Federal Aviation Administration
Aviation Rulemaking Advisory Committee

Transport Airplane and Engine Issue Area
Loads and Dynamics Harmonization Working Group

Task 2 – Engine Torque and Gyroscopic Loads

Task Assignment

Aviation Rulemaking Advisory Committee; Loads and Dynamics Harmonization Working Group

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of establishment of Loads and Dynamics Harmonization Working Group.

SUMMARY: Notice is given of the establishment of the Loads and Dynamics Harmonization Working Group of the Aviation Rulemaking Advisory Committee (ARAC). This notice informs the public of the activities of the ARAC on transport airplane and engine issues.

FOR FURTHER INFORMATION CONTACT: Mr. William J. (Joe) Sullivan, Assistant Executive Director, Aviation Rulemaking Advisory Committee, Aircraft Certification Service (AIR-3), 800 Independence Avenue, SW., Washington, DC 20591, Telephone: (202) 267-9554; FAX: (202) 267-5364.

SUPPLEMENTARY INFORMATION: The Federal Aviation Administration (FAA) has established an Aviation Rulemaking Advisory Committee (ARAC) (56 FR 2190, January 22, 1991; and 58 FR 9230, February 19, 1993). One area the ARAC deals with is transport airplane and engine issues (56 FR 31995; July 12, 1991). These issues involve the airworthiness standards for transport airplanes, engines and propellers in parts 25, 33 and 35 of the Federal Aviation Regulations (14 CFR parts 25, 33 and 35) which are the responsibility of the FAA Director of Aircraft Certification.

The FAA announced at the Joint Aviation Authorities (JAA)-Federal Aviation Administration (FAA) Harmonization Conference in Toronto, Ontario, Canada, (June 2-5, 1992) that it would consolidate within the Aviation Rulemaking Advisory Committee structure an ongoing objective to "harmonize" the Joint Aviation Requirements (JAR) and the Federal Aviation Regulations (FAR). Coincident with that announcement, the FAA assigned to the ARAC those projects related to JAR/FAR 25, 33 and 35 harmonization which were then in the process of being coordinated between the JAA and the FAA. The harmonization process included the intention to present the results of JAA/FAA coordination to the public in the form of either a Notice of Proposed Rulemaking or an advisory circular—an objective comparable to and compatible with that assigned to the Aviation Rulemaking Advisory Committee. The Loads and Dynamics Harmonization Working Group is being formed to address loads and dynamics issues in JAR/FAR parts 25 identified below. The Loads and Dynamics Harmonization Working Group will forward recommendations to the ARAC which will determine whether to forward them to the FAA.

Specifically, the Working Group's tasks are the following: The Loads and Dynamics Harmonization Working Group is charged with making recommendations to the ARAC concerning the FAA disposition of the following subjects recently coordinated between the JAA and the FAA:

Task 1—General Design Loads

Develop new or revised requirements, and associated advisory and guidance material, for the general design loads for transport category airplanes (FAR 25.331, 25.335, 25.341, 25.345, 25.351, 25.371, 25.427, 25.483, 25.511, 25.561 and 25.963 and other conforming changes).

Task 2—Engine Torque and Gyroscopic Loads

Develop new or revised requirements, and associated advisory and guidance material, for determining the design loads for engine seizure conditions (FAR 25.361, 25.371 and other conforming changes).

Task 3—Flutter, Deformation and Fail-Safe Criteria:

Develop new or revised advisory and guidance material for flutter, deformation and fail-safe criteria (FAR 25.629).

Reports

A. Recommend time line(s) for completion of each task, including rationale, for consideration at the meeting of the ARAC to consider transport airplane and engine issues held following publication of this notice.

B. Give a detailed conceptual presentation on each task to the ARAC before proceeding with the work stated under items C and D, below. If tasks 1 and 2 require the development of more than one Notice of Proposed Rulemaking, identify what proposed amendments will be included in each notice.

C. Draft one or more Notices of Proposed Rulemaking for Tasks 1 and 2 proposing new or revised requirements, a supporting economic analysis and other required analysis, advisory and guidance material, and any other collateral documents the Working Group determines to be needed.

D. Draft appropriate advisory and guidance material for Task 3.

E. Give a status report on each task at each meeting of the ARAC held to consider transport airplane and engine issues.

The Loads and Dynamics Harmonization Working Group will be comprised of experts from those organizations having an interest in the tasks assigned. A Working Group member need not necessarily be a representative of one of the member organizations of the ARAC. An individual who has expertise in the subject matter and wishes to become a member of the Working Group should *write* the person listed under the caption "FOR FURTHER INFORMATION CONTACT" expressing that desire, describing his or her interest in the task, and the expertise he or she would bring to the Working Group. The request will be reviewed with the Chairs of the ARAC Transport Airplane and Engine Interest Issues and the Loads and Dynamics Working Group, and the individual will be advised whether or not the request can be accommodated.

The Secretary of Transportation has determined that the information and use of the ARAC is necessary in the public interest in connection with the performance of duties of the FAA by law. Meetings of the ARAC will be open to the public except as authorized by section 10(d) of the Federal Advisory Committee Act. Meetings of the Loads and Dynamics Harmonization Working Group will not be open to the public except to the extent that individuals with an interest and expertise are selected to participate. No public announcement of Working Group meetings will be made.

Issued in Washington, DC, on March 8, 1993.

William J. Sullivan,

Assistant Executive Director for Transport Airplane and Engine Issues, Aviation Rulemaking Advisory Committee.

[FR Doc. 93-5815 Filed 3-12-93; 8:45 am]

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Recommendation Letter

Pratt & Whitney
00 Main Street
Hartford, CT 06108

Pratt & Whitney
A United Technologies Company

December 20, 1999

Department of Transportation
Federal Aviation Administration
800 Independence Ave, SW
Washington, D.C. 20591

Attention: Mr. Tom McSweeny, Associate Administrator for Regulation and Certification

Reference: ARAC Tasking, Federal Register, November 26, 1999

Dear Tom,

In accordance with the reference tasking statement, the ARAC Transport Airplane and Engine Issues Group is pleased to forward the attached technical report (in NPRM/AC format) which provides ARAC's recommendation for FAR/JAR harmonization of 25.361/25.362, Engine and Auxiliary Power Unit Load Conditions. This report has been prepared by the [redacted] the TAEIG.

Sincerely,

Craig R. Bolt

C. R. Bolt
Assistant Chair, TAEIG
Phone: 860-565-9348, Fax 860-557-2277, M/S 162-24
Email: boltcr@pweh.com

cc: Dorenda Baker – FAA-NWR*
Tony Fazio – FAA. ARM-1*
Kristin Larson – FAA-NWR
Larry Hanson, Gulfstream*
*letter only

Acknowledgement Letter

MAR 15 2000

Mr. Craig Bolt
Assistant Chair, Transport Airplanes
and Engines Issues Group
400 Main Street
East Hartford, CT 06108

Dear Mr. Bolt:

This letter acknowledges receipt of the following working group technical reports that you have submitted on behalf of the Aviation Rulemaking Advisory Committee (ARAC) on Transport Airplane and Engine Issues (TAE):

Date of Letter	**Task No.**	**Description of Recommendation**	**Working Group**
12/14/00	1, 2, 3	Fast track reports addressing §§ 25.703(a) thru (c) (takeoff warning system); 25.1333(b) (instrument systems; and 25.1423(b) (public address system)	ASHWG
12/17/00	5	Fast track reports addressing §§ 25.111(c)(4), 25.147, controllability in 1-engine inoperative condition; 25.161 (c) (2) and (4), and (e) (longitudinal trim and airplanes with 4 or more engines) 25.175(d) (static longitudinal stability; 25.177(a)(b) (static lateral-directional stability); 25.253(a)(3) (high speed characteristics); 25.1323(c) (airspeed indicating system); 25.1516 (landing gear speeds); 25.1527 (maximum operating altitude); 25.1583(c) and (f) operating limitations) 25.1585 (operating procedures); and 25.1587 (performance information)	FTHWG
12/17/00	7	Fast track report addressing § 25.903(e) (inflight engine failures)	PPIHWG

12/20/00	5	Fast track reports addressing §§ 25.1103 (auxiliary power units); 25.933(a) (thrust reverers); 25.1189 (shutoff means); 25.1141 (powerplant controls); 25.1093 (air intake/induction systems); 25.1091 (air intake system icing protection; 25.943 (thrust reverser system tests); 25.934 (negative acceleration); 25.905(d) (propeller blade debris); 25.903(d)(1) (engine case burn-through); 25.901(d) (auxiliary power unit installation; and 1.1 (general definitions)	PPIHWG
12/20/00	4	Fast track report, category 2 format--NRRM addressing § 25.302 and appendix K (interaction of systems and structures	LDHWG
12/20/00	2	Fast track report—(in NPRM/AC format) addressing §§ 25.361 and 25.362 (engine and auxiliary power unit load conditions)	LDHWG
12/20/00	1	Fast track report addressing § 25.1438 (pressurization and low pressure pneumatic systems)	MSHWG

The above listed reports will be forwarded to the Transport Airplane Directorate for review. The Federal Aviation Administration's (FAA) progress will be reported at the TAE meetings.

This letter also acknowledges receipt of your July 28, 1999, submittal which included proposed notices and advisory material addressing lightning protection. We apologize for the delay. Although the lightning protection task is not covered under the fast track proposal, the FAA recognizes that technical agreement has been reached and we will process the package accordingly. The package has been sent to Aircraft Certification for review; the working group will be kept informed of its progress through the FAA representative assigned to the group.

Lastly, at the December 8 - 9, 1999, TAE meeting, Mr. Phil Salee of the Powerplant Installation Harmonization Working Group indicated that the working group members agreed that § 25.1103 was sufficiently harmonized and that any further action was beyond the scope of task 8 assigned. We agreed with the TAE membership to close the task. This letter confirms the FAA's action to close the task to harmonize § 25.1103.

I would like to thank the ARAC, particularly those members associated with TAE for its cooperation in using the fast track process and completing the working group reports in a timely manner.

