ALPA
NOISE
ABATEMENT
HANDBOOK
ALPA NOISE ABATEMENT HANDBOOK

ALPA NOISE ABATEMENT COMMITTEE

Captain Richard Deeds, Chairman
Captain Sid Cook
Al Kurtzahn
Paul McCarthy
Captain Jim McLaughlin
Captain Roger Milsen
Bob Reich, Staff Contributor
Harold Olson, Staff Coordinator

Air Line Pilots Association
Engineering and Air Safety Department
535 Herndon Parkway
Herndon, VA 22070
### Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction</td>
<td>1-1</td>
</tr>
<tr>
<td>2</td>
<td>ALPA Positions Policies and Directives</td>
<td>2-1</td>
</tr>
<tr>
<td>3</td>
<td>Aviation Safety and Noise Abatement Act of 1979</td>
<td>3-1</td>
</tr>
<tr>
<td></td>
<td>A. Part 36</td>
<td>3-3</td>
</tr>
<tr>
<td></td>
<td>B. Part 130</td>
<td>3-33</td>
</tr>
<tr>
<td></td>
<td>C. Legal Background</td>
<td>3-43</td>
</tr>
<tr>
<td>4</td>
<td>Operational Considerations of Noise Abatement</td>
<td>4-1</td>
</tr>
<tr>
<td>5</td>
<td>Background of Integrated Noise Model (INM)</td>
<td>5-1</td>
</tr>
<tr>
<td>6</td>
<td>Glossary of Noise Abatement Terms</td>
<td>6-1</td>
</tr>
<tr>
<td>7</td>
<td>Part 130 Study Checklist</td>
<td>7-1</td>
</tr>
<tr>
<td>8</td>
<td>Appendices</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. DOT Aviation Noise Abatement Policy</td>
<td>8-1</td>
</tr>
<tr>
<td></td>
<td>B. FAA Order 8400.9 &quot;Operational Criteria for Runway Use Programs&quot;</td>
<td>8-67</td>
</tr>
<tr>
<td></td>
<td>C. Part 91, Subpart E</td>
<td>8-76</td>
</tr>
<tr>
<td></td>
<td>D. AC 91.53, Noise Abatement Departure Profile</td>
<td>8-83</td>
</tr>
<tr>
<td></td>
<td>E. AC 150/5020.1 Noise Control and Compatibility Planning for Airports</td>
<td>8-91</td>
</tr>
<tr>
<td></td>
<td>F. Noise Abatement Committee Members and Addresses</td>
<td>8-156</td>
</tr>
</tbody>
</table>

**FIRST EDITION - 1985**
SECTION 1

INTRODUCTION
INTRODUCTION

The advent of turbo jet-powered aircraft has been a stimulant to the commercial airline industry making air travel faster, smoother and easier. This expansion has not come without distractions such as an increase in noise levels at airports around the world. Airport neighbors have protested about this unwanted intruder and over the years some improvement has been accomplished. With the advent of deregulation much of the improvement has vanished and in some cases the impact has worsened. While noise-impacted residents are becoming more vocal and influential, there seems to be little left that can be done by ALPA to substantially lessen the impact. The communities, the airline companies, the airport operators, and the Federal Government, through the FAA and Congress, have all wrestled with this never-ending problem for years. We, as pilots, find ourselves caught in the middle of an ongoing dispute. Because of increased pressures from outside forces, communities, companies, FAA and etc., we find that we are being asked to do more and more to alleviate aircraft noise in various ways. It is our desire to be as helpful as possible while at the same time defending steadfastly any compromise in air safety.

ALPA was founded on, and still bases it's actions and beliefs on air safety. It is on this theme that the ALPA Noise Abatement Committee has worked. We believe that aircraft noise reduction should be accomplished by aircraft engineering and design, not by marginally safe and questionably effective flight techniques. We also believe that in most cases any noise relief that can be attained is by "fine tuning" existing procedures, and is probably minimal at best.

The purpose of this handbook is to acquaint the user, be he airline pilot, airport manager, or private concerned citizen, with the Air Line Pilots Association (ALPA) policies and positions on aircraft noise abatement. These ALPA policies, statements and positions have been developed with long and careful consideration to various factors. These factors include the broad mix of aircraft, engines and pilot qualifications, diverse route structures and segments, differing airport layout, capabilities and capacities, the constraints of air traffic control and airspace restrictions, varying terrain factors, and finally, the concern for the need for effective, standardized and safe procedures.

Since some of the contents included here are ALPA policy while others may be ALPA positions, directives or technical committee positions, and since these statements and policies may change with time, care must be exercised in the use of such material. As an explanation, the definitions of ALPA policy, position, directives etc., are included in Section 2 and will be so identified in the text. This handbook is intended as a guide in addressing aircraft noise related matters, and is not a hard and fast position. The user should consult with a member of the ALPA Noise Abatement Committee or other appropriate Air Safety personnel when clarification, or further detailed information on any statement or section of this handbook, is wanted or required.
SECTION 2

ALFA POSITIONS, POLICIES, AND DIRECTIVES
NOISE ABATEMENT COMMITTEE

The Committee's purpose is to study and analyze all airline/aircraft-related noise abatement problems and procedures; to develop safe and standardized operating procedures taking into account the aircraft performance and the human factors involved; and to correlate all procedures with other ALPA Committees, industry and government to achieve compliance with ALPA safety policies.

The following relates to ALPA Policy, Directives, and Positions of interest to the Committee and the positions the Committee has taken on air safety issues.

ALPA POLICY

1. Airport Curfews

ALPA opposes the imposition of curfews at airports where air carriers operate because of the detrimental effect such curfews can have on flight safety. (Board 1982) (See ALPA DIRECTIVES)

2. Noise Abatement Policy

Noise abatement procedures continue to be proposed throughout the country without regard to safety of operation; therefore, the Association maintains that aircraft noise should be reduced by engineering and design and not by marginally safe flying techniques. ALPA shall refuse to endorse or accept Noise Abatement procedures which require:

a. Clearances which include a heading change below 600 feet for noise abatement purposes unless terrain or airspace restrictions dictate that a turn at lower altitude would be more prudent. Departure flight paths which do not comply with the engine-out obstacle clearance requirements of the Federal Aviation Regulations must have published emergency procedures for engine failure which meet those obstacle clearance requirements.

2-2
b. Reduction of power earlier or to a greater extent than
   good operating practice would dictate.

c. Climbs at airspeeds less than maneuvering speeds for
   the existing flap configuration.

d. Use of noise abatement approach procedures when
   weather is below 1,000' - 3 miles.

e. Approaches to be conducted above glide slope for noise
   abatement purposes.

f. Communications other than those required for standard
   traffic separation during takeoff and approach. Pilot
   judgment will remain as the overriding factor in
   determining whether or not noise abatement policy will
   be followed based upon flight conditions incurred.
   (Board 1980)

3. Preferential Runway Noise Abatement Policy

Runways must not be designated as "preferential" for noise
abatement purposes unless they meet the following minimum
safe criteria:

a. Runway surface must be clear and dry.

b. Weather must be basic VFR.

c. Maximum tailwind component must not exceed five knots.

d. Total wind velocity must not exceed fifteen knots.

e. Opposite direction takeoff and landings from single
   and/or parallel runways (head to head) must be
   provided a minimum of eight miles horizontal
   separation.

Should a Captain's authority in such matters be abrogated,
he will receive the full support of AFA in his defense.
   (Board 1980)

4. Safety Aspects of Noise Abatement Takeoff and Landing
   Patterns at Air Carrier Airports

The President will make public proclamation of unsafe
procedures, such as in effect at Los Angeles International
Airport (LAX), through a vigorous public relations
program. He will exercise the full authority of his office
to resolve such problems in conformance with the
Association's "Noise Abatement" and "Preferential Runway"
policies, and through contact with appropriate government
agencies bring about implementation of rule making that
will resolve existing problems and preclude future
repetition. Further, he shall encourage and solicit the support of other labor and management groups to assist, if necessary, in support of this position.

(Ex. Ed., Nov. 1977; Board 1980)

5. Local Noise Procedures

ALPA supports and encourages federal preemption of local airport control of noise standards and procedures and encourages the FAA to develop and adopt federal standards and procedures for local noise control. (Ex. Ed., Nov. 1977; Board 1980)

6. ALPA Standard Takeoff Procedure

a. Takeoff. Normal takeoff thrust used until reaching \( V_{RF} \) (zero flap speed).

b. Initial Climb. Initial climb attitude following rotation is a predetermined pitch attitude which will produce \( V_{c} \) = 10 \( \pm \) 20 IAS (each aircraft type will have its own number calculated by the operator. The two engine types will generally have a higher climb speed).

c. Acceleration. After climbing through 400' but no later than 1000' A.F.L. (unless restricted by obstacles), allow aircraft to accelerate, continuing takeoff thrust until initial flap retraction speed is attained. Retract flaps per schedule.

d. Quiet Climb. After airspeed reaches \( V_{RF} \) (zero flap speed) reduce thrust to the pre-computed quiet power (QEP) which is that required for maintenance of certificated engine out climb gradient. Continue climb with this reduced power until clear of noise sensitive areas. 3000-4000' A.F.L. (above field level) is recommended prior to resuming normal climb power.

e. Normal Climb. After passing noise sensitive areas, apply normal climb thrust. Allow the aircraft to accelerate to normal climb speed (approximate rate of climb during acceleration 500 - 1000 FPM). Proceed on normal departure schedule.

NOTES: The ALPA Engineering and Air Safety Department staff will provide, on request, information and data to assist NEC and air safety representatives in developing the required charts that will provide the takeoff information for each aircraft type, i.e., DC-9-10, DC-10, etc. The information will include pitch attitudes, thrust requirements for each segment of the climb, and airspeeds for each segment.
Each AEC Chairman shall immediately seek the cooperation of
his individual airline management in implementing the ALPA
Takeoff Procedure as an industry-wide standard. Any
additional technical information required in this endeavor
will be supplied by the ALPA Engineering and Air Safety
Department.

(Executive Board, May 1977)

ALPA DIRECTIVES

1. Noise Abatement

ALPA shall initiate the necessary actions to form a
coalition initially composed of ALPA, AOA, and AFA to form
a joint strategy toward the goal of a national noise
abatement policy, regulations and legislation. (Executive
Board, May 1982) (See ALPA POLICY)

2. Airport Curfews

The President shall take appropriate action to oppose
airport curfews. (Board 1982) (See ALPA POLICY)

ALPA POSTIONS - None

COMMITTEE POSTIONS

1. Necessity for Minimum Aircraft Noise Impact on Communities

It is extremely important that pilots cooperate with
efforts to reduce the noise impact of airline operations on
the communities they serve. Noise has become a significant
source of community irritation to the point that a danger
exists of curtailment of or limitations on flight
operations; therefore, any aid the line pilot can offer
would be of benefit. However, each pilot must remember the
need to assure that any noise abatement procedure used does
not require unsafe operation of the aircraft or create a
threat to safety of flight.

2. Available Noise Abatement Techniques

The Committee endorses and encourages community use of
Comprehensive Zoning Ordinances and Land Use Plans which
minimize aircraft noise impact. Sound proofing of noise-
impacted structures is also encouraged. Use of safe,
proven, uniform noise abatement flight procedures is
encouraged; however, the only procedure which currently
meets these criteria is the ALPA Noise Abatement Takeoff
Procedure.

2-5
3. The Committee strongly opposes the following:
   a. Limitations on the use of reverse thrust for noise
      abatement.
   b. Use of two-segment glide slope procedures. This
technique eliminates the safety advantage of a
stabilised approach, increases vulnerability to wake
vortices, and results in higher noise levels at the
point of glide slope transition.
   c. Curfews. Operating curfews reduce the availability
of emergency, divert fields, create the potential for
missing to meet curfew limits and thus deviating from
normal operational patterns, and the likelihood of
diversions to unfamiliar or unprepared airfields.
SECTION 3

AVIATION SAFETY AND NOISE ABATEMENT ACT OF 1979
AVIATION SAFETY AND NOISE ABATEMENT ACT OF 1979

(P.L. 96-193, 96th Congress, HR 2440, February 5, 1980, effective February 18, 1980)

AN ACT to provide assistance to airport operators to prepare and carry out noise compatibility programs, to provide assistance to assure continued safety in aviation, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the “Aviation Safety and Noise Abatement Act of 1979”.

TITLE I

SEC. 101. For purposes of this title—
(1) the term “airport” means any air carrier airport whose projects for airport development are eligible for terminal development costs under section 20(b) of the Airport and Airway Development Act of 1970; (49 U.S.C. 1710(b));
(2) the term “airport operator” means any person holding a valid certificate issued pursuant to section 612 of the Federal Aviation Act of 1958; (49 U.S.C. 1422) to operate an airport; and
(3) the term “Secretary” means the Secretary of Transportation.

SEC. 102. Not later than the last day of the twelfth month which begins after the date of enactment of this Act, the Secretary, after consultation with the Administrator of the Environmental Protection Agency and such other Federal, State, and interstate agencies as he shall determine appropriate, shall by regulation—
(1) establish a single system of measuring noise, for which there is a highly reliable relationship between the projected noise exposure and surveyed reaction of people to noise, to be uniformly applied in measuring the noise at airports and the areas surrounding such airports;
(2) establish a single system for determining the exposure of individuals to noise which results from the operations of an airport which includes, but is not limited to, noise intensity, duration, frequency, and time of occurrence; and
(3) identify land uses which are normally compatible with various exposures of individuals to noise.

SEC. 103. (a) After the effective date of the regulations promulgated in accordance with section 102 of this title, any airport operator of an airport may submit to the Secretary a noise exposure map, prepared in consultation with any public agencies and planning agencies in the area surrounding such airport, which sets forth, in accordance with the regulations promulgated pursuant to section 102, the incompatible uses in each area of the map, as of the date of submission of such map, a description of the projected aircraft operations at such airport during 1985, and the ways, if any, in which such operations will affect such map.
(2) If, after the submission to the Secretary of a noise exposure map under paragraph (1), any change in the operation of an airport would create any substantial new noncompatible use in any area surrounding such airport, the operator of such airport shall submit a revised noise exposure map showing such new noncompatible use.

SEC. 104. Section 11 of the Airport and Airway Development Act of 1970 (49 U.S.C. 1711) is amended by renumbering paragraphs (6) through (21), and all references thereto, as paragraphs (7) through (22), respectively, and by adding immediately after paragraph (5) the following new paragraph:
“(6) ‘Airport noise compatibility planning’ means the development for planning purposes of information necessary to prepare and submit—
(A) the noise exposure map and related information pursuant to section 103 of the Aviation Safety and Noise Abatement Act of 1979, including any cost associated with obtaining such information, or
(B) a noise compatibility program for submission pursuant to section 104 of such Act.”

SEC. 105. (a) Section 13(a) of the Airport and Airway Development Act of 1970 (49 U.S.C. 1713) is amended by—
(1) inserting “(1)” immediately before the first sentence thereof; and
(2) adding at the end thereof the following new paragraph:
“(ii) In order to promote the development of an effective noise compatibility program, for fiscal year beginning after September 30, 1979, the Secretary may make grants of funds for airport noise compatibility planning to sponsors of lots of air carrier airports whose projects for airport development are eligible for terminal development costs under section 20(b) of this title.”

SEC. 106. Section 13(3) of such Act is amended to read as follows:
“(b) AMOUNT AND LIMITATION OF GRANTS.
(1) The award of grants under subsection (a)(1) of this section is subject to the following limitations:
(A) The total funds obligated for grants under subsection (a)(1) of this section may not exceed $150,000,000, and the amount obligated in any one fiscal year may not exceed $5,000,000.
(B) The United States share of any airport master planning grant under this section shall be that per cent...
for which a project for airport development at that airport would be eligible under section 17 of this Act, in the case of any airport system planning grant under this section, the United States share shall be 75 percent.

(C) No more than 10 percent of the funds made available under subsection (a)(1) of this section in any fiscal year may be allocated for projects within a single State, the Commonwealth of Puerto Rico, the Virgin Islands, American Samoa, the Trust Territory of the Pacific Islands, or Guam. Grants for projects encompassing an area located in two or more States shall be charged to each State in the proportion which the number of square miles the project encompasses in each State bears to the square miles encompassed by the entire project.

"(2)(A) The total funds obligated for grants under subsection (a)(2) of this section may not exceed $15,000,000.

"(B) The United States share of any airport noise compatibility planning grant under this section (1) do not create a precedent for which a project for airport development at that airport would be eligible under section 17 of this Act.

SEC. 104. (a) Any airport operator who has submitted a noise exposure map and the related information pursuant to section 102(a)(1) may, after consultation with the officials of any public agencies and planning agencies in the area surrounding such airport, the Federal officials having local responsibility for such airport, and any air carriers using such airport, submit a noise compatibility program to the Secretary. Such program shall set forth the measures which such operator has taken or proposes for the reduction of existing noncompatible uses and the prevention of the introduction of additional noncompatible uses within the area covered by the noise exposure map submitted by such operator. Such measures may include, but are not limited to—

(1) the implementation of any preferential runway system;
(2) the implementation of any restriction on the use of such airport by any type or class of aircraft based on the noise characteristics of such aircraft;
(3) the construction of barriers and acoustical shielding including the soundproofing of public buildings;
(4) the use of flight procedures to control the operation of aircraft to reduce exposure of individuals to noise in the area surrounding the airport;
(5) acquisition of land and interests therein, including, but not limited to, air rights, easements, and development rights, so as to assure the use of property for purposes which are compatible with airport operations;

(b) The Secretary shall approve or disapprove any program submitted pursuant to this section (other than as such program relates to flight procedures referred to in subsection (a)(4) of this section) within one hundred and eighty days after it is received by him. The Secretary shall approve such program (other than as such program relates to flight procedures referred to in subsection (a)(4) of this section) (A) if the measures are undertaken in carrying out such program are not an undue burden on interstate or foreign commerce, and (ii) are reasonably consistent with obtaining the goal of reducing existing noncompatible uses and preventing the introduction of additional noncompatible uses, and (B) if the program provides for its revision made necessary by any revised noise exposure map submitted under section 103(h)(2) of this title. Failure of the Secretary to approve or disapprove such program (other than as such program relates to flight procedures referred to in subsection (a)(4) of this section) within such time period shall be deemed to be an approval of such program. With respect to any part of such program which relates to flight procedures, the Secretary shall provide such part of such program to the Administrator of the Federal Aviation Administration who shall either approve or disapprove such part of such program.

(1) The Secretary is authorized to incur obligations to make grants under this Act from funds made available under subsection (e) of this section for any project to carry out a noise compatibility program or parts thereof approved under subsection (b) of this section. Grants under this Act may be made to operators of airports submitting noise compatibility programs and to units of local government in the area surrounding such airports if the Secretary determines such units have the capability to carry out the projects for which grants are made under this Act. The United States share of any project for which a grant is made under this subsection shall be 75 percent of the total cost of the project. All of the provisions of the Airport and Airway Development Act of 1970 applicable to grants made under this Act (except section 17 of those provisions relating to apportionment) shall be applicable to any grant made under this Act, unless the Secretary determines that any provision of such Act of 1970 is inconsistent with, or unnecessary to carry out, the purposes of this Act.

(2) The Secretary, further, is authorized under this section to make grants to operators of airports and to units of local government referred to in paragraph (1) for any project to carry out a noise compatibility program developed prior to the enactment of this Act or the promulgation of its implementing regulations if the Secretary determines that such prior program is substantially consistent with the purposes of reducing existing uses and preventing the introduction of additional noncompatible uses and that the purposes of this Act would be furthered by prompt implementation of such program.

(d) The United States shall not be liable for damages resulting from aviation noise by reason of any action taken by the Secretary or the Administrator of the Federal Aviation Administration under this section.

(e) The Secretary shall obligate from funds available for expenditure under section 14(a)(3) of the Airport and Airway Development Act of 1970, not less than $15,000,000, for the fiscal year ending September 30, 1980, for making grants under subsection (c) of this section.
AVIATION SAFETY, NOISE ABATEMENT ACT

SEC. 105. The Secretary, acting through the Administrator of the Federal Aviation Administration, after consultation with the officials of any public agencies or planning agencies in the area surrounding such airport, shall prepare and publish a noise exposure map and a noise compatibility program for the airport established by the Act of June 29, 1940 (44 Stat. 586), and the airport the construction of which was authorized by the Act of September 7, 1950 (64 Stat. 770). Such map and program shall be prepared and published in accordance with the requirements of this Act no later than 1 year after the effective date of the regulations promulgated in accordance with section 102 of this Act.

SEC. 106. No part of any noise exposure map or related information described in section 102(a) submitted to, or prepared by, the Secretary and no part of the list of land uses identified by the Secretary as land uses which are normally compatible with various exposures of noise shall be admitted as evidence, or used for any other purpose, in any suit or action seeking damages or other relief for the noise that results from the operation of an airport.

SEC. 107. (a) No person who acquires property or an interest therein after the date of enactment of this Act in an area surrounding an airport with respect to which a noise exposure map has been submitted under section 103 of this title shall be entitled to recover damages with respect to the noise attributable to such airport if such person had actual or constructive knowledge of the existence of such noise exposure map until, in addition to any other elements for recovery of damages, such person can show that—

(1) a significant change in the type or frequency of aircraft operations at the airport; or

(2) a significant change in the airport layout or

(3) a significant change in the flight pattern; or

(4) a significant increase in nighttime operations; occurred after the date of the acquisition of such property or interest therein and that the damages for which recovery is sought have resulted from any such change or increase.

(b) For purposes of this section, constructive knowledge shall be imparted, at a minimum, to any person who acquires property or an interest therein in an area surrounding an airport after the date of enactment of this Act if—

(1) prior to the date of such acquisition, notice of the existence of a noise exposure map for such area was published at least three times in a newspaper of general circulation in the county in which such property is located; or

(2) a copy of such noise exposure map is furnished to such person at the time of such acquisition.

SEC. 108. The Secretary shall study (1) airport noise compatibility planning carried out with grants made under section 13 of the Airport and Airway Development Act of 1970, and (2) airport noise compatibility programs carried out with grants made under this title, to determine what elements, such planning and programs, are achieving the goals of reducing existing noncompatible uses of land around airports and reversing the introduction of new noncompatible uses around airports. Not later than January 1, 1981, the Secretary shall submit a report to Congress setting forth the determinations made pursuant to such studies together with legislative recommendations, if any, which the Secretary deems necessary.

TITLE II

SEC. 201. (a) Paragraph (3) of subsection (a) of section 14 of the Airport and Airway Development Act of 1970 (49 U.S.C. 1714) is amended by striking out "$53,000,000 for fiscal year 1970" and inserting in lieu thereof "$56,000,000 for fiscal year 1970.

(b) Paragraph (4) of subsection (a) of section 14 of the Airport and Airway Development Act of 1970 is amended by striking out "$53,000,000 for fiscal year 1970" and inserting in lieu thereof "$58,000,000 for fiscal year 1970.

(c) The last sentence of paragraph (2) of section 14 of the Airport and Airway Development Act of 1970 is hereby repealed.

(d) Subsection (a) of section 14 of the Airport and Airway Development Act of 1970 is amended by adding at the end thereof the following new sentence: "If in fiscal year 1970, or in any subsequent fiscal year, the total amount obligated under subsection (a) of this section in such fiscal year is less than the minimum amount made available for obligation under such subsection for such fiscal year, the amount available for obligation or expenditure as determined under the preceding sentence of this subsection shall be reduced by an amount equal to the difference between the amount made available under section (c) for such fiscal year and the total amount obligated under such subsection (c) for such fiscal year.

(e) Subsections (a), (c), and (d) of section 14 of the Airport and Airway Development Act of 1970 (49 U.S.C. 1714) are amended by inserting the phrase "or more than" immediately after the words "not less than" each time those words appear therein.

SEC. 202. (a) Paragraph (4) of subsection (a) of section 15 of the Airport and Airway Development Act of 1970 (49 U.S.C. 1715(a)(4)) is amended by striking out "and minus $15,000,000 in the case of each of the fiscal years 1977 through 1980," and inserting in lieu thereof "and minus $15,000,000 in the case of each of the fiscal years 1977 through 1979, and minus $20,000,000 in the case of fiscal year 1980.

(b) Paragraph (4) of subsection (a) of section 15 of the Airport and Airway Development Act of 1970 is further amended by striking out "and $20,000,000 of the amount made available for each of the other fiscal years" and inserting in lieu thereof "$15,000,000 of the amount made available for each of the fiscal years 1977 through 1979, and $20,000,000 of the amount made available for fiscal year 1980.

SEC. 203. Paragraph (2)(A) of subsection (a) of section 17 of the Airport and Airway Development Act of 1970 (49 U.S.C. 1717) is amended by striking out "$90 per centum of the allowable project costs in the case of projects funded for fiscal year 1980" and inserting in lieu thereof "shall be 80 percentum of the allowable project costs in the case of projects funded for fiscal year 1980."
SUC. 204. Subparagraph (A) of section 208(1)(I) of the Airport and Airway Revenue Act of 1970, as amended (49 U.S.C. 1742(1)(II)(A)) is amended by striking out all after "1976" and inserting in lieu thereof "or of the Aviation Safety and Noise Abatement Act of 1979 (as such Acts were in effect on the date of enactment of the Aviation Safety and Noise Abatement Act of 1979)."

SUC. 205. Subsection (c) of section 16 of the Airport and Airway Development Act of 1970 (49 U.S.C. 1716(c)) is amended by adding at the end thereof the following new paragraph:

"(5) Notwithstanding any other provision of law, the Secretary may approve an application for an airport development project (other than an airport development project in which subsection (c)(1) applies) at an existing airport without requiring the preparation of an environmental impact statement with respect to noise for such project if:

"(A) completion of the project would allow existing aircraft operations at the airport that involve aircraft that do not comply with the noise standards prescribed for "stage 2" aircraft in 14 CFR 36.1 to be replaced by aircraft operations involving aircraft that do comply with such standards;

"(B) the project complies with all other statutory and administrative requirements imposed under this Act.",

SUC. 206. Part II of the Airport and Airway Development Act of 1970 (49 U.S.C. 1711 et seq.) is amended by adding at the end thereof the following new section:

"SEC. 31. Notwithstanding any other provision of this title, no airport development project involving the construction or extension of any runway may be approved by the Secretary at any general aviation airport located astride a line separating two counties within a single State if, before the submission of such project to the Secretary, such project has not been approved by the governing body of any village incorporated under the laws of that State which is located entirely within five miles of the nearest boundary of such airport.",

TITLE III
DEFINITIONS
SEC. 301. For purposes of this title —

(1) the term "noncomplying aircraft" means any civil subsonic turbojet powered aircraft which (i) has a maximum certificated takeoff weight of 75,000 pounds or more, and (ii) in the case of an aircraft registered in the United States, has a standard airworthiness certificate issued pursuant to section 602(c) of the Federal Aviation Act of 1958 (49 U.S.C. 1423), and (B) which does not comply with the noise standards prescribed for new subsonic aircraft in regulations issued by the Secretary, acting through the Administrator of the Federal Aviation Administration (14 CFR part 36), as such regulations were in effect on January 1, 1979, and

(2) the term "Secretary" means the Secretary of Transportation.

COMPLIANCE FOR INTERNATIONAL CARRIERS
SEC. 302. (a) If, by January 1, 1980, the International Civil Aviation Organization (hereafter referred to as "ICAO") does not reach an agreement (I) which adopts the noise standards prescribed for new subsonic aircraft in regulations issued by the Secretary, acting through the Administrator of the Federal Aviation Administration (14 CFR part 36), as such regulations were in effect on January 1, 1977, or (2) on noise standards and an international schedule for compliance with ICAO Noise Standards (annex 16) which are substantially compatible with the standards set forth in such regulations issued by the Secretary (14 CFR parts 36 and 91), the Secretary, acting through the Administrator, shall commence a rulemaking to require all air carriers and foreign air carriers engaging in foreign air transportation to comply with the noise standards set forth in such regulations (14 CFR parts 36 and 91) or with ICAO Noise Standards (annex 16) which are substantially compatible with the standards set forth in such regulations issued by the Secretary (14 CFR parts 36 and 91) during the 5-year period thereafter, at a phased rate of compliance similar to that in effect for aircraft registered in the United States. The requirement applied to air carriers engaging in foreign air transportation shall not be more stringent than those applied to foreign air carriers. Such rulemaking shall be concluded within 120 days.

(b) If, prior to January 1, 1980, the International Civil Aviation Organization reaches an agreement on noise standards that comply with clause (a)(I) or (a)(2) of this section, the Secretary, acting through the Administrator of the Federal Aviation Administration, shall immediately commence a rulemaking to require all air carriers and foreign air carriers engaging in foreign air transportation to comply with such regulations by a phased rate of compliance similar to that in effect for aircraft registered in the United States. The requirement applied to air carriers engaging in foreign air transportation shall not be more stringent than those applied to foreign air carriers. Such rulemaking shall be concluded within 120 days.

NEW TECHNOLOGY AIRCRAFT INCENTIVE
SEC. 303. (a) The Secretary shall provide an exemption from applicable noise standards to permit the operation of any noncomplying three-engine aircraft, but not beyond January 1, 1983, if (1) the operator of such aircraft has a plan for the replacement of such aircraft which has been approved by the Secretary, and (2) the operator of such aircraft has entered into a binding contract by January 1, 1983, for delivery prior to January 1, 1985, of a replacement aircraft which meets, at a minimum, the noise standards for new type certificated aircraft set forth in regulations issued by the Secretary, acting through the Administrator of the Federal Aviation Administration, on March 2, 1978 (F.R. Vol. 43, p. 8722, et seq.).

(b) The Secretary shall provide an exemption from applicable noise standards to permit the operation of any noncomplying two-engine aircraft, but not beyond January 1, 1986, if (1) the operator of such aircraft has a plan for the replacement of such aircraft which has been approved by the Secretary, and (2) the operator of such aircraft has entered into a binding contract by January 1,
AVIATION SAFETY, NOISE ABATEMENT ACT

1961, for delivery prior to January 1, 1966, of a replace-
ment aircraft which meets, at a minimum, the noise stan-
dards for new type certified aircraft set forth in regu-
lations issued by the Secretary, acting through the
Administrator of the Federal Aviation Administration,
on March 1, 1978 (F.R. Vol. 43, p. 3722, et seq.).

SMALL COMMUNITY SERVICE EXEMPTION
SEC. 304. (a) The Secretary shall provide an exempt-
ion from applicable noise standards to any person
operating a noncomplying two-engine aircraft to permit
such person to operate such aircraft.
(b) Any exemption issued pursuant to this section shall
terminate on whichever of the following dates first oc-
curs:
(1) in the event such operating sell or otherwise dis-
poses of such aircraft to another person on or after
January 1, 1983, on the date such aircraft is delivered to
such other person;
(2) in the case of an aircraft with a seating configu-
ration of 100 passenger seats or less, on January 1, 1988; or
(3) in the case of an aircraft with a seating configu-
ration of more than 100 passenger seats, on January 1,
1983.
(c) For the purposes of subsection (b) of this section,
the seating configuration of an aircraft shall be the
seating configuration that existed on such aircraft on
December 1, 1979, or such earlier date as the Secretary
can establish in individual cases.

TRADEOFF ALLOWANCE
SEC. 305. Notwithstanding any other provision of law
or any rule, regulation, or order issued pursuant thereto,
the tradeoff provisions contained in appendix C of part
36 of title 14 of the Code of Federal Regulations shall
apply in determining whether any aircraft complies with
the provisions of subpart E of part 91 of title 14 of the
Code of Federal Regulations.

TITLE IV
SEC. 401. Not later than 90 days after the date of
enactment of this Act, in such January 31 thereafter,
until implementation of collision avoidance systems in
the national air traffic control system, the Secretary of
Transportation shall submit to the Congress a report on
the status of the development of such systems. Such
reports shall set forth proposed timetables for the im-
plementation of such systems. The Secretary of
Transportation’s report shall include proposals for any
legislation needed to implement such systems.
SEC. 402. Section 1112 of the Federal Aviation Act of
1958 is amended to read as follows:
“STATE OR SUBDIVISION INCOME TAX
ON COMPENSATION PAID TO
INTERSTATE AIR CARRIER EMPLOYEES
SEC. 1112. (a) No part of the compensation paid by
an air carrier to an employee who performs his regularly
assigned duties as such an employee on an aircraft in
more than one State, shall be subject to the income tax
laws of any State or subdivision thereof other than the
State or subdivision thereof in which such employee’s residence
and the State or subdivision thereof in which such employee earns more than 50 per centum of his compen-
sation paid by the carrier to such employee.
(b) For the purposes of subsection (a), an employ-
ee shall be deemed to have earned 50 per centum of his com-
penation in any State or subdivision in which his
scheduled flight time in such State or subdivision is more
than 50 per centum of his total scheduled flight time in
the calendar year while so employed.
(c) For the purposes of this section the term ‘State’
also means the District of Columbia and any of the
possessions of the United States; and the term ‘compen-
sation’ shall mean all moneys received for services
rendered by the employee in the performance of his
duties and shall include wages and salary.”

SEC. 403. That portion of the table of contents con-
tained in the first section of the Federal Aviation Act of
1958 which appears under the heading
“TITLE XI — MISCELLANEOUS”,
is amended by striking the item designated as “Sec.
1112” and inserting in lieu thereof,
“Sec. 1112. State or subdivision income tax on com-
pensation paid to interstate air carrier employees.”

TITLE V
SEC. 501. (a) The Administrator of the Federal Avia-
tion Administration (hereinafter referred to as the “Ad-
ministrator”) shall, within 90 days after the date of
enactment of this Act, promulgate regulations for
parts operated by the Administrator for regular
access to public areas by individuals or by religious a
nonprofit organizations (as defined in section 501(c)(3) o
the Internal Revenue Code of 1954) for the purpose of
soliciting funds or distributing materials.
(b) In promulgating regulations under this section the
Administrator shall consider requiring any individual or
organization described in subsection (a) to submit an
application for a permit to engage in the soliciting of
funds or the distribution of materials. In considering such
an application the Administrator may require that —
(1) a responsible individual representative of the appli-
cant shall be designated to represent the organization;
(2) each individual participating in any solicitation or
distribution at any one time shall not exceed a
reasonable number, in keeping with the need for free
movement in and operation of the airports as provided
for by the permit;
(4) the solicitation or distribution be limited to
restricted areas and times, and
(5) no individual or organization which holds a permit
under this section shall be permitted to —
(A) use sound amplification or display signs (other
than signs approved by the Administrator);
(B) intentionally interfere with users of the airport;
(C) engage in the use of indecent or obscene ref-
or conduct; or
(D) engage in the use of loud, threatening, or abusive language intended to coerce, intimidate or disturb the peace.

(4)(1) The Administrator shall consider requiring that a copy of a permit (if such is required) be conspicuously posted in the area in which any solicitation or distribution is permitted.

(2) The Administrator shall consider whether revocation of approval for any permit if required and approved under this section should occur for any violation of any rule or regulation promulgated hereunder.

(3) Regulations intended to be promulgated under this section shall be submitted to Congress within 30 days after the date of enactment of this Act.

SEC. 502. (a) Paragraphs (1) and (2) of section 902(1) of the Federal Aviation Act of 1958 (49 U.S.C. 1472(1)) is amended to read as follows:

"(1) With respect to any aircraft in, or intended for operation in air transportation or intrastate air transportation, whenever —

(A) while aboard, or while attempting to board such aircraft, or about his person or property a concealed deadly or dangerous weapon which is, or could be, accessible to such person in flight;

(B) has placed, attempted to place, or attempted to have placed aboard such aircraft any bomb or similar explosive or incendiary device;

shall be fined not more than $1,000 or imprisoned not more than one year, or both.

(b) Paragraph (3) of section 902(1) of the Federal Aviation Act of 1958 is amended —

(1) by striking out "This subsection" and inserting in lieu thereof "Paragraph (1)(A) of this subsection";

(2) by inserting "officer or employee of" before "the Federal Government";

(3) by inserting "other than loaded firearms" after "persons transporting weapons".

(c) Section 902(1) of the Federal Aviation Act of 1958 is amended by adding at the end thereof the following new paragraph:

"(4) For purposes of this subsection —

(A) the term "firearm" means any starter gun and any weapon which is designed to or has been converted to ap-

pel any projectile by the action of an explosive; and

(II) "the term "loaded firearm" means any firearm which has a cartridge, detonator, or powder in the chamber, magazine, cylinder, or cilo of such firearm."

SEC. 503. (a) Except as provided in subsection (c), notwithstanding any other provision of law, neither the Secretary of Transportation, the Civil Aeronautics Board, nor any other officer or employee of the United States shall issue, reissue, amend, revoke, or otherwise modify (other than by action or inaction) any certificate or other authority to permit or otherwise authorize any person to provide the transportation of individuals, by air, as a common carrier for compensation or hire between Love Field, Texas, and one or more points outside the State of Texas, except (1) charter air transportation not to exceed ten flights per month, and (2) air transportation provided by commuter airlines operating aircraft with a passenger capacity of 56 passengers or less.

(b) Except as provided in subsections (a) and (c), notwithstanding any other provision of law, or any certificate or other authority heretofore or hereafter issued thereunder, no person shall provide or offer to provide the transportation of individuals, by air, for compensation or hire as a common carrier between Love Field, Texas, and one or more points outside the State of Texas, except that a person providing service to a point outside of Texas from Love Field on November 1, 1979, may continue to provide service to such a point.

(c) Subsections (a) and (b) shall not apply with respect to, and it is found consistent with the public convenience and necessity to authorize, transportation of individuals, by air, on a flight between Love Field, Texas, and one or more points within the States of Louisiana, Arkansas, Oklahoma, New Mexico, and Texas by an air carrier, if (1) such air carrier does not offer or provide any through service or ticketing with another air carrier or foreign air carrier, and (2) such air carrier does not offer for sale transportation to or from, and the flight or aircraft does not serve, any point which is outside any such State. Nothing in this subsection shall be construed to give authority not otherwise provided by law to the Secretary of Transportation, the Civil Aeronautics Board, any other officer or employee of the United States, or any other person.

(d) This section shall not take effect if enacted after the enactment of the International Air Transportation Compromise Act of 1973.

- Approved February 15, 1980.
SECTION 3A

PART 16
PART 36—NOISE STANDARDS: AIRCRAFT TYPE AND AIRWORTHINESS CERTIFICATION

Subpart A—General

Sec. 36.1 Applicability and definitions.
36.2 Special retrofitting requirements.
36.3 Compatibility with airworthiness requirements.
36.4 Limitation of part.
36.5 Incorporation by reference.
36.7 Acoustical emission: Transport category large airplanes and turbine-powered airplanes.
36.8 Acoustical emission: Propeller-driven small airplanes.

Subpart B—Noise Measurement and Evaluation for Transport Category Large Airplanes and Turbojet-Powered Airplanes

36.101 Noise measurement.
Title 14—Aeronautics and Space

§ 23.103 Noise evaluation.

Subpart C—Noise Limits for Subsonic Transport Category Large Aircraft and Subsonic Turbojet Powered Airplanes

23.104 Noise Limits.

Subpart D—Noise Limits for Supersonic Transport Category Aircraft

23.105 Noise Limits: Concordo.

Subpart E—[Reserved]

Subpart F—Propeller Driven Small Aircraft

23.105 Noise Limits.

Subpart G—Operating Limitations and Information

23.106 Procedures and other information.

23.107 Markings, markings, and placards.

23.108 Reporting and operating limitations.

Appendix A—Aircraft Noise Measurement under § 23.101

Appendix B—Aircraft Noise Evaluation under § 23.103

Appendix C—Noise Level for Transport Category and Turboprop Powered Airplanes under § 23.104

Appendix D—[Reserved]

Appendix E—Noise Requirements for Propelled Driven Small Airplanes

[Further text not shown]
§ 23.5 Limitation of part.

Pursuant to 10 U.S.C. 1321(b)(4), the noise levels in this part have been determined to be as low as is economically reasonable, technologically practicable, and appropriate to the type of aircraft to which they apply. No determination is made, under this part, that these noise levels are or should be acceptable or acceptable for operation at, into, or out of, any airport.

§ 23.6 Incorporation by reference.

(a) General. This part prescribes certain standards and procedures which are not set forth in full text in this rule. Those standards and procedures are contained in published material which is reasonably available to the class of persons affected and has been approved for incorporation by reference by the Director of the Federal Register under 5 U.S.C. 552 (a) and (1) CFR Part 51.

(1) Incorporated matter. (1) Each publication, or part of a publication, which is referenced but not set forth in full text in this part and which is identified in paragraphs (2) or (5) of this section is hereby incorporated by reference and made a part of Part 23 of this chapter with the approval of the Director of the Federal Register.

(2) Incorporated matter which is subject to subsequent change incorporated by reference according to the specific reference and to the identification statement. Adoption of any subsequent change in incorporated matter is made under Part 11 of this chapter and 1 CFR Part 51.

(c) Identification statement. The complete title or description which identifies each published matter incorporated by reference in this part is as follows:


Chapter 1—Federal Aviation Administration

§ 23.67 Acoustical changes: Transport category—large aircraft and turboprop-powered airplanes.

(a) Applicability. This section applies to all transport category large airplanes and turboprop-powered airplanes for which an acoustical change approval is applied for under § 23.03(b) of this chapter.

(b) General requirements. Except as otherwise specifically provided, for each airplane covered by this section, the acoustical change approval requirements in this section shall be applied.

(1) In showing compliance, noise levels that have been measured and evaluated in accordance with the applicable procedures and conditions prescribed in Appendices A and B of this part.

(2) Compliance with the noise limits prescribed in section 23.08 of Appendix C must be shown in accordance with the applicable provisions of sections 25.49 and 25.9 of Appendix C of this part.

(c) Stage I airplanes. For each Stage I airplane prior to the change in type design, in addition to the provisions of paragraph (b) of this section, the following applies:

(1) If an airplane is a Stage I airplane prior to the change in type design, it may not, after the change in type design, exceed the noise levels created against the change in type design. The noise levels prescribed in section 25.49 of Appendix C of this part may not be used to increase the Stage I noise levels.

(2) In addition, for an airplane for which application is made after September 17, 1971:

There may be no reduction in power or thrust below the highest airworthiness approved power or thrust, during the tests conducted before and after the change in type design; and

During the takeoff and sideline noise tests conducted before the change in type design, the quickest airworthiness approved configuration available for the highest approved takeoff weight must be used.

(3) Stage 2 airplanes. If an airplane is a Stage 2 airplane prior to the change in type design, in addition to the provisions of paragraph (b) of this section, the following applies:

(1) Applications before November 2, 1975. For an airplane for which an application for acoustical change approval is made before November 2, 1975, the airplane may not be a Stage 2 airplane after the change in type design.

(2) Applications on or after November 2, 1975, and before October 28, 1976. For an airplane for which an application for acoustical change approval is made on or after November 2, 1975, and before October 28, 1976—

(i) The airplane may not be a Stage 2 airplane after the change in type design.

(ii) During the takeoff and sideline noise tests conducted before the change in type design, the quickest airworthiness approved configuration available for the highest approved takeoff weight must be used.

(iii) Applications on or after October 28, 1976. For an airplane for which an application for acoustical change approval is made on or after October 28, 1976, the following applies:

(1) Airplanes with high bypass ratio turboshaft engines. For an airplane with high bypass ratio turboshaft engines, for an airplane with high bypass ratio of 3 or more before a change in type design—

(a) The airplane after the change in type design may not exceed either (i) the N180 limit by more than 2 dB(N), or (ii) the Stage 2 noise limit, whichever is lower.

(b) The threshold provisions of section 23.08(b)(2) of Appendix C of this part may be used in determining compliance under this paragraph with re-
§ 23.9

To be Stage 2 noise limit or to the Stage 3 plus 3 dBA noise limits, as applicable.

(i) During the takeoff and sideline noise test conducted before the change in type design, the airplane must be in an approved configuration available for the highest approved takeoff weight that is used.

(ii) Airplanes that do not have high bypass ratio turbojet engines. For an airplane that does not have turbojet engines with a bypass ratio of 2 or more before the change in type design, compliance must be shown under the requirements of paragraphs (i)(1) and (i)(2) of this section.

(iii) Stage 2 Airplanes. If an airplane is a Stage 2 airplane prior to the change in type design, in addition to the requirements of paragraph (i)(1) of this section, the following apply:

(1) Applications before May 5, 1978. For an airplane for which an application for acoustical change approval is made before May 5, 1978, the airplane may be a Stage 2 airplane after the change in type design.

(2) Applications on or after May 5, 1978. For an airplane for which an application for acoustical change approval is made on or after May 5, 1978, the airplane must—

(A) be a Stage 2 airplane after the change in type design and compliance must be shown under the provisions of paragraph (i)(2), or (ii) of (a) at this section, as applicable; and

(B) remain a Stage 2 airplane after the change in type design and compliance must be shown under the provisions of paragraph (1)(ii) of this section.

(iii) If compliance with Stage 2 noise levels is required before the change in type design, the airplane must be a Stage 2 airplane after the change in type design.

(b) Acoustical change Propeller-driven Small Airplanes.

For propeller driven small airplanes in the normal, utility, aerial, transport, and restricted categories for which an acoustical change approval is applied for under § 23.250(b) of this chapter after January 1, 1978, the following apply:

(a) If the airplane was type certificated under Appendix F of this part prior to the change in type design, it may not, after the change in type design, exceed the noise limits that were applied to that approval.

(b) If the airplane was not type certificated under Appendix F but can achieve the noise limits prescribed in section 23.250(b) of that appendix prior to the change in type design in that it may not exceed these limits, measured and corrected as prescribed in Appendix F of the airplane, after the change in type design.

(c) If the airplane cannot achieve the noise limits prescribed in section 23.250(b) of Appendix F prior to the change in type design, it may not, after the change in type design, exceed the noise limits created prior to the change in type design, measured and corrected as prescribed in Appendix F.

Title 14—Aeronautics and Space

Chapter 1—Federal Aviation Administration

Subpart C—Noise Limits for Subsonic Transport Category Large Airplanes and Subsonic Turbojet Powered Airplanes

§ 23.251 Noise limits.

(a) For Subsonic Transport category large airplanes and turbojet powered airplanes compliance with this section must be shown with noise levels measured and evaluated as prescribed in Subpart E of this part, and demonstrated by the meeting points and in accordance with the flight test conditions under sections 23.27 and 23.60 for the approved equivalent procedure, prescribed under Appendix C of this part.

(b) Airplanes with high bypass ratio turbojet engines. For airplanes that have turbojet engines with bypass ratios of 2 or more, the noise limit requirements are as follows:

(1) Applications before January 1, 1977. If application is made before January 1, 1977, it must be shown that the noise levels of the airplane are no greater than the Stage 2 noise limits prescribed in section 23.250(b) of Appendices C of this part, or are reduced to the lowest levels that are economically reasonable, technologically practicable, and appropriate to the particular type design.

(2) Applications on or after January 1, 1977, and before November 5, 1978. If application is made on or after January 1, 1977, and before November 5, 1978, it must be shown that the noise levels of the airplane are no greater than the Stage 2 noise limits prescribed in section 23.250(b) of Appendices C of this part.

(3) Applications on or after November 5, 1978. If application is made on or after November 5, 1978, it must be shown that the noise levels of the airplane and the Stage 2 noise limits prescribed in section 23.250(b) of Appendices C of this part.
33.1501 Noise limits. 
(a) Compliance with this subpart must be shown for—
(1) Propeller driven small airplanes for which application for the issuance of a type certificate in the normal utility, acoustic, transport, or restricted category is made on or after October 10, 1970; and
(2) Propeller driven small airplanes for which application is made for the original issuance of a standard airworthiness certificate or restricted category airworthiness certificate, and that have not had any flight time before January 1, 1955 (regardless of date of application).
(b) Compliance with this subpart must be shown with noise levels measured and corrected as prescribed in Parts D and E of Appendix F, or under approved equivalent procedures.
(c) For airplanes covered by this section, it must be shown that the noise level of the airplane is no greater than the applicable limit prescribed in Part D of Appendix F.

Chapter 1—Federal Aviation Administration

33.1501 Manuals, markings, and placards.
(a) Each Airplane Flight Manual approved, the approved portion of the Airplane Flight Manual in accordance with the procedures and other information, and as applicable under § 33.1503 of this part, if an Airplane Flight Manual is not approved, the procedures and information must be furnished in any combination of approved manuals, markings, and placards.
(b) The following statement must be furnished near the listed noise levels:
no determination has been made by the Federal Aviation Administration that the noise levels of this airplane are or should be acceptable or unacceptable for operation at, into, or out of any airport.
(c) For transport category large airplanes and turboprop powered airplanes, for which the weight used in computing the takeoff or landing noise requirements of this part is less than the maximum weight or design landing weight, respectively, established under the applicable airworthiness requirements, those lesser weights must be furnished, as operating limitations, in the operating limitations section of the Airplane Flight Manual.
(d) For propeller driven small airplanes for which the weight used in meeting the flyover noise requirements of this part is less than the maximum weight by an amount exceeding the amount of fuel needed to conduct the test, that lesser weight must be furnished, as an operating limitation, in the operating limitations section of an approved Airplane Flight Manual, in approved manual material, or on an approved placard.
(e) Excess as provided in paragraphs (a) and (c) of this section, no operating limitations are furnished under this part.

33.1501 Procedure and other information.
(a) All procedures, and other information for the flight crew, that are employed for obtaining the noise reductions prescribed in this part must be developed. This must include noise levels achieved during type certification.

Appendix A—Aircraft Noise Measurement. 26.1501

A3.3 Evaluation of aircraft noise. 26.1503
A3.4 Measurement of aircraft noise. 26.1505
A3.5 Method of measuring noise. 26.1507
A3.6 Definitions. 26.1509
Part 25, App. A

Title 14—Aeronautics and Space

(1) No rain or other precipitation.
(2) Ambient air temperature between 20 and 32 degrees C (68 and 90 degrees F)."
Title 14—Aeronautics and Space

Chapter I—Federal Aviation Administration

Part 36, App. A

Section 1—FARs

Title 14—Aeronautics and Space

Chapter I—Federal Aviation Administration

Part 36, App. A

Section 2—Technical Standards

Title 14—Aeronautics and Space

Chapter I—Federal Aviation Administration

Part 36, App. A

Section 2—Technical Standards
Title 14—Aeronautics and Space

Chapter I—Federal Aviation Administration

(a) General. The symbols used in Appendices A and B of this part have the following meanings.

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Part 26, App. A

Noise level (SPL) correction must be less than 3 dB for any combination of the following:

(i) The aircraft is not passing vertically above the observer.
(ii) Any distance between 200 feet and 1,000 feet between the observer and the aircraft.
(iii) Any distance between 200 feet and 1,000 feet between the observer and the approach runway.
(iv) Any distance at or more than 200 feet between the observer and the approach runway.
(v) Any aircraft noise level (SPL) at or more than 200 feet between the observer and the approach runway.

Part 26. Nomenclature. The published numbers for the aircraft noise levels determined in accordance with this Appendix are:

(b) Control Measures. The published numbers shall be listed at the bottom of Appendix D, Appendix E, and Appendix F.

(c) Noise Certification. The noise certification shall be listed at the top of Appendix D, Appendix E, and Appendix F.

Part 26, App. A

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(ii) Any distance between 200 feet and 1,000 feet between the observer and the aircraft.
(iii) Any distance between 200 feet and 1,000 feet between the observer and the approach runway.
(iv) Any distance at or more than 200 feet between the observer and the approach runway.
(v) Any aircraft noise level (SPL) at or more than 200 feet between the observer and the approach runway.

Part 26, App. A

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(iv) Any distance at or more than 200 feet between the observer and the approach runway.
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Part 26, App. A

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Part 26, App. A

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Part 26, App. A

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(i) The aircraft is not passing vertically above the observer.
(ii) Any distance between 200 feet and 1,000 feet between the observer and the aircraft.
(iii) Any distance between 200 feet and 1,000 feet between the observer and the approach runway.
(iv) Any distance at or more than 200 feet between the observer and the approach runway.
(v) Any aircraft noise level (SPL) at or more than 200 feet between the observer and the approach runway.
Section 30.8 Atm. Atm. attenuation of sound.

(a) General. The measured values of the one-third octave band spectra must not be corrected, or be corrected to the reference-day conditions listed in section 30.8 (c) of this appendix. Each correction must account for any differences in the atmospheric attenuation of sound between the test-day conditions and the reference-day conditions along the sound propagation path between the aircraft and the microphone. Unless the meteorological conditions conform to those prescribed in section 30.8 (c) of this appendix, the test data are not acceptable.

(b) Meteorological measurements. (1) The location of an airport, or other facility, used for meteorological measurements must be approved for use as representative of those atmospheric conditions existing near the surface over the geographical area in which aircraft noise measurements are made. However, for the purpose of making corrections under this section, the wind velocity, temperature, and relative humidity must be measured at the site of the microphone at the takeoff, approach, and sideline measuring stations.

(2) The temperature and relative humidity must be measured from a point 10 m above the surface at the measuring stations at the altitude of the aircraft, using previously approved equipment and methods.

(3) Meteorological measurements must be obtained within 25 minutes of each noise test measurement. Meteorological data must be interpolated to actual times of each noise measurement.

(c) Attenuation rates. The atmospheric attenuation rates of sound with distance for each one-third octave band from 60 Hz to 12,500 Hz must be determined in accordance with the formulations and tabulations of NASA AIP 5980, entitled "Standard Values of Atmospheric Absorption as a Function of Temperature and Humidity for the Evaluation of Aircraft Figure Noise" given in Appendix 3 of this part.

(d) Correction for atmospheric attenuation. The EPNL values calculated for noise measurements shall be corrected by the method prescribed in section 30.8 (c) of this appendix when:

1. The atmospheric attenuation of sound between the test-day conditions and reference-day conditions cause a difference in the EPNL calculated from the measured sound pressure levels of more than 3 dB, and

2. The measured takeoff or approach flight paths do not conform to the reference flight paths.

(e) The measured atmospheric attenuation coefficients do not vary over the sound propagation path by more than 0.5 dB/100 ft. (In the 310 Hz one-third octave band from the value of the absorption coefficients derived from the meteorological measurements obtained at 10 meters above the surface of the noise measuring station, the measurements prescribed in paragraph (b) of this section may be used to determine the atmospheric attenuation rates for each one-third octave band.

(f) The resulting atmospheric attenuation rate may be used to compute the EPNL correction for each one-third octave band.

(g) If the conditions do not conform to those prescribed in paragraph (c) of this section, the corrections for atmospheric attenuation must be determined by the following procedure:

1. The sound propagation path must be divided into increments no greater than 100 feet in altitude, and the average temperature and relative humidity that exist within each increment at the time of the test must be calculated from the meteorological data prescribed in paragraphs (a) and (b) of this section.

2. Atmospheric attenuation rates must be determined under paragraph (c) of this section for each one-third octave band in each increment.

3. The mean attenuation rate over the complete sound propagation path from the aircraft to the microphone must be computed for each one-third octave band from the sound propagation path. The computed correction required in section 30.8 (c) of this appendix.

Section 30.8 (c) Detailed correction procedure.

(a) General. If the test conditions do not conform to those prescribed in noise certification reference conditions under section 30.8 (c) of this appendix, the following correction procedure and requirements apply:

1. The sound propagation path and the attenuation correction must be calculated for each one-third octave band from the location of the aircraft to the microphone.

2. Corrections for noise measurements at the EPNL calculated from the measured data, Conditions which can result in a difference of more than 3 dB are:

(a) Atmospheric absorption of sound under test conditions which is greater than the reference;

(b) Test flight path at an altitude which is less than 300 feet or exceeds the maximum certification weight.

(c) If the negative results from any difference between reference and test conditions, the corrected EPNL value must be added to the EPNL calculated from the measured data.

(d) An atmospheric absorption of sound under test conditions which is less than the reference.

(e) A test flight path at an altitude which is greater than the reference.

(f) The following correction procedure must be used:

1. The sound propagation paths must be divided into increments no greater than 100 feet in altitude, and the average temperature and relative humidity that exist within each increment at the time of the test must be calculated from the meteorological data prescribed in paragraphs (a) and (b) of this section.

2. Atmospheric attenuation rates must be determined under paragraph (c) of this section for each one-third octave band in each increment.

3. The mean attenuation rate over the complete sound propagation path from the aircraft to the microphone must be computed for each one-third octave band from the mean attenuation rate derived from the atmospheric conditions at the time of the test. The computed correction required in section 30.8 (c) of this appendix.

4. Atmospheric absorption of sound under test conditions which is greater than the reference;

5. Test flight path at an altitude which is less than 300 feet or exceeds the maximum certification weight.

6. A test flight path at an altitude which is greater than the reference.

(g) The following correction procedure must be used:

1. The sound propagation paths must be divided into increments no greater than 100 feet in altitude, and the average temperature and relative humidity that exist within each increment at the time of the test must be calculated from the meteorological data prescribed in paragraphs (a) and (b) of this section.

2. Atmospheric attenuation rates must be determined under paragraph (c) of this section for each one-third octave band in each increment.

3. The mean attenuation rate over the complete sound propagation path from the aircraft to the microphone must be computed for each one-third octave band from the mean attenuation rate derived from the atmospheric conditions at the time of the test. The computed correction required in section 30.8 (c) of this appendix.

4. Atmospheric absorption of sound under test conditions which is greater than the reference;

5. Test flight path at an altitude which is less than 300 feet or exceeds the maximum certification weight.

6. A test flight path at an altitude which is greater than the reference.

7. The following correction procedure must be used:

1. The sound propagation paths must be divided into increments no greater than 100 feet in altitude, and the average temperature and relative humidity that exist within each increment at the time of the test must be calculated from the meteorological data prescribed in paragraphs (a) and (b) of this section.

2. Atmospheric attenuation rates must be determined under paragraph (c) of this section for each one-third octave band in each increment.

3. The mean attenuation rate over the complete sound propagation path from the aircraft to the microphone must be computed for each one-third octave band from the mean attenuation rate derived from the atmospheric conditions at the time of the test. The computed correction required in section 30.8 (c) of this appendix.

4. Atmospheric absorption of sound under test conditions which is greater than the reference;

5. Test flight path at an altitude which is less than 300 feet or exceeds the maximum certification weight.

6. A test flight path at an altitude which is greater than the reference.

7. The following correction procedure must be used:

1. The sound propagation paths must be divided into increments no greater than 100 feet in altitude, and the average temperature and relative humidity that exist within each increment at the time of the test must be calculated from the meteorological data prescribed in paragraphs (a) and (b) of this section.

2. Atmospheric attenuation rates must be determined under paragraph (c) of this section for each one-third octave band in each increment.

3. The mean attenuation rate over the complete sound propagation path from the aircraft to the microphone must be computed for each one-third octave band from the mean attenuation rate derived from the atmospheric conditions at the time of the test. The computed correction required in section 30.8 (c) of this appendix.

4. Atmospheric absorption of sound under test conditions which is greater than the reference;

5. Test flight path at an altitude which is less than 300 feet or exceeds the maximum certification weight.

6. A test flight path at an altitude which is greater than the reference.

7. The following correction procedure must be used:

1. The sound propagation paths must be divided into increments no greater than 100 feet in altitude, and the average temperature and relative humidity that exist within each increment at the time of the test must be calculated from the meteorological data prescribed in paragraphs (a) and (b) of this section.

2. Atmospheric attenuation rates must be determined under paragraph (c) of this section for each one-third octave band in each increment.

3. The mean attenuation rate over the complete sound propagation path from the aircraft to the microphone must be computed for each one-third octave band from the mean attenuation rate derived from the atmospheric conditions at the time of the test. The computed correction required in section 30.8 (c) of this appendix.

4. Atmospheric absorption of sound under test conditions which is greater than the reference;

5. Test flight path at an altitude which is less than 300 feet or exceeds the maximum certification weight.

6. A test flight path at an altitude which is greater than the reference.

7. The following correction procedure must be used:

1. The sound propagation paths must be divided into increments no greater than 100 feet in altitude, and the average temperature and relative humidity that exist within each increment at the time of the test must be calculated from the meteorological data prescribed in paragraphs (a) and (b) of this section.

2. Atmospheric attenuation rates must be determined under paragraph (c) of this section for each one-third octave band in each increment.

3. The mean attenuation rate over the complete sound propagation path from the aircraft to the microphone must be computed for each one-third octave band from the mean attenuation rate derived from the atmospheric conditions at the time of the test. The computed correction required in section 30.8 (c) of this appendix.

4. Atmospheric absorption of sound under test conditions which is greater than the reference;
including the significant geometrical relationships influencing sound propagation. EP represents the measured sound propagation path with climb angle θ, and EC' represents the corrected sound propagation path at reduced climb angle θ-λ. Position A represents the point on the measured sound propagation path nearest the noise measuring station R, and P is the corresponding position on the corrected flight path. The measured and corrected sound propagation paths are GA and EC', respectively, which are normal to their flight paths.

Figure A1. MEASURED TAKEOFF PROFILE

Figure A2. COMPARISON OF MEASURED AND CORRECTED TAKEOFF PROFILES

Note: Under reference atmospheric conditions and with maximum takeoff weight, the gradient of the sound constant climb angle θ may not be less than 4 percent. However, the actual gradient will depend upon the real atmospheric conditions assuming maximum takeoff weight and the parameters characterizing engine performance are constant. Any parameter may vary from the flight.

Figure A3. TAKEOFF PROFILE CHARACTERISTICS INFLUENCING SOUND PROPAGATION
Chapter 1—Federal Aviation Administration

Title 14—Aeronautics and Sp.

Part 3

Section 3.A.1—Federal Aviation Administration

Section 3.A.2—Aircraft Noise Evaluation Urban § 3.A.103

Sec.

3.A.1 General

3.A.2 Perceived noise level

3.A.3 Correction for spectral irregularities

3.A.4 Maximum tone corrected perceived noise level

3.A.5 Duration correction

3.A.6 Effective perceived noise level

3.A.7 Mathematical formulation of noise level

Section 3.B.1 General. The procedures in this appendix must be used to determine the noise emissions as designated as effective perceived noise level, EPNL, as specified in § 3.A.2. These procedures, which use the physical properties of noise measurement as prescribed by Appendix A of this part, consist of the following:

(a) The 24 one-third octave bands of sound pressure levels are converted to perceived noise levels by means of a noise table. The tabular values are compiled and then subjected to instantaneous perceived noise levels, EPNL.

(b) A tone correction factor, C, is calculated for each spectrum in account for the subjective tonal quality of the perceived noise level.

(c) The tone correction factor is added to the perceived noise level to obtain tone corrected perceived noise levels, EPNL*C, at each one-third octave increment of tone. The instantaneous values of tone corrected perceived noise level are noted with respect to time and the noise level value, EPNL, is determined.

PMNL (A) = EPNL*C - C

A duration correction factor, D, is computed by integration under the curve of tone corrected perceived noise level versus time.

The effective perceived noise level, EPNL, is determined by the algebraic sum of the maximum tone corrected perceived noise level and the duration correction factor.

EMNL = EPNL (A) + D

Section 3.B.2 Perceived noise level instantaneous perceived noise levels, EPNL, must be calculated from instantaneous one-third octave band sound pressure levels, EPNL(A), as follows:

(a) Step 1. Correct each one-third octave band EPNL(A) from 0 to 150 db to per
corrected noise levels, EPNL(B), by reference to Table 3.B, or to the mathematical formul
ation of the noise level given in § 3.A.12 of this appendix.

(b) Step 2. Combine the corrected perceived noise

levels, EPNL(B), found in Step 1 by the following formula:

\[ EPNL = \sum \frac{EPNL(B) \times (N_{min})}{N_{min}} \]

where Nmin is the largest of the 24 values of N(E) and N(B) in the total perceived sound

level.

