

FAA RW. 21-62
25-63
36-15

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Parts 21, 25, and 36

[Docket No. 23340 Amendment Nos. 21-62, 25-63, and 36-15]

Standards Governing the Noise Certification of Aircraft

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final rule.

SUMMARY: This final rule revises certain provisions of the regulations prescribing requirements for aircraft noise certification to make them more understandable and easier to use. This amendment also contains substantive regulatory changes simplifying noise certification test and recordkeeping requirements. This regulation is part of the President's regulatory reform program and is based on the body of good engineering practice that has developed since the original adoption of Part 36 in 1969. It also reflects comments received from the general public and the aviation industry in response to a Petition for Rulemaking from the Aerospace Industries Association of America and to an FAA Notice of Proposed Rulemaking.

EFFECTIVE DATE: Effective date of this amendment is May 6, 1988.

FOR FURTHER INFORMATION CONTACT: Mr. Harvey VanWynen, Noise Policy and Regulatory Branch (AEE-110), Noise Abatement Division, Office of Environment and Energy, Federal Aviation Administration, 800 Independence Avenue SW., Washington, DC 20591, Telephone (202) 267-3558.

SUPPLEMENTARY INFORMATION: The purpose of this revision is to amend portions of the Federal Aviation Regulations (14 CFR Part 36) and amend references in Part 36 contained in other parts (14 CFR Parts 21 and 25). This amendment is based on Notice No. 85-2 (50 FR 4172, January 29, 1985). Comments were invited. All comments have been received and considered in the issuance of this final rule.

Synopsis of the Proposal

Part 36 of the Federal Aviation Regulation (14 CFR Part 36) contains noise standards for aircraft type and airworthiness certification. As the part is currently organized, Subparts B and C and Appendices A, B, and C apply in part to transport category large airplanes and subsonic turbojet powered airplanes regardless of these

sections of the part to better reflect the actual technical basis for noise certification of aircraft. Substantive changes are made in the noise certification testing, recordkeeping and reporting requirements. The Federal Aviation Administration (FAA) has found that while there will be a substantial cost reduction realized as a result of these changes, there will be no net increase or decrease in noise standard compliance stringency for any class of aircraft. Further, this amendment will not result in any increase or decrease in aircraft noise levels.

Changes in Test Requirements

This amendment to the noise certification test requirements is intended to simplify the noise test procedures, to clarify the purpose of the tests, to update equipment specifications to better accommodate the use of modern digital electronics, and to further reduce the number of flight tests conducted solely for approval of relatively minor aircraft modifications. One such change involves decreasing from four to two the minimum number of sideline noise measuring stations which are used to define the maximum sideline noise. By placing the remaining microphones on either side of the point where the jet aircraft reaches 1000 feet or 1440 feet altitude (AGL), the maximum aircraft noise can be accurately determined at significantly lower costs for equipment, installation, calibration and data reduction.

Similarly, relative humidity and wind limits on test conditions are eased to maximize available test sites and usable days at those sites. The humidity limit is increased for those applicants using higher-precision instruments, while the wind limit increase is based on wide industry/government experience. The requirement which specifies the location of the meteorological instrumentation is clarified to require that the weather be measured in the vicinity of the noise measuring stations, rather than at the nearest airport.

A number of technical amendments to the analyzer specifications and to the data reporting requirements are adopted to facilitate the use of a wider variety of instrumentation, particularly the newer digital analyzers. Further, because recent computer processing advances make it possible to use data closer to the ambient noise floor and, in some cases, to reconstruct data where parts of the spectrum are below the ambient, greater flexibility is provided to the FAA in approving test and analysis procedures.

One of the major purposes of this amendment is to provide clearer

guidelines on the use of nonflight, supplemental tests to meet Part 36 certification requirements. The cost of noise certification of a single jet aircraft type often runs from several hundred thousand dollars to well over a million. Where a long production run of a complex and sophisticated aircraft is anticipated, this cost is generally insignificant when compared to the total development cost of the project. However, to meet the increasingly competitive nature of aviation in this decade, aircraft manufacturers have shortened production runs of standard models and now produce families of related short production run versions. This revision will make it easier to collect a flight data base of sufficient quality and breadth from the first aircraft in such a family so that other related aircraft can be noise certificated using that data base, supplemented by only relatively simple and inexpensive tests and analyses. For instance, noise data from static tests conducted at either the engine or aircraft manufacturer's ground facilities may be approved, as appropriate, by FAA certifying authorities.

Changes in Documentation Requirements

The documentation requirements placed on industry and on individual applicants are reduced as a result of this amendment. These changes will result in lower expenditures in manpower and effort by the government in the review and approval of noise certification documents.

The elimination of certain requirements for prior FAA approval of test procedures greatly simplify the paperwork prior to the test, as well as simplify the test itself. As amended, Part 36 retains the requirement for an approved test plan, albeit a simpler one. Similarly, the certification report requirement which contains the engineering data supporting the certification also remains.

Reduction of the post-certification paperwork, however, is where this amendment works its greatest effect. Previously, Part 36 required that each Airplane Flight Manual (AFM) must contain all procedures that are employed in the flight test, the certificated noise levels, any weight limitations that were required to meet the noise level requirements, and "other information for the flight crew." While this did not appear to be an onerous burden at the time the original Part 36 was adopted, the FAA has found a number of situations where these seemingly simple requirements have

resulted in a distortion of the AFM functions. Several large commercial jet aircraft types have been certificated with hundreds of different versions within each type. As a result, the AFMs contain hundreds of pages of noise "information." Under these circumstances, it becomes extremely difficult to identify which data are applicable to any particular airplane on a given day.

The AFM is a required document providing on-board information necessary for the flight crew. It contains specific aircraft performance data, flight procedures, and aircraft limitations vital to the safe operation of the airplane. As indicated above, noise information is also included. However, after careful consideration, the FAA found that it was appropriate to greatly reduce and simplify the noise portion of the manual. Aircraft weight limits or operating configurations required to meet Part 36 certification will continue to be placed in the limitations section of the AFM. However, beyond this, the FAA feels that only the minimum information necessary to obtain a Part 36 compliance statement and the takeoff, approach, and sideline noise levels for that specific airplane configuration is needed. Thus, the FAA clarifies Parts 25 and 36 to preclude the inclusion of inappropriate information in the AFM.

Other Changes

The acoustical change provisions of Part 21 are clarified by specifically excepting from the noise certification requirements several temporary configurations and conditions used for maintenance. Since none of these conditions represents the permanent configuration of any aircraft type, the FAA finds that this action is consistent with Section 611 of the Federal Aviation Act (as amended).

Numerous references to obsolete dates and conditions are removed to shorten and simplify Part 36 while several sections have been retitled more appropriately.

Regulatory History

Since its adoption in November 1969, FAR Part 36 has been a significant basis for all Federal aircraft noise regulations in the United States. That regulation was structured to provide a firm, consistent foundation for subsequent rulemaking activities to abate and control aircraft noise. Part 36 includes precise instructions concerning the acquisition, processing, and documentation of noise data from in-flight aircraft. As originally promulgated, part 36 applied only to turbojet aircraft and propeller-driven

transport category airplanes over 12,500 pounds maximum gross weight.

Amendment 36-4 (40 FR 1029, January 6, 1975) added noise certification standards for propeller-driven small airplanes. The noise level limits for certain new turbojets and transport category airplanes were lowered in 1977 by Amendment 36-7 (42 FR 12360, March 3, 1977). In 1978, these lower noise level standards were applied to derivatives of older aircraft types. Noise standards for Concorde supersonic transport airplanes were also adopted in 1978 by Amendment 36-10 (43 FR 28406, June 29, 1978).