Sincerely,

ORGINIAL SIGNED BY
ANTHONY F. FAZIO

Tony F. Fazio
Director, Office of Rulemaking

ARM-209:EUpshaw:fs:6/27/00:PCDOCS #12756v1
cc: ARM-1/20/200/209; APO-300/320, ANM-114
File #1340.12

File #ANM-98-182-A (landing gear shock absorption test requirements) and ANM-94-461-A (Taxi, takeoff, and landing roll design loads)

Recommendation

ANM-93-760-A
TAE
LOADS + D/W
#2

Summary

The Federal Aviation Administration proposes to amend the airworthiness standards for transport category airplanes concerning engine loads design requirements for the engine mounts, auxiliary power unit mounts, engine pylons, and adjacent supporting airframe structures. The proposed amendment would revise the regulations to further define the engine loading conditions that must be considered. The current regulations do not adequately define the engine loading conditions experienced in service. This proposal is intended to ensure that engine mounts and adjacent supporting structures are able to withstand the severest loads expected in service. Adopting this proposal would eliminate regulatory differences between the airworthiness standards of the U.S. and the Joint Aviation Requirements of Europe, without affecting current industry design practices.

How Does This Proposed Regulation Relate to "Fast Track"?

This proposed regulation results from the recommendations of ARAC submitted under the FAA's Fast Track Harmonization Program. In this notice, the FAA proposes to amend § 25.361, concerning engine and auxiliary power unit (APU) load conditions. The JAA plans a similar revision to the JAR.

What is the Underlying Safety Issue Addressed by the Current Standards?

The current airworthiness standards contained in 14 CFR part 25 require that turbine engine mounts and supporting structure must be designed to withstand *". . . a limit engine torque load imposed by sudden engine stoppage due to malfunction or structural failure (such as compressor jamming)."* This was first made a specific requirement for U.S.-manufactured transport category airplanes in 1957 by Civil Air Regulation (CAR) 4b.216(a)(4). It was later carried forward in § 25.361(b)(1) of part 25 when the Federal Aviation Regulations were recodified. This same requirement is contained in paragraph 25.361 of JAR-25.

These standards were issued to ensure that engine mounts and adjacent structures are able to withstand the loads expected to be imposed on them during service. Failure of the engine mount or supporting structure could lead to loss of an engine and/or damage to the airframe.

What are the Current 14 CFR Standards?

The current text of 14 CFR § 25.361 is:

<u>Sec. 25.361 Engine torque.</u>

(a) Each engine mount and its supporting structure must be designed for the effects of--

(1) A limit engine torque corresponding to takeoff power and propeller speed acting simultaneously with 75 percent of the limit loads from flight condition A of Sec. 25.333(b);

(2) A limit torque corresponding to the maximum continuous power and propeller speed, acting simultaneously with the limit loads from flight condition A of Sec. 25.333(b); and

(3) For turbopropeller installations, in addition to the conditions specified in paragraphs (a)(1) and (2) of this section, a limit engine torque corresponding to takeoff power and propeller speed, multiplied by a factor accounting for propeller control system malfunction, including quick feathering, acting simultaneously with 1g level flight loads. In the absence of a rational analysis, a factor of 1.6 must be used.

(b) For turbine engine installations, the engine mounts and supporting structure must be designed to withstand each of the following:

(1) A limit engine torque load imposed by sudden engine stoppage due to malfunction or structural failure (such as compressor jamming).

(2) A limit engine torque load imposed by the maximum acceleration of the engine.

(c) The limit engine torque to be considered under paragraph (a) of this section must be obtained by multiplying mean torque for the specified power and speed by a factor of--

(1) 1.25 for turbopropeller installations;

(2) 1.33 for reciprocating engines with five or more cylinders; or

(3) Two, three, or four, for engines with four, three, or two cylinders, respectively.

What are the Current JAR standards:

The current text of JAR-25.361 is:

JAR 25.361 Engine and APU torque.

(a) Each engine mount and its supporting structure must be designed for engine torque effects combined with --

(1) A limit engine torque corresponding to takeoff power and propeller speed acting simultaneously with 75 percent of the limit loads from flight condition A of JAR 25.333(b);

(2) A limit torque corresponding as specified in sub-paragraph (c) of this paragraph acting simultaneously with the limit loads from flight condition A of JAR 25.333(b); and

(3) For turbopropeller installations, in addition to the conditions specified in sub-paragraphs (a)(1) and (2) of this paragraph, a limit engine torque corresponding to takeoff power and propeller speed, multiplied by a factor accounting for propeller control system

malfunction, including quick feathering, acting simultaneously with 1g level flight loads. In the absence of a rational analysis, a factor of 1.6 must be used.

(b) For turbine engines and auxiliary power unit installations, the limit torque load imposed by sudden stoppage due to malfunction or structural failure (such as a compressor jamming) must be considered in the design of engine and auxiliary power unit mounts and supporting structure. In the absence of better information, a sudden stoppage must be assumed to occur in 3 seconds.

(c) The limit engine torque to be considered under sub-paragraph (a)(2) of this paragraph is obtained by multiplying the mean torque by a factor of 1.25 for turbopropeller installations.

(d) When applying JAR 25.361(a) to turbo-jet engines, the limit engine torque must be equal to the maximum accelerating torque for the case considered. [See ACJ 25.301(b).]

How Have the Standards Been Applied?

Previous methods of complying with the requirements of § 25.361 have entailed either:

- designing to a specific torque value prescribed by the engine manufacturer, or
- designing to a torque level established by the polar moment of inertia of the rotating sections and the time required to stop the rotation, as defined by the engine manufacturer.

Since the circumstances and the events from which these loads are generated are dependent on the characteristics of the particular engine, the engine manufacturers traditionally have provided the airframe manufacturers with the information necessary to install each engine.

Why is a Revision to the Current Standards Needed?

The size, configuration, and failure modes of jet engines have changed considerably since § 25.361(b) was first adopted. The original requirement addressed primarily turbine engine failure conditions that resulted in sudden engine deceleration and, in some cases, seizures. Those failure conditions were usually caused by internal structural failures or ingestion of foreign objects such as birds or ice. Whatever the source, those conditions could produce significant structural loads on the engine, engine mounts, pylon, and adjacent supporting airframe structure.

With the development of larger high-bypass ratio turbofan engines, however, it has become apparent that engine seizure torque loads alone do not adequately define the full loading imposed on the engine mounts, pylons, and their adjacent supporting airframe structure. The progression to high-bypass ratio turbofan engines of larger diameter and fewer blades with larger chords has increased the magnitude of the transient loads that can be produced during and following engine failures. As engines have grown much larger, their fans are capable of producing much higher torque loads when subjected to sudden deceleration.

The FAA finds that, relative to the engine configurations that existed when the rule was first developed, these later generations of jet engines are sufficiently different and novel to justify amending the regulations to ensure that adequate design standards are available for the mounts and the structure supporting these newer engines. Over the last several years, manufacturers have applied for, and the FAA has granted, numerous Special Conditions (under the provisions of 14 CFR § 21.16, "Special Conditions") for use of new design standards applicable to engine load conditions airplane models incorporating new-technology engines. Such Special Conditions have been approved recently for Boeing Models:

- 737-600/700/800 (62 FR 50494, September 26, 1997),
- 757-300 (64 FR 32011, January 21, 1999), and
- 767-400ER (64 FR 27478, May 20, 1999).

Likewise, the JAA has granted "exceptions" to manufacturers who have applied to use similar new engine design standards.

In order to maintain the level of safety intended by § 25.361(b)(1), and to address the newer-technology engine designs, the FAA considers that the addition to the regulations of a more comprehensive criterion is necessary -- one that considers all load components when designing to address engine failure events.

What are "Engine Loads"?

When addressing loads and their effects on aircraft engines and structure, the term limit load is generally used to specify the maximum load to be expected in service. The structure must support the limit load without detrimental permanent deformation. Further, at any load up to limit loads, the deformation may not interfere with safe operation of the airplane.

The term ultimate load is used to specify the limit load multiplied by a prescribed factor of safety. The structure must be able to support this ultimate load without failure. Loads arising from very infrequent events (discussed below) are sometimes prescribed directly as ultimate loads without any additional factor of safety.

These terms are discussed in § 25.301 ("Loads"), § 25.303 ("Factor of safety"), and § 25.305 ("Strength and deformation").

What are the Types of "Engine Events" that This Proposed Rule Addresses?

Studies made by the engine and the airframe manufacturers have shown that large turbofan engines exhibit two distinct classes of sudden deceleration events:

The first type of event involves transient deceleration conditions involving rapid slowing of the rotating system. These events are usually associated with temporary loss of power or thrust capability, and often result in some engine distress, such as blade and/or wear strip damage. Examples are high power compressor surges, blade tip rub during maneuvers, bird encounters, or combinations of these events. Based on the frequency of occurrence, the FAA considers these events to be limit load conditions that require the 1.5 factor of safety prescribed in § 25.303 to obtain ultimate loads.

The second type of event involves major engine failures that result in extensive engine damage and permanent loss of thrust-producing capability. Examples of these types of events are fan blade failures, bearing failures, and shaft failures. It is evident from service history that these most severe sudden engine failure events are sufficiently infrequent to be considered ultimate load conditions. Because of the rare occurrence of these events and the conservative rational method in which the loads are to be obtained, the FAA proposes that these ultimate loads be applied to engine mounts and pylon structure without an additional factor of safety. At the same time, to provide additional protection for the more critical airframe structure, the FAA proposes that these ultimate loads be multiplied by an additional factor of 1.25 when applied to the adjacent supporting airframe structure.

What Is the Proposed Action and How Does It Address the Underlying Safety Issue?

This proposal would add a new § 25.362 addressing engine failure loads, which would distinguish between design criteria for the more common failure events (described above as the "first type of event") and design criteria for those rare events resulting from structural failures (described above as the "second type of event"). For the more rare but severe engine failure events, the proposed criteria would allow deformation in the engine supporting structure in order to absorb the higher energy associated with high-bypass turbofan engines. At the same time, the proposed criteria would protect the adjacent primary structure in the wing and fuselage by providing an additional safety margin.

Specifically, new § 25.362 would require that the engine mounts, pylons, and adjacent supporting airframe structure be designed to withstand 1g flight loads combined with transient dynamic loads that could result from various engine structural failure conditions (i.e., .the loss of any fan, compressor, or turbine blade; and, for certain designs, any other engine structural failure that results in higher loads).

Although the FAA recognizes that some engine configurations may exist in which the blade failure event is not the most critical load, the FAA expects that, for most conventional engines, the blade failure event will be the most severe event that needs to be investigated. Such a failure event, in which the most critical blade is assumed to fail at the maximum permissible rotational speed, is a required test under the certification standards of § 33.94, "Blade containment and rotor unbalance tests."