(c) Step 3. Correct the total perceived noise

level, EPNL(A), to get corrected noise level, EPNL(B), by the following formula:

\[ EPNL = \sum \frac{EPNL(B) \times (N_{min})}{N_{min}} \]

which is plotted in Figure 3.B. EPNL may also be determined by combining EPNL(A) in the 0.5 db column of Table 3.B and then reading the corresponding value of EPNL(B) which, at 0.5 db, equals EPNL(A).
Chapter 1 - Federal Aviation Administration

Section 355.5 Correction for spectra irregularities. Noise having pronounced irregularities in the spectrum (for example, discrete frequency components or ripples) must be adjusted by the correction factor \( C_{th} \) calculated as follows:

(a) Step 1. Marking with the corrected sound pressure level in the 22 kHz one-third octave band (band number 22), calculate the changes in sound pressure level (also) in the remainder of the one-third octave bands as follows:

\[
\begin{align*}
\Delta L_{22(k)} &= \text{no value} \\
\Delta L_{46(k)} &= 10 \log \left( \frac{P_{22(k)}}{P_{46(k)}} \right) \\
\Delta L_{47(k)} &= 10 \log \left( \frac{P_{22(k)}}{P_{47(k)}} \right) \\
\Delta L_{48(k)} &= 10 \log \left( \frac{P_{22(k)}}{P_{48(k)}} \right) \\
\Delta L_{49(k)} &= 10 \log \left( \frac{P_{22(k)}}{P_{49(k)}} \right) \\
\Delta L_{50(k)} &= 10 \log \left( \frac{P_{22(k)}}{P_{50(k)}} \right) \\
\Delta L_{51(k)} &= 10 \log \left( \frac{P_{22(k)}}{P_{51(k)}} \right) \\
\Delta L_{52(k)} &= 10 \log \left( \frac{P_{22(k)}}{P_{52(k)}} \right) \\
\Delta L_{53(k)} &= 10 \log \left( \frac{P_{22(k)}}{P_{53(k)}} \right) \\
\Delta L_{54(k)} &= 10 \log \left( \frac{P_{22(k)}}{P_{54(k)}} \right) \\
\end{align*}
\]

(b) Step 2. Calculate the value of the slope, \( m_{22(k)} \), where the arithmetic mean value of the change in slope is greater than 0.7; that is, where

\[
| m_{22(k)} | > 0.7 
\]

(c) Step 3. If the absolute value of the slope \( m_{22(k)} \) is positive and greater than 0.7, calculate the changes in sound pressure level (also) in the remainder of the one-third octave bands as follows:

\[
\begin{align*}
\Delta L_{46(k)} &= 10 \log \left( \frac{P_{22(k)}}{P_{46(k)}} \right) \\
\Delta L_{47(k)} &= 10 \log \left( \frac{P_{22(k)}}{P_{47(k)}} \right) \\
\Delta L_{48(k)} &= 10 \log \left( \frac{P_{22(k)}}{P_{48(k)}} \right) \\
\Delta L_{49(k)} &= 10 \log \left( \frac{P_{22(k)}}{P_{49(k)}} \right) \\
\Delta L_{50(k)} &= 10 \log \left( \frac{P_{22(k)}}{P_{50(k)}} \right) \\
\Delta L_{51(k)} &= 10 \log \left( \frac{P_{22(k)}}{P_{51(k)}} \right) \\
\Delta L_{52(k)} &= 10 \log \left( \frac{P_{22(k)}}{P_{52(k)}} \right) \\
\Delta L_{53(k)} &= 10 \log \left( \frac{P_{22(k)}}{P_{53(k)}} \right) \\
\Delta L_{54(k)} &= 10 \log \left( \frac{P_{22(k)}}{P_{54(k)}} \right) \\
\end{align*}
\]

(d) Step 4. Calculate the difference, \( P_{22(k)} \), between the original and the adjusted sound pressure levels as follows:

\[
P_{22(k)} = P_{22(k)} - P_{22(k)} 
\]

and note only value greater than zero.

(e) Step 5. For each of the 22 one-third octave bands, determine the true correction factor (from the sound pressure level differences \( P_{22(k)} \) and Table 355.5.15). An example of the true correction procedure is given in Table 355.5.16.

(2) True corrected perceived loudness \( P_{th}(k) \) are determined by adding the \( P_{22(k)} \) values to corresponding \( P_{th}(k) \) values, that is,

\[
P_{th}(k) = P_{th}(k) + P_{22(k)} 
\]

(f) For any 4 kHz one-third octave band, at any half increment of an octave, for which the true correction factor is subject to result from something other than for in addition to an actual tone, for any spectral irregularity other than ripples noise, an additional analysis may be made using a filter with a bandwidth less than one-third of an octave. If this function analysis indicates that no reflection, then a revised value for the background sound pressure level, \( P_{Bth}(k) \), may be determined from the analysis and used to compute a revised true correction factor, \( P_{Bth}(k) \), for that particular one-third octave band.
not being related to the engine noise. This identification may be made either by comparing measured data with data from a flash mounted microphone, or by observing the Doppler shift characteristics of the tones during the flyover-noise history. Since loudness is related to ground reflections, a microphone mounted flush to the ground will yield a spectral shape which can be distinguished from that produced by the 4-foot high microphones at those frequencies which can be related to ground reflection's geometrical relationship. Identification through Doppler shifting due symmetric variation of frequency with time can be made because the Doppler frequency variation yields a frequency increase for an approaching signal and a frequency decrease for a receding signal. Pseudorales at frequencies above 200 Hz generally should not yield significant tone corrections. However, for consistency, each tone correction value must be included in the computation for spectral irregularities. While the tone corrections below 200 Hz may be ignored for the spectral irregularity correction, the NPL values must be included in the NPL calculation prescribed in section 153.12 of this appendix.

(a) After the value of FNILTM for each flyover-noise history is identified, the frequency for the lowest tone correction factor (CNL) must be identified for the two preceding and the two succeeding, 60-second time intervals, to identify possible tone suppressor at FNILTM as a result of sharp filtering of the tone. If the value of CNL for FNILTM is less than the average value of CNL for the five consecutive time intervals, that average value of CNL must be used to constitute the new value for FNILTM.

(2) After determining tone corrected perceived noise level. (a) The maximum tone corrected perceived noise level, FNILTM, is the maximum calculated value of the tone corrected perceived noise level, FNILTM, calculated in accordance with the procedure of section 153.12 of this appendix. Figure 10 is an example of a flyover noise history where the maximum value in the noise level is clearly identified. Half-second time intervals, CNL, are small enough to obtain a satisfactory noise level history.
Table 14—Aeronautics and Space

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Step 1: \( (f_0) - (f_1) \)
Step 2: \( (f_0) - (f_1) \)
Step 3: see instructions
Step 4: see instructions
Step 5: see Table 12

Diagram:

- **Figure 32. Example of Perceived Noise Level Corrected for Noise as a Function of Aircraft Flyover Time**
- **Equation:** \( D = 10 \log \left( \frac{1}{T} \right) \int_{t_1}^{t_2} \text{PNLTM} \, \text{dB} \) - PNLTM
- **Diagram:**
  - T is a normalization time constant.
  - (1) and (2) are the limits of the aircraft flyover time.
  - PNLTM is the maximum value of PNL.
  - FNLTM is the minimum value of PNL.

(1) Since PNLTM is calculated from measured values of SPL, there will, in general, be no obvious equation for PNLTM as a function of time. Consequently, the equation can be rewritten with a summation sign instead of an integral sign as follows:

where \( T \) is a normalization time constant, and \( t_1 \) and \( t_2 \) are the limits of the aircraft flyover time.
Title 14—Aeronautics and Space

Appendix A and Appendix B of this part, or more approved equivalent procedures

Section C35.1 Noise measurement and evaluation. Compliance with the noise levels standards of section C35.3 must be shown—

(a) For takeoff, at a point 30 feet (9.16 meters) from the start of the takeoff roll on the extended centerline of the runway.

(b) For approach, at a point 30 feet (9.16 meters) from the threshold on the extended centerline of the runway and

(c) For sideline at the point on a line parallel to and 1,470 feet (450 meters) from the extended centerline of the runway, where the noise level after takeoff is greatest, except that for an airplane powered by more than three turbine engines, this distance must be 3.05 nautical miles for the purpose of establishing compliance with Stage 1 or Stage 2 noise limits as applicable.

Sec. C35.3 Noise levels.

(a) Limits. Except as provided in paragraph (c) of this section, the noise level in the vicinity of the airport, at the measuring points described in section C35.3, does not exceed the following with appropriate interpolation between values.

(b) Table D4 lists the values of the important constants necessary to calculate sound pressure level as a function of perceived loudness.

(1) For takeoff, 105 EPNdB for maximum weight of 50,000 pounds or more, reduced by 5 EPNdB per increase of the 50,000 pounds maximum weight down to 0 EPNdB for maximum weight of 10,000 pounds or less.

(2) For approach and stage 3 noise limits are as follows:—

(3) Stage 3 noise limits are as follows:

(a) For aircraft with more than 3 engines, 105 EPNdB for maximum weight of 50,000 pounds or more, reduced by 5 EPNdB per increase of the 60,000 pounds maximum weight down to 0 EPNdB for maximum weight of 44,673 pounds or less.

(b) For airplanes with 3 engines—105 EPNdB for maximum weight of 50,000 pounds or more, reduced by 4 EPNdB per increase of the 60,000 pounds maximum weight down to 0 EPNdB for maximum weight of 44,673 pounds or less.

(c) For airplanes with less than 3 engines—105 EPNdB for maximum weight of 50,000 pounds or more, reduced by 4 EPNdB per increase of the 60,000 pounds maximum weight down to 0 EPNdB for maximum weight of 44,673 pounds or less.

(4) For airplanes with less than 3 engines—105 EPNdB for maximum weight of 50,000 pounds or more, reduced by 4 EPNdB per increase of the 60,000 pounds maximum weight down to 0 EPNdB for maximum weight of 44,673 pounds or less.

(d) For airplanes with less than 3 engines, 105 EPNdB for maximum weight of 50,000 pounds or more, reduced by 4 EPNdB per increase of the 60,000 pounds maximum weight down to 0 EPNdB for maximum weight of 44,673 pounds or less.

(2) For approach, regardless of the number of engines, 105 EPNdB for maximum weight of 50,000 pounds or more, reduced by 3 EPNdB per increase of the 60,000 pounds maximum weight down to 0 EPNdB for maximum weight of 44,673 pounds or less.

(2) For approach, regardless of the number of engines, 105 EPNdB for maximum weight of 50,000 pounds or more, reduced by 3 EPNdB per increase of the 60,000 pounds maximum weight down to 0 EPNdB for maximum weight of 44,673 pounds or less.

(2) For approach, regardless of the number of engines, 105 EPNdB for maximum weight of 50,000 pounds or more, reduced by 3 EPNdB per increase of the 60,000 pounds maximum weight down to 0 EPNdB for maximum weight of 44,673 pounds or less.

(2) For approach, regardless of the number of engines, 105 EPNdB for maximum weight of 50,000 pounds or more, reduced by 3 EPNdB per increase of the 60,000 pounds maximum weight down to 0 EPNdB for maximum weight of 44,673 pounds or less.
(c) The approaches must be conducted with a steady state angle of 2° or less and must be continued to a normal touchdown with no airframe configuration changes.

(2) Except as provided in paragraph (1) of this section, a steady approach speed of not less than 1.30 VSO + 10 knots must be established and maintained over the approach measuring point.

(3) All engines must be operating at approximately the same power or thrust.

(4) For applications made for aeronautical charts published after December 17, 1971, for Corvair airplanes, the following apply:

(1) For Corvair airplanes the steady approach speed is 1.30 VSO + 10 knots or the approved landing speed at 35 feet (for turbine engine powered airplanes) or 50 knots (for reciprocating engine powered airplanes), whichever speed is greater, as determined by the procedures contained in the regulations for the type certification basis of the airplane. These speeds need not be less than the approach speed at the test altitude.

(2) For Corvair airplanes the test speed and the approach speed must be determined by the procedures contained in the regulations for the type certification basis of the airplane. These speeds need not be less than the approach speed at the test altitude.

(3) For Corvair airplanes, the test speed and the approach speed must be the minimum speed required by the regulations for the type certification basis of the airplane. These speeds need not be less than the approach speed at the test altitude.

(4) Except as provided in paragraphs (1) and (2) of this section, a speed of at least 1.30 VSO + 10 knots must be maintained over the approach measuring point.
Title 14—Aeronautics and Space

Chapter I—Federal Aviation Administration

Part 90—Data Communications

Sec. 90.90 Correlation of data

(a) Noise data obtained when the temperature is outside the range of 68 degrees F. ± 5 degrees F., or the relative humidity is below 40 percent, must be corrected to 71 degrees F. and 10 percent relative humidity by a method approved by the FAA.

(b) The performance correction prescribed in paragraphs (a) of this section must be used. It must be determined by the method described in this appendix, and must be added algebraically to the measured value. It is limited to 0.01 dBA.

(c) The performance correction must be computed by using the following formula:

\[ \text{dB} = 05 - 20 \log \left( \frac{91,440 \cdot \text{Da}}{\text{Vc}} \right) \]

Where:

- \( \text{dB} \) = Spared critical test rate of climb (cpi)
- \( \text{Vc} \) = Speed for best rate of climb in the same unit as rate of climb

(d) When takeoff distance to 50 feet is not as described in approved performance information, the figures at 2000 for single-engine airplanes and 1600 for multi-engine airplanes must be used.

Sec. 90.91 Validation of results

(a) The test results must be published in an aeronautical publication and shall be made available to the public. The test results shall be published in a manner approved by the FAA.

(b) The test results shall be published in such a manner as to provide for the general public the information necessary to make an informed decision regarding the performance of the aircraft.

Sec. 90.92 Airplanes produced under type certificates conforming to this paragraph must meet paragraphs (a) of this section for the operational conditions:

- Air temperature and relative humidity.

Sec. 90.93 Calculations

(a) Maximum, minimum, and average wind velocities.

(b) Comments on topography, ground cover, and winds that might interfere with sound recordings must be reported.

Sec. 90.94 Airplane information

(a) Type, model, and serial numbers of all airplanes, engines, and propellers.

(b) The stability, performance, and operating characteristics of the airplane, including maximum certificated takeoff weight.

(c) Altitude and wind speed in knots for each equivalent of the measuring point.

(d) Engine power in terms of revolutions per minute and other related parameters for each test flight.

(e) Aircraft height in feet determined by a calibrated altimeter in the airplane, approved photographic techniques, or approved tracking facilities.

(f) Aircraft speed and position and engine performance parameters must be recorded at an approved sampling rate sufficient to ensure compliance with the test procedures and conditions of this appendix.

Sec. 90.111 Flight procedures

(a) Tests to demonstrate compliance with the noise level requirements of this appendix must include at least six flight tests over the measuring station at a height of 1,000 ± 50 and 410 degrees from the zenith when testing overhead.

(b) Each test over flight must be conducted:

1. At not less than the highest power in the normal operating range provided in an Airplane Flight Manual, or in any combination of approved material such as a replacement, or approved instrument rating.

2. At stabilized speed with propellers synchronized and with the airplane in cruise configuration, except that if the speed at the power setting prescribed in this paragraph would exceed the maximum speed authorized in level flight, accelerated flight is acceptable.
§ 20.

(a) For issuance or renewal of any airworthiness certificate or rating for which application for a certificate or an amendment thereto is received on or after January 1, 1975, the aural limits prescribed in paragraph (a) of this section apply. Such limitations may not be exceeded at weights from 25,000 to 12,000 pounds.

(b) The aural limits prescribed in paragraph (a) of this section apply, except that the requirements of paragraph (c) of this section apply, regardless of date of application, to the original issuance of the certificate for that airplane.

(Rev. Apr. 12, 1973, 38 F.R. 13079, Feb. 11, 1973; as amended by
SECTION 3B

PART 150
Part 150—Airport Noise Compatibility Planning

Subpart A—General Provisions

§ 150.1 Scope and purpose.

This Part prescribes the procedures, standards, and methodology governing the development, submission, and review of airport noise exposure maps and airport noise compatibility programs, including the process for evaluating and approving or disapproving those programs.

It prescribes single systems for—(a) measuring noise at airports and surrounding areas that generally provides a highly reliable relationship between projected noise exposure and surveyed reaction of people to noise; and (b) determining exposure of individuals to noise that results from the operations of an airport. This Part also identifies those land uses which are normally compatible with various levels of exposure to noise by individuals. It provides technical assistance to airport operators, in conjunction with other local, State, and Federal authorities, to prepare and execute appropriate noise compatibility planning and implementation programs.

§ 150.3 Applicability.

This Part applies to the airport noise compatibility planning activities of the operators of "public use airports," not used exclusively by helicopters, as that term is used in Section 101(1) of the ASNA Act as amended (49 U.S.C. 2101) and as defined in § 502(17) of the Airport and Airway Improvement Act of 1982 (49 U.S.C. 2202).

§ 150.5 Limitations of this Part.

(a) Pursuant to the ASNA Act (49 U.S.C. § 2101 et seq.), this Part provides for airport noise compatibility planning and land use programs necessary to the purposes of these provisions. No submission of a map, or approval or disapproval, in whole or part, of any map or program submitted under this Part is a determination concerning the acceptability or unacceptability of that land use under Federal, State, or local law.

(b) Approval of a noise compatibility program under this Part is neither a commitment by the FAA to financially assist in the implementation of the program, nor a determination that all measures covered by the program are eligible for grant-in-aid funding from the FAA.

(c) Approval of a noise compatibility program under this Part does not by itself constitute an FAA implementing action. A request for Federal action or approval to implement specific noise compatibility measures may be required, and an FAA decision on the request may require an environmental assessment of the proposed action, pursuant to the National Environmental Policy Act (42 U.S.C. § 4321 et seq.) and applicable regulations, directives, and guidelines.

(d) Acceptance of a noise exposure map does not constitute an FAA determination that any specific parcel of land lies within a particular noise contour. Responsibility for interpretation of the effects of noise contours upon adjacent land uses, including the relationship between noise contours and specific properties, rests with the sponsor or with other State or local government.

§ 150.7 Definitions.

As used in this Part, unless the context requires otherwise, the following terms have the following meanings:

"Airport" means any public use airport, not exclusively used by helicopters, as defined by the ASNA Act, including: (a) Any airport which is used or to be used for public purposes, under the control of a public agency, the landing area of which is publicly owned; (b) any privately owned reliever airport; and (c) any privately owned airport which is determined by the Secretary to enplane annually 2,500 or more passengers and
receive scheduled passenger service of aircraft,  
which is used or to be used for public purposes.

"Airport noise compatibility program" and  
"program" mean that program, and all revision  
thereto, reflected in documents (and revised documents) developed in accordance with  
Appendix B of this Part, including the measures  
proposed or taken by the airport operator to  
reduce existing noncompatible land uses and to  
prevent the introduction of additional noncompatible land uses within the area.

"Airport Operator" means the operator of an  
airport as defined in the ASNA Act.

"ASNA Act" means the Aviation Safety and  
Noise Abatement Act of 1979, as amended (49  
U.S.C. § 2101 et seq.).

"Average sound level" means the level in  
decibels, of the mean-square, A-weighted sound  
pressure during a specified period, with  
reference to the square of the standard  
reference sound pressure of 20 micropascals.

"Compatible land use" means the use of land  
that is identified under this Part as normally  
compatible with the outdoor noise environment  
(or an adequately attenuated noise level)  
resulting from any indoor activities and at the  
location because the yearly day-night average sound level is at or below that identified for that or similar use under Appendix A (Table 1) of this Part.

"Day-night average sound level" (DNL)  
means the 24-hour average sound level, in  
decibels, for the period from midnight to midnight,  
obtained after the addition of ten decibels to  
sound levels for the periods between midnight and 7 A.M., and between 10 P.M. and midnight,  
local time." The symbol for DNL is $L_{\text{DNL}}$.

"Noise exposure map" means a scaled,  
geographic depiction of an airport, its noise  
contours, and surrounding area developed in  
accordance with Section A185.101 of Appendix  
A of this Part, including the accompanying  
documentation setting forth the methodology  
descriptions of forecast aircraft operations at  
the airport during the fifth calendar year begin- 
ning after submission of the map, together with  
the ways, if any, those operations will affect the  
map (including noise contours and the forecast  
land uses).

"Noise level reduction" (NLR) means the  
amount of noise level reduction in decibels  
achieved through incorporation of noise attenua- 
tion (between outdoor and indoor levels) in the  
design and construction of a structure.

"Noncompatible land use" means the use of  
land that is identified under this Part as  
normally compatible with the outdoor noise  
environment (or an adequately attenuated noise  
level reduction for the indoor activities involved  
at the location) because the yearly day-night  
average sound level is above that identified for  
that or similar use under Appendix A (Table 1)  
of this Part.

"Regional Director" means the Director of  
the FAA Region having responsibility for the  
geographic area in which the airport in question  
is located.

"Restriction affecting flight procedures"  
means an enactment, regulation, limitation, or other  
requirement affecting the operation of aircraft in the air  
or on the ground.

"Sound exposure level" means the level, in  
decibels, of the time integral of squared  
A-weighted sound pressure during a specified  
period or event, with reference to the square of  
the standard reference sound pressure of 20  
micropascals and a duration of one second.

"Yearly day-night average sound level"  
(YDNL) means the 365-day average, in decibels,  
day-night average sound level. The symbol for  
YDNL is $L_{\text{YDNL}}$.

§ 150.9 Designation of noise systems.

For purposes of this Part, the following  
designations apply:

(a) The noise at an airport and surrounding  
areas covered by a noise exposure map must be  
measured in A-weighted sound pressure level  
($L_{\text{A}}$) in units of decibels (dBA) in accordance  
with the specifications and methods prescribed  
under Appendix A of this Part.

(b) The exposure of individuals to noise  
resulting from the operation of an airport must  
be established in terms of yearly day-night  
average sound level (YDNL) calculated in  
accordance with the specifications and methods  
prescribed under Appendix A of this Part.

(c) Use of computer models to create noise  
contour maps must be in accordance with the criteria  
prescribed under Appendix A of this Part.
§ 150.11 Identification of land uses.

For the purposes of this Part, uses of land which are normally compatible or noncompatible with various noise exposure levels to individuals around airports must be identified in accordance with the criteria presented under Appendix A of this Part. Determination of land use must be based on professional planning criteria and procedures utilizing comprehensive, or master, land use planning, zoning, and building and site designing, as appropriate. If more than one current or future land use is permissible, determination of compatibility must be based on that most adversely affected by noise.

§ 150.12 Incorporations by reference.

(a) General. This Part prescribes certain standards and procedures which are not set forth in full text in the rule. These standards and procedures are hereby incorporated by reference and were approved for incorporation by reference by the Director of the Federal Register under 5 U.S.C. § 552(a) and 1 CFR Part 51.

(b) Changes to incorporated matter. Incorporated matter which is subject to subsequent change is incorporated by reference according to the specific reference and to the identification statement. Adoption of any subsequent change in incorporated matter that affects compliance with standards and procedures of this Part will be made under 14 CFR Part 11 and 1 CFR Part 51.

(c) Identification statement. The complete title or description which identifies each published matter incorporated by reference in this Part is as follows:


(d) Availability for purchase. Published material incorporated by reference in this Part may be purchased at the price established by the publisher or distributor at the following mailing addresses:

IEC publications:

(1) The Bureau Central de la Commission Electrotechnique, Internationale, 1, rue de Varanbo, Geneva, Switzerland.

(2) American National Standards Institute, 1430 Broadway, New York, NY 10018.

(e) Availability for inspection. A copy of each publication incorporated by reference in this Part is available for public inspection at the following locations:

(1) FAA Office of the Chief Counsel, Rules Docket, Room 916, Federal Aviation Administration Headquarters Building, 800 Independence Avenue, SW., Washington, D.C. 20591.

(2) Department of Transportation, Branch Library, Room 930, Federal Aviation Administration Headquarters Building, 800 Independence Avenue, SW., Washington, D.C. 20591.

(3) The respective Regional Offices of the Federal Aviation Administration as follows:


(iii) Southern Regional Office, 3400 Norman Berry Street, East Point, Georgia (P.O. Box 20838, Atlanta, Georgia) 30320.


(v) Central Regional Office, 601 East 12th Street, Kansas City, Missouri 64106.

(vi) Southwest Regional Office, 4400 Blue Mound Road, (P.O. Box 1689), Fort Worth, Texas 76101.

(vii) Northwest Mountain Regional Office, 17900 Pacific Highway, South, C-88986, Seattle, Washington 98188.

(viii) Western Pacific Regional Office, 15000 Aviation Boulevard, Hawthorne, California (P.O. Box 92007, Worldway Postal Center, Los Angeles) 90009.

(ix) Alaskan Regional Office, 701 "C" Street, Box 14, Anchorage, Alaska 99513.

(x) European Office, 15, Rue de la Loi (3rd Floor) B!040 Brussels, Belgium.

(x) The Office of the Federal Register, Room 8401, 1100 "L" Street, NW, Washington, D.C.
§ 150.27 Noise exposure maps and related descriptions.

(a) Each airport operator may, after completion of the consultations and public procedure specified under paragraph (b) of this section, submit to the Regional Director five copies of the noise exposure map (or revised map) which identifies each noncompatible land use in each area depicted on the map, as of the date of submission, and five copies of a map each with accompanying documentation setting forth—

(1) The noise exposure based on forecast aircraft operations at the airport for the fifth calendar year beginning after the date of submission (based on reasonable assumptions concerning future type and frequency of aircraft operations, number of nighttime operations, flight patterns, airport layout including any planned airport development, planned land use changes, and demographic changes in the surrounding areas); and

(2) The nature and extent, if any, to which those forecast operations will affect the compatibility of land uses depicted on the map.

(b) Each map, and related documentation submitted under this section must be developed and prepared in accordance with Appendix A of this part, or an FAA approved equivalent, and in consultation with states, and public agencies and planning agencies whose area, or any portion of whose area, of jurisdiction is within the Ldn 65 dB contour depicted on the map, FAA regional officials, and other Federal officials having local responsibility for the area depicted on the map. This consultation must include regular aeronautical users of the airport. The airport operator shall certify that it has afforded interested persons adequate opportunity to submit their views, data, and comments concerning the correctness and adequacy of the draft noise exposure map and descriptions of forecast aircraft operations. Each map and revised map must be accompanied by documentation describing the consultation accomplished under this paragraph and the opportunities afforded the public to review and comment during the development of the map. One copy of all written comments received during consultation shall also be filed with the Regional Director.

(c) The Regional Director acknowledges receipt of noise exposure maps and descriptions and indicates whether they are in compliance with the applicable requirements. The Regional Director publishes in the FEDERAL REGISTER a notice of compliance for each such noise exposure map and description, identifying the airport involved. Such notice includes information as to when and where the map and related documentation are available for public inspection.

(d) If, after submission of a noise exposure map under paragraph (a) of this section, any change in the operation of the airport would create any "substantial, new noncompatible use" in any area depicted on the map beyond that which is forecast for the fifth calendar year after the date of submission, airport operator shall, in accordance with this section, promptly prepare and submit a revised noise exposure map. A change in the operation of an airport creates a substantial new noncompatible use if that change results in an increase in the yearly day-night average sound level of 15 dB or greater in either a land area which was formerly compatible but is thereby made noncompatible under Appendix A (Table 1), or in a land area which was previously determined to be noncompatible under that Table and whose noncompatibility is now significantly increased. Such updating of the map shall include a reassessment of those areas excluded under Sec. A150.101(e) (6) of Appendix A because of high ambient noise levels. If the five-year forecast map is based on assumptions involving recommendations in a noise compatibility program which are subsequently disapproved by the FAA, a revised map must be submitted if revised assumptions would create a substantial, new noncompatible use not indicated on the initial five-year map. Revised noise exposure maps are subject to the same requirements and procedures as initial submissions of noise exposure maps under this Part.

(e) Each map, or revised map, and description of consultation and opportunity for public comment submitted to the FAA, must be certified as true and complete under penalty of 15 U.S.C. § 1001.

(f) (1) The ASNA Act provides, in Section 107(a) (49 U.S.C. 2117(a)), that no person who acquires property or an interest therein after the date of enactment of the Act in an area sur-
ronding an airport with respect to which a noise exposure map has been submitted under Section 107 of the Act shall be entitled to recover damages with respect to the noise attributable to such airport if such person had actual or constructive knowledge of the existence of such noise exposure map unless, in addition to any other elements for recovery of damages, such person can show that—

(i) A significant change in the type or frequency of aircraft operations at the airport;

(ii) A significant change in the airport layout;

(iii) A significant change in the flight patterns;

(iv) A significant increase in nighttime operations, occurred after the date of the acquisition of such property or interest therein and that the damages for which recovery is sought have resulted from any change or increase.

(2) The Act further provides in Section 107(b), (49 U.S.C. 2107(b)): That for this purpose, "constructive knowledge" shall be imputed, at a minimum, to any person who acquires property or an interest therein in an area surrounding an airport after the date of enactment of this Act if—

(i) Prior to the date of such acquisition, notice of the existence of a noise exposure map for such area was published at least three times in a newspaper of general circulation in the country in which such property is located; or

(ii) A copy of such noise exposure map is furnished to such person at the time of such acquisition.

(g) For this purpose, the term "significant" in paragraph (f) of this section means that change or increase in one or more of the four factors which results in a "substantial new noncompatible use" as defined in § 150.21(d), affecting the property in issue. Responsibility for applying or interpreting this provision with respect to specific properties rests with local government.

§ 150.23 Noise compatibility programs.

(a) Any airport operator who has submitted an acceptable noise exposure map under § 150.21 may, after FAA notice of acceptability and other consultation and public procedure specified under paragraphs (b) and (c) of this section, as applicable, submit to the Regional Director five copies of a noise compatibility program.

(b) An airport operator may submit the noise compatibility program at the same time as the noise exposure map. In this case, the Regional Director will not begin the statutory 180-day review period (for the program) until after FAA reviews the noise exposure map and finds that it and its supporting documentation are in compliance with the applicable requirements.

(c) Each noise compatibility program must be developed and prepared in accordance with Appendix B of this Part, or an FAA approved equivalent, and in consultation with FAA regional officials, the officials of the state and of any public agencies and planning agencies whose area, or any portion of whose area, is depicted on the noise exposure map, and other Federal officials having local responsibility for land uses depicted on the map. Consultation with FAA regional officials shall include, to the extent practicable, informal agreement from FAA on proposed new or modified flight procedures. For air carrier airports, consultation must include any air carriers and, to the extent practicable, other aircraft operators using the airport. For other airports, consultation must include, to the extent practicable, aircraft operators using the airport.

(d) Prior to and during the development of a program, and prior to submission of the resulting draft program to the FAA, the airport operator shall afford adequate opportunity for the active and direct participation of the states, and public agencies and planning agencies in the areas surrounding the airport, aeronautical users of the airport, and the general public to submit their views, data, and comments on the formulation and adequacy of that program.

(e) Each noise compatibility program submitted to the FAA must consist of at least the following:

(1) A copy of the noise exposure map and its supporting documentation as found in compliance with the applicable requirements by the FAA, per § 150.21(c).

(2) A description and analysis of the alternative measures considered by the airport operator in developing the program, together
with a discussion of why each rejected measure was not included in the program.

(3) Program measures proposed to reduce or eliminate present and future incompatible land uses and a description of the relative contribution of each of the proposed measures to the overall effectiveness of the program.

(4) A description of public participation and the consultation with officials of public agencies and planning agencies in areas surrounding the airport, FAA regional officials and other Federal officials having local responsibility for land uses depicted on the map, any air carriers and other users of the airport.

(5) The actual or anticipated effect of the program on reducing noise exposure to individuals and incompatible land uses and preventing the introduction of additional incompatible uses within the area covered by the noise exposure map. The effects must be based on expressed assumptions concerning the type and frequency of aircraft operations, number of nighttime operations, flight patterns, airport layout including planned airport development, planned land use changes, and demographic changes within the Ldn 65 dB noise contour.

(6) A description of how the proposed future actions may change any noise control or compatibility plans or actions previously adopted by the airport proprietor.

(7) A summary of the comments at any public hearing on the program and a copy of all written material submitted to the operator under paragraphs (c) and (d) of this section, together with the operator's responses and disposition of those comments and materials to demonstrate the program is feasible and reasonably consistent with obtaining the objectives of airport noise compatibility planning under this Part.

(8) The period covered by the program, the schedule for implementation of the program, the persons responsible for implementation of each measure in the program, and, for each measure, documentation supporting the feasibility of implementation, including any essential governmental actions and anticipated sources of funding that will demonstrate that the program is reasonably consistent with achieving the goals of airport noise compatibility planning under this Part.

(9) Provision, for revising the program if made necessary by revision of the noise exposure map.

Subpart C—Evaluations and Determinations of Effects of Noise Compatibility Programs

PART A—GENERAL

§ 150.21 Preliminary review: acknowledgments.

(a) Upon receipt of a noise compatibility program submitted under § 150.20, the Regional Director acknowledges to the airport operator receipt of the program and conducts a preliminary review of the submission.

(b) If, based on the preliminary review, the Regional Director finds that the submission does not conform to the requirements of this Part, he disapproves and returns the unacceptable program to the airport operator for reconsideration and development of a program in accordance with this Part.

(c) If, based on the preliminary review, the Regional Director finds that the program conforms to the requirements of this Part, the Regional Director publishes in the FEDERAL REGISTER a notice of receipt of the program for comment which indicates the following:

1. The airport covered by the program,

2. The date of receipt.

3. The availability of the program for examination in the offices of the Regional Director and the airport operator.

4. That comments on the program are invited and will be considered by the FAA.

5. The date of signature of the published notice of receipt starts the 120-day approval period for the program.

§ 150.23 Evaluation of programs.

(a) The FAA conducts an evaluation of each noise compatibility program and, based on that evaluation, either approves or disapproves the program. The evaluation includes consideration of proposed measures to determine whether they—

1. May create an undue burden on interstate or foreign commerce (including unjust discrimination);
(2) Are reasonably consistent with obtaining the goal of reducing existing noncompatible land uses and preventing the introduction of additional noncompatible land uses; and

(3) Include the use of new or modified flight procedures to control the operation of aircraft for purposes of noise control, or affect flight procedures in any way.

(b) The evaluation may also include an evaluation of these proposed measures to determine whether they may adversely affect the exercise of the authority and responsibilities of the Administrator under the Federal Aviation Act of 1958, as amended.

(c) To the extent considered necessary, the FAA may—

(1) Confer with the airport operator and other persons known to have information and views material to the evaluation;

(2) Explore the objectives of the program and the measures, and any alternative measures, for achieving the objectives;

(3) Examine the program for developing a range of alternatives that would eliminate the reasons, if any, for disapproving the program;

(4) Convene an informal meeting with the airport operator and other persons involved in developing or implementing the program for the purposes of gathering all facts relevant to the determination of approval or disapproval of the program and of discussing any means to accommodate or modify the program as submitted.

(d) If requested by the FAA, the airport operator shall furnish all information needed to complete FAA's review under (c).

(e) An airport operator may, at any time before approval or disapproval of a program, withdraw or revise the program. If the airport operator withdraws or revises the program or indicates to the Regional Director, in writing, the intention to revise the program, the Regional Director terminates the evaluation and notifies the airport operator of that action. That termination cancels the 180-day review period. The FAA does not evaluate a second program for any airport until any previously submitted program has been withdrawn or a determination on it is issued. A new evaluation is commenced upon receipt of a revised program, and a new 180-day approval period is begun, unless the Regional Director finds that the modifications made, in light of the overall revised program, can be integrated into the unmodified portions of the revised program without exceeding the original 180-day approval period or causing undue expense to the government.

§ 150.25 Determinations; publication; effectivity.

(a) The FAA issues a determination approving or disapproving each airport noise compatibility program (and revised program). Portions of a program may be individually approved or disapproved. No conditional approval will be issued. A determination on a program acceptable under this Part is issued within 180 days after the program is received under § 150.23 of this Part or it may be considered approved, except that this time period may be exceeded for any portion of a program relating to the use of flight procedures for noise control purposes. A determination on portions of a program covered by the exceptions to the 180-day review period for approval will be issued within a reasonable time after receipt of the program. Determinations relating to the use of any flight procedure for noise control purposes may be issued either in connection with the determination on other portions of the program or separately. Except as provided by this paragraph, no approval of any noise compatibility program, or any portion of a program, may be implied in the absence of the FAA's express approval.

(b) The Administrator approves programs under this Part, if—

(1) It is found that the program measures to be implemented would not create an undue burden on interstate or foreign commerce (including any unjust discrimination) and are reasonably consistent with achieving the goals of reducing existing noncompatible land uses around the airport and of preventing the introduction of additional noncompatible land uses;

(2) The program provides for revision if made necessary by the revision of the noise map; and

(3) Those aspects of programs relating to the use of flight procedures for noise control can be implemented within the period covered by the program and without—
(i) Reducing the level of aviation safety provided;

(ii) Derogating the requisite level of protection for aircraft, their occupants and persons and property on the ground;

(iii) Adversely affecting the efficient use and management of the Navigable Airspace and Air Traffic Control Systems or

(iv) Adversely affecting any other powers and responsibilities of the Administrator prescribed by law or any other program, standard, or requirement established in accordance with law.

(c) When a determination is issued, the Regional Director notifies the airport operator and publishes a notice of approval or disapproval in the FEDERAL REGISTER identifying the scope and extent of the determination.

(d) Approvals issued under this Part for a program or portion thereof become effective as specified therein and may be withdrawn when one of the following occurs:

(1) The program or portion thereof is required to be revised under this Part or under its own terms, and is not so revised;

(2) If a revision has been submitted for approval, a determination is issued on the revised program or portion thereof, that is inconsistent with the prior approval.

(3) A term or condition of the program, or portion thereof, or its approval is violated by the responsible government body.

(4) A flight procedure or other FAA action upon which the approved program or portion thereof is dependent is subsequently disapproved, significantly altered, or rescinded by the FAA.

(5) The airport operator requests rescission of the approval.

(6) Impacts on flight procedures, air traffic management, or air commerce occur which could not be foreseen at the time of approval.

A determination may be sooner rescinded or modified for cause with at least 30 days written notice to the airport operator of the FAA's intention to rescind or modify the determination for the reasons stated in the notice. The airport operator may, during the 30-day period, submit to the Regional Director for consideration any reasons and circumstances why the determination should not be rescinded or modified on the basis stated in the notice of intent. Thereafter, the FAA either rescinds or modifies the determination consistent with the notice or withdraws the notice of intent and terminates the action.

(e) Determinations may contain conditions which must be satisfied prior to implementation of any portion of the program relating to flight procedures affecting airport or aircraft operations.

(f) Noise exposure maps for current and five year forecast conditions that are submitted and approved with noise compatibility programs are considered to be the new FAA accepted noise exposure maps for purposes of Part 150.
Appendix A

Noise Exposure Maps

PART A—GENERAL

§ A150.1 Purpose.

(a) This Appendix establishes a uniform methodology for the development and preparation of airport noise exposure maps. This methodology includes a single system of measuring noise at airports for which there is a highly reliable relationship between projected noise exposure and surveyed reactions of people to noise along with a separate single system for determining the exposure of individuals to noise. It also identifies land uses which, for the purpose of this Part are considered to be compatible with various exposures of individuals to noise around airports.

(b) This Appendix provides for the use of the FAA's Integrated Noise Model (INM) or an FAA approved equivalent, for developing standardized noise exposure maps and predicting noise impacts. Noise monitoring may be utilized by airport operators for data acquisition and data refinement, but is not required by this Part for the development of noise exposure maps or airport noise compatibility programs. Whenever noise monitoring is used, under this Part, it should be accomplished in accordance with Sec. A150.5 of this Appendix.

§ A150.2 Noise descriptors.

(a) Airport Noise Measurement. The A-Weighted Sound Level, measured, filtered and recorded in accordance with Sec. A150.5 of this Appendix, must be employed as the unit for the measurement of single event noise at airports and in the areas surrounding the airports.

(b) Airport Noise Exposure. The yearly day-night average sound level (YDNL) must be employed for the analysis and characterization of multiple aircraft noise events and for determining the cumulative exposure of individuals to noise around airports.

§ A150.5 Noise measurement procedures and equipment.

(a) Sound levels must be measured or analyzed with equipment having the “A” frequency weighting, filter characteristics, and the “slow response” characteristics as defined in International Electrotechnical Commission (IEC) Publication No. 179, entitled “Precision Sound Level Meters” as incorporated by reference in Part 150 under § 150.11. For purposes of this Part, the tolerances allowed for general purpose, type 2 sound level meters in IEC 179, are acceptable.

(b) Noise measurements and documentation must be in accordance with accepted acoustical measurement methodology, such as those described in American National Standards Institute publication ANSI 51.13, dated 1971 as revised 1979, entitled “ANS—Methods for the Measurement of Sound Pressure Levels”; ARP No. 796, dated 1969, entitled “Measurement of Aircraft Exterior Noise in the Field”; “Handbook of Noise Measurement,” Ninth Ed. 1980, by Arnold P. G. Peterson; or “Acoustic Noise Measurement,” dated Jan. 1979, by J. R. Hassell and K. Zavoti. For purposes of this Part, measurements intended for comparison to a State or local standard or with another transportation noise source (including other aircraft) must be reported in maximum A-weighted sound levels (L_{A,eq}) for computation or validation of the yearly day-night average level (L_{D,eq}). Measurements must be reported in sound exposure level (L_{AEP}), as defined in Sec. A150.205 of this Appendix.
PART 8—NOISE EXPOSURE MAP DEVELOPMENT

§ A180.101 Noise contours and land uses.

(a) To determine the extent of the noise impact around an airport, airport proprietors developing noise exposure maps in accordance with this Part must develop Ldn contours. Continuous contours must be developed for YDNL levels of 65, 70, and 75 (additional contours may be developed and depicted when appropriate). In those areas where YDNL values are 65 YDNL or greater, the airport operator shall identify land uses and determine land use compatibility in accordance with the standards and procedures of this Appendix.

(b) Table I of this Appendix describes compatible land use information for several land uses as a function of YDNL values. The ranges of YDNL values in Table I reflect the statistical variability for the responses of large groups of people to noise. Any particular level might not, therefore, accurately assess an individual's perception of an actual noise environment. Compatible or noncompatible land use is determined by comparing the predicted or measured YDNL values at a site with the values given. Adjustments or modifications of the description of the land-use categories may be desirable after consideration of specific local conditions.

(c) Compatibility designations in Table I generally refer to the major use of the site. If other uses with greater sensitivity to noise are permitted by local governments at a site, a determination of compatibility must be based on that use which is most adversely affected by noise. Where appropriate, noise level reduction through incorporation of sound attenuation into the design and construction of a structure may be necessary to achieve compatibility.

(d) For the purpose of compliance with this Part, all land uses are considered to be compatible with noise levels less than Ldn 65 dB. Local needs or values may dictate further delineation based on local requirements or determinations.

(e) Except as provided in (c) below, the noise exposure maps must also contain and identify:

(1) Runway locations.
(2) Flight tracks.
(3) Noise contours of Ldn 65, 70, and 75 dB resulting from aircraft operations.
(4) Outline of the airport boundaries.
(5) Noncompatible land uses within the noise contours, including those within the Ldn 65 dB contours. (No land use has to be identified as noncompatible if the self-generated noise from that use and/or the ambient noise from other nonairport and nonairport uses is equal to or greater than the noise from aircraft and airport sources.)
(6) Location of noise sensitive public buildings (such as schools, hospitals, and health care facilities), and properties on or eligible for inclusion in the National Register of Historic Places.
(7) Locations of any aircraft noise monitoring sites utilized for data acquisition and refinement procedures.
(8) Estimates of the number of people residing within the Ldn 65, 70, and 75 dB contours.
(9) Depiction of the required noise contours over a land use map of a sufficient scale and quality to discern areas and other identifiable geographic features.

(f) Notwithstanding any other provision of this Part, noise exposure maps prepared in connection with studies which were either Federally funded or Federally approved and which commenced before October 1, 1981, are not required to be modified to contain the following items:

(1) Flight tracks depicted on the map.
(2) Use of ambient noise to determine land use compatibility.
(3) The Ldn 70 dB noise contour and data related to the Ldn 70 dB contour. When determinations on land use compatibility using Table I differ between Ldn 65–70 dB and the Ldn 70–75 dB, determinations should either use the more conservative Ldn 70–75 dB column or reflect determinations based on local needs and values.
(4) Estimates of the number of people residing within the Ldn 65, 70, and 75 dB contours.
### TABLE 1

**LAND USE COMPATIBILITY* WITH YEARLY DAY-NIGHT AVERAGE SOUND LEVELS**

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Below 65</th>
<th>65-70</th>
<th>70-75</th>
<th>75-80</th>
<th>80-85</th>
<th>Over 85</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Residential</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residential, other than mobile homes and transient lodgings</td>
<td>Y N(1)</td>
<td>N(1)</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Mobile home parks</td>
<td>Y N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Transit lodgings</td>
<td>Y N(1)</td>
<td>N(1)</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td><strong>Public Use</strong></td>
<td>Y N(1)</td>
<td>N(1)</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Schools</td>
<td>Y 25</td>
<td>30</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Hospitals and nursing homes</td>
<td>Y 25</td>
<td>30</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Churches, auditoriums, and concert halls</td>
<td>Y Y(2)</td>
<td>Y(2)</td>
<td>Y(3)</td>
<td>Y(4)</td>
<td>Y(4)</td>
<td>Y(5)</td>
</tr>
<tr>
<td>Governmental services</td>
<td>Y Y</td>
<td>Y(2)</td>
<td>Y(2)</td>
<td>Y(4)</td>
<td>Y(4)</td>
<td>Y(5)</td>
</tr>
<tr>
<td>Transportation</td>
<td>Y Y</td>
<td>Y(2)</td>
<td>Y(2)</td>
<td>Y(4)</td>
<td>Y(4)</td>
<td>Y(5)</td>
</tr>
<tr>
<td>Parking</td>
<td>Y Y</td>
<td>Y(2)</td>
<td>Y(2)</td>
<td>Y(4)</td>
<td>Y(4)</td>
<td>Y(5)</td>
</tr>
<tr>
<td><strong>Commercial Use</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Offices, business and professional</td>
<td>Y Y</td>
<td>25</td>
<td>30</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Wholesale and retail—building materials, hardware and farm equipment</td>
<td>Y Y</td>
<td>Y(2)</td>
<td>Y(3)</td>
<td>Y(4)</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Retail trade—general</td>
<td>Y Y</td>
<td>25</td>
<td>30</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Utilities</td>
<td>Y Y</td>
<td>Y(2)</td>
<td>Y(2)</td>
<td>Y(4)</td>
<td>Y(4)</td>
<td>Y(5)</td>
</tr>
<tr>
<td>Communication</td>
<td>Y Y</td>
<td>25</td>
<td>30</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td><strong>Manufacturing And Production</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manufacturing, general</td>
<td>Y Y</td>
<td>Y(2)</td>
<td>Y(3)</td>
<td>Y(4)</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Photographic and optical</td>
<td>Y Y</td>
<td>25</td>
<td>30</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Agriculture (except livestock) and forestry</td>
<td>Y Y(6)</td>
<td>Y(7)</td>
<td>Y(8)</td>
<td>Y(8)</td>
<td>Y(8)</td>
<td>Y(8)</td>
</tr>
<tr>
<td>Livestock farming and breeding</td>
<td>Y Y(6)</td>
<td>Y(7)</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Mining and fishing, resource production and extraction</td>
<td>Y Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td><strong>Recreational</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outdoor sports arenas and spectator sports</td>
<td>Y Y(6)</td>
<td>Y(5)</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Outdoor music halls, amphitheaters</td>
<td>Y Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Nature exhibits and zoos</td>
<td>Y Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Amusement parks, resorts and camps</td>
<td>Y Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Golf courses, riding stables and water recreation</td>
<td>Y Y</td>
<td>25</td>
<td>30</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
</tbody>
</table>

Numbers in parentheses refer to notes.

*The designations contained in this table do not constitute a Federal determination that any use of land covered by the program is acceptable or unacceptable under Federal, State, or local law. The responsibility for determining the acceptable and permissible land uses and the relationship between specific properties and specific noise contours rests with the local authorities. FASA determinations under Part 150 are not intended to substitute internally determined land uses for those determined to be appropriate by local authorities in response to locally determined needs and values in achieving noise compatible land uses.*

**KEY TO TABLE 1**

Y (Yes) = Land Use and related structures compatible without restrictions.
N (No) = Land Use and related structures are not compatible and should be prohibited.
NLR = Noise Level Reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure.
25, 30, or 35 = Land use and related structures generally compatible; measures to achieve NLR or 25, 30, or 35 dB must be incorporated into design and construction of structure.
NOTES FOR TABLE 1

(1) Where the community determines that residential or school uses must be allowed, measures to achieve reduced community Noise Level Reduction (NLR) of at least 25 dB and 30 dB should be incorporated into building codes and be considered in individual approvals. Normal residential construction can be expected to provide a NLR of 20 dB. Due to the reduction requirements are often met as 1.0 or 1.5 dB over standard construction and normally assumes mechanical ventilation and closed windows year round. However, the use of NLR criteria will not eliminate outdoor noise problems.

(2) Measures to achieve NLR of 25 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.

(3) Measures to achieve NLR of 30 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.

(4) Measures to achieve NLR of 35 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.

(5) Land uses comparable to special sound reduction systems are installed.

(6) Residential buildings require an NLR of 25.

(7) Residential buildings require an NLR of 30.

(8) Residential buildings not permitted.

§ A150.103 Use of computer prediction model.

(a) The airport operator shall acquire the computer-based data necessary to develop noise exposure contours using an FAA approved methodology or computer program, such as the Integrated Noise Model (INM). In considering approval of a methodology or computer program, key factors include the demonstrated capability to produce the required output and the public availability of the program or methodology to provide interested parties the opportunity to substantiate the results.

(b) The following information must be obtained for input to the calculation of noise exposure contours:

(1) A map of the airport and its environs at an adequately detailed scale (not less than 1 inch = 8,000 feet) indicating runway length, alignments, landing thresholds, takeoff point, centerline, boundary, and flight lines.

(2) Airport activity levels and operational data which will indicate, on an annual average-daily basis, the number of aircraft, by type of aircraft, which utilize each flight path, in both the standard daytime (0700-2100 hours local) and nighttime (2100-0700 hours local) periods for both landings and takeoffs.

(3) For landings—glide slopes, glide path intercept altitudes, and other pertinent information needed to establish approach profiles along with the engine power levels needed to fly that approach profile.

(4) For takeoffs—the flight profile which is the relationship of altitude to distance from smart of roll along with the engine power levels needed to fly that takeoff profile; these data must reflect the use of noise abatement procedures and, if applicable, the takeoff weight of the aircraft or some proxy for weight such as stage length.

(5) Existing topographical or airspace restrictions which preclude the utilization of alternative flight tracks.

(6) The government furnished data depicting aircraft noise characteristics (if not already a part of the computer program's stored data bank).

(7) Airport elevation and average temperature.

§ A150.105 Identification of public agencies and planning agencies.

(a) The airport operator shall identify each public agency and planning agency whose jurisdiction or responsibility is either wholly or partially contained within the L_{10} 65 dB boundary.

(b) For those agencies identified in (a) that have land use planning and control authority, the supporting documentation shall identify their geographic area of jurisdiction.
PART C—MATHEMATICAL DESCRIPTIONS

§ A150.201 General.

The following mathematical descriptions provide the most precise definition of the yearly day-night average sound level (L_{dn}), the data necessary for its calculation, and the methods for computing it.

§ A150.202 Symbols.

The following symbols are used in the computation of L_{dn}:

<table>
<thead>
<tr>
<th>Measure (in dB)</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Sound Level, During Time T</td>
<td>L_{T}</td>
</tr>
<tr>
<td>Day-Night Average Sound Level (individual day)</td>
<td>L_{di}</td>
</tr>
<tr>
<td>Yearly Day-Night Average Sound Level</td>
<td>L_{dn}</td>
</tr>
<tr>
<td>Sound Exposure Level</td>
<td>L_{AE}</td>
</tr>
</tbody>
</table>

§ A150.203 Mathematical computations.

(a) Average sound level must be computed in accordance with the following formula:

\[ L_{T} = 10 \log_{10} \left[ \frac{1}{T} \int_{0}^{T} L_{A(t)} dt \right] \]  

(1)

where T is the length of the time period, in seconds, during which the average is taken; \( L_{A(t)} \) is the instantaneous time varying A-weighted sound level during the time period T.

(1) Noise: When a noise environment is caused by a number of identifiable noise events, such as aircraft flyovers, average sound level may be conveniently calculated from the sound exposure levels of the individual events occurring within a time period T:

\[ L_{T} = 10 \log_{10} \left[ \frac{1}{T} \sum_{i=1}^{n} L_{AEi} \right] \]  

(2)

where \( L_{AEi} \) is the sound exposure level of the i-th event, in a series of n events in time period T, in seconds.

(2) Note: When T is one hour, \( L_{T} \) is referred to as a one-hour average sound level.

(b) Day-night average sound level (individual day) must be computed in accordance with the following formula:

\[ L_{di} = 10 \log_{10} \left[ \frac{1}{24000} \int_{0}^{24000} L_{A(t)} dt \right] \]  

(3)

Time is in seconds, so the limits shown in hours and minutes are actually interpreted in seconds. It is often convenient to compute day-night average sound level from the one-hour average sound levels obtained during successive hours.

(c) Yearly day-night average sound level must be computed in accordance with the following formula:

\[ L_{dn} = 10 \log_{10} \left[ \frac{1}{365} \sum_{i=1}^{365} L_{di} \right] \]  

(4)

where \( L_{di} \) is the day-night average sound level for the i-th day out of one year.

(d) Sound exposure level must be computed in accordance with the following formula:

\[ L_{AE} = 10 \log_{10} \left( \frac{1}{t_{2} - t_{1}} \int_{t_{1}}^{t_{2}} L_{A(t)} dt \right) \]  

(5)
where $t_p$ is one second and $L_A(t)$ is the time-varying A-weighted sound level in the time interval $t_1$ to $t_2$. The time interval should be sufficiently large that it encompasses all the significant sound of a designated event.

The requisite integral may be approximated with sufficient accuracy by integrating $L_A(t)$ over the time interval during which $L_A(t)$ lies within 10 decibels of its maximum value, before and after the maximum occurs.
Appendix B

Noise Compatibility Programs

§ 150.3 Scope and purpose.
(a) This Appendix prescribes the content and the methods for developing noise compatibility programs authorized under this Part. Each program must set forth the measures which the airport operator (or other person or agency responsible) has taken, or proposes to take, for the reduction of existing noncompatible land uses and the prevention of the introduction of additional noncompatible land uses within the area covered by the noise exposure map submitted by the operator.

(b) The purpose of a noise compatibility program is:

(1) To promote a planning process through which the airport operator can examine and analyze the noise impact created by the operation of an airport, as well as the costs and benefits associated with various alternative noise reduction techniques, and the responsible impacted land use control jurisdictions can examine existing and forecast areas of noncompatibility and consider actions to reduce noncompatible uses.

(2) To bring together through public participation, agency coordination, and overall cooperation, all interested parties with their respective authorities and obligations, thereby facilitating the creation of an agreed upon noise abatement plan especially suited to the individual airport location while at the same time not unduly affecting the national air transportation system.

(3) To develop comprehensive and implementable noise reduction techniques and land use controls which, to the maximum extent feasible, will confine severe aircraft YDNL values of L_{dn} 75 dB or greater to areas included within the airport boundary and will establish and maintain compatible land uses in the areas affected by noise between the L_{dn} 65 and 75 dB contours.

§ 150.2 Requirement for noise map.
(a) It is required that a current and complete noise exposure map and its supporting documentation as found in compliance with the applicable requirements by the FAA, per § 150.21(c) be included in each noise compatibility program:

(b) If the proposed noise compatibility program would yield maps differing from those previously submitted to FAA, the program shall be accompanied by appropriately revised maps. Such revisions must be prepared in accordance with the requirements of Sec. A150.101(c) of Appendix A and will be accepted by FAA in accordance with § 150.32(f).

§ 150.3 Program standards.
Based upon the airport noise exposure and noncompatible land uses identified in the map, the airport operator shall evaluate the several alternative noise control actions and develop a noise compatibility program which—

(a) Reduces existing noncompatible uses and prevents or reduces the probability of the establishment of additional noncompatible uses;

(b) Does not impose undue burden on interstate and foreign commerce;

(c) Provides for revision in accordance with § 150.23 of this Part.
(d) Is not unjustly discriminatory.
(e) Does not derogate safety or adversely affect the safe and efficient use of airspace.
(f) To the extent practicable, meets both local needs and needs of the national air transportation system, considering tradeoffs between economic benefits derived from the airport and the noise impact.
(g) Can be implemented in a manner consistent with all of the powers and duties of the Administrator of FAA.

§ 3150.7 Analysis of program alternatives.
(a) Noise control alternatives must be considered and presented according to the following categories:
(1) Noise abatement alternatives for which the airport operator has adequate implementation authority.
(2) Noise abatement alternatives for which the requisite implementation authority is vested in a local agency or political subdivision governing body, or a state agency or political subdivision governing body.
(3) Noise abatement options for which requisite authority is vested in the FAA or other Federal agency.

(b) As a minimum, the operator shall analyze and report on the following alternatives, subject to the constraints that the strategies are appropriate to the specific airport (for example, an evaluation of night curfews is not appropriate if there are no night flights and noise are forecast):
(1) Acquisition of land and interests therein, including, but not limited to air rights, easements, and development rights, to ensure the use of property for purposes which are compatible with airport operations.
(2) The construction of barriers and acoustical shielding, including the soundproofing of public buildings.
(3) The implementation of a preferential runway system.
(4) The use of flight procedures (including the modifications of flight tracks) to control the operation of aircrafts to reduce exposure of individuals (or specific noise sensitive areas) to noise in the area around the airport.
(5) The implementation of any restriction on the use of airport by any type or class of aircraft based on the noise characteristics of those aircraft. Such restrictions may include, but are not limited to—
(i) Denial of use of the airport to aircraft types or classes which do not meet Federal noise standards;
(ii) Capacity limitations based on the relative noisiness of different types of aircraft;
(iii) Requirement that aircraft using the airport must use noise abatement takeoff or approach procedures previously approved as safe by the FAA;
(iv) Landing fees based on FAA certificated or estimated noise emission levels or on time of arrival; and
(v) Partial or complete curfews.
(6) Other actions or combinations of actions which would have a beneficial noise control or abatement impact on the public.
(7) Other actions recommended for analysis by the FAA for the specific airport.
(c) For those alternatives selected for implementation, the program must identify the agency or agencies responsible for such implementation, whether those agencies have agreed to the implementation, and the approximate schedule agreed upon.

§ 3150.8 Equivalent Programs.
(a) Notwithstanding any other provision of this Part, noise compatibility programs prepared in connection with studies which were either Federally funded or Federally approved and commenced before October 1, 1981, are not required to be modified to contain the following items:
(1) Flight tracks.
(2) A noise contour of Ldn 70 dB resulting from aircraft operations and data related to the Ldn 70 dB contour. When determinations on land use compatibility using Table 1 of Appendix A differ between Ldn 85-70 dB and Ldn 70-75 dB, the determinations should either use the more conservative Ldn 70-75 dB column or reflect determinations based on local needs and values.
(3) The categorization of alternatives pursuant to Sec. 810.7(a), although the persons responsible for implementation of each measure in the program must still be identified in accordance with § 150.23(a)(3).

(4) Use of ambient noise to determine land use compatibility.

(b) Previously prepared noise compatibility program documentation may be supplemented to include these and other program requirements which have not been excepted.
SECTION 3C

LEGAL BACKGROUND
LEGAL ASPECTS OF NOISE ABATEMENT

My purpose today is not to make you "environmental lawyers" by giving you a detailed course in aviation noise law. Time precludes this and moreover, if I were to make you "noise lawyers" you wouldn't need me.

The Aircraft Noise Problem, in its purest sense, is a technological one which should be solved by engineers, not by lawyers. Although technological advances have reduced noise at the source (Stage III aircraft), the noisiest problem facing pilots and operators are the political ramifications of aircraft noise. This has provided the impetus for the noise lawsuits, which is where the lawyers get involved.

I intend to give you a brief review of the development of "aircraft noise" law which is being used by citizens as a tactic to force curfew of airports, to reduce capacity and to require the use of preferential runways and the flying of noise abatement procedures.

In doing this I intend to cover three main areas which are: (1) Landowner rights; (2) the airport proprietor's liability and authority to restrict operations, and (3) the role of the FAA/Federal Government.

Our law has generally jealously guarded the rights of property owners and has followed the old maxim, a man's home is his castle. When one bought a parcel of land, he owned not only the surface but the air above and the ground below. Our interest today centers on the air rights above the property rather than the mineral rights below. In the early days when airplanes were novel, people were delighted when one flew over their property just so they could see it.

The noise problem from the legal standpoint had its starting place, like aviation, in North Carolina. In 1946, a chicken farmer who was in the flight path of the Greenville, NC airport filed suit against the U.S. Government whose military planes were flying over his land both day and night. He sought money damages because they were unable to sleep, were nervous, and were frightened because of the overflights and unable to raise chickens as they flew into the walls and killed themselves when planes passed low overhead. The Supreme Court held that the overflights were taking (inverse condemnation of an easement) and the U.S. may pay the landowner for the diminution of the value of the property. In this case the Government who leased the Airport and owned and operated the aircraft was held liable. There was no other significant noise litigation until 1962 when the Supreme Court was faced with the question of who should pay for the "noise taking" of one's property — the airport owner, the Federal Government, or the airlines who operated the aircraft which generated the noise? In this case, which involved the greater Pittsburgh Airport, the county owned and operated the airport. However, the United States had shared in the cost of building the airport (50-75%) and had laid out the airport and runways in accordance with the standards established by the FAA administrator. The airlines had a lease arrangement with the airport allowing them to land and takeoff aircraft.
In this case the lower courts determined that there was a noise taking of the property and the question presented to the Supreme Court was who should pay for the taking. Should it be the Government who prescribed how the approaches should be laid out? Or was it the airlines that were the real culprits since it was their airplanes that made the noise or was it the county who determined the site of the airport. The court was faced with deciding which one of these three entities would be liable. Parenthetically, a nameless predecessor of Dick Dead the airline's argument that operators and manufacturers should share the costs of aircraft noise on the basis that only the city could acquire by condemnation an easement over the land and surrounding the airport. Furthermore, there was no indication in the lease that the parties intended the airlines to indemnify the city for using flight paths in the manner contemplated by and provided for in the lease. In Milwaukee, property owned attempted to hold both the county and airlines liable for noise nuisance. The Court determined that the county was not responsible and not the airlines since it created and operated the airport. Several other cases involving Minneapolis, Chicago, New York, and again Los Angeles uniformly followed the Griggs Supreme Court reasoning and held the airport proprietor solely liable for aircraft noise damages.

Since it is settled that the airport owner has liability, the next question to arise was the authority of airports or owners to restrict airport usage. In 1972 California was beginning to become very aggressive in the environmental area and the city of Burbank exercised its police power as a municipality and imposed a night time curfew on a privately owned airport within its jurisdiction. The airport owner sued the city to invalidate the ordinance on the grounds that the federal government by virtue of the Federal Aviation Act and the Noise Control Act has preempted state and local control over airport noise. The Supreme Court agreed holding that the noise control act of 1972
prevented the city's exercise of police power. That seemed to establish federal preemption in the aircraft noise area, except in that a footnote the Court was careful to point out that the opinion did not determine what limits, if any, would apply to an airport proprietor. Indeed, the court suggested that owners could deny use of their airports so long as the exclusion was not discriminatory. Thereafter, again in California, the authority of a city, who was the proprietor of an airport, to restrict airport usage was put to a judicial test. The city of Hayward, who was the proprietor of the airport, enacted an ordinance that prohibited all aircraft from operating between the hours of 11 p.m. and 7 a.m. if they exceeded 75 dBA. The city of Santa Monica imposed a total restriction on jet aircraft and imposed a total curfew between 11 p.m. and 7 a.m. These ordinances differed in that one was based on noise levels and one was a total ban.

The courts have upheld both of these ordinances. As a result of these and subsequent cases, the test for validity of airport restrictions imposed by proprietors is that they must be (1) reasonable, (2) nondiscriminatory and (3) not regulate the aircraft while in flight which is the sole responsibility of the FAA. Subsequent court decisions in other jurisdictions have followed the theory that the airport owner can control airport access and set noise limits as long as they are reasonable and even-handedly applied. The courts have held that this authority is necessary since the airport operator is liable. If the airport proprietor is to be held responsible for noise damage, he must have the authority to control it.

The authority of an airport proprietor to restrict operations was summed up by the court that directed the city of New York Port Authority to permit the Concorde to land at JFK.

