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UNITED STATES

ENVIRONMENTAL PROTECTION AGENCY

PROJECT REPORT

MINIMUM ALTITUDES FOR NOISE ABATEMENT

25 November 1974

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FOREWORD

This is the third draft of the Project Report on Minimum Altitudes for Noise Abatement.

In response to the distribution of the second draft, dated 5 March 1974, a number of comments were received from interested persons and organizations. Several of the respondents raised substantive issues on such matters as health and welfare aspects, safety, economic reasonableness, need for the regulation, airport operators' authority over airplane operations, etc. A summary tabulation and detailed discussion of these comments and issues is presented in Appendix B.

Serious consideration was given to the comments received, and, as a result, this third draft of the project report contains substantial revisions from Draft No. 2.

SUMMARY

This report presents the supporting data for a proposed regulation on minimum altitudes for noise abatement.

Based on the background data and analysis, it is concluded that a "keep-'em-high" regulation applied to turbojet-powered airplanes in the vicinity of airports can provide meaningful noise relief on the ground (e.g., a reduction of 20-25% in the area exposed to 90 EPNdB and above and a reduction of up to 9 EPNdB on the flight track.)

It is recommended that the FAA promulgate a regulation, based largely on Advisory Circular 90-59, requiring noise abatement minimum altitudes for turbojet-powered airplanes of 5,000 feet for both IFR and VFR operation except where operational requirements dictate otherwise, and requiring intercept of the glideslope at 3000 feet.

The Appendixes present excerpts or copies of existing FAA regulations and advisory circulars on minimum altitudes, and a review of comments received on the second draft of this project report.

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NOMENCLATURE

Abbreviation	Name
AC	Advisory Circular (FAA)
AGL	Above Ground Level. The height above the official elevation of the airport or air field (sometimes written AFL).
ANPRM	Advance Notice of Proposed Rule Making
ATC	Air Traffic Control
FAR	Federal Aviation Regulations
IFR	Instrument Flight Rules
ILS	Instrument Landing System
NPRM	Notice of Proposed Rule Making
RTOL	Reduced (field) Takeoff and Landing
STOL	Short (field) Takeoff and Landing
R/STOL	Reduced and/or Short (field) Takeoff and Landing
V/STOL	Vertical and/or Short (field) Takeoff and Landing
VTOL	Vertical Takeoff and Landing
VFR	Visual Flight Rules

LIST OF SYMBOLS

Symbol	Unit	Description
AL	dB or AdB	A-weighted Sound Pressure Level
EPNL	dB or EPNdB	Effective Perceived Noise Level
Ldn	dB	Day-Night Noise Level (sometimes written DNL but the preferred usage here is Ldn.)
Leq	dB	Equivalent Noise Level (sometimes written EQL but the preferred usage here is Leq).
log	---	Logarithm to the base 10.
NEF	dB	Noise Exposure Forecast

1 INTRODUCTION AND PERSPECTIVES

Public Law 90-411 amended the Federal Aviation Act of 1958 to require that, in order to afford present and future relief and protection to the public from unnecessary aircraft noise and sonic boom, the Federal Aviation Administration (FAA) 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 addition, PL 90-411 provided detailed specifications that must be considered by the FAA in prescribing and amending aircraft noise and sonic boom regulations.

The Noise Control Act of 1972 (Public Law 92-574) supersedes Public Law 90-411 and 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 FAA and the Environmental Protection Agency (EPA) in the control and abatement of aircraft noise and sonic boom. Specifically, the Noise Control Act 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 Noise Control Act also requires that 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 regulations proposed by EPA are to be based upon, but not submitted before completion of, a comprehensive study to be undertaken by the EPA and reported to Congress.

The Aircraft/Airport Noise Study, which has been completed, was required to investigate 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.

The study was implemented by a task force composed of six task groups whose product consisted of a report to Congress and six volumes of supporting data (one volume for each task group). The reports are identified as References 1 through 7.

Concurrent with the Aircraft/Airport Noise Study, the EPA prepared a general document of criteria, Reference 8, in conformance with Section 5(a)(1) of the Noise Control Act. This "Criteria Document" reflects the scientific knowledge most useful in indicating the kind and extent of all identifiable effects on the public health and welfare which may be expected from differing quantities of noise.

to the FAA of three complementary types of regulations:

(1) Noise abatement flight procedures,

(2) Noise source emission regulations (type certification) affecting the design of new aircraft and requiring the modification or phaseout of certain portions of the existing fleet, and

(3) An airport noise regulation, which would limit the cumulative exposure received by noise-sensitive land areas in communities surrounding airports. Such a regulation, by acting as a performance standard for the airport as a complex source, would require achievement of mutually compatible airport operational and land use patterns.

The following eight areas have been identified for aircraft noise regulations to be proposed by the EPA for promulgation by the FAA under Section 611 of the Federal Aviation Act as amended.

(a) Flight Procedures

(1) Takeoff

Individual airports, or runways of the airports, can be placed into the following three main categories regarding community noise exposure: sideline noise sensitive; near downrange noise sensitive; and far downrange noise sensitive. A set of three standard takeoff procedures suitable for safe operation of each type of civil turbojet airplanes are being considered for use, as appropriate, to minimize the noise exposure of the noise sensitive communities.

(2) Approach and Landing

The following two standardized approach procedures suitable for safe operation of each type of civil turbojet airplane shall be proposed for use as appropriate to minimize community noise exposure: reduced flap settings; and two segment approach (approximately 6°/3°).

(3) Minimum Altitudes

Minimum safe altitudes, higher than are presently specified in the Federal Aviation Regulations, shall be proposed for the purpose of noise abatement, applicable to civil turbojet powered airplanes regardless of category.

(b) Type Certification

(4) Retrofit/Fleet Noise Level

Nearly 1,800 existing large turbojet airplanes, having at least 4,000,000 operations per year in the United States are not covered by any noise rule but are the major source of noise impact in the vicinity of most air-carrier airports. Regulations shall be proposed to insure that both the existing and future civil aircraft fleet are controlled to noise levels as low as possible by available technology.

(5) Supersonic Civil Aircraft

Regulations shall be proposed which would limit the noise generated by future types of civil supersonic aircraft to levels commensurate with the subsonic civil fleet.

(6) Modifications to Federal Aviation Regulations (FAR 36)

Modifications to FAR 36 shall be proposed for lowering the noise criteria levels for all new airplane types that must comply. In addition, various amendments shall be proposed that would: require altitude and temperature accountability; strengthen test conditions for acoustical change approvals; and, in general, make the rule clearer and more effective.

(7) Propeller Driven Small Airplanes

Noise standards shall be proposed for propeller driven small airplanes applicable to new type designs, newly produced airplanes of older type designs, and to the prohibition of "acoustical changes" in the type design of those airplanes.

(8) Short Haul Aircraft

Noise standards shall be proposed for all aircraft capable of vertical, short, or reduced takeoff or landing operations. The required lengths of runways for these operations are being considered as: 1,000 ft. for VTOL; 2,000 ft. for STOL; and 4,000 ft. for RTOL.

It should be understood that the eight proposed aircraft noise regulations represent a package which, in toto, is expected to bring about a substantial improvement in the noise environment due to aircraft. While any one regulation, by itself, will not solve the community noise problems due to aircraft, each one as a building block will result in appreciable improvement, and it is anticipated that all eight together will effectuate a marked reduction in the number of persons exposed to undesirably high levels of aircraft noise. This effect will be additive to the improvement expected over the next decade or so as the older, noisier aircraft in the U.S. aviation fleet are retired and replaced with newer, quieter types with larger passenger capacity.

In prescribing and amending standards and regulations, Section 611 of the Federal Aviation Act as amended requires that the FAA shall consider whether any proposed standard or regulation is:

(1) consistent with the highest degree of safety in air commerce or air transportation in the public interest;

(2) economically reasonable;

(3) technologically practicable; and

(4) appropriate for the particular type of aircraft, aircraft engine, appliance, or certificate to which it will apply.

The above considerations of safety, economics, and technology are constraints on the noise regulatory actions that may conflict with full achievement of the stringent requirement of protection to the public health and welfare. To achieve compatibility, the regulations must be carefully constructed, comprehensive, and sophisticated instruments for exploiting the most effective and feasible technology, flight procedures, and operating controls available.

The regulations proposed by the EPA for promulgation by the FAA must be practically as complete and comprehensive as the FAA would propose on their own initiative. Otherwise, conflicts between the regulatory constraints of safety, economics, and technology and the requirement of protection to the public health and welfare could delay constructive action indefinitely.

The development of an aircraft noise regulation starts with the preparation of a project report, which is primarily a technical document providing as much definitive information as possible on such matters as background, objectives, available technology, cost-effectiveness, and recommended criteria for levels, measurements, and analyses. The project report will provide the basic input necessary for the preparation of a notice of proposed rulemaking (NPRM), which will be the format of each regulation to be proposed by the EPA to the FAA.

The procedure is to solicit comments on each project report from an EPA Working Group and a broad segment of interested organizations and the public. Numerous representatives of Government, the aviation community, environmental groups, and private citizens are participating in the review process and are making valuable contributions. The project reports, while in the draft stage, do not reflect official EPA policy or position. They are, however, an effective medium for informing the interested parties of contemplated actions, furnishing them with pertinent data, and providing a vehicle or conduit for receiving information.

The comments are carefully analyzed and used where appropriate to prepare a second draft reflecting constructive suggestions and including valuable supplementary information. It is anticipated that three drafts at most are needed to surface all of the controversial issues and to identify and gain access to all data necessary for the development of the regulations.

The EPA has issued a Notice of Public Comment Period (Federal Register, Vol. 39, No. 34, 19 February 1974) (Reference 10) concerning aircraft and airport noise regulations. This Notice can be considered as an ANPRM identifying nine aircraft and one airport noise regulatory actions that could be effective in controlling aircraft noise. The first seven actions proposed in the Notice are identical to the first seven items presented here. Actions 8 and 9 of the Notice, R/STOL and V/STOL aircraft, respectively, are included in Item 8, Short Haul Aircraft, presented here. Action 10 of the Notice refers to the airport noise regulation.

The purpose of the Notice is to invite interested persons to participate in EPA's development of the regulations to be proposed, by submitting such written data, views, or arguments as they may desire.

The Notice is not definitive in regard to any particular proposed regulation but refers to them in a general way. Information is solicited relating to the basic requirement that the regulations contribute to the promotion of an environment for all Americans free from noise that jeopardizes their health or welfare, or to the four statutory constraints pertaining to safety, economics, and technology.

Requests for information concerning the Notice should not be confused with similar requests concerning a project report on any one of the proposed regulatory actions. The project reports are specialized detailed documents containing recommended procedures and much supporting data, and are circulated for comment and critique.

2. SYSTEMS CONTROL OF AIRCRAFT NOISE

Protection to the public health and welfare from aircraft noise is accomplished most effectively by exercising four noise control options taken together as a system:

(a) source control consisting of the application of basic design principles or special hardware to the engine/airframe combination which will minimize the generation and radiation of noise;

(b) path control consisting of the application of flight procedures which will minimize the generation and propagation of noise;

(c) receiver control consisting of the application of restrictions on the type and use of aircraft at the airport which will minimize community noise exposure; and

(d) land use control consisting of developing or modifying airport surroundings for maximum noise compatible usage.

In general, the primary approach for noise abatement is to attempt to control the noise at the source to the extent that the aircraft would be acceptable for operations at all airports and enroute. And in principle, aircraft noise can be controlled extensively at the source by massive implementation of available technology. In practice, however, technology capability for complete control without exorbitant penalties is not yet available and may never be. A regulation requiring full protection to the public health and welfare by source control, therefore, would have the effect of preventing the development of most new aircraft and grounding the existing civil fleet.

Path control, for most cases, can be an effective option for substantial reduction of aircraft noise. Furthermore, it has the advantage that the results are additive to those obtained by source control. However, specialized flight procedures are limited because of the need to maintain the highest degree of safety. Therefore, a regulation requiring full protection to the public health and welfare by flight procedures is not feasible at this time and probably never will be. Nevertheless, all aircraft can be flown safely in various modes that produce a wide range of noise exposure. And, at the least, those safe modes, which will minimize the generation and propagation of noise, should be identified and standardized.

The major problem with aircraft noise in terms of numbers of people exposed, occurs in the vicinity of airports. This problem could be relieved by the application of various operating restrictions at the airport. Extensive use of restrictions, however, is practical only if all feasible source and path control options have been implemented. Unless this has been done, the airport restrictions may result in unnecessary damage to the local and national economy.

A concept under consideration at this time is that the airport authorities in some cases, and the FAA in other cases, would impose restrictions on the aircraft operators as needed (curfews, quotas, weight, and type limitations, preferential runway use, noise abatement takeoff and approach procedures, landing fees, etc.) to ensure that the airport neighborhood communities are noise-compatible consistent with the requirements of health and welfare. It must be clearly understood that the restrictions available to the airport operator will be those approved by the FAA, CAB, and EPA. The highest degree of safety must be maintained and interstate and foreign commerce requirements must be considered. Restrictions involving flight safety and air traffic control would be the sole responsibility of the FAA.

As an example of this concept, determination of runway usage to minimize community noise impact would be made by the airport operator after consultations with the municipal authorities of the airport neighborhood communities. High priority would be given to maximum implementation of long range land use planning for noise compatibility. If the FAA agrees with the operator's runway designations, the FAA would decide which takeoff and approach procedures must be implemented by aircraft using the designated runways. In all cases, pilots would be given discretionary authority over operating procedures for safety and air traffic reasons.

After all feasible noise control measures have been applied to the aircraft by design, treatment, or modification of the source, by flight and air traffic control procedures, and by proper design, location and use of airports, the noise may still be a problem at some locations. In this event, compatible land use is probably the only remaining solution. The land use control option is more easily exercised in the development of new airports than as a remedial measure for existing noise impacted communities. For the latter case, the costs of land use control are so high that maximum effort must be devoted to implementing the source, path, and receiver control options taken together as a system.

The extent to which the control options must be regulated is dependent upon the meaning and quantification of public health and welfare. Three important considerations must be emphasized. First, the FAA noise regulations have the requirement of protection to the public health and welfare. Second, the regulations are constrained by safety, economics, and technology. Third, the requirement and the constraints may appear to be in opposition to each other and the conflict can be resolved only by implementation of the noise control options taken together as a system.

The foregoing discussion is relevant to the basic fact that aviation is a needed element of the national transportation system. If regulations intended to protect the public health and welfare imposed such a burden that the survival of the national aviation system were threatened, this would not be in the national interest. On the other hand, well-conceived regulations which optimally exploit the available alternatives, could protect the public health and welfare and, by improving the acceptability of airplanes, engender continuing development of the aviation system.

