost entirely by aircraft powered by engines designed about a decade ago. With less than 5% of world fleets currently comprising the newer more quiet Trijets, the L-1011 and DC.10, this situation is likely to prevail until at least 1978, when the FAA propose that all types comply with FAR Part 36 Standards. Even then the improved standard of the high bypass engines over modified earlier counterparts will ensure that newer types cannot be cited as the main offenders. There would therefore appear to be little justification for demanding unduly improved standard from new equipment, for the effect would not be reflected in the overall environmental picture.

However, some improvement in noise standard for new types entering service in the second half of this decade is desirable, to ensure that the problem is largely solved during the 1980's. Having said this, two important problems to be addressed are how much the improvement should be and when new regulations should be enacted. The following paragraphs express our view and are offered to the EPA for their consideration.

The RB.211 is a prime example of the new breed of quiet engines. Its main features were designed in 1966, development commenced in 1967, and the first production engines entered service in early 1972. Any radically new engine can be expected to follow approximately the same cycle of events, and therefore it would be unrealistic to apply stringent new regulations before the end of this decade, since the technology to meet such standards is not developed today.

What is available today is the technology to make limited, but nevertheless, worthwhile improvements. The improvements possible are limited by the new problems that have been revealed in the developments of the newer engines, a prime example being the noise floor created by the core engine. This fact has already been recognised by U.S. Government Agencies in the Research and Development Contracts offered to Industry in the recent past, and clearly the answers will not appear without considerable research, involving in some cases new test facilities.

We therefore see two clearly defined stages in improving the noise environment, viz:

a) limited improvements possible with todays technology, for implementation on engines entering service in the second half of this decade.

b) further improvements made possible by ongoing research, over the next three to five years, for implementation on engines entering service during the early to mid 1980's.

Let us consider each category in turn.

a) Improvements possible using todays technology

On an engine of the RB.211 type there are two important flight conditions to be considered in defining the improvement afforded by engineering action. These are the high power case for lateral and Take-off noise, and part power for Approach.

The RB.211 noise source distribution has been defined as shown in Figure 1. Without resorting to major changes to the rotating machinery improvements are possible by virtue of better aerodynamic standards and improved liner performance. The latter may result from improved design of the liner structure, or the introduction of extra surfaces in the main air-flow passages.

Already we are proposing modest improvements for developed versions of the RB.211, and estimate that such action will improve the standard by about 2 EPNL. Even these improvements are not, however, without penalty. The weight change alone would cost the Tristar the equivalent of five passengers (unless the aircraft weight can be increased by an equivalent amount). On an aircraft already bettering Part 36 standards by 10 EPNL at full power and 4 EPNL at approach it is difficult to see the extra cost being readily borne by the operator.

Further improvements are possible, at an increased operating penalty. The Company entered a partnership with the U.K. Government nine months ago to produce a quiet engine demonstrator based on the RB.211. This programme is directed at improving the noise standard by 5 PNdB, but the modifications are not in any way designed for the production powerplant. Some of the modifications could eventually be incorporated in a saleable powerplant, but others like the full length bypass duct splitters, would involve major redesign, performance penalties and mechanical complication. For example the whole thrust reverser system would need replacing. To integrate all the improvements in a powerplant would cost around 350 lbs weight per engine, and the cruise sfc penalty would probably be of the order of 1/2%. Furthermore if significant modification were required to the inlet system, for example by the introduction of a splitter ring, the full effect would be a further increase of sfc of at least 1/2% and 200 lb in weight per engine. Moreover such devices would require careful consideration of the vibration problems of the fan assembly and may necessitate changes to the fan design.

We would estimate that a 5 PNdB package would take not less than four years to develop and apply to a production standard engine. Assuming a go-ahead early in 1974, quieted production engines could be available in the late 1970's.

The overall result, taking installed performance into account, would probably be a Trijet some 3 - 4 EPNL better than the standard of the Tristar today.

b) Further improvements in newly designed engines

Our research programmes are indicating that basic improvements, other than the extensive use of sound absorbing materials, will only come from more extensive redesign.