"The proper domain of the operator is the issuance of regulations or the establishment of requirements as to the permissible level of noise which can be created by aircraft using the airport. . . It is clear to us that the Port authority is vested only with the power to promulgate reasonable, nonarbitrary and nondiscriminatory regulations that establish acceptable noise levels for the airport and its immediate environs. Any other conduct by an airport proprietor would frustrate the statutory scheme and unconstitutionally burden the commerce Congress sought to foster.

While the airport owner/operator has the control of noise on the ground, the FAA continues to have the authority to prescribe flight rules and control noise at the source.

Given this state of the law, the landowners near airports who want to reduce the noise level have concentrated on two courses of action (1) pressure on the local government and (2) lawsuits designed to force the airport owner to curtail operations. They are suing the airport for (1) a taking, (2) trespassing and (3) nuisance. Under the taking theory you could only recover your damages once. Since the standard measure of damages for a "taking" is the difference between the value of the property before the airport began operations and the value after, often there is no damages; because of the airport's proximity, the value of the property often increases. This makes the
nuisance theory more attractive. The latter cause of action, nuisance, has become the most popular because it is a continuing damage, that is, if it is not abated, you can get damages periodically. In California for instance, every 100 days you have a new cause of action. This varies from state to state. Needless to say, such suits can become very expensive from the damages aspect, the public relations aspect and the litigation costs, so naturally the airport operator is forced to reduce the noise by seeking new flight procedures from FAA, reducing operations, using only certain runways and imposing curfews. Therefore, by using this litigation-tactic, the homeowners achieve their goal of curtailting operations at a given airport. Additionally, we find landing fees and other user charges being increased to cover the increased legal expenses, damage awards and to purchase property or insulate homes near the airport. The problem is that the permissible level of noise before it becomes a nuisance varies from place to place. There are no standard legal definitions or what level of noise is permissible. If we do not adopt some national standards soon, interstate commerce could be adversely impacted.

I would like to move now to more fully consider the role of the FAA. The FAA is, of course, responsible for all flight procedures and noise source control from aircraft engines, and this exclusive authority to regulate stems from the Federal Aviation Act of 1958. This is now a settled law. The FAA's role in aviation noise was recognized by Congress as early as 1958 when they enacted the Control and Abatement of Aircraft Noise and Sonic Boom Act. Congress later enacted the Noise Control Act of 1972 to involve the EPA in the federal control of aircraft noise. Most recently they enacted the Aviation Safety and Noise Abatement Act of 1979 which was amended in 1982. This provides that if airport operators engage in airport noise planning and submit a noise exposure map to the FAA they will be eligible to receive limited federal funds from the Airport Improvement Program to purchase property and insulate homes.

While this legislation is a step in the right direction, it stops short of providing mandatory uniform national minimum noise standards and makes participation in “noise planning” voluntary. Congress elected not to preempt the local government's authority to control ground aircraft noise. There are reasons for this. The Federal Government does not want to preempt control of aircraft upon the ground primarily because of the liability involved. It could prove very expensive. Moreover, the Federal Government would like to avoid becoming involved in the local political thicket of noise control. The FAA has implemented this statute in Part 150 of the FAR's. However, Part 150, like the statute, is voluntary and may be best described as advisory.

Another statute which is not directly related to noise but which the FAA has made effective use of in opposing efforts to impose curfews and other restrictions upon airport operators is the Airport Improvement Program Act. In giving airports grants for improvement, the FAA has imposed conditions that among other things require the airport to keep the airport open to "all types, kinds and classes of aeronautical uses on fair and reasonable terms and to operate the airport lights each night." Based upon these covenants, the FAA has successfully resisted restrictions on type of aircraft using an airport (Orange County) and enjoining the imposition of a curfew at Republic Airport in Farmingdale, NY. So the FAA has reacted in a few situations to counter the
restrictions at airports resulting from noise. However, as Dick Beeds has pointed out, it is difficult for the FAA to tell an airport they cannot impose restrictions on aircraft operations which amount to curfews when they have done so themselves at National airport. This brings us to the airport operator who is holding the bag in regard to aircraft operations noise. Most, if not all, of the air carrier airports are operated by local political bodies which by their nature are extremely sensitive to voter pressures. Even though many of the most vocal homeowners may have bought their house with full knowledge of the nearby airport and its operations, they nevertheless want the noise curtailed, especially at night. To achieve a reduction in operations, they have organized and been very effective in using their political muscle. This has resulted in the studies, community roundtables, and such, which seek ways to reduce noise and have been required to monitor noise levels and impose restrictions to reduce noise levels. These restrictive actions are also brought about by the nuisance lawsuits and the need of the airport to abate the nuisance to avoid large damage awards. The airport operator is caught between competing interests of those who want increased capacity and those who want peace and quiet. Of course, as pilots, you want to be "good neighbors" but our interest and indeed, responsibility is to insure that any noise abatement procedures which may be imposed are safe and if possible standardized.

The best solution to this problem in my view is a national aircraft noise policy that would preempt the diverse standards we now have. Short of this solution, one of the ways to obtain this goal is for pilots to be active in the formulation of the airport's noise abatement policies. This can be done by participating in the community noise meetings and explaining to pilots you want to be a good neighbor, but there are limitations from a safety standpoint that affects them both as passengers and possible victims on the ground. I know Dick Beeds has had some success in this area. Sometimes an explanation by a pilot of why certain actions that may reduce noise are unacceptable from the safety standpoint is enough to cause the citizens involved to seek reasonable alternatives.

The ultimate solution to the noise problem is to set a national standard and reduce the noise at the source to that level. However, until that is achieved and the airlines can afford to purchase this new equipment, we must find means to permit the continued use of existing equipment to ensure interstate commerce is not impeded and flight safety is not impaired. That is the challenge for the aviation community and hopefully we can work together to further our common interest which is unfettered access to airports utilizing safe and standardized procedures that generate the least amount of noise.
FEDERAL STATUTORY BACKGROUND OF AIRCRAFT NOISE

The aircraft noise problem has not been left to the sole purview of the Courts. Congress has attempted to address this difficult problem through legislation. However, because of the intense pressures from the environmental groups and the economic considerations involved, the resulting legislation has not been really effective for anyone, as it lacks the necessary mandatory requirements.

As we discussed earlier, Congress is fully aware of the liability involved in aircraft noise and so far has been unwilling to pass any really effective legislation for fear of assuming that liability.

However, it is useful to know what legislation has been enacted as it explains the reason for the FAA's actions, or at least part of them, in the area of noise abatement.

As most of you know, the act that created the FAA and empowered it to license pilots, certificate aircraft, establish flight rules and procedures, is the Federal Aviation Act of 1958. At the time the FAA was created aircraft noise was not a major problem and this legislation did not address noise. As time progressed and noise became a problem, Congress in 1968 enacted and amended the Aviation Act to add Section 611 which was entitled "Control and Abatement of Aircraft Noise and Sonic Boom."
This statute directed the FAA, after consultation with the Secretary of Transportation and EPA, to prescribe and amend standards for the measurement of aircraft noise and sonic boom and to prescribe such regulations as may be necessary to provide for the control and abatement of aircraft noise and sonic boom. The statute also directed the FAA not to issue an original type certificate unless the aircraft meets the FAA standards which are designed to protect the public from aircraft noise. This statute was slightly amended in subsequent years.

The FAA's response or implementation of this law was the promulgation of Part 36 in 1969 which was designed to control aircraft noise at its source by prescribing noise standards that had to be met by all newly certified aircraft. Of course as we know, Part 36 was amended to require all aircraft to meet Part 36 standards by January 1, 1989. There was a small community exemption from this standard which was later imposed by Congress although neither Congress nor the FAA defined a small community.

Of course Congress has now agreed to exempt two airports, Miami and Bangor from Part 36 requirements, providing the operators involved have made good faith efforts to install hush kits when they become available.

Congress took no major legislative role in aircraft noise abatement until 1972 when the Noise Control Act of 1972 was passed.

This act amended Section 611 to the extent that it prohibited the FAA from issuing an original type certificate to any aircraft that failed to meet Part 36 standards. It also sought to impose noise standards for all products.
distributed in interstate commerce. This included aircraft, motor carriers, railroads engines, etc. The law required the EPA to publish noise standards for all products which could be identified as major sources of noise and required manufacturers to warrant that their affected products met the standards in the EPA regulations. With regard to aircraft noise the Act required both the FAA and EPA to consider the effect of aircraft noise on the public health and welfare. The FAA retained its authority over aircraft noise but was required to hold public hearings on EPA proposed aircraft noise regulations. However, the law really had no teeth with respect to the FAA as they were not mandated to implement any of the EPA proposed regulations. As a result, although EPA has proposed several regulations regarding aircraft noise virtually all have been rejected. While the FAA paid little heed to the EPA, it was busy preparing its response to the Noise Control Act. This response is embodied in the Aviation Noise Abatement Policy published in November 18, 1978 by the Department of Transportation.

The FAA's interpretation of the law was that the airport proprietor has single liability for any noise damages but that responsibility for aircraft noise abatement was jointly shared by federal, state and local governments, the air carriers, airport proprietors and citizens.

The FAA's view of the law was stated as follows:

1. The federal government has preempted the areas of airspace use and management, air traffic control, safety and the regulation of aircraft noise at its source. The federal government also has substantial power to influence airport development through its administration of the Airport and

3-512
Airway Development Program now the Airport Improvement Program.

2. Other powers and authorities to control noise rest with the airport proprietor — including the power to select an airport site, acquire land, assure compatible land use, and control airport design, scheduling and operations — subject only to Constitutional prohibitions against creation of an undue burden on interstate and foreign commerce, unjust discrimination, and interference with exclusive federal regulatory responsibilities over safety and airspace management.

3. State and local governments may protect their citizens through land use controls and other police power measures not affecting aircraft operations. In addition, to the extent they are airport proprietors, they have powers described in paragraph 2.

The PAA went on in its policy to define the actions an airport could implement without any consultation or approval from the PAA and those actions that required the PAA or someone else's cooperation or action.

For review purposes these are:

a. Actions that the airport proprietor can implement directly:
   (1) Location of engine run-up areas;
   (2) Time when engine run-up for maintenance can be done;
   (3) Establishment of landing fees based on aircraft noise emission characteristics or time of day.
b. Actions that the airport proprietor can implement directly if he has authority, or propose to other appropriate local authorities:

(1) plan and control of land use adjacent to the airport by zoning or other appropriate and use controls, such as utility expenditures and the issuance of building permits;

(2) enact building codes which require housing and public buildings in the vicinity of airports to be appropriately insulated; and

(3) require appropriate notice of airport noise to the purchasers of real estate and prospective residents in areas near airports.

c. Actions that the airport proprietor can implement directly in conjunction with other appropriate local authorities and with financial assistance from the FAA, where appropriate:

(1) acquire land to insure its use for purposes compatible with airport operations;

(2) acquire interests in land, such as easements or air rights, to insure its use for purposes compatible with airport operations;

(3) acquire noise suppressing equipment, construction of physical barriers, and landscape for the purpose of reducing the impact of aircraft noise; and

(4) undertake airport development, such as new runways or extended runways, that would shift noise away from populated areas or reduce the noise impact over presently impacted areas.

d. Actions that the airport proprietor can propose to FAA for implementation at a specific airport as operational noise control procedures:

(1) a preferential runway use system;
(2) preferential approach and departure flight tracks;
(3) a priority runway use system;
(4) a rotational runway use system;
(5) flight operational procedures such as thrust reduction
or maximum climb on takeoff;
(6) higher glide slope angles and glide slope intercept
altitudes on approach; and
(7) displaced runway threshold.

e. Actions an airport proprietor can establish, after providing
an opportunity to airport users, the general public and to FAA to review and
advise:

(1) restrictions on the use of or operations at the airport
in a particular time period or by aircraft type, such as:
   (a) limiting the number of operations per day or year;
   (b) prohibiting operations at certain hours - curfews;
   (c) prohibiting operation by a particular type or class
of aircraft; and
(2) any combination of the above.

f. Actions an airport proprietor can propose to an airline:
(1) shifting operations to neighboring airports;
(2) rescheduling of operations by aircraft type or time of
day.

Congress, unhappy with FAA's slow response to EPA proposals to abate
aircraft noise, when it enacted the "Quiet Communities Act of 1976" it amended
Section 611 of the Federal Aviation Act to require the FAA to respond to EPA proposals in ninety days.

Finally, in 1979 Congress again addressed aircraft noise and enacted the Aviation Safety and Noise Abatement Act of 1979.

Congress defined aircraft noise as a major problem facing this country and observed:

Over $200 million has been expended by airport proprietors to acquire noise-impacted land around airports and the Nation’s major airports have suits currently pending for hundreds of millions of dollars and potential liabilities that can be assessed in the billions of dollars.

Citizen opposition to aircraft noise has delayed, and in some cases prevented, airport development and expansion and the installation of facilities to improve safety and airport capacity.

Airport operators, in the face of prolonged Federal inaction, are imposing unilaterally, and at an accelerated rate, curfews and other restrictions on airport use for noise relief purposes.

Aircraft noise is a major problem affecting the present viability and future growth of this Nation’s air transportation system. The problem of aircraft noise is not a localized problem restricted to a few critical airports - it is a national problem.

Over 6 million people and 900,000 acres of land are impacted by aircraft noise levels deemed normally unacceptable for new residential construction loan guarantees by the Department of Housing and Urban development (HUD).

The President’s Council on Wage and Price Stability has estimated that aircraft noise costs taxpayers around airports some $3.25 billion annually in decreased property values.

To respond to this problem, Congress directed the Secretary of Transportation to promulgate a regulation to:

1. establish a single system of measuring noise for which there is a highly reliable relationship between projected noise exposure and surveyed reactions of people to noise, to be uniformly applied in measuring these noise at airports and the areas surrounding such airports;
2. Establish a single system for determining the exposure of individuals to noise which results from the operations of an airport and which includes, but is not limited to, noise intensity, duration, frequency, and time of occurrence; and

3. Identify land uses which are normally compatible with various exposures of individuals to noise.

The act provided for airport plans submitted pursuant to the regulation to be approved by the FAA and further provided that airport development funds would be provided to implement noise abatement actions in the approved plan.

Additionally, the act precluded property owners who acquired property in the vicinity of an airport after the act and with knowledge of a noise exposure map which had been submitted to recover any damages for noise.

There were exceptions to this provision and they provided for damage suits even if a noise exposure map had been submitted if any of the following occurred:

1. A significant change in type or frequency of aircraft operations at the airport;
2. A significant change in airport layout;
3. A significant change in flight patterns
4. A significant increase in nighttime operations.
While this act was a step in the right direction, it stopped short of making the program mandatory. Whether airports wanted to participate was a voluntary choice on their part. Congress was unwilling to preempt state and local authority because of the large liability for noise damage which they estimated could range to 3-1/4 billion dollars per year.

The passage of the Noise Abatement Act was the impetus that caused the FAA to publish Part 150 which has been thoroughly discussed.

The statutes which I have discussed are the legislative background, from a federal standpoint, of aircraft noise abatement and explain some of the reasons for the FAA regulations in this area.

I have not discussed, and will not in this forum, the plethora of state laws on this subject. To those of you who will become embroiled in state laws because of your participation in an individual study, I offer my services on an "as needed" basis to provide that information.
THE AVIATION NOISE ABATEMENT CONTROVERSY: MAGNIFICENT LAWS, NOISY MACHINES, AND THE LEGAL LIABILITY SHUFFLE†

by

John M. Werlich
Richard P. Krinsky

I. Introduction

Citizens of this nation, especially those residing near airports, have endeavored for two decades to stem the burgeoning tide of airport noise, which may cause significant physical or psychological injury or may be simply annoying. Since the commercialization of jet aircraft, federal, state, and local governments have enacted a plethora of laws...
designed to attain relief from noise. Meaningful relief, however, has not been achieved.

Through legislation, Congress has attempted to create a uniform national noise abatement plan directed and monitored by one entity: the Federal Aviation Administration (FAA). Unfortunately, this goal has not been realized. Apparently in an effort to limit federal government liability, the FAA has failed to assume the responsibility envisioned in the federal legislation. In addition, the recent trend of decisions by courts that have held airport proprietors liable for the personal injury and property damages caused by aircraft noise, and Congress' retreat from its previous policy favoring financial aid to noise-impacted airports, have also undermined the movement for a uniform national aviation noise abatement plan.

The FAA's abdication of leadership, adverse court decisions, and the reduction in federal financial aid have left airport proprietors to fend for themselves. Spurred on by a rash of noise lawsuits, local airport proprietors, in a legitimate effort to minimize their liability exposure, have adopted noise abatement regulations based on parochial, rather than national, interests. These local regulations, in turn, have culled a further divisiveness in the effort to create a national aircraft noise abatement plan.

The unfortunate consequence is that the liability for aviation noise has been partially disconnected from the responsibility for aviation noise abatement. This is a result of decisions in which various courts have held that the liability for aviation noise damages rests solely on the hundreds of individual airport proprietors, while responsibility for aviation noise abatement resides collectively among federal, state and local governments, air carriers, and airport proprietors. This "single liability/shared responsibility" situation promotes, rather than discour-

4. See infra text accompanying notes 8-17.
5. See infra text accompanying notes 64-74, 109-27.
6. See supra, Legal Basis for Noise, The Nat'l L.J., Dec. 1, 1960, at 1, col. 2. "In the last four years, at least 16 other cities other than Los Angeles have been faced with airport noise claims in excess of $150 million." Id. at 15, col. 1.


In addition, aircraft noise has resulted in curfews and other operational constraints which have restricted the use of existing facilities, and have caused problems relating to the safety of the system. Because of noise emanating from the operations at airports, full utilization and expansion of airports to accommodate current and future traffic have been hampered.
1981] AVIATION NOISE ABATEMENT 71

ages, confusion. The result is unwarranted agony for all the parties—particularly citizens living near airports.

This article will (1) review national aviation noise legislation and its implementation by the FAA, (2) analyze the judicial decisions that discuss the imposition of liability for aircraft noise, and (3) offer two alternative approaches that would more equitably apportion liability.

II. FEDERAL LAWS AND FAA IMPLEMENTATION

A. Regulatory Provisions

1. Federal Aviation Act of 1958—the beginning

Federal regulation of airspace and air commerce is authorized under the Federal Aviation Act of 1958 (1958 Act) which entrusted certain powers to the FAA and to the Civil Aeronautics Board (CAB). The FAA's responsibility under the 1958 Act, to be carried out primarily through the promulgation of Federal Aviation Regulations (FARs), was to promote air safety, regulate the use of the navigable airspace, establish air navigation facilities, operate a national system of air traffic control, and certify aircraft, airports and certain airports for commercial use. This exclusive federal control was based on Congress' recognition that the public has a basic right to air travel. Moreover, the power to ensure such travel was declared to be a right of national sovereignty.

1. 49 U.S.C. §§ 1301-1352 (1976 & Supp. III 1979). The 1958 Act, as amended, is the basis of federal aviation regulations. This article is not intended to review all of its provisions.

9. The authority of the CAB is concerned primarily with the economic aspects of the aviation industry. For the CAB's area of responsibility, see 49 U.S.C. §§ 1302, 1321-1329 (1976 & Supp. III 1979). Theoretically, the CAB could regulate aircraft noise by relating to noise new cases or by suspending or changing existing cases. However, Congress, in § 401(a)(4) of the 1978 Act, placed limits on the CAB's power to do this. Moreover, the CAB has never exercised this power, and in light of the recent enactment of the Airline Deregulation Act of 1978, Pub. L. No. 95-504, 92 Stat. 1763 (codified in scattered sections of 49 U.S.C. (Supp. III 1979)), it is unlikely to do so in the future. The Airline Deregulation Act will gradually eliminate the CAB's control over routes and fares. The Airline Deregulation Act also provides for the phased elimination and transfer of the CAB's remaining functions to other governmental agencies: the Department of Transportation, the Postal Service, and the Department of Justice. By January 1, 1983, the CAB's functions will terminate.


11. Id. at §§ 1421-1422.

12. Id. at § 1301(a). "The United States is declared to possess and exercise exclusive and complete sovereignty in the airspace of the United States..."
2. Federal Aviation Act Amendments of 1968—aircraft noise problem recognized

While the 1958 Act seemingly granted the FAA responsibility for all aspects of aviation, it did not specifically authorize the FAA to establish limits on aircraft noise emissions or otherwise to regulate for noise abatement purposes. In 1968, however, Congress added section 611 to the 1958 Act. This section recognized that there was a noise problem and authorized the FAA to prescribe standards for the measurement of aircraft noise and to establish regulations to control and abate such noise. This grant of authority was limited, however. The standards and regulations had to be "consistent with the highest degree of safety" and be "economically reasonable, technologically practicable, and appropriate for the particular type of aircraft." Thus, the resulting regulations were directed at the source of noise—the aircraft itself—rather than at airport proprietors.

3. Part 36—FAA attempts to control noise at its source

In response to section 611, the FAA promulgated FAR Part 36 (Part 36) in 1969. Part 36 was the embodiment of the FAA's attempt to control aircraft noise at its source. It provided a mechanism by which aircraft noise could be uniformly measured. It also established maximum allowable noise levels (depending on weight and number of engines) that aircraft of new design could not exceed in order to obtain type certification. It did not address possible changes in flight procedures to reduce noise, nor did it apply to then currently operating aircraft. The noise levels were expressed as an Effective Perceived Noise Level (EPNdB) and permitted heavier aircraft to make more noise.

The adoption of Part 36 encouraged new airplane types to be markedly

14. For example, although the FAA, in accordance with 49 U.S.C. § 1423(c) (1976), could certify aircraft as "airworthy," the certification had to be based on safety considerations, not noise.
18. Before an aircraft may fly, it must first be type certified. The FAA Administrator is vested with the power to issue type certificates for aircraft. 49 U.S.C. § 1423 (1976). Type certificates concern the basic design of an aircraft. Once a general design is type certified, all other aircraft built according to that design are entitled to type certificates. See Morton v. Dow, 521 F.2d 1028 (5th Cir. 1975).
20. For example, depending upon the type of engine, the standard for new B-747-100 aircraft is approximately 108 EPNdB, the maximum noise output allowable. U.S. Dep't of
quicker than the generation of turboprops developed in the late 1950s and early 1960s.

Since 1969, Part 36 has been amended several times to expand its coverage from newly designed domestic subsonic jet aircraft to all jet powered and propeller driven aircraft. For example, by extending the standards to newly manufactured domestic subsonic aircraft of older design, the 1973 amendment significantly increased the number of aircraft subject to Part 36. In a 1976 amendment, the FAA tackled the most controversial aspect of controlling aircraft noise at its source by requiring currently operating domestic subsonic aircraft with maximum gross weights over 75,000 pounds to meet Part 36 standards. This was accomplished by establishing a phased compliance program for all operating aircraft. Whether by retrofitting or otherwise, all operating aircraft were required to comply with Part 36 standards on or before January 1, 1981. However, effective February 1, 1981, the compliance dates were extended for some types of aircraft to January 1, 1988, and

TRIFIED FEDERAL AVIATION ADMIN. ADVISORY CIRCULAR NO. 10-1B, CERTIFIED AIRPLANES NOISE LEVELS (1977); NOISE ABATEMENT POLICY, supra note 1, at 36.

Because people's reactions to noise differ widely, it is difficult to establish a simple mathematical formula that accurately represents human reaction to noise annoyance. For example, the noise emanating from a waterfall may produce more sound energy than the roar of traffic across a freeway. To many, however, the latter is much more annoying. Even the experts are not in agreement on the relative merits of expressing noise impact in terms of dBA, dBC, PDV, SEL, SELNL, CNR, NFR, CNRL, ASDS, LIII or LNI. For the purposes of type certification, see supra note 16, the FAA utilizes noise data generated by an appropriate source of perceived noise that attempts to take into account the actual sound energy received by a listener, the ear's response to that sound energy, the added annoyance of any pure tones or "creaking" and its duration. NOISE ABATEMENT POLICY, supra note 1, at 13-14.

On the other hand, the FAA has recently designated decibels (dBA) and the yearly day-night average sound level (Ldn) as the standards for determining the level of airport noise exposure. 47 Fed. Reg. 8238, 8239 (1982) (to be codified in 14 C.F.R. § 150). For further information, see Calabrese, Noise and Its Measurement, Minnesota Citrus, Feb. 1982, at 26; Akilab, 2d Aircraft Noise Law A Technical Perspective, 25 A.B.A. 740 (1982).


22. It was controversial primarily because of the potential economic impact on the airline industry of being required to retrofit (acoustically modify by applying sound absorbent material), reengine or replace noncomplying aircraft. 41 Fed. Reg. 56,049 (1976). For example, in 1974, the FAA estimated that modification of all affected aircraft would cost close to $1 billion dollars. Id. at 56,052.

23. This was accomplished by adding a new Subpart B to 14 C.F.R. § 91, 41 Fed. Reg. 56,049, 56,053-58 (1976) (current version at 14 C.F.R. §§ 91.101-311 (1981)). The FAA adopted the phased compliance program because, as of the effective date of the amendment, only 503 of the United States fleet of 2,100 large jet aircraft complied with Part 36. 41 Fed. Reg. 56,049 (1976).

24. These include certain two-engine or three-engine aircraft under FAA approved replacement plans and certain two-engine aircraft under the small communities exemption provisions. 43 Fed. Reg. 79,102, 79,113 (1980). Interestingly, neither Congress, which man-

1981] AVIATION NOISE ABATEMENT 73
Part 36 was made applicable to foreign as well as domestic aircraft.\textsuperscript{25} The last amendment was in direct response to a congressional mandate.\textsuperscript{26}


In 1972, Congress, apparently dissatisfied with the progress of the FAA,\textsuperscript{27} passed the Noise Control Act of 1972.\textsuperscript{28} Among other things, the Act amended section 611. In essence, it prohibited the FAA from issuing an original type certificate to any aircraft that failed to meet Part 36 noise standards.\textsuperscript{29} The Act also recognized a role for local governments, but added the Environmental Protection Agency (EPA) to the regulatory process and required both the FAA and EPA to consider the effect of aircraft noise on the public health and welfare. While the FAA maintained regulatory authority over aircraft noise, it was mandated to hold public hearings on EPA proposed aircraft noise regulations. The FAA, however, was not required to adopt the regulations. As a result, the EPA has had meager influence on the regulatory process—nearly all EPA proposals have been rejected,\textsuperscript{30} sometimes after

\begin{itemize}
\item 25. In its Aviation Noise Abatement Policy, the FAA noted that it would unilaterally impose its own aircraft noise standards on foreign air carriers unless the International Civil Aviation Organization (ICAO) established a noise abatement schedule substantially similar to Part 36. \textit{Noise Abatement Policy}, supra note 1, at 42. The ICAO is responsible for setting international noise standards. This was not done to the FAA’s satisfaction, so the FAA considered itself mandated by the Aviation Safety and Noise Abatement Act of 1979, Pub. L. No. 96-155, 94 Stat. 98 (1980) (codified in scattered sections of 49 U.S.C.A. (West Supp. 1981)), to apply Part 36 standards to foreign air carriers. 49 Fed. Reg. 75,102, 79,105-09 (1980).
\item 27. During the first four years after the addition of § 611 to the 1975 Act, the FAA had promulgated only one noise regulation, Part 36. This regulation applied only to new designs for domestic aircraft and left both operating aircraft and foreign aircraft unregulated. 49 U.S.C. §§ 4001-4918 (1976); 49 U.S.C. § 1431 (1976). Actually, the Act addressed much more than aircraft noise. Among other things, it mandated the EPA to set noise standards for all products in interstate and foreign commerce.
\item 28. 49 U.S.C. § 4471 (1976). In other words, Congress wanted the FAA to apply Part 36 standards to all newly produced aircraft even though aircraft of that type were already in operation, as opposed to those merely on the drawing boards. Aircraft that do not comply with Part 36 standards as originally promulgated in 1975 include: all B-707s and DC-8s depending on engine type, most B-737s, DC-9s, and SAC 1-11s; some B-727s and a few B-747s. All DC-10 and L-1011 aircraft comply. \textit{Noise Abatement Policy}, supra note 1, at 34.
\item 29. To date, the EPA has proposed 11 regulations; only one has been adopted in full.
\end{itemize}
long delays.


It is one thing for Congress to enact legislation and proffer its intent through committee reports. It is quite another for the federal bureaucracy to interpret the meaning of the legislation and promulgate regulations. In 1976, the FAA issued its interpretation of congressional intent in the area of aviation noise abatement when it published its Aviation Noise Abatement Policy. In the FAA's view, single liability for noise damages resides in the airport proprietor, but shared responsibility for aviation noise abatement resides jointly among federal, state and local governments, air carriers, airport proprietors, and citizens. Taking into account the entire breadth of legislative history concerning aviation noise law, the FAA formulated a "legal framework" that is best stated in its own words:

1. The federal government has preempted the areas of airspace use and management, air traffic control, safety and the regulation of aircraft noise at its source. The federal government also has substantial power to influence airport development through its administration of the Airport and Airway Development Program.

2. Other powers and authorities to control airport noise rest with the airport proprietor—including the power to select an airport site, acquire land, assure compatible land use, and control airport design, scheduling and operations—subject only to Constitutional prohibitions against creation of an undue burden on interstate and foreign commerce, unjust discrimination, and interference with exclusive federal regulatory responsibilities over safety and airspace management.

3. State and local governments may protect their citi-

Statement of Walter C. Collins, Noise Abatement Officer at Los Angeles International Airport (June 23, 1981). For example, on August 29, 1973, the EPA proposed two amendments to the Federal Aviation Regulations which would have required pilots of all civil turbojet-powered aircraft to use an approach procedure to a landing runway. Generally, a two-segment approach procedure requires the pilot to fly an initial steep glide path segment (at degrees) and to intercept the conventional glide path (three degrees) at 700 feet above the elevation of the airport. This procedure was to be used under certain circumstances during clear weather and upon approach to a runway that had an FAA-approved two-segment Instrument Landing System (ILS) approach procedure. Both proposals were rejected for safety reasons. 41 Fed. Reg. 32,348 (1976).

zens through land use controls and other police power measures not affecting aircraft operations. In addition, to the extent they are airport proprietors, they have the powers described in paragraph 2.\textsuperscript{12}

To alleviate the burden of these proprietary powers, the FAA declared that it would support local airport proprietors' actions to abate noise; however, it reserved the right to block the implementation of such actions under either the supremacy or the commerce clause of the Constitution.\textsuperscript{13} The FAA was, and still is, asserting that the extensive federal role envisioned by congressional legislation should be fragmented and accomplished piecemeal by local airport proprietors but, importantly, with no federal liability.\textsuperscript{14} Thus, exclusive airport proprietor liability exists in the midst of pervasive federal control of aircraft flight operations.


Partially to speed up FAA response to EPA proposals, Congress further amended section 611 in the Quiet Communities Act of 1978.\textsuperscript{31} It specified a ninety-day time limit for FAA response to EPA suggested regulations for noise abatement. It further required the FAA to provide the public with a detailed analysis and response to the EPA proposals.

In 1979, Congress continued its march toward pervasive controls and enacted the Aviation Safety and Noise Abatement Act of 1979 (ASNA).\textsuperscript{30} ASNA required the Secretary of Transportation to estab-

\textsuperscript{30} See id. at 58, in which the FAA discusses its review procedure of airport proprietor use restrictions. See also U.S. Const. art. I, § 8.
\textsuperscript{31} See supra note 30.
lish federal standards for measuring and assessing noise as it impacts residents near airports.\textsuperscript{27} Additionally, airport proprietors were made eligible under the Airport and Airways Development Act of 1970 to obtain federal funds to assist them in airport noise compatibility planning.\textsuperscript{28}

Interestingly, according to ASNA, airport proprietors may, but are not required to, submit "noise exposure maps" and "noise compatibility programs" to the Secretary.\textsuperscript{19} The map, if submitted, must set forth the incompatible land uses existing near the airport as well as the projected effects of airport operations in 1985.\textsuperscript{20} The program should list the measures taken or to be taken to reduce any incompatible noise. However, after the first map is submitted, the proprietor must report any changes that create a "substantial new incompatible use in any area surrounding [the airport]"\textsuperscript{21} Importantly, if the Secretary approves a noise program and allocates funds, the United States Government is not "liable for damages resulting from aviation noise by reason of any action taken by the Secretary or the Administrator of the Federal Aviation Administration under this section."\textsuperscript{22}

Again, the negative aspect of liability is apparent. Although Congress excluded federal liability for noise damages related to the approval of a noise compatibility plan around a federally supported airport, it failed to address the thorny question of what liability, if any, an airport proprietor should have for noise damage resulting from the proprietor's management of its airport. This statutory program could represent the ultimate "Catch-22" for the airport proprietors who seem to be in dire need of assistance to protect their dual-faceted interest of economic survival and airport noise abatement.\textsuperscript{23}

\textsuperscript{27} 49 U.S.C.A. § 2102 (West Supp. 1981). EPM was the standard used by the FAA to measure aircraft noise. Congress wanted the FAA to establish a standard for assessing the impact of the noise on the community. See note 28.
\textsuperscript{29} See 46 C.F.R. §§ 116071, 116072 (1983).
\textsuperscript{32} Id. at § 210406.
\textsuperscript{33} See Brey, Legal Aspects of Noise, Nat'l L.J., Dec. 1, 1980, at 1, col. 1.
\textsuperscript{34} "It's kind of a Catch-22 situation," said Maureen C. Geary, chairwoman of the National Association of Municipal Law Officers' airport litigation committee.
\textsuperscript{35} The courts are saying that these have no authority to control noise," she said.
\textsuperscript{36} "But on the other hand (noise courts) are finding that duties are liable for the damage coming from that noise."
B. Federal Funding of Airport Development

For over thirty-five years Congress has experimented with different methods of aiding the aviation industry. In 1970, finding the airport and airway system inadequate to meet the requirements of the then projected growth in aviation, Congress enacted the Airport and Airway Development Act of 1970 (AADA) as the vehicle for expanding and improving the system. Congress included in the AADA a provision establishing a ten-year program (1970 through 1980) for increased federal matching grants to airport proprietors for eligible "airport development" projects. Eligible projects included construction, equipment purchases, and land and easement acquisitions related to improving the safety of airports. Significantly, eligible projects did not include noise abatement projects.

The FAA, under the direction of the Secretary of Transportation, was charged with administering this program. Hundreds of millions of dollars per year were spent on airport development. An Airport and Airway Trust Fund was established in the United States Treasury, with revenues derived from various taxes on airport activities, to meet the obligations incurred under the AADA. At least one-third of the amount authorized was to be distributed at the discretion of the Secretary of Transportation. In 1973, Congress amended the AADA to increase federal financial assistance to airports and to prohibit the levy of a "head" tax on aviation passengers by state or local governments; the latter could have been used by airport proprietors to supplement their revenues.

In 1976, Congress recognized that aircraft noise was becoming a

46. Id. at §§ 2, 14 (current version at 49 U.S.C. § 1701, 1714 (1975)).
47. Id. at § 11(c) (current version at 49 U.S.C. § 1711(c) (1975)).
49. Airport Development Assistance Act of 1975, § 7(a), 49 U.S.C. § 1313 (1976). The purpose of the federal head tax was to ensure both that passengers and air carriers would be taxed at a uniform rate and that the flow of interstate commerce and the development of air transportation would not be inhibited by local head taxes. 52 S. Rep. No. 12, 93d Cong., 1st Session, reprinted in 1973 U.S. Code Cong. & Ad. News 1434, 1435.
major problem. It amended the definition of "airport development" contained in the AADA to include "any acquisition of land or of any interest therein necessary to ensure that such land is used only for purposes which are compatible with the noise levels of the operation of a public airport." Thus, airport proprietor were eligible to receive funds for such projects as the construction of physical barriers, landscaping to diminish noise, and the purchase of land for noise attenuation purposes. In addition, the 1976 amendment increased the federal government’s matching share of airport development projects for large airports from 50% to 75%.

In 1978, Congress authorized the FAA to grant airport proprietor funds for the development of noise abatement plans around airports. In 1980, funding for noise compatibility purposes was expanded. The FAA received authority to award grants not only for the development of airport noise compatibility planning studies, but also to make limited amounts available for those projects approved by the FAA as contained in an approved noise compatibility plan. Eligible projects included the construction of barriers and acoustical shielding, soundproofing of buildings, and the acquisition of land and air easements for noise compatibility purposes. This funding created the potential for a greatly expanded program to reduce the amount of noise incident on residents surrounding airports. The program, however, was never fully developed, primarily because funding for such projects was discontinued when, on September 30, 1980, the ten-year funding program contained in the AADA expired in accordance with its own terms.

50. (Aircraft noise has resulted in curfews and other operational constraints which have restricted the use of existing facilities, and have caused problems relating to the safety of the system. Because of noise emanating from the operation of airports, full utilization and expansion of airports to accommodate current and future traffic have been hampered. H.R. Rep. No. 594, 94th Cong., 2d Sess. 13, reprinted in 1976 U.S. Code Cong. & Ad. News 1000, 1062.
56. Id. at § 2104(a)(3). (c).
57. See Panel, Airport and Airway Until 1980. Express, AVIATION WEEK & SPACE TECHNOLOGY, Oct. 13, 1980, at 56. Because of Congress’ failure thus far to ratify the funding provisions of the AADA, two of the largest United States Airport Associations recently told
The legislative history described above clearly illustrates the con-
geressionally created atmosphere of pervasive federal involvement in the
area of aviation noise abatement. Although the federal government
has not totally preempted local proprietors from exercising certain
responsibilities, the FAA's role has certainly been predominant. How-
ever, despite its predominance, the FAA has consistently refused to
accept primary responsibility for noise abatement or any liability for
aircraft noise damages. This refusal has led to extensive litigation over
the powers, rights, and obligations of local airport proprietors. Because
legislative intent in this area is not perfectly clear, and because the
FAA's actions have been below apparent congressional authorization,
the courts have played a major role in attempting to resolve these is-

sues. In that light, this article will leave the partly cloudy world of
legislators and regulators to go to the partly sunny world of
adjudicators.

III. JUDICIAL DECISIONS

A. Introduction—Room for the Litigious Litigant

Citizens, individually or as a group, may sue an airport proprietor
to recover damages for injuries to property or person resulting from
aircraft noise; they may also seek injunctive relief. Moreover, air
Carriers and aviation associations can sue airport proprietors for injunctive
relief to modify or eliminate airport proprietor or local government-im-
posed airport use restrictions (e.g., curfews) designed to reduce aircraft
noise. Conversely, an airport proprietor can sue an airline or aviation

Congress that a program allowing members to withdraw voluntarily from participation in
the airport development program and impose their own head taxes "must be included in any

For a discussion of "inverse condemnation" and "taking" actions, see Griggs v. Alle-
geny County, 369 U.S. 84 (1962); United States v. Ciavabra, 323 U.S. 226 (1945); Luedtke v.
County of Milwaukee, 371 F. Supp. 1040 (E.D. Wis. 1974), aff'd in part, vacated and re-

manded in part, 521 F.2d 387 (7th Cir. 1975); Greater Wenatchee Homeowners Ass'n v.
City of Los Angeles, 26 Cal. 3d 36, 603 P.2d 1239, 160 Cal. Rptr. 723 (1979), cert. denied, 449
U.S. 820 (1980); Aaron v. City of Los Angeles, 40 Cal. App. 3d 471, 115 Cal. Rptr. 162
(1974), cert. denied, 411 U.S. 1122 (1975); Adams v. County of Dane, 355 So. 2d 594 (Dist.
Cl. of App.), cert. denied, 344 So. 2d 232 (Fla. 1979); Thornsburg v. Port of Portland, 233 Or.
178, 178 P.2d 100 (1962).

For cases discussing airport proprietors' potential liability for serious management, see
and remanded in part, 521 F.2d 387 (7th Cir. 1975); Greater Wenatchee Homeowners Ass'n
v. City of Los Angeles, 26 Cal. 3d 36, 603 P.2d 1239, 160 Cal. Rptr. 723 (1979), cert. denied,
449 U.S. 820 (1980); San Diego Unified Port Dist. v. Superior Cl. of 67 Cal. App. 3d 381, 136

39. See e.g., City of Burbank v. Lockheed Air Terminal, 411 U.S. 524 (1973) (curfew);
aircraft noise cases which constitute the foundation upon which the lower courts have determined that the airport proprietor is liable for certain consequences of aircraft noise. These cases are United States v. Caudy, 64 Griggs v. Allegheny County, 65 and City of Burbank v. Lockheed Air Terminal, Inc. 66 Interestingly, all three majority opinions were written by Mr. Justice Douglas.

In *Caudy*, decided in 1946, military aircraft had repeatedly passed over a chicken farmer's land at an altitude of eighty-three feet. The noise from these aircraft was sufficient to destroy the residential and commercial value of the farmer's land. The Supreme Court agreed with the landowner's contention that his property had been taken by the federal government (the airport proprietor) without compensation in violation of the Fifth Amendment. 67

The airspace, apart from the immediate reaches above the land, is part of the public domain. We need not determine at this time what those precise limits are. Flights over private land are . . . a taking, if they are so low and so frequent as to be a direct and immediate interference with the enjoyment and use of the land. 68

*Caudy* was not the last word on the parameters of federal liability for aircraft noise; 69 *Griggs v. Allegheny County* 70 extended the general

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64. 323 U.S. 256 (1946).
67. See U.S. Const., amend. V, which provides in part: "[N]or shall private property be taken for public use, without just compensation."
68. 323 U.S. 255, 266 (1946).
69. Lower federal courts have applied *Caudy* narrowly, in *Samson v. United States*, 106 F.2d 100 (10th Cir. 1943), cert. denied, 317 U.S. 923 (1943), which also involved military aircraft, property owners were denied the right to recover damages as a result of noise and vibrations caused by aircraft that did not invade the plaintiff's airspace or render the property uninhabitable. Thus, when the federal government is the airport proprietor, recovery is permitted for a "taking" only when an aircraft physically invades the property's airspace.
70. *Griggs* v. *City of Los Angeles*, 40 Cal. App. 3d 471, 115 Cal. Rptr. 162 (1974), cert. denied, 419 U.S. 1122 (1974). The *Griggs* court was of the view that physical invasion was not necessary because aircraft noise is capable of accurate measurement. The court concluded that in California there is a taking if there is a 'reasonable reduction in market value resulting from the operation of the airport in such manner that the noise from aircraft using the airport causes a substantial interference with the use and enjoyment of the [adjacent] property, and the interference is sufficiently direct and sufficiently peculiar that the [property] owner, if uncompensated, would pay more than his property share to the public undertaking.
71. 464, 115 Cal. Rptr. at 176 (emphasis added).
72. 369 U.S. 54 (1962).
aircraft noise cases which constitute the foundation upon which the lower courts have determined that the airport proprietor is liable for certain consequences of aircraft noise. These cases are United States v. Caubey, Griggs v. Allegheny County, and City of Burbank v. Lockheed Air Terminal, Inc. Interestingly, all three majority opinions were written by Mr. Justice Douglas.

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64. 328 U.S. 255 (1946).
65. 369 U.S. 84 (1962).
67. See U.S. CONV. amend. V, which provides in part: "[N]or shall private property be taken for public use, without just compensation."
68. 328 U.S. 255, 265 (1946).
69. Lower federal courts have applied Caubey narrowly. In Bacon v. United States, 106 F.2d 902 (9th Cir. 1940), cert. denied, 311 U.S. 696 (1940), which also involved military aircraft, property owners were denied the right to recover damages as a result of noise and vibrations caused by aircraft that did not invade the plaintiff's airspace or render the property uninhabitable. Thus, when the federal government is the airport proprietor, recovery is permitted for a "taking" only when an aircraft physically invades the property's airspace. State courts, however, in interpreting the just compensation clauses contained in their state constitutions, have allowed recovery for less than physical invasion of airspace. See, e.g., Ascion v. City of Los Angeles, 43 Cal.App. 3d 701, 115 Cal.Rptr. 162 (1974), cert. denied, 419 U.S. 1122 (1972). The Ascion court was of the view that physical invasion was not necessary because aircraft noise is capable of accurate measurement. The court concluded that in California there is a taking if there is a

measurable reduction in market value resulting from the operation of the airport in such manner that the noise from aircraft using the airport causes a substantial interference with the use and enjoyment of the (adjacent) property, and the interference is sufficiently direct and sufficiently peculiar that the (property) owner, if uncompensated, would pay more than his proper share to the public undertaking.
AVIATION NOISE ABATEMENT

concept enunciated in Handy to local airport proprietors via the four-
teenth amendment. In Grips, the defendant, Allegheny County, oper-
ated the Greater Pittsburgh Airport. The aircraft utilizing the airport
drew low and near Mr. Grips' residential property that his family
was forced to move. The Court reasoned that the airport proprietor
was responsible for acquiring sufficient land adjacent to the airport to
reduce the impact of aviation noise and, if it failed to perform that
function, it was liable for the resulting aircraft noise damage to Mr.
Grips' property because a "constitutional taking" had occurred.71
Justice Douglas set the tone for airport operator liability by stating that
"[r]espondent in designing . . . [the airport] had to acquire some pri-
ivate property. Our conclusion is that by constitutional standards it did
not acquire enough."72 The airport proprietors, rather than the FAA
or the airlines operating out of the commercial airport, were held liable
for any noise damage.

In a strong dissent, Justice Black, joined by Justice Frankfurter,
urged that because "Congress has over the years adopted a com-
prehensive plan for national and international air commerce, regulating in
minute detail virtually every aspect of air transit,"73 it would be unfair
to saddle localities such as Allegheny County with a heavy financial
burden or to throw a "monkey wrench into Congress' finely tuned na-
tional transit mechanism."74 Thus, even early on, serious dissension
existed within the Supreme Court as to whether local proprietor liability
was the equitable solution to the aircraft noise problem.

Grips seems to have a narrow holding that is often soft-pedaled or
ignored: the airport proprietor had the original opportunity to
purchase enough land possibly to prevent the noise damage and, be-
cause it did not, it was liable. The Court's rationale does not indicate
what the result would have been had some damage still resulted from
federally approved flights even though the airport proprietor had done
all that reasonably could have been done to prevent noise damage.
Under what fact pattern would the Court have absolved the proprietor
yet held the federal government liable?

C. Municipalities Are Proscribed from Imposing Airport Use
Restrictions—Or Are They?

Eleven years after Grips, the Supreme Court decided City of Bur-
In 1970, the City of Burbank, through exercise of its police powers, enacted an ordinance establishing an 11:00 p.m. to 7:00 a.m. curfew on jet aircraft operations at the then privately owned Hollywood-Burbank Airport. The airport operator sued for an injunction against the enforcement of the Burbank ordinance. After reviewing the provisions of the Federal Aviation Act of 1958, the Noise Control Act of 1972, and the regulations enacted pursuant to them, the Supreme Court held the ordinance to be an impermissible intrusion into a federally preempted area. Justice Douglas, again writing for the Court, stated that the Noise Control Act of 1972 "reinforces and strengthens the conclusion that the FAA, now in conjunction with the EPA, has full control over aircraft noise, pre-empting state and local control." Justice Douglas continued by observing that while the "control of noise is of course deep-seated in the police powers of the States . . . [t]he pervasive control vested in EPA and in FAA under the 1972 Act seems to us to leave no room for local curfews or other local controls." The Burbank Court did not set forth "the ultimate remedy . . . for aircraft noise which plagues many communities and tens of thousands of people." However, it hinted that the remedy might be found in the procedures adopted in accordance with the Noise Control Act of 1972 and in the procedures involved in the implementation of various rules and regulations relating to the control of aircraft noise. The Court noted that the Administrator of the FAA had already imposed regulations relating to takeoff and landing procedures, runway preferences, and noise standards which aircraft must meet as a condition to type certification. Moreover, "[a]ny regulations adopted by the Administrator to control noise pollution must be consistent with the highest degree of safety." The interdependence of these factors, the Court concluded, "requires a uniform and exclusive system of federal regulation if the congressional objectives underlying the Federal Aviation Act are to be fulfilled.

Thus, the rationale for the Burbank decision is that the delicate balance between aircraft safety and efficiency man-

74. Id. at 635.
75. Id. at 635 (emphasis added).
76. Id. at 638 (emphasis added).
77. Id. at 618.
78. Id. at 639 (quoting 49 U.S.C. § 1431(c)(3)).
79. 411 U.S. at 618. Justice Douglas wrote that a municipality cannot control the hours of operation of an airport through its police powers, i.e., impose a curfew. Id.
dated by the Federal Aviation Act requires a uniform and exclusive system of federal regulation.

*Burbank* seemed to offer a simple point of law: the federal government's control over aviation noise abatement is pervasive and preemptive. It would have remained a simple case had the Court used only thirteen footnotes. Justice Douglas' footnote 14, however, hinted that an airport proprietor might have power to regulate the use of its airport that a nonproprietor municipality did not have. The issue was not resolved because it was not before the Court. Footnote 14, though possibly hidden, turned out to be a dormant volcano waiting to erupt.

D. The "Proprietor Exception" to Preemption—Airport Proprietors Have Limited Power

Now notwithstanding the lack of specific Supreme Court recognition, there has been legislative, executive, and judicial reliance on what has become known as the "proprietor exception" to Burbank's preemption decision. Such reliance has created a legal anomaly. Because federal preemption was the basis for striking down the curfew in *Burbank*, one could hardly believe that Congress would accept an airport proprietor's tinkering with the national transportation system, but not accept

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13. Footnote 14 provides:

The lesser from the Secretary of Transportation also expressed the view that "the proposed legislation will not affect the rights of a State or local public agency, as the proprietor of an airport, to issue regulations or establishing requirements as to the permissible level of noise which can be created by aircraft using the airport. Airport owners acting as "proprietors" can presently deny the use of their airports to aircraft on the basis of noise considerarions so long as such exclusion is nondiscriminatory." This portion also was quoted with approval in the Senate Report.

Appellants and the Solicitor General submit that this indicates that a municipality with jurisdiction over an airport has the power to impose a curfew on the airport, notwithstanding federal responsibility in the area. But, we are concerned here not with an ordinance imposed by the City of Burbank as "proprietor" of the airport, but with the exercise of police power. While the Hollywood-Burbank Airport may be the only major airport which is privately owned, many airports are owned by one municipality yet physically located in another. For example, the principal airport serving Cincinnati is located in Kentucky. Thus, authority that a municipality may have as a landlord is not necessarily congruent with its police power. We do not consider here what limits, if any, apply to a municipality as a proprietor.

14. Id. at 633 n.14 (emphasis in original).

15. See generally Santa Monica Airport Ass'n v. City of Santa Monica, 461 F. Supp. 927, 932 (C.D. Cal. 1979), app'd, 669 F.2d 100 (9th Cir. 1981); Brief of the United States of America, Appellee, Santa Monica Airport Ass'n v. City of Santa Monica, app'd; Brief of the United States of America, Appellee, San Diego Unified Port Dist. v. Glancey, 457 F. Supp. 223 (S.D. Cal. 1978), app'd, 611 F.2d 1309 (9th Cir. 1980).

a sovereign state or political subdivision's intrusion. Furthermore, the
Supreme Court, to validate such an interpretation, would have had to
conclude that the ill-effects of a curfew imposed by a proprieto
er/municipality are acceptable, while the ill-effects of a curfew im-
posed by a nonproprietor/municipality are not. 87 Unfortunately,
though the Supreme Court clearly decided the specific preemption is-
ue in Burbank, it left somewhat of a "sticky wicket" in its wake, par-
ticularly the controversy regarding proprietor/municipality powers.

An objective view of Burbank suggests that the Supreme Court
knows exactly what it was doing: placing limits on local interference
with federal management of the airspace—be the interferer a proprieto-
or nonproprietor. The Supreme Court accepts cases because of
their national impact. It may be beyond credibility that the Supreme
Court granted certiorari in Burbank to reach a decision that would
apply solely to Hollywood-Burbank Airport, the only privately owned
major airport in the United States. Consequently, footnote 14 might
well be the latest in a long list of convenient "red herrings." 88

The Caudy, Griggs, and Burbank decisions have established a
classic confrontation, and their progeny reflect the resulting confusion.
While Griggs represents proprietor liability in the midst of a sea of fed-
eral regulatory actions, Burbank represents federal preemption in the
minds of a sea of locally imposed airport use restrictions. Can the two
principles coexist?

An early test came in Air Transport Association v. Cort, 89 where
the Air Transport Association sought a determination of whether air-

87. In discussing the effects of a curfew along with the FAA's position, the Supreme
Court pointed out that according to the testimony at trial, the increased congestion and
incapacity brought on by Burbank-type curfews would aggravate the same problem. See

88. This view was supported by the FAA in a 1973 study:  However, the Supreme Court
does not see probable jurisdiction and affirm a case such as Burbank unless a substantial Federal question is presented. If after
noting probable jurisdiction, the Court finds that the plaintiff [he] constitutes a
class of one or two and that no broad question is therefore presented, the case will
be dismissed. When the Court affirms with a precedent setting opinion it "must"
have believed that state and local government owned airports could be included
within the preemption rationale . . . . Nothing in the opinion explicitly suggests the
foregoing except that with an exception of two, all air carriers are
owned by states or political subdivisions thereof. If all such airports can be
owned by their owners, as owners, the Burbank opinion means very little.
Brief for Plaintiff/Appellant and Plaintiff-Intervenors/Appellants Santa Monica Airport
Assn. v. City of Santa Monica, 439 F.2d 100 (9th Cir. 1971) (quoting Environmental Protec-
tion Agency, Aircraft/Airport Noise Report—Legal and Institutional Analysis of Aircraft
and Airport Noise Aprointments of Authority Between Federal, State and Local Govern-
ments, at 2-46 (July 27, 1973)).

1981]

AVIATION NOISE ABATEMENT


These standards seek to achieve a gradual reduction in the amount of noise generated by aircraft takeoffs and landings at California airports. They establish what is known as a Community Noise Equivalent Level (CNEL). CNEL provides a method for computing on a 24-hour basis an average noise exposure level. A cumulative analysis, for example, nighttime operations are penalized ten times) takes into account the total noise generated by aircraft “events” over a given period of time. In graduated steps, no airport is to have a “noise impact boundary” containing an “unacceptable land use” in excess of 60 dB on the CNEL scale by 1982.

The CNEL standards require an airport operator to operate its airport so as not to exceed the applicable CNEL noise levels. 21 Cal. Admin. Code § 1002 (1977). An operator unable to comply with the noise standards may apply to the Department for a variance. 21 Cal. Admin. Code § 1005 (1979). As a practical matter, the noise standards are so stringent that all of the major airports in California—including those at Los Angeles, San Francisco, San Jose, Burbank, San Diego, and Ontario, as well as John Wayne Airport in Orange County—must apply for an annual basis for a variance as a matter of routine. Newhouse v. Selleck, 13 Cal. 3d 633, 634-635 (1975).

90. See 283 F. Supp. at 63-64.

91. Id. at 63. The court stated:

"We believe that the Airliners' total reliance on "airwaves" is misplaced. The formal picture of the airwaves is of narrow focus, a single police power en masse of a municipality—no airport proprietor—suggesting restrictions of aircraft noise by forbidding aircraft flight at certain times. The holding in Davis is limited to that provision as constituting an unlawful exercise of police power in a state pre-empted by the federal government, and we ask as to the words in 14:11 in another: "A legislature may cast a notice not necessarily congruent with its police power. We do not consider here what limits if any apply to a municipality as a proprietor.""

92. Id. at 63-64.

93. Id. at 63-64. Perhaps Green is not the final word for California's CNEL methodology. In San Diego Unified Port Dist. v. Giammarco, 457 F. Supp. 283 (S.D. Cal. 1978), app'd, 481 F.2d 1306 (9th Cir. 1973), a district court found that California's attempt to condition the granting of a variance from its CNEL requirement for the operation of the San Diego airport was a nonproprietary regulation prohibited by Davis. See infra note 122.
invasion of a federally preempted area. However, the same court also cited Burbank to strike down California's Single Event Noise Exposure Levels (SENELs) because the use of this standard was an attempt to regulate "noise levels occurring when an aircraft is in direct flight [which is an unlawful intrusion] into the exclusive federal domain of control over aircraft flights and operations."54

If liability follows responsibility, the Croft decision suggests two propositions: first, airport proprietors are liable for damage that they can control (noise from an aircraft while on the ground at the airport and possibly noise that could be excluded by preventing or limiting air service); and, second, the federal government preempts airport proprietor liability for noise damage that the proprietor cannot control (aircraft in flight). However, Croft did not go the "extra mile" because it said nothing about federal liability for noise damages caused by aircraft while under FAA control in the air.54

The culprit is Burbank; it left some "daylight" for proprietor-initiated restrictions on airport use that were ultimately supported in principle by the FAA in its 1975 Noise Policy and in other pronouncements.57 Courts could then use congressional vagueness, executive interpretations, and judicial dicta to support an exception to the Burbank preemption rule. But that is not always such an easy task, and one court's difficulty was aptly expressed by Judge Peckham in National Aviation v. City of Hayward:58

Thus, this court finds itself caught on the horns of a particularly sharp dilemma: if on one hand, we follow the dicta

54. 389 F. Supp. at 64-65. The court left for another day the decision of whether the CNEL provisions were invalid as actually applied. Id. at 65.
55. Id. at 65.
56. Although the Croft court viewed CNEL as a legitimate manner of measuring and regulating noise near airports in a recent speech FAA Administrator J. Lynn Helms reached a contrary conclusion. According to Mr. Helms, the FAA is drafting legislation to require FAA approval of local restrictions on airport noise. Specifically addressing California's use of this CNEL concept, Mr. Helms commented that "inaccurate California noise standards will either shut down significant segments of the air transportation industry or create compromises on safety." Helms continued, "Clearly, the California noise laws are putting such pressures on the airport operators that the operators are seeking solutions which make trade-offs between noise and safety." Finally, the FAA Administrator considered that such measures "could cripple our air transportation system and stifle this nation's continued economic development." See States Airport Noise Rules Called Too Strident, Los Angeles Times, Feb. 19, 1974, at 20, col. 4. Quot.
57. See Noise Abatement Policy, supra note 1, at 34.
in footnote 14 of the Burbank opinion, which is intended to comport with the court's holding in Griggs, we will severely undercut the rationale of Burbank's finding of preemption. If on the other hand, we disregard the proprietor exception as dicta in order to fully effectuate the Burbank rationale, we impose upon airport proprietors the responsibility under Griggs for obtaining the requisite noise abatement, yet deny them the authority to control the level of noise produced at their airports.99

Hayward involved an action brought by four airplane operators at the Hayward Municipal Airport, a noncommercial airport, to declare unconstitutional an ordinance enacted in the City's capacity as airport proprietor. The ordinance prohibited aircraft exceeding certain noise levels from taking off between 11 p.m. and 7 a.m. In harmonizing Burbank and Croff, the court held that preemption did not forbid the enforcement of the Hayward ordinance. In the court's view, Congress intended only to preclude a municipal authority that was not an airport proprietor from enacting police power regulations regarding airport noise. It did not intend to preclude an airport proprietor from taking steps to exclude aircraft on the basis of noise considerations.100

The court also found that there was insufficient evidence to conclude that the Hayward ordinance did more than "incidentally" burden interstate commerce. Moreover, the court viewed, as mere speculation, the possibility that other airport proprietors might adopt similar ordinances, which together would create an impermissible burden.101

Hayward did not resolve the liability/responsibility dilemma because Judge Pechham seemed to be searching for total preemption, which, of course, he did not find. The decision, however, implies that Congress and the FAA could take charge and preempt most local noise abatement efforts while simultaneously curtailling expensive litigation.102 Also, the FAA could more clearly establish the acceptable limits of locally imposed use restrictions. However, because neither the

99. Id. at 424.
100. Id. at 424-25.
101. Id. at 425.
102. Judge Pechham was not the only judge to suggest the potential for federal preemption. Justice Bullock did the same in his dissent in Brown:

Clearly Congress could preempt the field to local regulation if it chose, and very likely the authority conferred on the Administrator of FAA by 49 U.S.C. § 431 is sufficient to authorize him to promulgate regulations effectively precluding such action. But neither Congress nor the Administrator has chosen to go that route.

411 U.S. at 633 (Rehnquist, J. dissenting).
Court nor the Hayward court found sufficient evidence of preemption, it was left for another day and another court to determine Congress' intent in this area.

Such a day came when the Second Circuit Court of Appeals addressed the Concorda landing rights issue in *British Airways Board v. Port Authority (Concorde I)* and *British Airways Board v. Port Authority (Concorde II)*. In these cases, the Port Authority of New York tried to ban the operation of the Concorda at John F. Kennedy Airport after the United States Secretary of Transportation had ordered a sixteen-month operational test to consider the feasibility and desirability of supersonic transport service to selected American airports. In two separate opinions, the court acknowledged that both airport proprietors and the FAA have a stake in airport noise abatement but that there were significant limitations to proprietary actions as well as to the degree of federal preemption. Accordingly, the court recognized and accepted an implied sharing of responsibility. It noted that "Congress repeatedly has declined to alter this cooperative scheme... [T]he legislative history clearly states that the statute [the Federal Aviation Act] was merely intended to strengthen the FAA's regulatory role within the area already totally preempted—control of flights through navigable airspace."

While recognizing that the FAA had broad executive powers, the court in *Concorde I* observed that "the Supreme Court [in Burbank] has refrained from holding that Congress has occupied the field of noise regulation to the exclusion of airport proprietors." Thus, airport proprietors can impose use restrictions. However, according to the court, an airport proprietor is subject to two important constitutional restrictions: first, proprietor-imposed noise regulations must not create an undue burden on interstate or foreign commerce; second, such restrictions may not unjustify discriminate between different categories of airport users.

While it is easy to speak of congressional intent and two-tiered responsibility, it is much more difficult to discuss two-tiered liability. In fact, after all its in-depth reading of federal statutory schemes, the Second Circuit did not even hint that the federal government could or should be liable for any noise damages it might have caused. If there is

103. 558 F.2d 75 (2d Cir. 1977).
104. 564 F.2d 1002 (2d Cir. 1977).
105. 558 F.2d at 11; 564 F.2d at 1010; n.11.
106. 558 F.2d at 12-13 (footnotes omitted).
107. Id. at 14.
108. Id.
no federal liability, can pervasive federal presence shield the airport proprietor from liability for noise damage?

E. Airport Proprietor Personal Injury Liability—A Split Decision

That question can be addressed by examining San Diego Unified Port District v. Superior Court,109 in which the court denied an attempt by a group of noise-distressed residents to recover nuisance damages from an airport proprietor because the federal government controlled the flight of the airplanes. In San Diego, the plaintiff homeowners sued under nuisance and negligence theories, claiming that the airport proprietor had failed to enact adequate regulations, such as a curfew, for the control of noise. The court used federal preemption to shield the airport proprietor from liability.110 It reasoned that because a nonairport proprietor could not impose a curfew, neither could an airport proprietor. In the court’s view, the impact of the curfew remained the same—congestion and interference with flight schedules.111 The Port District, according to the court, did not have the authority to impose a curfew and thus could not be liable for failing to do what it was not authorized to do.112 No mention was made, however, of federal liability. Interestingly, the court indicated that the supremacy clause, the basis for preemption, would not shield the proprietor from liability for various mismanagement of those noise abatement aspects under its control.113 Although this court did shield the proprietor from one aspect of liability, the principle of shared responsibility was basically reinforced.

It is an understatement that airport proprietors would rather not have the distinction of being the sole entity liable for aircraft noise. However, to date, but for a few exceptions,114 that distinction has been

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110. Id. at 376, 156 Cal. Rptr. at 564.
111. Id. at 364, 156 Cal. Rptr. at 561. The court of appeal, in referring to the propri-
112. Id. at 376, 156 Cal. Rptr. at 566.
113. Id. at 377, 156 Cal. Rptr. at 567.
114. See Lautz v. County of Milwaukee, 771 F. Supp. 1045 (E.D. Wis. 1974), aff’d in
      part, reversed and remanded in part, 511 F.2d 377 (7th Cir. 1975); San Diego Unified Port
      Dist. v. Superior Ct., 67 Cal. App. 3d 361, 156 Cal. Rptr. 257, cert. denied, 434 U.S. 859

In Lautz, the Seventh Circuit affirmed the district court’s refusal to permit residents who were aggrieved by aircraft noise, seeking, among other remedies, nuisance damages, under Wisconsin law. The court stated:

3-80
honored. In two 1974 cases, the City of Los Angeles attempted to pass noise damage liability to air carriers, manufacturers, and the federal government. The courts, however, concluded that the airport proprietor was solely liable for failure to acquire air easements.