If it could be established that some particular design change or retrofit hardware for airplanes, or operating rule, could completely satisfy the requirements for protection (from airplane noise) to the public health and welfare, then that specific method should be used. It is unlikely, however, that any single option, within the legislative constraints, could completely satisfy the requirements for such protection. Consequently, a systems implementation, employing each noise control option available within its area of optimal application, should be considered as the most feasible method for accomplishing the desired objectives and equitably sharing the costs of noise control among all segments of the aviation community and that portion of the public that benefits from aviation.

The noise control regulations prescribed by the FAA for the aircraft manufacturers and operators are required to provide protection to the public health and welfare to the highest degree possible in conformance with the systems implementation of the source and path control options. The regulations shall be expected to reflect the latest state of the art of safe technology without prohibitive impairment of aircraft performance (range, payload, field length, etc.). If, however, it is evident that source and/or path control are the only or least costly options, then aircraft performance loss to any reasonable extent must be accepted.

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, from what airports they will be operated, or what noise-compatible land use will be implemented in the vicinity of these airports. Consequently, source emissions or flight procedures regulations should be developed with due consideration given to the total system concept. The regulations should be of the "umbrella" type in the sense that those aircraft regulated can all comply by use of available technology although some may be capable of and are achieving lower noise levels than others. Various models of aircraft within specific type classification may not have the same capability for generating or controlling noise because of such differences as size, weight, powerplant, etc. The regulations should be flexible enough to consider the effect of these factors on noise and attempt to control the levels to the maximum practical extent. "Umbrella" type regulations do not mean that the worst offenders would be permitted to comply without penalty. On the contrary, a properly constructed set of regulations, representing components of a system of noise control options, probably would require ultimately the greatest sacrifice from the worst offender. The various aircraft/engine types have different weights, thrust, engine characteristics, and flight performance characteristics, all of which influence their noise generation and reduction capabilities. Consequently, it is not reasonable to expect that a particular source or flight procedures regulation should require equal noise level compliance from all types, weights, thrust, etc., of aircraft.

As an example, FAR 36 has several features that discriminate, in the "umbrella" sense, among the various classes of airplanes. Greater weight airplanes are permitted higher compliance levels; four engine airplanes are permitted greater sideline distances; and four engine airplanes are not permitted as much percent thrust reduction at takeoff. The above discriminating features contained in the same source control regulation permit some airplanes to make more noise than others. In the end, however, the airplanes producing the most noise will be the primary candidates for operating restrictions at the airports as necessary to protect the public health and welfare. The implementation of these restrictions is likely to impose the greatest burden on the noisiest airplanes.

The airport restrictions would provide incentive for the aircraft operators to conduct thorough investigations and consider maximum utilization of the available noise control options. The fact that an aircraft manufacturer or operator has barely complied with an FAA "umbrella" type regulation would not ensure unlimited 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 maximum utilization of the source emissions and flight operations noise control technology within their capability and not merely to comply with specified limits.

3. OBJECTIVE

The objective of this project is to promulgate a rule which will help to reduce the noise exposure on the ground due to low altitude flight of turbojet powered and/or large airplanes by requiring them to comply with the present recommended altitude limitations and operational procedures of FAA Advisory Circular 90-59, and to maintain an altitude of at least 3,000 feet AGL until beginning descent on the approach glideslope. It is intended that the rule:

(a) will be fully responsive to the guidelines of Reference 9 for protection to the public health and welfare,

(b) will not impose unreasonable economic burdens on the national aviation system,

(c) will not degrade the environment in any manner, and

(d) will not cause a significant increase in fuel consumption.

The intent of this project report is to provide as much definitive information as possible on such matters as background, available technology, cost effectiveness, and recommended criteria for levels, measurements, and analyses. This project report will provide the basic input for the preparation of a notice of proposed rule making (NPRM) which will be the format of the regulation to be proposed by the EPA for promulgation by the FAA in conformance with the Noise Control Act of 1972.

4. BACKGROUND

Three regulations to date have been prescribed which have a significant influence on aircraft noise and sonic boom. These rules, identified as References 11, 12, and 13, accomplish the following:

(a) Reference 11 (FAR 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 rule initiated the noise abatement regulatory program of the FAA under the statutory authority of Public Law 90-411.

(b) Reference 12 is an operating rule prohibiting supersonic flights of civil aircraft except under terms of a special authorization to exceed the speed of sound (Mach 1.0). Authorization to operate at a true Mach number greater than unity over a designated test area may be obtained for special test purposes. 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.

(c) Reference 13 requires new production turbojet and transport category subsonic airplanes to comply with FAR 36, irrespective of type certification date. This rule established the following dates by which new production airplanes of older type designs must comply with FAR 36.

- 1 December 1973 for airplanes with maximum weights greater than 75,000 pounds, except for airplanes that are powered by Pratt and Whitney JT3D series engines.
- 31 December 1974 for airplanes with maximum weights greater than 75,000 pounds which are powered by Pratt and Whitney JT3D series engines.
- 31 December 1974 for airplanes with maximum weights of 75,000 pounds and less.

A. <u>FAA Regulations and Advisory Circulars Relating to Minimum Altitudes</u>

It is generally recognized that flying at high altitudes results in relatively low noise on the ground from aircraft. Recommendations contained in the reports of the aircraft/airport noise study (References 1 and 3) include the adoption of standard minimum altitudes higher than are presently specified in the Federal Aviation Regulations.

The pertinent FAA material that relates to the subject includes the following:

1. FAR Part 91.87, "Operations at Airports with Operating Control Towers";
2. FAR Part 91.79, "Minimum Safe Altitudes";
3. Advisory Circular 90-59, "Arrival and Departure Handling of High Performance Aircraft";
4. Advisory Circular 91-36, "VFR Flight Near Noise-Sensitive Areas".

The pertinent paragraphs of the Federal Aviation Regulations and the two Advisory Circulars listed above are reproduced in Appendix A. For convenient reference, relevant sections of these documents are summarized and paraphrased below, and a brief summary tabulation is provided, Table 1.

(a) FAR Part 91.87 requires in part that turbine-powered or large airplanes:

(1) Enter the airport traffic area at an altitude of at least 1500 feet above ground level (AGL);

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(2) Climb to 1500 feet above ground level after takeoff as rapidly as practical;

(3) Use a noise abatement runway for takeoff and/or landing if one is designated.

(b) FAR Part 91.79 requires in part the following:

(1) All aircraft maintain a minimum altitude of 1,000 feet above ground level when flying over congested areas;

(2) All aircraft maintain a minimum altitude of 500 feet above ground level when flying over non-congested areas;

(3) Helicopters may fly at lower altitudes but in such a way as not to present a hazard to persons or property on the surface.

(c) Advisory Circular 90-59. This circular describes the "keep-'em-high" program which applies to airports with operating control towers, and includes the following points:

(1) High performance aircraft are to enter the terminal area at an altitude of 10,000 feet and remain at that altitude as long as possible before descent to 5,000 feet, at which altitude they will enter the descent area for the landing direction required. Departing aircraft are to climb to their flight plan altitude as soon as possible after liftoff;

(2) High performance aircraft flying VFR are also encouraged to "keep-'em-high". Pilots of other VFR aircraft are urged to avoid the descent areas most used by the high performance aircraft;

(3) This procedure enhances safety and affords significant noise relief to neighbors.

(d) Advisory Circular 91-36. This circular makes the following points:

(1) Pilots flying VFR conditions near noise-sensitive areas are encouraged to fly at altitudes higher than the minimum permitted by regulations and on flight paths that will reduce noise in those areas;

(2) The intent of the advisory circular is to improve the quality of the environment;

(3) VFR flights over noise-sensitive areas should be at least 2,000 feet above ground level;

(4) Pilots should avoid noise-sensitive areas if at all practical.

B. Discussion of Comments Received on Second Draft of Project Report

The present document is the third draft of the project report on minimum altitudes for noise abatement. Although the second draft was revised to some extent, reflecting an evolution in viewpoint based on review of the comments received on the first draft, comments in the second draft were received from 17 sources, indicating continuing disagreement or criticisms of content among the original respondents.

The key issues commented on are summarized and reviewed in the following paragraphs. Additional details of these and several minor issues raised are provided in Appendix C.

The five issues basic to all aircraft noise regulation and project reports are the following:

(a) Health and Welfare - Does the proposed regulation substantially protect public health and welfare, and does the project report adequately demonstrate it?

(b) Safety - Is the proposed regulation adequately protective of safety (at least does not degrade safety) and does the project report substantiate it?

(c) Technology - Is the proposed regulation technologically practicable and does the project report adequately address this matter?

(d) Economic Reasonableness - Is the proposed regulation economically reasonable, and does the project report show that it is?

(e) Appropriateness - Is the proposed regulation appropriate to the type of aircraft affected by the regulation?

A sixth and seventh may be added as well:

(f) Necessity - Is the proposed regulation necessary to protect the public health and welfare, and does the project report justify it?

(g) Energy aspects - Does the proposed regulation affect energy usage in a conservative manner - that is, either reduce or at least not cause an undesirable increase in energy usage requirements?

The comments received addressed five of these issues, as discussed briefly below; the questions of technological practicability (c) and appropriateness (e) were not raised as issues.

(a) Health and Welfare

One respondent suggested that inadequate data had been provided to show that the proposed regulation was protective of public health and welfare, and the extent of this protection. In response to this comment, as well as similar comments on related project reports, there has been considerable revision and expansion of the text concerning that subject. In addition, a more detailed analysis has been made and estimated data provided showing the health and welfare benefits of the proposed regulation.

(b) Safety - Four commentators raised the question of effects on safety of the proposed regulation. The thrust of the comments was that an altitude of 5000 feet is too high for an airplane to be in the vicinity of an airport it was approaching for a landing, as this would require a rate of descent that should not be required by regulation without having adequate external guidance equipment available. This objection is not considered valid, inasmuch as the proposed regulation is consistent with much of existing practice, being derived from FAA Advisory Circular 90-59.

(d) Economic Reasonableness - Three respondents commented that the economic analysis presented was inadequate. There was no explicit criticism that the proposed regulation was economically unreasonable. The economic analysis has been revised, and in particular, strengthened by the expanded discussion of the closely related health and welfare benefits.

(f) Necessity - Four respondents argued that no statistical data had been provided showing significant non-compliance with AC 90-59, and therefore it had not been shown that there was any need for this regulation. One pointed out in addition that FAA Order 7110.22 B implements the Advisory Circular, implying apparently that such implementation obviates the need for a regulation.

As regards the question of data on compliance with AC 90-59, such data has been sought, but does not appear to be available. Whether or not there is general compliance with AC 90-59 is not crucial, however, since a major provision of the proposed regulation is the 3000-foot glide-slope intercept, which is not part of that Advisory Circular. The discussion provided in this report, of the benefits of the 3000-foot intercept and the relation of this rule to the total package of aircraft noise regulations, is intended to show the need for the regulation.

(g) Energy Aspects - One respondent suggested that the assumptions made in the discussion of effects of the regulation on fuel usage were incorrect. After discussions with EPA's consultant on airplane operations, the text was revised to reflect more closely the operations involved. The basic conclusions did not change significantly, however.

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5. ANALYSIS

A. Effects of Airplane Altitude on Flyover Noise

Typical noise levels on the ground due to various types of aircraft flying over at 1,000 feet are shown in Figure 1 (based on data from References 14, 15 and 16). It can be seen from the data in this figure that turbojet airplanes are substantially noisier than other and smaller aircraft. The noise levels on the ground range from 75 to 115 EPNdB, depending on aircraft size and type. It is not surprising, therefore, that the consensus of the Task Group on Operating Procedures reported in Reference 3 was that higher minimum altitudes would help to alleviate noise problems due to overflights of aircraft. This noise reduction, indeed, is one of the purposes of the FAA "keep-'em-high" program described in Advisory Circular 90-59. Because by far the largest noise exposure and the bulk of the noise problem occurs in the vicinity of airports serving commercial airline traffic and is due mainly to landing approach and takeoff noise, it is apparent that primary emphasis should be directed toward this major portion of the problem.

Requiring arriving airplanes to maintain higher altitudes in the vicinity of the airport generally is likely to result in increasing the altitude at which the glide slope is intercepted. This can reduce approach noise significantly. The regulatory minimum altitude for turbine-powered or large aircraft to enter the airport traffic area is 1500 feet above ground elevation in accordance with FAR Part 91.87. For straight-in approaches, Reference 17 indicates that, for a 707-320B, the area exposed to 90 EPNdB or greater can be reduced by 25% and the flight track EPNL reduced by up to 13 EPNdB if the glide slope intercept altitude is increased to 3,000 feet. This is shown in Figure 2.

Computation of noise for various airplanes based on the data on effective perceived noise level (EPNL) versus slant range in Reference 18, shows similar results. For a 707 with JT3D engines, the computed reduction in EPNL on the ground for a 3000-foot intercept in lieu of a 1500-foot intercept ranges up to 9 EPNdB, becoming zero at the 1500-foot intercept point, as shown in Figure 3. The amount of reduction in EPNL depends partly on the flap settings assumed. The influence of assumed flap setting on the results obtained can be seen by comparison of Figures 2 and 3. In Figure 2, which shows a maximum 13 EPNdB improvement with the 3000-foot intercept, the descent is made at 25° flaps from a horizontal flight intercept at 14° flap setting. The thrust required for a 3° glide angle at 25° flaps is lower than that required for horizontal flight at 14° flaps. Consequently, the noise level under the flight path decreases, resulting in a maximum improvement of 13 EPNdB, as shown. In Figure 3, the descent is assumed at 50° flaps from a horizontal approach at 14° flaps. The thrust needed for a 3° glide at 50° flaps is greater than that for horizontal flight at 14° flaps. Consequently, the noise level under the flight path increases, resulting in the maximum improvement shown of only 9 EPNdB. This is a clear indication of the noise-reduction effectiveness of using reduced flap settings. The area within the 90 EPNdB contour, shown in Figure 4, is reduced by about 23%, the amount of computed reduction being dependent on the assumption as to how far ahead of the glideslope intercept stabilized level flight begins. The data on two-segment approach shown in Figures 3 and 4 are discussed in Section 6.

Similar data for a 727-200 are shown in Figures 5 and 6. For this airplane as well as the 707, the EPNL on the ground with a 3000-foot intercept of the glideslope is up to 9 EPNdB lower than it is with a 1500-foot intercept. The area within the 90 EPNdB contour is reduced about 24%, again depending on the assumed point of level flight stabilization ahead of glideslope intercept.

Another way of estimating the reduction in perceived noise on the ground that would result from a 3000-foot glideslope intercept requirement, as compared to a 1500-foot intercept, is to compare the EPNL values for various airplanes in approach thrust condition at the two heights. This is shown for the airplanes of the current jet fleet in Table 2. Also listed in Table 2 are the EPNL values for a 5000-foot height. In addition, the differences in EPNL are shown for a 3000-foot height versus 1500 feet, and 5000 feet versus 3000 and 1500 feet.