In addition to these certification tests, the engine manufacturers normally conduct additional developmental tests for each engine design. These tests, taken as a whole, allow a very reliable estimate of the transient engine loads resulting from failure events. Because the loads are supported by actual tests conducted in the most critical conditions of operation, the proposed rule would allow the loads developed from these conditions to be used directly as ultimate loads, with no additional factor when applied to engine mounts and pylons. However,

(d) For auxiliary power unit installations, the power unit mounts and adjacent supporting airframe structure must be designed to withstand 1g level flight loads acting simultaneously with the maximum limit torque loads imposed by each of the following:

(1) sudden auxiliary power unit deceleration due to malfunction or structural failure; and

(2) the maximum acceleration of the power unit.

Add a new section 25.362, to read as follows:

§ 25.362 Engine failure loads

(a) For engine supporting structure, an ultimate loading condition must be considered that combines 1g flight loads with the transient dynamic loads resulting from:

(1) the loss of any fan, compressor, or turbine blade; and

(2) separately, where applicable to a specific engine design, any other engine structural failure that results in higher loads.

(b) The ultimate loads developed from the conditions specified in paragraph (a) are to be:

(1) multiplied by a factor of 1.0 when applied to engine mounts and pylons; and

(2) multiplied by a factor of 1.25 when applied to adjacent supporting airframe structure.

[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 25

[Docket No. ; Notice No.]

RIN: 2120-

Engine and Auxiliary Power Unit Load Conditions.

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of proposed rulemaking (NPRM).

SUMMARY: This notice proposes to amend the engine loads design requirements for the engine mounts, auxiliary power unit mounts, engine pylons and adjacent supporting airframe structures on transport category airplanes by further defining the engine loading conditions to be considered. The current regulation does not adequately define the engine loading conditions experienced in service. This proposal is intended to ensure that engine mounts and adjacent supporting structures are able to withstand the severest loads expected in service. This proposal also is intended to achieve common design and certification requirements for this subject between the U.S. regulations and the Joint Aviation Requirements (JAR) of Europe; doing so would relieve manufacturers of the current burden of certifying airplanes to two different sets of standards to achieve essentially the same intended safety benefit.

DATES: Comments must be received on or before [insert date 90 days after date of publication in the Federal Register].

ADDRESSES: Comments on this document should be mailed or delivered, in duplicate, to: U.S. Department of Transportation Dockets, Docket No. ______, 400 Seventh Street SW., Room Plaza 401, Washington, DC 20590. Comments also may be sent electronically to the following Internet address: 9-NPRM-CMTS@faa.dot.gov.

Comments may be filed and examined in Room Plaza 401 between 10:00 a.m. and 5:00 p.m. weekdays, except Federal holidays.

In addition, the FAA is maintaining an information docket of comments in the FAA, Transport Airplane Directorate, Aircraft Certification Service, 1601 Lind Avenue S.W., Renton, Washington 98055-4056. Comments in the information docket may be inspected between 7:30 a.m. and 4:00 p.m. weekdays, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: James Haynes, FAA, Airframe and Cabin Safety Branch (ANM-115), Transport Airplane Directorate, Aircraft Certification Service, 1601 Lind Ave S.W., Renton, Washington 98055-4056; telephone (425) 227-2131; facsimile (425) 227-1320.

SUPPLEMENTARY INFORMATION:

Comments Invited

Interested persons are invited to participate in the making of the proposed action by submitting such written data, views, or arguments as they may desire. Comments relating to the environmental, energy, federalism, or economic impact that might result from adopting the proposals in this document are also invited. Substantive comments should be accompanied by cost estimates. Comments must identify the regulatory docket or notice number and be submitted in duplicate to the DOT Rules Docket address specified above.

All comments received, as well as a report summarizing each substantive public contact with FAA personnel concerning this proposed rulemaking, will be filed in the docket. The docket is available for public inspection before and after the comment closing date.

All comments received on or before the closing date will be considered by the Administrator before taking action on this proposed rulemaking. Comments filed late will be considered as far as possible without incurring expense or delay. The proposals in this document may be changed in light of the comments received.

Commenters wishing the FAA to acknowledge receipt of their comments submitted in response to this document must include a pre-addressed, stamped postcard with those comments on which the following statement is made: "Comments to Docket No. ________." The postcard will be date stamped and mailed to the commenter.

Availability of NPRMs

An electronic copy of this document may be downloaded using a modem and suitable communications software from the FAA regulations section of the Fedworld electronic bulletin board service (telephone: 703-321-3339), the Government Printing Office's (GPO) electronic bulletin board service (telephone: 202-512-1661), or, if applicable, the FAA's Aviation Rulemaking Advisory Committee bulletin board service telephone: 800-322-2722 or 202-267-5948).

Internet users may reach the FAA's web page at http://www.faa.gov/avr/arm/nprm/nprm.htm or the GPO's webpage at http://www.access.gpo.gov/nara for access to recently published rulemaking documents.

Any person may obtain a copy of this document by submitting a request to the Federal Aviation Administration, Office of Rulemaking, ARM-1, 800 Independence Avenue, SW., Washington, DC 20591; or by calling (202) 267-9680. Communications must identify the notice number or docket number of this NPRM.

Persons interested in being placed on the mailing list for future rulemaking documents should request from the above office a copy of Advisory Circular No. 11-2A, "Notice of Proposed Rulemaking Distribution System," which describes the application procedure.

Background

The airworthiness standards for transport category airplanes are contained in 14 CFR part 25 [commonly referred to as the Federal Aviation Regulations (FAR), part 25]. Manufacturers of transport category airplanes must show that each airplane they produce of a different type design complies with the relevant standards of part 25. These standards apply to airplanes manufactured within the U.S. for use by U.S.-registered operators, and to airplanes manufactured in other countries and imported to the U.S. under a bilateral airworthiness agreement.

In Europe, the Joint Aviation Requirements (JAR) were developed by the Joint Aviation Authorities (JAA) to provide a common set of airworthiness standards for use within the European aviation community. The airworthiness standards for European type certification of transport category airplanes are contained in JAR-25, and are based on 14 CFR part 25 [commonly referred to as part 25 of the Federal Aviation Regulations (FAR)].. Airplanes certificated to the JAR-25 standards, including airplanes manufactured in the U.S. for export to Europe, receive type certificates that are accepted by the aircraft certification authorities of 26 European member countries.

Although part 25 and JAR-25 are very similar, they are not identical in every respect. Differences between the two sets of standards can result in substantial additional costs when airplanes are type certificated to both standards. These additional costs, however, frequently do not bring about an increase in safety. For example, part 25 and JAR-25 may use different means to accomplish the same safety intent. In this case, the manufacturer is usually burdened with meeting both requirements, although the level of safety is not increased correspondingly. Recognizing that a common set of standards would not only economically benefit the aviation industry, but also would maintain the necessary high level of safety, the FAA and JAA consider "harmonization" of the two sets of standards to be a high priority.

In 1988, the FAA, in cooperation with the JAA and other organizations representing the American and European aerospace industries, began a process to harmonize the airworthiness requirements of the United States and the airworthiness requirements of Europe, especially in the areas of Flight Test and Structures.

The Aviation Rulemaking Advisory Committee

Later, in 1992, the FAA harmonization effort was undertaken by the Aviation Rulemaking Advisory Committee (ARAC). The ARAC was formally established by the FAA on January 22, 1991 (56 FR 2190), to provide advice and recommendations concerning the full range of the FAA's safety-related rulemaking activity. This advice was sought to develop better rules in less overall time using fewer FAA resources than are currently needed. The committee provides the opportunity for the FAA to obtain firsthand information and insight from interested parties regarding proposed new rules or revisions of existing rules.

There are 64 member organizations on the committee, representing a wide range of interests within the aviation community. Meetings of the committee are open to the public, except as authorized by section 10(d) of the Federal Advisory Committee Act.

The ARAC establishes working groups to develop proposals to recommend to the FAA for resolving specific issues. Tasks assigned to working groups are published in the Federal Register. Although working group meetings are not generally open to the public, all interested parties are invited to participate as working group members. Working groups report directly to the ARAC, and the ARAC must accept a working group proposal before that proposal can be presented to the FAA as an advisory committee recommendation.

The activities of the ARAC will not, however, circumvent the public rulemaking procedures. After an ARAC recommendation is received and found acceptable by the

FAA, the agency proceeds with the normal public rulemaking procedures. Any ARAC participation in a rulemaking package will be fully disclosed in the public docket.

Harmonization Working Group

The Loads and Dynamics Harmonization Working Group was chartered by notice in the Federal Register (58 FR 13819, March 15, 1993). The Working Group is made up of structural specialists from the aviation industry and government of Europe, the United States, and Canada. The task given to this Working Group was to harmonize the design loads section of Subpart C ("Structure") of 14 CFR part 25 with the counterpart requirements of the JAR. The Working Group developed specific recommendations for harmonizing the engine loading conditions. The ARAC approved those recommendations and recommended them to the FAA for rulemaking. The FAA has accepted ARAC's recommendation, and the proposed rulemaking contained in this notice follows from those recommendations and the activity of the Working Group.

Issues Prompting This Proposal

The current airworthiness standards contained in 14 CFR part 25 and JAR-25 require that turbine engine mounts and supporting structure must be designed to withstand ". . . A limit engine torque load imposed by sudden engine stoppage due to malfunction or structural failure (such as compressor jamming)." This was first made a specific requirement for U. S. transport category airplanes in 1957 by Civil Air Regulation (CAR) 4b.216(a)(4). It was later carried forward in § 25.361(b)(1) of part 25 when the Federal Aviation Regulations were recodified. This same requirement is contained in section 25.361 of JAR-25.

Previous methods of complying with this requirement have entailed either:

- designing to a specific torque value prescribed by the engine manufacturer, or

- designing to a torque level established by the polar moment of inertia of the rotating sections and the time required to stop the rotation, as defined by the engine manufacturer.

Since the circumstances and the events from which these loads are generated are dependent on the characteristics of the particular engine, the engine manufacturers traditionally have provided the airframe manufacturers with the information necessary to install each engine.

The size, configuration, and failure modes of jet engines have changed considerably since § 25.361(b) was first adopted. The original requirement addressed primarily turbine engine failure conditions that resulted in sudden engine deceleration and, in some cases, seizures. Those failure conditions were usually caused by internal structural failures or ingestion of foreign objects such as birds or ice. Whatever the source, those conditions could produce significant structural loads on the engine, engine mounts, pylon, and adjacent supporting airframe structure.