Even so the potential for such further basic improvement does not, at the present time, appear to be more than about 3 PNdB, and it is our belief that the contribution of the powerplant alone cannot be regarded as the ultimate solution to the noise problem. It will be necessary for the airframe design to be even more closely integrated with the powerplant to ensure full benefit from shielding by wing and fuselage structures, and such constraints may well dictate the design of future airplanes. Another factor clearly affecting potential noise reduction is the noise generated by the airframe itself, and unless this can be reduced it is unprofitable to demand an improved standard from the engines alone.

CONCLUSIONS

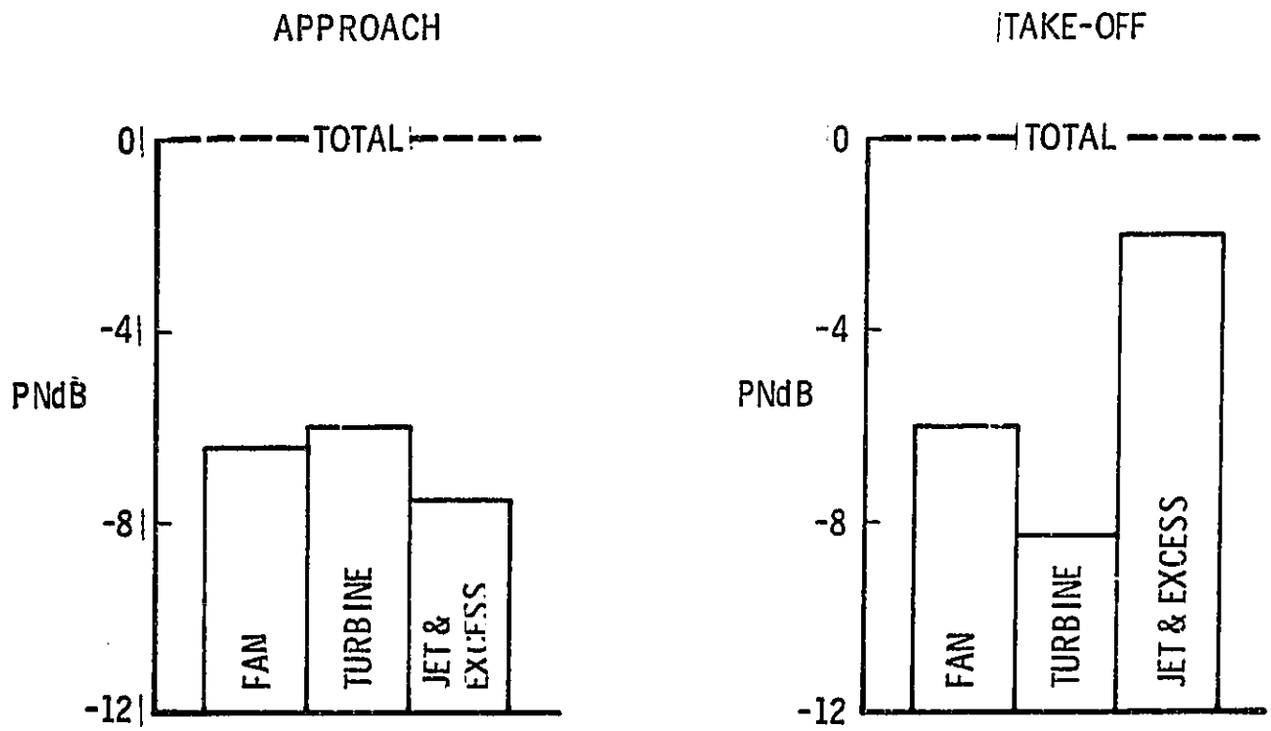
We see two distinct stages relating to future noise legislation;

1. A reduction in Part 36 standards during the latter part of this decade, probably of the order of 4 - 8 EPNL with the provision that the measuring points are modified to remove the current inequality between the landing and take-off measuring distance. Such reduced levels could be demanded from all new aircraft, including developed versions of existing types. The relationship between the two, three and four engined aircraft would however need careful consideration.

2. A further reduction of the order of 5 EPNL during the early part of the 1980's, to be applicable to completely new types only. The practicality of this reduction, of course, depends upon the level to which airframe noise can be reduced.