The EPNL differences shown in Table 2 confirm that raising the glideslope intercept altitude from 1500 to 3000 feet will result in a maximum reduction in EPNL on the ground from about 6 to 8.5 EPNdB. The additional benefit of keeping the airplane at 5000 feet can be seen the data listed in Table 2 to be another 6 to 8.5 EPNdB, relative to a 3000-foot altitude, or about 12 to 16.5 relative to a 1500-foot altitude.

Operational experience obtained at Minneapolis/St. Paul International Airport provides a case in point (Reference 19). A procedure denoted "High Random Visual Approaches", after being subjected to a 60-day operational evaluation, was adopted as a routine procedure under

VFR conditions. The key features of this procedure are:

1. Inbound turbojet aircraft are held at an altitude of 5,000 MSL feet until approximately ten flying miles from the approach end of the landing runway.
2. At the ten-mile point, the aircraft is cleared for a "visual approach".
3. After the clearance, the aircraft is "on his own" with regard to his path to the airport.

Surveys of the resultant aircraft noise indicated significant noise relief, averaging 6 - 7 AdB at four miles out, and about 3 - 4 AdB at the three-mile point. The procedure appears to be satisfactory from the standpoint of all major factors, including safety, and has not generated any adverse comment from pilots or carriers.

In some cases, it may be argued that an increased intercept altitude increases total noise exposure by causing the aircraft to fly a longer ground track when making a curved approach. On the other hand, even for those aircraft that fly a longer track, the noise impact is ameliorated by the higher altitude - approximately a 6 to 8.5 EPNdB improvement for a 3000-foot altitude flyover compared to a 1500-foot flyover. Furthermore, the experience at San Jose Airport (Reference 20) indicates that, in VFR conditions, rather than travelling a long distance to intercept the glide slope from below, many pilots will actually choose to make an approach steeper than 3° in order to shorten the distance. In IFR conditions the requirement for a long stabilized approach would require path stabilization far from the airport anyway. To the extent that curved approaches might be lengthened, (which would occur in some, but not all, cases) additional fuel would be consumed, approximately 60 pounds per mile for a Boeing 727 (Reference 21). It is apparent, therefore, that the "keep-'em-high" procedures provide meaningful noise relief and are technically feasible. Obviously, such procedures must be closely coordinated with other air traffic control requirements.

B. <u>Noise Exposures due to Low Altitude Flights Remote from Airports</u>

Of the four FAA documents, referred to earlier, concerned with minimum altitudes, FAR Part 91.87 and AC 90-59 in particular deal mainly with operations in the vicinity of airports. FAR Part 91.79 prescribes minimum safe altitudes for flight over congested and non-congested areas (which need not be confined to the vicinity of airports) and AC 91-36 encourages higher minimum altitudes over noise-sensitive areas.

While there is a great body of literature on community and individual noise exposure in the vicinity of airports, there is relatively little information on noise exposure due to airplanes in areas remote from airports. This is not surprising, for at least two major reasons:

(1) The highest levels of airplane noise exposures occur near airports, since it is here that low-altitude operations must of necessity occur in large numbers; and

(2) most airports serving air-carrier operations are located close to large metropolitan areas where there are likely to be large concentrations of people exposed to the noise.

Nevertheless, noise exposures occur and complaints arise in locations other than near large air-carrier airports. These are usually due to low altitude flights not necessarily associated with a large airport. Two examples are reported in References 22 and 23.

Reference 22 comments specifically on excessive noise due to low-flying police helicopters in urban areas. Reference 23, on the other hand, is a complaint concerning low-flying Coast Guard airplanes (pre-

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sumed to be non-turbojet-powered) as well as helicopters from a nearby airport which is not primarily an air-carrier port.

A brief review of the information presented in References 22 and 23 indicates that the low-altitude operations which are the basis of the complaints probably fall within the category of "operational necessity" so that the relevant FAA regulations and advisory data would not be applicable in any event.

The foregoing discussion leads to a tentative conclusion that there is insufficient data available on noise exposures at locations remote from air-carrier airports to justify establishing regulations controlling flight at those locations for the sole purpose of minimizing noise exposure.

It is inferred from the previous discussion that regulatory effort should concentrate on high performance turbojet airplanes in the vicinity of airports handling commercial passenger traffic. In fact, it appears that regulation of aircraft altitudes away from the airports is not required, for the reasons discussed.

Although a small percentage of pilots may fail to comply with such regulatory and advisory limitations on altitude without a genuine overriding operational need, such occurrences may create individual disturbances, but do not represent a significant contribution to total noise exposure. The promulgation of a regulation for this type of case seems to be unwarranted. It may be instructive to consider the complaints registered in References 22 and 23 in the light of the foregoing comments. As indicated previously, Reference 22 was concerned about the noise (and related disturbance) of low-flying police helicopters, and Reference 23 complained mainly about low-flying Coast Guard airplanes as well as helicopters. In both of these cases, it is highly likely that "operational necessity" would be asserted as the reason for the low-altitude operations. If this is indeed the case, then, in view of the provisions for operational necessity in the pertinent FAA regulations and advisory circulars, this sort of disturbance would not be affected nor prevented by additional regulations.

Nevertheless, the question remains: what can be done to provide relief to citizens subjected to frequent repetition of this sort of noise exposure? It seems clear that, in situations such as the ones described here, the officials of the agencies involved have a profound obligation to be sensitive and responsive to legitimate complaints. This would involve, among other possible actions, promplty assessing the validity of the complaints and reviewing the operations generating the complaints, with an eye to revision of procedures and constraints that would ameliorate the disturbance to the complainants. In this type of case, judicious decisions and actions by sensitive and considerate officials would be more useful and effective than another set of regulations.

In general, it appears that no significant noise problem susceptible to regulatory control has been demonstrated to exist due to low-flying aircraft at locations remote from air-carrier airports.

On the other hand, the large number of airplane operations of civil turbojet transports from air-carrier airports, and the resulting noise exposure of neighboring communities due to aircraft noise, suggest that all practical procedural measures designed to reduce that noise be established by regulation to help ameliorate the existing noise pollution.

The purpose of the regulation proposed herein, therefore, is to make mandatory the advisory "keep-'em-high" requirements of Advisory Circular 90-59 and add a requirement for the approach glide path to begin no lower than 3000 feet in order to prohibit unnecessary, noise-inducing, low-altitude flights by high performance airplanes in the vicinity of airports.

6. HEALTH, WELFARE AND ECONOMIC CONSIDERATIONS

A. Implementation Costs

Raising the altitude of the glideslope intercept point does not require any equipment changes, or additional investment. It can, however, affect the operational costs of the airlines to a small extent.

It has been amply demonstrated elsewhere (Reference 3 and 4) that the noise generated by commercial aircraft operations around airports produces adverse public health and welfare effects on populations exposed to such high levels of noise. Unfortunately, accurate data on the costs of all the possible public health and welfare effects are not available. Therefore, cost-benefit tradeoffs on how much noise reduction is justified cannot now be made. Consequently, specific decisions on the "economic reasonableness" of the noise reduction alternatives under consideration cannot be made until either the effects data are monetized or standards of noise exposure are established. Until either set of decision data is available, the only criteria available are qualitative and hold that if noise level exposure decreases for the public and the increased cost is modest, "economic reasonableness" is presumed.

Implementing this procedure for minimum altitude of glideslope intercept should decrease population noise exposure by about 6 to 8.5 EPNdB under the flight path from 5 to 10 nautical miles from an airport's runway approach threshold. Such a decrease in population noise exposure represents a reduction in the adverse public health and welfare effects of noise exposure due to airport activity. Since the public impacts of noise reduction are site-specific, e.g., reductions may occur where there is no population to be impacted, no accurate systemwide estimate can be made of the reduction in adverse public health and welfare effects due to the implementation of this procedure. However, the discussion presented later in this section indicates approximately the benefits obtained.

Raising glideslope intercept altitudes and requiring strict operational geometry can induce several system changes which affect airline operating costs. For example, aircraft that directly proceed into final approach courses at higher altitudes should save fuel, relative to current practices, because of the relatively lower aerodynamic drag and reduced power settings. Offsetting this potential fuel savings is the consideration that higher intercept altitudes can extend the curved flight paths of aircraft turning into the final approach from other directions. Obviously, there are impacts that must be analyzed. Appropriately enough, the FAA has recently investigated such strict geometry system impacts. The investigation posed the question as to whether higher approach and intercept altitudes induce additional operational costs due to the following factors:

(a) Decreased practical capacity of an airport

(b) Increased delay times resulting from the dynamics of flight control at an airport.

(c) Increased maneuver distances associated with the geometry.

Field tests of the 3000-foot glideslope intercept concept were sponsored by the FAA at Detroit Metropolitan and Tampa International Airports. Three variations of the concept were tested and an airport capacity impact study plus an economic analysis were conducted. The noise measurement results are presented in Reference 24 and the capacity impact and economic analysis are presented in Reference 25. The field test results indicate that, at distances greater than nine nautical miles from runway touchdown, significant noise benefits (9 EPNdB projected with some benefit extending in to about five nautical miles) can be attained by requiring all aircraft to remain 3,000 feet AGL until glideslope intercept versus a 1,500 feet AGL intercept. The benefits, i.e., the number of people receiving noise relief or the reduction in NEF contour areas associated with increased minimum altitudes were not estimated.

For each of the variations examined, there were expected to be some operating cost increases associated with their respective implementations. The estimated capacity and cost effects for each variation are delineated below.

a. The greatest impact on airport capacity and highest costs were realized when all aircraft were vectored so as to intercept the glideslope at a minimum of 3,000 feet AGL. A 2% reduction in practical annual capacity was indicated and the average cost per flight was estimated to be $8.10*

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* Average cost per flight does not reflect the cost incidence by type of aircraft; it is simply total cost divided by total flights. Cost per aircraft class may be found in Reference 25.

b. When only turbojet aircraft were vectored so as to intercept the glideslope at a minimum of 3,000 feet AGL, the capacity impact and costs were significantly decreased. The results were an 0.8% reduction in practical annual capacity and an average increase in operating cost per flight affected of \$8.95, which would be higher with the higher fuel costs now being incurred.

c. The minimum impact case resulted when all arriving Instrument Flight Rules (IFR) aircraft were required to maintain at least 3,000 feet AGL until five flight path miles from an optimum turn-on point. Less than 0.8% reduction in practical annual capacity was indicated; the average cost increment per flight affected was estimated to be \$3.13, due to additional flight lengths only. The airport capacity impact and operational costs would, of course, be further decreased if only turbojet aircraft were required to comply with this procedure.

Since the effectiveness of each variation is relatively constant, i.e., about 6 to 8.5 EPNdB maximum reduction, and there exist large cost per flight differences among the approaches, a question of the scope of the proposed regulation arises. Briefly, the issue is whether all aircraft operators should incur increased operating costs, regardless of whether they are contributing to a particular airport noise problem. Economic doctrines require that those creating the problem should pay the full costs of the problem solution, otherwise there will arise equity problems and distortions in the pricing system which result in a mis-allocation of resources. When an airport's noise problem can be alleviated by this procedure, only the noise-dominating aircraft should be required to intercept the glideslope at a minimum of 3,000 feet AGL. This is believed to result in an average cost increase per flight of approximately $8.95 for the noise-dominating aircraft.

The final economic considerations that must be mentioned are that these cost impacts reported here are believed to be maximum estimates. This results from the fact that there have been several recent and significant changes in the operational character of the airline industry due to the energy crisis. The first is that significant reductions in flight frequencies (10-15%) are occurring as well as equipment substitutions of narrow bodies for wide bodies. This means that "practical" airport capacities are changing and that the separation distances dictated by aircraft activity mix have changed. The second is that cruise speed in most cases has been reduced in the interest of fuel conservation, thereby changing arrival times at airports. It follows that, if:

(1) airport capacity requirements are reduced;

(2) separation distances are tending to be reduced because of equipment substitutions; and

(3) arrival times have been changed;

then the cumulative effect of these changes should be reductions in the operational cost increases quoted. Furthermore, load factors are increasing; consequently, profit per flight may increase to the extent that revenues offset the dramatic increases occurring in aircraft fuel prices.

B. Estimate of Health and Welfare Benefits Obtained

It should be recognized that the regulation proposed herein represents just one of the "building blocks" in the regulatory structure being proposed by EPA. The benefits to be obtained from implementation of this procedure should be viewed, at least partly, in the light of the contribution made by this particular building block to the overall improvement expected from the entire package.

Probably the most comprehensive analysis available concerning the effects on national noise exposure of various noise abatement measures is the 23-airport study (Reference 26 and 27) supported by the Department of Transportation. Much of the discussion that follows is based on the data in those reports.

(1) As indicated in Section 5 of this project report, use of a 3000-foot glideslope intercept, in lieu of a 1500-foot intercept, by a turbojet-powered transport is expected to result in about a 25% decrease in the area of the 90 EPNdB "footprint", i.e., the area enclosed by the 90 EPNdB contour. This is based both on data from Reference 17 and computations using the noise data from Reference 18, plotted in Figures 4 and 6.

(2) These results may be compared with the results for the two-segment approach. Based on computation of the areas within the 90 EPNdB contours for the 707 and the 727 shown in Figures 4 and 6, the two-segment approach (6°/3°) using a 3000-foot intercept provides a reduction in the 90 EPNdB footprint area of about 54%. This is a somewhat smaller benefit provided by the two-segment approach than

the estimate of 75% given in Reference 3, but the later data appear somewhat more realistic. Comparing the 24% estimated reduction in footprint area for the 3000-foot intercept, relative to the 1500-foot intercept, with the 54% reduction in area obtained with the two-segment (6°/3°) approach, relative to the 1500-foot intercept, 3° glide angle approach, one may infer that the 3000-foot intercept is, conservatively, about 40% as effective as the two-segment approach in reducing the noise-impacted area in the community.

(3) From data in the 23-airport study, it may be estimated that implementation of the two-segment approach reduces the total 23-airport area within the 30 Noise Exposure Forecast (NEF 30) contours in 1978 by about 8.5%. It should be noted that Day-Night Level (Ldn) which is the standard measure of cumulative noise exposure used by EPA, is related to Noise Exposure Forecast (NEF) approximately by the following equation:

$$Ldn = NEF + 35.$$

Therefore the NEF30 contour can be considered equivalent to Ldn 65 to a degree of accuracy satisfactory for this discussion. On the approximation that the 23 major airports represent about 70% of the national problem, this corresponds approximately to a reduction of 340,000 persons nationally within the Ldn 65 contour, compared to a baseline number of 4,300,000 persons.