With the development of larger high-bypass ratio turbofan engines, however, it has become apparent that engine seizure torque loads alone do not adequately define the full loading imposed on the engine mounts, pylons, and their adjacent supporting airframe structure. The progression to high-bypass ratio turbofan engines of larger diameter and fewer blades with larger chords has increased the magnitude of the transient loads that can be produced during and following engine failures. As engines have grown much larger, their fans are capable of producing much higher torque loads when subjected to sudden deceleration.

The FAA finds that, relative to the engine configurations that existed when the rule was first developed, these later generations of jet engines are sufficiently different and novel to justify amending the regulations to ensure that adequate design standards are available for the mounts and the structure supporting these newer engines. Therefore, in order to maintain the level of safety intended by § 25.361(b)(1), the FAA considers that a more comprehensive criterion is necessary -- one that considers all load components when designing to address engine failure events.

Engine Loads and Events

When addressing loads and their effects on aircraft engines and structure, the term limit load is generally used to specify the maximum load to be expected in service. The structure must support the limit load without detrimental permanent deformation. Further, at any load up to limit loads, the deformation may not interfere with safe operation of the airplane.

The term ultimate load is used to specify the limit load multiplied by a prescribed factor of safety. The structure must be able to support this ultimate load without failure. Loads arising from very infrequent events (discussed below) are sometimes prescribed directly as ultimate loads without any additional factor of safety.

These terms are discussed in § 25.301 ("Loads"), § 25.303 ("Factor of safety"), and § 25.305 ("Strength and deformation").

Studies made by the engine and the airframe manufacturers have shown that large turbofan engines exhibit two distinct classes of sudden deceleration events:

The first type of event involves transient deceleration conditions involving rapid slowing of the rotating system. These events are usually associated with temporary loss of power or thrust capability, and often result in some engine distress, such as blade and/or wear strip damage. Examples are high power compressor surges, blade tip rub during maneuvers, bird encounters, or combinations of these events. Based on the frequency of occurrence, the FAA considers these events to be limit load conditions that require the 1.5 factor of safety prescribed in § 25.303 to obtain ultimate loads.

The second type of event involves major engine failures that result in extensive engine damage and permanent loss of thrust-producing capability. Examples of these types of events are fan blade failures, bearing failures, and shaft failures. It is evident from service history that these most severe sudden engine failure events are sufficiently infrequent to be considered ultimate load conditions. Because of the rare occurrence of these events and the conservative rational method in which the loads are to be obtained, the FAA proposes that these ultimate loads be applied to engine mounts and pylon structure without an additional factor of safety. At the same time, to provide additional protection for the more critical airframe structure, the FAA proposes that these ultimate loads be multiplied by an additional factor of 1.25 when applied to the adjacent supporting airframe structure.

Discussion of Proposal

Accordingly, this proposal would add a new § 25.362 addressing engine failure loads, which would distinguish between design criteria for the more common failure events (described above as the "first type of event") and design criteria for those rare events resulting from structural failures (described above as the "second type of event"). For the more rare but severe engine failure events, the proposed criteria would allow deformation in the engine supporting structure in order to absorb the higher energy associated with high-bypass turbofan engines. At the same time, the proposed criteria would protect the adjacent primary structure in the wing and fuselage by providing an additional safety margin.

Specifically, new § 25.362 would require that the engine mounts, pylons, and adjacent supporting airframe structure be designed to withstand 1g flight loads combined with transient dynamic loads that could result from various engine structural failure conditions (i.e., .the loss of any fan, compressor, or turbine blade; and, for certain designs, any other engine structural failure that results in higher loads).

Although the FAA recognizes that some engine configurations may exist in which the blade failure event is not the most critical load, the FAA expects that, for most conventional engines, the blade failure event will be the most severe event that needs to be investigated. Such a failure event, in which the most critical blade is assumed to fail at the maximum permissible rotational speed, is a required test under the certification standards of § 33.94, "Blade containment and rotor unbalance tests."

In addition to these certification tests, the engine manufacturers normally conduct additional developmental tests for each engine design. These tests, taken as a whole, allow a very reliable estimate of the transient engine loads resulting from failure events. Because the loads are supported by actual tests conducted in the most critical conditions of operation, the proposed rule would allow the loads developed from these conditions to be used directly as ultimate loads, with no additional factor when applied to engine mounts and pylons. However, the ultimate loads would be required to be multiplied by a factor of 1.25 when applied to adjacent supporting airframe structure.

Further, the proposed new § 25.362 would address only the transient engine failure load condition, since the sustained loads resulting from continued windmilling after failure currently are addressed by §§ 25.901 and 25.903 of part 25.

The proposed new conditions addressed in § 25.362 are more rationally determined, and will be treated as dynamic conditions including all significant input and response loads. The FAA has determined that designing for these new conditions would achieve an improved level of safety over that provided by the existing static engine torque criterion.

With the addition of new § 25.362, the current requirements of § 25.361 would be revised as follows:

1. Current § 25.361(a) would remain unchanged.
2. Current § 25.361(c) would be redesignated as new § 25.361(b).
3. Current § 25.361(c)(3), which refers to engines with two, three, or four cylinders, would be deleted. Transport category airplanes have not used these engines in

the past, nor are they expected to use them in the future. Therefore, the references serve no purpose in the rule.

4. Current § 25.361(b) would be redesignated as § 25.361(c).

5. Current § 25.361(b)(1) includes a sudden engine stoppage event as a limit load condition. This condition was addressed by considering only engine torque as a static load condition. This proposal would remove the sudden engine stoppage condition from these particular requirements, since new engine failure ultimate load conditions would be contained in new § 25.362.

6. Proposed revised § 25.361(c) would now require that the engine mounts, pylons, and adjacent supporting structure be designed to withstand 1g level flight loads acting simultaneously with the maximum limit torque loads imposed by:

- sudden engine deceleration due to a malfunction which could result in a temporary loss of power or thrust, and
- maximum engine acceleration.

This proposal also would add a new § 25.361(d) that would contain similar design load requirements as those of proposed revised § 25.361(c). However, they would apply strictly to the power unit mounts and adjacent supporting airframe structure for auxiliary power unit (APU) installations.

Finally, the title of § 25.361 would be changed from the current "Engine torque" to "Engine and auxiliary power unit torque." This change is necessary in order to provide a better indication of what the paragraph addresses.

Relevant Advisory Materials

The FAA is preparing to issue a new proposed Advisory Circular 25.362-1 to describe a means of compliance with the proposed regulation, which would meet the intended level of safety and promote consistent and effective application of the proposed revised standards. Public comments concerning the proposed AC are invited by separate notice published elsewhere in this issue of the Federal Register

Paperwork Reduction Act

In accordance with the Paperwork Reduction Act of 1995 [44 U.S.C. 3507(d)], the FAA had determined there are no requirements for information collection associated with this proposed rule.

Compatibility with ICAO Standards

In keeping with U.S. obligations under the Convention on International Civil Aviation, it is FAA policy to comply with International Civil Aviation Organization (ICAO) Standards and Recommended Practices to the maximum extent practicable. The FAA determined that there are no ICAO Standards and Recommended Practices that correspond to this proposed regulation.

Regulatory Evaluation Summary

Changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 directs that each Federal agency shall propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs. Second, the Regulatory Flexibility Act of 1980 requires agencies to analyze the economic effect of regulatory changes on small entities. Third, the Office of Management and Budget directs agencies to assess the effects of regulatory changes on international trade. And fourth, the Unfunded Mandates Reform Act of 1995 (Pub. L. 104-4) requires agencies to prepare a written assessment of the costs, benefits, and other effects of proposed or final rules that include a Federal mandate likely to result in the expenditure by State, local, or tribal governments, in the aggregate, or by the private sector, of $100 million or more annually (adjusted for inflation). In conducting these analyses, the FAA has determined that this proposed rule: (1) would generate benefits that justify its costs and would not be "a significant regulatory action" as defined in section

3(f) of Executive Order 12866 and, therefore, is not subject to review by the Office of Management and Budget; (2) would not have a significant impact on a substantial number of small entities; (3) would not constitute a barrier to international trade; and (4) would not contain a significant intergovernmental or private sector mandate. These analyses, available in the docket, are summarized below. The FAA invites the public to provide comments and supporting data on the assumptions made in this evaluation. All comments received will be considered in the final regulatory evaluation.

Initial Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 (RFA) establishes "as a principle of regulatory issuance that agencies shall endeavor, consistent with the objective of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of the business, organizations, and governmental jurisdictions subject to regulation." To achieve that principle, the Act requires agencies to solicit and consider flexible regulatory proposals and to explain the rationale for their actions. The Act covers a wide-range of small entities, including small businesses, not-for-profit organizations, and small governmental jurisdictions.

Agencies must perform a review to determine whether a proposed rule will have a significant economic impact on a substantial number of small entities. If the determination is that it will, the agency must prepare a regulatory flexibility analysis as described in the Act.

However, if an agency determines that a proposed or final rule is not expected to have a significant economic impact on a substantial number of small entities, section 605(b) of the 1980 Act provides that the head of the agency may so certify and a regulatory flexibility analysis is not required. The certification must include a statement providing the factual basis for this determination, and the reasoning should be clear.

[APO to add economic evaluation here.]

International Trade Impact Assessment

The provisions of this proposed rule would have little or no impact on trade for U.S. firms doing business in foreign countries and foreign firms doing business in the United States.

Federalism Implications

The regulation proposed herein would not have a substantial direct effect on the States, on the relationship between the national Government and the states, or on the distribution of power and responsibilities among the various levels of government. Therefore, in accordance with Executive Order 12612, it is determined that this proposal would not have sufficient federalism implications to warrant the preparation of a federalism assessment.

Unfunded Mandates Reform Act

Title II of the Unfunded Mandates Reform Act of 1995 (the Act), codified in 2 U.S.C. 1501-1571, requires each Federal agency, to the extent permitted by law, to prepare a written assessment of the effects of any Federal mandate in a proposed or final agency rule that may result in the expenditure by State, local, and tribal governments, in the aggregate, or by the private sector, of $100 million or more (adjusted annually for inflation) in any one year. Section 204(a) of the Act, 2 U.S.C. 1534(a), requires the Federal agency to develop an effective process to permit timely input by elected officers (or their designees) of State, local, and tribal governments on a proposed "significant intergovernmental mandate." A "significant intergovernmental mandate" under the Act is any provision in a Federal agency regulation that will impose an enforceable duty upon State, local, and tribal governments, in the aggregate, of $100 million (adjusted annually for inflation) in any one year. Section 203 of the Act, 2 U.S.C. 1533, which supplements section 204(a), provides that before establishing any regulatory requirements that might significantly or uniquely affect small governments, the agency shall have developed a plan that, among other things, provides for notice to potentially affected small governments, if any, and for a meaningful and timely opportunity to provide input in the development of regulatory proposals.