The city's fortunes remained poor when a group of homeowners adjacent to Los Angeles International Airport sued to recover for injuries from aircraft noise. In Greater Winchester Homeowners Association v. City of Los Angeles, the plaintiffs sought damages under both inverse condemnation and nuisance theories. The California Supreme Court rejected the city's claim of federal preemption, concluding that no federal shield existed to insulate the airport proprietor from tort damages. After an exhaustive study of congressional intent, federal and state case law, and FAA regulatory actions, the court determined that neither Congress nor the FAA expressly precluded either local noise abatement actions or concomitant state remedies for personal injury awards arising out of an inverse condemnation suit. Moreover,

Since the federal laws and regulations have preempted local control of aircraft flights, supra, the defendants may not, to the extent they comply with such federal laws and regulations, be charged with negligence or creating a nuisance. Similarly, § 1.404 of the Wisconsin Statutes cannot be invoked to make unlawful flights which are in accordance with federal laws and regulations. If, as the plaintiffs allege, the aircraft flights have rendered the "taking" of their property, the plaintiffs have actions in law to recover just compensation from the County, supra . . . . To the extent that the County may be violating the federal laws or regulations, the plaintiffs should . . . obtain their administrative remedies.

321 P.2d at 391.

113. City of Los Angeles v. Japan Airlines Co., 41 Cal. App. 3d 415, 116 Cal. Rptr. 69 (1974) (city as owner-operator of Los Angeles International Airport liable because California statute provided a mechanism for city to acquire air easements absent structural agreements or legislative mandate, air carriers did not have to indemnify city); supra v. City of Los Angeles, 40 Cal. App. 3d 471, 115 Cal. Rptr. 125, cert. denied, 419 U.S. 872 (1974) (Federal control of navigable airspace no defense for airport proprietor's failure to purchase adequate air easements— as held in Gregory).


115. Id at 106, 603 P.2d at 1339, 160 Cal. Rptr. at 729. In a concurring opinion, Chief Justice Bli accounted for the majority's reliance upon the inverse condemnation law to support its holding that federal legislation had not preempted the aviation noise abatement field, id at 106-07, 603 P.2d at 1339, 160 Cal. Rptr. at 742-43 (Bli, C.J., concurring). The court concluded that the city was liable because of its failure to take action, such as construction of ground barriers or soundproofing of homes, to reduce airport noise. These actions, Chief Justice Bli concluded, would have been within the spirit of, and consistent with, federal and state laws, id at 108, 603 P.2d at 1340, 160 Cal. Rptr. at 744.

Chief Justice Bli's concurring opinion suggests the possibility that had the proprietor done all it could, it may have been absolved of liability. Id at 108, 603 P.2d at 1340-41, 160 Cal. Rptr. at 744. Furthermore, her statement that "federal regulations cannot preemp-
the court believed that airport proprietors had the power to limit their liability under Griggs because Congress had preserved proprietary control over airport design, planning, and use. This limited power of airport proprietors to impose certain controls doomed them. After finding "no appellate agreement on the scope of the so-called 'proprietor exception' to the federal preemption rule [of Burbane] and its effect on the tortious liability of airports," the California Supreme Court found no basis for federal preemption of personal damage awards.

The court's decision was based on the following legal points:

1. San Diego Blvd. Trade Council v. Garrett, 355 U.S. 236 (1957), held that the California Supreme Court was correct in finding that the "dangerous activity" provision of the Federal Labor Relations Act precluded jurisdiction over the airport.

2. In Grimm v. City of Adelanto, 217 Cal. App. 142 (1942), the court held that the City of Adelanto was not liable for the damages caused by aircraft noise, as it was not within the ambit of "dangerous activity" or "situation continuous" provisions of the Federal Labor Relations Act.

3. The court also cited Oregon v. Manhattan Packing Co., 124 U.S. 515 (1888), which upheld the right of a city to regulate aircraft noise to protect its residents.

4. Finally, the court referred to the Federal Preemption Doctrine, which holds that federal law preempts state law in cases where the federal law is applicable.

In summary, the court believed that airport proprietors had the power to limit their liability under Griggs because Congress had preserved proprietary control over airport design, planning, and use. After finding "no appellate agreement on the scope of the so-called 'proprietor exception' to the federal preemption rule [of Burbane] and its effect on the tortious liability of airports," the California Supreme Court found no basis for federal preemption of personal damage awards.

Id. at 84, 864 P.2d at 229, 160 Cal. Rptr. at 742.

119. Id. at 97, 864 P.2d at 1334, 160 Cal. Rptr. at 731.

120. Id. at 96, 864 P.2d at 1333-34, 160 Cal. Rptr. at 737.

121. Id. at 100, 864 P.2d at 1356, 160 Cal. Rptr. at 739. The city's argument for preemption was as follows: (1) Burbane provided that a nonairport proprietor cannot regulate aircraft noise; (2) the State of California is a nonairport proprietor; (3) the award of tort damages is a form of regulation, and, therefore, (4) the State of California is preempted from imposing tort damages on an airport proprietor.

Authority for the proposition that the award of tort damages is a form of regulation is found in San Diego Blvd. Trade Council v. Garrett, 355 U.S. 236 (1957). In Grimm, the Supreme Court, speaking through Justice Frankfurter, held that because it was arguable that certain union activities involved in that case fell within the ambit of the "dangerous activity" or the "unfair labor practices" provisions of the National Labor Relations Act, state jurisdiction to award tort damages was preempted. Concerning this issue, Justice Frankfurter wrote:

"Nor is it significant that California asserted in power to give damages rather than to enjoin what the Board may restrain though it could not compensate. Our concern is with delimiting areas of control which must be free from state regulation if national policy is to be unhindered. Such regulation can be as effectively exerted through an award of damages as through some form of preventive relief. The obligation to pay compensation can be, indeed, designed to be, a potent method of governing contested and controlling policy, given the States' auxiliary effort to redress private wrongs or grant compensation for past harm cannot be shown to regulate activities that are potentially subject to the exclusive federal regulatory scheme. (Citations omitted.) It may be that an award of damages in a particular situation will not, in fact, conflict with the asserted assertion of federal authority. The same may be true of the incidence of a particular state jurisdiction. To sanctum either involves a conflict with federal policy in that it involves allowing two law-making sources to govern."

Id. at 94, 864 P.2d at 1334.

122. Under the doctrine of Griggs v. Duke Power Co., 461 U.S. 91 (1983), the Georgia supreme court held that the City of Adelanto, as proprietor of Harford of Adelanto, is immune from state tort liability because residents in the vicinity of the airport were allegedly injured by noise emanating from aircraft using its airport.

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Other courts are also taking the provisions contained in Greater Worcester seriously. In a recent small claims case heard in South San Francisco Municipal Court, for example, a judge awarded $200 to residents $271.00 each because they were annoyed by aircraft noise near San Francisco International Airport. Most troubling are Judge Dunbar's reasons for awarding the damages. He appeared particularly disturbed that the airport proprietor had caused
Not only are there noise problems in Burbank and San Diego, but in Santa Monica as well. In Santa Monica Airport Association v. City of Santa Monica, a federal district court upheld, inter alia, a proprietary-imposed night departure curfew and the use of a SENEL standard while striking down the airport's total ban on jet aircraft. Judge Hill upheld the night departure curfew and the 100 dBA SENEL despite commerce clause, equal protection, and supremacy clause arguments from the plaintiffs, Santa Monica Airport Association, and plaintiffs-intervenors, National Business Aircraft Association and General Aviation Manufacturers Association.

One interesting aspect of the Santa Monica case concerns the issue of federal preemption and implied liability. The FAA, in its amicus brief, urged the court to hold the SENEL unconstitutional because it invaded a federally preempted area. The FAA justified this conclusion by arguing that Congress had intended that the FAA control all matters affecting aircraft in flight and that because pilots try to "beat the meter" which measures the single noise event, the SENEL "affects aircraft in flight" and is thus preempted. Despite the FAA's explicit advancement of federal preemption, Judge Hill upheld the Santa Monica SENEL. To do so, Judge Hill implicitly must have found Santa Monica potentially subject to Griggs-type liability in order to permit it to go so far as to limit its liability by imposing a SENEL. Thus, the question raised is whether the local proprietor or the federal government should have Griggs-type liability for noise damages resulting from aircraft in flight.

All of this remains rather perplexing because neither the judiciary nor Congress has adequately dealt with the subject of liability. The FAA, interpreting the federal role, has acknowledged that "although many aspects of the aircraft noise problem are appropriate for local control, the range of remedial measures available to the airport proprietor has been somewhat limited by the exercise of the paramount au-


Judge Hill is not the only one who is on the "horrid of a particularly sharp dilemma." Nationaleron, 411 F. Supp. at 924. Should the airport proprietor take the initiative and impose noise regulations en route to being second-guessed by the FAA or do something in between and be second-guessed by judge and jury? The airport proprietor must walk a fine line.

122. 441 F. Supp. 927 (C.D. Cal. 1977), aff'd, 519 F.2d 100 (9th Cir. 1971).
123. See id. at 912-13, 941, 942.
124. Id. at 915.
authority of the United States to regulate commerce."

One point seems clear, however. If airport proprietors are eventually saddled with sole liability for property damages and personal injuries resulting from airport noise, they will, in self-preservation, devise airport use restrictions with only their local interests in mind, thus destroying the hope for a uniform national air transportation system.

IV. RECOMMENDATIONS—THE SEARCH FOR SMOOTH AIR

To say the least, it is not an easy task to summarize this complex subject and to fashion simple recommendations. Exploration of the major congressional acts dealing with aviation noise and discussion of the myriad of relevant court opinions reveal that a heated controversy exists over whether the FAA should be the country's leading proponent for enacting a coordinated effort to reduce aircraft noise.

While the FAA is perfectly willing to share responsibility, on its own terms, i.e., along with Congress, dreads the thought that the federal government should help pay for the current shortcomings in the national aircraft noise abatement effort. Moreover, the courts have supported the federal government's position and have made airport proprietors the scapegoat for damages caused by aviation noise. As a result of the courts' refusal to place a portion of the liability on the federal government, airport proprietors face the unenviable honor of being solely liable for potentially unlimited damages, even though they have only limited rights to impose use restrictions to minimize aviation noise.

Not only does this shared responsibility/sole liability scheme impose liability on the least likely candidates—those with the least financial resources, the least power, and the least knowledge—it is inherently unfair. The remaining portion of this article will discuss two alternative approaches that would more equitably apportion the cost of reducing aircraft noise and the payment of noise damages.

A. The Federal Government Should Share Liability

The federal government should accept liability for the aviation noise damages caused by situations under its control, such as aircraft in flight. Alternatively, the courts should impose liability on the federal government if it refuses to accept such liability.

This shared responsibility/shared liability approach would reflect
the divisions within the aviation noise abatement effort. The airport proprietor's sphere of influence in the noise abatement field generally encompasses airport site location and design, adequate zoning and procurement of air easements, fair and reasonable access to the airport, and management of ground facilities. Conversely, the federal government's role encompasses noise abatement actions related to quieter engines, aircraft operational procedures and flight patterns, review and approval of local use restrictions, and management of the air traffic control system. 128 Airport proprietors should be liable only for the aviation noise damages they actually cause or fail to prevent. In turn, the FAA should be held proportionately liable for aviation noise damages caused by situations over which it has control. 129 This division is similar to a comparative negligence approach.

The judiciary must be made aware that there exists a rationale for a shared responsibility/shared liability approach. For this concept to become a reality, Griggs would not have to be overturned per se. It simply must be viewed in the context of present-day conditions. Griggs was decided in 1962, well before the enactment of most of the airport noise legislation that has been reviewed. A fresh look would reveal that the federal government's involvement in this area has become pervasive. The CAB certifies airlines for economic fitness; the FAA certifies airlines, airports, and airplanes, and controls the flight of aircraft from the clouds to the runway. The federal government should be liable if it has "permissive control" of the situation but fails to fulfill its responsibility to reduce or avoid aviation noise damage. 130 Rather than being detrimental to the national interest, shared liability would prompt the federal government to take a more assertive role in the effort to reduce aircraft noise.

Congress may not have intended complete federal preemption, but

128. Noise Abatement Policy, supra note 1, at 1.
129. The Air Transport Association (ATA) has argued that the imposition of liability on the FAA is preferable to the preemption of the national air transportation network by a mass of locally imposed airport use restrictions. For example, in a recent petition to the FAA urging it to adopt noise abatement rules, the ATA discussed federal responsibility and potential liability

[Even if the court... determines that liability should attach to the Federal Government by virtue of the FAA's affirmation and assertion of federal preemption, it would be a small price to pay to prevent uncounted and unilateral restrictions at various (sic) airports from working separately (sic), or in combination, to endanger the maintenance, promotion and development of the national air transportation system.]

neither has it discouraged shared liability. The legislators probably were unaware that airport proprietors would be saddled with complete liability for the failures of the federal government. Yet the FAA continues to imply, not necessarily in specific terms, that the only way for the federal government to assume any liability would be for it to assume complete preemptory status.\footnote{11} However, the FAA has not explained why its liability cannot coexist with airport proprietors' liability. Room exists for compromise, but the FAA has chosen an all or nothing approach. The consequence of this position is that federal leadership in aviation noise abatement is being stilled because of a fear of liability.\footnote{12}

\footnote{11} See Noise Abatement Policy, supra note 1, at 34, where the FAA euphemistically proclaims:

Our concept of the legal framework underlying this policy statement is that proprietors must face the necessity to impose such restrictions if they do not violate any Constitutional preemption. We have been urged to undertake—and have considered carefully and rejected—full and complete federal preemption of the field of aviation noise abatement. In our judgment the control and reduction of airport noise will remain a shared responsibility among airport proprietors, users, and government.

\footnote{12} The federal preemption, or lack thereof, in the form of active leadership in aviation noise abatement, is an interesting subject to another California case. San Diego United Port Dist. v. Glinsmann, 457 F. Supp. 283 (S.D. Cal. 1978), aff'd, 651 F.2d 1106 (9th Cir. 1981). The California Department of Transportation (CalTrans) conditioned its grant of a CIVEL noise variance to the Port District for its operation of Lindbergh Field on the District's extension of its voluntary curfew from six to eight hours. Id. at 285. After receiving the variance from CalTrans, the Port District sued for injunctive and declaratory relief on the ground that the "curfew condition" was unconstitutional because it invaded a field preempted by the federal government. Id. at 286-88. The district court found that CalTrans' attempts to enact San Diego's curfew was a nonproprietary regulation of an airport prohibited by 18 U.S.C., id. at 292, and granted the Port District's application for a preliminary injunction. Id. at 295.

While the court's decision was clear, the FAA's conduct in this case is not easily understood. Before Judge Schwartz heard the merits of the case, he ruled that the Port District was required to initiate administrative remedies because complying with a CalTrans request that it seek FAA review of the curfew extension, id. at 286 n.1. However, after being provided with full background information on the issue by all the parties, the FAA announced that "it would not provide any response and that no written statement concerning its review would be forthcoming." Id. at 287. The FAA's refusal to respond clearly violated its 1976 Noise Abatement Policy which encouraged such requests. See Noise Abatement Policy, supra note 1, at 29.

One additional point stands out. When San Diego originally established the voluntary night curfew in 1973, the FAA "expressed the hope that Port District would suspend the night restrictions pending completion of the FAA's efforts to develop a noise policy under which all parties concerned could move together in a comprehensive nationwide noise abatement program," and that while the FAA would publish the curfew it "would not 'deny take-off or landing clearance' because to do so might give the appearance of tacit approval of the restrictions by FAA." Brief for United States of America, amicus curiae, at 11, San Diego United Port Dist. v. Glinsmann, 457 F. Supp. 283 (S.D. Cal. 1978). Yet when the Port
The entire aviation community depends upon an integrated, comprehensive, and safe national air transportation system. The traveling public and airport neighbors want a safe system too, but they also would appreciate a quieter environment. Consequently, no party can or should be permitted to shirk its responsibilities or hide from its liabilities. Unless some positive national leadership is assumed by the FAA, all hopes for maintaining a modicum of order and for avoiding potential systemwide chaos will be dashed.

Although the Supreme Court ultimately may resolve the responsibility/liability issue, continuous resort to the courtroom is not the most efficient way to run a national air transportation system. It is time for federal authorities, within constitutional limits, not only to take charge but also to assume their liability, if necessary, through appropriate legislation.

2. An Aviation Noise Abatement Trust Fund

If the shared responsibility/sole liability concept persists, airport proprietors will continue to incur judgments for the diminution in value of private property and, in some jurisdictions, for the personal injury damages caused by noise emanating from aircraft utilizing their facilities. In response, airport proprietors will continue and, perhaps, increase their efforts to promulgate noise abatement programs designed to reduce their liability exposure. These efforts, which may include the initiation of curfews, jet bans, prohibitions against all but Part 16 aircraft or limitations on service, will be parochial in nature. Little effort will be exerted to consider their impact on the nation's air transportation system. As a result, Congress' attempt to achieve a uniform national transportation system will be thwarted.

What else might be done to prevent the balkanization of the air transportation system? One option is the creation of a program that

Dissent asked the FAA for advice, three years after the FAA had published its Noise Abatement Policy, the FAA refused to respond.

123. Examples of completed or proposed airport use restrictions by airport proprietors to reduce aircraft noise include: (1) Negotiated operating restrictions (Lindbergh Field, San Diego, California; Pearl Harbor, Oahu, Washington National, Washington, D.C.), (2) total jet bans (Santa Monica Municipal Airport, California, Waterfront Municipal Airport, Washington, D.C.), (3) excluding certain Part 16 aircraft (Los Angeles International, Logan International, Boston), (4) limiting the number of aircraft operations (Stewart Airport, New York), (5) excluding particular types of aircraft (Los Angeles International and Logan International have prohibited SST's), (6) limiting number of nighttime operations (Minneapolis—St. Paul), (7) operational noise limits (JFK International), (8) displaced threshold (Logan International and many more), and (9) preferential runways (Atlanta Miami Tampa San Juan O'Hare, Chicago; Denver; Montreal, New Orleans; Newark and many more).
would satisfy the concerns of both those in and those affected by the air transportation industry. The FAA should remain at the helm of any program so that the transportation industry remains both national and uniform; airport proprietors should not be the sole entity to bear the liability burden; air carriers should not be faced with the uncertainty resulting from locally designed noise abatement rules and regulations; noise impacted residents should not continue to be subjected to high levels of aircraft noise; and, most importantly, the users of the system, passengers, the airline industry, and others, should pay for the damages caused by aircraft noise.

These concerns can be satisfied by the creation of a federal matching grants program similar to the plan created by the Airport and Airway Development Act. However, the framework established in AADA is not adequate. For one reason, although currently more than three billion dollars remain in the Airport Trust Fund, the FAA presently has authority to award only minor grants for noise abatement projects. Second, user taxes are no longer funneled into the Trust Fund; since September 30, 1981, they have been siphoned off into the general fund. The following is a compendium of the essential components of a noise abatement program that should satisfy most of the concerns of all parties involved:

1. A Noise Abatement Trust Fund (NATF) should be created. The NATF must be separate from the Trust Fund established by AADA or its replacement. Additionally, the AADA Trust Fund should no longer fund the limited noise abatement projects it now funds. A certain portion of the existing AADA Trust Fund should be transferred to NATF to put NATF solidly on its feet from its inception. This amount should approximate the amounts that would reasonably have been allocated to noise projects from the AADA Trust Fund. Moreover, the NATF should be scrupulously administered so that the monies received are actually spent on valid noise abatement projects and not squandered in the federal treasury or spent for nontrust fund purposes.

134. As of October 31, 1980, the Airport and Airway Trust Fund balance was $5.30 billion, down from $5.49 billion at the end of September, 1980. In addition, no user taxes were collected during October, 1980. 223 AVIATION DAILY 4 (1981). As of May, 1981, $5.6 billion remained. CREASY, Final Teams Up For Gifts in Legislative Game, COMMERTER A.A., May 15, 1981, at 25 (henceforth cited as CREASY).

135. CREASY, supra note 134, at 25.

This may prove difficult, however. Capitol Hill sources indicate there may be a battle over what happens to the Airport Trust Fund proceeds, and it does not appear that noise abatement has high priority on the allocation list. Id. at 54.
2. The current "user taxes" established by AADA must continue with a portion of the revenues going to the AADA Trust Fund and a portion to the NATF. The prohibition against state and local "head taxes" should continue, so that the user taxes will remain uniform throughout the United States. Whether such taxes should be increased or decreased would depend on projected needs.

3. The FAA should continue in its role of determining which noise abatement projects should be funded. Thus, most of the FAA's decisions in this area would remain discretionary. However, where there is an overriding public necessity, the FAA should be mandated to make specific noise abatement grants.127

4. No airport proprietor or other governmental agency should be eligible for grants unless the airport proprietor first submits a "noise exposure map" and an "airport noise compatibility plan" as currently outlined by both the Aviation Safety and Noise Abatement Act of 1979 and its implementing regulations.128 Several airports are in the process of preparing such plans.129

5. All legitimate noise claims within a certain noise exposure area would be eligible for grants once an appropriate "Airport Noise Compatibility Plan" is approved by the FAA. These grants should be funded from the NATF. Legitimate claims would include only those permitted by that particular state, thus new sources of action would not be created. Preferably the entire claims system would be administrative, perhaps modeled after the workers compensation claim process. The Ldn 40 noise contour130 proposed in Part 150 would be an adequate compromise. It is envisioned that an airport proprietor's airport noise compatibility plans will contain alternative noise abatement res-

127. This suggestion is not unlike that made by FAA Administrator J. Lynn Heims in a recent speech in Dallas, Texas. Mr. Heims indicated that the FAA is preparing legislation for presentation to Congress this summer that would require some form of FAA review and approval of local airport restrictions. Mr. Heims stated that the FAA's perspective in this review process would be "national in scope ... recognizing that the closing of an airport even for one hour has effects on the national air transportation system well beyond the local community." See Simon, FAA Preparing Contours' Airport Noise Regulations, Daily News (Van Nuys, Cal.), Feb. 19, 1982 at 1, col. 4.


129. For example, Los Angeles International Airport has its Airport Noise Control and Land Use Compatibility Study (ANCLUC) in progress. Representatives of the cities of Los Angeles, Inglewood, El Segundo, and Hawthorne, as well as the County of Los Angeles, meet on a regular basis to gather data in order to prepare a noise exposure map and the required noise compatibility plan. It should be completed within a year. Statement of Maurice Lazar, Los Angeles International Airport Environmental Coordinator, in John St. Wedick (July 1, 1981).

130. See supra note 20 for a discussion of Ldn.
commendations. Such recommendations would be made by the airport proprietor after consultation with representatives of noise-affected communities and other public interest groups within the 65 LdN contour. The recommendations might urge soundproofing certain homes and/or schools, construction of sound barriers on or near the airport, land conversion of one form or another, acquisition of air easements by the airport proprietor, condemnation of the most severely impacted residential properties, or, perhaps even the institution of a "dollars for decibels" fund at a particular airport. The FAA would have discretion in determining what is a legitimate claim. Most likely, it would be guided by the number of claims in a particular area, and perhaps it would place limits on the amount a claimant could receive for non-physical (e.g., emotional distress) personal injury claims. After all, in part, the purpose of the NATF is to pay for noise damage and reduce the impact of aircraft noise.

6. In order to qualify for grants, the airport proprietor would have to follow the reasonable recommendations of the FAA with reference to noise abatement procedures that must be instituted by the proprietor. For example, if the FAA approves a plan to construct a sound barrier, the airport proprietor would have to comply or risk not only being declared ineligible for a specific grant, but also risk absorbing 100% of future noise damage claims.

7. The federal government would be legally liable only for the payment of airport noise-related damage claims as provided for in the NATF program. Thus, within constitutional limitations the federal government could not be made a defendant in an aircraft noise suit.

V. Conclusion

Throughout this article it has been assumed that Congress wishes to maintain a uniform national air transportation system. If this is correct, something must be done before the system becomes chaotic. The concept of sole liability hangs over the heads of airport proprietors like the sword of Damocles, and they can react in only one way: self-defense. The authors' recommendations offer a reasonable compromise between total preemption and complete federal abdication. The former

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141. Some commentators have suggested that noise-based landing fees, keyed to the noiseiest aircraft, should be part of a comprehensive plan for the abatement of aircraft noise. See Banas & Allen, Legal Aspects of Airport Noise, 15 J. L. & ECON. 1, 70 (1972); Ellingsworth, Noise Policy 1973 (Industry/DOE Debate, Aviation Week & Space Tech., Dec. 9, 1974) at 14; Baiz & Bell, Airport Noise: Legal Developments and Economic Alternatives, 8 Ecology L.Q. 607, 608 (1980).
is probably too costly and ignores local prerogatives, while the latter is equally costly at the local level and is potentially destructive of any national transportation scheme. Either the institutionalization of shared liability or the creation of proper noise abatement funding would go a long way toward helping to prevent the fractionalization of the nation's air transportation system by nonuniform local or court-imposed solutions to airport noise problems. Simultaneously, the adoption of either approach would eliminate the airport practitioners' greatest continuing fear: shared responsibility/single liability.
SECTION 4

OPERATIONAL CONSIDERATIONS
RESERVED

TO BE INSERTED AT A LATER DATE
AIRCRAFT PERFORMANCE CONSIDERATIONS FOR NOISE ABATEMENT CLIMB PROFILES

William W. Melvin

Figure 1 shows the resolution of forces along the direction of motion of a vehicle as it climbs a hill. Thrust must overcome drag as well as the component of weight acting opposite to thrust. Excess thrust can either accelerate the vehicle or cause it to climb a steeper hill. If the vehicle descends a hill, the weight component acts in the same direction as thrust so thrust must be decreased to maintain a constant speed.

Aircraft can make their own hill to climb or descend a constant speed within the limitations of their thrust and drag capabilities. It should be noted that aircraft not changing the direction of their inertial trajectory are in one G flight condition when G is measured normal (perpendicular) to the direction of flight. This means that climbing aircraft do not require more lift than descending aircraft. It does require a change in G or lift to change the direction of the inertial trajectory, but to sustain a climb or descent at a constant airspeed requires a balance of thrust and drag for the required condition.

An aircraft's drag is composed of two basic parts. One is profile drag which increases as a square function of an increase in airspeed. The other drag is that which is induced by the generation of lift and is called induced drag. As air encounters a moving airfoil, it is deflected downward as shown in Figure 2 if positive lift is generated. This deflection of the air causes the airfoil to see an angle of attack relative to the local air flow that is different from the angle of attack relative to the remote free stream air. Using the definition of lift being perpendicular to the relative airflow, the lift vector can be expressed as relative to the remote free stream air, which is the generally accepted use of the term, and also expressed as relative to the local induced flow. The vector difference between the two lift vectors is the direction of drag is defined an induced drag and is a necessary consequence of producing lift. Induced drag increases as a function of the reciprocal of the square of the airspeed. One purpose for defining it separately is to understand the shape of the drag curve where drag increases from the minimum value with either an increase of a decrease in airspeed.

A total drag curve for a typical aircraft is as shown in Figure 3. The net thrust over drag margin defines the aircraft's capability to climb or its flight path angle. Note that the minimum climb angle for jet aircraft will occur at the minimum drag point and that either an increase or decrease from that condition will result in a lower climb angle capability. This is not usually true for propeller aircraft because they often times have large increases in propeller thrust with decreases in airspeed.

If an aircraft increases its bank angle the induced drag will increase and shift the minimum drag point to a higher airspeed with a total increase in drag which reduces the aircraft's climb capability. This is the reason for limiting an aircraft's bank angle with an engine failure to 15 degrees. At this level the induced drag only increases about 7 percent and since induced drag is only one half of total drag at the minimum drag point, aircraft climb
capability is not appreciably affected. However, at a 30 degree bank angle the
induced drag increases about 33 percent for a total drag increase of more than
15 percent which is intolerable in the engine out case. With a 30 degree bank
the increase in stall speed is only about 15 percent, so contrary to popular
belief, the 15 degree limit for engine out flight is to limit drag instead of
being for stall protection.

It is the position of the Airworthiness and Performance Committee that noise
abatement departures requiring 30 degree bank angles are satisfactory so long
as the pilot is not required to maintain a 30 degree bank in the event of an
engine failure. Most such cases are to avoid populated areas where there is no
real physical obstacle so if an engine fails the pilot has no safety problem in
ignoring the noise abatement track. However, certain noise abatement
departures are selected where physical obstacles are limiting such as the
shoreline and quiet departures at SFO. In these cases we insist that
performance accountability be taken for the engine out case with the required
bank angle to miss the obstacle.

Not all airlines do this. The departure plate for the Shoreline and Quiet
departures at SFO requires a 7 percent climb gradient (420 feet per nautical
mile), but the straight out departure for runway 28 only requires a 5 percent
climb gradient (300 feet per nautical mile). Some airlines use the climb
gradient requirements for a straight out departure to limit the takeoff on
runway 28 with no account for the Shoreline or Quiet gradients. Thus if an
aircraft is weight limited for the takeoff and uses the Shoreline or Quiet
departure, the pilot will be in deep trouble if an engine fails and he is
committed to make the turn to avoid Mt. San Bruno.

Back to the main topic at hand. It is clear than an aircraft will achieve its
best climb angle with the maximum margin of thrust over drag. If thrust
reductions are used to reduce noise, the aircraft will have a performance
advantage if it has reduced its drag from the initial condition. The twin
ingine aircraft has brilliant performance with both engines running and very
limited performance with one shut down. For this reason we are opposed to
extending the exposure time to the risks of engine failure in takeoff drag
configuration and advocate a reduction of drag at the earliest possible
opportunity.

Unfortunately, many pilots see the reduction of drag from the takeoff condition
as a requirement to lower the pitch to about one half of the original value and
accelerate. Although this is one procedure in use by some airlines it should
not be considered a requirement when at low altitudes. If an aircraft has had
a normal takeoff it will usually have a speed of about V2 + 10 knots after the
climb is stabilized. This is usually sufficient to reduce the drag by the
first increment which will offer a significant safety advantage in the event of
subsequent engine failure. However, if a pilot interprets this as a signal to
reduce the pitch by one half he will be most reluctant to do so at low
altitude.

The 400 foot level above the takeoff surface has been used by some as a
reference to reduce thrust, turn on airfoil anti-ice and disarm autopilot trip
systems. This is based upon a misunderstanding of the certification process.
From certification tests, aircraft are weight restricted so that twin engine aircraft demonstrate a 2.4 percent climb gradient with an engine failure in the takeoff condition with the gear retracted. Three engine aircraft must have a 2.7 percent capability and four engine aircraft a 3.0 percent capability.

These requirements came from the ICAO Standing Committee on Performance report of 1953 and were based upon a mathematical probability study to not penetrate an arbitrary one percent surface more frequently that the design incident probability that was selected. If the design incident probability of one event in 10 million takeoffs is selected then the above numbers fall out. The higher values for greater numbers of engines is due solely to the fact that there is a greater probability of an engine failure as the number of engines increases.

The transition from the second segment to the final or enroute segment cannot begin before 400 feet nor later than 1500 feet according to certification criteria. But remember that this criteria is based upon the assumption of an engine failure. For certification, the drag reduction is always associated with a level or nearly level segment where a total transition to the clean configuration occurs. Intermediate drag levels are not considered. In real life though if an aircraft has in fact achieved a speed suitable for a drag reduction and an engine fails, the aircraft will achieve a greater climb gradient by taking the incremental reduction in drag and continuing the climb until clear of obstacles.

However, many airlines have worked this in the direction opposite to the safest approach. Instead of using an early drag reduction to reduce risks in the event of engine failure, they have reduced thrust to barely meet the enroute gradient requirements. In addition pilots are advised they can disarm the autopilot trip systems and use airfoil anti-ice. It is our contention that this is not allowed by the certification criteria, i.e., there is no provision for a thrust reduction in the second segment configuration even if clear of obstacles. Disarming the autopilot trip and using airfoil anti-ice is based upon being out of the second segment configuration which can occur only after an initial drag reduction. However, none have made the interpretation that an aircraft is out of the second segment after 400 feet or clear of obstacles. This is clearly not the intent of the certification rules.

Second segment engine out climb requirements are minimum requirements derived from a safety analysis to not penetrate the arbitrary one percent surface and are not the minimum requirements for obstacle clearance which are specified in the operating rule. The excess thrust that exists to meet the climb gradient requirement is that which is used to accelerate the aircraft in a level condition for flap retraction. If this thrust margin is significantly reduced by only requiring an engine out gradient that is less than one half of the certification minimum (enroute instead of second segment) then the capability to accelerate to the clean configuration is greatly reduced. With autopilot trip disarmed, the aircraft could be in a position from which it could not accelerate in level flight to conform to the flap retraction schedule. The pilot would have to increase thrust and/or manually trip the A/C pressurization pack. Likewise, if airfoil anti-ice had been selected it might have to be turned off until the aircraft achieved a sufficient performance margin by drag reduction to tolerate the thrust drain.

The above situation where a pilot is required to perform unusual tasks in the worst case is clearly not in the best interest of air safety.
Airworthiness and Performance Committee recommends a procedure that is consistent with what would be required in the worst case of engine failure. This is to reduce drag at the earliest opportunity. We prefer to clean the aircraft up before reducing thrust which produces the best performance margin at reduced thrust as well as being the safest procedure. There is no conflict in this case with disarming the autopack trip or in using airfoil anti-ice. It should be noted though that in any drag condition if the aircraft is operated significantly faster than the minimum drag point then climb gradient capability suffers and more noise is perceived on the ground.

Some procedures are very complicated and require large changes in pitch and thrust to comply with. However, a very simple and safe procedure would not have to be so encumbered with specific altitude limits. Our recommendation is that when a normal rotation results in an airspeed that is appropriate for a drag reduction, the pilot should take that reduction as soon as he feels comfortable. If 400 feet makes him comfortable, that is fine. He should not reduce pitch to accelerate unless he is above the obstacle clearance altitude or clean up altitude used for the engine failure case. When above the engine out clean up altitude the pilot should further reduce drag, preferably to the clean configuration, and then reduce thrust for noise abatement.

Because most aircraft use large incremental drag reductions there usually occurs in the retraction schedule a requirement for a large speed increase which imposes a constraint upon the most desirable procedure when noise sensitive areas are very close to the take off point. We feel that if the aircraft is not in the enroute configuration (clean) that thrust should never be reduced below the requirement for the appropriate second segment or obstacle clearance requirement in the event of an engine failure unless the aircraft is above an altitude that can be safely used to return to the airport for landing and at an appropriate drag condition for such operation. This allows some flexibility for the close in sensitive area when a total drag reduction would occur too late to be of practical benefit. However, we caution against reducing the thrust to the enroute engine out level when not in the enroute configuration (clean) and at an altitude too low to be safely used to return for a landing.

If the thrust is set for the engine out enroute gradient after attaining a safe altitude for return, allowance should be made to account for the facts that autopack trip may have been disarmed and airfoil anti-ice selected.
Angle of Climb Determination

Figure 1.
Figure 1.

Typical Drag Curve for Jet Aircraft

Induced Drag

Figure 2.
SECTION 5

BACKGROUND OF INM
INTEGRATED NOISE MODEL
The Cause of Jet Airplane Noise - The Engine

The vast majority of aircraft noise disturbances near airports are due to the operation of commercial jet-air carrier airplanes. Although the movement of an aircraft flying at subsonic speed generates some noise due to turbulence, the primary source of jet aircraft noise is the engines.

The two principal sources of noise from turbofan engines are the jet exhaust and the fan/compressor, as shown in Figure 1. Jet exhaust noise—the roar of the primary jet exhaust—comes from turbulent mixing of high-velocity exhaust gases with the ambient air. The jet exhaust generates sound energy over a wide band of frequencies. During a fly-over, the exhaust noise will increase after the aircraft has passed overhead, and reach a maximum when the listener is located at approximately a 45-degree angle to the jet exhaust axis. Turbo-machinery noises of the jet engine are generated within the fan, compressor, and turbine rotating elements. The sounds from the turbo-machinery encompass many frequencies and may contain high frequency tones that screech and are particularly annoying.

**FIG. 1**

[Diagram of engine noise sources]
The perceived noise from any source decreases as the distance is increased between that source and people. Aviation noise is a problem near airports, where aircraft are flying near the ground as they depart or arrive.

**Characteristics of the Takeoff and Landing Operations**

**Takeoff Noise**

Aircraft use their highest power during takeoff. While the level of this power varies with the type and size of the airplane, all are at their noisiest during takeoff. Typical patterns of noise reaching the ground for various types of airplanes during takeoff are illustrated in Figure 2.

**FIG. 2**

**NOISE PATTERNS**

**TAKEOFF**

Since the noise heard depends on both the intensity of sound at the source and the distance between the source and the receiver, it is important for the airplane to reach optimum altitude before ever-flying residential areas. At certain airports where residential communities are close to the runway, flexibility in the takeoff procedure allows power cutbacks (see Figure 3), which can be initiated after the airplane has reached a safe altitude in order to reduce the source noise (Figure 4).
FIG. 3

ALTITUDE

DISTANCE FROM RUNWAY

TAKEOFF

TAKEOFF POWER

POWER CUTBACK

FIG. 4

EPNdB

DISTANCE [SOURCE TO RECEIVER]

TAKEOFF

TAKEOFF POWER

POWER CUTBACK
The power cutback procedure, however, reduces the airplane's rate of climb. This results in the airplane being at a lower altitude over areas farther away from the runway (see Figure 1) thus exposing those areas to more noise than if the original climb-power had been sustained. The best solution depends on the location of noise-sensitive areas, and will differ from site to site.

Additional flexibility exists for takeoffs in that flight tracks may be prescribed which permit airplanes to avoid flying over noise-sensitive areas after safe altitudes have been attained.

**Landing Noise**

Airplane engines produce less noise during the approach-to-landing operation because lower power is required. However, the noise produced from the fan-compressor in some airplanes may be more annoying because of its scratch or whine characteristics. Additionally, less flexibility is afforded in this operation compared to the takeoff procedure since a gradual descent for a landing usually begins 5 to 10 miles away from the airport, normally following a 3 degree "glideslope." This results in a constantly increasing noise level on the ground, as the aircraft comes closer to the airport. The noise diagram for this operation is depicted in Figure 3, which shows a 1500 ft. glide slope intercept as well as a 3000 ft. intercept. This higher flight track reduces the noise level on the ground.

**FIG. 8**

**APPROACH-TO-LANDING**
A Simulation Model to Define Airport Noise Impacts

Noise impact of any one airplane takeoff and/or landing depends on many factors. The noise generated by the specific airplane, the power being used, the airplane's performance, and the airplane's flight path in the air are all pertinent. Where more than one airplane is in operation, additional parameters must be considered to define noise impact. Such parameters are the total airport mix of airplane types and the varying flight tracks; the operational procedures; the total number of takeoff and landings by airplanes type; and, the time of day of each takeoff and landing. Only after consideration of all pertinent factors can a full understanding be achieved of the noise impact of a given airport's operation.

Airport noise impact can be expressed in a number of "noise metrics" depending on the preference of the user, the ultimate objective of the impact assessment, or both. The INM, developed to satisfy user requirements, provides these metrics.

Noise metrics available from the model are "cumulative metrics", such as the Noise Exposure Forecast (NEF), Day-Night Average Sound Level (Ldn), Equivalent Sound Level (Leq), Community Noise Equivalent Level (CNEL), and "exposure metrics" in Time Above (TA) a number of user specified A-weighted sound levels in decibels, e.g., dBA (TA90, TA95, etc.). See Appendix A for further discussion of these metrics.

Noise contours can be computed and printed at selected map scales. The user may plot contours of any of the four cumulative energy metrics or contours of equal exposure in minutes for TA specified A-weighted sound levels. The user will normally choose the single metric of greatest interest for contour plotting, but more than one metric may be used.

The model automatically provides numerical listings of the calculated noise values at all intersecting points on a grid, which encompasses the airport and surrounding neighborhoods. This printed output includes computations of any or all of the four metrics based on accumulated acoustical energy, and Time Above A-weighted sound levels for six selected noise thresholds, from 65 decibels to 115 decibels. The time of exposure calculations are further broken down into three daily periods: 1) a 24-hour day, 2) evening hours (7 p.m. to 10 p.m.) and 3) night hours (10 p.m. to 7 a.m.).

The model's data base contains common flight profiles and noise characteristics for numerous aircraft types. Changes to this built-in aircraft noise and performance data base can be accomplished through user option commands.

The noise file for each aircraft consists of noise-vs-altitude range (distance between airplane and the receiver) curves for several thrust settings. The user options are designed so that changes can be made to data from these files, if necessary. The scale of the contour map can be specified by the user as well as the spacing of the grid points for which numerical answers are provided.

5-7
TNM Outputs

The program output consists of a printout of the input data, plotted noise contours, and computed noise levels at the grid points. With the input data listed prior to calculations, the user may check for possible errors which occurred while assembling or entering the data.

The contours for a sample case are shown in the figure on page 8. Included in this example are equal noise coordinates for any of four cumulative energy metrics and Time Above 65, 75, 85, 95, 105 and 115 dBA. The user may specify the contour plot scale so it matches the scale of a desired map. The runways are drawn on the contour to provide visual orientation and reference when the contours are used as overlays on maps of the same scale.

Calculations of grid points specified by the user are printed in tabular form as shown on page 9. A lettered code relates the tabular data to grid intersections on the contour map. This facilitates the location of user specified grid points on the contour plot. For example, the coordinate (1, D) as seen on the grid-tabulated form shows the following information about that location for a 24-hour period:

1. Time Above 75 dBA = 30.3 min/24 hrs; 4.4 min/evening; 1.6 min/night
2. Time Above 85 dBA = 9.8 min/24 hrs; 1.3 min/night
3. Time Above 95 dBA = 0.9 min/24 hrs; 0.1 min/night
4. Laeq = 70.8;
5. Ldn = 73.5;
6. MEF = 30.8; and,
7. CNEQ = 74.5.

This, plus additional information is shown in tabular form on page 9.

This location can be referenced on the contour map by locating the coordinate (1, D) and should agree with any contour point if computed for that location. The grid analysis is particularly suited to determine the noise impact of specific locations without computing unnecessary information.

How the TNM May Be Used

Various individuals or organizations may have use for the TNM including:

1. airport proprietors - to gain a better understanding of the noise impacts of the operation of their airport or in the preparation of an environmental impact statement;
2. airport consultant - to better assist their clients in planning for future expansion or revision of current airport operations;
3. state or local authorities - to identify sensitive noise areas which can then be appropriately zoned for compatible land use; or,
4. the FAA - as an aid to assess the impacts of proposed revised terminal area operating procedures.
In addition to the above, a land planner or developer would find the INM a useful tool to determine the speciﬁcation he should use for noise transmission by structures planned for construction near an airport. Additionally, private citizens may avail themselves of the use of the INM.

Several speciﬁc uses of the INM suggest themselves from the preceding illustration:

- Development by local governments of land use controls or limits on utility hookups to bring about noise compatibility.
- Comparison of different aircraft types and ﬂeet mixes which could use the airport, including alternative schedules for their use.
- Comparison of aircraft operational procedures and ﬂight tracks.
- Use in Noise Control and Land Use Compatibility Plans.
- Use in assessing noise impacts when necessary for environmental impact statements.
- Identiﬁcation of future noise assessment or airport land acquisitions.
- Determination of optimal locations for on-airport acoustical barriers.
- Development of dedicated restricted areas of on-airport noise—causing operations, e.g., engine runups.

INM Enhancements

Comprehensive as the capabilities of the INM are, improvements or new uses involving increased ﬂexibility are important in improving the state-of-the-art. Based on day-to-day applications of the INM, work will continue to expand its scope, improve its functional efﬁciency, and provide new parameters to further serve the user’s needs.

Availability

The Integrated Noise Model is currently available for use from time-sharing vendors. The FAA encourages Federal, state, and local ofﬁcials and other interested parties to use the INM for aviation noise assessments. Additionally, the program for the model is available from the FAA on a loan basis. For information concerning use of the model, please refer to the “FAA Integrated Noise Model Version I: Basic User’s Guide” (Report FAA-AEQ-78-01, January 1978). Comments, suggestions, or other inquiries concerning the INM may be sent to the Federal Aviation Administration, Office of Environmental Quality, AEQ-110, 800 Independence Avenue, SW., Washington, D.C. 20591.
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APPENDIX A

This appendix presents an overview of the noise metrics which are contained in the INM. A brief discussion of each noise metric is provided. The discussion includes definitions, additional descriptive language concerning each metric, a brief treatment of the use of different INM outputs, and correlations between the metrics.

DEFINITIONS

The noise metrics available in the INM may be defined as follows:

\textbf{\textit{L}}
\textbf{eq (Equivalent A-weighted Sound Level)} - unit is \text{dB}

\textit{Leq} is the average (i.e., the average on an energy basis) noise level (usually A-weighted sound level) integrated over some specified amount of time. The A-weighted sound level (\textit{LA}) is a sound pressure level which has been fitted or weighted to approximate the human ear's perception of sound. \textit{Leq} provides a single number measure of time-varying noise for a predetermined time period.

\textbf{\textit{L}}
\textbf{dn (Average Day-Night A-weighted Level)} - unit is \text{dB}

\textit{Ldn} is the average (i.e., on an energy basis) A-weighted sound level integrated over a 24-hour period, with an arbitrary weighting applied for the noise levels occurring in nighttime periods.

Its purpose is to provide a single number measure of the impact of time-varying noise over a 24-hour period. It was developed for noise exposure surveillance and as an aid in land use planning.

\textbf{\textit{NEF}} (Noise Exposure Forecast) - scale is in \text{dB}

\textit{NEF} is the cumulative impact of aircraft noise over a 24-hour period (weighted for the time of day) of Effective Perceived Noise Level (EPNL). \textit{NEF} is used to determine the relative noise impact of aircraft noise.

\textbf{\textit{CNEL}} (Community Noise Equivalent Level) - unit is \text{dB}

\textit{CNEL} is the average (i.e., average on an energy basis) A-weighted sound level for a 24-hour period with different weighting factors for the noise levels occurring during the day, evening, and nighttime periods. The \textit{CNEL} is used in the assessment of noise impact areas around airports.

\textbf{\textit{TA}} (Time Above a Threshold of A-weighted Sound Level) - unit in minutes

\textit{TA} is the total time that a preselected, A-weighted sound level is exceeded due to aircraft operations during a specified period of time.
Description of Metrics

The noise metrics available in the INM deal basically with two characteristics of noise: the noise intensity and the number of occurrences of the noise events. Metrics in the INM which have the ability to deal with specific divisions of time of day are NEF, Ldn, CNEL and TA. The metrics in the INM can account for the acoustical effects of nonstandard conditions of field elevation and temperature; however, they do not account for seasonal effects. Based on these considerations, the metrics can be grouped under three headings:

a. NEF includes a methodology that accounts for the number of occurrences by logarithmic summation of the noise intensity of all events measured in terms of Effective Perceived Noise Level (EPNL) in units of EPNdB.

b. Ldn, Leq and CNEL are based on methodologies that utilize logarithmic summation of the noise intensity of all events measured in terms of A-weighted sound pressure level in units of dBA.

c. TA is based on a methodology that measures noise intensity and accounts, by a linear summation, for the total time above a selected A-weighted sound level.

USE OF DIFFERENT INM OUTPUTS

Different INM outputs will be relevant for use for specific situations. Several examples will illustrate this principle:

1. Peak levels, reflected in the time above (TA) metric, will provide the actual noise levels at specific locations. This information will be useful for many purposes including levels of soundproofing attenuation necessary to achieve a desired interior level of noise. For instance, a concert hall will be designed according to maximum exterior noise levels in relation to the need for a quiet interior. Peak noise levels will be pertinent to the evaluation of attenuation methods. As another example, with a 15-20 dB acoustic reduction from housing structures, an indoor awakening threshold 70-75 dBA is not likely to be exceeded for those areas where outdoor noise levels do not reach 85 dBA. With the same 15-20 dB acoustic benefit from housing structure, indoor speech interference levels (approximately 65 dBA) at a separation of 8 feet should not generally be exceeded for areas where the outdoor noise level does not reach 85 dBA.

2. The time of day will be relevant to other determinations. For instance, schools are generally not sensitive to night operations. The nighttime weighting for the cumulative metrics may be misleading as applied to school locations.
3. Cumulative metrics, such as NEF or Ldn, are valuable for showing the relative impact of alternative actions. This assists the analyst in evaluating alternative courses of action.

CORRELATION BETWEEN METRICS

There are correlations among the various cumulative noise metrics. NEF is equivalent to CNEL or Ldn minus 15, plus or minus 1. For example, Ldn 65 and CNEL 65 are approximately equal to NEF 30. Basically, Ldn, CNEL and Leq are similar, within numerical constants, and differ either in the manner evening noise is weighted or in the time-of-day corrections.
SECTION 6

GLOSSARY OF TERMS
GLOSSARY OF TERMS

Annual Average Busy Day - The number of annual average busy day operations in the average of the twelve monthly averages of workday operations.

Audible Range (of Frequency) (Audio-Frequency Range) - The frequency range 18 Hz to 20,000 Hz (20kHz). This is conventionally taken to be the normal frequency of human hearing.

A-Weighted Sound Level, A-Level (AL) - The ear does not respond equally to sounds of all frequencies, but is less efficient at low and high frequencies than it is at medium or speech range frequencies. Thus, to obtain a single number representing the sound pressure level of a noise containing a wide range of frequencies in a manner approximating the response of the ear, it is necessary to reduce, or weight, the effects of the low and high frequencies with respect to the medium frequencies. Thus, the low and high frequencies are deemphasized with the A-weighting.

The A-scale sound level is a quantity, in decibels, read from a standard sound-level meter with A-weighting circuitry. The A-scale weighting discriminates against the lower frequencies according to a relationship approximating the auditory sensitivity of the human ear. The A-scale sound level measures approximately the relative "noisiness" or "annoyance" of many common sounds.

Broad-Band Noise - Noise whose energy is distributed over a broad range of frequency (generally more than one octave).

Composite Noise Rating (CNR) - CNR is a measure of the noise produced by aircraft operations over a 24-hour annual average busy day. The CNR is calculated from aircraft noise expressed in FdBA, and the number of operations in daytime and nighttime periods. Both nighttime and ground ramp operations are penalty weighted. The CNR has been utilized by the Department of Defense and the FAA to define the noise environment about airports since the early 1960's.

Continuous Noise - Ongoing noise whose intensity remains at a measurable level (which may vary) without interruption over an indefinite or a specified period of time.

C-Weighted Day-Night Average Sound Level (Ldn) - Refer to the day-night average sound level, Ldn. The C-weighted Ldn is determined in similar manner, with C-weighting substituted for A-weighting.

C-Weighted Sound Exposure Level (SEL) - The C-weighted SEL is the SEL (see definition below), based on the C-weighted level rather than the A-weighted level.

C-Weighted Sound Level, C-Level (CL) - The C-scale sound level is a quantity, in decibels, read from a standard sound level meter with C-weighting circuitry. The C-scale weighting approximates overall sound pressure level for
the average of human hearing and most common noise sources. The C-scale incorporates slight de-emphasis of the low and high portion of the audible frequency spectrum.

**Day-Night Average Sound Level (Ldn)** - The day-night average sound level is a measure of the noise environment over a 24-hour annual average busy day. It is the 24-hour A-weighted sound level, with a 10dB weighting applied to the nighttime levels. When hourly equivalent level (Leq) information is available, the Ldn is calculated as follows:

\[
L_{dn} = 10 \log \left[ \frac{1}{24} \left( \sum_{i} 10^{\frac{L_{eq,i}}{10}} + 10 \sum_{i} 10^{\frac{L_{tn,i}}{10}} \right) \right]
\]

where \( d \) and \( n \) refer to daytime and nighttime periods.

Alternatively, when a noise source produces discrete noise events, the Ldn may be computed by summation of individual SEL values according to:

\[
L_{dn} = 10 \log \left[ \sum_{i} \frac{SEL_{d,i}}{10} + 10 \sum_{i} \frac{SEL_{n,i}}{10} \right] - 49.4
\]

**Decibel (dB)** - The decibel is a logarithmic unit of measure of sound pressure, calculated according to a formula (see sound pressure level). One decibel is the level of the squared sound pressure that is \( 10^{1/20} = 1.253 \) times the squared reference sound pressure; also, one decibel is the level of the sound pressure that is \( 10^{1/20} = 1.122 \) times the reference pressure.

**Effective Perceived Noise Level (EPNL)** - EPNL is a single number rating of the noisiness of complex aircraft flyover noise signals. It is calculated by the integration with time of the tone-corrected perceived noise levels (PNLT) during a single noise event, such as an aircraft flyover. The EPNL includes adjustments for the relative duration of the noise signal and presence of audible pure tones or discrete frequencies (such as the whine of a jet engine compressor or fan). The reference signal duration is 10 seconds.

For the case where the PNL values are measured at 0.5 second intervals during the noise event, the computational formula for EPNL is:

\[
EPNL = 10 \log \left[ \frac{2}{5} \sum_{k=0}^{2d} \frac{PNLT(k)}{10} \right] - 13
\]

where the summation extends over the time period of the signal between the first and last times at which PNL(k) is within 10 dB of the maximum PNL; and
d is the duration, in seconds, between the first and last values of PNL (x) are within 10 dB of the maximum PNL.

The SPNL is formally defined in ANSI S6.4-1973 "Definition and Procedures for Computing the Effective Perceived Noise Level for Flyover Aircraft Noise".

Equivalent Sound Level (Leq) - The equivalent sound level, Leq, is the level of a constant sound which, in a given situation and time period, has the same sound energy as does a time-varying sound. Technically, equivalent sound level is the level of the time-weighted, mean square, A-weighted sound pressure. The time interval over which the measurement is taken should always be specified.

The energy averaging is given explicitly by:

\[ Leq = 10 \log \left( \frac{1}{t_2 - t_1} \int_{t_1}^{t_2} 10^{AL(t)/10} dt \right) \]

where the averaging is performed over the period \( t_2 - t_1 \).

The typical averaging time for the equivalent level is a period of one hour. However, the time period can be altered to meet one's needs.

For noise sources which are not in continuous operation, the equivalent level may be obtained by summing individual SEL values and normalizing over the appropriate time period.

Frequency - Number of complete oscillation cycles per unit of time. The unit of frequency often used is the Hertz (Hz).

Frequency Band - Difference in Hertz between the upper and lower frequencies that delineate a band, or the interval in octaves between the two frequencies. The band is located frequency-wise by the geometric mean frequency between the two band-edge frequencies. Examples are: "an octave centered at 500 Hz", or more simply, "the 500 Hz octave band".

Hertz - Unit of frequency equal to one cycle per second.

Impulse Noise (Impulsive Noise) - Noise of short duration (typically less than one second) especially of high intensity, abrupt onset and rapid decay, and often rapidly changing spectral composition. Impulse noise is characteristically associated with such sources as explosions, impacts, the discharge of firearms, the passage of supersonic aircraft (sonic boom) and many industrial processes.

Infrasound - Having a frequency below the audible range for man (customarily deemed to cut off at 16 Hz).

Intermittent Noise - Fluctuating noise whose level falls one or more times to lower or unmeasurable values during an exposure.
Noise Exposure - The cumulative acoustic stimulation reaching the ear of a person over a specified period of time (e.g., a work shift, a day, a working life, or a lifetime).

Noise Exposure Forecast (NEP) - NEP is a measure of the noise environment over a 24-hour annual average busy day. It is based upon summation of individual noise events over the 24-hour period, with adjustments applied for nighttime noises and aircraft ground runups. EPNL is the basic noise event measure. The nighttime adjustment differs from that used in calculation of "dn".

\[
\text{NEF} = 10 \log \left[ \sum_{1}^{10} \frac{\text{EPNL}_{d1}/10 + 16.67 \sum_{1}^{10} \text{EPNL}_{n1}/10}{10} \right] - 25
\]

Noise Hazard (Hazardous Noise) - Acoustic stimulation of the ear which is likely to produce noise-induced permanent threshold shift in some portion of a population.

Noise Level Reduction (NLR) - NLR is the difference in decibels, between the A-weighted sound level outside a building and the A-weighted sound level inside a designated room in the building. The NLR is dependent upon the transmission loss characteristics of the building surfaces exposed to an exterior noise source, the particular noise characteristics of the exterior noise source and the acoustic properties of the designated room in the building.

Overall Sound Pressure Level (OASPL) - OASPL level is the sound-pressure level measured in a broad frequency band. This band is often taken to extend from approximately 25 Hz to 10,000 Hz.

Perceived Noise Level (PNL) - PNL is a rating of the "noisiness" of a sound calculated from acoustic measurements. The unit is the perceived noise decibel (PNdB). The perceived noise level is calculated from sound pressure levels measured in octave (or 1/3-octave) frequency bands. This rating is most accurate in rating the noisiness of broadband sounds of similar time duration which do not contain strong discrete frequency components.

The PNL is formally defined in the Society of Automotive Engineers (SAE) Aerospace Recommended Practice 865A "Definitions and Procedures for Computing the Perceived Noise Level of Aircraft Noise".

Pythagorean Theorem - A theorem in geometry, the square of the lengths of the hypotenuse of a right triangle equals the sum of the squares of the lengths of the other two sides.

Sound Exposure Level (SEL) - The sound exposure level (SEL) is a measure of single noise events, such as an aircraft flyover. It is the A-weighted sound level integrated over the duration of a noise event (referred to a reference time of one sound). Hence, it gives the equivalent level of a continuous signal of one second duration for the event.
For purposes of aircraft noise evaluation, SEL is computed from A-levels sampled at discrete intervals of 0.5 seconds or less. Thus, the working expression for SEL becomes:

\[ k = \frac{d}{t} \sum_{10}^{\infty} \frac{A_l(k)}{10} + 10 \log \lambda t \]

where \( d \) is the time interval during which \( A_l(k) \) is within 10 dB of the maximum A-level, and \( t \) is the time interval between noise level samples.

**Sound Level Meter** — A sound level meter is an instrument that provides a direct reading of the sound pressure level at a particular location. It consists of a microphone and electronic amplifier together with a meter having a scale graded in dB. Using appropriate built-in electrical filters, it is possible to directly measure the overall, the A- or D-weighted sound pressure levels. Standard sound level meters must satisfy the requirements of American National Standards Institute (ANSI) Specification for Sound Level Meters, S1.4-1971.

**Sound Pressure** — The sound pressure at a point in a sound field is a measure of the fluctuating variations in pressure from the static value (i.e., atmospheric pressure) caused by the presence of the sound field. For most complex sound sources, the sound pressure contains energy over a broad frequency range audible to humans.

**Sound Pressure Level (SPL)** — The range in sound pressures from the minimum audible sound wave to those existing in the vicinity of a modern jet airplane is greater than a factor of one million. A measure of the sound pressures is therefore more convenient on a reduced scale. Consequently, a logarithmic scale is used in which equal increments correspond to equal multiples of sound pressure; the reference pressure corresponds approximately to the minimum audible sound pressure. This is a convenient scale to use since the ear responds to sound waves in a similar manner. On such a scale, the measurement of sound pressure is termed SPL, the units being the decibel or dB.

In more formal mathematical formulation, the sound-pressure level of a sound, in decibels, is 20 times the logarithm to the base ten of the ratio of the pressure of thin sound to the reference pressure [\( dB = 20 \log \frac{P}{P_0} \)], the common reference pressure for acoustic in air is 20 micropascals (20 micropascals per square meter). In English units this quantity is approximately 4.2 X 10^{-7} pounds per square foot.

**Sound Transmission Class (STC)** — STC is a single-figure rating of the sound insulating properties of a partition as determined by methods described in "Determination of Sound Transmission Class", American Society of Testing and Materials Designation 2413-73.

**Sound Transmission Loss (STL)** — STL is a measure of the sound insulating properties of a wall, floor, ceiling, window, door, that are characteristics of the partition itself and not the room of which it is a part. The STL may be
calculated from the noise reduction between two rooms, in a specified frequency
band, plus ten times the common logarithm of the ratio of the area of the
partition to the total sound absorption in the receiving room, as determined by
methods described in "Measurement of Airborne Sound Insulation in Building",
American Society of Testing and Materials Designation E90-70 or latest revision
thereof.

Standard Land Use Coding Manual (SLUCM) - Standard system for identifying
and coding land use activities. Published by U.S. Department of Commerce in
1985.

Steady State Noise Level (L_s) - L_s is the A-weighted noise level
produced in the space by the ventilation or mechanical systems (or other
interior noise sources) which operate more or less continuously. The L_s
value for design should be the noise level produced in the space by the
equipment during the most usual mode of operation during the time of occupancy.

Tone-Corrected Perceived Noise Level (PNLT) - The tone-corrected perceived
noise level is the perceived noise level adjusted for the presence of audible
discrete frequency components which increase the noisiness of the sound
signal. The PNLT was developed to aid in assessing the perceived noisiness of
aircraft or vehicle noises which contain pure tones or have perceived
irregularities in their spectrum.

The PNLT is formally defined in ANSI S6.4-1973 "Definition and Procedures for
Computing the Effective Perceived Noise Level for Flyover Aircraft Noise".

6-6.
SECTION 7

PART 150 STUDY CHECKLIST
As a guide to representing ALPA at any noise study, be it a Part 150 Airport Noise Study, an Airport Master Plan Study, or a Follow-Up Study to either of the above, ALPA has developed a "check list" to help the ALPA Representative in attendance. It is important to remember that the attendee must represent ALPA and not merely his or her airline or his or her personal feeling. It is important that the ALPA Representative read this handbook and be as familiar with its contents as possible. You must be aware that the ALPA policies, positions and statements included in this handbook have been developed through years of work and interaction with other ALPA committees and have been formulated through the process of development, ratification and approval before any item is an official ALPA policy, position or statement. Therefore caution should be taken when speaking for ALPA, so that only ALPA policies and positions are expressed. When circumstances arise that call for statements or positions not covered in this handbook, make no comment until you have received help or clarification. When situations do arise where additional information is required, contact the ALPA Staff Engineer or any of the ALPA Noise Abatement Committee members. It is also important to be sure, at the beginning of a noise study that you set a tone of cooperation. ALPA wants to be a good airport neighbor, we want to cooperate and do as much as we can to help alleviate unwanted aircraft noise. We want to ensure that unsafe flight procedures and profiles are not used, considered or developed.

In the process of a noise study, generally a technical or operations committee or panel will be formed. It is important that ALPA be represented on this very critical committee. If you are not assigned to it, ask to be. This is where the potentially critical flight procedures and criteria are developed or rejected and ALPA should actively participate in and monitor this most important phase of a noise study.

The following is a "check list" to follow when you are assigned as an ALPA representative to a noise study at a given airport.

1. Contact the airport manager/director by phone. Inform him that you are requesting to be included as an ALPA representative to the upcoming noise study (Part 150, Master Plan or Update). Request that he inform the head of the study to notify both yourself and ALPA Headquarters of dates and locations of the meetings. (See Appendix F for addresses.)

2. Familiarize yourself with the airport, environs and geography of the area, and local committees as much as possible. Use your Jeppesen charts and maps as an aid and take them with you to the meetings. They are very helpful in addressing questions that might arise. If you do not have a complete set for the airport involved contact the ALPA Noise Committee Staff Engineer for copies.

3. Read and familiarize yourself with the ALPA Noise Abatement Handbook, especially the section on ALPA policy and positions. If questions arise as to the meaning or application of any part of this section, clarify it with ALPA Headquarters or an ALPA Noise Abatement Committee member before attending your meetings.
4. Prior to attending your first meeting contact the ALPA Noise Committee staff member to coordinate any transportation, housing, or related expenses.

5. Attend as many noise meetings as possible. Attendance at the first meeting is desired to ensure being included as a member of the study. It is also at this first meeting that a copy of the ALPA policies and positions on noise abatement and related matters can be given to the study chairman for inclusion in the study documents. (Section 2 of the Handbook).

6. When attending meetings or in correspondence with the study group it is important to adjust remarks so as to conform with ALPA's position, as opposed to personal or company views. When in doubt either make no statement or delay reply until after consultation with other appropriate ALPA personnel.