Amendment 36-9 (43 FR 873, March 2, 1978), which was adopted in 1978, widely revised the test and analysis specifications contained in Appendices A and B of Part 36. The specifications were expanded to include technical details that had been omitted from the original publication. An example of this was the addition of a section on the calibration of acoustical test equipment. Other changes were made to bring FAR Part 36 into substantial agreement with international standards on noise measurement and with the procedures adopted for noise certification by the International Civil Aviation Organization (ICAO).

The FAA published (47 FR 47854, October 28, 1982) for public comment, a petition from the Aerospace Industries Association of America (AIA) on behalf of its member aircraft manufacturers for amendment of FAR Parts 21 and 36. Notice No. 85-2 (50 FR 4172, January 29, 1985) contained a summary of the comments submitted to the Docket in response to the petition, and the disposition of the issues raised. Notice No. 85-2 also proposed 41 specific changes to Part 36. A discussion of docketed comments on those proposals and the disposition of the issues follow.

Discussion of Comments

Interested persons have been afforded the opportunity to participate in development of all aspects of this rulemaking by submitting written comments to the public regulatory docket. The period for submitting comments closed April 4, 1985. All comments received have been reviewed and considered in the issuance of this final rule.

Thirteen public comments were received in response to the notice (Docket No. 23340). All of the commenters supported the stated goals and most of the 41 proposed amendments. In addition, nearly every response contained specific suggestions or recommendations about one or more issues.

The comments are discussed below. They are grouped by broad categories of issues.

Acoustical Change

Meeting the noise requirements of Part 36 is one of the steps in the certification approval process for any change to an already certificated aircraft. Included are changes to the aircraft type design which might affect the noise emission characteristics of the aircraft. The definition of acoustical change and the requirement to meet Part 36 standards for design changes within that definition are in Part 21. In Notice 85-2, the FAA proposed to exempt from the definition of acoustical change for turbojet aircraft and transport category large aircraft configured for (a) gear down flight with one or more retractable landing gear down during the entire flight and (b) carriage of a spare engine and nacelle carriage external to the skin of the airplane (and just the pylon or other external mount).

Only two comments were received on this issue. Both supported the proposed change as reasonable and necessary. The FAA agrees and is adopting the modification as proposed.

Aircraft Flight Manual

Over the past several years, there has been some concern that the aircraft operational limits, if any, that are established as a result of FAR 36 noise certification are not being expressed properly in the Aircraft Flight Manual (AFM) when promulgated with reference to the airworthiness limitations. To clarify the intent of the existing regulations, Notice No. 85-2 proposed to add clarifying language in Part 25 (where additional AFM requirements are listed) and in Part 36.

Section 25.25(a) clarifies that the maximum gross weight which meets the noise requirements of Part 36 limits the maximum certification weight. One of the two commenters supported the clarification; the other, a large trade association, reported that some members were opposed while others were favorable. The FAA notes that this provision does not change the regulatory requirement, but simply clarifies the Part 25 certification process by expressly referencing the weight certification requirements of Part 36. The FAA, therefore, is adopting this clarification.

Similarly, Notice No. 85-2 proposed to clarify the definition of Stage 1, Stage 2, and Stage 3 airplanes by categorically stating that each airplane can only be classified in one stage given a specific configuration.

Five commenters responded on this issue. All were opposed to the specific wording proposed for § 36.1(g) because, in their opinion, the words could be interpreted as requiring each airplane to remain within one Part 36 Stage. However, none of the commenters appeared to object to the stated intent of the proposal and several suggested small changes in the regulatory language to eliminate the problem.

For more than a decade, the FAA has both encouraged and required the application of available noise reduction technology. The goal has been to move Stage 1 aircraft into Stage 2 and Stage 2 aircraft into Stage 3. In most cases, this has been done voluntarily without the need for regulation. The FAA does not intend to inhibit such actions. Therefore, in light of the comments the FAA had decided to accept the suggestion of one commenter that the regulation should more clearly indicate that an airplane may not be certified to two stages simultaneously or that an airplane may not, without a change in type design configuration, comply with one stage and then another. Further, it should be noted that current regulations clearly prohibit Stage 2 or Stage 3 aircraft from becoming Stage 1 aircraft.

Notice No. 85-2 also proposed three minor changes in § 36.1581 to clarify that the AFM allows only one certification noise value each for takeoff, approach, and sideline. Since, for flight safety reasons, the AFM on board any airplane may only describe the one current certificated configuration for the airplane, the present rules only require the AFM to have the noise information for that one configuration. As noted in Notice 85-2, the lack of clarity in the Federal Aviation Regulations has caused some manuals to contain detailed noise information on dozens and possibly hundreds of different configurations. The AFM, however, is basically a flight safety document containing vital information for the pilot and crew. While it was determined more than 15 years ago that it would serve a legitimate and useful purpose for the AFM to contain limited noise information, it never was intended for the AFM to become a noise primer on every possible variation in noise levels that might result from changes in configuration, operating procedure, or weather conditions. Thus, Notice 85-2 proposed to consolidate the existing regulations that affect the selection of noise data for the AFM and eliminate the requirement for noise certification test procedures to be included.

Seven comments were received on the proposed amendments to § 36.1581. All

agreed with the need to reduce the volume of noise information in the AFMs and with the proposal to eliminate the requirement for noise certification test procedure documentation. Several commenters expressed concern that the FAA's proposed language would limit the use of several "configurations" that have been approved for both safety and noise. The FAA cannot agree.

An airplane is a versatile machine. In most cases, it is designed and built so that it may be operated with different combinations of weight, speed, flap settings, engine power setting, etc. Combinations of these parameters are optimized by the manufacturer for different missions (range payload, speed, weather, runway length, etc.). Each combination is called a configuration. Each configuration, in turn, has clearly stated operating limits involving various parameters. These limits are set by the airplane's manufacturer on the basis of safety. Occasionally, these limits may be further restricted by the manufacturer to lower the noise level of the airplane. The FAA oversees this process on each configuration of every airplane type, maintaining first the highest degree of safety. The FAA's approval is called certification. As a part of this certification, the FAA approves the manufacturer's AFM which contains detailed information needed by the pilot and crew to safely operate the airplane within the limitations of one configuration.

An airline or other operator may purchase from the manufacturer the right to use several different configurations of the same airplane. However, for safety reasons it is vital that the pilot and crew know the limitations applicable to the specific configuration that they are flying that day. Thus, FAA safety rules require each AFM to describe only one configuration at any point in time, no matter how many other configurations the manufacturer has sold to the operator. The proposed changes to § 36.1581 would not change this; they would only restate the existing airworthiness requirement in that portion of Part 36 which deals with AFM information. The FAA believes that this is necessary to avoid confusion. For that reason, the proposed amendments to § 36.1581 are adopted.

Obsolete Dates and Conditions

Numerous references to dates and conditions that are no longer pertinent to present and future applicants for type certification were proposed for removal under Notice No. 85-2. All commenters

to the Docket endorsed this activity. Three, however, had comments on specific proposed deletions. A U.S. trade association suggested that "(except as provided in § 36.7)" be inserted in § 36.201(b) after the words "type certifications." The FAA does not agree and the language as proposed in the Notice is adopted.