(4) Applying the computed effectiveness for the 3000-foot intercept (about 40% that of the two-segment approach) leads to the estimate that implementation of this procedure would reduce by about 136,000

the number of persons within the Ldn 65 contour, in the 1978 time period. While this is only 3.3% of the baseline number of 4.3 million, it represents a useful improvement in the acoustical environment. It should be kept in mind that early implementation of the 3000-foot intercept procedure can bring this improvement about almost immediately. Since the two-segment ILS approach now under consideration probably cannot be implemented for several years, not until the air-carrier fleet has been equipped with the necessary airborne avionics, the minimum altitude regulation incorporating 3000-foot glideslope intercept can serve as a mechanism for considerably earlier improvement than can be achieved otherwise.

7. CONCLUSIONS

Significant noise relief consisting of a reduction of about 25% in the area enclosed by the 90 EPNdB contour and a reduction in EPNL on the flight track of about 6 to 8.5 EPNdB would be obtained in the airport terminal areas if minimum altitude procedures were implemented. The costs, if any, for these operations would be modest. Fuel consumption would increase if the curved flight paths were lengthened significantly. Offsetting this, however, would be the reduction in fuel consumption due to the advantages of increased altitude (less aerodynamic drag resulting in lower thrust settings). The overall effect, whether there would be more or less fuel consumption and how much, is difficult to determine. In any event, the additional fuel consumption, if any, would be modest.

The minimum altitude procedures would have the effect of improving safety because of increased maneuvering heights and larger separation distances between aircraft. These proposed procedures are simply extensions of existing FAA requirements or recommendations developed solely for safety.

It appears that there is no need to introduce regulations, beyond those proposed herein, pertaining to minimum altitudes of aircraft other than high-performance (e.g., turbojet-powered or large turboprop) airplanes, or at locations other than in the terminal areas of airports.

8. RECOMMENDATIONS

A regulation should be prescribed which would make it mandatory for turbojet powered airplanes to be operated at minimum altitudes consistent with the following:

(1) The advisory "keep-'em-high" procedures for high performance aircraft under IFR outlined in Advisory Circular 90-59 should be made mandatory;

(2) Consistent with these altitude minimums, a requirement should be added that the rate of descent below an altitude of 3,000 feet above ground level (AGL) must be no less than that associated with the existing ILS glideslope at the airport (and preferably, at least 3°). Note that this would not necessarily represent a 3,000 foot intercept of the glideslope, since it would allow for a curved path to the approach glideslope;

(3) High-performance aircraft operating under VFR also should be subject to the requirement of a minimum 3° glide angle below 3,000 feet AGL.

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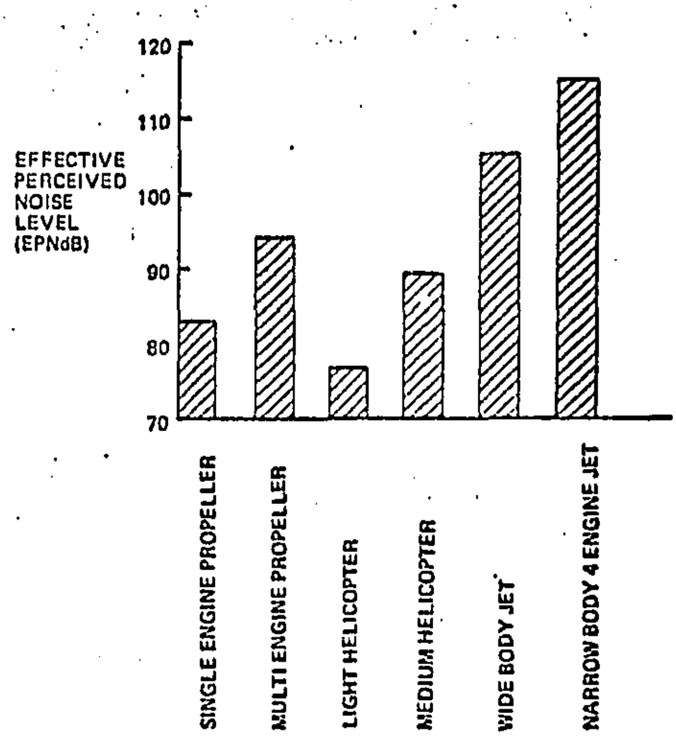

Figure 1. Typical Noise Levels at 1000 feet, Maximum Continuous Power

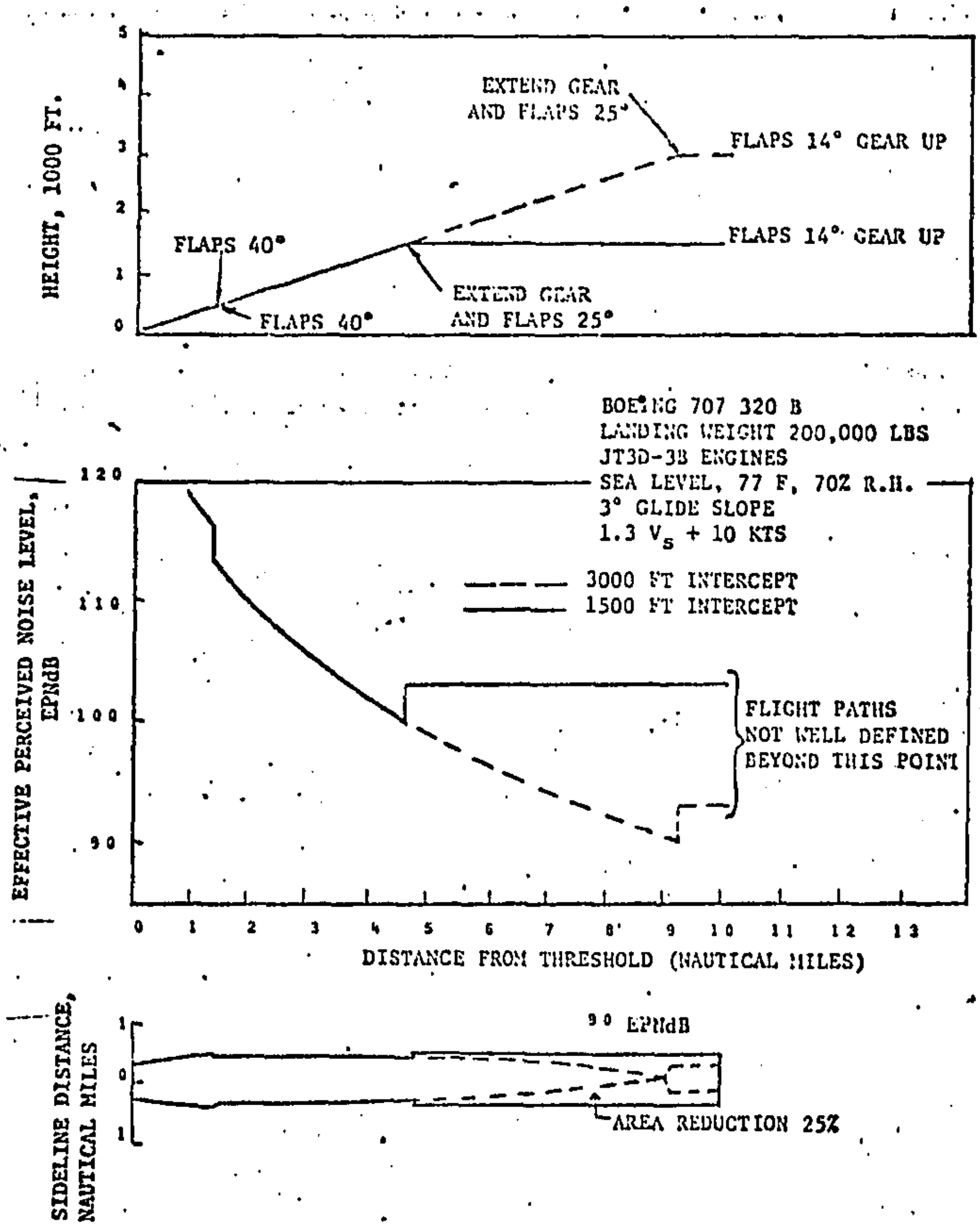

FIGURE 2. NOISE DATA FOR 1500 AND 3000 FT INTERCEPT ALTITUDES

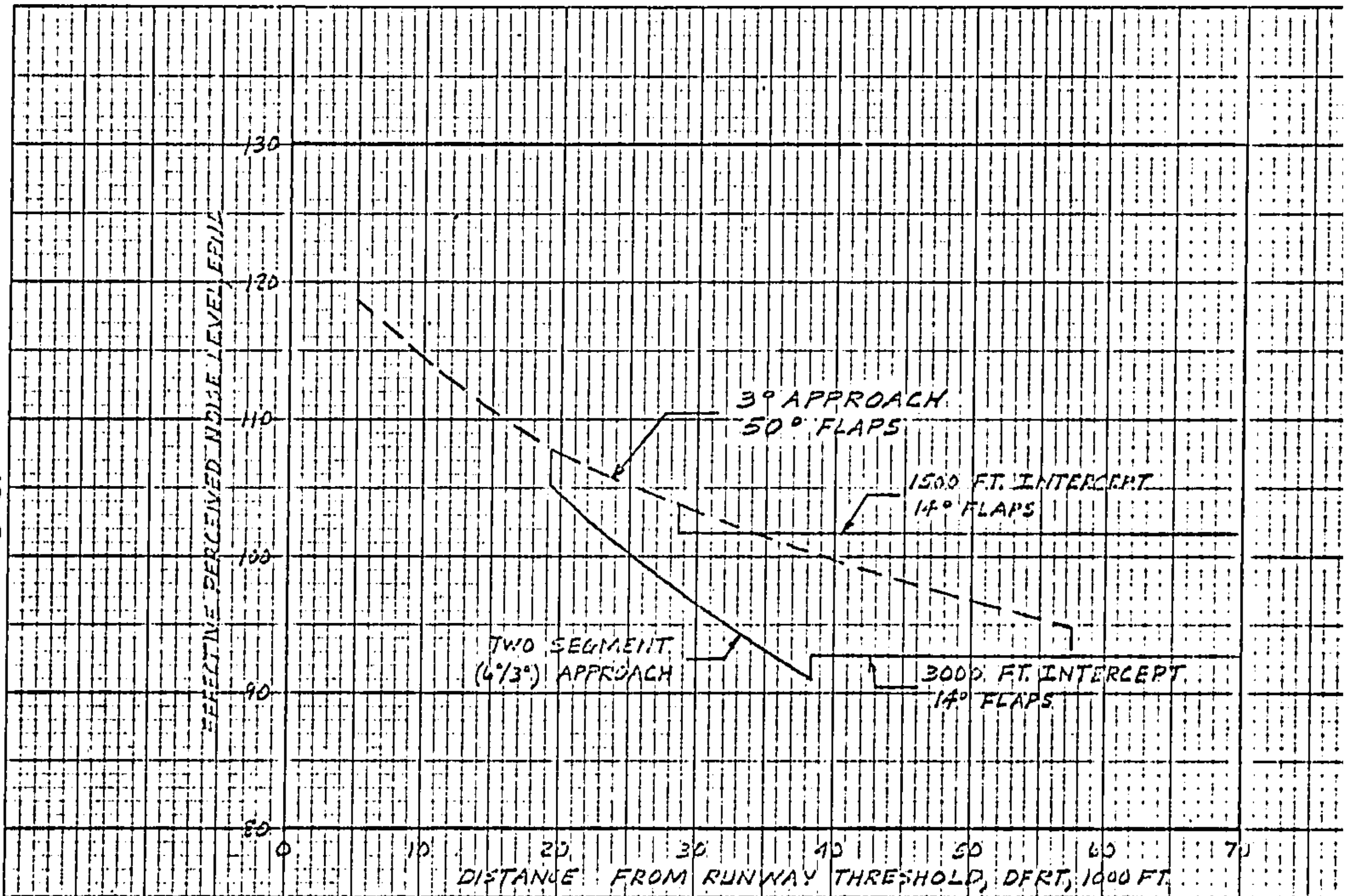

FIGURE 3. NOISE PROFILES FOR VARIOUS APPROACHES : 707 AIRPLANE.

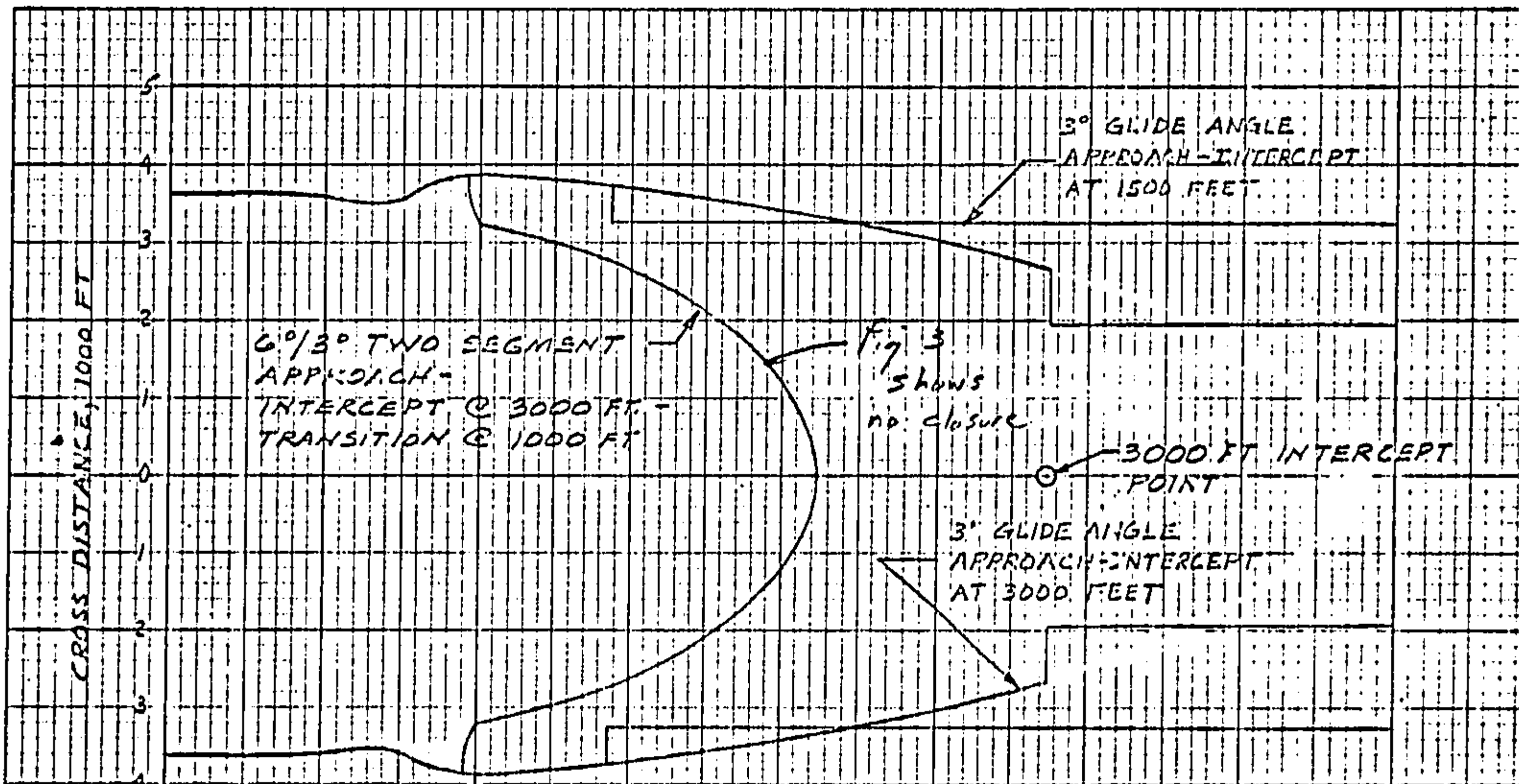

FIGURE 4. 90 EPNdB CONTOURS FOR VARIOUS APPROACHES : 707 AIRPLANE.