Beyond that point it is necessary to define both the technically feasible noise floor and the noise level beyond which community exposure is not longer a problem. Assuming that these two criteria are not coincident, it will be necessary to carefully balance technical feasibility and economic impact against any long term legislation proposals.

RB.211-22C IN FLIGHT NOISE SOURCE DISTRIBUTION



25 KNOB HILL ROAD, GLASTONBURY, CONNECTICUT 06033
203 - 633-2835
National Organization to Insure a Sound-controlled Environment

Mr. William C. Sperry, Chairman
Task Group 5, Aircraft/Airport Noise Study Report
U.S. Environmental Protection Agency
Building 2, Crystal Mall
Arlington, Virginia 20460

June 30,1973

Dear Mr. Sperry,

We have participated in the meetings of your Task Group 5 and have reviewed the Draft Final Report, "Review and Analysis of Present and Planned FAA Noise Regulatory Actions and Their Consequences Regarding Aircraft and Airport Operations" dated 1 June 1973.

We are submitting this position paper based on the material which has been presented at the Task Group meetings and on first hand experience in working on the aircraft noise problems for many years.

We find your listing of the FAA regulatory actions, "Since the advent of FAR Part 36" very interesting. "You list ---two regulations, two NPRMs, three ANPRMs, and three project reports". Two of the ten made it to the regulation stage. The others were either killed or postponed indefinitely. The ones which made it were aircraft certification for noise which was specifically required by Congress and which, for the most part, approved the current noise levels of new aircraft designs, and the sonic boom regulation which still left SST takeoff and approach noise unrestricted.

This record of non regulation of aircraft noise by the FAA both before and after FAR Part 36 emphasizes a point made in our

position paper to Task Group 1 that a more objective agency than FAA should decide what regulations should be promulgated and what noise limits should be established in the regulations.

NASA to certify as to ERTPS

It is recommended that whereas FAA has the expertise and responsibility for drafting and promulgating regulations relating to the operation of the air transport system NASA has the expertise, experience, organization and facilities for developing aircraft and operating procedures which will be economically reasonable, technologically practical, appropriate to the aircraft type and safe (ERTPS). NASA has demonstrated this ability in the development of quiet engines and quiet nacelle installations and in determining the cost of various noise abatement powerplants. NASA is also involved in developing noise abatement approach procedures with specific concern regarding the safety of the procedures.

It is recommended that after NASA has demonstrated the noise levels which can be achieved by given aircraft configurations and/or operating procedures the FAA be required to draft and promulgate noise regulations which will require new aircraft to achieve this performance or equivalent in terms of area exposed to noise above specified levels.

It is also recommended that NASA be given the broad responsibility of doing R&D work on the air transport system to develop aircraft-airports-air traffic control systems which will minimize noise in the airport environs.

Airport Certification

It is recommended that the regulatory system for abating aircraft noise be reoriented and instead of looking at airline fleet problems we look at the problem from the standpoint of the noise in local airport environs where the problem really is. Our position paper submitted to Task Group 1 outlines an airport certification procedure from the legal/institutional standpoint. Here we will outline the airport certification from the standpoint of regulation promulgation.

The first step in the process is the certification by NASA of a series of aircraft noise levels which can be met by specified aircraft configurations and/or operating procedures. The second step is the promulgations by FAA of noise regulations for new and retrofitted aircraft and for operating procedures designed to achieve specific goals regarding noise distribution during takeoff and approach. For example, there might be three takeoff procedures, one to be used where the most noise sensitive area is alongside the runway, as at LAX, another where the most noise sensitive area is under the takeoff flight path near the airport and a third where the most noise sensitive area is under the takeoff flight path some distance from the airport. The FAA could certify takeoff procedures A,B and C for these three situations.

The third step would then be for the airport operator to call for takeoff A on one runway, takeoff B on a second and takeoff C on a third to distribute the aircraft noise so as to avoid noise sensitive areas.

to achieve airport noise certification as explained in our position paper submitted to Task Group 1, the airport operator would be required to adjust his airport operations to contain the aircraft noise exposure at specified levels with specified contours. These contours would enclose areas which the state appointed regional planners are willing to zone for or convert to land uses which are compatible with the specified noise exposure levels. Thus it would be up to the states or the regions served by the airports to decide how much air transport service it wants on the basis of how much it would be willing to pay in terms of zoning and/or land use change.