7. Please attempt to ensure ALPA is on the mailing list for any documents, notices or material relating to the study and that both yourself and the ALPA Washington staff are informed as to meeting dates and places in a timely fashion.

8. When timing is appropriate ask to have ALPA included as a member of the "technical" or "operations" working committee or panel.

9. After each meeting, if possible, contact either the ALPA Noise Abatement Staff Engineer or a Noise Abatement Committee member with progress or update reports. This can be accomplished by either a short informal memo or telephone call.

10. If unable to attend a meeting contact ALPA staff or another Noise Abatement Committee member as soon as possible prior to the meeting to consider availability or need of an alternate representative to attend.

11. If during the progress of a noise study you are faced with any press or news media for comments or statements and you don't feel you want to respond, refer that question or questions to the ALPA Public Relations Department in Washington, D.C. at (202) 797-4000.
SECTION 3

APPENDICES
APPENDIX 8-A

DOT AVIATION NOISE POLICY
DEPARTMENT OF TRANSPORTATION
UNITED STATES OF AMERICA

AVIATION NOISE ABATEMENT POLICY

November 18, 1976

OFFICE OF THE SECRETARY    FEDERAL AVIATION ADMINISTRATION
CONTENTS

PART ONE: INTRODUCTION AND SUMMARY OF AVIATION NOISE ABATEMENT POLICY

I. INTRODUCTION 1

II. AVIATION NOISE ABATEMENT POLICY 5
   A. Basic Principles 5
   B. Authorities and Responsibilities 5
   C. Federal Action Plan to Implement These Policies 6
      1. Aircraft Source Noise Regulation 6
      2. Operating Procedures 8
      3. Airport Development Aid Program 8
      4. Airport Noise Policy 9
   D. Air Carrier Action Plan 9
      1. Aircraft Compliance 9
      2. Financing 10
   E. Local Actions 10

PART TWO: ANALYSIS OF THE NOISE PROBLEM, LEGAL FRAMEWORK, AND DESCRIPTION OF THE FEDERAL ACTION PROGRAM

I. STATEMENT OF THE PROBLEM 13
   A. The Noise Problem 13
      1. How Noise is Described 13
      2. How Noise Affects People 17
      3. Whom Does Noise Affect and Where Do They Live 17
      4. The Source of Aircraft Noise: Composition of the Fleet 22
   B. The Financial Problem 24
      1. Ability of Airlines to Finance Aircraft Replacement 24
      2. The Aerospace Industry 27

II. LEGAL FRAMEWORK 29
   A. Legal Responsibilities of the Federal Government 29
   B. Legal Responsibilities of State and Local Governments 31
   C. Legal Responsibilities of Airport Proprietors 32

III. FEDERAL RESPONSE 35
   A. Quieting the Air Carrier Fleet 35
      1. Federal Regulation of Existing Aircraft 35
      2. Economic Benefit from a Mixed Replacement and Modification Program 39
      3. Time Frame 40
      4. International Air Carriers 42
   B. Financing Mechanism 42
   C. Additional Federal Action 43
      1. Source Regulation for Future Aircraft 43
      2. Aircraft Operating Procedures 44
      3. Federal Research and Development Technology 47
D. Protecting the Airport Environment
   1. Airport Proprietor's Responsibilities 49
   2. State and Local Government Responsibility 50
   3. Federal Support for Airport Proprietor and Local Government Noise Abatement Activities 51
   4. FAA Review of Proprietary Use Restrictions 52
E. Private Sector Responsibility 53

CONCLUSION 61
PART ONE

INTRODUCTION AND SUMMARY OF AVIATION NOISE ABATEMENT POLICY
1. INTRODUCTION

Aircraft noise is a significant annoyance for six to seven million Americans. The annoyance is particularly serious at many of our major airports, including those in large metropolitan areas from coast to coast. But noise constitutes a present or potential problem for residents living near many other airports across the nation, and as air travel increases it will become a serious problem at some of these other airports as well.

The aircraft noise issue became increasingly apparent in the early 1960's with the advent of jet aircraft and was soon magnified by the rapidly increasing number of commercial operations in the latter part of the decade. Because of its adverse effect on people, aircraft noise was recognized as a major constraint on the further development of the commercial aviation network, threatening to limit the construction and expansion of airports and access to them. Joint action by government and the private sector was taken to address it. The engine manufacturers and the federal government both engaged in extensive research into quieting jet engines. In 1969, Congress gave the Federal Aviation Administration ("FAA") the responsibility to regulate aircraft design and equipment for noise reduction purposes. The FAA then embarked upon a long-term program of controlling aircraft noise at its source.

A regulation promulgated in 1969 established noise standards for turbojet aircraft of new design effective December 1, 1969; an amendment in 1973 extended the same standards to all new aircraft of older design. The third step in the source noise control program is a regulation requiring compliance with noise standards by jet aircraft already in the fleet. Initially called the "retrofit" rule, it has been the subject of two major FAA rulemaking proposals, a notice of proposed rulemaking published in 1974 and a similar Environmental Protection Agency (EPA) proposal published in 1975. The FAA noise proposal for operating aircraft was the product of considerable study and analysis and was submitted by the Federal Aviation Administrator to the Secretary of Transportation in January because consultation with the Secretary is required by the Noise Control Act of 1972, and because the FAA concluded that some form of federal financing might be required to complete that program.

Intensive review of various proposals by the Secretary of Transportation, with the support of the FAA Administrator, led to a far-ranging analysis of the aircraft noise problem, alternative methods of dealing with it, and the economic consequences of imposing a rule applicable to operating aircraft as well as to newly certificated aircraft.

On October 21, 1976, President Ford advised us that, after considering the proposal we jointly presented to him, and the views of other interested agencies, including EPA, he had accepted our recommendation that action should be taken to extend current noise standards to domestic U.S. commercial airplanes in not more than eight years. He directed that the FAA promulgate its noise compliance rule not later than January 1, 1977. Our statement today announces that action, and the companion measures we believe are an integral part of a comprehensive aviation noise abatement policy.
The scope of the noise problem, the interrelationship and special responsibilities of the many parties concerned with it, and the general confusion and prevalent uncertainty about what it is possible to achieve and who is responsible have led us to conclude that the federal government should address the overall noise problem with a more comprehensive approach than mere promulgation of a new regulation. From recognition of the need for a comprehensive response to the noise problem, this policy statement will analyze the aviation noise problem, and delineate the shared responsibilities of those who must act to alleviate it - industry, government and private citizens.

Although progress has been made in the development of quieter aircraft, much remains to be accomplished. Aircraft noise, of course, cannot be completely eliminated unless we go back to the glider; its adverse effect on people can only be reduced. The complex division of legal authority and practical responsibility among airport proprietors, federal and local government agencies, air carriers, and manufacturers calls for a clearer understanding, first, of what is technologically and financially attainable and, second, of how each of these parties can and must perform those functions for which it is uniquely suited. Only if each party assumes responsibility and acts on the basis of complete cooperation and coordination will we achieve significant and measured progress in reducing the impact of aircraft noise on airport neighbors.

As the federal officials principally concerned with aviation noise, it is our duty to provide leadership in a national effort to reduce aircraft noise. The aviation noise abatement policy that follows represents our views about what action should be taken. Within the constraints of technology, productivity, and financing, it clarifies the responsibility of the federal government to reduce aircraft noise at its source, to promote safe operational procedures that abate the impact of noise on populated areas and to promote positive efforts to attain compatible land use in areas adjacent to airports. It deals realistically with the time that will be required to bring the current fleet of aircraft into compliance with noise level standards that are now technologically feasible and with the financial requirements necessary to make compliance possible.

Those who anticipate a complete federal solution to the aircraft noise problem misunderstand the need for federal, local and private interaction. The primary obligation to address the airport noise problem always has been and remains a local responsibility. Consequently, we have also set forth what we believe to be the legal and proper responsibilities of the airport proprietors, air carriers and other aircraft operators, aeronautical manufacturers, state and local governments, and private citizens. The full benefit of a federal plan of action will be realized only if complementary action is taken by all these participants.
Local capability to plan and take action will be enhanced by a clearer understanding of what the federal government intends to do. As the federal government reduces cumulative noise exposure by controlling the source of noise, so must local governments and airport proprietors, with federal financial assistance in some instances, acquire land and assure compatible land use in areas surrounding the airport in order to confine severe noise exposure within the boundaries of the airport and to minimize the impact of noise beyond those boundaries.

Because of the complexity of the noise problem, we have set forth the following synopsis of our Aviation Noise Abatement Policy which summarizes the key responsibilities of each participant and highlights the federal action program. The analysis of the noise and financing problems that led to the formulation of this policy, the legal foundation upon which the policy rests, and the specific explanation of how certain timing, noise levels and policy conclusions were reached are set forth in Part Two. Accordingly, we invite your attention to Part Two and the underlying rationale that we believe will clarify and support the conclusions set forth in the following section.

[Signatures]

John M. Lechman
Federal Aviation Administrator

William P. Coleman, Jr.
The Secretary of Transportation

The summary of the policy probably should follow Part Two, which defines the terms, quantifies the problems and explains both the analytical process by which the conclusions were reached and the reasons for them. In this form, however, people have become accustomed to receiving their information quickly and concisely. Consequently we have conceded that a number of readers may not follow us through to the end and have put the proverbial cart before the horse.
II. AVIATION NOISE ABATEMENT POLICY

A. Basic Policy Principles

Because aircraft noise adversely affects a significant portion of the nation's population, a nationwide commitment, involving federal, local and private resources, is required to reduce the impact of aviation noise on the people who live in areas surrounding airports.

Public understanding is essential to an effective program to reduce aircraft noise so that we do not raise the expectations of airport neighbors for noise reductions beyond the levels which technology and reasonable cost-effectiveness make possible.

Each of the participants in the noise abatement effort - the airport users, aircraft manufacturers, the airport proprietors, federal, state and local governments, and residents in communities surrounding airports - must take specific steps that are essential in reducing the number of people adversely affected by noise and the severity of the effect on all people.

Planning and acting in coordination, each of these parties should move toward the goal of confining severe aircraft noise exposure levels around U.S. airports to the areas included within the airport boundary or over which the airport has a legal interest, and of reducing substantially the number and extent of areas receiving noise exposure levels that interfere with human activity.

B. Authorities and Responsibilities Under the Policy

The Federal Government has the authority and responsibility to control aircraft noise by the regulation of source emissions, by flight operational procedures, and by management of the air traffic control system and navigable airspace in ways that minimize noise impact on residential areas, consistent with the highest standards of safety. The federal government also provides financial and technical assistance to airport proprietors for noise reduction planning and abatement activities and, working with the private sector, conducts continuing research into noise abatement technology.

Airport Proprietors are primarily responsible for planning and implementing action designed to reduce the effect of noise on residents of the surrounding area. Such actions include optimal site location, improvements in airport design, noise abatement ground procedures, land acquisition, and restrictions on airport use that do not unjustly discriminate against any user, impede the federal interest in safety and management of the air navigation system, or unreasonably interfere with interstate or foreign commerce.
State and Local Governments and Planning Agencies must provide for land use planning and development, zoning, and housing regulation that will limit the uses of land near airports to purposes compatible with airport operations.

The Air Carriers are responsible for retirement, replacement, or retrofit of older jets that do not meet federal noise level standards, and for scheduling and flying airplanes in a way that minimizes the impact of noise on people.

Air Travelers and Shippers generally should bear the cost of noise reduction, consistent with established federal economic and environmental policy that the adverse environmental consequences of a service or product should be reflected in its price.

Residents and Prospective Residents in areas surrounding airports should seek to understand the noise problem and what steps can be taken to minimize its effect on people. Individual and community responses to aircraft noise differ substantially and, for some individuals, a reduced level of noise may not eliminate the annoyance or irritation. Prospective residents of areas impacted by airport noise thus should be aware of the effect of noise on their quality of life and act accordingly.

C. Federal Action Plan to Implement These Policies.

1. Aircraft Source Noise Regulation
   a. Currently Operating Aircraft

   The Federal Aviation Administration will promulgate a rule requiring that subsonic jet airplanes with maximum weight in excess of 75,000 pounds that do not meet the present Federal Aviation Regulations Part 36 noise levels must be retired from the fleet or modified ("retrofitted") to meet those levels in accordance with the following schedule. To bring about the earliest reduction of noise levels possible, the phased-in compliance deadlines for each aircraft type have been established on the basis of what is technologically practicable and economically reasonable. The deadlines are:

   747s within six years, with one-half to be completed within four years;
   727s, 737s, DC-9, BAC 1-11s within six years, with one-half to be completed within four years; and
720s, 707s, DC-8s, CV-990s within eight years, with one-quarter to be completed within four years, and one-half to be completed within six years.

These time periods will start to run with the issuance of appropriate regulations to be effective January 1, 1977. In accordance with such procedures as are authorized by law and FAA regulations, persons subject to these regulations may petition for an exemption. In evaluating petitions for an exemption, the FAA will consider the economic ability of the petitioner to meet the regulatory timetable and whether the petitioner is able to operate the airplanes for which an exemption is sought into airports where a significant noise problem does not exist. As a matter of policy, it is our view that such exemptions should not in any event extend to more than one-third of the 720 powered airplanes in an operator's fleet.

In conjunction with the issuance of the Part 36 compliance regulation, the United States will work through the International Civil Aviation Organization to reach agreement with other nations on means to abate aircraft noise. If agreement is not reached in three years, it is the intention of the federal government to require aircraft flown by carriers of other countries to meet U.S. established noise levels at the end of five additional years. For the time being, aircraft operated by foreign carriers and that portion of the fleets of U.S. air carriers used in international service will not be covered by the noise regulations issued pursuant to this statement.

b. Future Design Aircraft

The FAA will complete, by March 1, 1977, its consideration of new, more stringent noise standards for new aircraft designs that reflect recent advances in noise suppression technology and are technologically practicable, economically reasonable, and appropriate for the particular type of aircraft. These regulations will be applicable to supersonic aircraft developed for the replacement of the old four-engine jets and to airplanes type certificated after the effective date of the regulation.

In the establishment of the eight year deadline for the older four-engine jets, we considered, for example, the time required to develop and certificating a retrofit kit for the 707 (two years) and the DC-8 (36 months) and the time required to produce and install enough kits to bring these planes into compliance (there are currently over 500 in operation).
c. Supersonic Aircraft

Using information that is now available on a continuing basis from the Concorde demonstration, the FAA, not later than thirty days after the conclusion of the sixteen month demonstration periods, will act to promulgate a noise rule applicable to supersonic aircraft that is necessary to protect the public health and welfare and that is consistent with the statutory requirement that the Administrator consider technological practicability, economic reasonableness, and appropriateness to aircraft type.

2. Operating Procedures

The FAA has evaluated a number of concepts for aircraft operating procedures designed to abate noise. The FAA has taken regulatory action this week to maximize the noise reduction benefits of new aircraft and retrofitted aircraft, consistent with the highest degree of safety. Additional analysis and evaluation is underway which is expected to lead to future regulatory action.

3. Airport Development Aid Program

Under the new authority granted in the 1976 Amendments to the Airport and Airway Development Act, the FAA will establish a high priority for the allocation of discretionary Airport and Airway Trust Funds for airport land acquisition to ensure compatible use of land near airports, the purchase of noise suppressant equipment, the construction of physical barriers and other noise reduction activities.

The Department of Transportation, in appropriate cases, will encourage the development of new airports to replace some of the older airports in areas with large populations adversely affected by noise. In the development of new airports, federal financing will be conditioned on effective noise abatement planning. Federal funding for new airport development and for airport expansion and improvement will require documentation that the proprietor is taking all reasonable steps to ensure that the use of land areas exposed to serious levels of noise is restricted to uses compatible with airport operations projected for the foreseeable future.

The Administration will request the Congress to amend further the Airport and Airway Development Act to include among airport proprietor activities eligible for federal-aid funding the acquisition, installation and operation of airport noise monitoring equipment. Use of such equipment is vital to
assist airport proprietors in quantifying noise exposure, identifying specific airplanes and operators that are major contributors to community noise, and developing programs to reduce aircraft noise exposure.

4. **Airport Noise Policy**

To bring about further relief from excessive aircraft noise, airport proprietors are encouraged to develop aggressive noise abatement programs for their airports. The FAA will assist proprietors in attaining their noise abatement goals and will advise them on how their proposed plans affect the overall air transportation system. The FAA will accept preliminary proposals from airport sponsors for comprehensive noise abatement plans and will fund a select number of innovative noise abatement model plans and demonstrations. In addition, the FAA will encourage noise abatement plans from airport proprietors in conjunction with both applications for major airport development grants and proposals to establish use restrictions, such as curfews or scheduling and equipment restrictions. The FAA will advise airport operators whether proposed use restrictions are unjustly discriminatory or place an undue burden on inter-state or foreign commerce because of their impact on the national air transportation system. Where necessary, the FAA will seek adjudication of the constitutional issues involved if it believes that a use restriction established at an airport is unjustly discriminatory or creates an undue burden on interstate or foreign air commerce.

D. **Air Carrier Action Plan**

1. **Aircraft Compliance**

Under the federal rule described above, the older, noisier / four-engine jets using the JT3D and similar engines (707s, DC-8s, QV-99s) must be modified to meet Part 36 noise levels or they must be retired from operation within eight years. Many of the four-engine jets are old and relatively inefficient to operate. After weighing the advantages of modification and replacement, the Secretary of Transportation and the Administrator of the Federal Aviation Administration have concluded that it would be in the public interest if most of these aircraft were replaced by new airplanes, particularly by new airplanes that incorporate new technologies currently under development. Replacement would reduce further noise and pollution emissions levels. In addition, replacement would increase energy efficiency, accelerate introduction of advanced safety and design technologies, increase employment opportunities, improve service for the air traveler, and improve prospects for exports by the American aerospace industry.
2. Financing

To ensure that the air carriers can meet the new aircraft noise standards within the deadlines established by regulation, President Ford directed me, as Secretary of Transportation, to hold a public hearing on December 1, 1976, to determine whether any additional financing arrangements may be necessary. Further details on this hearing and the issues to be addressed are set forth in separate documentation.

E. Local Actions

While federal action will form the basis of our program, substantial local action will be necessary to complement the noise reduction actions of the federal government and air carriers. Since a federal program would be significantly less effective without commensurate local actions, we have delineated those actions we believe local authorities should take.

The FAA will encourage airport proprietors, who are legally responsible for the effect of aircraft noise on the surrounding community, to assess their particular noise problem and, where local authorities determine that there is a significant problem, to develop an action plan to reduce the impact of noise. That action plan should include a program to ensure maximum land use compatibility with airport operations both by the acquisition of easements or other rights in the use of land or airspace and by encouraging local governments to adopt and enforce zoning or other land use controls. It should also address other actions that may be taken, such as the establishment of a formal noise abatement runway system, control of ground operations, and preferential arrival and departure routes. The proprietor may wish to propose to the FAA special landing and takeoff procedures to deal with any unique conditions around his airport.

In addition, state and local governments with jurisdiction over property adjacent to airports must take action of their own, preferably in cooperation with the local airport proprietor. State and local governments are directly and uniquely responsible for ensuring that land use planning and zoning and land development activities in areas surrounding airports are consistent with the objective of ensuring land use that is compatible with present and projected aircraft noise exposure in the area. Construction standards for new buildings should ensure appropriate insulation from aircraft noise, and programs to insulate existing public and residential buildings should be advanced where needed.

State and local governments also should require that appropriate notice of airport noise exposure be provided to the purchasers of real estate and to prospective residents in areas near airports to ensure awareness of the nature of the airport environs.
F. Concluding Note

With realistic public appreciation for the complexity of the task to be performed and with full and open communication and cooperation among the participants, the actions that each of us take separately pursuant to this policy will contribute toward significant and recognizable progress in the reduction of the adverse effect of aircraft noise on airport neighbors.
PART TWO

ANALYSIS OF THE NOISE PROBLEM, LEGAL FRAMEWORK, AND DESCRIPTION OF THE FEDERAL ACTION PROGRAM
I. STATEMENT OF THE PROBLEM

In determining what action can and should be taken at the federal and local levels and in the private sector to reduce the adverse effect of excessive aircraft noise, a full understanding of this multidimensional problem is essential. In this part, we will explain the underlying rationale that supports the conclusions set forth in our Aviation Noise Abatement Policy and the federal action program to implement it. In describing the noise problem, we will explain first the technical framework for measuring the noise problem, how it affects people and how they react to it, how many people are subjected to excessive noise and where they live, and how actions to reduce noise affect interstate commerce. Because progress in noise reduction is heavily dependent upon the financial ability of airlines to modify or replace their old, noisy airplanes and on the ability of manufacturers to design, produce, and sell less noisy airplanes, we also will consider the financial condition of the airlines and the impact of proposed actions on the aerospace industry.

The responsibilities of federal and local governments, airport proprietors, and industry in responding to the noise problem are defined in large measure by statutory and case law. Accordingly, the legal framework set forth in this part establishes the foundation upon which the federal program must be constructed. Finally, the federal response summarized in this policy is described in greater detail in terms of the precise nature of the noise problem it is designed to address and the financial and technological constraints within which progress must be made.

A. The Noise Problem

1. How Noise is Described

People's reactions to noise differ widely. It is difficult, therefore, to derive a simple mathematical formula that accurately represents human reaction to noise annoyance. For example, it remains uncertain whether people, in reacting to aircraft noise, are more annoyed by the number of aircraft noise events or the noise levels of individual events. To help measure, quantify and understand the effects of noise on people, there has been a proliferation of approaches, the acronyms of which threaten to challenge the supremacy of the federal bureaucracy in this regard. Rationales of discourse is not greatly aided by a debate over the relative merits of expressing noise impact in terms of dBA, dBA, dBD, PNL, EPNL, EPNdB, SEL, SENEL, CNR, NEF, CNEL, ASDS, Ldn, and Leq. In this policy statement, we have relied primarily on the two most common measurements of noise: noise generated by a single event (expressed in EPNdB, usually at the 10 dB measuring point) and cumulative noise exposure (expressed in Noise Exposure Forecast or NEF).
Human response to single-event jet aircraft noise is best represented in terms of Effective Perceived Noise Level, expressed in units of EPNdB. This unit of perceived noise takes into account the actual sound energy received by a listener, the ear's response to that sound energy, the added annoyance of any pure tones or "screetches" in the noise, and the duration of the noise. In any discussion of aircraft noise abatement, a key consideration is the difference in noise level which a listener is able to perceive and find meaningful, in terms of both the single event and the cumulative exposure. Few humans can detect differences between single events of aircraft noise of less than about 5 EPNdB. However, an increase of 10 EPNdB is usually perceived as a doubling in loudness.

The Part 36 measuring points are standardized locations from which aircraft noise is measured for certification purposes. Such measurements are specified at three points: one under the approach path,** one under the takeoff path,*** and one to the side of the runway at the point of maximum noise during takeoff.** Although the Part 36 values do not give a complete picture of the total noise impact at an airport, they do provide a standardized method of measuring aircraft noise, and are useful in comparing noise levels of different aircraft.

In general, if noise events, such as aircraft flyovers, are infrequent, the peak noise level of the individual events will probably determine individual reactions to that noise. If the noise events are relatively continuous or repetitive, however, the total noise "dose" or cumulative noise exposure becomes a more important factor in people's reactions to aircraft noise. Noise Exposure Forecast (NEF) provides a measure of the total aircraft-generated noise energy received at locations near an airport during a typical 24-hour period. The NEF value at a given point near an airport is calculated by summing the noise energy received at that point from all of the aircraft operating into and out of that airport during a day, with an added penalty for nighttime noise (flights after 10 p.m.). Points of equal NEF value are then joined to form contours of equal noise exposure. Calculation of these values requires knowledge of the number and type of aircraft operating, the noise characteristics of each aircraft, the flight paths they follow, the time of day they fly, and the manner in which they are operated (for example, power settings during takeoff and landing).

* One nautical mile from the runway threshold.
** 3.5 nautical miles from the start of the takeoff roll.
*** 0.35 nautical miles to the side of the runway for four-engine aircraft, 0.25 nautical miles for two- and three-engine aircraft.
The NEF procedure has been developed over the last decade for land use planning around airports as the number of jet aircraft has increased and their noise has become more of an annoyance. It is particularly meaningful in measuring the overall impact that residents around busy airports might experience, and research into human reaction to aircraft noise indicates that cumulative noise exposure is the most useful measure of public reaction to aircraft noise.

*References for Cumulative Measure Support*


In assessing community reaction to aircraft noise exposure, the following interpretations of NEF values are often used:

Less than NEF 30: Essentially no complaints expected; noise may interfere with community activities.

NEF 30 to NEF 40: Individuals may complain; group action possible.

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

A reduction of one NEF unit is equivalent to a reduction of about two percent in the number of people highly annoyed and equal to a reduction of about 14 percent in the area exposed to the same level of noise exposure.* A difference in noise level below 5 EPNDB may not be significant as a single event, but if there are frequent occurrences the cumulative effect of that difference may be substantial, and the change in NEF value would reflect this.

The NEF method has been adopted by the Department of Housing and Urban Development. It will not guarantee mortgages on properties within NEF 40 and normally considers properties within NEF 30 unacceptable. NEF and other descriptors of cumulative noise exposure* are useful in determining the effect of federal noise control activity on airport communities and in commensurate local land use development and planning.

* The relationship between NEF reduction and land area reduction is logarithmic - i.e., a 50 percent reduction in land area is approximately equivalent to a 4.5 NEF unit reduction, while a 25 percent reduction in land area is approximately equal to a 2.0 NEF unit reduction.

** The Environmental Protection Agency has recommended that cumulative noise exposure be expressed by a measure called Day/Night Average Noise Level (Ldn). The equivalent values are:

NEF 30 = Ldn 66; NEF 40 = Ldn 75
2. How Noise Affects People

Aircraft noise disturbs the normal activities of airport neighbors—their conversation, sleep, and relaxation—and degrades their quality of life. Depending on the use of land contiguous to an airport, noise may also affect education, health services, and other public activities.

Although there may be indirect and subtle social and psychological harms, aircraft noise is predominantly an annoyance problem. It does not present any direct physical health danger to the vast majority of people exposed.

3. Whom Does Noise Affect and Where Do They Live

Approximately six million U.S. citizens currently reside on 900,000 acres of land exposed to levels of aircraft noise that create a significant annoyance for most residents.* Of this number, approximately 600,000 citizens reside within areas that are severely impacted by aircraft noise; that is, areas in excess of NEF 40.

The subjective reactions of individuals to aircraft noise vary substantially.** These differences become increasingly apparent in the comparison of noise problems surrounding specific airports, taking into consideration the number and kind of local complaints about noise, the political pressures on the airport operator to take unilateral action to restrict use of the airport, and the environmental and social contexts—climate, lifestyles, community concern—in which noise is perceived.

* Over NEF 30.

** The 1973 Annual Housing Survey conducted by the Bureau of the Census for the Department of Housing and Urban Development, indicated that of those surveyed:

- 20.2 percent experienced noise from airplane activity in the vicinity of their home. Of those experiencing noise, 34.2 percent considered the noise to be disturbing, harmful or dangerous;
- 6.3 percent felt airplane noise to be so objectionable that the household would like to move from the neighborhood.
In some communities, people's reaction to aircraft noise is increasingly being expressed in the courtroom where homeowners are receiving awards for nuisance and for diminution of property value (inverse condemnation). Over the past five years, airport proprietors have paid out over $25,000,000 in legal judgments or settlements in noise-related suits and have spent over $3,000,000 in legal fees, expert testimony and similar defense efforts.

The absence of lawsuits in some severely impacted areas and the recent occurrence of the most significant court precedents cause some observers to consider the pending suits to be merely the "tip of the iceberg," with substantial potential liabilities yet to arise. Others consider the concentration of lawsuits in certain areas to be an indication of the diversity in community response to aircraft noise, concluding that noise is not yet perceived as a substantial problem around many airports.

Partly as a reaction to such lawsuits, some airport proprietors have acquired substantial residential areas near their boundaries. The largest such programs have been undertaken by Seattle-Tacoma International and Los Angeles International Airports. Los Angeles alone has spent over $130 million to purchase private residences and plans to spend $21 million on sound-proofing schools and other public buildings near the airport.

Because the magnitude of the noise problem at any particular airport is a function of many factors, there is not any single criterion that defines a "noisy" airport. Depending on which criteria are used, the number of airports that are categorized as: "noisy", "noise sensitive", "noise problem", or "impacted by excessive noise", will vary. For example, the Air Transport Association (ATA) has identified 26 airports as "noise sensitive." On the other hand, the Airport Operators Council International has indicated that all airports receiving jet airliner service now are or soon will be "noise impacted." By any definition, however, it is clear that an acute noise problem exists at many airports located in metropolitan areas.

Based on an analysis of citizen and Congressional complaints, the imposition of airport use restrictions, litigation and the number of people affected, the FAA has identified 100 airports where noise is in varying degrees an issue. A 1974 DOT study...
of 23 major U.S. airports identified eight airports that have neighboring populations of over 25,000 residing within the NEF 40 contour (extremely serious problem), and 13 airports with at least 100,000 residing within the NEF 30 contours (considerable annoyance).* For the 23 airports surveyed, five million people live within NEF 30 and a half a million within NEF 40. Clearly the vast majority of people exposed to serious levels of noise live near the major metropolitan airports.** The following chart tabulates the number of people exposed to serious aircraft noise within the NEF 30 and 40 contours around the 23 airports included in DOT's study.

These airports, in the order of the number of people affected, are: LaGuardia, O'Hare, Kennedy, Newark, Boston, Los Angeles, Miami, Denver, Cleveland, San Francisco, Seattle, Buffalo, and St. Louis.

## Extent of Noise Problem at 23 Major Airports

<table>
<thead>
<tr>
<th>Airport</th>
<th>Number of People ** (1000)</th>
<th>Court-</th>
<th>Restrictions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NEF 30</td>
<td>NEF 40</td>
<td></td>
</tr>
<tr>
<td>1. <em>Atlanta</em></td>
<td>99.8</td>
<td>27.0</td>
<td>Yes</td>
</tr>
<tr>
<td>2. <em>Boston</em></td>
<td>431.3</td>
<td>32</td>
<td>Yes</td>
</tr>
<tr>
<td>3. <em>Buffalo</em></td>
<td>113.8</td>
<td>9.7</td>
<td></td>
</tr>
<tr>
<td>4. Chicago-Midway</td>
<td>38.5</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>5. <em>Chicago-O'Hare</em></td>
<td>771.7</td>
<td>66.6</td>
<td></td>
</tr>
<tr>
<td>6. Cleveland</td>
<td>128.7</td>
<td>11.2</td>
<td></td>
</tr>
<tr>
<td>7. <em>Denver</em></td>
<td>180.3</td>
<td>28.3</td>
<td></td>
</tr>
<tr>
<td>8. Dulles</td>
<td>3.5</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>9. <em>J.F. Kennedy</em></td>
<td>507.3</td>
<td>111.5</td>
<td></td>
</tr>
<tr>
<td>10. <em>LaGuardia</em></td>
<td>1067.0</td>
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</tr>
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<td>11. <em>Los Angeles</em></td>
<td>292.4</td>
<td>51.1</td>
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<td>12. <em>Miami</em></td>
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</tr>
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<td>13. <em>Minneapolis-St. Paul</em></td>
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<td>14. <em>Newark</em></td>
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<td>27.5</td>
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<td>15. New Orleans</td>
<td>32.5</td>
<td>8.9</td>
<td>Yes</td>
</tr>
<tr>
<td>16. Philadelphia</td>
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<td></td>
</tr>
<tr>
<td>17. <em>Phoenix</em></td>
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<td>6.2</td>
<td></td>
</tr>
<tr>
<td>18. Portland</td>
<td>1.2</td>
<td>0.3</td>
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</tr>
<tr>
<td>19. <em>San Diego</em></td>
<td>77.3</td>
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<tr>
<td>20. <em>San Francisco</em></td>
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<td></td>
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<tr>
<td>21. <em>Seattle</em></td>
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<td>22. St. Louis</td>
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<td>23. <em>Washington National</em></td>
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<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
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<tr>
<td>All other airports</td>
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<td>.1M</td>
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<tr>
<td><strong>GRAND TOTAL</strong></td>
<td>5.0M</td>
<td>0.5M</td>
<td></td>
</tr>
</tbody>
</table>

* Identified by Air Transport Association as being "noise sensitive."

Other airports on the current ATA list but not included in the study are: Detroit, Honolulu, Memphis, Las Vegas, Tampa, Ft. Lauderdale, San Juan, Oakland, and San Jose.

** Estimated from 1970 Census data
In response to public opposition to noise, some airports have imposed or are considering various use restrictions. These measures include curfews, restrictions on the use of certain equipment, and limitations on operations. Such restrictions may have a substantial effect on interstate commerce and on the air navigation system.

* Major examples of completed or proposed actions by airport owners to reduce noise levels by restricting the use of the airport are:

- **Night Time Operating Restrictions** - Lindbergh Field in San Diego, California; Pearl Harbor, Oahu; Washington National
- **Total Jet Ban** - Santa Monica Municipal Airport, California; Watertown Municipal Airport, Wisconsin
- **Limit Number of Aircraft Operations** - Stewart Airport, N.Y.
- **Exclude Particular Types of Aircraft** - Los Angeles International and Logan International have prohibited SSTs, JFK International is considering a similar ban
- **Limit Number of Nighttime Operations** - Minneapolis-St. Paul
- **Operational Noise Limits** - JFK International
- **Displaced Threshold - Logan International** and many others
- **Noise Preferential Runways** - Atlanta, Miami, Tampa, San Juan, Boston-Logan, Hartford-Bradley, O'Hare, Midway, Cleveland
- **Hopkins, Detroit-Wayne County, Minneapolis-St. Paul, Moisant-New Orleans, Denver, Pittsburgh, LaGuardia, Newark, Los Angeles, San Francisco and others.**

In some of the above cases, the restrictions have been developed voluntarily through operator/users agreements, while in others they have been imposed unilaterally by the airport proprietor.
Curfews at large, medium and small hubs could have very serious effects. New York City is an illustration:

Air cargo shipments by weight remain at a relatively constant level for 24 hours at Newark and Kennedy. Accordingly, restrictions on night operations would severely disrupt freight shipment and handling. During May 1974, 37 percent of the total New York air cargo was transported between 10 p.m. and 7 a.m. local time. With a nationwide curfew applying to the same time period, the foreclosure of freight traffic to New York would extend to the hours during which 49 percent of the New York cargo moves.

A curfew's impact on mail shipments would also be significant. The movement of mail between 10 p.m. and 7 a.m. at New York amounted to 22 percent of the daily air transported mail for the sample studied. A nationwide curfew would curtail flights for the hours in which 35 percent of the New York mail moves.

Five to 13 percent of all passenger movements would be affected by similar New York and nationwide curfews. Much of the night passenger travel makes use of the reduced night coach fare structure enabling those with less financial resources to travel by air.

Other disbenefits are also likely if curfews are widely adopted. A substantial number of airplane operations might have to be shifted to earlier hours, which, while eliminating noise at night, would result in congestion and delays and an increase in the noise exposure during daylight and evening hours. Airlines would require more aircraft, more expensively operated, to overcome positioning problems if even one or two major hubs were curfewed. Time zone differences would cause additional scheduling problems. A curfew at O'Hare, for example, would cause a major restructuring of most of the domestic air transportation system.

4. **The Source of Aircraft Noise: Composition of the Fleet**

Some have argued that normal attrition will eventually take care of the aircraft noise problem, as the older, noisier planes are phased out of the fleet. The evidence indicates, however, that unless federal action is taken, the problem of airport noise will remain and, with increasing operations occurring at more airports, will be exacerbated. At the end of 1975, only 494 of the 2,148 jet airplanes in the U.S. airline fleet (about 23 percent) complied with the noise levels of Part 36. It bears repeating that the 77 percent of the fleet that exceeded Part 36 levels were not required to meet those standards since they were produced prior to the effective date.
of Part 36. Of the 1,654 aircraft in the fleet that do not meet Part 36 noise levels, 523 or 30 percent are the noisiest, four-engine models (Boeing 707s and 720s, Douglas DC-8s). Assuming normal attrition, the FAA projects that in 1990 48 percent of the air carrier fleet still will not meet Part 36.*

Since 1972, there has been a reduction in cumulative aircraft noise exposure around airports due in part to the introduction of new quieter jet aircraft and in part to the slowed rate of increase in passenger growth. Because of forecasted aviation growth, the airport noise problem is expected to increase in the future despite the introduction of quieter aircraft. Between 1975 and 1990, annual air carrier operations are estimated to increase from 10 million to 16 million, creating additional noise exposure that, without federal action, could more than offset the reduction in noise levels resulting from the replacement of the older airplanes by newer, quieter models. The major reason why progress in the replacement of older airplanes has been slow is the financial condition of the air carrier industry, to which we now turn.

* Details concerning the aircraft currently operating that do not meet Part 36 noise levels and an FAA projection of the non-Part 36 aircraft that will remain in commercial service in 1984 is set forth in the Environmental Impact Statement issued in conjunction with the Part 36 compliance regulation.
9. The Financial Problem

1. Ability of Airlines to Finance Aircraft Replacement

As older noisier airplanes are modified or replaced with new planes that meet or better Part 36 standards, the cumulative noise exposure around major airports will be reduced. The degree and speed with which this occurs depends upon the financial capability of the air carriers to modify or replace their older airplanes. Since additional noise reduction and other benefits accrue from replacement rather than retrofit of these planes, replacement appears to be a more desirable goal. But since replacement requires a much greater capital outlay than retrofit, the forecasted economic environment for the airline industry becomes doubly important.

In recent years many major airlines have experienced very serious difficulty in obtaining from private capital markets the financing necessary for equipment and other needs. Some have found themselves short even of working capital to continue operations. Between 1970 and 1975, the trunk carriers spent $14.6 billion on capital needs: $8.7 billion for aircraft, equipment and property; $1.7 billion for leases of aircraft and engines; and most of the rest for debt service. The sources of this financing were mainly depreciation ($5 billion to $7 billion) and new long term debt ($4 billion), with earnings contributing only about $400 million. Equity financing was insignificant in this period, and low earnings and existing high debt levels forced some carriers to lease rather than purchase new aircraft. In addition, because of their recent earnings records, conventional sources of debt financing also have been effectively foreclosed to some carriers. Insurance companies and banks have been unwilling or unable to make further financing commitments and in recent months have stated publicly that, until the airlines' financial situation is sufficiently improved, new loans will not be forthcoming.

In this financially strained economic environment, some carriers have been forced to resort to existing revolving credit arrangements to raise working capital.

The 1974/1975 period was particularly difficult for the industry. The sudden and substantial increase in fuel prices that began in 1974, accompanied by inflation in other cost categories, forced carriers to raise fares sharply. This coincided, unfortunately,
with the economic recession of 1974-75 when demand was already
softening, and traffic levels were driven down even further.
Moreover, many airlines in the late 1960s had purchased equipment
to meet a predicted demand growth that never occurred, leaving
them for a time with substantial excess capacity. The airlines' financial problems were exacerbated by the existing economic
regulatory system which does not normally allow for timely fare
increases, and denies airlines the pricing and management
freedom available to other industries.

The airline industry's financial performance has been showing
steady improvement since the end of the recession, however, and
prospects for increased earnings over the next few years are
good. Traffic growth is expected to resume, though at a long-
term rate about equal to GNP growth, in contrast to more rapid
growth rates in the past. Since, at present, the airlines have
relatively few new aircraft on order, any near term traffic
growth will be accommodated largely through increases in aircraft
productivity. Load factors are likely to increase, earnings
should remain fairly stable at a relatively high level, and new
capital needs should be relatively modest until 1980.

After 1980, however, traffic growth will begin to press against
the fleet's capacity, and airlines will begin to require new
capital to finance the replacement of aging aircraft and to meet
the growth demand. Leaving aside the new noise requirements, the
Department estimates that between 1975 and 1985 the trunk carriers
will need from 700 to 800 new aircraft and will require between
$22 and $30 billion dollars to finance this acquisition (based on
estimates by Government and private sector financial analysts).
About $6 billion will be needed for debt repayment and other uses.
A mid-range estimate of total capital needs, therefore, would be
$32 billion.

Depreciation and sales of used aircraft can be expected to
generate about $18 billion of this amount, leaving $17 billion
to be financed through earnings and external sources. If earnings
in the period were to rise to $6 billion which implies a 9 percent
return on equity, as contrasted with the average 2.8 percent return
of the past five years, external financing needs would be $11
billion. The airlines would probably be able to obtain this
financing from conventional financial sources. The following
table summarizes these estimates:

8-29
Sources and Uses of Funds (Mid-range Estimate)

<table>
<thead>
<tr>
<th>Uses of Funds:</th>
<th>($ Billions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property, Plant and Equipment</td>
<td>$26</td>
</tr>
<tr>
<td>Debt Repayment and Other</td>
<td>$22</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source of Funds:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Depreciation and Sales of Used Aircraft</td>
<td>$15</td>
</tr>
<tr>
<td>Amount Required from Earnings and External Sources</td>
<td>$17</td>
</tr>
<tr>
<td>Earnings Assumption</td>
<td>$6</td>
</tr>
<tr>
<td>External Financing Requirement</td>
<td>$11</td>
</tr>
</tbody>
</table>

It is unlikely that capital needs can be met in this manner, however, if the industry does not achieve $6 billion in earnings by the end of 1985. As indicated, this level of earnings implies an average annual return on equity three times as large as that earned over the last five years. It also assumes no unexpected negative developments, such as another recession or substantial new increases in fuel or other costs. These or other events would materially reduce the ability of the industry to earn a 9 percent return on equity.*

Under one scenario for meeting the new noise abatement regulation schedule, the "regular" 707s and DC-8s are retired and replaced with a new technology airplane and the stretched DC-8s and the remainder of the noncomplying fleet are retrofitted. This would increase the trunk carriers' capital requirements to 1985 by between $5.5 and 7.5 billion, an increase of 20 to 27 percent more than the amount required as discussed above. An incremental capital requirement of this magnitude would appear to be clearly beyond the industry's ability to finance, given the other financing burdens they will face in the early 1980s.

*It must be noted that the above estimates of financial needs and sources are predicated on industry-wide estimates. Carriers that are in relatively inferior financial position will have greater difficulty in obtaining needed funds than will other carriers.
We believe passage of regulatory reform bill (the proposed Aviation Act of 1977) to be reintroduced by the Administration in early 1977 will help the airlines with their overall financing problem. If the carriers had been operating under the regulatory environment envisioned in the proposed legislation they would not face major difficulty in adjusting prices to anticipate needed capital investment requirements and in obtaining the needed financing for the rule. Under the cost-based guidelines now used by the Civil Aeronautics Board in evaluating requests for fare increases, the capital outlay for new equipment, about a third of which is made before the aircraft is delivered, cannot be recovered through fare increases until the aircraft is delivered and in operation. Thus if today's economic regulatory environment continues, it may be impossible for the industry to commit to the manufacturers the substantial amount of cash necessary to get a new technology aircraft into production and delivered soon enough to replace the DC-8/707 fleet by the end of 1984.* Complicating the problem is the fact that a number of carriers are significantly weaker than others and it is these carriers who are the owners of large numbers of noisy aircraft and thus face some of the largest financing requirements.

It is clear that over the period in which the noisy aircraft must be modified or replaced, timely passage of the Aviation Act of 1977 should make a large difference in the carriers' ability to finance new aircraft purchases. However, this very desirable change in regulatory policy would not go into effect for at least a year, and if, as expected, its provisions are phased to allow ample time for adjustment to the new operating environment, its full effect will not be felt for several years.

2. The Aerospace Industry

Lasting noise reduction benefits will be achieved with newer, quieter technology, but a major new aircraft has not been developed in the United States for almost 10 years. In that time, important design and technological advances have been made — many specifically intended to meet the new economic, operating, and environmental constraints dictated by rising labor costs, energy shortages, environmental requirements, and changing market demands.

* A large number of firm orders from U.S. air carriers are required by manufacturers before they can start production of a new aircraft. The cost of developing the new aircraft alone is put at $500 million to $1 billion.
In past programs to develop a new aircraft, American manufacturers have had enough preproduction sales to U.S. airlines to provide a solid base for financing front-end costs and to assure a near break-even position without foreign sales. This is not the case today, largely because of the financial condition of several of the largest U.S. airlines, which traditionally have led the way with new purchases. Although the carriers gradually are replacing their older inefficient jets, they are doing so with existing model aircraft, and these only in small numbers. The aircraft available now to replace four-engine jets are improperly sized for some markets (e.g., 727s, 747s, L-1011s, or DC-10s). Most U.S. airlines would prefer to wait for a family of new, higher technology aircraft, if it were probable that these airplanes would be available within a few years.

Moreover, the public interest is served by the substantial and long term noise benefits available from new technology aircraft. The new technologies that will be utilized in meeting the stricter FAA noise regulations for new aircraft types to be promulgated by next March will bring about an average reduction of 12 to 16 dBA from the noise levels of the 707. The accelerated introduction of these quieter replacement planes offers obvious advantages.

Although we are concerned primarily in this policy statement with reducing the impact of aircraft noise, it would be myopic, if not negligent, for us to overlook opportunities for achieving other important national objectives as well. Consequently, we have considered, in addition to the noise benefits accruing from replacement of four-engine aircraft, the energy conservation benefits of improved fuel efficiency, the increasing importance of aeronautical exports to our aviation industry, the declining role of aerospace research and development as a percentage of national defense and NASA outlays, the stimulation of employment in the aerospace and related industries, and the advantages to the consumer of more advanced design and lower operating costs.

How the carriers choose to comply with our noise rules will have long range effects on the development of U.S. technology, employment, the viability and competitiveness of national aerospace industry, and the long term noise benefits that are to be realized. The sum of total benefits, however, mandates a careful assessment of the relative merits of retrofit or replacement by new technologies.
II. LEGAL FRAMEWORK
A. Legal Responsibilities of the Federal Government

The principal aviation responsibilities assigned to the Federal Aviation Administrator, and since 1966 to the Secretary of Transportation, under the Federal Aviation Act of 1958, as amended, concern safety and the promotion of air commerce. The basic national policies intended to guide our actions under the Federal Aviation Act are set forth in section 103, 49 U.S.C. 1303, which provides public interest standards, including:

(a) The regulation of air commerce in such manner as to best promote its development and safety and fulfill the requirements of national defense;

(b) The promotion, encouragement, and development of civil aeronautics;

(c) The control of the use of the navigable airspace of the United States and the regulation of both civil and military operations in such airspace in the interest of the safety and efficiency of both; and

(e) The development and operation of a common system of air traffic control and navigation for both military and civil aircraft.

To achieve these statutory purposes, sections 307(a) and (c) of the Federal Aviation Act, 49 U.S.C. 1348(a), (c), provide extensive and plenary authority to the FAA concerning use and management of the navigable airspace and air traffic control. The FAA has exercised this authority by promulgating wide-ranging and comprehensive federal regulations on the use of navigable airspace and air traffic control.* Similarly the FAA has exercised its aviation safety authority, including the certification of airmen, aircraft, air carriers, air agencies, and airports under Title VI of the Federal Aviation Act, section 601 et seq., 49 U.S.C. 1402 et seq., by extensive federal regulatory action.** In legal terms the federal government, through this exercise of its constitutional and statutory powers, has preempted the areas of airspace use and management, air traffic control and aviation safety. The legal doctrine of preemption, which flows from the Supremacy Clause of the Constitution, is essentially that state and local authorities do not have legal power to act in an area which already is subject to comprehensive federal regulation.

* See 14 C.F.R. Parts 1, 73, 75, 91, 93, 95 and 97.
** See 14 C.F.R. Parts 21 through 43, 61 through 67, 91, 121 through 149.
Because of the increasing public concern about aircraft noise that accompanied the introduction of turbojet powered aircraft into commercial service in the 1960s and the constraints such concern posed for the continuing development of civil aeronautics and the air transportation system of the United States, the Federal government in 1968 sought - and Congress granted -- broad authority to regulate aircraft for the purposes of noise abatement. Section 611 of the Federal Aviation Act, 49 U.S.C. 1431, constitutes the basic authority for federal regulation of aircraft noise. In 1972, displaying some dissatisfaction with the FAA's methodical regulatory practice under section 611, the Congress amended that statute in two important respects. To the original statement of purpose -- "to afford present and future relief from aircraft noise and sonic boom" -- it added consideration of "protection to the public health and welfare." It also added the Environmental Protection Agency (EPA) to the rulemaking process. Section 611 now requires the FAA to publish EPA proposed regulations as a notice of proposed rulemaking. Within a reasonable time of that publication, if the FAA does not adopt an EPA proposal as a final rule after notice and comment, it is obliged to publish an explanation for not doing so in the Federal Register.

Whether considering a rule it proposes on its own initiative or in response to the EPA, the FAA is required by section 611(d) to consider whether a proposed aircraft noise rule is consistent with the highest degree of safety in air commerce and air transportation, economically reasonable, technologically practicable and appropriate for the particular type of aircraft.

The FAA acted promptly in implementing section 611. On November 18, 1969, it promulgated the first aircraft noise regulations, Federal Aviation Regulations, Part 36, 14 C.F.R. 36, which set a limit on noise emissions of large aircraft of new design. It reflected the technological development of the high-bypass ratio type engine, and was initially applied to the Lockheed 1011, the Boeing 747, and the McDonnell-Douglas DC-10. The Part 36 preamble announced a basic policy on source noise reduction and a logically phased strategy of bringing it about. The Part 36 standard would serve as the basic standard for aircraft engine noise and was initially applicable to new types of aircraft. As soon as the technology had been demonstrated, the standard was to be extended to all newly manufactured aircraft of already certificated types. Ultimately, the preamble indicated, when technology was available the standard would be extended to aircraft already manufactured and operating. The last step would require modification or replacement of all aircraft in the fleet which did not meet the Part 36 noise levels. The first two steps have already been accomplished. This third step is being taken now.
Part 36 is commonly misunderstood. Many believe that it estab-
lished a federal standard of acceptable noise emissions. It did
not. Part 36 basically established the quietest uniform standard
then possible, taking into account safety, economic reasonableness
and technological feasibility. Many think it is a standard that
all American aircraft must meet. It is not. Part 36 to date has
been applicable only to newly manufactured aircraft and is not
applicable to aircraft manufactured before 1973. Nearly eighty
percent of the present fleet is not obliged to and does not meet
the Part 36 standard. Many think that it is an operating rule --
that is, that planes that do not meet it in daily operations may
not fly. It is not. Part 36 applies to aircraft at the time of
their manufacture, and does not apply at all to foreign-manufactured
aircraft operated by foreign carriers.*

In addition to its regulatory authority over aircraft safety and
noise, the FAA has long administered a program of federal grants-
in-aid for airport construction and development. Through its decisions
on whether to fund particular projects, the FAA has been able, to
a degree, to insure that new airports or runways will be selected
with noise impacts in mind. That indirect authority was measurably
strengthened when in 1970 the Airport and Airway Development Act
expanded and revised the FAA's grant-in-aid program for airport
development and added environmental considerations to project
approval criteria. 1976 Amendments to the 1970 Act have increased
funding levels and provided new authority to share in the costs of
certain noise abatement activities, but the ability of the FAA to
provide financial assistance remains limited in terms of both
percentage of project costs and the types of projects eligible for
federal aid.

B. Local Responsibilities of State and Local Governments

While the federal government's exclusive statutory responsibility for
noise abatement through regulation of flight operations and aircraft
design is broad, the noise abatement responsibilities of state and
local governments through exercise of their basic police powers are
circumscribed. The scope of their authority has been most clearly
described in negative terms, arising from litigation over their
rights to act.

The chief restrictions on state and local police powers arise from the
exclusive federal control over the management of airspace. Local
authorities long have been preempted by the federal assumption of
authority in the area from prohibiting or regulating overflight for
any purposes. That principle was found in 1973 to include any
exercise of police power relating to aircraft operations in City of
Burbank v. Lockheed Air Terminal, 411 U.S. 624 (1973). In the Burbank

*Annex 16 to the Chicago Convention provides an international noise
certification standard.
case, the Supreme Court struck down a curfew imposed by the City in the exercise of its police power. The Court's reliance on the legislative history of section 511 and the 1972 amendments to it indicate that other types of police power regulation, such as restrictions on the type of aircraft using a particular airport, are equally proscribed. The Court, however, specifically excluded consideration of the rights of an airport operator from its decision.

There remains a critical role for local authorities in protecting their citizens from unwanted aircraft noise, principally through their powers of land use control. Control of land use around airports to ensure that only compatible development may occur in noise-impacted areas is a key tool in limiting the number of citizens exposed to noise impacts, and it remains exclusively in the control of state and local governments. Occasionally, it is a power enjoyed by individual airport operators; some operators are municipal governments that can impose appropriate land use controls through zoning and other authority. But even where municipal governments themselves are operators, the noise impacts of their airports often occur in areas outside their jurisdiction. Other police power measures, such as requirements that noise impacts be revealed in real estate transactions, are also available to them. Finally, local governments have legal authority to take noise impacts into account in their own activities, such as their choice of location and design of new schools, hospitals, or other public facilities, as well as sewers, highways and other basic infrastructure services that influence land development.

C. Legal Responsibilities of Airport Proprietors

The responsibilities of state and local governments as airport proprietors are far less restricted. Under the Supreme Court decision in Griggs v. Allegheny County, 369 U.S. 84 (1962), proprietors are liable for aircraft noise damages resulting from operations from their airport. The proprietor, the court reasoned, planned the location of the airport, the direction and length of the runways, and has the ability to acquire more land around the airport. From this control flows the liability, based on the constitutional requirement of just compensation for property taken for a public purpose. The Court concluded: "Respondent in designing the Greater Pittsburgh Airport had to acquire some private property. Our conclusion is that by constitutional standards it did not acquire enough." The role of the proprietor described by the Court remains the same today.

But the proprietor's responsibilities do not end there. A three-judge district court observed in Air Transport Association v. Crotti, 389 F. Supp. 58 (N.D. Cal., 1975):
"It is now firmly established that the airport proprietor is responsible for the consequences which attend his operation of a public airport; his right to control the use of the airport, is a necessary concomitant, whether it be directed by state police power or by his own initiative.... That correlating right of proprietorship control is recognized and exempted from judicially declared federal preemption by footnote 14 [of the Burbank opinion]. Manifestly, such proprietary control necessarily includes the basic right to determine the type of air service a given airport proprietor wants its facilities to provide, as well as the type of aircraft to utilize those facilities...."

The Crotti case upheld in part a California airport noise statute imposing noise abatement duties on airport proprietors and established the principle that a state statute could reach proprietors that are governmental agencies and hence arms of the state. The Burbank preemption rule thus has not extended to proprietors, except with respect to regulations that actually affect the flight of aircraft. The portion of the California statute struck down by the court provided for criminal sanctions against the operator of an aircraft that exceed a single-event noise standard on takeoff or landing, a clear interference with the FAA's control over flight operations in the navigable airspace.

The Crotti principle has recently been upheld in National Aviation v. City of Hayward, No. C-75-2279 RFP (N.D. Cal., July 13, 1976), a case in which an air freight company sought to enjoin a curfew on noisier aircraft imposed at the municipally owned Hayward Air Terminal in California. The court addressed squarely the legal issue of the rights of a proprietor and found that the curfew had not been preempted:

[This court cannot, in light of the clear Congressional statement that the amendments to the Federal Aviation Act were not designed to and would not prevent airport proprietors from excluding any aircraft on the basis of noise considerations, make the same findings [as the Burbank Court] with respect to regulations adopted by municipal airport proprietors...." Slip opinion, 14, citing S. Rep. No. 1353, 90th Cong., 2d Sess., 8-7.

The court went on to indicate that the FAA had the authority to preempt such proprietor regulation, although it had not yet exercised it. The court also found that the ordinance, which required some of the plaintiff's aircraft to use another airport between 11 p.m. and 7 a.m., had an effect on interstate commerce, but that the effect was: 8-37
"...incidental at best and clearly not excessive when weighed against the legitimate and concededly laudable goal of controlling the noise levels at the Hayward Air Terminal during late evening and morning hours." Slip opinion, 19.

The power thus left to the proprietor - to control what types of aircraft use its airports, to impose curfews or other use restrictions, and, subject to FAA approval, to regulate runway use and flight paths, is not unlimited. Though not preempted, the proprietor is subject to two important constitutional restrictions. He first may not take any action that imposes an undue burden on interstate or foreign commerce and, second may not unjustly discriminate between different categories of airport users.

These limitations on the proprietor's control over the use of the airport have not been addressed by the Supreme Court, and it remains unclear the extent to which constitutional limitations would prevent some of the restrictions that have been imposed or proposed by proprietors in recent years.

Our concept of the legal framework underlying this policy statement is that proprietors retain the flexibility to impose such restrictions if they do not violate any constitutional proscription. We have been urged to undertake - and have considered carefully and rejected - full and complete federal preemption of the field of aviation noise abatement. In our judgment the control and reduction of airport noise must remain a shared responsibility among airport proprietors, users, and governments.

The legal framework with respect to noise may be summarized as follows:

1. The federal government has preempted the areas of airspace use and management, air traffic control, safety and the regulation of aircraft noise at its source. The federal government also has substantial power to influence airport development through its administration of the Airport and Airway Development Program.

2. Other powers and authorities to control airport noise rest with the airport proprietor - including the power to select an airport site, acquire land, assure compatible land use, and control airport design, scheduling and operations - subject only to constitutional prohibitions against creation of an undue burden on interstate and foreign commerce, unjust discrimination, and interference with exclusive federal regulatory responsibilities over safety and airspace management.

3. State and local governments may protect their citizens through land use controls and other police power measures not affecting aircraft operations. In addition, to the extent they are airport proprietors, they have the powers described in paragraph 2.
III. THE FEDERAL RESPONSE

Consistent with the legal principles set forth above, this section explains in greater detail the program we intend to implement and our reasons for adopting it. The cornerstone of the federal program is the requirement that airplanes comply with Part 36 noise standards within six to eight years. This policy clarifies the relative responsibilities of all participants in achieving reduced aircraft noise exposure. The way in which the air carriers meet this requirement for particular types of aircraft will have substantial implications not only for noise reduction but also for other national objectives - energy conservation, employment, and export promotion - as well. Moreover, the effectiveness of any resource commitment which may be required to meet this standard is contingent upon complementary action by airport proprietors and local government, actions that will be encouraged with federal financial assistance, other incentives, grant conditions and technical assistance. Complementary federal action includes noise abatement procedures, research and development and stricter noise standards for new technologies. The complete comprehensive strategy to bring about substantially reduced noise impact on residential populations is set forth in the following federal action program.

A. Quieting the Air Carrier Fleet

1. Federal Regulation of Existing Aircraft

Federal action is required to ensure that commercial aircraft meet Part 36 noise levels within the next decade. The normal incentives of the private marketplace do not operate to achieve optimal noise reduction. Noise is an "external cost" of providing certain goods and services. In the case of aircraft noise, the recipient of the noise -- such as the resident under the flight path -- is most often not a party to the market transactions (e.g., the purchase and sale of aircraft and of aircraft-passenger tickets) that result in the noise that affects him. The purchasers of aircraft service -- the aviation passengers -- are not necessarily the recipients of the aircraft noise, and therefore the provider of that service (the airline) does not have a normal market incentive to reduce noise. Because the marketplace does not compensate airport neighbors for noise damages, they may seek redress from the courts. However, lawsuits are an expensive, time consuming and uneven way of dealing with the problem, and damage payments may drain away scarce resources that could be applied to reducing noise impact.

Because there are important differences among the airplanes that do not meet Part 36, it is useful to consider them separately.

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The projections set forth in this document are based on the best available data. We realize it is subject to continuing refinement and improvement.
A significant problem is posed by the older, four-engine models (707s, 720s, DC-8s) in the current fleet. These aircraft are, for the most part, powered by JT3D turbofan engines and impose the most severe noise insult on airport neighbors because they cause the noisiest single events (10 to 12 EPNdB over Part 36). They are perceived to be at least twice as loud as the new wide-body aircraft. They are particularly significant contributors to the overall noise level at major airports having serious noise problems.

Replacement or acoustic modification (retrofit) of these older four-engine jets must be given high priority. Acoustic modification or retrofit consists of the addition of quiet nacelles using sound absorbing material (SAM) that reduces significantly the noise levels of these four-engine aircraft to at least the Part 36 noise levels. This approach, however, is subject to the availability of retrofit kits and, has been shown to be somewhat fuel inefficient. Because of the environmental benefits of replacement, discussed below, retirement of most of these older aircraft is clearly preferable.

The older two- and three-engine aircraft (727s, 737s, DC-9s, BAC 1-11s, mainly powered by JT8D turbofan engines) are not as noisy on single events. But, because they are medium and short-range models, they take off and land more than four times as often per day as the long-range four-engine models. Since they are also more pervasive in our domestic system, they account for most of the air carrier operations (80 percent) nationwide.*

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**Scheduled Air Carrier Jet Operations**

Average Daily, 1975

<table>
<thead>
<tr>
<th>Airplane Type</th>
<th>Number of Operations</th>
<th>Percent</th>
<th>Percent Meeting Part 36 Noise Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>707/DC-8</td>
<td>2225</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>747</td>
<td>411</td>
<td>2</td>
<td>54</td>
</tr>
<tr>
<td>DC-10/L-1011</td>
<td>1340</td>
<td>6</td>
<td>100</td>
</tr>
<tr>
<td>727</td>
<td>9208</td>
<td>41</td>
<td>25</td>
</tr>
<tr>
<td>737/DC-9/BAC 1-11</td>
<td>9334</td>
<td>41</td>
<td>8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>22518</strong></td>
<td><strong>100</strong></td>
<td></td>
</tr>
</tbody>
</table>

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* An operation is a takeoff or a landing.

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Although the technology to retrofit these JT3D aircraft is available, the resulting reductions in noise levels is not as large as the reductions for the JT3Ds. A modified JT3D airplane is significantly quieter than an unmodified JT3D airplane, especially on approach. We estimate that the cost of retrofitting all of these airplanes will be about $223 million in 1976 dollars. Since most of these airplanes have a long remaining useful life, we anticipate that they will be modified rather than replaced.

Because of their larger numbers, more frequent operation, and more widespread use, the cumulative effect of reducing the noise of these JT3D aircraft is greater than that for the four-engine aircraft alone. By requiring that both the two/three- and the four-engine aircraft meet Part 36 noise levels, we will realize significantly greater reduction at the 26 largest air carrier airports at the time compliance is completed. Additionally, many more air carrier airports would benefit from quieting of the two- and three-engine airplanes. Without including the two- and three-engine jets, which constitute 70 percent of that part of the operating fleet that does not meet Part 36 and which account for 80 percent of the air carrier operations nationwide, 75 percent of the air carrier airports in the country would not receive any noise benefit and 85 percent would not receive any significant benefits.

There are also about 50 early 747s that do not meet Part 36 noise levels. Economics clearly make retrofit the logical alternative for these aircraft, which have a long remaining useful life, and a retrofit kit for modification of these aircraft has been included in later production versions of the 747.

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Noise measurements taken during routine airline operations at airports in the New York City area showed that 727-200 aircraft with SAE retrofit treatment operated at 65 PNdB (estimated from dBD measurements) lower levels on approach than did 727-200 aircraft without retrofit.

8-41
The following table illustrates the comparative reductions expressed in EPNdB of the retrofit of those airplanes that do not meet FAR 36.