This proposed rule does not contain a Federal intergovernmental or private sector mandate that exceeds $100 million in any one year.

Environmental Analysis

FAA Order 1050.1D defines FAA actions that may be categorically excluded from preparation of a National Environmental Policy Act (NEPA) environmental assessment or environmental impact statement. In accordance with FAA Order 1050.1D, appendix 4, paragraph 4(j), this rulemaking qualifies for a categorical exclusion.

Energy Impact

The energy impact of the proposed rule has been assessed in accordance with the Energy Policy and Conservation Act (EPCA) and Public Law 94-163, as amended (42 U.S.C. 6362). It has been determined that it is not a major regulatory action under the provisions of the EPCA.

Regulations Affecting Intrastate Aviation in Alaska

Section 1205 of the FAA Reauthorization Act of 1996 (110 Stat. 3213) requires the Administrator, when modifying regulations in Title 14 of the CFR in a manner affecting intrastate aviation in Alaska, to consider the extent to which Alaska is not served by transportation modes other than aviation, and to establish such regulatory distinctions as he or she considers appropriate. Because this proposed rule would apply to the certification of future designs of transport category airplanes and their subsequent operation, it could, if adopted, affect intrastate aviation in Alaska. The FAA therefore specifically requests comments on whether there is justification for applying the proposed rule differently to intrastate operations in Alaska.

List of Subjects in 14 CFR Part 25:

Aircraft, Aviation safety, Reporting and record keeping requirements

The Proposed Amendment

In consideration of the foregoing, the Federal Aviation Administration proposes to amend part 25 of Title 14, Code of Federal Regulations, as follows:

Part 25 - AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY AIRPLANES

1. The authority citation for Part 25 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701-44702, and 44704.

2. Amend § 25.361 by revising the title, by revising paragraphs (b) and (c), and by adding new paragraph (d), to read as follows:

§ 25.361 Engine and auxiliary power unit torque

(a) * * * * *

(b) The limit engine torque to be considered under paragraph (a) of this section must be obtained by multiplying mean torque for the specified power and speed by a factor of -

(1) 1.25 for turbopropeller installations;

(2) 1.33 for reciprocating engines.

(c) For turbine engine installations, the engine mounts, pylons, and adjacent supporting airframe structure must be designed to withstand 1g level flight loads acting simultaneously with the maximum limit torque loads imposed by each of the following:

(1) sudden engine deceleration due to a malfunction which could result in a temporary loss of power or thrust; and

(2) the maximum acceleration of the engine.

(d) For auxiliary power unit installations, the power unit mounts and adjacent supporting airframe structure must be designed to withstand 1g level flight loads acting simultaneously with the maximum limit torque loads imposed by each of the following:

(1) sudden auxiliary power unit deceleration due to malfunction or structural failure; and

(2) the maximum acceleration of the power unit.

3. By adding a new section 25.362, to read as follows:

§ 25.362 Engine failure loads

(a) For engine supporting structure, an ultimate loading condition must be considered that combines 1g flight loads with the transient dynamic loads resulting from:

(1) the loss of any fan, compressor, or turbine blade; and

(2) separately, where applicable to a specific engine design, any other engine structural failure that results in higher loads.

(b) The ultimate loads developed from the conditions specified in paragraph (a) are to be:

(1) multiplied by a factor of 1.0 when applied to engine mounts and pylons; and

(2) multiplied by a factor of 1.25 when applied to adjacent supporting airframe structure.

Issued in Washington, D.C., on

Director,
Aircraft Certification Service

U.S. Department
of Transportation
**Federal Aviation
Administration**

Advisory Circular

Subject: ENGINE FAILURE LOADS **Date:** DRAFT ~~8/13~~~~16~~9/21/99 **AC No:** 25.362-1

Initiated By: ANM-115 **Change:** Rev 3~~2~~ w/Legal input

WORKING DRAFT -- NOT FOR PUBLIC RELEASE.

1. **PURPOSE**. This Advisory Circular (AC) describes an acceptable means for showing compliance with the requirements of §25.362, "Engine and Auxiliary Power Unit Load Conditions," of 14 CFR part 25 [commonly referred to as ~~of~~ part 25 of the Federal Aviation Regulations (FAR)], as it applies to transport category airplanes. These means are intended to provide guidance to supplement the engineering and operational judgment that must form the basis of any compliance findings relative to the design of engine mounts and their supporting structures for loads developed from the engine failure conditions described in § 25.362.

The guidance provided in this document is directed to airplane and engine manufacturers, modifiers, foreign regulatory authorities, and Federal Aviation Administration transport airplane type certification engineers and their designees.

Like all advisory circular material, this AC is not, in itself, mandatory, and does not constitute a regulation. It is issued to describe an acceptable means, but not the only means, for demonstrating compliance with the requirements for transport category airplanes. Terms such as "shall" and "must" are used only in the sense of ensuring applicability of this particular method of compliance when the acceptable method of compliance described in this document is used.

2. **RELATED SECTIONS OF FEDERAL AVIATION REGULATIONS.**

a. Title 14, Code of Federal Regulations (CFR) Part 25:

Section 25.361 "Engine and auxiliary power unit torque"
Section 25.901 "Powerplant installation"

b. Title 14, Code of Federal Regulations (CFR) Part 33:

Section 33.23 "Engine mounting attachments and structure"
Section 33.65 "Surge and stall characteristics"
Section 33.94 "Blade containment and rotor unbalance tests"

3. **DEFINITIONS**. Some new terms have been defined for the transient engine failure conditions in order to present criteria in a precise and consistent manner in the following pages. In addition, some terms are employed from other fields and may not necessarily be in general use. For the purposes of this Advisory Circular, the following definitions should be used.

a. Adjacent supporting airframe structure: Those parts of the primary airframe that are directly affected by loads arising within the engine.

b. Blade loss: The loss of the most critical fan, compressor, or turbine blade.

~~c. Factor of Safety: The ratio of ultimate load to limit load.~~

~~d~~c. Ground Vibration Test :~~(GVT):~~ Ground resonance tests of the airplane normally conducted ~~in~~ for compliance with § 25.629, "Aeroelastic stability requirements."

~~e. Limit Load: The maximum load that the structure is designed to carry without detrimental permanent deformation.~~

~~f~~d.. Transient failure loads: Those loads occurring from the time of the engine structural failure, up to the time at which the engine stops rotating or achieves a steady windmilling rotational speed.

~~g. Ultimate Load: The load that the structure must withstand without failure.~~

~~h~~e. Windmilling engine rotational speed. The speed at which the rotating shaft systems of an unpowered engine will rotate due to the flow of air into the engine as a result of the forward motion of the airplane. ~~The windmilling engine rotational speed will vary as a function of aircraft speed.~~

4. **BACKGROUND**.

a. Requirements. Section 25.362 ("Engine and Auxiliary Power Unit Load Conditions") requires that the engine mounts, pylons, and adjacent supporting airframe structure be designed to withstand 1g flight loads combined with transient dynamic loads resulting from each engine structural failure condition.

b. Engine failure loads. Turbine engines have experienced failure conditions that have resulted in sudden engine deceleration and, in some cases, seizures. These failure conditions ~~have~~ are usually ~~been~~ caused by internal structural failures or ingestion of foreign objects, such as birds or ice. Whatever the source, these conditions may produce significant structural loads on the engine, engine mounts, pylon, and adjacent supporting airframe structure. With the development of larger high-bypass ratio turbine engines, it became apparent that engine seizure torque loads alone did not adequately define the full loading imposed on the engine mounts, pylons, and their adjacent supporting airframe structure. The progression to high-bypass ratio turbine engines of larger diameter and fewer blades with larger chords has increased the magnitude of the transient loads that can be produced during and following engine failures. Consequently, for engine failure events, it is considered necessary that the applicant ~~to~~ perform dynamic analysis that considers all load components.

A dynamic model of the aircraft and engine configuration must be sufficiently detailed to characterize the transient ~~and steady state~~ loads for the engine mounts, pylons, and adjacent supporting airframe structure during the failure event and subsequent run down.

c. Engine structural failure conditions. Of all the applicable engine structural failure conditions, ~~D~~design and test experience have shown that~~, of all the applicable engine structural failure conditions,~~ the loss of a blade is likely to produce the most severe loads on the engine and airframe. Therefore, § 25.362 requires that the transient dynamic loads from these blade failure conditions be considered when evaluating structural integrity. However, service history shows examples of other severe engine structural failures where the engine thrust-producing capability ~~is~~ was lost, and the engine ~~has~~ experienced extensive internal damage. For each specific engine design, the applicant should ~~consideration should be given as to~~ consider whether these types of failures are applicable, and if they present a more critical load condition than blade loss. Examples of other engine structural failure conditions that should be considered in this respect are:

- failure of a shaft, or
- failure or loss of any shaft support bearing.

5. EVALUATION OF TRANSIENT FAILURE CONDITIONS

a. Objective. The applicant should show, by a combination of tests and analyses, that the airplane is capable of continued safe flight and landing after ~~partial or complete~~ loss of a blade, including ensuing damage to other parts of the engine.

The primary failure condition is expected to be blade release (refer to 14 CFR part 33, § 33.94, "Blade containment and rotor unbalance tests"). However, other structural failures may need to be considered as well, depending upon the engine configuration.

The applicant also should ~~give consideration to~~consider the transient loads from the time of the engine structural failure, up to the time at which the engine stops rotating or achieves a steady windmilling rotational speed. [**NOTE**: The effects of continued rotation (windmilling) are described in AC 25-901-1, "System Safety Assessment of Powerplant Installations" -- ***currently in D-R-A-F-T form***.]

b. Evaluation. The applicant's evaluation should show that, from the moment of engine structural failure and during spool-down to the time of windmilling engine rotational speed, the engine-induced loads and vibrations will not cause failure of the engine mounts, pylon, and adjacent supporting airframe structure.