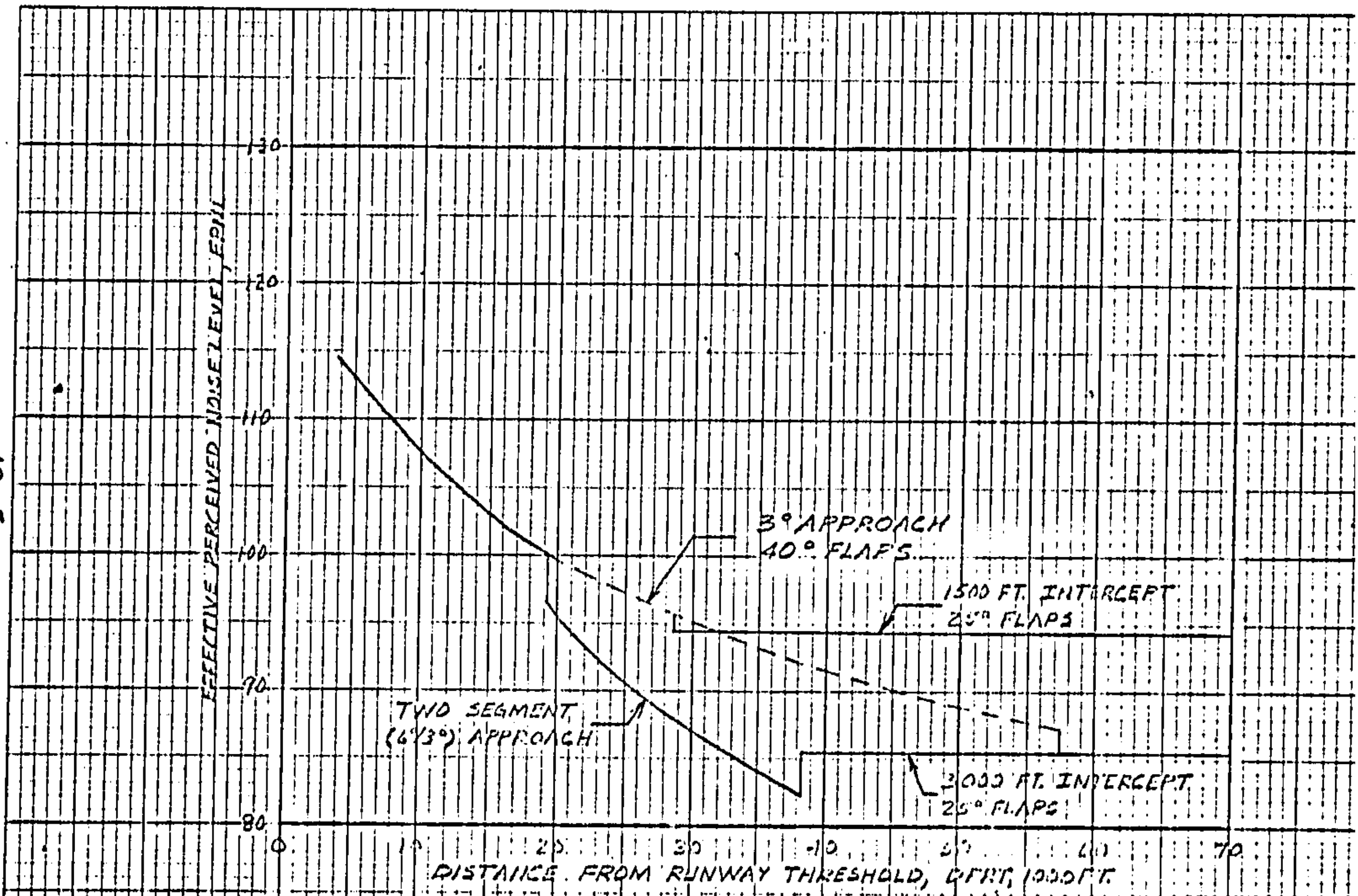

FIGURE 5. NOISE PROFILES FOR VARIOUS APPROACHES: 727 AIRPLANE.

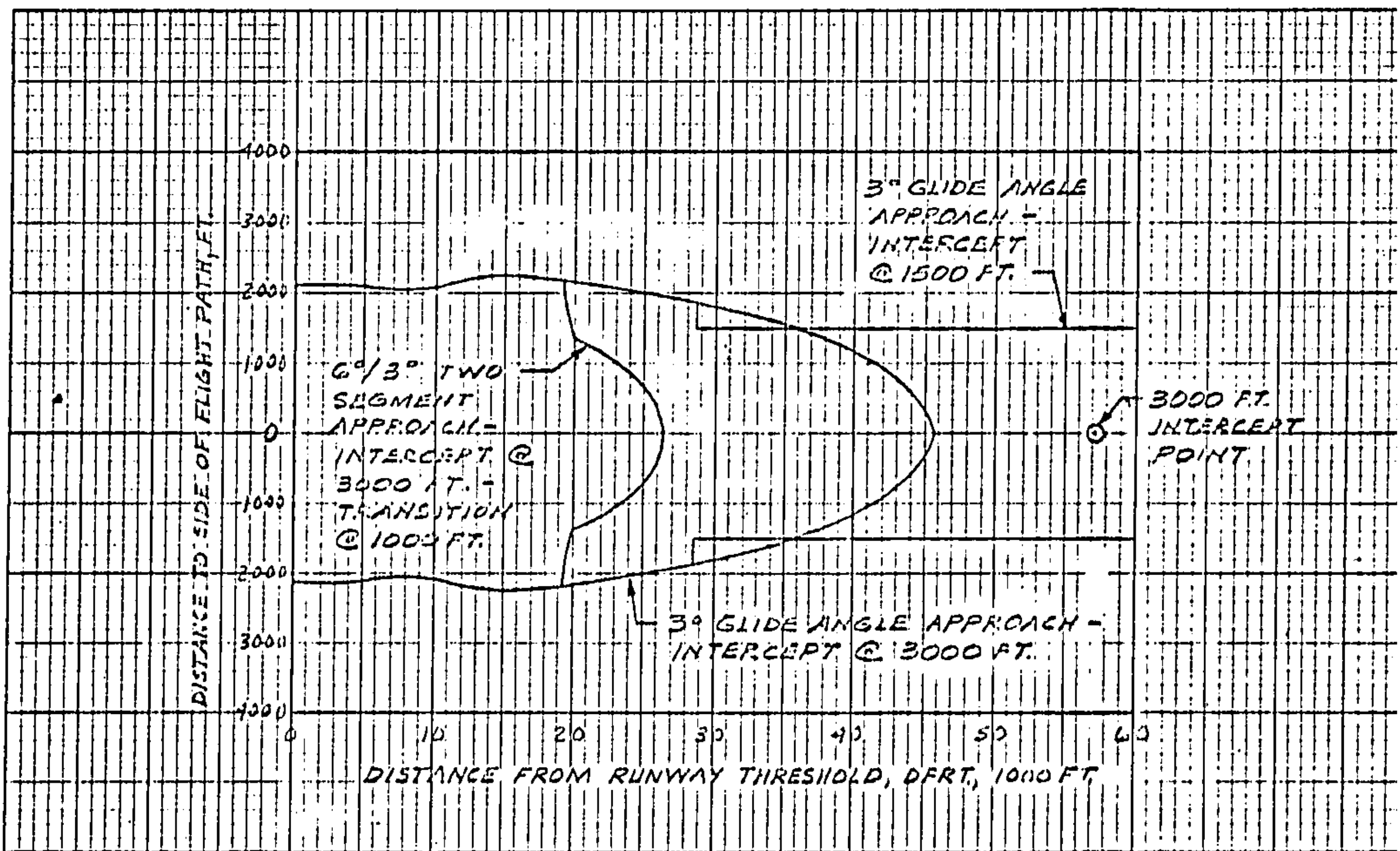

FIGURE 6. 90 EPNdB CONTOURS FOR VARIOUS APPROACHES: 727 AIRPLANE

RULE DESIGNATION	FAR ¶ 91.79	FAR ¶ 91.87	AC 90-59	AC 91-36	EPA PROPOSAL
AFFECTED AREA/LOCATION	(a) CONGESTED AREAS (b) ELSEWHERE	AIRPORT TERMINAL AREAS	AIRPORT TERMINAL AREAS	NOISE-SENSITIVE AREAS	AIRPORT TERMINAL AREAS
AFFECTED AIRCRAFT	FIXED AND ROTARY-WING AIRCRAFT	TURBINE-POWERED OR LARGE AIRPLANES	TURBOJET AND LARGE TURBOPROP	FIXED AND ROTARY-WING AIRCRAFT	TURBOJET AIRPLANES
MINIMUM ALTITUDE	(a) 1000 FT ABOVE HIGHEST OBSTACLE WITHIN 2000 FT (b) 500 FT ABOVE SURFACE OR OBSTACLE	1500 FT	• 10,000 FT AS LONG AS POSSIBLE • BELOW 5000 FT ON ENTERING DESCENT AREA	2000 FT ABOVE SURFACE	• ENTER AT 10,000 FT AGL. • DESCEND BELOW 5000 FT AFTER ENTERING DESCENT AREA. • INTERCEPT GLIDESLOPE AT 3000 FT.
MINIMUM ENDS	WHEN DESCENDING TO LAND	WHEN DESCENDING TO LAND	WHEN DESCENDING TO LAND	WHEN DESCENDING TO LAND	WHEN DESCENDING TO LAND

TABLE 1. SUMMARY OF REGULATORY AND ADVISORY MINIMUM ALTITUDE PROVISIONS.

AIRPLANE TYPE	ENGINE THRUST FN LB	FAN N1 RPM	NOISE LEVEL ON FLIGHT TRACK EPNL, EPNdB			DIFFERENCE IN NOISE LEVEL ΔEPNL, dB		
			HEIGHT 1500 FT	HEIGHT 3000 FT	HEIGHT 5000 FT	3000 FT VS 1500 FT	5000 FT VS 3000 FT	5000 FT VS 1500 FT
707/DC-8	6000	--	103.0	95.0	86.5	8.0	8.5	16.5
707/DC-8, QN	6000	--	92.8	86.6	80.1	6.2	6.5	12.7
727	6000	--	95.3	86.7	80.5	8.6	6.2	14.8
737/DC-9	6000	--	93.3	84.7	78.5	8.6	6.2	14.8
747-100A	--	2400	101.5	94.6	86.9	7.1	7.7	14.6
747-100D	--	2400	94.7	88.0	81.9	6.7	6.1	12.8
DC-10-10	--	2600	93.6	87.1	81.4	6.5	5.7	12.2
DC-10-40	--	2400	92.5	86.1	80.4	6.4	5.7	12.1

TABLE 2. APPROACH NOISE FOR VARIOUS JET TRANSPORTS IN HORIZONTAL FLIGHT AT SEVERAL HEIGHTS.

APPENDIX A

EXCERPTS FROM RELEVANT FAA REGULATIONS AND ADVISORY CIRCULARS

FAR PART 91.79. MINIMUM SAFE ALTITUDES - GENERAL.

Except when necessary for takeoff or landing, no person may operate an aircraft below the following altitudes:

(a) Anywhere. An altitude allowing, if a power unit fails, an emergency landing without undue hazard to persons or property on the surface.

(b) Over congested areas. Over any congested area of a city, town, or settlement, or over an open air assembly of persons, an altitude of 1000 ft. above the highest obstacle within a horizontal radius of 2000 feet of the aircraft.

(c) Over other than congested areas. An altitude of 500 feet above the surface, except over open water or sparsely populated areas. In that case, the aircraft may not be operated closer than 500 feet to any person, vessel, vehicle or structure.

(d) Helicopters. Helicopters may be operated at less than the minimums prescribed in paragraph (b) or (c) of this section if the operation is conducted without hazard to persons or property on the surface. In addition each person operating a helicopter shall comply with route or altitudes specifically prescribed for helicopters by the Administrator.

FAR PART 91.87. OPERATION AT AIRPORTS WITH OPERATING CONTROL TOWERS. (excerpts)

(a) General. Unless otherwise authorized or required by ATC, each person operating an aircraft to, from, or on an airport with an operating control tower shall comply with the applicable provisions of this section.

(d) Minimum altitudes. When operating to an airport with an operating control tower, each pilot of -

(1) A Turbine-powered airplane or a large airplane shall, unless otherwise required by the applicable distance from cloud criteria, enter the airport traffic area at an altitude of at least 1500 feet above the surface of the airport and maintain at least 1500 feet within the airport traffic area, including the traffic pattern, until further descent is required for a safe landing;

(f) Departure. No persons may operate an aircraft taking off from an airport with an operating control tower except in compliance with the following:

(1) Each pilot shall comply with any departure procedures established for that airport by the FAA.

(2) Unless otherwise required by the departure procedure or the applicable distance from clouds criteria, each pilot of a turbine-powered airplane and each pilot of a large airplane shall climb to an altitude of 1500 ft. above the surface as rapidly as practicable.

(g) Noise abatement runway system. When landing or taking off from an airport with an operating control tower, and for which a formal runway use program has been established by the FAA, each pilot of a turbine-powered airplane and each pilot of a large airplane, assigned a noise abatement runway by ATC, shall use that runway. However, each pilot has final authority and responsibility for the safe operation of his airplane and if he determines in the interest of safety that another runway should be used, ATC will assign that runway (air traffic and other conditions permitting).

FAA ADVISORY CIRCULAR 91-36. VFR FLIGHT NEAR NOISE-SENSITIVE AREAS.