A British trade association and a British manufacturer submitted identical comments suggesting deletion of the provisions, contained in § 36.7(d), which use the engine bypass ratio in determining which provisions apply to applications for "acoustical changes". The FAA agrees that § 36.7(d) should be simplified and shortened. However, the FAA also believes that implementation of this specific suggestion would be neither economically reasonable nor technologically practicable. The differing technologies available to high and low bypass ratio engines require different treatment under the regulation. Thus, the FAA believes that implementation of this suggestion would have the effect of restricting the applicability of Part 36 to new type designs and to the first few derivative configurations. Since adoption of this restriction would prevent the FAA from complying with the intent of Part 36, the FAA declines to accept the suggestion.

Certification Reports

Sections 36.1501 and A36.5 contain the documentation requirements for technical data reports on certification tests and results. Notice 85-2 proposed to clarify the required information and further proposed to specifically allow inclusion of data from supplemental test (such as ground-based static tests of engines). This increased flexibility would allow wider use of cost-saving equivalent procedures as long as the data could be analyzed to yield results that would be equivalent to the results of actual aircraft flight tests.

Only one comment was received on the proposed change to § 36.1501. The commenter opposed the use of "equivalent procedures" such as ground-based static engine tests since such tests by themselves would not be a true measure of the noise increments experienced from an engine change. The commenter states that such changes are often accompanied by changes in nacelles, wing design, fuselage length, and gross weight. The FAA, on the basis of experience, agrees with the reasoning but does not agree with the conclusion. No equivalent procedure has ever been approved (nor would it be under the revised text) under the conditions described where the only supplemental

data are those derived from static engine testing. All acoustical and performance data used to develop noise certification levels are based on actual flight tests. The supplemental tests which would be documented under § 36.1501 and section A36.5 are only used to make adjustments to the flight data where it can be shown that there are no other changes to the noise sources, including their relative contributions to the total noise signature. Supplemental flight data or a totally new flight data base might be necessary to derive the noise level numbers under the cited conditions. For these reasons, and because the proposed change would not affect the approval of equivalent procedures but only the test documentation, the FAA disagrees and adopts the language proposed on the Notice.

Two comments were received on the proposed change to section A36.5. Both suggested the inclusion of "appropriate propeller powered aircraft performance parameters relevant to noise generation." While the FAA believes this suggestion may be valuable, its inclusion would be outside the scope of Notice 85-2. The FAA will consider including this concept in future rulemaking.

One commenter also noted that the wording of the proposed revision to section A36.5(b)(5)(vii) would remove the requirement for aircraft height and position data independent of normal flight instrumentation. Since this is a key part of ICAO certification, adoption of the proposed wording could have the effect of invalidating international acceptance of U.S. certifications, along with the attendant economic consequences. The FAA did not intend to remove the requirement for independent height and position data, but agrees that the proposed wording would have that effect. Consequently, the FAA has decided not to adopt the proposed revision of that section.

Test Procedures

Notice 85-2 proposed nine separate changes in the Part 36 noise certification test procedures. In each case, the intent of the proposed change was to lower the cost of certification without significantly diluting the quality of the noise data used for certification.

Seven comments were received on the proposed changes to section A36.1(b). All supported the proposed simplifications, although one commenter expressed concern with regard to the FAA's credibility in administering the noise certification process. It should be noted that the FAA continues its commitment to a strong noise regulatory

structure. To this end, the FAA has reviewed these procedures with national and international experts and remains confident that the noise certification process will remain intact and effective. Simplification and cost savings are not being purchased by a decrease in stringency or thoroughness.

In response to a British suggestion, the word "height" is substituted for "altitude" in section A36.1(b)(7) to signify the airplane's height above the local terrain containing the noise measuring sites. Similarly, a test tolerance (500 to 0 ft.) on this height is inserted, because without such a tolerance the airplane would be required to make every test flight 1000 to 1440 ft. above the terrain.

Notice 85-2 proposed to require more accurate measurements of ambient temperature and relative humidity. It also establishes a higher upper limit average wind speed for the microphone and a higher limit crosswind speed average for the aircraft. It also proposed to increase the upper limit average wind speed from 10 knots to 12 knots for the instrumentation and the acceptable crosswind speed for the microphone from 5 knots to 7 knots. The maximum wind speed cannot exceed 15 knots for the instrumentation and 10 knots for the crosswind. The Notice also proposed to clarify that the meteorological variables should be measured in the vicinity of the noise monitors. Widening these weather windows would lower costs to both industry and government by minimizing the delays which presently tie up equipment, aircraft, and personnel for days while waiting for specific weather conditions. Five comments were received. One supported the proposal, one wanted to remove all test weather limits under certain conditions, and three foreign organizations objected because of the belief that the Notice proposed maximum winds of 15 knots and crosswind limits of 10 knots. They suggested use of the ICAO limits, 12 and 7 knots, respectively. However, the FAA notes that Notice 85-2 did, indeed, propose the ICAO values of 12 and 7 knots for the upper average limits while also setting maximum values. Therefore, the FAA adopts the proposed revisions.

A number of changes were proposed in the technical specifications for the electronic equipment used in the collection and analysis of the noise data. These changes generally follow the standards adopted by the ICAO and should minimize costs where manufacturers have to certificate to both ICAO and U.S. standards.

Eight comments were received on the proposed revisions to the microphone specifications. Most were general

comments on the need to duplicate the ICAO specifications. One specific comment noted that the wording of the last sentence of section A36.3(c)(2)(ii) varied somewhat from the ICAO standard and that this difference would cause applicants difficulty. After considering the issue, the FAA agrees and the amended specification is adopted with the suggested change.

The FAA also proposed to revise the electronic specifications for the noise analyzer. Earlier specifications were based on the analog system used a decade ago. Notice 85-2 proposed, instead, to update this section, based on the digital equipment currently in use. Since ICAO has not yet adopted similar revisions, most of the seven commenters recommended delaying adoption. However, the FAA believes that the problems encountered by both applicants and government in trying to qualify digital systems under analog specifications require the FAA to act. Thus, the proposed revision to section A36.3(d) is adopted. However, should ICAO eventually adopt differing specifications, it is the intention of the FAA to issue a subsequent notice proposing adoption of the ICAO standard in the United States. In adopting section A36.3(d)(5)(i), the FAA also corrects a typographical error that appeared in the Notice. The correct standard deviation is 0.48 decibels.

Data Correction and Analysis

Notice 85-2 proposed to amend section A36.5 to clarify the information that is needed to correct the data to standard reference conditions in that the referenced atmosphere should be considered to be homogeneous. Specifically, only those engine performance parameters relevant to noise generation, such as net thrust, engine pressure ratio, exhaust temperatures, and fan or compressor rotational speeds, would be reported. Aircraft sound pressure levels need to exceed the ambient background by only 3 decibels instead of the present 5 decibels. The Notice proposed to allow lower signal-to-noise ratios if the method for separating the signal from the noise is approved by the FAA. Several other amendments to Appendices A and B of FAR 36 were proposed that would make relatively minor changes to mathematical constants in the correction procedures or that would make minor revisions in the description of the procedures. These were considered to be clarifying, not substantive, even when the amount of data to be reported was reduced.

Seven of the comments responded to these proposed changes with suggestions for improving the clarity of the revisions. These minor typographical suggestions have been incorporated.

Other Comments

Several respondents to the Docket took the opportunity to make suggestions for additional changes and modifications outside the scope of Notice 85-2. Even though some of these comments appear to have merit, the FAA does not believe their cumulative value justifies a delay in issuing this final rule in order to issue a supplemental NPRM.

Section-by-Section Analysis

Part 21

Section 21.93 prescribes the procedural requirements for the approval of changes in type design that may increase the noise levels of an airplane type. Paragraph (b)(2) is amended to add an exclusion for gear down flight with one or more retractable landing gear down during the entire flight and for spare engine and nacelle carriage external to the airplane skin (and the return of the pylon or other external mount).