Major engine structural failure events are considered as ultimate load conditions, since they occur at a sufficiently infrequent rate. For design of the engine mounts and pylon, the ultimate loads may be taken without any additional multiplying factors. At the same time, protection of the basic airframe is assured by using a multiplying factor of 1.25 on those ultimate loads for the design of the adjacent supporting airframe structure.

c. Blade loss condition. The applicant should determine loads ~~within the engine, and~~ on the engine mounts, pylon, and adjacent supporting airframe structure by dynamic analysis. The analysis should take into account all significant structural degrees of freedom. The transient engine loads should be determined for the fan blade failure condition and rotor speed, as specified in § 33.94, and over the full range of blade release angles to allow determination of the critical loads for all affected components. The amount of engine damage that develops during the failure event and, consequently, the loads produced, depends on material properties and temperature. Therefore, the analysis of transient engine loads should consider the effects of variations in engine material properties and temperature. This ~~requirement~~ step in the analysis may be satisfied by analyzing:

- the engine stiffness characteristics at typical flight temperatures, and
- the engine strength and deflection characteristics at maximum design temperatures.

The forcing function to be applied to the pylon and airframe is normally generated and validated by the engine manufacturer, including those changes needed to represent the critical flight conditions.

The analysis of incremental transient airframe loads should consider:

- the effects of the engine mounting station on the airplane (i.e., right side, left side, inboard position, etc.); and
- the most critical airplane mass distribution (i.e., fuel loading for wing-mounted engines and payload distribution for fuselage-mounted engines).

For calculation of the combined ultimate airframe loads, the 1g component may be associated with typical flight conditions.

d. Other failure conditions. If any other engine structural failure conditions, applicable to the specific engine design, are identified that present a more critical load condition than the blade loss condition, they should be evaluated by dynamic analysis to a similar standard and using similar assumptions to those described in paragraph 5.c., above.

6. ANALYSIS METHODOLOGY.

a. Objective of the methodology. The objective of the analysis methodology is to develop acceptable analytical tools for conducting investigations of dynamic engine structural failure events. The goal of the analysis is to produce loads and accelerations suitable for evaluations of structural integrity. However, where required for compliance with § 25.901 ("Powerplant installation"), loads and accelerations may also need to be produced for evaluating the continued function of systems related to the engine installation that are essential for immediate flight safety (for example, fire bottles and fuel shut off valves).

b. Scope of the analysis. The analysis of the aircraft and engine configuration should be sufficiently detailed to determine the transient and steady-state loads for the engine mounts, pylon, and adjacent supporting airframe structure during the engine failure event and subsequent run-down.

~~c. Results of the analysis. The engine structural failure analysis should provide loads for all parts of the primary structure that are significantly affected by the failure.~~

7. MATHEMATICAL MODELING AND VALIDATION.

a. Components of the integrated dynamic model. The applicant should calculate ~~A~~airframe dynamic responses ~~should be calculated~~ with an integrated model of the engine, pylon, and ~~adjacent supporting~~ airframe structure. The integrated dynamic model used for engine structural failure analyses should be representative of the airplane to the highest frequency needed to accurately represent the transient response. The integrated dynamic model consists of the following components that may be validated independently:

- Airframe structural model.
- Engine structural model.

b. Airframe Structural Model and Validation.

(1) An analytical model of the airframe is necessary in order to calculate the airframe responses due to the transient forces produced by the engine failure

event. The airframe manufacturers currently use reduced lumped mass finite element analytical models of the airframe for certification of aeroelastic stability (flutter) and dynamic loads, including gust, landing impact, and taxi. A typical model consists of relatively few lumped masses connected by weightless beams. A full airplane model is not usually necessary for the engine failure analysis, and it is normally not necessary to consider the whole aircraft response, the effects of automatic flight control systems, or unsteady aerodynamics.

(2) A lumped mass beam model of the airframe, similar to that normally used for flutter analysis, is acceptable for frequency response analyses due to engine structural failure conditions. However, additional detail may be needed to ensure adequate fidelity for the engine structural failure frequency range. In particular, the engine structural failure analysis requires calculating the response of the airframe at higher frequencies than are usually needed to obtain accurate results for the other loads analyses, such as dynamic gust and landing impact. The applicant should use Ffinite element models should be used as necessary. As far as possible, the measured ground vibration tests (GVT) normally conducted for compliance with § 25.629 ("Aeroelastic stability requirements") should be used to validate the analytical model.

(3) Structural dynamic models include damping properties, as well as representations of mass and stiffness distributions. In the absence of better information, it will normally be acceptable to assume a value of 0.03 (i.e., 1.5% equivalent critical viscous damping) for all flexible modes. Structural damping may be increased over the 0.03 value to be consistent with the high structural response levels caused by extreme failure loads, provided it is justified.

c. Engine Structural Model and Validation.

(1) Engine manufacturers construct various types of dynamic models to determine loads and to perform dynamic analyses on the engine rotating components, static structures, mounts, and nacelle components. Dynamic engine models can range from a centerline two-dimensional (2D) model, to a centerline model with appropriate three-dimensional (3D) features, such as mount and pylon, up to a full 3D finite element model. (3D FEM). Any of these models can be run for either transient or steady state conditions. The guidance provided in paragraph 6.b of this advisory circular should be considered when determining the modeling detail required.

(2) Detailed FEM finite element models typically include all major components of the propulsion system, such as:

- the nacelle intake,
- fan cowl doors,
- thrust reverser,
- common nozzle assembly,

- all structural casings,
- frames,
- bearing housings,
- rotors,
- gearbox, and
- a representative pylon.

Gyroscopic effects are included. The FEM finite element models provide for representative connections at the engine-to-pylon interfaces, as well as all interfaces between components (e.g., inlet-to-engine and engine-to-thrust reverser).

(3) Features modeled specifically for blade loss analysis typically include:

- fan imbalance,
- component failure,
- rubs (blade-to-casing, and intershaft),
- resulting stiffness changes, and
- aerodynamic effects, such as thrust loss and engine surge.

Manufacturers whose engines fail the rotor support structure by design during the blade loss event should also evaluate the effect of the loss of support on engine structural response.

(4) The model should be validated based on dedicated vibration tests and results of the blade loss test required for compliance with § 33.94, giving due allowance for the effects of the test mount structure. The model should be capable of accurately predicting the transient loads from blade release through run-down to steady state. In cases where compliance with § 33.94 is granted by similarity instead of test, the model should be correlated to prior experience. For compliance with § 25.362, the engine model, once validated, should be modified to include the influence of representative adjacent supporting airframe structure.

(5) Validation of the engine model static structure including the pylon is achieved by a combination of engine and component tests, which include structural tests on major load path components. The adequacy of the engine model to predict rotor critical speeds and forced response behavior is verified by measuring engine vibratory response when imbalances are added to the fan and other rotors. Vibration data are routinely monitored on a number of engines during the engine development cycle, thereby providing a solid basis for model correlation.

(6) Correlation of the model against the § 33.94 blade loss engine test is a demonstration for which the model accurately predicts:

- initial blade release event loads,
- any rundown resonant response behavior,
- frequencies,
- potential structural failure sequences, and
- general engine movements and displacements.

To enable this correlation to be performed, instrumentation of the blade loss engine test should be used (e.g., use of high-speed cinema and video cameras, accelerometers, strain gauges, continuity wires, and shaft speed tachometers). This instrumentation should be capable of measuring loads on the adjacent support structure engine attachment structure.

(7) The airframe and engine manufacturers should mutually agree upon Tthe definition of the model should be mutually agreed upon between the airframe and engine manufacturers, based on test and experience.

[AE1]

Mr. Ron Priddy
President, Operations
National Air Carrier Association
1100 Wilson Blvd., Suite 1700
Arlington, VA 22209

Dear Mr. Priddy:

The Federal Aviation Administration (FAA) recently completed a regulatory program review. That review focused on prioritizing rulemaking initiatives to more efficiently and effectively use limited industry and regulatory rulemaking resources. The review resulted in an internal Regulation and Certification Rulemaking Priority List that will guide our rulemaking activities, including the tasking of initiatives to the Aviation Rulemaking Advisory Committee (ARAC). Part of the review determined if some rulemaking initiatives could be addressed by other than regulatory means, and considered products of ARAC that have been or are about to be forwarded to us as recommendations.

The Regulatory Agenda will continue to be the vehicle the FAA uses to communicate its rulemaking program to the public and the U.S. government. However, the FAA also wanted to identify for ARAC those ARAC rulemaking initiatives it is considering to handle by alternative actions (see the attached list). At this time, we have not yet determined what those alternative actions may be. We also have not eliminated the possibility that some of these actions in the future could be addressed through rulemaking when resources are available.

If you have any questions, please feel free to contact Gerri Robinson at (202) 267-9678 or gerri.robinson@faa.gov.

Sincerely,

Anthony F. Fazio
Executive Director, Aviation Rulemaking Advisory Committee

Enclosure

cc:
William W. Edmunds, Air Carrier Operation Issues
Sarah MacLeod, Air Carrier/General Aviation Maintenance Issues
James L. Crook, Air Traffic Issues
William H. Schultz, Aircraft Certification Procedures Issues
Ian Redhead, Airport Certification Issues

Billy Glover, Occupant Safety Issues
John Tigue, General Aviation Certification and Operations Issues
David Hilton, Noise Certification Issues
John Swihart, Rotorcraft Issues
Roland B. Liddell, Training and Qualification Issues
Craig Bolt, Transport Airplane and Engine Issues

ARAC Projects that will be handled by Alternative Actions rather than Rulemaking

(Beta) Reverse Thrust and propeller Pitch Setting below the Flight Regime (25.1155)
Fire Protection (33.17)
Rotor Integrity--Overspeed (33.27)
Safety Analysis (33.75)
Rotor Integrity – Over-torque (33.84)
2 Minute/30 Second One Engine Inoperative (OEI) (33.XX)
Bird Strike (25.775, 25.571, 25.631)
Casting Factors (25.621)
Certification of New Propulsion Technologies on Part 23 Airplanes
Electrical and Electronic Engine Control Systems (33.28)
Fast Track Harmonization Project: Engine and APU Loads Conditions (25.361, 25.362)
Fire Protection of Engine Cowling (25.1193(e)(3))
Flight Loads Validation (25.301)
Fuel Vent System Fire Protection (Part 25 and Retrofit Rule for Part 121, 125, and 135)
Ground Gust Conditions (25.415)
Harmonization of Airworthiness Standards Flight Rules, Static Lateral-Directional Stability, and Speed Increase and Recovery Characteristics (25.107(e)(1)(iv), 25.177©, 25.253(a)(3)(4)(50)). Note: 25.107(a)(b)(d) were enveloping tasks also included in this project—They will be included in the enveloping NPRM)
Harmonization of Part 1 Definitions Fireproof and Fire Resistant (25.1)
Jet and High Performance Part 23 Airplanes
Load and Dynamics (Continuous Turbulence Loads) (25.302, 25.305, 25.341 (b), etc.)
Restart Capability (25.903(e))

Standardization of Improved Small Airplane Normal Category Stall Characteristics Requirements (23.777, 23.781, 23.1141, 23.1309, 23.1337, 25.1305)

ATTC (25.904/App I)
Cargo Compartment Fire Extinguishing or Suppression Systems (25.851(b), 25.855, 25.857)
Proof of Structure (25.307)
High Altitude Flight (25.365(d))
Fatigue and Damage Tolerance (25.571)
Material Prosperities (25.604)

Paperwork Reduction Act of 1995 (44 U.S.C. 3501 *et seq.*).