<table>
<thead>
<tr>
<th>Aircraft</th>
<th>Condition</th>
<th>FAR 36 Limit</th>
<th>Non-Retrofit</th>
<th>Full Retrofit</th>
</tr>
</thead>
<tbody>
<tr>
<td>707-320B</td>
<td>Takeoff</td>
<td>103.7</td>
<td>113.0</td>
<td>102.2</td>
</tr>
<tr>
<td></td>
<td>Approach</td>
<td>106.3</td>
<td>116.8</td>
<td>104.0</td>
</tr>
<tr>
<td></td>
<td>Sideline</td>
<td>106.3</td>
<td>102.1</td>
<td>99.0</td>
</tr>
<tr>
<td>DC-8-61</td>
<td>Takeoff</td>
<td>103.5</td>
<td>114.0</td>
<td>103.5</td>
</tr>
<tr>
<td></td>
<td>Approach</td>
<td>106.2</td>
<td>115.0</td>
<td>106.0</td>
</tr>
<tr>
<td></td>
<td>Sideline</td>
<td>106.2</td>
<td>103.0</td>
<td>99.0</td>
</tr>
<tr>
<td>727-200</td>
<td>Takeoff</td>
<td>99.0</td>
<td>101.2</td>
<td>97.5</td>
</tr>
<tr>
<td></td>
<td>Approach</td>
<td>104.4</td>
<td>108.2</td>
<td>102.6</td>
</tr>
<tr>
<td></td>
<td>Sideline</td>
<td>104.4</td>
<td>100.4</td>
<td>99.9</td>
</tr>
<tr>
<td>DC-9</td>
<td>Takeoff</td>
<td>96.8</td>
<td>92.0</td>
<td>92.0</td>
</tr>
<tr>
<td></td>
<td>Approach</td>
<td>103.1</td>
<td>109.0</td>
<td>102.0</td>
</tr>
<tr>
<td></td>
<td>Sideline</td>
<td>103.1</td>
<td>103.0</td>
<td>103.0</td>
</tr>
<tr>
<td>747-100</td>
<td>Takeoff</td>
<td>108.0</td>
<td>115.0</td>
<td>107.0</td>
</tr>
<tr>
<td></td>
<td>Approach</td>
<td>108.0</td>
<td>113.0</td>
<td>107.0</td>
</tr>
<tr>
<td></td>
<td>Sideline</td>
<td>108.0</td>
<td>101.0</td>
<td>99.0</td>
</tr>
</tbody>
</table>

The following table provides an estimate of the numbers of airplanes to be modified acoustically or replaced. Also included are what the associated capital costs of retrofit would be if the turbofan-powered 707s and DC-8s are not retired or replaced earlier than they otherwise would have been as a result of the new federal regulation.

<table>
<thead>
<tr>
<th>Airplane Type</th>
<th>Number to be modified</th>
<th>Average Cost (million $)</th>
<th>Total Cost (million $)</th>
<th>1975 Present Value (million $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>727</td>
<td>454</td>
<td>.225</td>
<td>102</td>
<td>60</td>
</tr>
<tr>
<td>737 &amp; DC-9</td>
<td>446</td>
<td>.27</td>
<td>121</td>
<td>71</td>
</tr>
<tr>
<td>747</td>
<td>45</td>
<td>.25</td>
<td>11</td>
<td>6</td>
</tr>
<tr>
<td>707 &amp; DC-8</td>
<td>270</td>
<td>1.2</td>
<td>324</td>
<td>159</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1217</td>
<td></td>
<td>558</td>
<td>296</td>
</tr>
</tbody>
</table>
These costs are in constant 1975 dollars, and do not include any tax benefits or changes in operating costs. The present values were computed using a 10% discount rate before inflation. If changes in operating costs are also included, the 1975 present value costs increase to a total of $440 million. These operating cost increases are primarily the result of the increased fuel inefficiency of modified 707s and DC-8s and include the cost of an additional 320 million gallons of fuel which would be consumed by these airplanes.

2. Economic Benefits from a Mixed Replacement and Modification Program

Despite the arguments that the variables and projections are uncertain, cost-benefit analysis is a useful tool to compare means of reducing aircraft noise. Our analysis indicates that replacement of all JT30 aircraft and acoustic modification of the JT8D aircraft will yield positive net benefits of $350 million to the airlines* whereas altering the scenario by retrofitting the JT30 airplanes instead would cost them $440 million. The primary reasons for these differences are varying fuel consumption and maintenance costs.

A replacement program also produces many benefits that are difficult to calculate, but which would be significant.

- The noise benefit from replacing these jets with new aircraft or new technology will range from a 12 to 16 \( \text{EPAdB} \) improvement over current 707/720 and DC-8 airplanes.

- Replacement would offer substantial advantages in increased fuel efficiency over the 707/720 and DC-8. 20 percent with currently-available replacement models, and as much as 30 percent for the new-technology airplanes compared to a fuel penalty of approximately one percent for modified 707 and DC-8 airplanes.

- Replacement would provide aircraft that will meet the new, rigorous air pollutant emissions standards effective in 1979.

* See the FAA benefit-cost study published as an attachment to the Final Environmental Impact Statement issued November 17, 1976.
Replacement would strengthen the aerospace industry, stimulating the purchase orders to begin manufacture of aircraft of new design, which the airframe manufacturers cannot undertake now because of the lack of firm orders from their customers.

Replacement would contribute to the development of aviation technologies for export. Aerospace products have been second only to agricultural products as the nation's leading exports. Foreign operators own over 500 JT3D airplanes for which U.S. replacements sized for many of the markets being served are not now available. Most of these airplanes would be replaced if a properly sized replacement were available.

Replacement would provide many more jobs - each billion dollars in aircraft sales generates 60,000 job-years directly or indirectly in aerospace or related industries.

Replacement would offer to the carriers the advantage of more economic aircraft configurations resulting from the application of advanced technologies. These include new aerodynamic concepts, lighter propulsion systems, improved safety from inflight control systems, and new structural materials. With enactment of regulatory reform, many of these economies would be reflected in the fares.

In light of these benefits, we believe that it would be economically preferable for the Nation if most of the four-engine aircraft are replaced with new technology aircraft.

3. Time Frame

Since some combination of replacement and retrofit is advantageous in bringing current airplanes into compliance with the noise standards of Part 36, we have considered what would be a reasonable time frame to require such action.

In establishing a deadline, we have been concerned with the length of time needed to develop, certificate, produce, and install retrofit kits for those airplanes for which the operators decide that retrofit is best. The manufacturers have indicated that it will take six years to complete retrofit of the 747s.
727s, 737, and DC-9s, six to eight years to complete the 707s and DC-8s, including kit production* and installation time.

Retrofit kits are currently certificated and ready for installation for the two- and three-engine aircraft and the 747s, and are being installed on those aircraft that are currently in production. It may take 28 months and 36 months, respectively, to design and certificate kits for the 707s and DC-8s, with fabrication and installation time to follow. Thus, time to fabricate the required number of kits, and to install them during refurbishment periods for fleet aircraft must govern the mandatory compliance periods. Given these considerations, we have concluded that aircraft should be required to meet Part 36 noise levels within certain time periods.

The Federal Aviation Administration will promulgate a rule requiring that subsonic jet airplanes in domestic** service with maximum weight in excess of 75,000 lbs., that do not meet the present Federal Aviation Regulations Part 36 noise levels, must meet those noise levels or be retired from the fleet within six to eight years in accordance with the phased-in schedule set forth on pages 5-6 of this policy statement.

These time periods, which are established on the basis of the time it would be the completion of the development, production, and installation of retrofit kits for most of the existing fleet, will start to run on January 1, 1977. These time periods are also adequate to enable the development of new technologies for replacement of older, four-engine aircraft if adequate financing is available. Measures imposed by other jurisdictions that would require more accelerated compliance with Part 36 requirements would conflict with the purpose of this federal regulation.

<table>
<thead>
<tr>
<th>Airplane</th>
<th>From Production Decision to First Kit Delivery</th>
<th>Production Rate Ship Sets Per Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>707</td>
<td>2-1/3 yrs</td>
<td>22</td>
</tr>
<tr>
<td>DC-8</td>
<td>3 yrs</td>
<td>3.5</td>
</tr>
<tr>
<td>727</td>
<td>1-1/2 yrs</td>
<td>38</td>
</tr>
<tr>
<td>737</td>
<td>1-1/2 yrs</td>
<td>10</td>
</tr>
<tr>
<td>DC-9</td>
<td>1-3/4 yrs</td>
<td>15</td>
</tr>
<tr>
<td>747</td>
<td>1 yr</td>
<td>5</td>
</tr>
</tbody>
</table>

*Domestic service as used here includes flights to U.S. territories outside continental United States, generally classified as "overseas".
4. **International Air Carriers**

The United States will seek early agreement through the International Civil Aviation Organization (ICAO) on noise standards and an international schedule for compliance with Annex 16 or Part 36. In the event that agreement is not reached within three years, from January 1, 1977, then regulatory action will be taken to require all airplanes operated by all international operators to meet the noise level standards of Part 36 or Annex 16 during the five-year period thereafter at a phased rate of compliance similar to that established for domestic operations. The ultimate requirements applied to U.S. international flag carriers will not be any more stringent than those applied to foreign air carriers, because it would place the U.S. international flag carriers at a competitive disadvantage if they had to comply with the noise standards sooner than their foreign competition. Where U.S. air carriers serve both domestic and foreign routes, the delayed international requirements will be applied only for that percentage of total operations that are in international service. These requirements may be superseded by agreement reached through ICAO, in which the United States concurs and which does not discriminate against U.S. carriers.

B. **Financing Mechanism**

President Ford has instructed the Department of Transportation to promulgate rules to require that all aircraft in domestic service meet noise standards within eight years. He indicated at that time that he would again urge the Congress to enact his aviation regulatory reform measure to create an improved economic climate for the airline industry that would enable it to comply with these standards. He further directed the Secretary to begin public hearings promptly to assess whether additional financing assistance, if any, may be necessary to guarantee compliance with these standards within eight years.

At the public hearing, scheduled for December 1, 1978, we must first consider whether any financing arrangements at all are necessary. If there is persuasive evidence and documentation that such assistance is necessary, alternative financing proposals must be weighed against certain goals.

First, we would prefer that the costs of noise abatement be borne by users of air transportation, passengers and shippers. Any shift of that burden to the general public must be avoided. Second, enough financing must be available to enable the carriers to replace a significant portion of their noisy four-engine jets with a new generation...
airplane but not so much financing as to encourage the purchase of excess capacity. Third, federal involvement in any financing mechanism should be limited and not disturb unduly the mechanism of the private capital markets, nor unreasonably constrain the flexibility of air carrier management in determining how to comply with the noise regulation. Fourth, the cost of transportation to the passenger and shipper should not be increased. Fifth, assuming the enactment of aviation regulatory reform, we should consider both the need for additional financing in the improved aviation economic environment that will emerge and the consistency of any proposal with a less regulated aviation system. Finally, we should consider and assess the additional benefits to the public that would accrue from a replacement program, and the accelerated production of new technology airplanes, and determine whether these benefits outweigh the cost of such a program.

To address these issues and hear recommendations from concerned parties, a public hearing will be conducted on aviation noise financing on December 1, 1978.

C. Additional Federal Action

1. Source Regulation for Future Aircraft

The development of jet engine noise source technology since the high-bypass ratio engine was first produced will allow further reduction of noise emissions from aircraft designed in the future. Therefore, FAA proposed to reduce the Part 36 noise levels for future design aircraft in NPRM 75-37 issued October 29, 1975.

While recognizing that the full benefit of such a rule will not be felt until the next generation of aircraft enter regular service in substantial numbers, the FAA will soon complete its consideration of new, lower noise standards for future design aircraft. These standards will require that recent advances in noise suppression technology be employed if they are practicable, economically reasonable, and appropriate for the particular type of aircraft. These regulations would be applicable to all newly designed subsonic aircraft type certificated after the effective date of the regulation. The FAA plans to issue these regulations by March 1, 1977.

On September 30, 1976, the EPA submitted a proposed regulation to FAA on the subject of source regulation for future design aircraft. That proposal has been published by FAA as a notice of proposed rulemaking (41 F.R. 47358) and a public hearing will be held on December 14, 1976. The only difference between the FAA regulatory proposal and that of EPA is in the establishment of noise levels for aircraft designed for the 1980-1985 time period and beyond 1985 as well. While these EPA proposals are
being considered, the FAA believes it is important and prudent to establish lower noise levels for future designed aircraft and continues to analyze the technological developments to determine if even further reduced noise levels can be established.

In addition, the FAA is working through the International Civil Aviation Organization to obtain international agreement on noise standards which would make internationally established standards virtually identical to United States noise standards. This proposal was presented for public comment in the Federal Register on October 28, 1976, as NPRM 75-370. Both of these important proposals and the comments received on them will be thoroughly considered and carefully analyzed before final action is taken.

The FAA has already established noise standards on the subject of noise produced by propeller driven airplanes. In developing these standards, the FAA received a number of suggestions from the EPA which were adopted and incorporated into the final rule. These included the use of six rather than four noise certification test overflights and the use of longer standard takeoff distances in calculating performance corrections. These suggested improvements were submitted to FAA in the course of FAA's rulemaking action on this subject and were subsequently included as part of a formal EPA noise regulatory proposal submitted to FAA. The proposed disposition of the EPA regulatory proposal has been forwarded by FAA to the EPA for consultation pursuant to the provisions of the Noise Control Act. The time for this consultation has been extended by FAA at the request of the EPA and therefore the FAA is deferring its final action on this proposal at this time at the request of the EPA.

Using information being acquired on a continuing basis from the Concorde demonstration, the FAA will act consistent with the statutory requirements to promulgate a noise rule applicable to supersonic aircraft not later than thirty days after the conclusion of the 18-month demonstration periods.

2. Aircraft Operating Procedures

Operational procedures for the control of aircraft departures and arrivals at airports can effectively complement the reduction of aircraft source noise emissions. For example, operational controls that apply reduced thrust settings near the ground augment the noise reduction achieved through retrofitting because with the sound absorbing material or "quiet nacelle" modification of the JT3D and JT8D aircraft the noise reduction achieved becomes more effective at lower thrust levels. It must be clearly understood that, although much can be gained by operational procedures, they are not alternatives to reducing noise at the source by replacing or retrofitting the noisier airplanes.
Many air traffic and airspace management operational procedures are now used at particular airports to meet their particular needs. For some airports, normal approach paths cover substantial residential populations (Los Angeles); others are particularly sensitive to take-offs (Miami). Where possible, approach paths are designed to avoid residential neighborhoods. At some airports, steep climbs are used on takeoff over water areas so that aircraft will be higher than they would be otherwise when they reach inhabited areas. Where aircraft must climb over residential areas, they often do so with reduced power in order to minimize excessive noise from greater engine thrust.

In addition to these measures, which are used at many airports, two standardized operational procedures have been under consideration by the FAA. One EPA approach proposal involved the development and implementation of the use of a two-segment landing approach path for aircraft. Briefly, this procedure entails the use of a steeper glide slope (e.g., 5 to 6°) during the early stages of approach, followed by stabilization of the aircraft on the normal 3° glide slope for final approach and touchdown. During the steeper portion of the approach, the aircraft is higher from the ground and requires less engine power, thus achieving noise reductions at more distance points from the airport on the approach pattern. However, this would not provide significant noise relief to persons living close to an airport and could exacerbate their problem since there would probably be an increase in power required as the aircraft changes configuration from the steeper glide slope to the reduced glide slope. Additionally, this procedure has an inherent safety problem related to the impact of aircraft wake vortices on aircraft flying a standard 3° approach behind an aircraft utilizing a two-segment approach. Finally, this two-segment approach procedure could be applied at a limited number of airports because of limited equipment availability.

The second standardized approach procedure involves the use of minimum certificated flaps. This procedure was developed by FAA to abate airplane noise and then proposed by EPA as a regulatory action. Through the use of minimum certificated flaps during approach, aerodynamic drag is reduced, whereby less engine thrust is required. This has multiple advantages because reduced thrust results not only in a fuel saving but also a reduction in the source noise of the airplane over the entire approach phase, thereby providing a noise reduction along the entire approach path. Moreover, it is a procedure which can provide noise benefits at all rather than a limited number of airports. Because it is a stabilized approach procedure, it reduces cockpit workload in that no transition is required.
from a 6° to a 3° glide slope and the inherent potential wake vortex problem a serious safety problem for following aircraft or is eliminated. Final regulations and procedures on a noise abatement approach procedure will be issued by FAA by January 1, 1977.

Several opinions exist regarding the best noise abatement departure procedure following takeoff. The FAA requires that turbine-powered and large aircraft climb as rapidly as possible to 1500 feet above the ground. This procedure provides some noise relief by getting the noise source - the airplane - away from populated areas as rapidly as possible. FAA is in the process of evaluating different departure procedures which could be implemented after the 1500 foot altitude is reached. The issue is complicated by the fact that airports are unique in terms of their surrounding geography and adjacent land use. This means that there may be no single optimum noise abatement departure procedure.

The FAA currently recommends, in Advisory Circular 91-39, (January 18, 1974) a procedure that incorporates a reduction in engine power from takeoff thrust to normal climb power at an altitude of 1500 feet above ground level after takeoff with subsequent acceleration and climb after passing through 3000 feet by changing the deck angle and retracting the flaps. This procedure is generally used by scheduled air carriers. Northwest Airlines regularly uses a somewhat different departure procedure, in which the airplane is accelerated at takeoff power with an accompanying reduction in the deck angle and flap retraction followed by a larger power reduction than with the Advisory Circular procedure. Both procedures have merit in that both provide noise relief by reducing source noise through a reduction in engine power. The degree of perceived noise, however, depends on the location of noise sensitive areas beneath the departure path and the altitude and engine power of the airplane over those areas. The FAA expects to complete regulatory action on this subject by January 1, 1978.

Another operational rule under consideration involves possible restrictions on minimum altitudes in terminal areas by keeping airplanes high. Such restrictions would reduce the noise impact on the ground by maximizing the distance between the airplane and persons on the ground. This has been the FAA "Keep 'Em High" Program. A proposal on this subject to convert it from an air traffic management program to a regulatory requirement was submitted to the FAA by the EPA and was published in the Federal Register on January 6, 1975, as NPRM 75-40.

The design of each terminal area air traffic pattern is carefully constructed to meet the particular characteristics of the airport or airports encompassed within that terminal area. The runway configuration of the airport, character of the surrounding terrain,
proximity of other airports, the requirements to avoid when possible low altitude flight over communities when arriving or departing the airport, are among the many considerations that must be made in designing terminal area procedures. It is not feasible to develop a single rule that would be applicable to all terminal areas for all airports. Regulations, which are relatively difficult to change, could have a severe and far-reaching impact on the air traffic system in the flexibility required to adjust air traffic procedures to compensate for weather changes, traffic congestion and safety considerations. Regulatory action in this area would be unduly restrictive without achieving significant improvements in aircraft noise abatement since the proposed rules were not significantly different from the existing air traffic management program and would have adverse energy and economic impacts through increased flight time and increased fuel consumption.

The FAA concurs with the objective of the EPA proposed regulations, specifically to reduce the noise exposure on the ground. Through recent FAA studies of ways to improve the efficiency of the air traffic control system to conserve fuel, a new procedure has been developed which improves safety through reduced low altitude flying time, standardizes high performance aircraft arrival procedures, equalizes the arrival delays through regulating the traffic flow, and provides for departures to climb to cruise altitude unrestricted. These new procedures will soon be made final in an FAA Order on Local-Flow Traffic Management. The Order will apply to all airports where high performance aircraft operate. The existing "Keep-'Em-High" Order will be phased out as the provisions of the new Order are implemented. A substantial noise benefit can be realized through the implementation of the Local-Flow Traffic Management Order over those benefits achievable under the FAA "Keep-'Em-High" program or the EPA proposed minimum altitude regulatory proposal.

All of these operational procedures designed to provide noise relief have been the subject of a number of discussions with the EPA and have been the subject of formal consultation between the FAA, the EPA and the Secretary of Transportation. That consultation process has been completed and the FAA has taken final action to implement these operational procedures.

3. Federal Research and Development Technology

As is the case with most fields of technology, continuing research and development on aircraft noise is necessary to insure that advances in the state-of-the-art are available for each successive
It is expected that reduction in stability augmentation can become available for certain technology in the laboratory and the appearance of that technology in commercial airplanes. For example, the present generation of quieter wide-body airplanes, such as the 747, DC-10 and L-1011, which began to enter commercial service in 1970, applied quieter technology of the high-bypass ratio engine developed about 1960. Similarly, more advanced engine quieting technology, which is being developed today, cannot realistically be expected to enter commercial service for at least five to six years.

Aircraft noise is generated primarily by two major sources in the engines: the external turbulent jet exhaust and the internal compressors and combustion process. High-bypass ratio engines, such as the Pratt and Whitney JT9D, the General Electric CF-6 and the Rolls Royce RB-211 now used on the 747, L-1011 and DC-10 aircraft, reduce the primary jet exhaust velocity and thus reduce its noise. At the same time, improved sound absorbing materials in the nacelle surrounding the engine absorb much of the internal noise produced by the compressors and the combustion process. Current technology in new engines, such as the Pratt and Whitney JT10D, and the General Electric CFM56, show potential for further reductions in engine noise levels through improved designs of the internal compressors which, if combined with more efficient wing design, and more effective control surfaces (flaps, spoilers, etc.) will require less engine thrust for safe flight, thereby providing further noise reductions.

It is expected that the technology for use in the next generation of commercial airplanes should provide further significant reductions below current noise standards. These will be evaluated carefully in considering both the applicability and scheduling of lower level requirements, such as proposed in NPRM 76-22.

A recent NASA analysis* has shown quite clearly that substantial long-term (through the year 2000) reductions in noise, fuel consumption, and aircraft emissions are achievable through the development and introduction of more advanced technology than that currently available. Realization of potential advantages through the extensive use of composite materials to reduce airframe weight, stability augmentation to reduce drag, and improved performance of advanced-technology engines such as the prop-fan will depend on the research and development necessary to demonstrate these factors.

Such features can become available for service in the late 1980s, assuring continuing progress in aircraft quieting along with fuel economy, cleaner operation, and greater productivity.

The federal government will continue to sponsor and support aviation research and development, in cooperation with the aviation industry. As engine noise levels are reduced, the aerodynamic noise from airflow over and around the airframe itself and its necessary appendages, especially at low altitudes, when flaps and landing gear are extended, may become the major approach noise source. Research on this noise source to determine how it may best be reduced is now underway and will continue.

D. Protecting the Airport Environment

There are over 13,000 public airports operated in the United States today and they vary considerably in size, proximity to populated areas and function as well as in type and volume of operations. For example, only about 500 airports are fully certificated by the FAA, while another 500 have limited certificates. Only 427 airports have an FAA air traffic control tower. American airports are also the busiest in the world; 84 airports have a total of over 200,000 annual operations, while 160 airports have 150,000 or more annual operations. Busy airports are not only found in the larger metropolitan areas; while 244 airports have 100,000 or more annual operations, 58 of these only 15 are located in large or medium hubs. Most of those operations are general aviation; only the top ranked 24 airports each have 100,000 or more annual air carrier operations.

The variety of airports in the United States demonstrates that an airport noise reduction strategy cannot be completely generalized. The problem must be approached on an airport-by-airport basis, and all levels of government and the private sector should act with the recognition that solutions to the noise problem must be designed to meet the needs of a particular airport environment.

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* Under section 512 of the Federal Aviation Act, 49 U.S.C. 1432, the FAA issues operating certificates to airports served by Civil Aeronautics Board certificated air carriers that the FAA finds "properly and adequately equipped and able to conduct a safe operation."

** An operation is a takeoff or a landing; a flight thus consists of two operations, one takeoff and one landing.

*** A "hub" is defined by the FAA as a city in a standard metropolitan statistical area, as defined by the Bureau of the Census, requiring air service.
1. **The Airport Proprietor's Responsibility**

Substantial benefits will be achieved through federal actions to abate source noise and control operational flight procedure and airspace, but much of the noise problem is airport-specific and must be addressed by individual proprietors. Noise impact at any airport is in part due to local decisions on airport location, continuation of airport operations on a particular site, the layout and size of and airport and the purchase of buffer areas for noise abatement purposes. It is local decision-making that permits residential development near an airport. For these reasons, the Supreme Court concluded that proprietors are liable for aircraft noise damages. In addition, airport proprietors, particularly those that are public agencies, generally encourage more service to their airports in Civil Aeronautics Board route proceedings.

The need for local action is apparent. Without effective land use planning, the implementation of land use plans and zoning, the benefits achievable from federal source noise reduction requirements could be greatly reduced. Where land use controls have not been imposed, the need for substantial airport land acquisition has increased, and as aircraft operations increase, the need for land acquisition as well as its cost will rise unless source noise levels are reduced.

The airport proprietor is closest to the noise problem, with the best understanding of both local conditions, needs and desires, and the requirements of the air carriers and others that use his airport. The proprietor must weigh the costs the airport and the community must pay for failure to act, and consider those costs against any economic penalties that may result from a decision to limit the use of the airport through curfews or other restrictions for noise abatement purposes.

FAA officials have and will continue to work with and assist airport operators and representatives of communities affected by airport noise to encourage the development of compatible land use controls. What constitutes appropriate land use control action depends on the proprietor's jurisdiction to control or influence land use. This, of course, varies with airport location. Almost all airport proprietors, however, are public agencies with a voice in the affairs and decisions of their respective communities. In some instances they have land use control jurisdiction and are required to document how they will exercise it before receiving federal airport development funds. In other instances, where they lack such direct control,
before receiving federal airport development funds they are
required to demonstrate that they have used their best efforts

to assure proper zoning or the implementation of other appropriate
land use controls near the airport and will continue to do so.
Although the airport proprietor may not have zoning authority,
he is often the local party in the best position to assess the
need for it and to press the responsible officials into action.

2. State and Local Government Responsibility

State and local governments are directly and uniquely responsible
for assuring that land use planning, zoning, and land development
activities in areas surrounding airports is compatible with
present and projected aircraft noise exposure in the area.
They should work closely with airport proprietors in planning
actions to be taken in confining serious aircraft noise exposure
to within the airport boundary and reducing the number of
people seriously affected by airport noise.

State and local governments should support airport land use
acquisition programs developed by airport proprietors. As
federal noise source regulations shrink the contours of cumu-
lative noise exposure, local governments concurrently should
develop complementary land use plans preventing residential
development and other incompatible land use in areas adjacent
to the airport. Now that the federal government has defined a
program extending the application of Part 36 standards, the
local authorities will be able to plan effectively on the
basis of a reasonable set of assumptions about the shrinkage in
noise contours that will occur as a result of the federal action.

State and local governmental agencies can improve the insulation
of housing, schools, community facilities, institutions providing
health services and public buildings in areas exposed to
serious airport noise. To date, such action would have been
prohibitively costly. To achieve a 3 to 7 dBA reduction in
the level of noise heard inside buildings by insulation would
currently cost $1.9 billion nationwide, while a reduction of 8
to 12 dBA would cost $3.8 billion, and a reduction of 13 to 16
dBA would cost $7.2 billion. Given a federal program to require
compliance with Part 36, a housing insulation program becomes
more manageable and far less expensive. State and local govern-
ments should therefore develop appropriate programs to insulate
public buildings and to finance insulation by private residents.
In this regard, the Department is under a mandate in the Airport
The FAA has long encouraged planning to assure not only that airports will be adequate to provide the service required in the future but that prospective noise impacts are evaluated and minimized. In the past this FAA policy has been implemented through three principal methods involving the Airport Development Aid Program (ADAP).

First, under section 10 of the Airport and Airway Development Act, the Secretary may approve a project only if he is satisfied that it is "reasonably consistent" with the plans of planning agencies for the development of the area in which the airport is located. A project may not be approved unless "fair consideration has been given to the interest of communities in or near where the project may be located." The Act further declares as national policy that the projects involving airport location, runway location or a major runway extension shall "provide for the protection and enhancement of the natural resources and the quality of environment of the Nation," and provides that when an airport or runway location or major runway extension will have adverse environmental effect, it may not be approved unless "no feasible and prudent alternative exists and that all possible steps have been taken to minimize such adverse effect." In addition, section 18(4) of that Act provides that among the conditions precedent to project approval are:
appropriate action, including the adoption of zoning
laws, has been or will be taken, to the extent reason-
able, to restrict the use of land adjacent to or in the
immediate vicinity of the airport to activities and
purposes compatible with normal airport operations,
including landing and takeoff of aircraft.

While the FAA does not and, in our judgment, should not have the
power to control land use around airports throughout the United
States, the grant of federal funds for airport development has
been and will continue to be conditioned on the application of
the foregoing principles.

Second, the FAA has awarded ADAP funds for the development of
airport Master Plans. These plans contain an environmental
analysis and planning elements to assure that the airport’s
noise impact is kept to a minimum.

Third, the recent Airway Development Act Amendments
of 1976 (P.L. 94-353) authorize for the first time the use of
federal airport development funds on projects designed to achieve
noise relief. Specifically, section 11 of the Act now authorizes
federal financing of land acquisition to insure compatibility
with airport noise levels and the acquisition of noise suppression
equipment. We will also seek an amendment of that Act which would
authorize the use of ADAP funds for the purchase of noise monitoring
equipment.

For the most part, these provisions have led the FAA to concentrate
on noise abatement efforts in the context of capital investment.
Less attention and financial commitment has been devoted by
the federal government to the development by airport
proprietors of broader, and more comprehensive, noise abatement
plans. The increase in public concern about the airport noise
problem now requires that affirmative federal action be taken
beyond the evaluation of airport construction projects. Therefore,
FAA is initiating a pilot project to encourage the preparation
of comprehensive noise abatement plans by airport proprietors
through the planning grant program of the Airway Development Act.

In formulating this policy to provide a financial incentive for
airport noise abatement planning, FAA gave consideration to other
alternatives including (1) requiring preparation of such plans
by all airports certificated under section 612 of the Federal
Aviation Act; (2) requiring the preparation of such plans by the
busiest airports in the United States (for example, the top 100
airports by the number of operations); (3) requiring preparation of such plans as a prerequisite to imposition of an airport use restriction by FAA-certificated airports; (4) requiring preparation of such plans as a condition of awarding ADAP funds; and (5) encouraging preparation of such plans and review by FAA without providing federal financial support for this purpose. Although we are still open to further suggestions and comments, these proposals to make airport noise planning mandatory, or a condition of ADAP funding, or a prerequisite to the imposition of use restrictions by an airport proprietor were not adopted at this time because we have not had sufficient experience with this type of noise abatement planning by many airports that either may not have serious noise problems or may have already performed a comparable analysis*. Moreover, we strongly believe that airport proprietors have the incentives, the capacity, and the responsibility to undertake comprehensive noise abatement planning when it is needed, without detailed and duplicative federal oversight. We strongly urge them to do so. We will support them in this effort and provide technical and financial assistance where possible.

The FAA pilot comprehensive noise abatement planning program will have the following elements. Each year, to the extent that funds are available, FAA will award grants for not more than 25 plans on the basis of criteria including the quality of the proposal, the gravity of the noise problem afflicting the applicant airport and the likelihood that the development of such a plan will lead to the implementation of practicable noise abatement techniques of general value and applicability.

The objective of this policy is to promote a planning process through which the airport proprietor can examine and analyze the noise impact created by the operation of this airport as well as the costs and benefits associated with various selected alternative noise reduction techniques, individually and/or in combination. FAA personnel will support and cooperate with this effort through consideration of actions which they can take to reduce noise impacts.

Although FAA has not prescribed particular performance requirements for noise abatement plans funded under this program, the goal of the airport noise planning process should be to eliminate insofar as possible severe aircraft noise exposure and to reduce as much as possible significant aircraft noise exposure in communities adjacent to airports. The objective of airport noise

*In reaching this conclusion, the FAA considered public comments received in response to the July 9, 1975, notice (40 F.R. 28844) and testimony at public hearings held in 25 cities throughout the nation on Airport Noise Policy.
The Environmental Protection Agency was provided draft copies of this Policy Statement, and a number of informal discussions were held on the FAA's proposed airport policy as it was being developed. The EPA has advised FAA that it considers the FAA's policy a step forward in this area, although it believes further steps are necessary. On October 26, 1976, EPA proposed a regulation under section 611 of the Federal Aviation Act that would require all airports in the United States serving certificated air carriers to develop airport noise abatement plans by July 1979. These plans, developed according to a common methodology and with extensive public participation, would be submitted to the FAA. Unless disapproved by the FAA, each plan would become a part of the airport's operating certificate issued under section 612 of the Act. The EPA proposal, like ours, has as its objective the bringing together of all interested parties with their respective authorities and obligations, thereby facilitating the creation of an agreed-upon abatement plan especially suited to the individual airport location. The EPA proposal has been sent to the Federal Register for publication, and will be the subject of public hearings on January 17 and 18, 1977. On the basis of these hearings and other analysis, the FAA will determine what revisions of the airport policy enunciated in this document are necessary, if any.

In developing an airport noise control plan, the airport proprietor may wish to consider the following categories of action:

a. Actions that the airport proprietor can implement directly:

(1) location of engine run-up areas;
(2) time when engine run-up for maintenance can be done;
(3) establishment of landing fees based on aircraft noise emission characteristics or time of day.
b. Actions that the airport proprietor can implement directly if he has authority, or propose to other appropriate local authorities:

(1) plan and control of land use adjacent to the airport by zoning or other appropriate land use controls, such as utility expenditures and the issuance of building permits;

(2) enact building codes which require housing and public buildings in the vicinity of airports to be appropriately insulated; and

(3) require appropriate notice of airport noise to the purchasers of real estate and prospective residents in areas near airports.

c. Actions that the airport proprietor can implement directly in conjunction with other appropriate local authorities and with financial assistance from the FAA, where appropriate:

(1) acquire land to insure its use for purposes compatible with airport operations;

(2) acquire interests in land, such as easements or air rights, to insure its use for purposes compatible with airport operations;

(3) acquire noise suppressing equipment, construction of physical barriers, and landscape for the purpose of reducing the impact of aircraft noise; and

(4) undertake airport development, such as new runways or extended runways, that would shift noise away from populated areas or reduce the noise impact over presently impacted areas.

d. Actions that the airport proprietor can propose to FAA for implementation at a specific airport as operational noise control procedures:

(1) a preferential runway use system;

(2) preferential approach and departure flight tracks;

(3) a priority runway use system;

(4) a rotational runway use system;
(5) flight operational procedures such as thrust reduction or maximum climb on takeoff;

(6) higher glide slope angles and glide slope intercept altitudes on approach; and

(7) displaced runway threshold.

e. Actions an airport proprietor can establish, after providing an opportunity to airport users, the general public and to FAA to review and advise:

(1) restrictions on the use of or operations at the airport in a particular time period or by aircraft type, such as:
   (a) limiting the number of operations per day or year;
   (b) prohibiting operations at certain hours - curfews;
   (c) prohibiting operation by a particular type or class of aircraft; and

(2) any combination of the above.

f. Actions an airport proprietor can propose to an airline:

(1) Shifting operations to neighboring airports.

(2) Rescheduling of operations by aircraft type or time of day.

The existence, operation and development of an airport provides a service to and is interrelated with both the local community and airport users. These are also the parties who would be most directly affected by the airport operator's noise control plan. We therefore consider it vital that these parties have the opportunity to take part in the planning process. As a condition of FAA noise abatement planning grants, the airport proprietor will be required to provide for reasonable public notice of the plan and provide an opportunity for public participation in the development of the proposed plan. Public notice should describe the plan, the actions proposed, the reasons why these actions are proposed, alternative courses of action considered and why these alternatives were rejected. The FAA also encourages other means of involving the public, both formal and informal, to ensure meaningful public participation in the process.
The FAA will maintain communications with all airports involved in noise abatement planning -- whether or not FAA-funded -- and provide technical advice on the current state-of-the-art in airport noise reduction planning methods that have been successfully used throughout the country. This will include technical information regarding noise reduction and land use planning and guidance on procedures that airports may choose to consider in developing their plans. The FAA and other federal agencies, such as the Department of Housing and Urban Development and the Environmental Protection Agency, may suggest technical methodologies and criteria for land use compatibility that airports and affected local units of government may choose to utilize in their noise reduction planning. Federally funded model noise abatement plans will be monitored and evaluated. Information about successful noise abatement techniques will be disseminated by the FAA to all interested airport proprietors. The FAA will evaluate the model noise abatement planning program as well as the EPA proposal of October 26, 1976, to the FAA and the public comments on it at the conclusion of twenty-four months in order to determine whether broader noise abatement planning requirements should be encouraged or required.

4. FAA Review of Proprietary Use Restrictions

While the airport proprietor is best situated to judge the local noise problem and to determine how to respond to it, he is not always in the best position to judge the impact of his noise reduction proposal on the national and international air transportation systems. Because of the intricacy of those systems, use restrictions at a single airport could, under certain circumstances, cause wide-spread disruption throughout those systems. Pursuant to the general federal interest in the free flow of interstate and foreign commerce, the constitutional principle that states and local entities may not impose undue burdens even where Congress or federal agencies have not acted, and the specific FAA responsibility for regulating the air navigation system, the federal government has the obligation to assure that airport proprietor actions to meet local needs do not conflict with national and international purposes. The proprietor's obligations to refrain from imposing an undue burden on interstate or foreign commerce or discriminating unjustly, and to avoid potential conflicts with the FAA's control of airspace and air traffic, are not difficult to articulate as matters of principle but very difficult to apply to a given factual situation.

As noted above in the discussion of FAA's program to fund airport noise abatement plans, airport proprietors may propose so-called "use restrictions" or "operating procedures" as the
solution to an aircraft noise problem. Operating procedures, by their very nature, require implementation by the FAA. Indeed, the FAA, on its own initiative, has investigated and applied a number of operating procedures aimed at noise abatement, and has several others under consideration. In the future, where an airport proprietor proposes operating procedures to the FAA as a means of achieving noise relief, the FAA will review them to determine if they may be implemented without creating a safety hazard or significantly affecting the efficient use and management of the navigable airspace. If they are acceptable, the FAA will adopt and take appropriate steps to implement them.

The decision to propose a use restriction rests initially with the airport proprietor. It is expected that airport proprietors will consult and review such proposals with all the air carriers, other airport users and the FAA before any use restrictions are established. Here it is the role of the FAA to review those use restriction proposals and provide advice to the airport proprietor on his proposed actions. By this advice, the FAA will attempt to ensure that uncoordinated and unilateral restrictions at various individual airports do not work separately or in combination to create an undue burden on interstate or foreign commerce, unjustly discriminate or conflict with FAA's statutory regulatory authority.

For these reasons, all airport proprietors serving scheduled air carriers should apprise the Federal Aviation Administrator of their proposal to impose an airport use restriction. Such notification should be made a reasonable time in advance of the date the restriction is to go into effect. In all cases, notification of a proprietary use restriction should occur after and be accompanied by a detailed description of the alternative noise reduction techniques the proprietor has considered and the reasons supporting the adoption of the restriction in question instead of any other alternatives. The FAA will review all such use limitations submitted, advise the airport proprietor if it believes the limitation in question is or is not unjustly discriminatory or detrimental to the national air transportation system.

This review procedure is vital to the maintenance of harmonious relations between airport operators, air carriers and the FAA. By giving the FAA timely notification of use restrictions, supported by a thorough analysis of the alternative courses that have been considered, airport proprietors can assure FAA support, which may be necessary to administer the restriction in question successfully and which will prove valuable in any litigation which may ensue. If litigation over use restrictions does occur, the FAA will in appropriate cases ask the Justice Department to intervene or file amicus curiae in support of use
restrictions it considers valid. On the other hand, an airport
proprietor that imposes a use restriction without analyzing
alternatives and consulting with FAA cannot expect FAA to
provide expert advice or to support its policies. The FAA
will not endorse any proposed use restriction that has not had
prior review, including public and airport user review as well
as FAA review, nor will it recognize as valid any such restric-
tions that as a result of FAA review are considered to be
unjustly discriminatory or a significant disruption of the
air transportation system of the United States. In the latter
case, the United States may institute or support litigation
challenging an unacceptable use restriction.

E. Private Sector Responsibility

Air Carriers are responsible for assuring that the required portion of
their operating fleets meet Part 36 noise levels within the time period
required by federal regulations. Within that period it is also the
carriers' responsibility to assure that an efficient and effective
noise reduction plan is established that covers the retirement or
retrofit of aircraft not meeting Part 36 as well as the operation of
those aircraft in a manner designed to minimize their impact on noise
sensitive communities. To this end, air carriers should attempt to
schedule the operations of noncomplying airplanes into airports that
do not have noise problems.

Air carriers can enter into agreements with airport operators to
minimize the impact of aircraft noise through limitations on aircraft use.
These agreements, in certain cases, will be subject to FAA review and
advice. The carriers should also fly their airplanes on schedules
utilizing appropriate noise abatement operating procedures designed to
minimize noise impacts.

Air travelers generally should bear the cost of noise reduction,
consistent with sound economic principle and federal policy of
internalizing the adverse environmental consequences in the price
of a service or product.

Residents and prospective residents in areas surrounding
airports should seek to understand the noise problem and what
steps can reasonably be taken to minimize its effect on people.
Recognizing that individual and community responses to aircraft
noise differ substantially and that for some individuals, the
reduced level of noise resulting from the implementation of this
policy may not eliminate the annoyance or irritation. Prospective
residents considering moving into airport and noise impacted areas
should be aware of the effect of noise on their quality of life.
CONCLUSION

Aircraft noise abatement is a complex and controversial issue. In the wealth of information about the subject and midst the labyrinth of jurisdictional responsibilities, there are a few simple thoughts that should not be forgotten. In a society in which we are making rapid strides to improve the quality of life for all of our people, the continuing annoyance and irritation of excessive aircraft noise is an unwarranted intrusion upon the lives of some six million Americans. The federal government remains committed to taking all technologically feasible and economically reasonable actions to reduce excessive aircraft noise at its source and, working with airport proprietors, to reduce its impact on people.

It is clear, however, that the only successful attack that can be launched on this problem is one that involves the cooperative participation of all levels of government—state, federal and local—as well as airport operators, air carriers, aeronautical manufacturers, and airport neighbors. Only if each of these parties performs all the functions for which it is uniquely suited will we achieve significant and lasting progress in reducing both the number of people exposed to serious levels of aircraft noise and the severity of noise exposure for each and every American.

Although federal action to reduce the noise levels of operating aircraft has been long in coming, we hope that the time has enabled us to develop a policy which will work and will result in less noise exposure over the longer term as well as provide immediate relief. By the actions set forth in this policy, including those directed by the President, we are exercising those federal responsibilities that the Congress has required of us. We have set forth a federal action plan for the future so that other essential parties in the noise reduction effort can take complementary action and make their plans with a clear understanding of what the federal government has done and intends to do. Finally, we have set forth what we believe to be the responsibilities of other parties—airport operators, industry and local government—since the effectiveness of the federal action we take today is contingent on what these other parties do.

We thus invite these other parties to consult with us about their plans and proposals, to suggest innovative ways of meeting the noise problem in their communities, and to tell us how we can do our job more effectively. In turn, we will not hesitate to advise local governments and airport proprietors that they must exercise control over land use development and acquire additional land around airports to ensure that the national objective of confining severe aircraft noise to within the airport boundary is achieved. Nor will we hesitate to inform the air carriers and aeronautical manufacturers what this policy requires of them.

Working together, in the spirit of close cooperation and open communication, we will bring about quieter skies for all American citizens.
APPENDIX 8-8

FAA ORDER 8400.9
ORDER
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

SUBJ: NATIONAL SAFETY AND OPERATIONAL CRITERIA FOR RUNWAY USE PROGRAMS

1. PURPOSE. The purpose of this order is to provide safety and operational criteria for runway use programs. These criteria are applicable to all runway use programs developed for turbojet aircrafts. This order provides parameters in the form of safety and operational criteria which must be used in the evaluation and/or approval of runway use programs.

2. DISTRIBUTION. This Order is distributed to selected offices in Washington and Regional Headquarters, Mike Monroney Aeronautical Center, and FAA Technical Center; Air Traffic Field Offices and Facilities; General Aviation and Air Carrier District Offices, Flight Standards District Offices, Flight Inspection District Offices, Field Offices and Groups, Airports District Offices, and Interested aviation public.

3. BACKGROUND.
   a. FAA has responsibility to provide the public right of freedom of transit through the navigable airspace of the United States and to regulate air commerce in such a manner as to best promote its development. FAA also has the responsibility for, and must maintain a detailed knowledge of, the safe operation of aircraft at our nation's airports. A primary function of this responsibility is determining under what conditions flight operations may be conducted without causing a degradation of safety.

   b. Under ideal conditions aircraft takeoffs and landings should be conducted into the wind. However, other considerations such as delay and capacity problems, runway length, available approach aids, noise abatement, and other factors may require aircraft operations to be conducted on runways not directly aligned into the wind.

   c. The Aviation Noise Abatement Policy of 1976 and Order 1050.11, Noise Control Plans, identify airport proprietors as responsible for taking the lead in local aviation noise control plans. Accordingly, airport proprietors may propose specific noise abatement programs to the FAA. Order 1050.11 assigns FAA responsibilities in relation to noise control plans. It requires the Air Traffic Service to "Provide guidance and administer programs for aircraft noise abatement procedures. . . ." Furthermore, it requires that the Office of Flight Operations "Evaluate and make decisions in conjunction with the regional offices, as appropriate, concerning safety factors for flight operational procedures. . . ." The criteria in this order

Distribution: ZPS-840, Z07-710 (minus field facilities); Initiated by: AFO-219/TAO-12O
A-FAA-2,1,4,1,6,3 (STD); A-FAA-1,2,4,7 (STD);
A-FAA-1 (STD)

3-68
ill be utilized by Flight Standards personnel in evaluating the safety of proposed programs and by Air Traffic personnel in administering Formal and Informal Runway Use Programs.

d. This order is not intended to restrict a pilot's use of the full certificated capability of an aircraft. This order also does not limit a pilot in the use of instrument approach procedures or any other such factors. Applicable FAR's, flight and operations manuals and advisory material address the necessary safety aspects of aircraft operations for pilots and aircraft operators.


5. **DEFINITIONS.**

a. Runway Use Programs. A noise abatement runway selection plan designed to enhance noise abatement efforts with regard to airport communities for arriving and departing aircraft. These plans are developed into runway use programs and apply to all turbojet aircraft 12,500 pounds or heavier; turbojet aircraft less than 12,500 pounds are included only if the airport proprietor determines that the aircraft creates a noise problem. Runway use programs are coordinated with FAA offices as outlined in Order 1050.11. Safety criteria used in these programs are developed by the Office of Flight Operations. Runway use programs are administered by the Air Traffic Service as “formal” or “informal” programs.

b. Formal Runway Use Program. An approved noise abatement program which is defined and acknowledged in a Letter of Understanding between Flight Standards, Air Traffic Service, the airport proprietor and the users. Once established, participation in the program is mandatory for aircraft operators and pilots as provided for in FAR Section 91.87.

c. Informal Runway Use Program. An approved noise abatement program which does not require a Letter of Understanding and participation in the program is voluntary for aircraft operators/pilots.

6. **RESPONSIBILITIES.**

a. Terminal Facility Chiefs.

1. Provide technical assistance upon request of the airport proprietor in developing a runway use program.

2. Before any runway use program is implemented, ensure coordination with, and encourage participation in the development of the program by the airport proprietor, the local community, and aircraft operators who regularly use the airport.

3. Forward the completed runway use program to the Regional Air Traffic Division for review, further intra-agency coordination, and approval.
b. **Regional Air Traffic Division.**

(1) Review and coordinate all runway use programs with the regional Flight Standards and Airports Divisions, and the appropriate office for environmental/noise matters. When necessary as outlined in paragraph 8 of this order, or if concurrence cannot be reached within the region, forward the program with comments to the Air Traffic Service, ACC-1, for final approval.

(2) Upon completing proper coordination, return the runway use program to the facility with approval or disapproval and rationale.

(3) Maintain a current status of all runway use programs and periodically review for accuracy and completeness in accordance with this directive.

c. **Regional Flight Standards Division.** Coordinate with the regional Air Traffic Division on all runway use programs and review them for compliance with the criteria in this order. If the program is within the criteria of this order, return it to the Air Traffic Division with concurrence and supporting rationale. If it is not within the criteria in this order, return it to the Air Traffic Division with non-concurrence and rationale. If a waiver is requested in accordance with paragraph 8, perform a safety analysis to evaluate the proposed alternate criteria and return the program to the Air Traffic Division with concurrence or non-concurrence, recommendations, and supporting rationale (see Appendix 2).

7. **OPERATIONAL SAFETY CRITERIA FOR RUNWAY USE PROGRAMS.** Except as provided for in paragraph 8, the following criteria shall be applied to all runway use programs:

a. **Wind Shear or Thunderstorms.** There should be no significant wind shear or thunderstorms which affect the use of the selected runway(s) such as:

(1) That reported by an operating Low Level Wind Shear Alert System (LLWS), or

(2) Pilot report (PIREP) of wind shear, or

(3) No thunderstorms on the initial takeoff departure path or final approach path (within 5 nm) of the selected runway(s).

b. **Visibility.** In order to utilize landing runways associated with a runway use program, the reported visibility shall not be less than one statute mile (runway visual range [RVR] 5000).

c. **Runway Braking Effectiveness.** There should be no snow, slush, ice or standing water present or reported (other than isolated patches which do not impact braking effectiveness) on that width of the applicable runway or stopway (overrun) to be used. Braking effectiveness must be "good" (e.g., not "fair," "poor," or "nil") and no reports of hydroplaning or unusual slippery runway surfaces (e.g., as may occur on ungrooved new pavement or contaminated surfaces).
d. Winds.

(1) Clear and Dry Runways.

(a) Unless a greater crosswind component is approved by the applicable Flight Standards office considering local weather factors, facilities and characteristics of aircraft normally using the facility, the crosswind component for the selected runway (including gust values) must not be greater than 20 knots (Appendix 1, Table 1).

(b) Except for (c) below, the tailwind component must not be greater than 5 knots (Appendix 1, Table 4).

(c) Where anemometers are installed near the touchdown zone of the candidate runway for landings, or near the departure end for takeoffs, any tailwind component must not be greater than 7 knots (Appendix 1, Table 3).

(2) Runways Not Clear or Not Dry.

(a) The crosswind component (including gust values) must not exceed 15 knots (Appendix 1, Table 2), and.

(b) No tailwind component may be present except the nominal range of winds reported as calm (0-3 knots) may be considered to have no tailwind component.

(c) Unless otherwise approved by the applicable FAA Flight Standards office based on runway available and field lengths required for aircraft normally using the runway, the runway must be grooved or have a porous friction course surface.

e. Other Safety Factors. Factors peculiar to a specific airport must also be considered to the extent that they have been identified. These factors may include: runway length, runway gradient, aircraft type and performance characteristics, approach aids, etc.

f. WAIVERS. When necessary to accommodate unique site-specific situations, requests for waivers to the criteria contained in this order shall be submitted with justification, a safety analysis, and supporting data to AFO-1 who shall coordinate with AFO-1 for concurrence before granting final approval.

Page 4

8-71
9. APPLICABILITY.
   
a. This order applies to FAA personnel who may be called upon to advise,
evaluate, or coordinate on specific noise abatement plans for runway use programs
for particular airports.

b. This order does not require development or use of a runway use program where
such a program has not been used or is not needed.

J. Lynn Helms
Administrator
APPENDIX 1. TABLE OF MAXIMUM WIND VALUES

The following table illustrates the maximum components for wind directions in 10-degree increments relative to a runway. No headwind component limitation is stated because strong headwinds would dictate use of a runway aligned into the wind due to the crosswind limitation. Velocity values are rounded down to the nearest whole number.

<table>
<thead>
<tr>
<th>Wind Angle (Degrees)</th>
<th>Crosswind Component Table 1 (Dry Runway)</th>
<th>Wind Velocity (Knots)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td></td>
<td>114</td>
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<table>
<thead>
<tr>
<th>Wind Angle (Degrees)</th>
<th>Crosswind Component Table 2 (Runway Not Dry)</th>
<th>Wind Velocity (Knots)</th>
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### Tailwind Component Table 3
(WITH ANEMOMETERS)
DRY RUNWAY

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### Tailwind Component Table 4
(WITHOUT ANEMOMETERS)
DRY RUNWAY

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<th>Wind Velocity (Knots)</th>
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</table>
APPENDIX D. EVALUATION OF REQUESTS FOR WAIVERS

When reviewing waiver requests in accordance with paragraph 8 of the order, Flight Standards personnel must consider the operational impact of the following factors when providing a safety analysis to support alternate criteria:

a. Are there significant occurrences of wind shear or thunderstorms?

b. Is a low level wind shear alert system (LWSAS) installed?

c. Do runways significantly exceed critical field length for aircraft commonly using the airport?

d. Are runways grooved or do they have a porous friction course surface?

e. Are precision approach aids available to these runways?

f. Is a VASI present if these runways require a nonprecision approach?

g. Are 2 transmissometers installed?

h. Is runway slope a factor? If so, does it impact aircraft performance?

i. Is Maximum Brake Energy (V_{MBE}) a factor? If so, does it impact aircraft performance?
APPENDIX 8-C

PART 91 SUBPART E
one pilot station. The authorization contains any conditions that the Administrator finds necessary for safe operation.

(c) No person may designate a pilot to serve as second in command nor may any pilot serve as second in command of an airplane required under this section to have two pilots, unless that pilot meets the qualifications for second in command prescribed in § 61.5 of this chapter.

§ 91.215 Flight attendant requirements.
(a) No person may operate an airplane unless at least the following number of flight attendants are on board the airplane:

(1) For airplanes having more than 19 but less than 51 passengers on board—one flight attendant.

(2) For airplanes having more than 50 but less than 101 passengers on board—two flight attendants.

(3) For airplanes having more than 100 passengers on board—two flight attendants plus one additional flight attendant for each unit (or part of a unit) of 50 passengers above 100.

(b) No person may serve as a flight attendant on an airplane when required by paragraph (a) of this section, unless that person has demonstrated to the pilot in command that he is familiar with the necessary functions to be performed in an emergency or a situation requiring emergency evacuation and is capable of using the emergency equipment installed on that airplane for the performance of those functions.

§ 91.217 [Reserved.]

§ 91.218 [Reserved.]

Subpart E—Operating Noise Limits

§ 91.307 Applicability; relation to Part 36.

(a) This subpart prescribes operating noise limits and related requirements that apply as follows to the operation of civil aircraft in the United States:

(1) Sections 91.302, 91.303, 91.305, 91.306, and 91.307 apply to civil subsonic turbojet airplanes with maximum weights of more than 75,000 pounds and—

(i) If U.S. registered, that have standard airworthiness certificates; or

(ii) If foreign registered, that would be required by this chapter to have a U.S. standard airworthiness certificate in order to conduct the operations intended for the airplane were it registered in the United States.

Those sections apply to operations to or from airports in the United States under this Part and Parts 121, 123, 125, 129, and 133 of this chapter.

(2) Section 91.308 applies to U.S. operators of civil subsonic turbojet airplanes covered by this subpart. That section applies to operators operating to or from airports in the United States under this Part and Parts 121, 123, 125, and 133 but not to those operating under Part 139 of this chapter.

(3) Sections 91.302, 91.309 and 91.311 apply to U.S. registered civil supersonic airplanes having standard airworthiness certificates, and to foreign registered civil supersonic airplanes that, if registered in the United States, would be required by this chapter to have a U.S. standard airworthiness certificate in order to conduct the operations intended for the airplane. Those sections apply to operations under this Part and under Parts 121, 123, 125, 129, and 133 of this chapter.

(b) Unless otherwise specified, as used in this subpart “Part 36” refers to 14 CFR Part 36. Including the noise levels under Appendix C of that Part, notwithstanding the provisions of that Part excepting certain airplanes from the specified noise requirements. For purposes of this subpart, the various stages of noise levels, the terms used to describe airplanes with respect to those levels, and the terms “subsonic airplane” and “supersonic airplane” have the meanings specified under Part 36 of this chapter. For purposes of this subpart, for subsonic airplanes operated in foreign air commerce in the United States, the Administrator may accept compliance with the noise requirements under Annex 16 of the International Civil Aviation Organization when those requirements have been shown to be substantially compatible with, and achieve results equivalent
to those achievable under Part 38 for that airplane. Determinations made under these provisions are subject to the limitations of § 91.302 of this chapter as if those noise levels were Part 38 noise levels.

(c) [Reserved]

§ 91.302 Part 123 operators: designation of applicable regulations.

For airplanes covered by this subpart and operated under Part 123, the following regulations apply as specified:

(a) For each airplane operation to which requirements prescribed under this subpart applied before November 29, 1980, those requirements of this subpart continue to apply.

(b) For each subsonic airplane operation to which requirements prescribed under this subpart did not apply before November 29, 1980, because the airplane was not operated in the United States under this Part or Part 121, 122, 129, or 135, the requirements prescribed under § 91.303, 91.304, 91.307, and 91.308 of this subpart apply.

(c) For each supersonic airplane operation to which requirements prescribed under this subpart did not apply before November 29, 1980, because the airplane was not operated in the United States under this Part or Part 121, 122, 129, or 135, the requirements of §§ 91.309 and 91.311 of this subpart apply.

(d) For each airplane required to operate under Part 123 for which a deviation under that Part is approved to operate, in whole or in part, under this Part or Parts 121, 122, 129, or 135, notwithstanding the approval, the requirements prescribed under paragraphs (a), (b), and (c) of this section continue to apply.

§ 91.303 Final compliance: subsonic airplanes.

Except as provided in §§ 91.306 and 91.307, on and after January 1, 1983, no person may operate or from an airport in the United States any subsonic airplane covered by this subpart, unless that airplane has been shown to comply with Stage 2 or Stage 3 noise levels under Part 38 of this chapter.

§ 91.305 Phased compliance under Parts 121, 123, and 135: subsonic airplanes.

(a) General. Each person operating airplanes under Parts 121 or 135 of this chapter, or under Part 123 of this chapter, as prescribed under § 91.302 of this subpart regardless of the State of registry of the airplane, shall comply with this section with respect to subsonic airplanes covered by this subpart.

(b) Compliance schedule. Except for airplanes shown to be operated in foreign air commerce under paragraph (c) of this section or covered by an exemption (including those issued under § 91.307), airplanes operated by U.S. operators in air commerce in the United States must be shown to comply with Stage 2 or Stage 3 noise levels under Part 38, in accordance with the following schedule, or they may not be operated to or from airports in the United States:

1. By January 1, 1981:
   (i) At least one quarter of the airplanes that have four engines with no bypass ratio or with a bypass ratio less than two.
   (ii) At least half of the airplanes powered by engines with any other bypass ratio or by another number of engines.

2. By January 1, 1983:
   (i) At least one half of the airplanes that have four engines with no bypass ratio or with bypass ratio less than two.
   (ii) All airplanes powered by engines with any other bypass ratio or by another number of engines.

(c) Apportionment of airplanes. For purposes of paragraph (b) of this section, a person operating airplanes engaged in domestic and foreign air commerce in the United States may elect not to comply with the phased schedule with respect to that portion of the airplanes operated by that person shown, under an approved method of apportionment, to be engaged in foreign air commerce in the United States.

§ 91.306 Replacement airplanes.

A Stage 1 airplane may be operated after the otherwise applicable compliance dates prescribed under §§ 91.303 and 91.305 if, under an approved plan, a replacement airplane has been ordered by the operator under a binding contract as follows:

(a) For replacement of an airplane powered by two engines, until January 1, 1986, but not after the date specified in the plan, if the contract is entered into by January 1, 1983, and specifies delivery before January 1, 1986, of a replacement airplane which has been shown to comply with Stage 3 noise levels under Part 38 of this chapter.
(b) For replacement of an airplane powered by three engines, until January 1, 1985, but not after the date specified in the plan, if the contract is entered into by January 1, 1983, and specifies delivery before January 1, 1985, of a replacement airplane which has been shown to comply with Stage 3 noise levels under Part 36 of this chapter.

(c) For replacement of any other airplane, until January 1, 1985, but not after the date specified in the plan, if the contract specifies delivery before January 1, 1985, of a replacement airplane which—

1. Has been shown to comply with Stage 2 or Stage 3 noise levels under Part 36 of this chapter prior to issuance of an original standard airworthiness certificate; or

2. Has been shown to comply with Stage 3 noise levels under Part 36 of this chapter prior to issuance of a standard airworthiness certificate other than original issue.

(d) Each operator of a Stage 1 airplane for which approval of a replacement plan is requested under this section shall submit to the FAA Director of the Office of Environment and Energy an application constituting the proposed replacement plan (or revised plan) that contains the information specified under this paragraph and which is certified (under penalty of 18 U.S.C. § 1001) as true and correct. Each application for approval must provide information corresponding to that specified in the contract, upon which the FAA may rely in considering its approval, as follows:

1. Name and address of the applicant.

2. Aircraft type and model and registration number for each airplane to be replaced under the plan.

3. Aircraft type and model of each replacement airplane.

4. Scheduled dates of delivery and introduction into service of each replacement airplane.

5. Name and address of the parties to the contract and any other persons who may effectively cancel the contract or otherwise control the performance of any party.

6. Information specifying the anticipated disposition of the airplanes to be replaced.

(7) A statement that the contract represents a legally enforceable, mutual agreement for delivery of an eligible replacement airplane.

(8) Any other information or documentation requested by the Director, Office of Environment and Energy reasonably necessary to determine whether the plan should be approved.

§ 91.307 Service to small communities exemption; two-engine subsonic airplanes.

(a) A Stage 1 airplane powered by two engines may be operated after the compliance dates prescribed under §§ 91.303, 91.305, and 91.306, when, with respect to that airplane, the Administrator issues an exemption to the operator from the noise level requirements under this subpart. Each exemption issued under this section terminates on the earlier of the following dates—

1. For an exempted airplane sold, or otherwise disposed of, to another person on or after January 1, 1985—on the date of delivery to that person;

2. For an exempted airplane, with a seating configuration of 100 passenger seats or less—on January 1, 1988; or

3. For an exempted airplane with a seating configuration of more than 100 passenger seats—on January 1, 1985.

(b) For purposes of this section, the seating configuration of an airplane is governed by that shown to exist on December 1, 1979, or an earlier date established by the Administrator.

§ 91.308 Compliance plans and status: U.S. operators of subsonic airplanes.

(a) Each U.S. operator of a civil subsonic airplane covered by this subpart (regardless of the State of registry) shall submit to the FAA Director of the Office of Environment and Energy, in accordance with this section, the operator’s current compliance status and plan for achieving and maintaining compliance with the applicable noise level requirements of this subpart. If appropriate, an operator may substitute for the required plan a notice, certified as true (under penalty of 18 U.S.C. § 1001) by that operator, that no change in the plan or status of any airplane affected by the...
PART 91  GENERAL OPERATING AND FLIGHT RULES

\[
\begin{align*}
\text{plan has occurred since the date of the plan most} \text{ recently submitted under this section.} \\
(1) \text{Each compliance plan, including any revised plans, must contain the information} \\
\text{specified under paragraph (c) of this section for each airplane covered by} \\
\text{this section that is operated by the operator. Unless otherwise approved} \\
\text{by the Administrator, compliance plans must provide the required plan and status information as it} \\
\text{exists on the date 30 days before the date specified for submission of the plan. Plans} \\
\text{must be certified by the operator as true and complete (under penalty of 18 U.S.C. § 1001) and} \\
\text{be submitted for each airplane covered by this section on or before the following dates—} \\
(1) \text{May 1, 1980 or 90 days after initially commencing operation of airplanes covered} \\
\text{by this section, whichever is later, and thereafter—} \\
(2) \text{Thirty days after any change in the operator's fleet or compliance planning decisions that} \\
\text{has a separate or cumulative effect on 10 percent or more of the airplanes in} \\
\text{either class of airplanes covered by § 31.305(b); and} \\
(3) \text{Thirty days after each compliance date applicable to that airplane type under this} \\
\text{subpart and annually thereafter through 1985 or until any later compliance date for that} \\
\text{airplane prescribed under this subpart, on the anniversary of that submission date, to show} \\
\text{continuous compliance with this subpart.} \\
(4) \text{Each compliance plan submitted under this section must identify the operator and include} \\
\text{information regarding the compliance plan and status for each airplane covered by the} \\
\text{plan as follows:} \\
(1) \text{Name and address of the airplane operator.} \\
(2) \text{Name and telephone number of the person designated by the operator to be} \\
\text{responsible for the preparation of the compliance plan and its submission.} \\
(3) \text{The total number of airplanes covered by this section and in each of the following} \\
\text{classes and subclasses:} \\
(4) \text{Airplanes engaged in domestic air commerce.} \\
(A) \text{Airplanes powered by four turbojet engines with no bypass ratio or with a bypass ratio less than two,} \\
\end{align*}
\]
(xv) For airplanes covered by the exemption issued to the operator granting relief from noise level requirements of this section, the number of spare sets of acoustical components need for continuous compliance and the number available on demand to the operator in support of those airplanes and

(xvi) For airplanes for which none of the other codes prescribed under paragraph (c)(5) of this section describes either the technology applied, or to be applied to the airplane in accordance with the certification requirement under Parts 31 and 36 of this chapter, or the compliance strategy or methodology, following the code "OTH", enter the date of any certificate action and attach an addendum to the plan explaining the nature and extent of the certified technology, strategy, or methodology employed, with reference to the type certificate documentation.