Part 25

Section 25.25 contains the criteria upon which the maximum weight of an aircraft is based. This section is clarified to note that the highest weight at which compliance is shown with the certification requirements of Part 36 may be, under some circumstances, the limiting maximum weight.

Part 36

The last sentence of § 36.7(e)(1) is amended to clarify that Part 36 noise tradeoff provisions may not be used to increase non-complying Stage 1 noise levels. The Part 36 tradeoff provisions can be used, however, once the modified airplane qualifies as a complying Stage 2 airplane. This could occur, for instance, when the aircraft increase in weight raised the allowable Stage 2 limit by more than the measured increase in noise.

Sections 36.7 (d) and (e) and 36.301(b) are revised to remove obsolete language, dates, and references. Sections 36.201 (c) and (d) are deleted for similar reasons.

Section 36.1501 is expanded to clarify the need for approval of equivalent procedures and to allow wider flexibility in the use of non-flight test data to supplement approved flight data bases.

Two subparagraphs are added to § 36.1581(a) to clarify that only one value for each noise certification test

point for takeoff, sideline, and approach as defined by Appendix C may be placed in the Aircraft Flight Manual, along with associated weight and configuration. Similarly, one value for flyover as defined by Appendix F for propeller driven small airplanes may be placed in the Aircraft Flight Manual. If additional operational noise information is included in the Aircraft Flight Manual, it must be segregated from the certification data in accordance with § 36.1581(b). The old § 36.1581(c) is reworded to clarify its intent and redesignated as (d).

Appendix A of Part 36

Section A36.1(b) is revised to allow flight path intercept tests, rather than requiring only full stop takeoffs and landings for every test. This section is also amended to allow a minimum of two symmetrically-placed microphones to measure the sideline noise rather than the minimum of four currently required. Both changes are expected to provide wider flexibility in the choice of test sites and to significantly lower the cost of such tests.

Section A36.1 is revised to expand the flight test weather window when the dew point and dry bulb temperature are measured with an instrument accurate to within one-half degree Centigrade. The allowable winds during the test are increased to those specified in ICAO Annex 16. The requirements to generate noise level versus weight information for takeoff and approach are deleted.

A number of the technical specifications in section A36.3 are revised to accommodate the use of digital recording and filtering techniques. Sections A36.3(e)(7) is revised to require a performance calibration analysis of each piece of calibration equipment at least once every six months.

Section A36.5 contains the requirements on reporting and correcting measured data. Section A36.5(b) is revised to eliminate the need to obtain engine performance data solely from flight instrumentation or manufacturer's data. By this revision, static tests and other sources of supplemental data can be employed. Section A36.5(c) is also amended to indicate that the noise certification atmosphere is homogeneous. That section is also amended to replace an erroneous reference to "design" landing weight with the correct reference to "maximum" landing weight.

Section A36.5(d) is amended to accept one-third octave band data that are at least 3 decibels above the mean background noise in that band. Before this amendment, the data had to be at

least 5 decibels above ambient. This change permits greater flexibility in the choice of test conditions and is particularly necessary for the test of quiet airplanes. Greater flexibility is also provided by the approved use of time/frequency interpolation and equivalent procedures within the indicated limits.

Section A36.5(e) is revised to add a new paragraph (4) which specifically allows the orderly development of noise certification for certain derivatives of aircraft type design, and provides simplified methods for computing the 90 percent confidence limit for those derivatives.

The requirements in section A36.9(b) for locating meteorological measurements have been changed to permit their placement near the measuring stations, rather than using meteorological data from the nearest airport. This is intended to improve the quality of the meteorological data in those cases where the flight tests are not conducted at an airport. Another change to the meteorological specifications is made in section A36.9(d)(2) where the criterion for using the simplified method for deriving the values of the atmospheric coefficients has been broadened. Accordingly, the simplified method may be used if the atmospheric absorption coefficients do not vary over the sound propagation path of the maximum noise by more than plus or minus 1.6 decibels per thousand feet in the 3150 Hertz one-third octave band.

Section A36.11(a)(3)(v) is amended to delete the requirement for graphical or tabular data presentations during data correction. These corrections may not be done by computer or other appropriate means.

Several small corrections are made to section A36.11(e). One updates a cross-reference to sections A36.11 (b) and (c), while the others correct a mathematical constant used in the Delta 2 calculations for takeoff, approach and sidelines.

Section A36.11(f) is completely revised and considerably shortened to provide clearer guidance or appropriate correction procedures when the takeoff and/or approach noise measurements are made at non-standard locations. Two alternative methods are provided.

Appendix B of Part 36

Section B36.5(h) and Table B-2 are revised to eliminate calculation of tone penalties for tones less than 1.5 decibels.

Sections B36.9, B36.11, and B36.13 contain the technical and mathematical details of the methods for calculating Effective Perceived Noise Levels (EPNL). Several small changes are made in the

formulation to simplify the computerized procedure.

Appendix C of Part 36

Sections C36.5(c), C36.7(d), and C36.9(d) are deleted as unnecessary and the subsequent sections are redesignated accordingly. Sections C36.7 and C36.9 are retitled to better describe their functions.

Regulatory Impact Evaluation

The FAA conducted a detailed regulatory evaluation which is included in the regulatory docket. This evaluation assesses the economic impact of all changes to Parts 21, 25, and 36. The FAA has determined that this rule is consistent with the objectives of Executive Order 12291 as part of the President's Regulatory Reform Program to reduce regulatory burdens on the public. This rule imposes no additional costs on the Federal government.

The amendments in this rule will provide benefits in the aggregate to the aviation industry and the general public. These benefits arise from deletion of unnecessary noise certification testing and recordkeeping requirements, clarification of regulatory text, and relaxation of certain test and documentation requirements. The amendments better reflect new technologies and consequently many amendments are clarifying and editorial in nature. As an overall result of these amendments, the regulations are more concise and easier to understand. None of the amendments are expected to result in a major cost to the aviation industry. There are 10 amendments which are expected to yield minimal to minor benefits and three amendments are expected to result in minimal to minor costs. One of the amendments which will reduce from 4 to 2 the number of sideline measurement stations needed as part of the aircraft noise certification process is estimated to save manufacturers approximately \$2.0 million discounted over a 10 year period. For the reasons stated above, the benefits flowing from these amendments substantially outweigh any associated costs.

Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 (RFA) was enacted by Congress to ensure that small entities are not unnecessarily and disproportionately burdened by government regulations. The RFA requires government agencies to review rules which may have a "significant economic impact on a substantial number of small entities."

These amendments directly impact large manufacturers of aircraft. The

FAA size threshold for a determination of a small entity for aircraft manufacturers is 75 employees; that is, any aircraft manufacturer with more than 75 employees is considered not to be a small entity. Based upon this size threshold, the aircraft manufacturers affected by this rule are not small entities. Moreover, of the potential cost impacts, three require minimal computer programming changes which can be accomplished in-house. One of the amendments is estimated to save the manufacturers approximately \$2.0 million. The remaining changes are editorial in nature. This rule will not have any significant economic impact.

Therefore, the FAA certifies, this rule will not have a significant economic impact on a substantial number of small entities under the criteria of the Regulatory Flexibility Act.

Environmental Analysis

Pursuant to Department of Transportation "Policies and Procedures for Considering Environmental Impacts" (FAA Order 1050.1D), a Finding of No Significant Impact has been made. These amendments are primarily administrative, clarifying and organizational, and do not significantly affect the quality of the human environment.