1. PURPOSE. To encourage pilots making VFR flights near noise-sensitive areas to fly at altitudes higher than the minimum permitted by regulation and on flight paths which will reduce aircraft noise in such areas.

2. BACKGROUND.

   a. Increased emphasis on improving the quality of our environment required renewed effort to provide relief and protection from aircraft noise.

   b. Excessive aircraft noise can result in discomfort, inconvenience, or interference with the use and enjoyment of property, and can adversely affect wildlife. It is particularly undesirable near schools, nursing homes, hospitals, recreation areas, wildlife areas, etc.

   c. Application of the flight procedures described below would be a practical indication of pilot concern for environmental improvement and would tend to build public support for aviation.

3. PROCEDURE.

   a. Pilots operating fixed and rotary-wing aircraft under VFR over outdoor assemblies of persons, recreational and park areas, churches, hospitals, schools, wildlife areas, and other such noise-sensitive areas should make every effort to fly not less than 2,000 feet above the surface, weather permitting, even though flight at a lower level may be consistent with the provisions of FAR Part 91.79, Minimum safe altitudes: general.

   b. Avoidance of noise-sensitive areas, if practical, is preferable to over-flight at relatively low altitudes.

   c. During departure or arrival from/to an airport, climb after takeoff and descent for landing should be made so as to avoid prolonged flight at low altitude near such areas.

   d. This procedure does not apply where it would conflict with ATC clearances or instructions or where, in the pilot's judgement, an altitude of less than 2,000 feet is necessary in order for him to adequately exercise his duty to see and avoid other aircraft.

4. <u>COOPERATIVE ACTIONS</u>. Aircraft operators, user associations, airport managers and others are asked to assist in implementing the procedures contained herein by publicizing them and distributing information regarding known noise-sensitive areas.

FAA ADVISORY CIRCULAR 90-59. ARRIVAL AND DEPARTURE HANDLING OF HIGH-PERFORMANCE AIRCRAFT.

1. PURPOSE. This Advisory Circular describes ATC handling of high performance aircraft in terminal areas. It is designed to familiarize pilots with the "keep-'em-high" procedures so that total effectiveness of the program may be realized.

2. RELATED DOCUMENTS.

   a. Airman's Information Manual, Parts I and IV.

   b. FAA Order 7110.22A, Arrival and Departure Handling of High Performance Aircraft.

3. DISCUSSION.

   a. The FAA Near Midair Collision Report of 1968 revealed that a high percentage of terminal near midair collisions occur below 8,000 ft. within 30 miles of an airport with a control tower. The most critical area of this airspace is at the lower altitudes which are extensively used by controlled and uncontrolled aircraft. In an effort to reduce the number of incidents of this nature, the FAA developed a program which is designed to minimize exposure of controlled arriving and departing high performance aircraft in the terminal area. It is commonly referred to as the "Keep-'em-High" program. The procedures have been in effect for about one year and they have proven to be an effective noise abatement program in addition to reducing the time that high performance aircraft are exposed to uncontrolled aircraft at lower altitudes.

   b. The keep-'em-high program requires terminal airspace be configured so that high performance aircraft enter the terminal area at 10,000 feet and remain at that altitude as long as possible before beginning descent to 5,000 feet above airport elevation. Descent below the 5,000 foot altitude begins when the arrival enters the descent area established for the landing direction. Departing aircraft are climbed to the highest altitude filed by the pilot as soon as possible after takeoff. In keeping with this program, controllers will not initiate clearances to arriving and departing high performance aircraft which will place them at lower altitudes commonly used by uncontrolled aircraft. Routine pilot requests for altitudes below 5,000 feet above airport elevation will not be honored until the aircraft has entered the descent area established for the landing runway. At non-radar approach control facilities exceptions are made to provide the controller flexibility in accommodating lower altitude requests within specific parameters.

c. To assist VFR pilots, FAA facility chiefs will normally issue Facility Bulletins explaining the program and describing local procedures. It will be accompained by a graphic notice depicting descent areas and normal arrival and departure routes. These charts are designed to help VFR pilots to identify areas and routes that are normally used by high performance aircraft. Avoiding these areas will result in a higher degree of safety in the terminal area.

4. APPLICABILITY. As used in this program, high performance aircraft means turbojets and large turboprops that file IFR at 5,000 feet AGL or above. In most cases the formal facility bulletin will be issued. At the lower density locations the keep-'em-high procedures will be applied by controllers without a formal advertising program. Since these procedures are designed for safety enhancement and noise relief for airport neighbors, they will be applied at all times by air traffic controllers except when different altitudes are necessary due to unusual circumstances, e.g., turbulent conditions, thunderstorm activity, local noise abatement requirements, aircraft emergencies, etc.

5. MISCELLANEOUS. The FAA believes this program enhances safety and affords significant noise relief to our airport neighbors. Pilots of high performance aircraft, when flying IFR, are urged to cooperate with Air Traffic Control. When pilots of these particular aircraft are flying VFR they are encouraged to abide by the keep-'em-high philosophy, i.e., remain as high as possible as long as possible. Pilots of other VFR aircraft are urged to avoid, to the extent possible, the routes and descent areas most frequently used by high performance aircraft in the terminal area. When these areas must be traversed, extreme vigilance should be exercised by VFR pilots. Although controllers will abide by the established keep-'emhigh procedures most of the time, there are times, as mentioned earlier, when deviations will be required.

APPENDIX B

SUMMARY OF REVIEW OF COMMENTS RECEIVED ON SECOND DRAFT REPORT.

Approximately 250 copies of Draft No. 1 of this project report were distributed to persons and organizations evincing interest in or concern with the work of EPA on abatement and control of aircraft noise.

Some 17 responses were received, submitting comments on the draft report. The summary matrix on page B-2 lists the commentators by category and indicates the key issues tto which their comments were addressed. The detailed discussion beginning on page B-3 briefly describes each of the key issues and indicates the responses to each as manifested in this third draft of the project report.

12 Nov

APPENDIX B

REVIEW OF COMMENTS RECEIVED ON SECOND DRAFT OF REPORT

1. SUMMARY MATRIX - MAJOR ISSUES

COMMENTATOR CATEGORY	MAJOR ISSUES ADDRESSED								
	A	B	C	D	E	F	G	H	I
1. AIRCRAFT OPERATORS	--	No	--	No	--	No	--	No	--
2. AIRPORT OPERATORS	--	--	--	--	--	--	--	--	X
3. ENVIRONMENTAL GROUPS	--	--	--	--	--	--	--	--	--
4. FEDERAL GOVT:DOT/FAA/NASA	--	--	--	--	--	--	--	--	--
5. FEDERAL GOVT: EPA	No	--	--	No	--	--	--	--	X
6. FEDERAL GOVT: MISC.	--	--	--	--	--	No	No	--	X
7. FOREIGN GOVTS	--	--	--	--	--	--	--	--	--
8. MANUFACTURERS.	--	--	--	--	--	--	--	--	--
9. MISCELLANEOUS	--	--	--	--	--	--	--	--	X
10. PROFESSIONAL/TRADE GROUPS	--	No	--	--	--	No	--	No	X
11. STATE & LOCAL GOVT	--	--	--	--	--	--	--	--	--

ISSUES:

A. Health and Welfare: Does regulation protect health and welfare? (Does report substantiate?)
B. Safety: Is regulation consistent with maximum safety?
C. Technology: Is regulation technologically practicable?
D. Economics: Is regulation economically reasonable? (Does report address issue adequately?)
E. Appropriateness: Is regulation appropriate to the type of aircraft affected?
F. Necessity: Is regulation needed? (Does report justify the necessity?)
G. Energy: Does regulation offset energy usage conservatively? (Does report discuss adequately?)
H. Is the airport noise regulation as proposed a suitable component of the regulation package?
I. Miscellaneous

2. DETAILED DISCUSSION OF COMMENTS RECEIVED

A. HEALTH AND WELFARE

Issue: Is the proposed regulation adequately protective of the public health and welfare? Does the project report demonstrate that it is?

Comment:

One commentator suggested that inadequate data had been provided to show that the proposed regulation met the foregoing requirement. As pointed out under Section 4B of this report, the textual material on health and welfare has been revised and expanded and a more detailed analysis has been provided, showing the health and welfare benefits of the proposed regulation.

B. SAFETY

Issue: Is the regulation consistent with maximum safety as required by law?

Comment:

Four respondents (two "aircraft operators" and two classed as "professional and trade groups") submitted comments related to safety. They indicated that the requirement to maintain an altitude of 5,000 feet in the vicinity of the airport implied the need for a high rate of descent sometime during the approach to the final glideslope. They objected to incorporating a requirement for such a high rate of descent in a regulation, particularly in the absence of adequate external and airborne equipment to allow precise navigation in a descent path.

This point appears to have some validity, but it is inconsistent with the position that there is no problem with lack of compliance with AC 90-59, basically held by the same categories of commentators.

This subject was discussed with EPA's consultant on airplane operation and safety, who asserted that rates of descent such as those required by the regulation and by AC 90-59, which is now in effect, are not unsafe when they take place above 2,000 feet AGL, and they are used regularly by airplanes complying with that advisory circular.

C. TECHNOLOGY

Issue: Is the regulation technologically practical?

Comment:

No comments were received on this issue, indicating no disagreement with the technological practicability.

D. ECONOMICS

Issue: Is the regulation economically reasonable? Does the report address the question adequately?

Comment:

Three commentators criticized the economic analysis as being inadequate, i.e., lacking in corroborative detail or thoroughness of analysis.

In partial response, it should be pointed out that details of costs relevant to the subject at hand are difficult to come by as data is not readily available on the additional airplane distance flown to comply with the proposed rule. Additional information has been presented regarding the estimated effectiveness of the proposed procedure in reducing noise-impacted population compared to other noise control options, and this should shed some additional light on the estimated benefits to be obtained.

E. APPROPRIATENESS

Issue: Is the proposed regulation appropriate to the type of aircraft affected?

Comment:

No comments were received on this issue, indicating no disagreement about appropriateness of the proposed regulation.

F. NECESSITY

Issue: Is the regulation really needed, and does the project report justify the necessity?

Comment;

Four commentators (including two trade organizations) suggested that the draft report provided no adequate justification for creating a new regulation; no evidence was presented to show significant non-compliance with Advisory Circular 90-59. One pointed out in addition that FAA Order 7110.22B implements the Advisory Circular, the implication being that the existence of such an order has essentially the effect of a regulation.

As regards the question of data on compliance with AC 90-59, such data has been sought, but does not seem to be available. It should be pointed out, however, that the proposed regulation does more than simply make AC 90-59 into a rule. In addition, it adds the requirement for affected airplanes to maintain a rate of descent equivalent to the approach glideslope below 3,000 feet. This feature, indeed, is the only part of the rule for which the public health and welfare benefit can be quantified, as discussed in the report.

In related comments, three commentators suggested that it was irrelevant to present Figure 1, which showed comparative perceived noise levels on the ground for various airplanes flying at 1,000-foot altitude on maximum continuous power. The point is that no airplane is even flown in level flight at 1,000 feet at that power setting, and consequently it is not pertinent to compare airplanes under this condition.

While accepting the factual basis of that assertion, the report nevertheless continues to display that figure, for the simple reason that it provides a convenient basis for comparing the noise-polluting potential of the various airplanes. All airplanes operate in a variety of modes, over a wide range of power settings: comparing noises at a specified distance and power setting seems to be as reasonable a basis as any to use for the intended purpose.

G. ENERGY

Issue: Does the proposed regulation affect energy usage in a conservative manner - that is, either reduce, or at least not cause an undesirable increase in, energy usage requirements?

Comment:

One commentator suggested the need for additional discussion of energy considerations.

Although there has been a slight expansion of the comments on energy effects, the available data on near-terminal flight paths is inadequate to provide reliable information on present fuel usage and probable effects of the proposed regulation on such usage. Consequently, further expansion of the discussion on energy seems unwarranted.

II. AIRPORT NOISE REGULATION

Issue: Is the airport noise regulation as implicitly proposed a suitable component of the regulation package?

Comment:

Three commentators (including two in the category of Professional/Trade Groups) expressed opposition to the exercise of any control over aircraft operations by airport management. One aircraft operator asserted that a curfew, for example, would interfere with his ability to meet public carrier obligations.

It appears that the previous draft was not sufficiently clear in delineating the rationale of the proposed control of airplane operators at the airport, as embodied in the concept of the proposed Airport Noise Regulation. The intent is that the airport authorities, in collaborative effort with local governmental authorities and the FAA, determine the best mix of land use control measures and airplane/airport operational restrictions (such as use of preferred runways, airplane operational restrictions, curfews, etc.) to minimize community noise impact due to airplane/airport operations. This mix would be identified in a plan to be prepared by the airport operator in consort with the local governmental authorities. Upon acceptance by the FAA, the plan would then be promoted and enforced by that agency.

In addition, two commentators took issue with the concept that it is necessary to implement all feasible source and path controls before implementing airport control.

It is generally recognized in noise control problems that control at the source is the most effective approach to the problem. Further, by economic doctrine that the burden for removing a disbenefit (in this case noise) be borne by the entity that created the disbenefit, it is reasonable to take all feasible control measures at the source. Consequently, the statement is considered to be satisfactory and reasonable as it stands.

I. MISCELLANEOUS

A number of comments were addressed to relatively minor points of grammar, rhetoric, clarity of presentations, etc. All of the comments were taken into consideration, and minor editorial and similar changes were made to accommodate those that appeared to justify such revision.

It does not appear useful to devote detailed attention to all of the minor comments, as that could serve only to distract attention from the main issues considered. However, a number of interesting sidelights were revealed in the comments, and those are discussed briefly in ensuing paragraphs.

(1) Four commentators indicated that the provision of the proposed rule requiring departing airplanes to climb to 10,000 feet as soon as practical was inconsistent with the projected application of noise abatement takeoff procedures. The intent was that departing airplanes climb to 10,000 feet as soon as possible, consistent with noise abatement takeoff procedures. This latest draft is accompanied by a draft NPRM which eliminates the apparent inconsistency.

(2) One respondent pointed out that AC 90-59 applies only to airports with operating control towers, and that air carriers operate into uncontrolled airports. Partly as a consequence of this fact, the comment continues, attempting to weave AC 90-59 into a regulation is unworkable.

It is true that AC 90-59 applies only to airports with operating control towers, and the implementing order 7110.22B is directed to flight controllers. If indeed as EPA believes, the "keep-'em-high" rule should apply at all air-carrier airports, then incorporation of the rule into a regulation will accomplish that desired expanded application of the rule.