Public Protection Notification

The NRC may not conduct or sponsor, and a person is not required to respond to, a request for information or an information collection requirement unless the requesting document displays a currently valid Office of Management and Budget (OMB) control number.

VI. Plain Writing

The Plain Writing Act of 2010 (Pub. L. 111–274) requires Federal agencies to write documents in a clear, concise, and well-organized manner. The NRC has written this document to be consistent with the Plain Writing Act as well as the Presidential Memorandum, ''Plain Language in Government Writing,'' published June 10, 1998 (63 FR 31883).

VII. Backfitting and Issue Finality

The NRC has determined that the amendments in this final rule do not constitute backfitting and are not inconsistent with any of the issue finality provisions in 10 CFR part 52. The amendments are non-substantive in nature, and include adding three inadvertently omitted addenda to Section XI of the ASME B&PV Code to the list of documents approved for incorporation by reference and correcting a footnote number. They impose no new requirements and make no substantive changes to the regulations. The amendments do not involve any provisions that would impose backfits as defined in 10 CFR part 50, or would be inconsistent with the issue finality provisions in 10 CFR part 52. For these reasons, the issuance of the rule in final form would not constitute backfitting or represent an inconsistency with any of the issue finality provisions in 10 CFR part 52. Therefore, the NRC has not prepared any additional documentation for this final rule addressing backfitting or issue finality.

VIII. Congressional Review Act

In accordance with the Congressional Review Act of 1996 (5 U.S.C. 801–808), the NRC has determined that this action is not a major rule and has verified this determination with the Office of Information and Regulatory Affairs, Office of Management and Budget.

List of Subjects in 10 CFR Part 50

Antitrust, Classified information, Criminal penalties, Fire protection, Incorporation by reference, Intergovernmental relations, Nuclear power plants and reactors, Radiation protection, Reactor siting criteria, Reporting and recordkeeping requirements.

For the reasons set out in the preamble and under the authority of the Atomic Energy Act of 1954, as amended; the Energy Reorganization Act of 1974, as amended; and 5 U.S.C. 552 and 553, the NRC is adopting the following amendments to 10 CFR part 50.

PART 50—DOMESTIC LICENSING OF PRODUCTION AND UTILIZATION FACILITIES

■ 1. The authority citation for part 50 continues to read as follows:

Authority: Atomic Energy Act secs. 102, 103, 104, 105, 147, 149, 161, 181, 182, 183, 186, 189, 223, 234 (42 U.S.C. 2132, 2133, 2134, 2135, 2167, 2169, 2201, 2231, 2232, 2233, 2236, 2239, 2273, 2282); Energy Reorganization Act secs. 201, 202, 206 (42 U.S.C. 5841, 5842, 5846); Nuclear Waste Policy Act sec. 306 (42 U.S.C. 10226); Government Paperwork Elimination Act sec. 1704 (44 U.S.C. 3504 note); Energy Policy Act of 2005, Pub. L. 109–58, 119 Stat. 194 (2005). Section 50.7 also issued under Pub. L. 95–601, sec. 10, as amended by Pub. L. 102–486, sec. 2902 (42 U.S.C. 5851). Section 50.10 also issued under Atomic Energy Act secs. 101, 185 (42 U.S.C. 2131, 2235); National Environmental Protection Act sec. 102 (42 U.S.C. 4332). Sections 50.13, 50.54(d), and 50.103 also issued under Atomic Energy Act sec. 108 (42 U.S.C. 2138). Sections 50.23, 50.35, 50.55, and 50.56 also issued under Atomic Energy Act sec. 185 (42 U.S.C. 2235). Appendix Q also issued under National Environmental Protection Act sec. 102 (42 U.S.C. 4332). Sections 50.34 and 50.54 also issued under sec. 204 (42 U.S.C. 5844). Sections 50.58, 50.91, and 50.92 also issued under Pub. L. 97–415 (42 U.S.C. 2239). Section 50.78 also issued under Atomic Energy Act sec. 122 (42 U.S.C. 2152). Sections 50.80–50.81 also issued under Atomic Energy Act sec. 184 (42 U.S.C. 2234).

■ 2. In § 50.55a, add paragraphs (a)(1)(ii)(B)(*5*) through (*7*) to read as follows:

§ 50.55a Codes and standards.

(a) * * *

(1) * * *

(ii) * * *

(B) * * *

(*5*) 1975 Winter Addenda,

(*6*) 1976 Summer Addenda, and

(*7*) 1976 Winter Addenda.

* * * * *

§ 50.55a [Amended]

■ 3. In § 50.55a, paragraph (e)(1), in the second sentence, remove footnote ''9'' and add, in its place, footnote ''7''.

Dated at Rockville, Maryland, this 8th day of December 2014.

For the Nuclear Regulatory Commission.

Cindy Bladey,

Chief, Rules, Announcements, and Directives Branch, Division of Administrative Services, Office of Administration.

[FR Doc. 2014–29037 Filed 12–10–14; 8:45 am]

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DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 25

[Docket No.: FAA–2013–0142; Amdt. No. 25–141]

RIN 2120–AK12

Harmonization of Airworthiness Standards—Gust and Maneuver Load Requirements

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final rule.

SUMMARY: This final rule amends certain airworthiness regulations for transport category airplanes, based on recommendations from the FAA-sponsored Aviation Rulemaking Advisory Committee (ARAC). This amendment eliminates regulatory differences between the airworthiness standards of the FAA and European Aviation Safety Agency (EASA). It does not add new requirements beyond what manufacturers currently meet for EASA certification and does not affect current industry design practices. This final rule revises the pitch maneuver design loads criteria; revises the gust and turbulence design loads criteria; revises the application of gust loads to engine mounts, high lift devices, and other control surfaces; adds a ''round-the-clock'' discrete gust criterion and a multi-axis discrete gust criterion for airplanes equipped with wing-mounted engines; revises the engine torque loads criteria; adds an engine failure dynamic load condition; revises the ground gust design loads criteria; revises the criteria used to establish the rough air design speed; and requires the establishment of a rough air Mach number.

DATES: Effective February 9, 2015.

ADDRESSES: For information on where to obtain copies of rulemaking documents and other information related to this final rule, see ''How To Obtain Additional Information'' in the **SUPPLEMENTARY INFORMATION** section of this document.

FOR FURTHER INFORMATION CONTACT: For technical questions concerning this action, contact Todd Martin, Airframe and Cabin Safety Branch, ANM–115, Transport Airplane Directorate, Aircraft Certification Service, Federal Aviation Administration, 1601 Lind Avenue SW., Renton, WA 98057–3356; telephone (425) 227–1178; facsimile (425) 227–1232; email *Todd.Martin@faa.gov.*

For legal questions concerning this action, contact Sean Howe, Office of the Regional Counsel, ANM–7, Federal Aviation Administration, 1601 Lind Avenue SW., Renton, Washington 98057–3356; telephone (425) 227–2591; facsimile (425) 227–1007; email *Sean.Howe@faa.gov.*

SUPPLEMENTARY INFORMATION:

Authority for This Rulemaking

The FAA's authority to issue rules on aviation safety is found in Title 49 of the United States Code. Subtitle I, Section 106 describes the authority of the FAA Administrator. Subtitle VII, Aviation Programs, describes in more detail the scope of the agency's authority.

This rulemaking is promulgated under the authority described in Subtitle VII, Part A, Subpart III, Section 44701, ''General Requirements.'' Under that section, the FAA is charged with promoting safe flight of civil aircraft in air commerce by prescribing regulations and minimum standards for the design and performance of aircraft that the Administrator finds necessary for safety in air commerce. This regulation is within the scope of that authority. It prescribes new safety standards for the design and operation of transport category airplanes.

I. Overview of Final Rule

The FAA is amending Title 14, Code of Federal Regulations (14 CFR) Part 25 as described below. This action harmonizes part 25 requirements with the corresponding requirements in Book 1 of the EASA Certification Specifications and Acceptable Means of Compliance for Large Aeroplanes (CS–25). As such, this action—

1. Revises § 25.331, ''Symmetric maneuvering conditions,'' to prescribe both positive and negative checked pitch maneuver loads that take into account the size of the airplane and any effects of the flight control system. The introductory paragraph, § 25.331(c), is revised by moving some criteria to § 25.331(c)(2) where those criteria apply.

2. Removes appendix G to part 25, ''Continuous Gust Design Criteria,'' and § 25.341(b) now clearly sets forth the continuous turbulence requirement.

3. Revises § 25.341, ''Gust and turbulence loads,'' to—

• Remove the optional mission analysis method currently specified in appendix G in favor of the design envelope analysis method.

• Update the turbulence intensity criteria in § 25.341(b) to take into account in-service measurements of derived gust intensities.

• Update § 25.341(a) to require evaluation of discrete gust conditions at airplane speeds from design speed for maximum gust intensity, V_B, to design cruising speed, V_C, (previously required only at V_C) and to specify reference gust velocities up to 60,000 feet, rather than the previously specified 50,000 feet.

• Add a new paragraph § 25.341(c) that specifies a ''round-the-clock'' discrete gust criterion and a multi-axis discrete gust criterion for airplanes equipped with wing-mounted engines.

4. Revises § 25.343, ''Design fuel and oil loads,'' § 25.345, ''High lift devices,'' § 25.371, ''Gyroscopic loads,'' § 25.373, ''Speed control devices,'' and § 25.391, ''Control surface loads: General,'' by adding to each of these regulations a requirement to evaluate the continuous turbulence loads criteria in § 25.341(b).

5. Revises § 25.361, ''Engine and auxiliary power unit torque,'' to—

• Remove the requirement to assess engine torque loads due to engine structural failures (this requirement is re-established in the new § 25.362, outlined below).