Conclusion

For the reasons stated above, the FAA has determined that this document involves a regulation which is not major as defined in Executive Order 12291 and not significant under Department of Transportation Regulatory Policies and Procedures (44 FR 11034, February 26, 1979). In addition, the FAA certifies that under the criteria of the Regulatory Flexibility Act this final rule will not have a significant economic impact on a substantial number of small entities. A copy of the regulatory evaluation may be examined in the regulatory docket or obtained by contacting the person identified under the caption "FOR FURTHER INFORMATION CONTACT."

List of Subjects

14 CFR Part 21

Aircraft certification procedures for products and parts, Aircraft.

14 CFR Part 25

Airworthiness standards, Aircraft.

14 CFR Part 36

Noise standards, Aircraft noise and type certification.

The Final Rule

Accordingly, the Federal Aviation Regulations (14 CFR Parts 21, 25, and 36)

are amended, effective May 6, 1988, as follows:

PART 21—CERTIFICATION PROCEDURES FOR PRODUCTS AND PARTS

1. The authority citation for Part 21 continues to read as follows:

Authority: 49 U.S.C. 1344, 1348(c), 1352, 1354(a), 1355, 1421 through 1431, 1502, 1651(b)(2), 42 U.S.C. 1857f-10, 4321 et seq.; E.O. 11514; 49 U.S.C. 106(g) (Revised Pub. L. 97-449, January 12, 1983).

2. Section 21.93(b)(2) is revised to read as follows:

§ 21.93 Classification of changes in type design.

* * * * *

(b) * * *

(2) Turbojet powered airplanes (regardless of category). For airplanes to which this paragraph applies, "acoustical changes" do not include changes in type design that are limited to one of the following—

(i) Gear down flight with one or more retractable landing gear down during the entire flight, or

(ii) Spare engine and nacelle carriage external to the skin of the airplane (and return of the pylon or other external mount), or

(iii) Time-limited engine and/or nacelle changes, where the change in type design specifies that the airplane may not be operated for a period of more than 90 days unless compliance with the applicable acoustical change provisions of Part 36 of this chapter is shown for that change in type design.

* * * * *

PART 25—AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY AIRPLANES

3. The authority citation for Part 25 is revised to read as follows and the authority citations following the sections in Part 25 are removed:

Authority: 49 U.S.C. 1344, 1354(a), 1355, 1421, 1423, 1424, 1425, 1428, 1429, 1430; 49 U.S.C. 106(g) (Revised Pub. L. 97-449, January 12, 1983).

4. Section 25.25 is amended by adding "; or" at the end of paragraph (a)(2) and by adding a new paragraph (a)(3) to read as follows:

§ 25.25 Weight limits.

(a) * * *

(3) The highest weight at which compliance is shown with the certification requirements of Part 36 of this chapter.

* * * * *

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

5. The authority citation for Part 36 continues to read as follows:

Authority: 49 U.S.C. 1344, 1348, 1354(a), 1355, 1421, 1423, 1424, 1425, 1428, 1429, 1430, 1431(b), 1651(b)(2), 2121 through 2125; 42 U.S.C. 4321 et seq.; Sec. 124 of Pub. L. 98-473, E.O. 1114, 49 U.S.C. 106(g) (Revised Pub. L. 97-449, January 12, 1983).

6. Section 36.1 is amended by redesignating (g) as (h) and adding a new (g) to read as follows:

§ 36.1 Applicability and definitions.

(g) For purposes of showing compliance with this part for transport category large airplanes and turbojet airplanes regardless of category, each airplane may not be identified as complying with more than one stage or configuration simultaneously.

7. Section 36.7 is amended by revising the last sentence of paragraph (c)(1), and revising paragraphs (d) and (e) to read as follows:

§ 36.7 Acoustical change: Transport category large airplanes and turbojet powered airplanes.

(c) * * *
(1) * * * There tradeoff provisions of section C36.5(b) of Appendix C of this part may not be used to increase the Stage 1 noise levels, unless the aircraft qualifies as a Stage 2 airplane.

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

(1) *Airplanes with high bypass ratio turbojet engines.* For an airplane that has turbojet engines with a bypass ratio of 2 or more before a change in type design—

(i) The airplane, after the change in type design, may not exceed either (A) each Stage 3 noise limit by more than 3 EPNdB, or (B) each Stage 2 noise limit, whichever is lower:

(ii) The tradeoff provisions of section C36.5(b) of Appendix C of this part may be used in determining compliance under this paragraph with respect to the Stage 2 noise limit or to the Stage 3 plus 3 EPNdB noise limits, as applicable; and

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

(2) *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 a change in type design—

(i) The airplane may not be a Stage 1 airplane after the change in type design; and

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

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

(1) If compliance with Stage 3 noise levels is not required before the change in type design, the airplane must—

(i) Be a Stage 2 airplane after the change in type design and compliance must be shown under the provisions of paragraph (d)(1) or (d)(2) of this section, as appropriate; or

(ii) Remain a Stage 3 airplane after the change in type design. Compliance must be shown under the provisions of paragraph (e)(2) of this section.

(2) If compliance with Stage 3 noise levels is required before the change in type design, the airplane must be a Stage 3 airplane after the change in type design.

8. Section 36.201(b) is revised and (c) and (d) are removed.

§ 36.201 Noise limits.

(b) Type certification applications for subsonic transport category large airplanes and all subsonic turbojet powered airplanes must show that the noise levels of the airplane are no greater than the Stage 3 noise limits prescribed in section C36.5(a)(3) of Appendix C of this part.

9. Section 36.1501 is revised to read as follows:

§ 36.1501 Procedures, noise levels and other information.

(a) All procedures, weights, configurations, and other information or data employed for obtaining the certified noise levels prescribed by this part, including equivalent procedures used for flight, testing, and analysis, must be developed and approved. Noise levels achieved during type certification must be included in the approved airplane (rotorcraft) flight manual.

(b) Where supplemental test data are approved for modification or extension of an existing flight data base, such as acoustic data from engine static tests used in the certification of acoustical

changes, the test procedures, physical configuration, and other information and procedures that are employed for obtaining the supplemental data must be developed and approved.

10. Section 36.1581 is amended by revising paragraph (a); removing paragraph (c); redesignating paragraphs (b), (d), (e), and (f), as (c), (e), (f), and (g) respectively; adding new paragraphs (b) and (d); and revising newly redesignated paragraph (g) to read as follows:

§ 36.1581 Manuals, markings, and placards.

(a) If an Airplane Flight Manual or Rotorcraft Flight Manual is approved, the approved portion of the Airplane Flight Manual or Rotorcraft Flight Manual must contain the following information, in addition to that specified under § 36.1583 of this part. If an Airplane Flight Manual or Rotorcraft Flight Manual is not approved, the procedures and information must be furnished in any combination of approved manual material, marketing, and placards.

(1) For transport category large airplanes and turbojet powered airplanes, the noise level information must be one value for each takeoff, sideline, and approach as defined and required by Appendix C of this part, along with the maximum takeoff weight, maximum landing weight, and configuration.

(2) For propeller driven small airplanes the noise level information must be one value for flyover as defined and required by Appendix F of this part, along with the maximum takeoff weight and configuration.

(b) If supplemental operational noise level information is included in the approved portion of the Airplane Flight Manual, it must be segregated, identified as information in addition to the certificated noise levels, the clearly distinguished from the information required under § 36.1581(a).

(d) For transport category large airplanes and turbojet powered airplanes, for which the weight used in meeting the takeoff or landing noise requirements of this part is less than the maximum weight 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. Further, the maximum takeoff weight must not exceed the takeoff weight that is most critical from a takeoff noise standpoint.