Each Airport Certification Different

It will become obvious as airport certification procedes that each airport is different. For example, an airport such as LAX, especially if the runways diverged so that take-offs toward the west and approaches from the west were not parallel but farther apart out over the water, could operate with a minimum disturbance to the land areas around the airport. Assuming that sideline noise is satisfactory, LAX could then accept relatively noisy aircraft.

There are many large hub airports adjacent to water or swamp areas where the airport configuration could be arranged to make use of these areas to absorb the takeoff and approach noise leaving other areas relatively free from excessive noise exposure. The cost of airport and aircraft changes including the cost of modifying aircraft to operate in higher crosswind

and tailwind conditions would be the price of eliminating the necessity for land use change.

Airport Certification Takes the Place of Other Regulations.

When an airport operator develops a position with the regional planners where he has a specified area above a given noise exposure level he will be required to allot portions of noise exposure to each airline. Each airline will then find it necessary to consider the noise contribution of each aircraft on takeoff and approach, the operating procedures used, time of day, number of operations and percent of operations which can be made on the preferential runway. The airline may then find that some noisy aircraft, some times of day and some aircraft which cannot takeoff in a crosswind are not usable at some airports, or if they are used a surcharge may be assessed for the extra noise.

This airport certification which may limit the airlines flight operations brings the competition for quiet aircraft to the marketplace in a realistic manner. An airline will not invest in a retrofit which will be usable for only a short time as noise exposure levels are lowered on a prescribed schedule. It may be obvious that a more effective retrofit or an early retirement schedule will be called for. On the other hand some airports with preferential runways pointing out over water may permit the use of some noisy aircraft for a long time.

In any case these decisions should be made looking at noise

exposure contours in the airport environs and the schedule for shrinking these contours rather than just on the basis of fleet noise levels or arbitrary retrofit schedules for duct treatment and refaning engines.

Sincerely,

John M. Tyler and Lloyd V. Hinton, Executive Directors

Pratt & Whitney Aircraft DIVISION OF UNITED AIRCRAFT CORPORATION

May 11, 1973

Mr. William C. Sperry
Office of Noise Abatement and Control
Aircraft/Airport Task Force
Environmental Protection Agency
Washington, D.C. 20460

Dear Bill:

During the meetings of your Environmental Protection Agency Task Group 5, you requested position papers from the members commenting on various FAA regulatory actions on aircraft noise.

The attached enclosure provides brief comments from Pratt & Whitney Aircraft on several regulatory actions proposed by the FAA. The comments include suggested revisions and recommended action for each regulatory notice. These regulatory actions will contribute toward the protection of public health and welfare provided the final noise rules are truly economically reasonable so they do not disrupt the national aviation system.

Sincerely,

PRATT & WHITNEY AIRCRAFT

W. E. Helfrich

W. E. Helfrich
Project Engineer - Noise Reduction

WEH:m

Enclosure

COMMENTS ON FAA NOISE REGULATORY ACTIONS

ANPRM 70-33: SST NOISE TYPE CERTIFICATION STANDARDS

No action is recommended on this ANPRM at the present time since it is too early to consider firm requirements for SST noise certification. After additional research is completed and second generation SST design studies have progressed to the point where the noise/economics/performance trades are better known, then an NPRM could be considered. Any SST rule should be a separate part of the FAA standards, not a revision to Part 36, because SST operating characteristics will be completely different from those of subsonic aircraft.

ANPRM 70-44: AIRPLANE NOISE REDUCTION RETROFIT REQUIREMENTS

Comments from Pratt & Whitney Aircraft on the various possible options for retrofit of the JT3D and JT8D powered commercial transport fleet are given in Reference 1. It is our opinion that this ANPRM should be dropped and retrofit options be incorporated in a modified version of the fleet noise level concept in ANPRM 73-3.