(5) TABLE OF ACOUSTICAL TECHNOLOGY/STRATEGY CODES

<table>
<thead>
<tr>
<th>Code</th>
<th>Aircraft Type</th>
<th>Certified Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B-707-120</td>
<td>Quiet Nacelles = 1-Ring</td>
</tr>
<tr>
<td>B</td>
<td>B-707-120/C</td>
<td>Double Wall Fan Duct Treatment</td>
</tr>
<tr>
<td>C</td>
<td>B-727-200</td>
<td>Double Wall Fan Duct Treatment (Pre-January 1977 installations and Amended Type Certification)</td>
</tr>
<tr>
<td>D</td>
<td>B-727-200</td>
<td>Quiet Nacelles = Walk-Off Duct Treatment</td>
</tr>
<tr>
<td>E</td>
<td>B-747-100</td>
<td>Sound Absorbing Material Kit</td>
</tr>
<tr>
<td>F</td>
<td>DC-8</td>
<td>New Extended Inlet and Exhaust Treatment = Fan Duct Treatment Area</td>
</tr>
<tr>
<td>G</td>
<td>DC-9</td>
<td>B-25 Sound Absorbing Material Treatment Kit</td>
</tr>
<tr>
<td>H</td>
<td>BAC-111-200</td>
<td>Fan Duct Treatment Kit (BAC Sound Absorbing Material Kit)</td>
</tr>
<tr>
<td>I</td>
<td>BAC-111-400</td>
<td>(To be identified later of certification)</td>
</tr>
<tr>
<td>J</td>
<td>B-707</td>
<td>Engine Ecoweight Nacelles = Quiet Nacelles (if certified under Stage 3 noise level requirements)</td>
</tr>
</tbody>
</table>

REP—For airplanes covered by an approved replacement under § 91.308(c) of this subpart.

ESP—For airplanes designated as "engaged in foreign commerce" in accordance with an approved method of apportionment under § 91.308(c) of this subpart.

RET—For DC-8 and B-707 airplanes operated in domestic U.S. air commerce and retired from service in the United States without replacement between January 1, 1967, and January 1, 1968.

RFC—For DC-8 and B-707 airplanes operated by U.S. operators in foreign air commerce in the United States and retired from service in the United States without replacement between April 14, 1968, and January 1, 1969.

EXD—For airplanes exempted from allowing compliance with the noise level requirements of this subpart.

OTH—For airplanes for which no other prescribed code describes either the certified technology applied, or to be applied to the airplane, or the compliance strategy or methodology. An addendum must explain the nature and extent of technology, strategy or methodology and reference the type certificate documentation.

§ 91.309 Civil supersonic airplanes that do not comply with Part 36.

(a) Applicability. This section applies to civil supersonic airplanes that have not been shown to comply with the Stage 2 noise limits of Part 36 in effect on October 13, 1977, using
PART 91  GENERAL OPERATING AND FLIGHT RULES

applicable tradeoff provisions, and that are operated in the United States after July 31, 1973.

(b) Airport use. Except in an emergency, the following apply to each person who operates a civil supersonic airplane to or from an airport in the United States:

(1) Regardless of whether a type design change approval is applied for under Part 21 of this chapter, no person may land or take off an airplane, covered by this section, for which the type design is changed, after July 31, 1973, in a manner constituting an "acoustical change" under § 21.23, unless the acoustical change requirements of Part 36 are complied with.

(2) No flight may be scheduled, or otherwise planned, for takeoff or landing after 10 p.m. and before 7 a.m. local time.

§ 91.231 Civil supersonic airplanes: noise limits.

Except for Concorde airplanes having flight time before January 1, 1980, no person may, after July 31, 1978, operate in the United States, a civil supersonic airplane that does not comply with the Stage 2 noise limits of Part 36 in effect on October 12, 1977, using applicable tradeoff provisions.
APPENDIX 8-D

AC 91.53
NOISE ABATEMENT DEPARTURE PROFILE
Subject: NOISE ABATEMENT DEPARTURE PROFILE

1. PURPOSE. This advisory circular provides a technical analysis and description of a generally effective standardized noise abatement departure profile that is consistent with the Federal Aviation Administration's safety responsibilities. It describes safe standard noise abatement departure profiles for turbojet-powered airplanes with a maximum certificated takeoff weight over 75,000 pounds, consistent with Federal Aviation Regulation (FAR) Section 91.87; and Aviation Noise Abatement Policy, dated November 19, 1976. The profiles contained in this circular should be considered for inclusion in all air carrier training and flight operations manuals as well as in airport noise abatement plans.

2. BACKGROUND.

   a. On October 30, 1967, the Federal Aviation Administration (FAA) adopted Amendment 91-46 to FAR Part 91 (32 FR 15422; November 4, 1967). It amended, among other provisions, paragraph 91.87(f) regarding departures at airports with operating air traffic control towers. Under this amendment, all turbine-powered airplanes were added to the class of aircraft to which the safety/noise abatement departure rule applies.

   b. For several years, the FAA has been actively involved in continuing efforts to develop and provide safe and effective control and abatement of aircraft noise. As part of these efforts, the FAA has worked with airport and aircraft operators, pilots, and other federal, state, and local agencies in numerous developmental and operational flight test programs for measuring and evaluating noise levels in the airport environment, including consideration of various departure flight tracks and profiles. Regulatory and nonregulatory techniques for enhancing the safety, noise, and energy benefits have been reviewed and, when appropriate, implemented.
a. From an environmental standpoint, whenever possible, the avoidance of departures over or near noise sensitive areas by the use of preferential noise abatement runways and flight paths is an effective noise control technique. The FAA believes that use of a noise abatement departure profile for turbojet-powered airplanes with a maximum certificated takeoff weight over 75,000 pounds, which incorporates a thrust reduction and airplane configuration management, provides additional general benefits to the airport community. This noise abatement departure profile may be used in conjunction with preferential runway and flight path techniques and other noise abatement measures. This AC addresses turbojet-powered airplanes with a maximum certificated takeoff weight over 75,000 pounds because they present some of the most significant noise impacts on the airport community and because their operating characteristics are different from other airplane groups.

b. FAA review of current air carrier departure profiles indicates that they result in varying degrees of noise control and abatement at different points along the departure flight tracks. Different airplane types using the same profile also produce different results in terms of noise abatement and fuel efficiency. Accordingly, assessments of which departure profile is preferable from environmental standpoint, including noise abatement and energy conservation, require consideration of airplane type and various airport factors. Relevant airport factors include the location of affected noise sensitive areas. Based on its experience with airplane noise matters and its review of existing operating procedures, the FAA recommends the use of a standardized noise abatement departure profile. The standard profile is intended to be applied consistent with the responsibility of the airport proprietor, local government bodies, and local residents to assess the noise impact of operations at particular airports and for airport proprietors to fulfill their "local option" obligations in a comprehensive aircraft noise abatement program under the Aviation Noise Abatement Policy.

3. NOISE ABATEMENT DEPARTURE PROFILES.
   
a. Takeoff and climb at an airspeed of \( V_1 + 10 \) to 20 knots until attaining an altitude of 1000 feet above airport elevation (AAE).

b. Upon attaining 1000 feet AFE, accelerate to the zero flap minimum safe maneuvering speed \( (V_{AMS}) \) while retracting flaps on schedule and reduce thrust. Thrust should not be reduced below the minimum thrust at which compliance has been shown with the required final takeoff climb performance gradient with one engine inoperative under § 25.121(c) of Part 25 ("final takeoff engine-out climb gradient"). Thrust should be reduced consistent with the following:
   
   (1) Thrust for airplanes with high bypass ratio engines should be reduced to normal climb thrust.

   (2) Thrust for airplanes with low bypass ratio engines should be reduced below normal climb thrust but in no case lower than that necessary to maintain the final takeoff engine-out climb gradient.
(3) Thrust for airplanes with slow flap retraction rates should be reduced at an intermediate flap setting.

c. Continue climb at an airspeed not greater than V_{1} + 10 knots at the reduced thrust to an altitude of not less than 1000 feet above ground level (AGL) upon which the pilot should smoothly initiate a normal climb profile (Figure 1). However, the reaplication of power can be delayed if that event would occur over a noise sensitive area.

d. Notwithstanding paragraph b. above, airplanes not using wing flaps for takeoff should reduce thrust before attaining 1000 feet AGL but not before 500 feet AGL.

4. DISCUSSION.

a. The FAA, in conjunction with other Federal agencies and the aviation industry, has evaluated numerous flight test programs and the operational experience of turbojet-powered airplane operations prior to selecting a standard noise abatement departure profile. These profiles include flying the airplane to 1000 feet at V_{1} + 10 to 20 knots followed by flap retraction and thrust reduction. This achieves climbing the airplane to a safe altitude as quickly as practical where the pilot then reduces thrust to reduce the airplane's noise. This combination of altitude and reduced thrust setting will have a direct effect on the level of noise that is perceived on the ground near the airport. These profiles were developed with five major considerations in mind: safety, noise abatement, standardization, fuel conservation, and operational flexibility.

b. These standard noise abatement profiles are safe. A review of airports served by the affected airplane types has shown that a standard profile containing a thrust reduction below 1000 feet would compromise safety due to obstacle clearance and airplane performance considerations. Further, a thrust reduction below 1000 feet which is required to maintain the 25 foot initial takeoff engine-out climb gradient would not provide enough thrust to maintain an adequate climb rate should an engine fail during departure. Due to these factors, the standard noise abatement profile contains a minimum altitude for thrust reduction of 1000 feet, and a limitation on the amount of thrust reduction based on the performance characteristics of the airplane and its takeoff weight.

c. Use of the standard noise abatement profiles described in this advisory circular will provide noise abatement. A review of airport noise problems shows that there are several noise abatement techniques which are effective depending on the location of the noise sensitive area. Typical airports can be divided into three categories: those with far-neighbor noise sensitive areas which lie beyond 10 miles from the airport; those with near-neighbor noise sensitive areas which lie within 10 miles of the airport; and those with both near-neighbor and far-neighbor noise sensitive areas.

(1) Airports which have only far-neighbor noise problems can generally achieve noise abatement by developing and using a preferential
runway use program and by, in cooperation with FAA, establishing departure tracks to avoid the noise sensitive areas. The FAA believes that these are effective techniques to provide noise abatement to far-neighbor communities.

(2) Airports which have near-neighbor noise problems can achieve noise abatement through developing and using a preferential runway use program in combination with the use of noise abatement departure profiles. Reviews of various noise abatement departure profiles have shown that they are most effective within 10 miles of an airport. Further, people who live within 10 miles of an air carrier airport on the departure flight track are most likely to be exposed to the highest levels of departure noise for the longest time periods. Therefore, the standard noise abatement departure profiles contained in this circular primarily addresses near-neighbor noise problems.

(3) Airports which have both near-neighbor and far-neighbor noise abatement problems, such as airports located in large metropolitan areas, may find it helpful to use a combination of departure profile, preferential runway, and flight track techniques as part of their total noise abatement program.

d. These noise abatement profiles have basic standardization. This standardization has three major benefits. It improves safety by reducing flight crew workload during a critical phase of flight; it improves the ability of the airport proprietor, local bodies, and local residents to assess the noise impact of operations at a particular airport; and it improves the ability of the airport proprietor and the FAA to monitor flight crew adherence to the profile. Many departure noise complaints involve nonstandard departure profiles. Investigations into these complaints frequently have shown that the airplanes involved may not have flown the profile, may not have been flown satisfactorily, or that the profile was not designed for noise abatement. A standardized departure profile could greatly lessen these problems since pilots would be trained in and would be more familiar with a standard noise abatement profile.

e. The standard noise abatement profile will encourage fuel conservation. Airplane data show that an airplane burns less fuel on departure when its flaps are retracted than when they are extended. Therefore, the standard noise abatement departure profile permits flap retraction as soon as safety and noise abatement considerations permit. Industry data on actual flights have shown a significant fuel savings in a mixed fleet of 105 aircraft, including B-727's, DC-10's, and B-747's, using a departure profile similar to the standard rather than a maximum takeoff climb profile. If these data are representative of the entire U.S. fleet, the potential savings, in both energy and cost, would be significant.

f. Operational flexibility in the profile is essential in order to operate each airplane type most efficiently in terms of both noise abatement and fuel conservation. Each airplane type, depending largely on the engines it has installed and its takeoff weight, has different noise and fuel burn
characteristics. Since the capability for thrust reduction and rate of climb diminishes as an airplane’s gross weight approaches its maximum, some differences in noise levels perceived on the ground for the same airplane type is expected. Application of the standard noise abatement profiles should, however, provide a significant reduction in overall airplane noise levels as compared to a maximum thrust departure profile. An evaluation of these different characteristics has resulted in the following recommendations in applying the standard noise abatement profile to specific airplane types.

(1) Thrust for airplanes with high bypass ratio engines (e.g., DC-10, B-747, L-1011, F-100) should not be reduced below normal climb thrust on departure. This is because the noise generated by these engines is not significantly affected by reducing thrust below normal climb thrust, but the climb performance is significantly reduced. A reduced thrust climb would result in more noise on the ground since the airplane would remain at lower altitudes longer.

(2) Thrust for airplanes with low bypass ratio engines (e.g., B-707/727/737, DC-8/9) should be reduced below normal climb thrust but no case, lower than that necessary to maintain the final takeoff engine-out climb gradient. Review of airplane data has shown that reducing thrust below normal climb thrust on these engines can provide significant noise benefits.

(3) Thrust for airplanes with slow flap retraction rates (e.g., B-747), should be reduced as an intermediate flap setting rather than waiting until the flaps are fully retracted. Otherwise, because of their flap deployment rate, these airplanes would be at takeoff thrust significantly longer than other airplanes. This longer time at takeoff thrust could result in a greater noise impact than if they had climbed out at reduced thrust beginning at an intermediate flap setting.

5. IMPLEMENTATION

a. Each operator of a turbojet-powered airplane with a maximum certificated takeoff weight over 75,000 pounds should amend its operating procedures and training programs to incorporate the standard noise abatement departure profiles.

b. The standard noise abatement profile would not apply when —

(1) Otherwise authorized or directed by air traffic control;

(2) Otherwise required under applicable provisions of the FARs; or

(3) An alternate profile is approved by the Director, Flight Standards Service.

c. This advisory circular, including the publication of a standard noise abatement profile, should not be construed to affect the responsibilities and authority of the pilot in command for the safe operation of the airplane under FAR § 91.3 or other regulations.

Par 4
d. The aviation noise abatement policy states that, after consultation with the local community and airport users, an airport operator may propose to the FAA for implementation at a specific airport as an operational noise procedure, "flight operational procedures such as thrust reduction or maximum climb on takeoff.

[Signature]

Laurence Land
Administrator

10/17/73
FIGURE 1. STANDARD NOISE ABATEMENT DEPARTURE PROFILE

- Takeoff thrust
  $V_2 + 10$ to $20$ knots

- Accelerate to $V_{2F}$
- Climb at $V_{2F}$ with reduced thrust
- Normal departure profile

3000 FT.
2000 FT.
1000 FT.
APPENDIX 8-E
AC 150/5020.1
Advisory Circular

Subject: NOISE CONTROL AND COMPATIBILITY PLANNING FOR AIRPORTS

1. PURPOSE. This advisory circular provides guidance for Noise Control and Compatibility Planning for airports under Federal Aviation Regulation (FAR) Part 150 and the Aviation Safety and Noise Abatement Act of 1979 (ASNA) (P.L. 96-191). It is intended for use by airport operators, state/local planners and other officials, and interested citizens who may engage in noise control planning. Airport noise compatibility planning has the goals of reducing existing non-compatible land uses around airports and of preventing the introduction of additional non-compatible land uses through the cooperative efforts of all those involved. The Part 150 program is voluntary and airport operators are encouraged to participate.

2. BACKGROUND. FAR Part 150 implements portions of Title I of the Aviation Safety and Noise Abatement Act of 1979. It establishes a single system for the measurement of airport (and background) noise, a single system for determining the exposure of individuals to airport noise, and a standardized airport noise compatibility planning program. The planning program includes (1) provision for the development and submission to the FAA of Noise Exposure Maps and Noise Compatibility Programs by airport operators; (2) standard noise units, methods and analytical techniques for use in airport assessments; (3) identification of land uses which are normally considered compatible (or non-compatible) with various levels of noise around airports; and (4) procedures and criteria for FAA approval or disapproval of noise compatibility programs by the Administrator. The program includes consideration of alternative noise control that might be employed as well as appropriate land use.
NOISE CONTROL AND COMPATIBILITY PLANNING FOR AIRPORTS

AUGUST 5, 1983
planning strategies. The goal of the overall program is for the airport proprietor, in consultation with state/local planners, local aviation groups and interested citizens, to develop a balanced and cost-effective program to minimize and/or mitigate the airport's noise impact on local communities.

JOHN H. WESLER
Director of Environment and Energy, AEK-1
### CONTENTS

<table>
<thead>
<tr>
<th>CHAPTER 1. GENERAL.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>SECTION 1. INTRODUCTION.</td>
<td>1</td>
</tr>
<tr>
<td>1. Purpose.</td>
<td>1</td>
</tr>
<tr>
<td>2. Background.</td>
<td>1</td>
</tr>
<tr>
<td>3. Benefits of Noise Compatibility Planning.</td>
<td>2</td>
</tr>
<tr>
<td>4. FAA Information Sources.</td>
<td>3</td>
</tr>
<tr>
<td>5. Definitions.</td>
<td>3</td>
</tr>
<tr>
<td>6-19. Reserved.</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SECTION 2. RELATIONSHIP TO OTHER ACTIONS.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>20. Airport Master Plans.</td>
<td>5</td>
</tr>
<tr>
<td>21. ANCLS Studies.</td>
<td>6</td>
</tr>
<tr>
<td>22. Air Installation Compatible Use Zones.</td>
<td>6</td>
</tr>
<tr>
<td>23. Environmental Assessments.</td>
<td>6</td>
</tr>
<tr>
<td>24. Federal Aviation Regulations, Part 36.</td>
<td>7</td>
</tr>
<tr>
<td>25. COB A-95 Notification and Review.</td>
<td>7</td>
</tr>
<tr>
<td>27-29. Reserved.</td>
<td>8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SECTION 3. OVERVIEW.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>30. Noise - Its Measurement and Assessment.</td>
<td>8</td>
</tr>
<tr>
<td>31. Sensitivity of Land Uses to Noise.</td>
<td>8</td>
</tr>
<tr>
<td>32. Noise Exposure Maps.</td>
<td>8</td>
</tr>
<tr>
<td>33. Noise Compatibility Programs.</td>
<td>9</td>
</tr>
<tr>
<td>34. Submission to the FAA.</td>
<td>9</td>
</tr>
<tr>
<td>35. Withdrawal or Revision.</td>
<td>9</td>
</tr>
<tr>
<td>36. Periodic Review and Updating.</td>
<td>10</td>
</tr>
<tr>
<td>37-199. Reserved.</td>
<td>10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CHAPTER 2. NOISE MEASUREMENT AND ASSESSMENT.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>SECTION 1. NOISE METRICS.</td>
<td>11</td>
</tr>
<tr>
<td>200. Sound.</td>
<td>11</td>
</tr>
<tr>
<td>201. Decibels.</td>
<td>11</td>
</tr>
<tr>
<td>202. Sound Pressure Levels.</td>
<td>11</td>
</tr>
<tr>
<td>203. A-Weighted Sound Pressure Levels.</td>
<td>12</td>
</tr>
<tr>
<td>204. Measurement System Response Time.</td>
<td>12</td>
</tr>
<tr>
<td>205-219. Reserved.</td>
<td>12</td>
</tr>
<tr>
<td>Section</td>
<td>Title</td>
</tr>
<tr>
<td>---------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>200.</td>
<td>Measuring Single Aircraft Events.</td>
</tr>
<tr>
<td>211.</td>
<td>Airport Cumulative Noise Exposure Levels.</td>
</tr>
<tr>
<td>221.</td>
<td>Basic Recommended Noise Measurement System.</td>
</tr>
<tr>
<td>222.</td>
<td>Validation of Noise Contours.</td>
</tr>
<tr>
<td>224.</td>
<td>Validation Noise Measurements vs. Micro-Sample Survey Measurements.</td>
</tr>
<tr>
<td>225.</td>
<td>Aircraft Noise Exposure Prediction Refinement Procedure.</td>
</tr>
<tr>
<td>226.</td>
<td>Continuous Airport Noise Monitoring Systems.</td>
</tr>
<tr>
<td>227.</td>
<td>Reserved.</td>
</tr>
</tbody>
</table>

**SECTION 2. NOISE MEASUREMENTS.**

**SECTION 3. NOISE EXPOSURE PREDICTION AND ITS USE.**

| 230.    | Prediction Analysis Tool.                                            | 18   |
| 231.    | Integrated Noise Model (INM).                                        | 18   |
| 233.    | Input Requirements.                                                  | 18   |
| 234.    | Accuracy.                                                            | 19   |
| 235.    | Use of Measurements in Refining/Validating Predictions.              | 20   |
| 237.    | Noise Compatibility Prediction.                                      | 20   |
| 238.    | Basis for Noise Compatibility.                                       | 20   |
| 239.    | Land Use Compatibility Table.                                        | 22   |
| 240.    | Interpretation of Noise Exposure Maps.                               | 23   |
| 241.    | Reserved.                                                            | 24   |

**CHAPTER 3. TOOLS OF AIRPORT NOISE COMPATIBILITY PLANNING.**

**SECTION 1. ELEMENTS OF AIRPORT NOISE PLANNING.**

| 300.    | General.                                                             | 25   |
| 301.    | Noise Compatibility Planning.                                       | 25   |
| 302.    | Scope of the Planning Effort.                                       | 25   |
| 303.    | The Context of Airport Noise Plans.                                 | 26   |
| 304.    | The Objective of Part 130 Planning.                                 | 26   |
| 305.    | Use of Local or State Standards.                                    | 26   |
| 306.    | Development of Alternatives and Implementation Strategies.          | 26   |
| 307.    | Reserved.                                                           | 27   |

**SECTION 2. AIRPORT PROPRIETOR OPTIONS.**

| 320.    | Denial of Use to Aircraft Not Meeting Federal Noise Standards.       | 27   |
| 321.    | Capacity Limits Based on Noise.                                     | 28   |
| 322.    | Noise Abatement Takeoff or Approach Procedures.                     | 30   |
| 323.    | Landing Fee Based on Noise.                                         | 31   |
| 324.    | Noise Barriers (Shielding).                                         | 31   |
| 325.    | Acquisition of Land and Interest Therein.                           | 31   |
| 326.    | Complete or Partial Curfews.                                        | 32   |
| 327.    | Reserved.                                                           | 32   |
SECTION 3. STATE/LOCAL GOVERNMENT OPTIONS (Strategies to Prevent New Noncompatible Development).

330. Development Control. 33
331. Zoning. 33
332. Easements. 34
333. Transfer of Development Rights (TDR). . 35
334. Purchase. 35
335.-339. Reserved. 36

SECTION 4. STATE/LOCAL GOVERNMENT OPTIONS (Actions to Reduce Existing Noncompatible Uses)

340. Remedial Actions. 36
341. Encouragement of Existing Favorable Land Use Trends. 36
342. Constructive Use of Planning and Zoning. 36
343. Constructive Use of Public Capital Improvements Projects. 37
344. Purchase Assurance Programs. 37
345. Soundproofing. . 37
346. Acquisition of Impacted Land. 38
347.-349. Reserved. 39

SECTION 5. CONSULTATIONS.

350. Consultations Under Part 130. 39
351. Reserved. 39
352. Consultation with Aviation Groups. 40
353. Public and Community Involvement. 40
354. Documentation. 41
355.-359. Reserved. 41

SECTION 6. ANALYSIS OF COST/BENEFITS AND SELECTION OF ALTERNATIVE

360. General. 41
361. Constraints Upon Interstate and Foreign Commerce. 41
362. Environmental Costs. 41
363. Economic Costs. 42
364. Social Costs. 42
365. Selection of an Alternative. 42
366. Development of the Selected Alternative into a Draft Compatibility Program. 43
367.-399. Reserved. 43

APPENDIX 1. TABLE OF LAND USES NORMALLY COMPATIBLE WITH VARIOUS NOISE LEVELS. 1

APPENDIX 2. CHECKLISTS FOR NOISE EXPOSURE MAPS AND NOISE COMPATIBILITY PROGRAMS. 1

APPENDIX 3. RECOMMENDED BASIC NOISE MEASUREMENT SYSTEM. 1

APPENDIX 4. BIBLIOGRAPHY. 1
CHAPTER 1. GENERAL

SECTION 1. INTRODUCTION

1. PURPOSE. This advisory circular provides guidance for Noise Control and Compatibility Planning for airports under Federal Aviation Regulation (FAR), Part 150 and the Aviation Safety and Noise Abatement Act of 1979 (ASNA) as amended. It is intended for use by airport operators, state/local planners and other officials, and interested citizens who may engage in noise control planning. Airport noise compatibility planning has the goals of reducing existing noncompatible land uses around airports and of preventing the introduction of additional noncompatible land uses through the cooperative efforts of all those involved. The Part 150 program is voluntary and airport operators are encouraged to participate.

2. BACKGROUND. There are existing airport noise/land use compatibility problems at many airports in the United States. In addition, there is a potential for exacerbation of these noise problems and the possibility of problems arising at other airports as urban areas and use of air travel continue to grow. Through cooperative efforts on both the local and national levels, much has already been accomplished in limiting the growth and spread of noise compatibility problems. Actions have included limits upon noise emissions by new aircraft, provisions for the retirement or retrofit with quieter engines of the noisiest transport aircraft, and an environmental review process for airport development projects. Some of the major remaining obstacles for implementing successful noise compatibility programs around airports have been the need for a single system for measuring airport noise, a single system for determining the exposure of individuals to airport noise, the identification of land uses that are normally compatible with the various levels of noise around airports, and a process for safety and economic evaluations of proposed actions. These remaining major obstacles have been addressed by recent regulatory actions detailed below.

a. Federal Aviation Regulation (FAR) Part 150 implements portions of Title I of the Aviation Safety and Noise Abatement Act. It specifically establishes a single system for the measurement of airport (and background) noise, a single system for determining the exposure of individuals to airport noise, and a standardized airport noise compatibility planning program. The planning program includes (1) provision for the development and submission to the FAA of Noise Exposure Maps and Noise Compatibility Programs by airport operators; (2) standard noise units, methods and analytical techniques for use in airport assessments; (3) identification of land uses that are normally compatible (or noncompatible) with various levels of noise around airports; and (4) procedures and criteria for FAA approval or disapproval of noise compatibility programs by the Administrator.

Chap 1
Par 1

Page 1

8-98
b. The Airport Noise Compatibility Planning Program includes land use planning and implementation programs necessary to carry out the ASNA Act. The Act does not in any way, however, interfere with established prerogatives of State and local governments concerning land use and related noise compatibility actions and responsibilities. Accordingly, approvals and disapprovals of programs submitted to the FAA under Part 150 do not constitute a Federal determination that the use of land covered by the program is acceptable or unacceptable under Federal, State, or local law. The responsibility for determining the acceptable and permissible land uses remains with the local authorities.

3. BENEFITS OF NOISE COMPATIBILITY PLANNING - PROGRAMMING UNDER PART 150.

a. Noise is one of the greatest threats to aviation today. Projected growth in demand for air travel means that we will have larger aircraft and more operations in the future. The increase in air carrier traffic at large airports will generate more air carrier traffic at feeder airports and more traffic by sophisticated general aviation aircraft at these and many general aviation airports.

b. The costs of most forms of noise mitigation are rapidly increasing. These include soundproofing, land purchases, relocations, land use changes, by-passing of impacted land, and construction of alternative aviation facilities. People's perceptions of what is an acceptable level of urban noise is becoming more critical while their opportunity to voluntarily move away from such noise is becoming more limited. All of these are resulting in strong pressures upon airport operators to impose operational constraints, curfews, growth limitations, and other severe constraints upon their airports as easy, "one-shot" solutions to the noise problem.

c. Relief of these pressures on the airport operators and the preservation of a national system of airports requires that aviation become as compatible as possible with its neighbors. This requires that the airport operators work much more closely with local jurisdictions than has been generally feasible in the past, since they control most of the viable non aviation-constraining noise mitigation measures.

d. The Part 150 Airport Noise Compatibility Planning Program offers an ideal vehicle for noise planning and implementation in this contemporary context. It includes:

(1) A balanced approach producing realistic and practical solutions fair to both aviation and non aviation interests.

(2) Positive FAA technical guidance through regional and airports district offices.

(3) Federally identified land uses which are normally compatible with various exposures of individuals to noise.

(4) Consultations and interactions between the airport operator, airport users, airport neighbors, local land use control jurisdictions, and the FAA designed to achieve broad-based confidence in and acceptance of the program and the support essential for its implementation over the long term.
3/5/81

(3) Recognition of factors beyond the control of the airport operator which strongly influence local land use decisions.

(4) A viable framework for conducting efficient and constructive compatibility programs which achieve large benefits in noise reduction for the costs in aviation.

(5) Community and airport operator decisions that are made from a fully informed position in order to weigh the full costs and benefits of the alternatives.

(6) Federal financial assistance available to the airport operator under the Airport Improvement Program for noise compatibility planning and implementation of that planning.

(7) Federal financial assistance also available to units of local government in the area surrounding the airport to carry out projects in accordance with FAA approved noise compatibility programs.

(8) Certain sanctions are available under Section 107 of the ASNA Act to protect the airport operator from land owner noise suits.

a. No two airport situations are alike, and each will likely require a unique combination of mitigation measures to achieve an acceptable solution. At a given airport, a full range of possible solutions is explored, then the best combination of solutions is chosen and carefully weighed before settling upon a final plan. The objective being to reduce the noise by the most efficient way and then balance this against the possible non-aviation solutions. A balance is sought between realistic environmental goals and the costs to the aviation system. When the proposed aviation constraints are significant, then the local needs and benefits are weighed and balanced against the needs and concerns of the rest of the nation.

4. FAA INFORMATION SOURCES. Users of this circular are strongly encouraged to contact their FAA Airports District Office or the Airports Division of their FAA regional office for additional information, guidance, and consultation prior to starting an Airport Noise Exposure Map or Airport Noise Compatibility Program. These offices are also prime sources for reference materials, such as other advisory circulars and citizen participation manuals.

5. DEFINITIONS. All terms used in this circular which are also used in Part 150 have the same meaning in this circular as they do in that Part.

a. A-Weighted Sound Level (Lw). The A-Weighted Sound Level is sound pressure level which has been filtered or weighted to reduce the influence of the low and high frequency noise (formerly dBA). It was designed to approximate the response of the human ear to sound. (See paragraph 203)

b. Average Day-Night Sound Level (Ldn). See Yearly Day-Night Average Sound Level.
c. Land Use. The present or planned utilization of a given parcel of land. Such land uses are normally indicated or delineated on a land use map. Land use maps may indicate uses for any given time period past, present, or future, and such period should always be indicated. (See paragraph 237)

d. Zoning. An exercise of the police powers of the State, as delegated to local governments, designating the uses permitted on each parcel of land within the zoning jurisdiction. (See paragraph 311)

e. Standard Land Use Coding Manual (SLUCM). A Standard System for Identifying and Coding Land Use Activities. Published jointly in 1965 by Urban Renewal Administration, Housing and Home Finance Agency (both now Parts of HUD) and the Bureau of Public Roads (now the Federal Highway Administration). (See paragraph 237)

f. Noise Level Reduction (NLR). The amount of noise level reduction achieved through incorporation of noise attenuation (between outdoor and indoor levels) in the design and construction of a structure. (See paragraph 237)

g. Noise Exposure Map. A scaled, geographica, depiction of an airport, its noise contours, and surrounding area developed in accordance with Section 1020.101 of Appendix A of FAR Part 150; including the accompanying documentation setting forth the required descriptions of projected aircraft operations at that airport during 1985 and if submitted after 1982, during the fifth calendar year beginning after submission of the map, together with the ways, if any those operations for each of those years will affect the map (including noise contours and the forecast land uses). See FAR Part 150 for legal definition.

h. Noise Contour. A continuous line on a map of the airport vicinity connecting all points of the same noise exposure level; for the purposes of this program usually the Ldn 65, 70, and 75 levels.

i. Airport Noise Compatibility Program. The program reflected in documents (and revised documents) developed in accordance with Appendix C of Part 150, including the measures proposed or taken by the airport operator to reduce existing noncompatible land uses and to prevent the introduction of additional noncompatible land uses within the area. See FAA Part 150 for legal definition.

j. NEPA. Acronym for the National Environmental Policy Act of 1969. (See paragraph 26)

k. Curfew. A restriction placed upon all or certain classes of aircraft by time of day for the purposes of reducing or controlling airport noise. (See paragraph 328)
1. Easement. The legal right of one party to use a portion of the 
total area owned by another party. This may include the 
right of passage over, on, or below the property; certain air rights above 
the property, including view rights; and the rights to any specified form of 
development or activity, as well as any other legal rights in the property 
that may be specified in the easement document. (See paragraph 312)

m. Office of Management and Budget Circular No. A-95. A regulation 
requiring coordination of federal and federally assisted programs and 
projects with each other and with State, areawide, and local plans and 
programs, utilizing a series of state and regional clearinghouses. (See 
paragraph 25)

n. Federal Aviation Regulation (FAR) Part 96. A regulation 
establishing noise certification standards for aircraft. (See paragraph 24)

o. Aviation Noise Abatement Policy (ANAP). Policy adopted jointly by 
the Secretary of Transportation and the FAA, on November 18, 1976, 
delineating the responsibilities of FAA, air carriers, airport operators, 
and local communities in achieving reductions in airport noise.

p. Airport Noise Control and Land Use Compatibility (ANCLUC) Program.
a pilot program for airport noise compatibility planning established by the 
ANAP and funded under Section 13 of the Airport and Airway Development Act 
of 1970 as amended. It was a voluntary planning process initiated and led 
by airport proprietors with Federal funding and technical assistance. (See 
paragraph 21)

q. Yearly Day-Night Average Sound Levels (Ldn) or (DNL). The 
24-hour average sound level, in decibels, for the period from midnight to 
midnight, obtained after the addition of ten decibels to sound levels for 
the periods between midnight and 7 a.m. and between 10 p.m. and midnight, 
local time, as averaged over a span of one year. It is the FAA standard 
metric for determining the cumulative exposure of individuals to noise. 
(See paragraph 121)

r. Equivalent Sound Level (Leq). Leq is the steady A-weighted 
sound level over any specified period (not necessarily 24 hours) that has 
the same acoustic energy as the fluctuating noise during that period (with 
no consideration of a nighttime weighting). It is a measure of cumulative 
acoustical energy. Because the time interval may vary, it should always be 
specifed by a subscript (such as Leq 8) for an 8-hr exposure to 
workplace noise or be clearly understood.

s. - 19. RESERVED.
SECTION 1. RELATIONSHIP TO OTHER AIRPORT AND NOISE PLANNING ACTIONS

20. AIRPORT MASTER PLANS. An Airport Noise Exposure Map or an Airport Noise Compatibility Program for an airport supplements but does not replace the Airport Master Plan (AMP) developed for that airport. The AMP may provide the basic data for the noise exposure map. However, operational data for use in the Integrated Noise Model (INM) (or an FAA approved equivalent) and the land use and jurisdictional data for the map should be certifiable by the airport operator as current data. Similarly, the AMP may offer inputs to development of the noise compatibility program. Again, all of the alternatives, analyses, consultations, and public involvement required by Part 150 for the program should be certifiable by the airport operator as up-to-date and based upon current data. See also, Section A150.101(f) of Part 150.

21. AIRPORT NOISE CONTROL AND LAND USE COMPATIBILITY (ANCLUC) PLANNING STUDIES. A number of ANCLUC planning studies have been undertaken and/or completed. Although this was an interim program, much valuable noise and land use information was produced and much viable compatibility planning accomplished. Where these studies meet the requirements of Part 150, or an FAA approved equivalent under Part 150, and are otherwise appropriate, airport operators are encouraged to incorporate that work into Noise Compatibility Programs; see Section A150.101(f) of Part 150.

22. AIR INSTALLATION COMPATIBLE USE ZONES. Complementary to ANCLUC, the U.S. Department of Defense developed the Air Installation Compatible Use Zones (AICUZ) Program for achieving noise/land use compatibility at military air installations. AICUZ studies have also been prepared for a number of joint civil-military use airports where there is a significant number of military operations. As in the case of ANCLUC's, information developed for an AICUZ study which is appropriate and certifiable as current by the airport operator may be used in developing an Airport Noise Exposure Map or Airport Noise Compatibility Program.

23. ENVIRONMENTAL ASSESSMENTS. Environmental Assessments (EA) are prepared for many types of airport development projects and/or airport operational changes under the requirements of the National Environmental Policy Act (NEPA), Regulations of the Council on Environmental Quality (CEQ), Department of Transportation Order 5610.1C (Procedures for Considering Environmental Impacts), FAA Order 1050.1C (Policies and Procedures for Considering Environmental Impacts), and FAA Order 5050.4 (Airport Environmental Handbook). Many EA's contain analyses of airport noise, compatible land use, social impacts, and induced socioeconomic impacts. An Airport Noise Compatibility Program may supplement, but is not intended to replace an EA in meeting required environmental analyses. Similarly, an EA may contain information that, provided it is current, can be valuable inputs to developing airport noise exposure maps and airport noise compatibility programs. To the extent the information in the EA is appropriate, such use of existing sources is encouraged. See also, paragraph 26 for applicability of NEPA to Part 150.
24. FEDERAL AVIATION REGULATIONS; PART 36. Federal Aviation Regulations, Part 36 contains noise certification standards for most airplane types, generally requiring newly designed and manufactured aircraft to be significantly quieter than older aircraft. However, as a certification standard, Part 36 has no provisions to control either the operations or number of operations at an airport in order to stabilize or reduce noise impacts. Part 350 works as a complement to Part 36 by integrating the gains in reduced aircraft noise emissions into an overall noise compatibility program with controls on both aviation noise and land uses to assure full implementation and long term protection to both the airport and its environs.

25. OMB A-95 NOTIFICATION AND REVIEW. Office of Management and Budget (OMB) Circular No. A-95 establishes a process whereby state and local clearinghouses are notified of proposed Federal Grant-In-Aid projects and other assistance actions. Interested parties are provided the opportunity to review and evaluate the proposals in advance in terms of their potential impact on or conflict with statewide or area-wide comprehensive planning or upon the plans and programs of local governments. The A-95 process (or its Federal or state successor) must (or should) be used to give notification and opportunity for comment when Federal assistance is involved. It does not, however, substitute for the consultative process as required by the ASNA Act. Note also that A-95 will be revised or replaced upon implementation of Executive Order 12372. See paragraphs 150-159 for guidance on Consultations.

26. NATIONAL ENVIRONMENTAL POLICY ACT. FAA compliance with the NEPA is controlled by FAA Order 1050.1c, Policies and Procedures for Considering Environmental Impacts. The FAA has determined that approval or disapproval of airport noise compatibility programs are "categorical exclusions" to the requirements for environmental assessment under Order 1050.1c. The ASNA Act requires an airport noise compatibility program to be either approved or disapproved within 180 days of receipt or it will be automatically approved. Development of a noise exposure map or noise compatibility program does not replace an environmental assessment but can be used in the preparation of such an assessment. Environmental assessment leading to a finding of no significant impact on or to an environmental impact statement must still be conducted, where required by applicable procedures, prior to taking any Federal Implementing action such as grant approvals or covered air traffic actions. Although the 180 day time constraint does not permit the normal federal Environmental Impact Assessment process, consideration of the potential impacts remains an integral part of the planning process. Airport operators should fully consider environmental as well as noise and land use consequences in developing an airport noise compatibility program.

27.-29. RESERVED.
SECTION 3. OVERVIEW

30. NOISE - ITS MEASUREMENT AND ASSESSMENT. It is assumed that users of this circular have a general technical background, but are not proficient in noise measurement, particularly aviation noise. Chapter 2 is devoted to a basic discussion of aviation noise and its measurement and assessment. Care has been taken to avoid technical language and the emphasis has been placed upon practical understanding. This should enable the typical user to understand what is involved; to estimate the size of the effort required; how to gather data for the Integrated Noise Model (or an FAA approved equivalent); how to interpret the noise contours; how to validate noise contours using noise measurements; and how to prepare an airport noise exposure map. FAA personnel are available to assist as necessary.

31. SENSITIVITY OF LAND USES TO NOISE. Different uses of land by people exhibit different sensitivities to noise. Schools, residences, churches, public health facilities, and concert halls often appear quite sensitive to noise. By contrast, factories, warehouses, storage yards, and open farmland are relatively insensitive to noise. Other uses, such as offices, shopping centers, recreation areas, or hotels, have intermediate levels of noise sensitivity. In order to assist the users in assessing noise compatibility/noncompatibility in the vicinity of their airports, a table of land uses and their compatibility/noncompatibility with various levels of noise is provided in Appendix 1. However, the designations in this table do not constitute a federal determination that any use of land covered by this program is acceptable or unacceptable under federal, state, or local law. The responsibility for determining the acceptable and permissible land uses remains with the local authorities. FAA determinations under Part 150 are not intended to substitute federally determined land uses for those determined to be appropriate by local authorities in response to locally determined needs and values in achieving noise compatible land uses.

32. NOISE EXPOSURE MAPS. FAR Part 150, in accordance with the ASNA Act, provides an opportunity for airport proprietors to submit Noise Exposure Maps to the FAA. Each such map is a scaled geographic depiction of an airport, its noise contours, and surrounding areas. Specifically, Part 150 requires that each noise exposure map shall depict continuous Leq contours for levels of 65, 70, and 75. Within the 65 Leq contour, the airport proprietor is required to identify land uses and to determine land use compatibility in accordance with the standards and procedures of Appendix A of FAR Part 150. Sections 150.21 and 150.101 contain other specific requirements on the form and contents of such maps.
33. **NOISE COMPATIBILITY PROGRAMS.** FAR Part 150 provides for the preparation and submission of Noise Compatibility Programs in addition to Noise Exposure Maps. The purpose of such a program is to seek optimal accommodation of both airport operations and community activities within acceptable safety, economic and environmental parameters. That may be accomplished by reducing existing incompatible land uses in the vicinity of the airport and preventing the introduction of new incompatible land uses in the future. To that end, the airport proprietor and other responsible officials should consider a wide range of feasible alternatives of noise control actions and land use patterns. A checklist for preparing Noise Compatibility Programs is contained in Appendix 2.

34. **SUBMISSION TO THE FAA.** Completed Airport Noise Exposure Maps and Airport Noise Compatibility Programs are submitted by the airport operator to the appropriate FAA Regional Director. They will be given Preliminary Review for acceptance for evaluation and then be given a Final Evaluation. Details of this procedure and of airport operator obligations following any change in the operation of the airport which might create any substantial incompatible land uses are described in Sections 150.23 through 150.33 of FAR Part 150.

35. **WITHDRAWAL OR REVISION.** At any time before approval or disapproval of a program, it may be withdrawn or revised. Such a termination stops the 130-day approval period. A new evaluation is begun upon receipt of a revised program and, unless the FAA finds that the revisions can be integrated without exceeding the original approval period, a new 130-day approval period is begun.

36. **PERIODIC REVIEW AND UPDATING.** Growth and transition in urban locations create pressures for changes to zoning and other controls established to achieve and protect compatibility. These stimuli are also likely to generate greater aviation activity and airport requirements with consequent changes in airport noise impacts. For these reasons, Part 150 requires the inclusion of a schedule for periodic review and updating of airport noise compatibility programs. Updating is also necessary to reflect increased operations and, with the map, continue the sanctions under Section 107 of the ASNA Act.

a. After the plan is adopted there is a need for the airport operator and the local planning agencies to continually evaluate its effectiveness and to identify those aspects of the plan which may need improvement. This includes evaluation to determine if proposed implementing actions are being carried out as scheduled. For instance, it should include review of land acquisition or soundproofing projects and ascertain whether they are effective, on schedule, or whether modifications are necessary. Also, operational procedures adopted as part of the noise control plan must be monitored to assure that they are being adhered to. The responsible organization, either the airport operator, the local planning authority, or both, should monitor all requests for changes in zoning, variances, or subdivision actions within the study area.

Chap 1
Par 33

Page 9
b. Periodic or formal reviews, at intervals of three to five years or when the noise exposure map or airport master plan is updated, should be scheduled and budgeted by the airport operator as an integral part of the program. Included within the formalized review should be consideration of those problems or deficiencies identified during the monitoring process and most notably those pertaining to the performance of the plan. The review will normally not be as extensive as the original effort but should establish whether the plan remains viable or what actions are necessary to correct existing or forecast deficiencies. The types of activities included in the review should be:

(1) A comparison of the current compatibility of the airport and its environs to that outlined in the program's goals and objectives.

(2) Appraisal of the rate of growth of both the community and airport to determine the current and future adequacy of the compatibility plan.

(3) Review of the airport noise exposure map in light of both current and forecast operations and the noise performance levels of aircraft.

(4) Review of the adequacy of current operational controls in maintaining aircraft noise within the designated noise impact areas.

(5) Review of the adequacy of the adopted development controls in protecting the designated noise impact areas from encroachment by noise sensitive uses.

(6) Review of the effectiveness of the corrective actions employed in resolving existing unprotected noise sensitive uses within the noise impact areas.

c. Revised Programs. Revised programs should be submitted to the Regional Director in the same manner as the original submission.
CHAPTER 2. NOISE MEASUREMENT AND ASSESSMENT

SECTION 1. NOISE FUNDAMENTALS

200. SOUND. This section provides a conceptual description of the acoustical metrics which comprise the FAA approved "system" for aircraft noise measurement. The sound experienced in our everyday lives is the result of objects or bodies being set into vibration. This vibration causes a motion in the surrounding air resulting in a minute variation in atmospheric pressure called "sound pressure." This sound pressure forms the basis to measure sound and is usually expressed as a sound pressure level in decibels which are dimensionless units expressing logarithmically the ratio of two values (i.e., a measured quantity and a referenced value). Another important characteristic of sound is its "frequency." The human ear is sensitive to frequencies ranging from 20 to 20,000 hertz (cycles per second). The simplest of all sounds are those composed of a single frequency. These sounds are called pure tones. However, the sounds to which people are usually exposed are much more complex, since they are composed of many frequencies, each occurring simultaneously at its own sound pressure level.

201. DECIBELS. Sound pressure level is a measure of the amplitude of the sound, while frequency relates to the sound's pitch. The range of sound pressures of interest is represented on the low end by the threshold of hearing of normal young people and on the upper end by the noise of gunfire at close range. Stated in physical terms, this sound pressure range is approximately from 0.00002 to 2,000 pascals. It is clear that this is a tremendous range of sound pressures. An analogous problem would be that of measuring lengths ranging from one inch to 1575 miles. Because acoustics deals with the effects of small changes near the threshold of hearing as well as the effects of small changes near the upper end of the scale, a proportional scale is more appropriate than a linear scale to handle this wide variation in sound pressure. The simplest mathematical scale available for this purpose is the logarithmic or decibel scale. A decibel (dB) is defined as ten times the logarithm (to the base 10) of a power or intensity ratio.

202. SOUND PRESSURE LEVELS. Sound pressure level is expressed as 10 log \( (P^2/P_0^2) \), where \( P_0 \) is the reference pressure and \( P \) is the differential pressure of a sound over that of ambient pressure. This is equivalent to twenty times the logarithm of the ratio of the pressures. It is also important to note that the reference pressure has been internationally standardized as 0.00002 pascals, which is approximately the threshold of human hearing. Because of the logarithmic nature of the decibel scale, a sound pressure level of 60 dB corresponds to a pressure, not 60 times the reference pressure, but 1000 times the reference pressure. Thus, 20 log (1000) = 20(3) = 60.
203. **A-WEIGHTED SOUND PRESSURE LEVELS (L_A).** Sound is a physical phenomenon that affects many things besides people. However, when sound is measured in order to relate to the reactions of people, it is necessary to use a measure which relates to the way human beings hear sound. It has been found that people are more sensitive to higher frequencies (treble) than lower frequencies (bass). That is, the human ear discriminates against lower frequencies. Naturally if we want to measure sound in a way which corresponds to the way people hear sound we want to duplicate the ear's discrimination. This is accomplished electrically using a device called a "weighting network." Because unweighted sound pressure level did not correlate well with human assessment of the loudness of sounds, weighting networks were added to sound level meters to attenuate low and high frequency noise to approximate the response of the human ear to sound. One of these weighting networks was designated "A" and was originally employed for sounds below 125 dbA in level. Now it is used for all levels. It is measured in decibels which are usually designated L_A (formerly dBA).

A-Weighted Sound Level has been found to correlate well with people's subjective judgment. Its simplicity and superiority over unweighted sound pressure level in predicting people's response to noise have made it the most widely used metric for assessing the impact of aircraft noise and for comparing that noise with other community noise sources.

204. **MEASUREMENT SYSTEM RESPONSE TIME.** While the A-weighted sound level (L_A) is the basic unit for most Federal, State, and local noise standards, variations do exist in its method of measurement. Sound level meters and other noise measuring systems are capable of operating in several characteristic modes, such as "slow," "fast," "impulse," and "peak." Basically, these modes differ in the way in which the output value (indicated sound level reading) follows rapid changes in the input sound level. The higher speed responses are often useful in architectural, industrial and research acoustics. However, for most community and transportation noise sources the "slow" response is preferred since experience has shown that it provides the most repeatable data. Thus, in response to the APNA Act requirements, the FAA uses a family of related noise units based on the slow response, A-weighted sound level (L_A).


205. **RESERVED.**

SECTION 2. NOISE MEASUREMENTS

220. **MEASURING SINGLE AIRCRAFT EVENTS.** Part 150 specifies use of the slow response A-weighted sound level L_A in decibels for measuring single events. Measurements of aircraft noise made in this unit can be directly related to sound levels of surface transportation noise sources since standards for the measurement of noise from these other sources also use L_A. Many communities throughout the U.S. have local noise ordinances which use this unit. L_A is also the metric used in FAA Advisory Circular 150-18, Estimated Airplane Noise Levels in A-Weighted Decibels. Most U.S. and foreign airports with noise monitoring systems provide L_A information. There is also a single event integrated A-weighted sound
level (L_{eq}) which is different from the maximum A-weighted sound level (L_{Aeq}) described in paragraphs 204 and 220. L_{eq} (sometimes also known as the Sound Exposure Level) is the level of an equivalent one-second duration reference signal. This metric quantifies the effect of both duration and magnitude for a single event measured above a specified threshold. The L_{eq} is sometimes best understood as the dose of noise associated with a single event. A survey program at an airport which provides average L_{eq} data for specific aircraft type categories can be used to compute L_{eq} values, one method of validating computer generated noise contours.

221. AIRPORT CUMULATIVE NOISE EXPOSURES. While people certainly respond to the noise of single events (particularly to the loudest single event in a series), the long-range effects of prolonged exposure to noise appear to best correlate with cumulative metrics. Such a unit provides a single number which is equivalent to the total noise exposure over a specified time period. Thus, cumulative noise units are based on both time and level. The day-night average sound level (L_{d-n}) specified as the noise metric for cumulative exposure under Part 150 is such a unit. Specifically, the L_{d-n} is the yearly average of the A-weighted sound level integrated over a 24-hour period. It also incorporates a 10 dB step function weighting to aircraft events between 10:00 p.m. and 7:00 a.m. to account for the increased annoyance to noise during the night hours.

222. BASIC RECOMMENDED NOISE MEASUREMENT SYSTEM. A recommended basic noise measurement system and suggestions regarding its use and maintenance is included in Appendix J.

223. VALIDATION OF NOISE CONTOURS. One of the primary objectives of many noise measurement programs is to validate computer generated noise contours. The understanding of a few important concepts (listed below) provides the basis for cumulative noise exposure estimation techniques.

a. Yearly average airport noise exposure contours are estimates of actual average airport noise exposure.

b. Actual airport noise exposure at any point on the ground may be approximated by the energy average (over a year's time) of the daily L_{eq} values for that point.

c. The actual daily L_{eq} value for any given location will vary from day to day. A large set of data acquired at Washington National Airport and Dulles International Airport (14 locations over 500 days) indicates that standard deviations in L_{eq} are generally 2 dB or less. For long term measurements
d. For daily $L_{dn}$ standard deviations of 2 dB, it can be shown from simple statistical theory that a sample of 10 days ($L_{dn}$) will provide an estimate of the actual yearly $L_{dn}$ accurate within 1 dB with 90 percent confidence. This "sample of 10" requirement involves the assumption that measurements are conducted on days when no bias exists in the airport operation. In order to assure "average" conditions over the 10 days, it is recommended that data be acquired for each direction of airport operation in proportion to the proper (annual) percent.

e. Thus one way to estimate the yearly $L_{dn}$ value is to conduct 10 random (representative) 24 hour measurement surveys. Measurement equipment is available which, left unattended, can measure three consecutive daily $L_{dn}$ values.

f. In lieu of conducting 24 hour continuous measurements in order to acquire 10 days $L_{dn}$ data, it is possible to conduct a shorter sample and then estimate the $L_{dn}$. The method of extrapolation must be carefully documented and must demonstrate that the short sample is "representative" of the average operation during the day. The requirement of 10 representative days remains a requirement for estimating the yearly average $L_{dn}$. Two "shorter than 24 hour" sampling techniques are available. One involves measuring the noise during a period in which the mix of aircraft and the number of aircraft are representative of daily average values. Calculations are then needed for the nighttime weighting and to account for the present curfew restrictions (if applicable) to arrive at an estimate of $L_{dn}$ for the day. The second technique involves quantifying average single event $L_{dn}$ values by aircraft type. The average $L_{dn}$ data must reflect yearly average variability for the particular aircraft type. The yearly average $L_{dn}$ is then computed from the mean $L_{dn}$ data along with a knowledge of the aircraft mix and the daily operations schedule. This technique however, involves certain difficult to answer questions:

1. How many measurements are needed for each aircraft type?

2. How many measurements on any one day?

3. How many total days of sampling?

Because of difficulty in identifying a statistical rationale, one may choose to use the first technique described in this subparagraph.

224. VALIDATION NOISE MEASUREMENTS VERSUS MICRO-SAMPLE SURVEY MEASUREMENTS.
In any measurement program there is the tradeoff to be considered between the statistical confidence interval for the measured data and the available manpower and time. In survey work, the usual objective is to achieve a practical level of accuracy at many locations rather than highly accurate data at a few. When conducting a short survey which includes numerous measurement locations and a single measurement system, one implicitly
accepts the medium accuracy confidence level associated with the survey.

These survey-measured levels accurately represent the acoustical environment at the time of the measurement. Short samples or surveys remain the most effective means (given limited time or resources) for quantifying the magnitude or environmental noise problems which affect large areas of a metropolis. If survey type measurements are utilized, it is important to identify them as such. In presenting single event survey data one should indicate means, standard deviations, and sample sizes. Care should be taken to avoid assigning statistical confidence limits to estimated daily Ldn values based on survey data unless the analytical and computational process is clearly set forth. This presentation is even more important when establishing an estimate of yearly average Ldn based on survey data alone.

225. AIRCRAFT NOISE EXPOSURE PREDICTION REFINEMENT PROCEDURE. The flow diagram shown in Figure 1 sets out the process by which FAA approved noise contours can be refined. Detailed modeling requirements are provided in Section 3 along with FAA approved procedures and standards. The key feature of this process is the "feedback loop" provided by Ldn data acquired either from continuous airport noise monitoring systems or from limited field measurement programs. This prediction refinement process (Figure 1) allows the contour analyst a chance to reevaluate the input assumptions and seek a reasonable explanation for differences (if any) between measured and predicted values. If suitable justifications can be provided, the analyst returns the noise prediction model with new or modified inputs. Theoretically, several iterations could be run if justified on the basis of better input assumptions.

226. CONTINUOUS AIRPORT NOISE MONITORING SYSTEMS. There are several optional measures which may be undertaken as part of an airport noise compatibility program and which can enhance its effectiveness. Continuous airport noise monitoring systems fall into this category. Such systems can provide important input to the process of refining airport noise contours. (Contact AER-125 for specific details). In brief, any FAA approved noise monitoring system would have the following minimum capabilities:

a. Provides continuous measurement of dBA at each site.
b. Provides hourly Leq data.
c. Provides daily Ldn data.
d. Provides single event maximum A-weighted sound level data.
Desirable but nonessential capabilities include:
AIRCRAFT NOISE EXPOSURE PREDICTION

Analysis Input Data

FAA Approval

Proposed prediction model input adjustment

INM or other FAA approval Noise Model

Initial Result (Iteration 1)

Optional additional refinement

Compare results

Refined Prediction (Iteration 2)

PAA Approved Micro-sample Noise Measurement Program

PAA Approved Noise Measurement System

FIGURE 1
(1) Aircraft event discrimination ability.

(2) Single event $L_{AG}$ data for each aircraft event.

(3) Differentiation between ambient and aircraft contributions to hourly $L_{eq}$ and $L_{dn}$.

(4) Monitoring data can be used to develop a statistical database of noise levels for each aircraft type category.

227.-229. RESERVED.
SECTION 3. NOISE EXPOSURE PREDICTION

230. PREDICTION ANALYSIS TOOL. Only a computer-based mathematical model is capable of predicting the noise impact associated with the operation of a complex airport and projecting that impact to some future period. FAA approval of a model is conditional on the capability of that model to produce the required output and the public availability of the model to provide interested parties the opportunity to substantiate the results. Accuracy of a noise prediction model is measured by the statistical comparison of the noise exposure calculations derived from the data base and observations of the noise emitted during operations of similar aircraft types. Statistically adequate samples of observations are obtained over periods of a year or more.

231. INTEGRATED NOISE MODEL (INM). The FAA's Integrated Noise Model is the standard prediction analysis tool to which all computer-based airport noise exposure models are compared. The INM calculates the total impact of aircraft noise at or around airports. Although this noise exposure level can be presented in contours of equal noise exposure for any one of the following noise measures: noise exposure forecast (NEP), Equivalent Sound Level (Leq), Day-Night Average Sound Level (Ldn), and Community Noise Equivalent Level (CNEQ); only the Ldn is approved for use with Part 150. In January 1978, the FAA released Version 1 of INM to provide an analytical tool for the preparation of environmental impact studies. In September 1979, the FAA released Version 2, an improvement to the first version, with an expanded data base and additional input options. Version 3 reflects further enhancements in the method of determining noise impacts and in the data base of individual aircraft noise and performance. FAA has shipped magnetic tapes of the INM to government offices, consultants and various foreign countries. Tapes are also already in the possession of several commercial computer time-share vendors, thus offering broad accessibility on national and even international levels. Wider distribution is envisioned for later versions which will be more readily adaptable to a variety of large computers. In addition, the FAA has conducted an INM validation project to determine the accuracy of both the computational methods and data base of the model by comparing the model's noise exposure calculations with measured levels. The first phase of validation was an analysis of air carrier flights over the monitoring system at Washington National and Dulles International Airport. Information on the continuing validation project, availability of INM documents and tapes can be obtained through the Office of Environment and Energy (AEE-120).

232. INPUT REQUIREMENTS. The first step in running an airport case study is to gather the necessary data and organize it in the way which is recognized by the computer program. While the INM and similar models are accompanied with sets of aircraft noise and performance information, information on airport geometry and aircraft movements is also necessary.
The gathering of information is a time consuming process. Care must be
taken in defining program input, especially in those situations in which a
clearcut choice does not exist among similar items. There is also the
problem of conflicting estimates of the airport operations from the airport
manager, tower chief, airline operators and others. The following
information needs to be obtained for input to INM computer program:

a. A map of the airport and its environs at an adequately detailed
scale not less than 1 inch to 8,000 feet. It should indicate runway length,
alignments, landing thresholds, takeoff start of roll points, and flight
tracks out to at least 30,000 feet from the end of each runway. The
locations of the nominal flight tracks are important. Exposure to aircraft
noise is highest directly underneath the flight profile.

b. Airport activity levels and operational data which will indicate,
on an annual average daily basis, the number of aircraft, by type, which
utilize each flight track, in both the day time (7:00 a.m. to 10:00 p.m.)
and nighttime (10 p.m. to 7 a.m.) periods for both landings and takeoffs.
The INM offers a wide selection of aircraft types from which to choose.
However, the model does not contain every combination of aircraft and engine
types. Decisions on equivalent types must be carefully thought out with
respect to possible ramifications to the calculation of exposure.

c. Landing glide slopes, glide slope intercept altitudes, and other
pertinent information needed to establish approach profiles, along with the
engine power setting for each aircraft type to fly that approach profile.

d. Takeoff flight profiles (the relationship of altitude to distance
from start-of-roll and associated engine power settings for each aircraft
type to fly that takeoff profile); these data must reflect the use of noise
abatement departure procedures and, if applicable, the takeoff weight of the
aircraft or some proxy for weight such as stage length. The INM data base
contains a set of representative profiles for each aircraft type. The INM
profiles conform to a widely used procedure. However, local conditions may
preclude the use of these profiles in favor of a local standard procedure.

e. Any topographical or airspace restrictions which preclude the use
of alternative flight tracks.

f. Government furnished data depicting aircraft noise
characteristics. The standard data can be refined with on-site measurements
by the procedure described in Section 234.

g. Airport elevation, wind conditions and average temperature.

233. ACCURACY. As is the case with any computer program or with any
prediction method, the accuracy of the output of the Integrated Noise Model
is directly dependent upon the appropriateness, completeness, and accuracy
of the input data. Use as input of average flight tracks, flight
procedures, aircraft types and mix, and the schedule of operations can
degrade the accuracy of the predicted contours. Further, the effects of
local topography, weather, buildings, etc., cause variations from point to
point along a contour. Accordingly, the accuracy of the INM computer noise
prediction model in estimating the yearly average $L_{dn}$ value at any
specific geographical point has been estimated to be $L_{dn}$ 75 contours $\pm 3$
$\text{dB}$ and $L_{dn}$ 95 contours $\pm 3 \text{dB}$ with the average error over all points
along the contour tending towards zero.

234. USE OF MEASUREMENTS IN REFINING/VALIDATING PREDICTIONS. On completion
of a noise exposure map, one may find that the noise contours vary somewhat
from measured conditions due to external influences that are not accounted
for in the INM. This problem is not unexpected for a sophisticated model
such as INM, since it is very difficult to compensate and model for all the
variables that influence the noise environment. If a permanent and
continuous noise monitoring system is in place, the airport operator may be
able to calibrate the model specifically for that airport. The data
acquisition will assist the airport operator in identifying specific problem
areas based upon on-site measurements. A noise monitoring system may also
allow the operator to fine tune or calibrate the output of the INM for
specific conditions that cannot otherwise be accounted for. Thus the
operator may be able to improve the noise compatibility program and the
noise exposure map.

235. NOISE COMPATIBILITY PREDICTION. Different uses of the land have
different sensitivities to noise. Individuals may each have different
perceptions of what is an acceptable or an intruding level of noise. The
background or residual noise against which a specific noise is perceived
varies both by location and by time of day. Even the specific situation of
the receiver, such as outdoor, indoor with windows open or closed, as well
as one's activity at the moment affect the perception of a noise as
intruding or not intruding. Regardless of the human activity, however, the
associated noise sensitivity must be translated into a land use category for
planning and regulatory purposes. The ASNA Act requires the FAA to identify
land uses that are "normally compatible" or "incompatible" with various
levels of noise exposure by individuals. This was done in Part 150 and is
used in developing and reviewing airport noise exposure maps and airport
noise compatibility programs. It is important to recognize, however, that
land use guidelines (even those adopted by regulation) are a planning tool
and as such provide general indications as to whether particular land uses
are appropriate for certain measured or calculated noise exposure levels.