(g) Except as provided in paragraphs (d), (e), and (f) of this section, no operating limitations are furnished under this part.

Appendix A—Aircraft Noise Measurement Under § 36.101

11. Section A36.1 is amended by revising paragraphs (b)(1), (b)(7), (c)(3), (c)(4); and removing (d) (5)(iii) and (7)(iii) to read as follows:

Section A36.1 *Noise certification test and measurement conditions.*

* * * * *

(b) * * *

(1) Tests to show compliance with established aircraft noise certification levels must consist of a series of takeoffs and approaches (or stabilized flight path segments thereof) during which measurements must be taken at noise measuring stations located at the measuring points prescribed in section C36.3 of Appendix C of this part. Each recorded segment must include measurements throughout the entire time period in which the recorded signal is within 10 dB of PNLTM.

* * * * *

(7) A minimum of two noise measuring stations, symmetrically positioned about the test flight track, must be used to define the maximum sideline noise with respect to location and level as required by section C36.3 of Appendix C of this part. For turbojet powered aircraft, when approved by the FAA, the maximum sideline noise at takeoff thrust may be assumed to occur at the point (or its approved equivalent) along the extended centerline of the runway where the aircraft reaches 1000 feet (305 meters) altitude above ground level. A height of 1440 feet (439 meters) may be assumed for Stage 1 or Stage 2 four engine airplanes. The altitude of the aircraft as it passes the microphone stations must be within +500 to -0 feet (+150 to -0 meters) of the target altitude. For aircraft powered by other than turbojet engines, the altitude for maximum sideline noise must be determined experimentally.

(c) * * *

(3) Relative humidity and ambient temperature over that portion of the sound propagation path between the aircraft and a point 10 meters above the ground at the noise measuring station is such that the sound attenuation in the one-third octave band centered a 8 kHz is not greater than 12 dB/100 meters and the relative humidity is between 20 and 95 percent, inclusively. However, if the dew point and dry bulb temperature used for obtaining relative humidity are measured with a device which is accurate to within ±0.5 °C, the sound attenuation rate shall not exceed 14 dB/100 meters in the one-third octave band centered at 8kHz.

(4) Average wind velocity 10 meters above ground is not to exceed 12 knots and the crosswind velocity for the airplane is not to exceed 7 knots. The average wind velocity shall be determined using a thirty-second averaging period spanning the 10 dB down time interval. Maximum wind velocity 10 meters above ground is not to exceed 15

knots and the crosswind velocity is not to exceed 10 knots during the 10 dB down time interval.

* * * * *

12. Section A36.3 is amended by revising paragraphs (c)(2), (d)(2), (d)(5), (d)(6), and (e)(7) to read as follows:

Section A36.3 *Measurement of aircraft noise received on the ground.*

* * * * *

(c) * * *

(2) The microphone must be a pressure sensitive capacitive type, or its approved equivalent, such as free field type with incidence corrector.

(i) After an adequate "warm-up" period, at least as long as that specified by the equipment manufacturer, the system output for constant acoustical input shall change by not more than 0.3 dB within any one hour nor by more than 0.4 dB within 5 hours.

(ii) The variation of microphone and preamplifier system sensitivity within an angle of ±30 degrees of grazing (60-120 degrees from the normal to the diaphragm) must not exceed the following values:

Frequency (Hz)	Change in sensitivity (dB)
45 to 1,120.....	1
1,120 to 2,240.....	1.5
2,240 to 4,500.....	2.5
4,500 to 7,100.....	4
7,100 to 11,200.....	5

With the wind screen in place, the variation in sensitivity in the plane of the diaphragm of the microphone system shall not exceed 1.0 dB over the frequency range 45 to 11,200 Hz.

* * * * *

(d) * * *

(2) A set of 24 consecutive one-third octave filters must be used. The first filter of the set must be centered at a geometric mean frequency of 50 Hz and the last filter at 10,000 Hz.

(i) The output of each filter must contain less than 0.5 dB ripple.

(ii) The correction for effective bandwidth relative to the response at the center frequency response for each one-third octave band filter must be determined by measuring the filter response to sinusoidal signals at a minimum of 20 frequencies equally spaced between the two adjacent preferred one-third octave frequencies or by using an approved equivalent procedure.

* * * * *

(5) The averaging properties of the integrator must be tested as follows:

(i) White noise must be passed through the 200 Hz one-third octave band filter and the output fed in turn to each detector/integrator. The standard deviation of the measured levels must then be determined from a large number of samples of the filtered white noise taken at intervals of not less than 5 seconds. The value of the standard deviation must be within the interval 0.48±0.06 dB for a probability limit of 95 percent. (An approved equivalent method may be substituted for this

test on those analyzers where the test signal cannot readily be fed directly to each detector/integrator.)

(ii) For each detector/integrator, the response to a sudden onset or interruption of a constant amplitude sinusoidal signal at the respective one-third octave band center, frequency must be measured at sampling times 0.5, 1.0, 1.5, and 2.0 seconds after the onset or interruption. The rising responses must be the following amounts before the steady-state level:

0.5 seconds.....	4.0±1.0 dB
1.0 seconds.....	1.75±0.75 dB
1.5 seconds.....	1.0±0.5 dB
2.0 seconds.....	0.6±0.5 dB

(iii) The falling response must be such that the sum of the decibel readings (below the initial steady-state level) and the corresponding rising response reading are 6.5±1.0 dB, at each sampling time.

(iv) Analyzers using true integration cannot meet the requirements of paragraphs (d)(5) (i), (ii), and (iii) of this section directly, because their overall average time is greater than the sampling interval. For these analyzers, compliance must be demonstrated in terms of the equivalent output of the data processor. Further, in cases where readout and resetting require a dead-time during acquisition, the percentage loss of the total data must not exceed one percent.

(6) The sampling interval between successive readouts shall not exceed 500 milliseconds and its precise value must be known to within ±one (1) percent. The instant in time by which a readout is characterized, shall be the midpoint of the average period. (The averaging period is defined as twice the effective time constant of the analyzer.)

* * * * *

(e) * * *

(7) A performance calibration analysis of each piece of calibration equipment, including piston phones, reference microphones, and voltage insert devices, must have been made during the six calendar months preceding the beginning of each day's test series. Each calibration must be traceable to the National Bureau of Standards.

* * * * *

13. Section A36.5 is amended by revising paragraph (b)(5)(vi) to read as follows:

Section A36.5 *Reporting and correcting measured data.*

* * * * *

(b) * * *

(5) * * *

(vi) Engine performance parameters relevant to noise generation, such as net thrust, engine pressure ratio, exhaust temperatures, and fan or compressor rotational speeds.

* * * * *

14. Section A36.5(c)(1) is amended by adding the word "homogeneous" ahead of the words "noise certification reference."

15. Section A36.5(c)(2)(i) is revised to read as follows:

- (c) * * *
- (2) * * *
- (i) Maximum landing weight, except as provided in § 36.1581(d) of this part;

16. Section A36.5(d)(3) is amended by revising the first sentence up to the words "octave band" to read as follows:

- (d) * * *
- (3) Aircraft sound pressure levels within the 10 dB-down points (described in section B36.9 of Appendix B) must exceed the mean background sound pressure levels determined under section A36.3(f)(3) by at least 3 dB in each one-third octave band * * *

17. Sections A36.5(d) (4) and (5) are added to read as follows:

- (d) * * *
- (4) Where more than seven one-third octaves are within 3 dB of the ambient noise levels, a time/frequency interpolation of the noise data shall be performed using an approved procedure.
- (5) If equivalent test procedures, different from the reference procedures are used, the test procedures and all methods for adjusting the results to the reference procedures must be approved by the FAA. The amounts of adjustments must not exceed 16 EPNdB on takeoff and 8 EPNdB on approach, and if the adjustments are more than 8 EPNdB and 4 EPNdB respectively, the resulting numbers must not be within 2 EPNdB of the appropriate Appendix C noise levels including tradeoffs.