(3) Two commentators objected to the assertion that the FAR 36 noise certification test procedure should represent the upper limit for noise generation propagation. One suggested that this procedure is not obviously the quietest practical one, whereas the other pointed out that the certification flight proceduress were never intended for use in day-to-day operation for noise abatement.

While it is true that the certification procedure was not intended for noise abatement use, the hope implied in the statement seems reasonable - namely, that it would be useful if airplanes were operated in such a manner that the noise on the ground due to their operation never exceeded the certification levels.

(4) Two respondents commented that the use of the "source-path-receiver" analogy is less than helpful in clarifying the relationship amongst the various elements of the aircraft/community noise problem. One of the comments indicated that the definitions of these elements were not consistent with those used in the classical source-path-

receiver analysis e.g., <u>receiver control</u> applying to operational restrictions at an airport.

Although it is admitted that the usage here is not entirely consistent with the more conventional usage, it provides a convenient mode of categorization of the elements of the problem which is considerably more complex than the typical single-source noise problem. As long as the terms and their application are adequately delineated, there should be no confusion as to the meaning.

(5) One commentator suggested that the regulation discussed not be summarized or paraphrased, as the regulations stand by themselves.

There is no argument that the most complete and accurate way to provide information on a regulation is to present it verlation. However, summaries have been provided in the Background section in order to establish a context and a framework for outlining the possible need for additional regulation. The advantage of compressing the basic ideas involved in order to allow a reasonably brief, coherent exposition appears to outweigh the possible disadvantage of lack of completeness or slight inaccuracy in interpretation. More complete data on the regulations is provided in Appendix A.

(6) Two commentators objected to a statement referring to the identified levels in the "Levels Document" (Reference 9)

as "requirements". This is recognized as a valid criticism, and the wording has been changed to eliminate the implication that the Levels Document establishes requirements.

UNITED STATES

ENVIRONMENTAL PROTECTION AGENCY

RECOMMENDED

NOTICE OF PROPOSED RULEMAKING

ON

NOISE ABATEMENT MINIMUM ALTITUDES WITHIN TERMINAL AREAS:

TURBOJET POWERED AIRPLANES

25 NOVEMBER 1974

Department of Transportation

Federal Aviation Administration

[14 CFR Part 91]

[Docket No. ; Notice No. 74-]

Noise Abatement Minimum Altitudes within Terminal Areas:

Turbojet Powered Airplanes.

Notice of Proposed Rule Making

In accordance with a recommendation by the Administrator of the Environmental Protection Agency, the Federal Aviation Administration is considering an amendment to Part 91 of the Federal Aviation Regulations to provide noise relief to communities in the vicinity of airports by prescribing minimum altitudes within terminal areas for turbojet powered airplanes.

Interested persons are invited to participate in the subject rule making process by submitting such written data, views, or arguments as they may desire. Communications should identify the regulatory docket or notice number and be submitted in duplicate to: Federal Aviation Administration, Office of the Chief Counsel, Attention: Rules Docket, AGC-24, 800 Independence Avenue, S.W., Washington, D.C. 20591 and the Environmental Protection Agency, Office of Noise Control Programs, AW-571, Attention: Aviation Rules Docket, 401 M Street, S.E., Washington, D.C., 20460. All communications received on or before will be considered by the Administrator before taking action on the proposed rule. The concepts contained in this notice may be changed in the light of comments received. All comments submitted will be available, both before and after the closing date for comments, in the Rules Docket for examination by interested persons.

In accordance with the provisions of section 7(a) of the Noise Control Act of 1972 (Pub. L. 92-574, 86 Stat. 1234) the Administrator of the Environmental Protection Agency conducted a study of aircraft and airport noise and submitted a report thereon to the Congress. (Report on Aircraft/Airport Noise, Senate Committee on Public Works, Serial No. 93-8, Aug. 1973). Under Section 611 of the Federal Aviation Act, as amended by the Noise Control Act of 1972 (Pub. L. 92-574; 86 Stat. 1234; 49 U.S.C. 1431) the Administrator of the EPA is also required, not earlier than the date of submission of his report to the Congress, 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 the Administrator of the EPA determines is necessary to protect the public health and welfare. This proposed regulation presenting minimum altitudes for terminal areas is the first regulation submitted to the FAA in accordance with the requirements of section 611 as so amended.

In the report submitted to the Congress under section 7(a) of the Noise Control Act, the Administrator of the EPA discussed, among other things, the adequacy of FAA aircraft noise regulations and made a tentative assessment therein of some of the regulatory actions that could effectively control aircraft noise. Based upon a study of the regulatory actions discussed in that report the Administrator of the EPA has determined that an effective program to protect the public health and welfare from aircraft noise requires the implementation of one or more of the following options of regulatory control:

(1) Engineering application of noise control techniques at the source. This control of aircraft noise consists of the application of basic design principles or special hardware to the aircraft engine or airplane, or both, to minimize the generation and radiation of noise.

(2) Noise control by use of flight procedures. This control of aircraft noise consists of flight procedures to minimize the generation and propagation of noise from the aircraft in flight.

(3) Airport operations control. This control of aircraft noise consists of the application of restrictions on the type and use of aircraft at the airport to minimize community noise exposure.

(4) Land use control. This control of community noise due to aircraft consists of developing or modifying airport surroundings for optimally compatible usage in the aircraft noise environment.

The primary approach for aircraft noise abatement is to attempt to control the noise at the source to the extent that an aircraft would be acceptable for operation at any airport as well as during enroute flight. In principle, aircraft noise can be controlled at the source by massive implementation of available technology. In practice, however, technology capability for complete control without exorbitant penalties is not yet available and may never be. Therefore, a regulation providing complete protection to the public health and welfare solely by noise control of the airplane as a source would discourage further development of most new aircraft and might effectively ground the existing civil fleet.

Flight procedures control of an aircraft can also be applied as an effective option for a substantial reduction of aircraft noise. This type of control can be combined with source control to help protect the public health and welfare from aircraft noise. However, complete noise abatement by the control of flight procedures only would relegate transportation by civil aircraft to flights conducted between airports located at, or within, isolated areas. Therefore, such regulations alone are not practicable. Since civil aircraft can be flown in modes that produce a wide range of noise exposure, it appears that those modes that minimize the generation and propagation of noise should be identified and utilized for the protection of the public health and welfare. For example, the EPA believes that the flight procedures used to demonstrate compliance with source control regulations (type certification) should represent the upper limit for noise generation and propagation and utilized whenever practicable.

Control of community noise from aircraft by airport regulation is practicable only if all feasible source and flight procedures controls have been implemented by appropriate regulations. Unless this has been done, the protection of public health and welfare from aircraft noise by means of airport restrictions only may result in unnecessary burdens upon the local and national economy.

After all feasible noise control measures have been exercised by the application of aircraft design, treatment, or modification, by operational control measures such as minimum altitudes and air traffic control procedures, and by airport control such as proper design, location and use of airports, the level of the aircraft noise may still have an adverse effect upon the public health and welfare at some locations. Should that problem occur, it appears that land use control is the only remaining option. However, a land use control option is more easily exercised in the development of land at new airports than as a remedial measure for noise impacted communities at existing airports. Morever, since the costs of land use control at airports would be exorbitant, maximum effort should first be devoted to the practical implementation of the source, flight procedures, and airport control options. The extent to which each of the foregoing control options must be implemented to achieve a satisfactory level of cumulative noise exposure is dependent upon the requirements of the public health and welfare. ("Public Health and Welfare Criteria for Noise", EPA Technical Document 550/9-73-002, 27 July 1973; "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety", EPA Technical Document 550/9-74-004, March 1974. A copy of each document is on file with the FAA in the docket for this Rulemaking action. Copies are for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402).

Although the Administrator of the FAA has adopted regulations for the reduction or abatement of aircraft noise, they have been constrained by reasons of safety, economics, and technology. Under the Noise Control Act of 1972, the Administrator of the EPA is directed to propose for adoption by the FAA those regulations he determines are necessary to protect the public health and welfare, including control and abatement through the exercise of the FAA's regulatory authority.

If it could be established that some particular design change or retrofit hardware for airplanes, or operating rule could completely satisfy the requirements for protection (from airplane noise) to the public health and welfare, then that specific method should be used. It is unlikely, however, that any single measure, within the legislative constraints, could completely satisfy the requirements for such protection. Consequently, a systems implementation, employing each noise control option available within its area of optimal application, should be considered as the most feasible method for accomplishing the desired objectives and equitably sharing the costs of noise control among all segments of the aviation community and that portion of the public that benefits from aviation.

For the information and comment of all interested persons, EPA published in the Federal Register on February 19, 1974, (39 F.R. 6112) a "Notice of Public Comment Period" containing a synopsis of 10 proposed rules it was considering to achieve a satisfactory level of the public health and welfare. Since the FAA has initiated a single rulemaking action covered by two of the proposals, the substance of proposed rules numbered 8 and 9 as published in the Federal Register has been combined into a single proposed rule entitled "Short Haul Aircraft". As combined, the 9 proposed rules and the type of control which each rule would implement are as follows:

Flight procedures noise control.

(1) Take off procedures.

(2) Approach procedures.

(3) Minimum altitudes.

Source noise control.

(4) Retrofit/Fleet noise level.

(5) Supersonic civil aircraft noise.

(6) Modifications to Part 36 of the Federal Aviation Regulations.

(7) Propeller driven small airplanes.

(8) Short haul aircraft.

Airport operations noise control.

(9) Airport goals, mechanisms and processes by which noise exposure of communities around airports can be limited to levels consistent with public health and welfare requirements.

The EPA has decided that regulation No. (3) proposing minimum altitudes for noise abatement within terminal areas should be among the first of the nine proposed regulations submitted to the FAA for consideration and adoption in accordance with the provisions of section

611 of the Federal Aviation Act of 1958, as amended. This proposed rule, based in part on the present "keep-'em-high" program set forth in FAA Advisory Circular 90-59, prescribes noise abatement minimum altitudes for turbojet powered airplanes operated under either IFR or VFR, except when otherwise required by safety or operational requirements such as turbulence, thunderstorms, or aircraft emergencies.

As stated in the advisory circular, the FAA believes that the "keep-'em-high" program enhances safety and affords significant noise relief to the airport neighbors. The EPA agrees that the program is capable of providing a significant noise relief in the vicinity of airports, but believes that it must be made mandatory for all turbojet powered airplanes to achieve its purpose in regard to noise relief.

As proposed herein, the rule would make the following provisions of Advisory Circular 90-59 mandatory for turbojet powered civil airplanes operating within the terminal area of an airport:

(1) Enter the terminal area at 10,000 feet AGL, and remain at that altitude until descent therefrom is required for a safe landing.

(2) Descend below 5,000 feet AGL after entering the descent area established by ATC for the direction of the landing runway.

(3) Descend below 3,000 feet AGL at the rate of descent now prescribed in §91.87(d)(2) and (3) for such airplanes. In the case of an airplane landing under visual flight rules (VFR) on a runway not served by an instrument landing system (ILS) or a visual approach slope indicator (VASI), the proposed regulation would require the rate of

descent to be not less than that associated with a 3° glide angle.

By far the highest noise levels due to the aircraft occur in the vicinity of those airports serving air carrier aircraft. This is due mainly to the landing approach and takeoff noise emissions from turbojet powered airplanes (including turbofan engines) used by those carriers. Consequently, the flight procedures for noise reduction and abatement proposed herein are directed toward the operation of turbojet powered airplanes only.

Since the area comprising a terminal area is dependent upon the facilities and procedures established for the control of air traffic at the airport in which it is located, the rule as proposed authorizes ATC to designate the boundaries of the terminal area to accommodate the flight procedures needed for operations to or from a particular airport.

It is to be noted that the rule as proposed herein does not include a provision similar to that contained in AC 90-59 requiring a departing airplane to climb to the highest altitude filed by the pilot as soon as possible after takeoff. The appropriate provisions for takeoff will be included in a separate rule proposing takeoff procedures and published in the Federal Register in the near future. In the meantime, the climb procedure prescribed in §91.87(f) remains applicable as prescribed in that section.

One of the basic features of this proposed regulation is the requirement that each turbojet powered airplane shall intercept the glideslope at an elevation of 3,000 feet AGL. In the case of a straight-in approach it has been shown that an area exposed to 90 EPNdB or greater can be reduced by at least 25% and the flight track EPNL reduced by up to 9 EPNdB under the flight path if the glide slope intercept altitude is increased to 3,000 feet as shown in the attached Figures 1, 2 and 3. This represents a sizeable initial reduction in the level of environmental noise associated with adverse effects on the public health and welfare in the vicinity of airports.

It is to be noted that a field evaluation of a 3,000 foot glideslope intercept was sponsored by the FAA at Detroit Metropolitan and Tampa International airports during the summer of 1971. (Report No. FAA-AT-72-1, March 1972). The evaluation included three variations of the 3,000 foot glideslope intercept concept, an airport capacity impact study and an economic analysis of the program. The field test results indicated that, at distances greater than nine nautical miles from runway touchdown, significant noise benefits (9 EPNdB projected) can be attained by requiring all aircraft to remain at 3,000 feet AGL until glideslope intercept versus a 1,500 feet AGL intercept.

The report made the following conclusions in regard to the economic impact of each phase of the program on the airport capacity and cost of each flight as a result of requiring an intercept of the glideslope at the increased altitudes:

(1) The greatest impact on annual airport capacity and cost per flight occurred when all aircraft were vectored so as to intercept the glideslope at an altitude of at least 3,000 feet AGL Under Phase A of the program, there was a 2 percent

reduction of the practical annual capacity of the airport and an increase in the direct aircraft operating costs of $8.10 for each flight. (This estimate is based upon the total cost divided by the total number of flights. The cost per aircraft type is provided in the FAA report.)

(2) The foregoing impact was significantly decreased when only turbojet aircraft were vectored to intercept the glideslope at an altitude of 3,000 feet AGL under Phase B of the program. Under this phase, there was an estimated .8 percent reduction of the practical annual capacity and an increase of $8.95 in the operating cost for each flight affected.

(3) The smallest impact occurred under Phase C when "all aircraft" operating under instrument flight rules were required to maintain at least 3,000 feet AGL until five flight path miles from an optimum turnon point. Under that phase, the FAA report estimates a reduction of less than .8 percent in the annual airport capacity and an average increase of $3.13 in the operating cost per flight. (The average operating cost increase, counting only the airplanes which followed that procedure, was $8.55 per flight.)

Since the turbojet airplane is the noise dominating airplane, the EPA has determined that a glide slope interception altitude of 3,000 feet AGL should be made mandatory for those airplanes as soon as possible for the protection of the public health and welfare of those persons living in the vicinity of airports. Moreover, it should be made applicable to those airplanes regardless of whether they are operated under VFR or IFR. Otherwise, the purpose of this requirement could be defeated by cancelling an IFR flight plan and conducting the approach and landing under VFR without regard to the minimum altitude requirements of this proposal.