NPRM 71-26: NOISE TYPE CERTIFICATION & ACOUSTICAL CHANGE APPROVALS

The temperature and altitude accountability section would present serious limitations. The present FAR 36 certification method of taking noise data over a limited range of conditions and then correcting the data to a reference day is a satisfactory method for comparing aircraft noise levels to a certification standard. Requiring Appendix C noise level compliance at all airline operational temperatures and altitudes would impose unreasonable operational restrictions on payload and range for an airplane which would meet Appendix C at reference conditions. The effect of this section would be to severely restrict airplane performance by highly suspect extrapolation techniques with little community noise benefit.

The proposed elimination of cutback thrust during takeoff and sideline noise tests to certificate acoustical changes for older aircraft which do not meet FAR 36 noise levels is not economically reasonable. This proposal would seriously curtail development of aircraft growth versions. It is suggested that thrust cutback be allowed if the noise tests before and after an acoustic change are made on a comparable basis.

We agree that the 90 PNdB "floor" should be eliminated for calculation of aircraft noise levels by FAR 36, but the duration correction factor should be limited to a range of +5 to -10 dB.

The effective date of an amendment resulting from this NPRM should be at least 60 days after the amendment is adopted. The FAA proposal for a retroactive effective date the same as the NPRM issue date is unreasonable and without justification.

NPRM 72-19: NEWLY PRODUCED AIRPLANES OF OLDER TYPE DESIGNS

The proposed compliance dates of July 1, 1973 for aircraft over 75,000 lbs. TOGW, and July, 1974 for aircraft under 75,000 lbs. are both too early. The compliance dates should be established to provide the aircraft manufacturers reasonable time to complete development, certification and production lead time for the aircraft/engine modifications required.

Parts intermix should be allowed in airline operations to eliminate the requirement for two separate spare parts systems.

ANPRM 73-3: CIVIL AIRPLANE FLEET NOISE REQUIREMENTS

The basic Fleet Noise Level (FNL) concept provides a choice of several alternatives for meeting lower noise requirements. The ANPRM as written, however, presents a number of serious problems which without some major revisions could create an unreasonable economic burden for most airlines.

The proposed formula for calculating FNL with a logarithmic summation does not give sufficient credit to the airlines which purchase new widebody aircraft which are below FAR 36 noise levels. We recommend that the formula for calculating FNL be revised to a summation of noise levels which would allow aircraft having noise levels below FAR 36 limits to offset aircraft above FAR 36. This would give airlines the incentive to purchase new quiet aircraft and to retrofit with the quietest configurations to reduce their FNL.

The concept of not allowing the initial FNL number to increase is unreasonable since it would prevent replacement of smaller aircraft with large widebody aircraft if the noise level increases. An allowable adjustment should be made as the operator's fleet mix changes in takeoff gross weight.

It is inconsistent for the FNL rule to specify no trade-offs between takeoff and approach noise levels when FAR Part 36 does permit tradeoffs.

The FNL concept will not be feasible until it is determined that there is an economic method for the 707 and DC-8 to meet FAR 36 noise levels. Forced premature retirement of JT3D powered aircraft would be too severe an economic penalty. Therefore, this technology question must be settled before any FNL rule can be proposed.

Another deficiency in the proposed FNL is that it incorporates no incentives to utilize noise abatement operational procedures. It is recommended that some provision be made in the FNL to account for the noise reductions available from both approach and takeoff operational procedures.

FAA PROJECT REPORT: NOISE CERTIFICATION RULE FOR QUIET SHORT HAUL CATEGORY AIRCRAFT

We agree with the statement in this Project Report that the Quiet Short Haul system development is in such a state of flux that is too early to establish QSH noise standards.

As noted in the report, QSH aircraft types include rotary wing, turboprop, turbofan with blown flap or augmentor wing, lift pod, and fan-in-wing aircraft. These can probably be divided into VTOL, STOL and RTOL types which would operate from different length runways. These aircraft will also vary by the number of passengers, range and cruise speed.

It would appear that QSH aircraft will have to be divided into numerous classes for certification with different noise limits and different measurement locations. The noise limits for each class should probably vary with the number of passengers.