236. BASIS FOR NOISE COMPATIBILITY. The adverse effects of noise exposure
on people can be grouped into three general categories: degradation of
health, attitudinal reactions, and activity interference. The first
category, which includes hearing loss, is not normally encountered from
aircraft sources at any point outside the airport boundary. However, the
noise levels defining the thresholds of interference with noise-sensitive
human activities, such as sleep and speech thresholds, are lower and airport
noise can affect compatibility or noncompatibility.

a. Interference with human activity. These may generally be grouped
as sleep interference; speech interference; interference with study,
concentration, or critical tasks; interference with the performing arts;
interference with outdoor activities; and interference with warning sounds.

Chap 2
Par 233

Page 20

8-117
(1) **Sleep Interference.** Interference with sleep activity is critical in hospitals, nursing homes, and certain other health facilities, and is important in individual homes. The zero interference threshold inside such health facilities is 40 dBA (Report No. DOT-FAM-AEC-77-9, Study of Soundproofing Public Buildings Near Airports, April 1977). Tests have shown that about 10 percent of people sleeping in a laboratory environment who were exposed to a noise level of 50 dBA were awakened. Most residences have ambient noise levels that are higher than might be expected in a laboratory. Due to this higher background noise level, fewer than 10 percent of those exposed to 50-55 dBA of interior noise from aircraft would be expected to be awakened (Metropolitan Washington Airport Policy, Supplement to the August 1980 Environmental Impact Statement, Final, September 1981).

(2) **Speech Interference.** Interference with speech is most critical in learning environments such as classrooms. It has been determined to be somewhat less critical in other activities where speech communications are important. At sound levels greater than 45 dBA speech interference can begin to occur (at distances of about 25 to 30 feet) in a classroom. (Study of Soundproofing Public Buildings, et. al).

(3) **Study, Concentration, and Critical Tasks.** These thresholds are more difficult to identify than are those for sleep or speech interference and are even more subjective. To a considerable degree, these thresholds are dependent upon the individual recipient, the task at hand, the background noise through which the specific noise intrudes, and the impulse characteristics of the noise. The absence of recognized standards should not, however, prevent adequate consideration being given to these sensitive tasks whenever it is appropriate.

b. **Relationship to Self-Generated Noise.** Part 150 directs that no use or activity should be considered to be incompatible as a result of airport noise if its own self-generated noise equals or exceeds the airport noise.

c. **Relationship to Background Noise.** Steady state background (ambient) noise which equals or exceeds the maximum noise resulting from individual aircraft events effectively masks uses in the immediate locale from aircraft noise impact. Hence, Part 150 directs that no uses in such an area should be considered to be incompatible. However, such cases can be determined only by analyzing the average 24 hour pattern of ambient noise and comparing it with the time of day distribution of aircraft events.

d. **Noise Attenuation.** Attenuation of noise, or outdoor to indoor Noise Level Reduction (NLR) through blocking of noise paths or soundproofing measures can reduce the intrusive impacts of noise. Where appropriate, NLR may be taken into account in determining the compatibility of indoor uses or activities. Inasmuch as this implies that windows and doors must be closed and that air conditioning or artificial ventilation must be used, due consideration should be given to the living environment and quality of life before using NLR to place individual residences or schools into a "compatible" designation. Consideration should also be given to the possible impacts upon outdoor and indoor-outdoor living and activities.

Chap 2
Par 226
LAND USE COMPATIBILITY TABLE. FAR Part 130 contains a table, Land Use Compatibility with Yearly Day-night Average Sound Levels, identifying land uses that are "normally compatible" or "noncompatible" with various levels of noise exposure. Appendix I contains that table, but expands the list of uses under most categories in order to be more useful. The expanded land use descriptions are based upon the Standard Land Use Coding Manual (SLUCM) published by the Federal Highway Administration and the Department of Housing and Urban Development in 1965. The levels of noise exposure, in yearly day-night average sound levels (Ldn) correspond to the contours required to be shown on Airport Noise Exposure Maps. The table indicates compatibility of the land uses with the outdoor noise environment. By comparing the predicted or measured yearly Ldn level at a particular site with the values given in the table the range of compatible uses may be determined. In using the land use compatibility table, the following cautions should be observed:

a. Ldn contours indicate the boundaries lines between areas of acceptable or unacceptable noise exposures for the various land uses in Appendix I. The contours do not indicate the trend in relative noise levels. However, vegetation, land contours, and the position of buildings or walls may often affect the impact of noise on the human users at a specific site.

b. Ldn levels may vary somewhat above or below the predicted levels for a particular location, depending upon local topography and vegetation, and upon final aircraft loadings and operations.

c. Although all land uses may be considered as normally compatible with noise levels less than 65 Ldn, local needs and values may dictate further delineation based on specific local requirements or determinations as well as low ambient levels.

d. When appropriate, noise level reduction may be achieved through incorporation of sound attenuation into the design and construction of a structure to achieve compatibility. However, more specific noise measurement and analysis is generally advisable prior to incurring the expense of such sound treatment. The cautions mentioned in paragraph 236d should be observed when applying Noise Level Reduction (NLR) to residential uses or other uses where indoor-outdoor activities are important.

e. Other local noise sources may often contribute as much or more than aircraft to the total noise exposure at a specific location.

f. Compatibility designations in the table generally refer to the major use of the site. If other uses with greater sensitivity to noise are permitted at a site, the compatibility determination is based upon the use which is most adversely affected by noise.
g. Designations contained in the table do not constitute a Federal
determination that any use of land covered by the program is acceptable or
unacceptable under Federal, State, or local law. The responsibility for
determining the acceptability and permissible land uses remains with the
local authorities.

h. Although Table 1 of FAR Part 150 defines the compatibility or
noncompatibility of various land uses for the purposes of Federal aid,
programs, or sanctions under the ASNA Act, adjustments or modifications of
the descriptions of the land use categories may be desirable after
consideration of specific local conditions.

238. INTERPRETATION OF NOISE EXPOSURE MAPS. Note that it is possible that
the process of plotting noise contours onto locally generated land use maps
may introduce a degree of charting imprecision, especially relative to
property lines on the land use map. For the purpose of Section 107 of the
ASNA Act, as amended, questions may arise concerning the precise
relationship of specific properties to noise exposure contours depicted on a
noise exposure map submitted under Section 103 of that Act. The FAA is not
involved in any way in determining the relative locations of specific
properties with regard to the depicted noise contours, or in interpreting
the noise exposure map to resolve questions concerning which properties
should be covered by the provisions of Section 107. These functions are
inseparable from the ultimate land use control and planning responsibilities
of local government. Therefore, the responsibility for the detailed
overlaying of noise exposure contours onto the map of subject properties
on the surface rest exclusively with the airport operator who submitted
these maps, and/or with those public agencies and planning agencies with
which consultation is required under Section 103 of the Act. In its
decisions to accept noise exposure maps, the FAA relies on the
certifications, by the airport operator that this statutorily required
consultation has been accomplished.

239.-239. RESERVED.
CHAPTER 3. AIRPORT NOISE COMPATIBILITY PLANNING

SECTION 1. ELEMENTS OF AIRPORT NOISE PLANNING

300. GENERAL. This chapter discusses the airport noise compatibility planning process and forms the primary background for preparing airport noise compatibility programs under FAR Part 150. In addition, noise control and noise impact abatement actions available to both airport operators and neighboring communities are discussed. Equal emphasis is placed upon urban planning and airport operational solutions. Throughout the chapter, emphasis will be placed upon reduction of airport noise (present and future) to the practical minimum; long-term protection of the agreed-upon noise impact areas from development with incompatible uses; and actions to reduce the noncompatibilities remaining within those noise impact areas to acceptable levels.

301. NOISE COMPATIBILITY PLANNING. Airport Noise Compatibility Planning is a joint planning effort which examines and weighs both aviation and urban planning strategies in seeking long-term solutions to existing and or future noise conflicts around an airport. Local consultation and citizen participation are key elements of the process. This includes the participation of airport users, affected local governments and airport neighbors, as well as the airport's operator. Section 103 of the ASNA Act requires that noise exposure maps be prepared in consultation with public agencies and planning agencies in areas surrounding the airport. FAR Part 150 requires consultation with the users and the agencies with land use control jurisdiction or planning responsibilities lying within the airport's 65 Ldn contour. Citizen participation in the planning and decisionmaking processes which affect their lives and property is now recognized as a cornerstone of planning and should be integrated into that process. See FAA Advisory Circular 150/5050-4, Citizen Participation in Airport Planning, and Report No. FAA-EE-79-06, Community Involvement Manual, for more detail on this subject.

302. SCOPE OF THE PLANNING EFFORT. The scope of the planning effort will, of course, vary considerably, depending upon the extent and complexity of the noise problems at a given airport. However, the planning effort should be sufficient to identify the most viable alternative of those which might be proposed, to demonstrate that it is equitable to those affected, and that it is fully implementable. This planning should be integrated into the existing or ongoing comprehensive planning for the region involved and should be realistic in its regard for monetary costs and its ability to generate the local planning and land use control actions necessary for its implementation and long-term planning and land use control actions necessary for its implementation and long-term.
303. THE CONTEXT OF AIRPORT NOISE PLANNING. The Airport Noise Compatibility Planning Program should be viewed as a more detailed segment of the overall comprehensive planning for the area. It should first determine the extent of existing problems (if any) and the effects of airport and air traffic growth trends, and then determine the needs and values of both the airport users and those impacted by the airport. The planning program must explore with equal vigor both aviation and urban planning solutions to the problems. Each viable solution or combination of solutions is then tested against the realities of the social, economic, and environmental needs of the community(ies) served and of the State and the Nation. It should also be recalled that aviation growth is not only a function of community growth but also the per capita usage of aviation.

304. THE OBJECTIVES OF PART 150 PLANNING. The objective of the planning effort is to find reasonable solutions to the noise problems and to present solutions that can be implemented. Although FAA environmental assessment of the compatibility program is not required prior to FAA approval or disapproval within the 180-day review period, each element or combination of elements going into the program should be capable of passing such a test prior to implementation. Failure to do so may seriously delay FAA funding of projects to carry out approved programs if, through the sponsor's failure to adequately assess those impacts, the FAA is forced to deal with those impacts without adequate environmental data at the funding stage. FAR Part 150 also requires that adequate provision be included for periodic review and updating of the compatibility program to account for changes in airport operations.

305. USE OF LOCAL OR STATE STANDARDS. The land use compatibility chart (Appendix I) is derived from FAR Part 150 and contains land uses that have been identified as "reasonably compatible" with various levels of noise. The values for residential use are based upon studies of noise-induced annoyance. For other land uses, the values are based primarily upon noise-induced interference with speech communication or upon interference with the critical activity associated with the use. However, in applying the table, it should be kept in mind that no two communities are likely to have situations or value systems that are identical. Adjustments to the land-use categories and noise levels may be necessary in considering specific local conditions. These decisions should be made early in the compatibility planning process. Citizen participation in this key element of the planning is advisable.

306. DEVELOPMENT OF ALTERNATIVES AND IMPLEMENTATION STRATEGIES. Development of reasonable alternatives is the nucleus of the compatibility planning process. The objective is to explore a wide range of feasible options and alternative compositions of land use patterns, noise control actions, and noise impact patterns, seeking optimum accommodation of both airport users and airport neighbors within acceptable safety, economic, and environmental parameters. Consideration of alternatives should address both physical planning and the implementation aspects of proposed solutions. It is, however, unlikely that any single option, by itself, will be capable of totally solving the problem(s) without having objectional impacts of its own. Some of the options may have little or no value in the situation,
especially if used alone. Realistic alternatives, then, will normally consist of combinations of the various options in ways which offer more complete solutions with more acceptable impacts or costs. Each alternative considered should: have the potential of resolving the problem(s); be implementable within acceptable economic, environmental, and social costs; and be legally implementable within existing State/Federal legislation and/or regulation. Brief summations or estimates indicating how these criteria are to be met should be prepared for each alternative. A sufficiently wide range of alternatives should be developed to assure that all reasonable routes to the ultimate solution have been explored and that there is a sufficiently broad range of choices available to give credibility to the studies. The matrix of noise control actions shown in Figure 2 on the following page, while not necessarily exhaustive, illustrates an array of options or possible solutions to a cross section of noise compatibility problems.

307–319. RESERVED.

SECTION 2. AIRPORT PROPRIETOR OPTIONS

320. DENIAL OF USE TO AIRCRAFT NOT MEETING FEDERAL NOISE STANDARDS. This strategy may be implemented by limiting access to the airport to aircraft that conform with certain FAR Part 36 standards. Most turbojets and other large aircraft produced after 1974 already meet these standards; so do most propeller-driven light airplanes. In addition, older turbojets over 75,000 lbs. maximum gross weight must (under FAR Part 91) be either retrofitted with quiet engines or be replaced by certain specific dates. The ASNA Act also directs that certain classes of aircraft be exempt from compliance with FAA noise standards until certain dates. Denial of the use of an airport to such aircraft prior to the Part 91 or ASNA Act prescribed retirement dates might force some owners to retrofit or replace the aircraft to meet Part 36 standards in order to continue to operate at the airport during the interim period. To this extent, such local rules are in conflict with the Federal scheme and should be avoided.

321. CAPACITY LIMITS BASED ON NOISE. Airport use restrictions are sometimes based upon noise limits. However, such restrictions often have uneven economic consequences and should be employed only after careful consideration of other alternatives and after thorough consultation with the affected parties. Some of the forms that such restrictions might take are as follows:

A. Restrictions based on cumulative impact. Under this strategy, a maximum cumulative impact (such as the total area within the Ldn 75 contour) is established and then the airport’s operations are adjusted or limited so as to not exceed that maximum. This is done through “capacity limitations,” e.g., limiting either the aircraft types based upon their noisiness, or the numbers and mix of aircraft so as to respect the established cumulative noise exposure restriction.
FIGURE 2
MATRIX OF NOISE CONTROL ACTIONS

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* These are examples of restrictions that involve FAA’s responsibility for safe implementation. They should not be accomplished unilaterally by the airport operator.

Chap 3
Par 321
b. Restrictions based upon certificated noise levels. Most aircraft types in general service today have been certificated for noise by the FAA. Consequently, it is possible to devise limitations based upon those certificated data. Such limitations might take the form of threshold noise levels for the airport or different levels for day and night at the airport.

c. Restrictions based upon estimated single event noise levels. Since aircraft noise levels vary widely with changes in operational procedures, it may be possible to set limits on estimated single event noise levels. However, it should be noted that this does not mean that the airport operator or community can set up a microphone and a noise level limit and challenge the pilots to "beat the box." The FAA considers this to be unwise and has never approved such a scheme. Instead, a target noise level limit or threshold is discussed in advance with the FAA and the aircraft operators and an appropriate level is selected, balancing the needs of aviation and the noise impacts on the community. FAA Advisory Circular 36-13, Estimated Airplane Noise Levels in A-Weighted Decibels is useful with this option.

322. NOISE ABATEMENT TAKEOFF OR APPROACH PROCEDURES. A basic noise mitigation strategy is the use of noise abatement takeoff and landing procedures. There are a number of alternatives within this strategy, including runway selection, takeoff and landing profiles and power settings, and approach or departure paths. Runway selection has an obvious relationship with wind vectors, runway lengths, aircraft performance and tolerance for crosswinds, and safety. Within these parameters, however, there are often a significant range of acceptable options. Some of these options may well offer significant relief to the airport's noise impact problem, especially when linked with appropriate landing and takeoff profiles and approach-departure paths. Takeoff and landing profiles and their attendant power and flap settings can be adjusted so as to offer relief to either close-in or more distant noise sensitive areas. These options are covered in more detail in other FAA documents such as Advisory Circular 91-11. Similarly, there are also often a number of viable choices for approach and departure paths. Some of these options may only be available during visual flight reference conditions, while others may be unavailable to certain aircraft. The objective is to achieve the greatest noise relief within the parameters of safety and economics and in coordination with the compatible land use strategies being developed for the airport's noise compatibility programs. Since FAA approval of these procedures is required, there should be discussion with the FAA region early in program development.
323. **LANDING FEES BASED ON NOISE.** This strategy bases all or a portion of the landing fee upon the noisiness of the individual aircraft, thus apportioning the fees to the relative noise "cost" of the operation to the airport's proprietor. The strategy promotes the use of quieter aircraft while producing additional revenue to offset noise induced expenses. For maximum benefit, noise fees should be used in concert with other noise abatement strategies. A steeply sloped-noise fee curve would offer additional disincentive to continued use of the noisiest aircraft. Noise fees could also be used differentially to help shift noisier aircraft from a close-in, urban impacted airport to an outlying airport with greater noise capacity. To avoid discrimination the noise fee for each aircraft should be based upon standard single event noise ratings for the aircraft, such as those published by the FAA in Advisory Circular 36-3B (subject to the limitations contained in its preamble). The reverse strategy can also be applied. Instead of assessing a fee, an airport operator can reward air carriers who go to extra lengths to reduce noise generated by their aircraft by providing a discount or a reduction in landing fees. This might also act as an incentive for air carriers to use one airport over another in special circumstances.

324. **NOISE BARRIERS (SHELDING).** Ground-level noise sources on an airport include run-up and maintenance areas, taxiways and freight warehouse areas. Because the noise is generated on the ground, the impact is usually confined to those areas immediately adjacent to the source. An effective method of mitigating this type of noise impact is through use of sound barriers or hedges. "Hush houses" may be appropriate in engine maintenance areas. Strategic placement of new hangar or terminal structures on the airport may also be used. These will shield adjacent neighborhoods by absorbing and third method is the movement of run-up and maintenance operations to an area of the airport away from the community. One common misconception is that trees or bushes will provide substantial attenuation of sound. This is not true except when wind breaks several hundred feet wide are used. The common method is to plant thickly with both trees and underbrush.

325. **ACQUISITION OF LAND AND INTEREST THEREIN.** Purchase of sufficient land to totally contain the significant noise impacts of an airport is generally impractical. Not only is it very costly, but it removes too much potentially valuable land from local tax rolls. However, certain land areas are often much more critical to achieving or maintaining an airport's noise compatibility than are others. Purchase of full or partial interest in such lands may be the only way the airport can be assured of long-term protection. Acquisition by the airport of development rights for all but noise tolerant development via easement in these critical areas may often be accomplished at much less cost than purchase in fee-simple. Compatible development under such restrictions should enhance the airport as well as the local tax rolls.
326. COMPLETE OR PARTIAL CURFEWS. Curfews are an effective though costly method of controlling noise intrusion into areas adjacent or in proximity to an airport. They should be reserved as a strategy of last resort, however, when all other options have been shown to be clearly inadequate, because of their drastic negative impacts upon both aviation and the community's benefit from aviation. They can take various forms, from restrictions upon some or all flights during certain periods of the day through restrictions based upon noise threshold and certificated aircraft noise levels (see AC 36-3B). Since unwanted noise intrusions are most pronounced in the late evening or early morning hours, curfews are usually implemented to restrict operations that occur during these periods. The period of 2200 hours to 0700 hours is when most people are resting and are most sensitive to noise intrusions. However, it should be pointed out that curfews have economic impacts upon airport users, upon those providing airport-related services, and upon the community as a whole. Other communities may also be impacted through curtailment of service. Thus undue burden on interstate or foreign commerce is a specific concern of the ASNA Act. Therefore, curfews should only be considered after careful consideration of other alternatives and after thorough consultation with the affected parties.

327.-329. RESERVED.
SECTION 1. STATE/LOCAL GOVERNMENT OPTIONS (STRATEGIES TO PREVENT NEW NONCOMPATIBLE DEVELOPMENT)

130. DEVELOPMENT CONTROL. Land use and development controls based upon a well worked out compatible land use plan is among the most potent and affordable of all the compatibility strategies. This is particularly so in small developing areas. The exercise of these land use and development controls is usually within the authority of local or county governments rather than the airport operator. Even when the airport is operated by the same governmental body which exercises these controls there is often little recognition of action based on the needs in these critical areas. This emphasized the need for a comprehensive approach to developing an airport noise compatibility program. A number of different controls are normally available to local governments and/or to airport operators to prevent intrusion of noncompatible development. The controls which are generally most useful for mitigating noise intrusions or achieving compatible land use within proximity to the airport are: zoning, easements, transfer of development rights, land purchase (for compatible public use), and capital improvements. In addition, local governments can consider establishing minimum acoustical insulation standards, expressed as Sound Transmission Coefficients (STC) for new residential dwellings within high noise impact contours. Appropriate expertise should be consulted in developing such a code.

131. ZONING. The most common land use control is zoning. Zoning is an exercise of the police powers of a state or local government which enables that government to designate the uses that are permitted for each parcel of land. It normally consists of a zoning ordinance which specifies land development and use constraints. One of the primary advantages of zoning is that it may be used to promote land use compatibility while leaving the land in private ownership, on the tax rolls, and economically productive. Although most cities and larger towns have zoning authority, it should be remembered that rural areas often are not subject to this remedy, since in many states counties have only limited (or no) zoning authority.

a. Use of Zoning. In order for zoning to work effectively it should be based upon a comprehensive plan. This plan must consider the total needs of the community along with the specific needs of the airport. A comprehensive plan defines the goals and objectives of a community and zoning is one of the tools available to the community for implementing that plan. Zoning can and should be used constructively to increase the value and productivity of the affected land. For zoning to be viable, there should be a reasonable present or future need for each designated use. Within its limitations, zoning is a preferred method of controlling land use in noise impacted areas.

b. Limitations of Zoning. Zoning has a number of limitations which must be considered when using it as a compatibility implementation tool:

(1) Zoning is not necessarily permanent. In most jurisdictions, the current legislative body is not bound by prior zoning actions and it may change that zoning. Consequently, zoning which achieves compatibility is subject to continual pressure for change from both urban expansion and those
who might profit from such changes. Also, from time to time the entire zoning ordinance for a jurisdiction will be updated to accommodate increased growth or incorporate new land use concepts.

(2) Cumulative zoning can permit noncompatible development. A number of communities still have "cumulative" type zoning districts which permit all "higher" uses (such as residential) in "lower" use districts (such as commercial or industrial), thus permitting development that may be incompatible. In these instances it would be necessary to prepare and adopt new or additional zoning use districts of the "exclusive" type which clearly specify the uses permitted and exclude all other uses.

(3) Zoning is usually not retroactive. Changing zoning primarily for the purpose of prohibiting a use which is already in existence is normally not possible. In some jurisdictions, any zoning or rezoning that affects current land uses may not pass state constitutional tests. However, if such zoning is permissible and is accomplished, the use may be permitted to remain as a "nonconforming" use until such time as it is changed voluntarily to a conforming use or until the owner has had ample opportunity to recoup his/her investment.

(4) Zoning controls are normally applicable to those areas within the boundaries of the zoning jurisdiction. Noise impacts with airport operation, however, often span more than one such jurisdiction. Therefore, effective zoning requires the coordinated efforts of all the involved jurisdictions. Zoning which implements a land use compatibility plan will often be a compromise of existing and new zoning districts within each of the jurisdictions covered by the plan. Often, each jurisdiction will have a different zoning ordinance with districts having different applicability for implementing the compatibility plan.

322. EASEMENTS. An easement is a right held by one person to make use of the land of another for a limited purpose. In the context of airport noise compatibility planning, two general types of easements are possible:

positive easements to allow someone to make noise over the land and negative easements to prevent the creation or continuation of unprotected noise sensitive uses on the property. Easements can be an effective strategy for assuring compatible development around airports. A major advantage of easements for controlling land use around airports is that they can be permanent, whereas zoning may be easily changed. Additionally, easements often may be acquired for a fraction of the total value of the land and thus be less expensive than outright purchase. Acquisition of easements does not reduce the noise impacts on people or by and of itself change noncompatible land uses to compatible uses. However, the purchase of price can and should be decided and can be soundproofing and or use change necessary to achieve compatibility. The most important advantage of easements over full acquisition is that the land is left on the tax rolls and remains free for compatible development by its owner(s).

a. Obtaining Easements. Easements may be obtained in a number of ways including purchase, condemnation, and dedication. For each easement acquired, consideration may be given to including a legal description of the noise that may be created over the property, describing classes of uses which may be established or maintained with and without soundproofing, and, where applicable, granting an aviation easement.
b. Purchase. Easements may be purchased via negotiation with the price based upon the value to the owner of the rights surrendered. Timing can have a significant effect upon the price paid; once the subject land has gotten into the arena of speculation, prices tend to rise quickly.

c. Condemnation. Easements may also be obtained by condemnation, in a manner similar to full rights condemnation. The cost, while still likely to be less than that of outright acquisition (fee simple) of the land, is likely to be significantly higher than similar rights obtained via negotiation because of the time and court costs involved. Also, the cost of any ill will generated by a condemnation action, while difficult to measure, can be significant.

d. Dedication. Dedication is another way to obtain easements. Subdivision regulations governing the development of land for industrial or other purposes can include provision for dedicating private land or easements upon private land for public purposes. When easements for airport-environ compatibility are considered necessary and when they are determined to be compatible with the intended use of the land, the need for such easements may be required by local agencies in the approval of subdivision dedications.

333. TRANSFER OF DEVELOPMENT RIGHTS (TDR). TDR involves separate ownership and use of the various “rights” associated with a parcel of real estate. Under the TDR concept, some of the property’s development rights are transferred to a remote location where they may be used to intensify allowable development. With TDR, for example, lands within an airport’s noise impact area could be kept in open space or agricultural uses and their development rights for residential uses transferred to locations outside the area. Landowners could be compensated for the transferred rights by their sale at the new location or the rights could be purchased by the airport. Depending upon market conditions and/or legal requirements, the airport could either hold or resell the rights. The TDR approach must be fully coordinated with the community’s planning and zoning. It may be necessary for the zoning ordinance to be amended in order to permit TDR’s. Also, such transfers must usually be contained within single zoning jurisdictions.

334. PURCHASE. There are often locations or circumstances within the noise impact areas which leave little choice other than direct acquisition of full or partial interest in the impacted land by either the airport sponsor or, perhaps, by state or local levels of government. Purchase of noise impacted land is the most direct (and usually the most expensive) of all forms of land use control. However, when combined with either resale for compatible
purposes can considerably enhance compatibility. Provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (P.L. 91-346) are applicable whenever Federal or federally-assisted programs are involved in such purchases.

333-339. RESERVED.

SECTION 4. STATE/LOCAL GOVERNMENT OPTIONS (ACTIONS TO REDUCE EXISTING INCOMPATIBLE USES)

340. REMEDIAL ACTIONS. In cases where there are already existing conflicts between land-use and airport noise, remedial or corrective actions may be appropriate. The degree of remedial action will be dependent upon the degree of urbanization around the airport. Where the noise impacts fall on predominately rural land or where a new airport is built in an undeveloped area, there may be only a few scattered incompatible uses to be resolved. In urbanized areas, however, remedial actions are complex and may be difficult to implement. Changes to noise compatible usages, soundproofing, and acquisition of full or partial interest in the land are examples of possible actions that can be used to mitigate noise impacts. Changes in the use of noise impacted land or changes in occupancy to uses or occupations less sensitive to noise are obvious and practical strategies for resolving conflicts.

341. ENCOURAGEMENT OF EXISTING FAVORABLE TRENDS. Land use in urban areas is in a continual state of change and transition. Many of these changes tend to favor a turnover in land use from incompatible to compatible. A typical example would be the transition of older residential areas into retail, commercial, or office uses. Encouragement and promotion of these trends can be through the implementation of public policy and local planning processes.

342. CONSTRUCTIVE USE OF PLANNING AND ZONING. Detailed planning of land within noise impact areas by local authorities and constructive uses of zoning changes can often improve both compatibility and land values. Noise sensitive uses cannot normally be forced to move by simply changing their zoning to a use district that is compatible. The existing use must be permitted to continue under the new zoning as "Legal Nonconforming Uses" as long as the use is continuous and unchanged or until the owner has had an opportunity to receive a fair value from the use. This strategy then finds productive and compatible uses for the land which will give the present land owner a fair return on his investment in addition to covering his relocation expenses. The land should then be rezoned accordingly.
343. CONSTRUCTIVE USE OF PUBLIC CAPITAL IMPROVEMENT PROJECTS. Locating and programming of public works projects can exert strong influences over land use trends and demands. These include road construction and widenings, transit service, schools, parks or recreation facilities, water and sewer lines, and flood control projects. Exercised judiciously as an implementation tool for promoting compatible land use such capital improvements can be a powerful tool.

344. PURCHASE ASSURANCE PROGRAMS. Purchase guarantees can be applied to residential properties within lightly or short-term noise impacted areas to help assure their salability. Such sales should then be to individuals not as sensitive to the noise impacts or who have trade off values for residing in those particular areas. Sales agreements should assure that all future purchasers are cognizant of the noise levels and sign appropriate releases or assignments. The advantages of this strategy are its relatively low costs and its retention of otherwise viable residential areas.

345. SOUNDPROOFING. Soundproofing consists of increasing the exterior to interior sound transmission losses of a building by identifying those structural elements providing transmission paths and applying appropriate modifications to improve noise attenuation.

a. Metrics. The airport cumulative noise metric (L_{eq}) is useful as an indicator that soundproofing may be required in a particular area. However, when considering any specific building site within a cumulative noise exposure contour (representing significant noise impact) it is recommended that additional analysis via single event maximum sound level and/or sound pressure level versus frequency data be used to determine the necessity (and/or eligibility) for soundproofing. While L_{eq} is utilized to assess eligibility, the sound pressure levels in each of the one-third octave bands are required to design and implement soundproofing measures. The A-weighted sound level is more utilitarian than other single event metrics in establishing the need for soundproofing as many of the sleep, speech and activity interference criteria have been developed using L_{eq} levels.

b. Sealing Existing Leaks. In soundproofing most structures, the first five decibels of additional sound insulation usually can be obtained by sealing existing leaks. A very small gap or imperfect seal in an otherwise massive wall can result in only moderate sound attenuation.

c. Retrofit of Existing Buildings. For rehabilitation of existing buildings, soundproofing modifications include: replacement of existing windows with windows of greater sound transmission coefficient (STC) rating, or adding a second layer of glass; upgrading doors and seals; acoustic baffling of vents; adding insulation to walls and attic spaces; adding another layer of wall material to existing walls, in effect creating a two-panel wall; eliminating windows and filling the space to match exterior walls (only recommended to achieve noise reduction commensurate with the
potential capability of the wall). Some very effective soundproofing techniques, such as staggered studs or fiberboard under paneling are not suitable for retrofit because they would involve virtual demolition of the existing structure and construction of a new wall.

d. New Construction. For new sound-insulated construction, design considerations often include: using brick or concrete masonry walls, using staggered studs, insulation and fiberboard under interior and exterior finish materials; installing attic space insulation; properly baffling vents avoiding single joint roof constructions where interior and exterior materials are attached to the same rafters; avoiding exposed rafter ceilings with any roof material other than thick concrete and with no interior finish ceilings; installation of air conditioning; mortar should be free of pinholes; and all joints should be well sealed.

e. Energy Savings from Soundproofing. The soundproofing of buildings has two direct energy effects - increased energy consumption by air conditioning equipment due to the elimination of natural ventilation and reduction in heat loss due to the sealing of walls, windows and other openings. Energy savings realized by reduction of heat loss, will in the long run outstrip the increased energy consumption of air conditioning. One caution is in order however; a reduction in thermal energy transmission does not always accompany a reduction in sound transmission (e.g., concrete wall).

f. Cost/Benefit of Soundproofing. While soundproofing is both a feasible and practicable means of alleviating the impact of external noise, the analysis should be made on a case by case basis in concert with both acoustical and architectural expertise. The general condition, age and repair of a structure normally dictate the degree of soundproofing application. Also, the building's location and noise exposure levels must be quantified to identify the target "reduction in noise level." Before a soundproofing program is initiated, tradeoffs in costs and benefits should be carefully examined. If some form of cost sharing arrangement between the airport operator or a governmental agency and the property owner should be utilized, suitable agreements or easements for current and future aircraft noise should also be obtained.

346. ACQUISITION OF IMPACTED LAND. In some circumstances, there may be locations or circumstances within the noise impact areas which leave little choice other than direct acquisition of full or partial interest in the impacted land by either the airport sponsor or, perhaps, by state or local levels of government. As described in paragraph 341, constructive use of land purchases for other public purposes can also enhance compatibility.
Land or interest in land (easement) may be acquired by negotiation, through a voluntary program, or via condemnation. In any case, the provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (P.L. 91-646) are applicable whenever federal or federally assisted programs are involved.

a. Land for Other Public Uses. Noise impacted land can be acquired by a public or semi-public agency either to implement the compatibility plan or in cooperation with the plan while fulfilling another public purpose. Typical uses may include sites for equipment maintenance or storage yards, water or sewer works, and floodways or reservoirs. Other possibilities include selected park, recreation, and open space uses which are noise tolerant (golf courses, skeet ranges, nature areas, etc.). All uses should respect the height and hazard requirements of the airport and be tolerant of future airport growth.

b. Land for Compatible Resale. Occasionally, state or local governments are willing to acquire land which is then resold with covenants or easements retained to assure long-term compatibility. In some cases, it may be feasible to change such land to compatible uses within existing or remodeled buildings. In other cases, it would be desirable to clear and redevelop the land before making it available for sale. In either case, the changes should be in compliance with the land use plan and be supported by appropriate zoning. Appropriate covenants or easements should be retained to assure long-term compatibility. Since this strategy approaches the complexity of urban renewal, appropriate expertise should be consulted.

347.-349. RESERVED.

SECTION 5. CONSULTATIONS

350. CONSULTATIONS UNDER PART 350. In developing a noise exposure map and identifying non-compatible land uses the airport proprietor should identify the geographic areas of jurisdiction of each public agency and planning agency which are either wholly or partially contained within the 65 db contour and meet with the appropriate officials to discuss means of reducing the noise impact as required by Part 350. Methods for mitigating and/or reducing the effects of noise that are available to local authorities after consulting with the airport proprietor are discussed in sections 3 and 4 of this chapter. Part 350 requires that consultation must include any air carriers and to the extent practicable, other aircraft operators using the airport. Prior to submission of the noise exposure map or noise compatibility program, the airport operator is required by Part 350 to allow interested persons adequate opportunity to submit their views, data, and comments concerning the correctness and adequacy of the map or program and projection of aircraft operations. FAA will not inject itself into the essentially local responsibility for consultation imposed directly on the airport operator by the ASRA Act, but will rely upon the airport operator's certification under penalty of 18 U.S.C. § 1001, that such consultation has occurred (See § 130.21).

351. RESERVED.
352. CONSULTATION WITH AVIATION GROUPS. Part 150 requires consultation with aviation groups. For air carrier airports, this consultation includes all air carriers and, to the extent practicable, other aircraft operators using the airport. For other than air carrier airports, consultations should include those aircraft operators that do use the airport. Thus, "operators" may include some or all of the following groups: airlines; commuter airlines; air taxi; and commercial; flight training and instruction; based aircraft operators (business, private, public); and fixed base operators. These consultations should take place as early as possible in the planning process in order that the view and perspectives obtained may be fully integrated into the study effort. Additional consultations, as may be appropriate, should be conducted throughout the progress of the study. If proposed aircraft operational changes are not coordinated with the appropriate parties until the end of the study, there is potential for real problems to develop.

353. PUBLIC AND COMMUNITY INVOLVEMENT.

a. The airport and the community have a number of important influences upon each other, including economic, social, and environmental considerations. The airport acts as an entry point for air travelers, vacationers and business persons and freight movement. Since the airport can act as a major focal point for growth, it should be integrated in the comprehensive planning process for the community and region. Therefore, it is essential to receive public response to any new proposed actions for airport development that would influence the public.

b. Community involvement and public participation are often determining factors in successfully assessing the compatibility/incompatibility of various land uses for individual communities. The goals, values and developmental needs of the community should always be considered from the early (planning) stages of land use evaluation. See FAA Advisory Circular 150/5050-4, Citizen Participation in Airport Planning, for guidance in developing citizen participation and community involvement programs.

c. When organizing a community involvement program, it is first necessary to identify the issues and to determine:

1. What information must be communicated to the public;
2. Which groups must receive this information;
3. What information must be received from the public;
4. From which groups this information can be obtained.

d. Specific community involvement techniques can then be evaluated and a sequence of activities developed, including formulation of alternatives, analysis and evaluation of alternatives, and the final decisionmaking process. Additional guidance that may be useful on aviation issues may be found in Federal Aviation Administration's Community Involvement Manual. This may be obtained from the Office of Environment and Energy, Noise Abatement Division, AEE-100, Washington, D.C., 20591.
354. DOCUMENTATION. In accordance with Part 150, the airport operator is to provide documentation summarizing the public procedure and input to the program. In addition, the operator is to provide documentation of consultation with officials of public agencies, planning agencies, FAA required, and other federal officials which may be affected by the proposed action. This documentation may consist of summaries of communications between the organizations indicating the issues and depth of review or it may consist of a summary of comments and replies to the plan or letters of approval adopting the proposed action.

355.-359. RESERVED.

SECTION 6. ANALYSIS OF COSTS AND BENEFITS AND SELECTION OF AN ALTERNATIVE

360. GENERAL. The costs and benefits of each reasonable alternative should be identified and assessed in order to form a logical basis for decisionmaking. Detailed alternatives most closely approaching an optimum solution to the noise compatibility problems of the particular airport should be identified. Costs may be generally grouped as possible constraints upon interstate or foreign commerce, or as environmental, economic, and social impacts. Obviously, solutions (alternatives) will not only differ in their costs and benefits; costs and benefits may also accrue to different groups, industries, geographical areas, or persons.

361. CONSTRAINTS UPON INTERSTATE AND FOREIGN COMMERCE. A stipulation of the AAMA Act and of FAA Part 150 is that an approved airport noise compatibility program not create an undue burden on interstate or foreign commerce. Such an undue burden is often difficult to identify and is based upon a number of trade-offs, which go beyond the responsibilities of the local airport operator. For example, a restriction upon the operations of aircraft exceeding a given noise level between 10 p.m. and 7 a.m. could create too small a "window" for connection with another airport 2,000 miles away. Full consultation with the FAA, the air carrier users of the airport, and with other users will identify constraints in this area and help generate mutually acceptable compromises.

362. ENVIRONMENTAL COSTS. Each action proposed by an airport noise compatibility program may have environmental costs and/or benefits to be traded off against its economic and social costs and benefits. The environmental impacts may also have to be assessed under Federal or state guidelines prior to implementing the action. The analysis at this preliminary stage should be sufficient to reasonably assure that future implementation will be both possible and within the constraints of economic and social costs. If a particular action is critical to the success of the alternative, then a more thorough analysis may be in order. FAA Orders 1050.10, Policies and Procedures for Considering Environmental Impact; and 5050.4, Airport Environmental Handbook, give detailed instructions for conducting environmental analyses when an environmental assessment is required for Federal approval of certain actions. Although FAA acceptance of noise exposure maps and approval of noise compatibility programs are both categorical exclusions, any application for Federal funding of any portion of noise compatibility program may involve the need for an environmental assessment before such funding decisions can be made.

Chap 3
Far 154
363. **ECONOMIC COSTS.** The economic costs or benefits of a noise compatibility alternative may be both direct and indirect. It is the total of these costs which should be assessed and considered against social and environmental costs. The direct costs are usually obvious and easily quantifiable. They include such things as construction costs, acquisition costs, the cost of extra fuel used in noise abatement operations, and the costs of aircraft idled by noise curfews. Benefits may include the increase in value of noncompulsory uses after the critical noise environment is removed. Indirect costs and benefits can be more difficult to identify and quantify. They can include increased development resulting from airport construction or from the introduction of noise tolerant industrial uses into the area. They may also include lost opportunities for development when there are more acres of noise impacted land than will be needed for noise compatible uses. Also, housing removed from noise impacted areas must be replaced with new housing in another location. Other costs and benefits may be more subtle but just as real as these.

364. **SOCIAL COSTS.** Evaluation of the social costs and benefits of the alternatives is of equal importance with those of economics and the environment. Social costs can include such impacts as the disruption of established neighborhoods or school districts through removal of noise impacted housing, altered surface transportation patterns, disruption of orderly planned development, or the creation of appreciable changes in employment. The often improved sense of safety with the diminishment of aircraft noise may also be a significant benefit. If preparation of an environmental assessment becomes necessary prior to approval of Federal funding for a program element, social costs are one of the prime impacts which must be assessed.

365. **SELECTION OF AN ALTERNATIVE.** The selection of one or a combination of the alternatives explored is the focal point of the whole planning and evaluation process. It is also a common point of failure of the process, either immediately or later, during the implementation stages. Although the final decision must remain with the duly elected or appointed decisionmaker(s), an appropriate degree of involvement by those affected by that ultimate decision during the deliberations and eliminations leading up to a final recommendation is likely to produce more workable and satisfying results. It is suggested that prior to this point in the planning process a logical and fair decisionmaking process be agreed upon and established. Such a process might take the following form:

a. A decision tree indicating the decisions to be made, who is to make them, and their sequence and timing.

b. A matrix which displays the costs and benefits of each alternative and arrays them against the costs and benefits of the other alternatives.

c. An outline of the possible decision combinations (some decisions automatically preclude other decisions or combinations).

d. A draft of a logical and probable scenario of future events based upon each decision combination.
a. Review and discussion of the issues in each of the alternatives by the reviewers and/or decisionmakers, following the sequences and format noted above, to make the evaluations and trade-offs leading to recommendations or decisions. A two-step selection process may be appropriate for multiple or complex alternatives.

366. DEVELOPMENT OF THE SELECTED ALTERNATIVE INTO A DRAFT COMPATIBILITY PROGRAM. Once an alternative has been selected, it should be fully developed into a complete airport noise compatibility program. This consists, essentially, of treating the alternative as an accepted preliminary schema, then making the more vigorous investigations into its viability and developing the details of the plan and its implementation. The recommended steps include:

a. Stringent investigation of the alternative's assets and liabilities to assure that it will stand the tests of reality.

b. Detailed development of the plan, giving particular attention to fully coordinating it with existing local planning, community growth trends and the local agencies which will be responsible for its implementation.

c. Development of the specific implementation actions necessary to fully implement the plan.

d. Assign to and get written agreement from the agencies (or officials) who will be responsible for each of the implementing actions.

e. Development of the implementation schedules and any documents required for adoption and full implementation. These could include resolutions for adoption as well as new or revised zoning districts designed to be added to existing local zoning ordinances.

367-399. RESERVED.
APPENDIX I. TABLE OF LAND USES NORMALLY COMPATIBLE WITH VARIOUS NOISE LEVELS.

1. LAND USE COMPATIBILITY TABLE. FAR Part 150 contains a table, Land Use Compatibility with Yearly Day-Night Average Sound Levels, identifying land uses that are "normally compatible" or "noncompatible" with various levels of noise exposure. This appendix contains that table, but expands the list of uses under most categories in order to be more useful. The expanded land use descriptions are based upon the Standard Land Use Coding Manual (SLUCM) published by the Federal Highway Administration and the Department of Housing and Urban Development in 1965. The levels of noise exposure, in yearly day-night average sound levels (L_{dn}) correspond to the contours required to be shown on Airport Noise Exposure Maps. The table indicates compatibility of the land uses with the outdoor noise environment. By comparing the predicted or measured yearly L_{dn} level at a particular site with the values given in the table the range of compatible uses may be determined. In using the land use compatibility table, the following cautions should be observed:

a. L_{dn} contours indicate the boundaries lines between areas of acceptable or unacceptable noise exposures for the various land uses in Appendix I. The contours do indicate the trend in relative noise levels. However, vegetation, land contours, and the position of buildings or walls may often affect the impact of noise on the human uses at a specific site.

b. L_{dn} levels may vary somewhat above or below the predicted levels for a particular location, depending upon local topography and vegetation, and upon final aircraft loadings and operations.

c. Although all land uses may be considered as normally compatible with noise levels less than 65 L_{dn}, local needs and values may dictate further delineation based on specific local requirements or determinations as well as low ambient levels.

d. When appropriate, noise level reduction may be achieved through incorporation of sound attenuation into the design and construction of a structure to achieve compatibility. However, more specific noise measurement and analysis is generally advisable prior to incurring the expense of such sound treatment. The cautions mentioned in paragraph 236d should be observed when applying Noise Level Reduction (NLR) to residential uses or other uses where indoor-outdoor activities are important.

ea. Other local noise sources may often contribute as much as or more than aircraft to the total noise exposure at a specific location.

f. Compatibility designations in the table generally refer to the major use of the site. If other uses with greater sensitivity to noise are permitted at a site, the compatibility determination is based upon the use which is most adversely affected by noise.
<table>
<thead>
<tr>
<th>Land use</th>
<th>Transmit Power levels (PEP)</th>
<th>Daytime Levels (Lp)</th>
<th>Nighttime Levels (Lp)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aircraft noise, loud and heavy machinery sound and traffic noise</td>
<td>155</td>
<td>170</td>
<td>120</td>
</tr>
<tr>
<td>Construction noise</td>
<td>145</td>
<td>160</td>
<td>110</td>
</tr>
<tr>
<td>Manufacturing noise</td>
<td>135</td>
<td>150</td>
<td>100</td>
</tr>
<tr>
<td>Agriculture noise</td>
<td>125</td>
<td>140</td>
<td>90</td>
</tr>
<tr>
<td>Forest fire</td>
<td>115</td>
<td>130</td>
<td>80</td>
</tr>
<tr>
<td>Mining and exploration</td>
<td>105</td>
<td>120</td>
<td>70</td>
</tr>
<tr>
<td>Recreation and tourism</td>
<td>95</td>
<td>110</td>
<td>60</td>
</tr>
<tr>
<td>Transportation noise</td>
<td>85</td>
<td>100</td>
<td>50</td>
</tr>
<tr>
<td>Electrical power lines</td>
<td>75</td>
<td>90</td>
<td>40</td>
</tr>
<tr>
<td>Utility and service lines</td>
<td>65</td>
<td>80</td>
<td>30</td>
</tr>
<tr>
<td>Construction noise</td>
<td>55</td>
<td>70</td>
<td>20</td>
</tr>
<tr>
<td>Farming noise</td>
<td>45</td>
<td>60</td>
<td>10</td>
</tr>
<tr>
<td>Forestry and logging</td>
<td>35</td>
<td>50</td>
<td>0</td>
</tr>
<tr>
<td>Marine transportation</td>
<td>25</td>
<td>40</td>
<td>0</td>
</tr>
<tr>
<td>Marine and harbor</td>
<td>15</td>
<td>30</td>
<td>0</td>
</tr>
</tbody>
</table>

Note: Levels are approximate and may vary depending on the specific situation.
The designations contained in this table do not constitute a Federal determination that any use of land covered by the program is acceptable or unacceptable under Federal, State, or local law. The responsibility for determining the acceptable and permissible land uses remains with the local authorities. FAA determinations under Part 130 are not intended to substitute federally determined land uses for those determined to be appropriate by local authorities in response to locally determined needs and values in achieving noise compatible land uses.

**KEY TO TABLE**

- **Y (Yes)**: Land Use and related structures compatible without restrictions.
- **N (No)**: Land Use and related structures are not compatible and should be prohibited.
- **25, 30, or 35**: Land use and related structures generally compatible; measures to achieve Noise Level Reduction (NLR), outdoor to indoor, of 25, 30, or 35 must be incorporated into design and construction of structure.

**NOTES FOR TABLE**

1. Where the community determines that residential uses must be allowed, measures to achieve outdoor to indoor Noise Level Reduction (NLR) of at least 25 dB and 10 dB should be incorporated into building codes and be considered in individual approvals. Normal construction can be expected to provide a NLR of 20 dB, thus, the reduction requirements are often stated as 5, 10 or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year round. However, the use of NLR criteria will not eliminate outdoor noise problems.

2. Compatible where measures to achieve NLR of 25 are incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.

3. Compatible where measures to achieve NLR of 30 are incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.
AC 150/5020-1
Appendix I

4. Compatible where measures to achieve NLR of 25 are incorporated into the
design and construction of portions of these buildings where the public is
received, office areas, noise sensitive areas or where the normal noise
level is low.

5. Land use compatible provided special sound reinforcement systems are
installed.

6. Prime use only, any residential buildings require an NLR of 25 to be
compatible.

7. Prime use only any residential buildings require an NLR of 30 to be
compatible.

8. Prime use only, NLR for residential buildings not normally feasible, and
such uses should be prohibited.

9. Designations in the table do not constitute a Federal
determination that any use of land covered by the program is acceptable or
unacceptable under Federal, State, or local law. The responsibility for
determining the acceptability and permissible land uses remains with the
local authorities.

h. Although Table 2 of FAR Part 150 defines the compatibility or
noncompatibility of various land uses for the purposes of Federal aid,
programs, or sanctions under the ASNA Act, adjustments or modifications of
the descriptions of the land use categories may be desirable after
consideration of specific local conditions.

2. INTERPRETATION OF NOISE EXPOSURE MAPS. Note that it is possible that
the process of plotting noise contours onto locally generated land use maps
may introduce a degree of charting imprecision, especially relative to
property lines on the land use map. For the purpose of Section 107 of the
ASNA Act, as amended, questions may arise concerning the precise
relationship of specific properties to noise exposure contours depicted on a
noise exposure map submitted under Section 103 of that Act. The FAA is not
involved in any way in determining the relative locations of specific
properties with regard to the depicted noise contours, or in interpreting
the noise exposure map to resolve questions concerning which properties
should be covered by the provisions of Section 107. These functions are
inseparable from the ultimate land use control and planning responsibilities
of local government. Therefore, the responsibility for the detailed
overlaying of noise exposure contours onto the map of subjacent properties
on the surface rests exclusively with the airport operator which submitted
these maps, and/or with those public agencies and planning agencies with
which consultation is required under Section 103 of the Act. In its
decisions to accept noise exposure maps, the FAA relies on the
certifications, by the airport operator that this statutorily required
consultation has been accomplished.
APPENDIX 2. CHECKLISTS FOR NOISE EXPOSURE MAPS AND NOISE COMPATIBILITY PROGRAMS.

The two checklists included in this appendix are intended as an aid to both developing and reviewing noise exposure maps and noise compatibility programs. They should not, however, be considered as definitive or as replacing in any way the requirements of FAR Part 150. Responsibility for compliance with the provisions of Part 150 remains with the preparers and reviewers.
<table>
<thead>
<tr>
<th>CHECKLIST FOR NOISE EXPOSURE MAPS</th>
<th>REFERENCE</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Base Map developed using INM or approved equivalent.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Land use identified.</td>
<td>A150.103(a)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Scale not less than 1 inch = 8000 feet.</td>
<td>A150.103(b)(1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Runway Locations and alignments.</td>
<td>A150.101(6) &amp; A150.102(b)(1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Airport boundaries.</td>
<td>A150.101(a)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Flight tracks.</td>
<td>A150.101(a)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Continuous noise for $L_{dn}$ 65, 70, and 75.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Estimates of number of people residing within each contour.</td>
<td>A150.101(a) &amp; A150.101(b)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Depicted on land use map of sufficient detail and quality to discern streets and other identifiable geographical features.</td>
<td>A150.101(b)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Depiction and Identification of each public and/or planning agency having jurisdiction within the $L_{dn}$ 65 contour.</td>
<td>A150.101(6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Brief analysis of the types of land use controls available to the identified agencies.</td>
<td>A150.105(a)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Noncompatible land uses identified within the $L_{dn}$ 65 contours using Table 2 of Part 150 and based on self generated noise (ambient).</td>
<td>A150.101(a) &amp; A150.101(b)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Location of noise sensitive public buildings (schools, hospitals, etc.).</td>
<td>A150.101(a)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Locations of any noise monitoring sites.</td>
<td>A150.101(a)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Projected aircraft operations for submission date and for fifth calendar year after submission date.</td>
<td>150.21(a)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Consultations with public, users, and other agencies.</td>
<td>150.21(b)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Certified as true and complete.</td>
<td>150.21(u)</td>
<td></td>
<td></td>
</tr>
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</table>
# Checklist for Noise Compatibility Programs

<table>
<thead>
<tr>
<th>Reference</th>
<th>Yes</th>
<th>No</th>
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<tbody>
<tr>
<td>150.23(a)(1)</td>
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<tr>
<td>150.23(a)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>150.23(c)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>150.23(d)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>150.23(a)(1,4,6&amp;8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>150.7(a)(1)</td>
<td></td>
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</tr>
<tr>
<td>150.7(a)(2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>150.7(a)(3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>150.7(b)(3)</td>
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</tr>
<tr>
<td>150.7(b)(5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>150.7(b)(5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>150.7(b)(5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>150.7(b)(5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>150.7(b)(5)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Current FAA accepted noise exposure map included.
2. Consultations with public and/or planning agencies within Ldn 65.
3. Consultations with air carriers and other airport users.
4. Opportunity afforded public to submit views, data and comments.
5. Description (summary) of the consultations conducted.
6. Alternatives considered and presented according to these categories:
   a. Those within airport operator's implementation authority.
   b. Those within authority of another local agency or state/local governing body.
   c. Those under Federal authority.
7. At a minimum have these alternatives been considered:
   a. Preferential runway system.
   b. Restrictions on use of airport based on noise:
      (1) Restrictions on aircraft not meeting FAA noise standard.
      (2) Capacity limitations based on relative noisiness.
      (3) Required use of noise abatement takeoff/ approach procedures.
      (4) Landing fees based on noise or on time of arrival.
      (5) Other actions recommended for FAA analysis.
<table>
<thead>
<tr>
<th>Description</th>
<th>Reference</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>c. Noise barriers and/or acoustical shielding.</td>
<td>8150.7(b)(2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Soundproofing of public buildings.</td>
<td>8150.7(b)(2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Modified flight procedures and/or flight tracks.</td>
<td>8150.7(b)(4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. Land purchases, air rights, easements and/or development rights.</td>
<td>8150.7(b)(1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>g. Other actions or combinations of actions having beneficial impact on noise.</td>
<td>8150.7(b)(6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Description of alternatives considered and the reasons why any alternatives were rejected.</td>
<td>150.23(a)(2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Specific alternative program measures (actions) proposed and the relative contribution of each to program effectiveness.</td>
<td>150.23(a)(3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Statement of the actual or anticipated effect of the program on reducing noise to individuals and noncompatible uses.</td>
<td>150.23(a)(5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Documentation of feasibility of each proposed measure, including:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Essential governmental actions.</td>
<td>150.23(a)(8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Anticipated funding sources.</td>
<td>150.23(a)(8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Relationship of proposals to existing FAA approved airport layout plan, master plan, and system plan.</td>
<td>150.23(a)(6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Summary of the comments and materials received via public comment and disposition.</td>
<td>150.23(a)(7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Time period covered by the program.</td>
<td>150.23(a)(6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Schedule for implementation of the program.</td>
<td>150.23(a)(8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Persons responsible for implementation of each program measure.</td>
<td>150.23(a)(8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Schedule for periodic review and updating.</td>
<td>150.23(a)(9)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX 3

RECOMMENDED BASIC NOISE MEASUREMENT SYSTEM

Noise monitoring may be utilized by airport operators for data acquisition and data refinement, but is not required by Part 150, for the development of noise exposure maps or airport noise compatibility programs. This Appendix describes a basic noise measurement system. First a few words about the purchase and maintenance of noise measurement equipment. There are at least four or five companies in the U.S. which carry special product lines of noise measurement equipment. The FAA Office of Environment and Energy, Noise Abatement Division, Noise Technology Branch, (AAE-120) will furnish a list of vendors upon request. At the time of purchase, two very important related needs must be considered, (1) periodic maintenance and (2) periodic re-calibration of equipment traceable to the National Bureau of Standards. If possible, try to minimize future difficulties, by assuring that local service is available. One should also seriously consider the advantages of establishing a maintenance service contract. This is especially recommended if long delays and extensive paperwork are required for each individual maintenance purchase order. The following list details the principle components of a mobile noise measurement system. The word "system" is underlined to indicate that much more than a sound level meter is required to be able to conduct an efficient multi-purpose noise measurement survey.
<table>
<thead>
<tr>
<th>ITEM</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microphone Windscreen</td>
<td>Purchase several for each microphone. Windscreen have a habit of disappearing, blowing away, becoming displaced etc.</td>
</tr>
<tr>
<td>Microphones</td>
<td>Purchase at least 2 per system. Microphones are easily damaged making one spare per system essential.</td>
</tr>
<tr>
<td>&quot;Dummy Microphone&quot;</td>
<td>This device simulates the microphone impedance and is used to determine the system electrical noise floor and as an aid in troubleshooting. One &quot;dummy mike&quot; per system is recommended.</td>
</tr>
<tr>
<td>Calibrators</td>
<td>At least one calibrator per system is recommended. Multi-frequency calibrators are very useful for checking the &quot;A-weighting&quot; filter characteristic, as well as for demonstrating the variation in human hearing response with frequency.</td>
</tr>
<tr>
<td>Calibrator Inserts</td>
<td>It is often advantageous to use a single calibrator type on different types and sizes of microphones. Plastic inserts are recommended as their low thermal conductivity avoids thermally shocking the microphone in cold weather, a problem encountered with metal inserts. One set is needed for each calibrator.</td>
</tr>
<tr>
<td>Tripod(s)</td>
<td>One tripod per system is necessary to remove the microphone 50 to 100 feet from the observer and any vertical reflective surface.</td>
</tr>
<tr>
<td>Microphone extension cable</td>
<td>Purchase at least one per system. The extension cable permits the microphone to be separated from the meter, as mentioned above. Caution: When ordering extension cable be sure the meter (with built in preamp) has enough power to handle the cable length.</td>
</tr>
</tbody>
</table>
ITEM (Concl'd)

Precision Integrating Sound Level Meter (PILSM)

The PILSM is a highly versatile instrument, part sound level meter-part computer, capable of providing single event metrics LAs and LAd as well as a cumulative metric. This meter can be used both for assessment of airport use restrictions as well as for noise contour validation. Some PILSMs can also provide octave band analysis capabilities. The PILSM "DC output" can be input to a graphic level recorder providing A-weighted time histories.

Sound Level Meter (SLM)

Most SLMs can provide maximum LAs as well as a continuous readout. The "DC output" of most SLM's can also be input into graphic level recorders providing A-weighted time histories. The typical SLM can be used to assess airport use restrictions but is difficult to use in evaluating airport noise contours. Many SLM's also have the capability of assessing octave band sound pressure levels, useful in analyzing stationary noise source problems.

Graphic Level Recorder (GLR)

The GLR is a highly recommended system component. Many situations arise in which a graphic time history "pictorial" is more understandable than tabulated decibels. Caution: The GLR must accept a DC signal within a voltage range corresponding to the SLM or PILSM output voltage. An AC signal GLR cannot be used in a manner which will provide an accurate SLM, slow response time history. The power supply of the GLR can be either AC or DC however a DC power option is highly recommended for field operational flexibility.
<table>
<thead>
<tr>
<th>Item (Cont'd)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portable Aviation Frequency Radio</td>
<td>The portable aviation frequency radio, preferably with rechargeable batteries, is a vital system component. Monitoring the Advisory Terminal Information System (ATIS) frequency provides airport wind and barometric pressure readings. Monitoring tower, approach and departure frequencies provides aircraft identification and most importantly warning that an aircraft overflight is imminent.</td>
</tr>
<tr>
<td>Walkie-Talkies</td>
<td>Communication between noise measurement teams is often a requirement both for aircraft identification as well as redeploying teams in response to a change in airport operational runways. Walkie-talkies can also be useful in estimating aircraft speed between two observation points.</td>
</tr>
<tr>
<td>Camera</td>
<td>A camera is useful for photo-scaling aircraft altitudes. It is usually not necessary to acquire aircraft altitude data, however, special programs do arise in which altitude is required. The camera is also used to document the test site environs, equipment set ups, and microphone locations to resolve post test questions.</td>
</tr>
<tr>
<td>Portable sling psychrometer</td>
<td>The sling psychrometer provides dry-bulb and wet-bulb temperature for computing relative humidity. Sound attenuation varies significantly with temperature and relative humidity and the measurement of those parameters is often necessary.</td>
</tr>
<tr>
<td>100 Ft. Tape Measure</td>
<td>Useful in siting microphone position relative to landmarks as well as microphone height.</td>
</tr>
<tr>
<td>Four-foot long rope (1.2m)</td>
<td>Convenient way to verify microphone height when a tape measure is not available.</td>
</tr>
</tbody>
</table>
2. RECOMMENDED MEASUREMENT PRACTICES. The following list of recommended measurement practices are key elements in providing a traceable record of a noise monitoring program.

   a. Conduct measurement with the microphone(s) at a height of 4 feet (1.2 m) above the ground.

   b. Orient the microphone properly, according to manufacturer's specifications.

   c. Avoid measuring aircraft noise in close proximity to vertical reflective surfaces (at least 25 feet whenever possible).

   d. Avoid overhead obstructions in the vicinity of the microphone. Ideally, a cone of free space, with a half angle of 75 degrees from vertical should exist above the microphone.

   e. Avoid the use of two-way radios in the immediate vicinity of microphone cables and SM's while recording data. The transmission of electromagnetic energy often can be picked up through the noise measurement system.

   f. Calibrate all instrumentation at least once an hour as well as at the beginning and the end of each measurement period. Take special care with calibrators. If a calibrator is dropped it must be checked against another calibrator known to be accurate. For this reason it is a good idea to keep a "laboratory standard" calibrator in the office.

   g. Use a windscreen at all times. Avoid measurements under windy conditions; if unavoidable, document the wind-induced sound level. If maximum sound levels of aircraft or other events exceed the wind noise by more than 10 dB, the sound level measurement error will be less than 0.5 dB.

   h. Check battery energy levels at least once every thirty minutes. Instruments, using nickel-cadmium batteries may require more frequent checking.

   i. Maintain accurate thorough data logs during a measurement program including: day, data, time, calibration levels, noise floor levels, battery checks and the selector and gain settings for every component in the measurement system. Noise event data sheets should also include aircraft type, carrier, elevation angle above the horizon, time, aircraft operation (takeoff or landing), and a space for comments. All intrusive noise events during data recording should be noted. When the time comes to write a report on the measurement survey, all of the little details noted during the test will prove most valuable.

   j. As further documentary record it is always good to draw a schematic diagram of the measurement setup showing equipment, orientation, proximity to obstructions, roadways, etc. Photos of each measurement site are also very useful in going back and addressing questions concerning field procedure or the neighborhood characteristics.
k. During data acquisition for any desired event avoid conversation in the vicinity of the microphone(s). Keep voice levels low at all times. This may seem obvious but is one of the most frequent errors in procedure made by inexperienced persons and observers.

l. The list shown below identifies certain essential items easily overlooked in preparing to go out and measure noise:

1. properly sized calibration screwdriver(s);
2. calibrated watch, clock, or other "time-pieces";
3. extra graphic level recorder pens and paper;
4. spare batteries;
5. maps;
6. data sheets, and clipboard.

m. Two of the "easiest errors to make" in sound level measurement are:

1. Meter Response Time set incorrectly on fast rather than SLOW.
2. Meter weighting network on some other setting than A.

n. The single biggest category of problems encountered with noise measurement equipment involves connections and cables. Time spent in checking and caring for these items will minimize the chance of wasting a day in the field. Avoid pulling cords anywhere but at the connector, avoid kinks in wiring (especially in cold weather) and frequently test cables for continuity. If a cable becomes crimped or damaged in any way, remove it from service until repaired.
APPENDIX 4. BIBLIOGRAPHY

NOISE MEASUREMENT, ESTIMATION, AND FORECASTING


CONSULTATION AND COMMUNITY PARTICIPATION


NOISE ABATEMENT AIRPORT/ AIRCRAFT OPERATIONS


LANG USE PLANNING AND CONTROLS


NOISE LEVEL REDUCTION, SOUNDPROOFING/TREATMENT


APPENDIX 8-P

NOISE ABATEMENT
COMMITTEE MEMBERS
HOISE ABATEMENT COMMITTEE

Capt. R. A. 'Dick' Deeds (WAL), Chairman
6555 Gillis Drive
San Jose, CA 95120
408-268-0670

Capt. Roger J. Nilsen (AOC)
669 Canyon View Drive
Laguna Beach, CA 92651
714-497-7124

Paul D. McCasky (DAL)
Mahant Street
Marblehead, MA 01945
617-631-0034

Capt. Sidney J. Cook (REP)
45 Monticello Way
Enatai I
Fairburn, GA 30213
404-461-8299

Capt. Jim L. McLaughlin (NWA)
56 Birmanwood Drive
Burnsville, MN 55337
612-890-9339

Alvin R. G. 'Al' Kurtzahn (NWA)
Post Office Box #999
Shakopee, MN 55329
206-968-9554