It is estimated that the application of this requirement to turbojet powered airplanes only would cause the least impact upon airport capacity and cost approximately $10 per flight. It would not, however, require any equipment changes or additional investment.

As proposed, the rule would also make it mandatory for turbojet powered airplanes to be operated at minimum altitudes consistent with those now applied on a voluntary basis under FAA Advisory Circular 90-59. Accordingly, turbojet powered airplanes would be required to enter the terminal area at an altitude of 10,000 feet AGL, and remain at that altitude as long as possible before beginning a descent to an altitude of 5,000 feet AGL. Descent below an altitude of 5,000 feet would begin when the airplane enters the descent area established by ATC for the landing direction of the runway to be used. As previously discussed herein the airplane must then be operated so that the glideslope is intercepted at an altitude of 3,000 feet AGL which it is to be noted, is not required under AC 90-59.

Finally, it is to be noted that, as proposed, the rule excepts an airplane from the prescribed altitude requirements for operational reasons such as turbulence, thunderstorm activity and aircraft emergencies, as are now permitted under AC 90-59. An exception is also permitted when required by the applicable distance from cloud criteria consistent with the exception permitted under §91.87(d)(1) for operation within an airport traffic area.

Implementing the glide slope intercept altitude as proposed herein with the minimum altitudes required under AC 90-59 would reduce the population noise exposure by as much as 9 EPNdB under the flight path of a turbojet powered airplane within a distance of 5 to 10 nautical miles from an airport's runway approach threshold. The EPA believes that such a reduction in population noise exposure by the flight procedure controls proposed herein is necessary for the protection of the public health and welfare of those communities in the vicinity of an airport and has submitted this proposed rule to the FAA for adoption under section 611 of the Federal Aviation Act of 1958, as amended.

In consideration of the foregoing, it is proposed to amend §91.87 of the Federal Aviation Regulations as follows:

1. By adding a new sentence at the end of paragraph (a) to read as follows:

   ...As used in this section a terminal area means that airspace within the horizontal radius of an airport designated by ATC for the control of aircraft operating to or from that airport.

2. By amending paragraph (d) by redesignating subparagraphs (1), (2), and (3), as subparagraphs (2), (3), and (4), respectively, and by inserting a new subparagraph (1) reading as follows:

(d) Minimum altitudes. * * * *

(1) A civil turbojet powered airplane approaching an airport for a landing shall, unless different altitudes are required by distance from cloud criteria, turbulence, thunderstorms, or aircraft emergency, (i) enter the terminal area of that airport at an altitude of 10,000 feet AGL and remain at that altitude until further descent is required for a safe landing, (ii) descend below an altitude of 5,000 feet AGL after entering the descent area established by ATC for the direction of the landing runway, (iii) maintain an altitude of not less than 3,000 feet AGL until intercepting the glide-slope, (iv) descend below an altitude of 3,000 feet AGL at the rate of descent prescribed in paragraphs (d)(3) or (d)(4) of this section for the type of landing facility used, except that the rate of descent shall not be less than 3 degrees. for operation under VFR when a runway not served by an ILS or a VASI is used.

3. By changing the words "turbine-powered airplane or a large airplane" appearing in the redesignated subparagraph (d)(2) to read as follows: "turbopropeller powered airplane or large reciprocating engine powered airplane".

This notice of proposed rulemaking is issued under the authority of Sections 313(a), 601, 603, 604, and 611, Federal Aviation Act of 1958 (49 U.S.C. 1354(a), 1421, 1423, 1424, and 1431) as amended by the Noise Control Act of 1972 (P.L. 92-574); Section 6(c), Department of Transportation Act (42 U.S.C. 1655(c)); Title I, National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.); Executive Order 11514, March 5, 1970.

Issued in Washington, D. C. on ________________, 1974.

____
Administrator

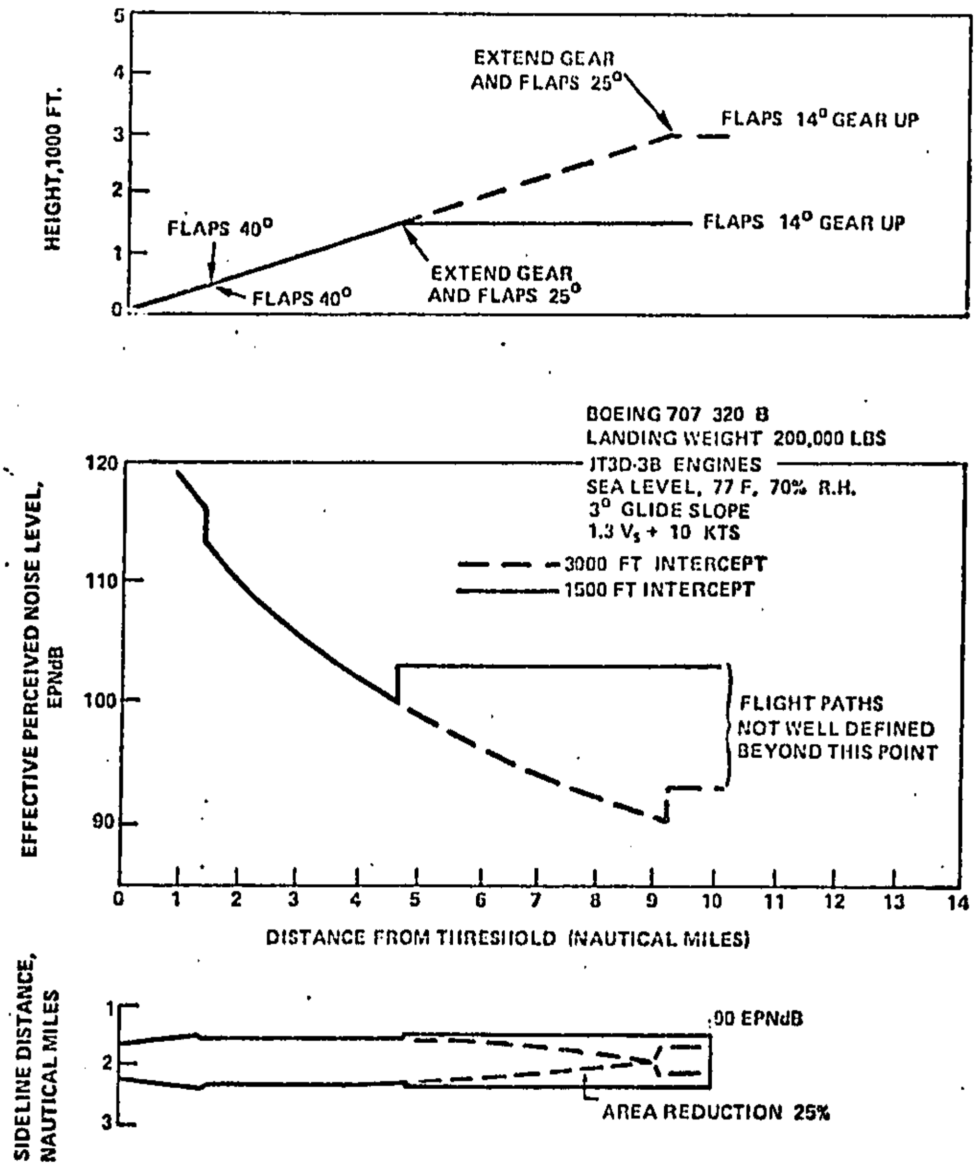

FIGURE 1. NOISE DATA FOR 1500 AND 3000 FT INTERCEPT ALTITUDES

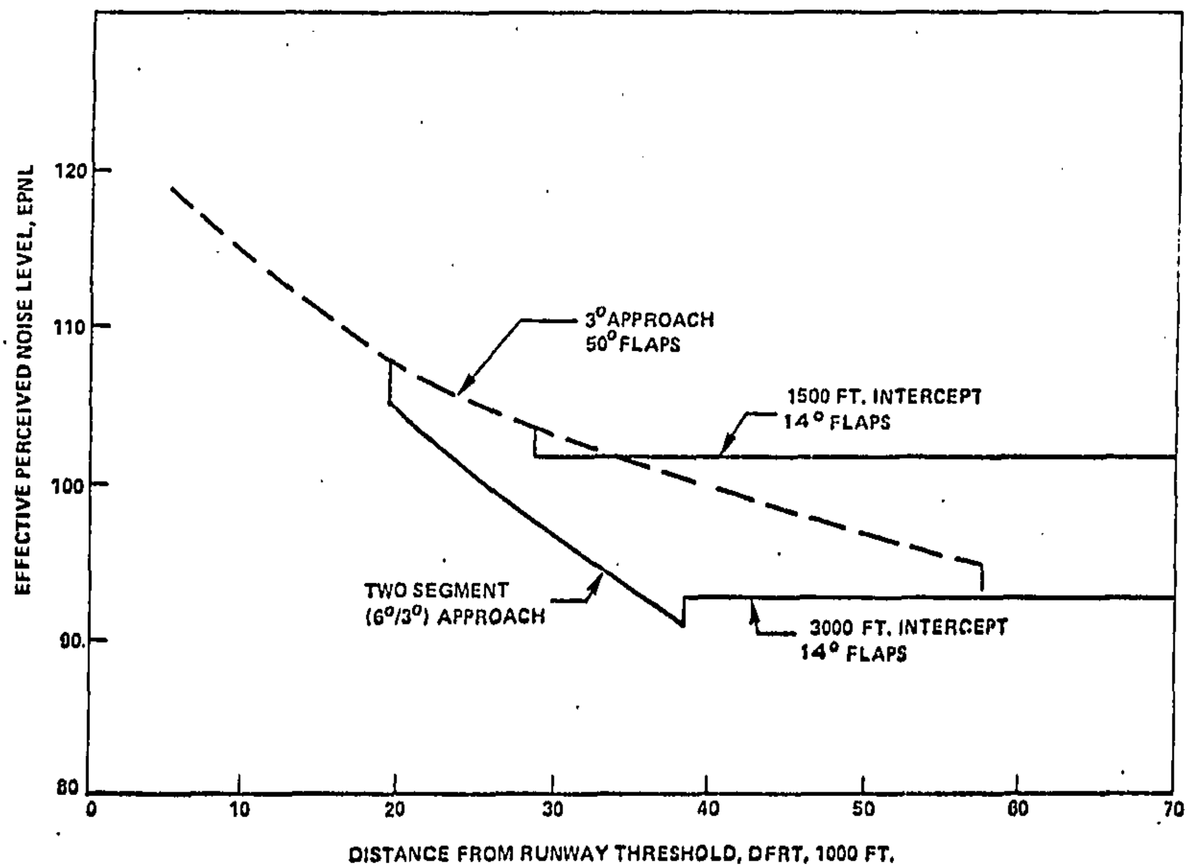

FIGURE 2. NOISE PROFILES FOR VARIOUS APPROACHES: 707 AIRPLANE

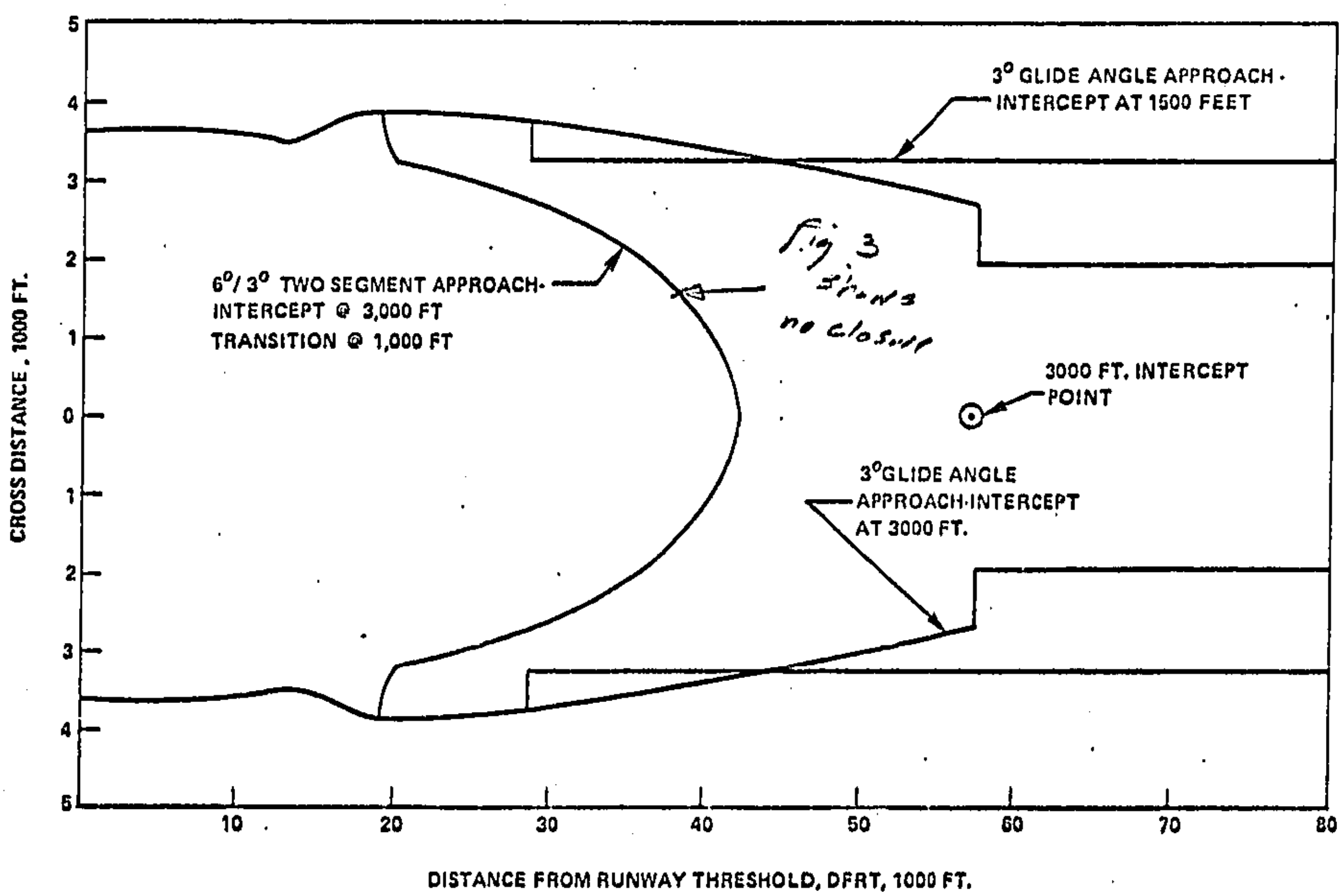

FIGURE 3. 90 EPNdB CONTOURS FOR VARIOUS APPROACHES: 707 AIRPLANE