18. Section A36.5(e) is amended by substituting the word "mean" for the word "average" each place it appears and by adding a new paragraph (4) to read as follows:

- (e) * * *
- (4) If equivalent procedures are to be used to certificate several airplane configurations of the same type from noise tests of a single airplane, the test procedures and analysis methods must be approved by the FAA. The request for approval must identify the noise measurement test procedures and data base, the airplane configurations, procedures and analysis methods, the method for establishing the 90 percent confidence limit for each noise certification level, and the proposed equivalent procedures.

19. Section A36.9 is amended by revising paragraph (b)(1) and (d)(2) to read as follows:

Section A36.9 *Atmospheric attenuation of sound.*

- (b) * * *
- (1) The wind velocity, temperature and relative humidity measurements required under this part must be measured in the vicinity of the noise measuring stations. The location of the meteorological measurements must be approved by the FAA as representative of those atmospheric conditions existing near the surface over the geographical area in which aircraft noise measurements are made. In some cases, a fixed meteorological station (such as those found at airports or other facilities) may meet this requirement.

- (d) * * *
- (2) If the atmospheric absorption coefficients do not vary over the PNLTM sound propagation path by more than ± 1.6 dB/1000 ft (± 0.5 dB/100 meters) in the 3150 Hz one-third octave band from the value of the absorption coefficient derived from the meteorological measurement obtained at 10 meters above the surface, the mean of the values of the atmospheric absorption coefficients at 10 meters above the surface and at the altitude of the aircraft at PNLTM may be used to determine the atmospheric attenuation rates for each one-third octave band. The resulting atmospheric attenuation rate may be used to compute the PNLTM correction under section A36.11(d) of this appendix.

20. Section A36.11 [Amended].
a. Section A36.11(a)(3)(v) is amended by removing the phrase "in the form of curves or tables giving the variation of EPNL with approach angle."

b. Section A36.11(e) introductory text is amended by revising the first sentence to read as follows: "If the measured takeoff and approach flight paths do not conform to those prescribed as the corrected and reference flight paths, under sections A36.11 (b) and (c) respectively, it will be necessary to apply duration corrections to the EPNL values calculated from the measured data."

c. Section A36.11(e) is amended by revising paragraph (1) up to the words "which represents", (2) up to the words "where NT is", and (3) up to the words "where LX and LXc are" to read as follows:

Section A36.11 *Detailed correction procedures.*

- (e) * * *
- (1) *Takeoff flight path.* For the takeoff flight path shown in Figure A3, the correction term is calculated using the formula—
 $\Delta 2 = -7.5 \log (KR/KRc)$
which represents * * *
- (2) *Approach flight path.* For the approach

flight path shown in Figure A6, the correction term is calculated using the formula—

$$\Delta 2 = -7.5 \log (NT/393)$$

where NT is * * *

(3) *Sideline flight path.* For the sideline flight path, the correction term is calculated during the formula—

$$\Delta 2 = -7.5 \log (LX/LXc)$$

where LX and LXc are * * *

d. Section A36.11(f) introductory text, (1), (2) introductory text up to the words "the noise levels", and (2)(ii) up to the words "noise evaluation" are revised as follows:

(f) *Nonstandard location correction.* When takeoff and approach noise measurements are conducted at points other than those prescribed in section C36.1 of Appendix C, the EPNL value computed from these measurements must be corrected to the value that would have occurred at the prescribed measuring points under one of the following procedures:

(1) *Simplified procedure.* Unless the amount of adjustment exceeds 8 dB on takeoff or 4 dB on approach, or the correction results in a final EPNL value which is within 1.0 dB of the noise levels prescribed in Appendix C of this part, the correction procedures prescribed in paragraphs (d) and (e) of this section may be used. Since this procedure accounts for extrapolation of PNLTM from the close-in measurement station to the prescribed measuring point, the remaining corrections for differences between test and reference conditions, including thrust and airspeed, must be made afterward.

(2) *Integrated procedure.* If the correction factor exceeds 8 dB on takeoff or 4 dB on approach, or the correction results in a final EPNL value which is within 1.0 dB of the noise levels * * *

(ii) After the measured one half (½) second spectra have been corrected to the measuring points prescribed in section C36.1 of Appendix C, the remaining noise evaluation * * *

Appendix B—Aircraft Noise Evaluation Under § 36.103

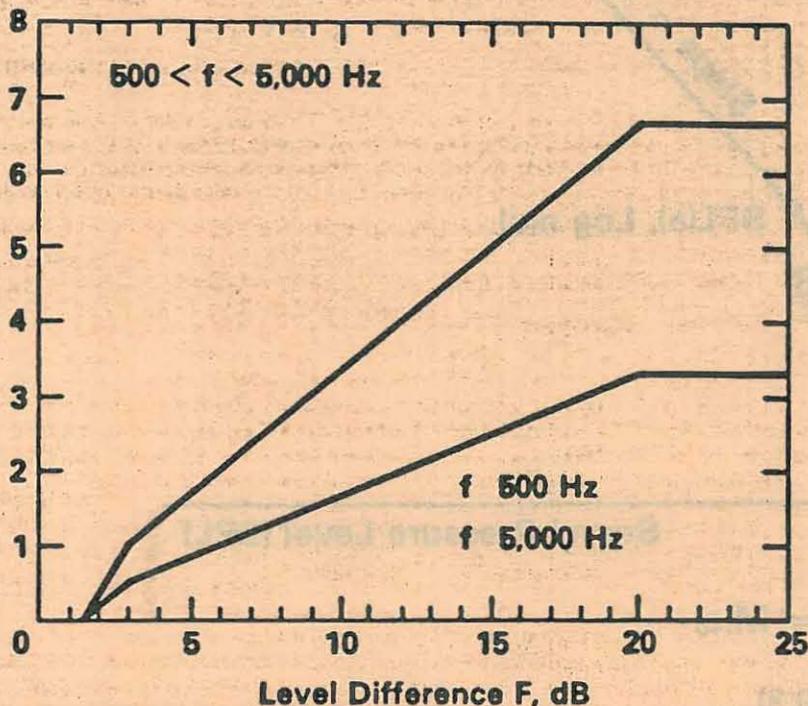
21. Section B36.5(h) is amended by replacing "zero" with "one and a half".

22. The graph and Table B2 now appearing in section B36.7(a) is moved into section B36.5(i) and revised to read as follows:

Section B36.5 *Correction for spectral irregularities.*

- (i) * * *

Table B2 — Tone Correction Factors



Frequency f, Hz	Level difference F, dB	Tone correction C, dB
50 < f < 500	1 1/2 * < F < 3	F/3 - 1/2
	3 < F < 20	F/6
	20 < F	3 1/2
500 < f < 5,000	1 1/2 * < F < 3	2 F/3 - 1
	3 < F < 20	F/3
	20 < F	6%
5,000 < f < 10,000	1 1/2 * < F < 3	F/3 - 1/2
	3 < F < 20	F/6
	20 < F	3 1/2

* See Step 8.

23. Section B36.9(c) is amended by revising the definition of Δt as follows:

Section B36.9 *Duration correction.*

(c) $\Delta t = 0.5$ sec. (or the approved sampling time interval), and

24. Section B36.9(f) is revised to read as follows:

(f) The aircraft testing procedures must

include the 10 dB-down points in the flyover noise/time record.