It is obvious from the recommended items to be included in the ANPRM that a vast amount of specific data is needed from the aircraft manufacturers on QSH aircraft noise characteristics and QSH economics before a viable noise rule can be constructed. The list of required information in the Recommendations appears to be quite complete, but would require considerable time to collect and digest. It is our suggestion that this information be collected by the FAA prior to any rulemaking activity on QSH.

Reference 1: Letter from W.E. Helfrich to W.C. Sperry dated 5-14-73 providing comments from Pratt & Whitney Aircraft for EPA Task Group 4.

Sikorsky Aircraft DIVISION OF UNITED AIRCRAFT CORPORATION
STRATFORD, CONNECTICUT 06602
PHONE (203) 378-6361

July 20, 1973

SEL-4095

Mr. William Sperry
Environmental Protection Agency
Crystal Mall, Building #2
1921 Jefferson Davis Highway
Arlington, Virginia 20460

Dear Mr. Sperry:

During the last meetings of the Environmental Protection Agency Task Groups on June 21 and 22, 1973, it was indicated that written positions from concerned groups would be considered and incorporated into the task group reports. The following remarks summarize the position of Sikorsky Aircraft on VTOL noise certification. It is requested that these remarks be incorporated into the Task Group 4 and 5 Reports.

In establishing the categories into which to place the various classes of aircraft for noise certification purposes, it is strongly recommended that VTOL be considered separately from STOL and RTOL. Placement of VTOL in a separate category would free it from the operational limitations necessary to accommodate the flight profiles of the other two classes if grouped in a combined category. Significant reductions in noise footprint by flight trajectory control are available and should be allowed to be developed in keeping with the intent of the Noise Control Act of 1972, to make aircraft inherently quieter and to have them flown as quietly as possible.

The issuance of a noise rule for the VTOL category of aircraft is premature at this time because of the following reasons:

a) There is insufficient data available on VTOLs in the unit most likely to be used in the rule to properly assess the state of the art. Measurement programs must be carried out to rectify this lack of information.

b) Relevant research is due to be completed by NASA within a year on VTOL noise to establish the state of the art on the applicability of noise reduction technology to current helicopter designs.

c) Operational procedures have not yet been adequately explored to assure that the noise certification concept will take full advantage of the low noise capabilities of the helicopter.

d) Current rating schemes do not appear to rate the annoyance of "blade slap" noise accurately. "Blade slap" is the impulsive type of noise that can be produced by some helicopter rotor systems under certain operating conditions.

No penalty should be levied against helicopters as a class for the occurrence of blade slap, as it occurs only on certain types of helicopters under a limited number of operating conditions.

An initial noise rule should allow all current generation helicopters to become certificated. De-escalation should not be considered until sufficient information has been generated to allow an accurate assessment of its economic impact and requirements for technological advances which may result.

Caution should be observed in attempting to relate the existing hover PNL data for helicopters to EPNL. The large variation in noise levels between the hover and the takeoff, landing, and cruise conditions coupled with the wide available operational range for these vehicles makes the conversion highly variable.

Economic considerations dictate flight paths below 3000 feet altitude for VTOLs in typical operations. Enroute noise controls which may force the cruise altitude to be significantly higher can have a significant impact on the operating economics of this type of aircraft, and therefore should not be considered until the consequences have been evaluated. A more viable solution to the regulation of enroute noise by certification appears to be the use of a measure of cumulative noise exposure impact, such as the Noise Exposure Forecast footprints, to dictate flight paths and operational procedures. This approach allows control of the environmental impact on areas of the community located between ports of operation in a manner which fully accounts for the environmental protection requirements of the community while not imposing unnecessary economic penalties on the helicopter operator.

Ambient noise should be considered when evaluating the impact of noise on the community. In V-port areas where higher than average background noise levels are likely to exist, the masking effect of these ambients should be factored into the allowable noise from aircraft.

We hope the preceeding comments have identified in a constructive manner, some of the potential pitfalls associated with VTOL noise regulation. It is our feeling that a workable VTOL noise certification rule can be developed in a reasonable period of time and that the rule can fully satisfy the environmental requirements intended by the Congress while stimulating the growth of this important facet of air transport. We hope to work further with you in this endeavor.

Yours truly,

SIKORSKY AIRCRAFT

Ronald G. Schlegel

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Appendix B

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