25. Section B36.11(c) is added to read as follows:

Section B36.11 *Effective perceived noise level.*

(c) If, during a test flight, one or more peak values of PNLTM are observed which are within 2 dB of PNLTM, the value of EPNL shall be calculated for each, as well as for PNLTM. If any EPNL value exceeds the value at the moment of PNLTM, the maximum value of such exceedance must be added as a further adjustment to the EPNL calculated from the measured data.

26. Section B36.13 is amended by revising paragraphs (a) and (b), Figure B3 and adding Table B4 to read as follows:

Section B36.13 *Mathematical formulation of noy tables.*

(a) The relationship between sound pressure level and perceived noisiness given in Table B1 is illustrated in Figure B3. The variation of $\log(n)$ with SPL for a given one-third octave band can be expressed by straight lines as shown in Figure B3.

- (1) The slopes of the straight lines M(b), M(c), and M(d) and M(e);
- (2) The intercepts of the lines on the SPL axis, SPL (b) and SPL (c); and
- (3) The coordinates of the discontinuities, SPL (a) and $\log n(a)$; SPL (d) and $\log n = -1.0$; and SPL (e) and $\log n = \log(0.3)$.

(b) The important aspects of the mathematical formulation are:

- (1) $SPL > SPL(a)$
 $n = \text{antilog}[M(c) \cdot (SPL - SPL(c))]$
- (2) $SPL(b) < SPL < SPL(a)$
 $n = \text{antilog}[M(b) \cdot (SPL - SPL(b))]$
- (3) $SPL(e) < SPL < SPL(b)$
 $n = \text{antilog}[M(e) \cdot (SPL - SPL(b))]$
- (4) $SPL(d) < SPL < SPL(e)$
 $n = 0.1 \text{ antilog}[M(d) \cdot (SPL - SPL(d))]$

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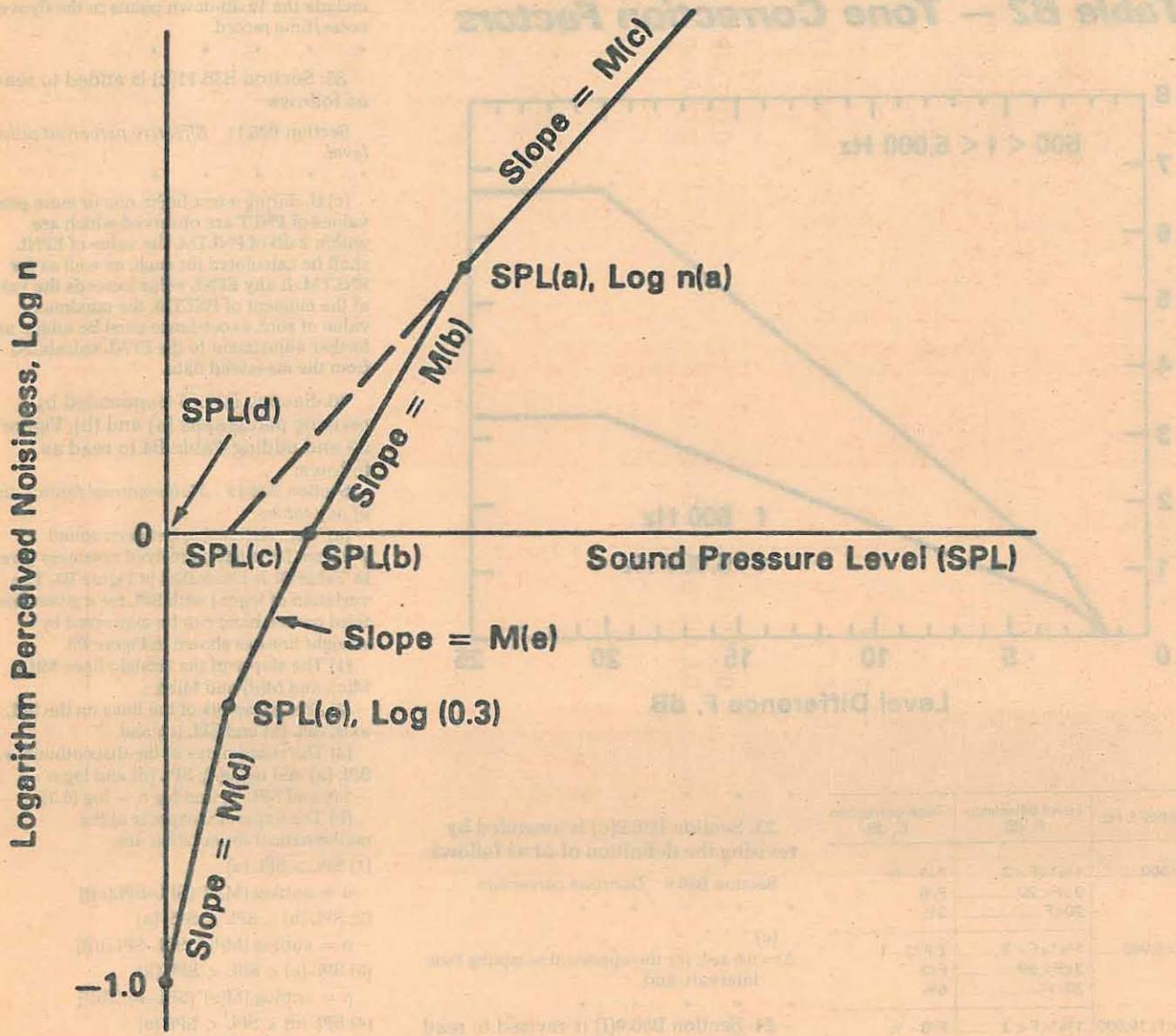


Fig. B3. Perceived Noisiness As a Function of Sound Pressure Level.

Appendix C—Noise Levels for Transport Category and Turbojet Powered Airplanes Under § 36.201

27. Section C36.5, the table after paragraph (b)(3), and paragraph (c) is removed.

28. Section C36.7 *Takeoff test conditions* is retitled *Takeoff Reference and Test Limitations*.

29. Section C36.7(d) is removed and paragraphs (e) and (f) are redesignated as paragraphs (d) and (e), respectively.

30. Section C36.9 *Approach test conditions* is retitled *Approach Reference and Test Limitations*.

31. Section 36.9(d) is removed and paragraphs (e) and (f) are redesignated as paragraphs (d) and (e), respectively.

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T. Allan McArtor,
Administrator.

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Category	Type	Model	Year	Weight	Takeoff		Approach		Noise
					(a)	(b)	(c)	(d)	
Category 1	Type 1	Model 1	1980	10000	100	100	100	100	100
			1981	10000	100	100	100	100	100
			1982	10000	100	100	100	100	100
			1983	10000	100	100	100	100	100
			1984	10000	100	100	100	100	100
			1985	10000	100	100	100	100	100
			1986	10000	100	100	100	100	100
			1987	10000	100	100	100	100	100
			1988	10000	100	100	100	100	100
			1989	10000	100	100	100	100	100
Category 2	Type 2	Model 2	1980	20000	200	200	200	200	200
			1981	20000	200	200	200	200	200
			1982	20000	200	200	200	200	200
			1983	20000	200	200	200	200	200
			1984	20000	200	200	200	200	200
			1985	20000	200	200	200	200	200
			1986	20000	200	200	200	200	200
			1987	20000	200	200	200	200	200
			1988	20000	200	200	200	200	200
			1989	20000	200	200	200	200	200

1988-05-06 10:00 AM