• Provide specific engine torque load criteria for auxiliary power unit installations.

• Remove the requirements that apply to reciprocating engines.

• Change the title of § 25.361 from ''Engine torque'' to ''Engine and auxiliary power unit torque.''

6. Adds new § 25.362, ''Engine failure loads,'' to require engine mounts and supporting airframe structure be designed for 1g flight loads combined with the most critical transient dynamic loads and vibrations resulting from failure of a blade, shaft, bearing or bearing support, or bird strike event.

7. Revises § 25.391, ''Control surface loads: General,'' and § 25.395, ''Control system,'' to remove references to the ground gust requirements in § 25.415.

8. Revises § 25.415, ''Ground gust conditions'' to—

• Reorganize and clarify the design conditions to be considered.

• Identify the components and parts of the control system to which each of the conditions apply.

• Make it stand alone in regard to the required multiplying factors and to provide an additional multiplying factor to account for dynamic amplification.

9. Revises § 25.1517, ''Rough air speed, V_{RA}'' to remove the reference to VB in the definition of rough air speed and to require that a rough air Mach number, MRA, be established in addition to rough air speed. Also, this action removes the reference to § 25.1585, ''Operating procedures,'' because it is no longer applicable since that regulation was modified.

II. Background

A. Statement of the Problem

Part 25 prescribes airworthiness standards for type certification of transport category airplanes for products certified in the United States. EASA CS–25 Book 1 prescribes the corresponding airworthiness standards for products certified in Europe. While part 25 and CS–25 Book 1 are similar, they differ in several respects.

The FAA tasked ARAC through the Loads and Dynamics Harmonization Working Group (LDHWG) to review existing structures regulations and recommend changes that would eliminate differences between the U.S. and European airworthiness standards. The LDHWG developed recommendations, which EASA has incorporated into CS–25 with some changes. The FAA agrees with the ARAC recommendations as adopted by EASA, and this final rule amends part 25 accordingly.

B. Summary of the NPRM

On May 6, 2013, the FAA issued a Notice of Proposed Rulemaking (NPRM), Notice No. 25–139,[1] Docket No. FAA–2013–0142, to amend §§ 25.331, 25.341, 25.343, 25.345, 25.361, 25.371, 25.373, 25.391, 25.395, 25.415, and 25.1517; to add § 25.362; and to remove appendix G of 14 CFR part 25. That NPRM was published in the **Federal Register** on May 28, 2013 (78 FR 31851). In the NPRM, the FAA proposed to (1) revise the pitch maneuver design loads criteria; (2) revise the gust and turbulence design loads criteria; (3) revise the application of gust loads to engine mounts, high lift devices, and other control surfaces; (4) add a ''round-the-clock'' discrete gust criterion and a multi-axis discrete gust criterion for airplanes equipped with wing-mounted engines; (5) revise the engine torque loads criteria and add an engine failure dynamic load condition; (6) revise the ground gust design loads criteria; (7) revise the criteria used to establish the rough air design speed; and (8) require the establishment of a rough air Mach number.

[1] On April 16, 2014, the **Federal Register** published a correction (79 FR 21413) changing the Notice No. to ''13–04'' for the NPRM that published May 28, 2013 (78 FR 31851) and for subsequent NPRM corrections that published June 24, 2013 (78 FR 37722) and July 16, 2013 (78 FR 42480).

The FAA proposed these changes to eliminate regulatory differences between the airworthiness standards of the FAA and EASA. The NPRM comment period closed on August 26, 2013.

On June 24, 2013, the **Federal Register** published a correction to the NPRM to correct three equations in the proposed amendments to § 25.341 (78 FR 37722). On July 16, 2013, the **Federal Register** published a second correction to one equation in the proposed amendments to § 25.341 (78 FR 42480). The equations in this final rule have not changed from those in the corrected NPRM.

C. General Overview of Comments

The FAA received two comments. One commenter supported the NPRM and the ongoing international harmonization of certification requirements. The other comment addressed § 25.341 and is discussed below.

III. Discussion of Public Comments and Final Rule

A. Section 25.341, ''Gust and Turbulence Loads''

Section 25.341(a)(6) uses the term Z_{mo}, which is the maximum operating altitude, in feet, specifically defined in § 25.1527. A commenter noted that the units for the term Z_{mo} are not provided in the current rule. While § 25.341(a)(6) was not being revised as part of this rulemaking, the commenter recommended that this paragraph be revised to include the appropriate units for Z_{mo} (feet) for ease of reference. We agree, and revise the rule as recommended.

B. Section 25.415, ''Ground Gust Conditions''

After further FAA review of what we proposed by NPRM, we now specify that control system gust locks are to be taken into account only when the airplane is so equipped. As proposed, § 25.415 would have required that the airplane be evaluated while taxiing with the controls locked and unlocked, and while parked with the controls locked. However, many transport category airplanes with powered flight controls do not have control system gust locks. As noted in the NPRM, these airplanes rely on their hydraulic actuators to provide protection from ground gusts. We, therefore, now revise § 25.415 to clarify that, for all airplanes, the ground gust conditions apply when the airplane is taxiing and while parked. For airplanes that include control system gust locks, the taxiing condition must be evaluated with the controls locked and unlocked, and the parked condition must be evaluated with the controls locked. Airplanes not equipped with gust locks are to be evaluated in their normal configuration while taxiing and while parked. With these changes to § 25.415, the rule wording will no longer be exactly the same as CS 25.415; however, the intent of the two rules is the same in how airplanes with and without gust locks are evaluated.

C. Advisory Material

On May 31, 2013, the FAA published and solicited public comments on three proposed ACs that describe acceptable means for showing compliance with the NPRM's proposed regulations. The comment period for the proposed ACs closed on September 26, 2013. The FAA did not receive any comments on the proposed ACs. Concurrently with this final rule, the FAA is issuing the following final ACs to provide guidance material for the new regulations adopted by this amendment:

- AC 25.341–1, ''Dynamic Gust Loads.''
- AC 25.362–1, ''Engine Failure Loads.''
- AC 25.415–1, ''Ground Gust Conditions.''

IV. Regulatory Notices and Analyses

A. Regulatory Evaluation

Changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 and Executive Order 13563 direct that each Federal agency shall propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs. Second, the Regulatory Flexibility Act of 1980 (Public Law 96–354) requires agencies to analyze the economic impact of regulatory changes on small entities. Third, the Trade Agreements Act (Pub. L. 96–39) prohibits agencies from setting standards that create unnecessary obstacles to the foreign commerce of the United States. In developing U.S. standards, the Trade Act requires agencies to consider international standards and, where appropriate, that they be the basis of U.S. standards. Fourth, the Unfunded Mandates Reform Act of 1995 (Pub. L. 104–4) requires agencies to prepare a written assessment of the costs, benefits, and other effects of proposed or final rules that include a Federal mandate likely to result in the expenditure by State, local, or tribal governments, in the aggregate, or by the private sector, of $100 million or more annually (adjusted for inflation with base year of 1995). This portion of the preamble summarizes the FAA's analysis of the economic impacts of this final rule.

Department of Transportation Order DOT 2100.5 prescribes policies and procedures for simplification, analysis, and review of regulations. If the expected cost impact is so minimal that a proposed or final rule does not warrant a full evaluation, this order permits that a statement to that effect and the basis for it be included in the preamble if a full regulatory evaluation of the cost and benefits is not prepared. Such a determination has been made for this final rule. The reasoning for this determination follows.

The FAA is amending certain airworthiness standards for transport category airplanes. Adopting this final rule will eliminate regulatory differences between the airworthiness standards of the FAA and EASA. This final rule does not add new requirements beyond what manufacturers currently meet for EASA certification and does not affect current industry design practices. Meeting two sets of certification requirements raises the cost of developing new transport category airplanes with little to no increase in safety. In the interest of fostering international trade, lowering the cost of manufacturing new transport category airplanes, and making the certification process more efficient, the FAA, EASA, and several industry working groups came together to create, to the maximum extent possible, a single set of certification requirements that would be accepted in both the United States and Europe. Therefore, as a result of these harmonization efforts, the FAA is amending the airworthiness regulations described in section I of this final rule, ''Overview of Final Rule.'' This action harmonizes part 25 requirements with the corresponding requirements in EASA CS–25 Book 1.

Currently, all manufacturers of transport category airplanes, certificated under part 25 are expected to continue their current practice of compliance with the EASA certification requirements in CS–25 Book 1. Since future certificated transport airplanes are expected to meet CS–25 Book 1, and this rule simply adopts EASA requirements, manufacturers will incur minimal or no additional cost resulting from this final rule. The FAA made this same determination in the NPRM and received no comments.

The FAA has, therefore, determined that this final rule is not a ''significant regulatory action'' as defined in section 3(f) of Executive Order 12866, and is not ''significant'' as defined in DOT's Regulatory Policies and Procedures.

B. Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 (Public Law 96–354) (RFA) establishes ''as a principle of regulatory issuance that agencies shall endeavor, consistent with the objectives of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of the businesses, organizations, and governmental jurisdictions subject to regulation. To achieve this principle, agencies are required to solicit and consider flexible regulatory proposals and to explain the rationale for their actions to assure that such proposals are given serious consideration.'' The RFA covers a wide-range of small entities, including small businesses, not-for-profit organizations, and small governmental jurisdictions.

Agencies must perform a review to determine whether a rule will have a significant economic impact on a substantial number of small entities. If the agency determines that it will, the agency must prepare a regulatory flexibility analysis as described in the RFA.

However, if an agency determines that a rule is not expected to have a significant economic impact on a substantial number of small entities, section 605(b) of the RFA provides that the head of the agency may so certify, and a regulatory flexibility analysis is not required. The certification must include a statement providing the factual basis for this determination, and the reasoning should be clear.

In the NPRM, the FAA determined that this rule would not impose more than minimal cost.

The FAA believes that this final rule does not have a significant economic impact on a substantial number of small entities for the following reasons. We did not receive any comments from small entities. All United States transport category airplane manufacturers exceed the Small Business Administration small-entity criteria of 1,500 employees. Therefore, as provided in section 605(b), the head of the FAA certifies that this rulemaking will not result in a significant economic impact on a substantial number of small entities.

C. International Trade Impact Assessment

The Trade Agreements Act of 1979 (Pub. L. 96–39), as amended by the Uruguay Round Agreements Act (Pub. L. 103–465), prohibits Federal agencies from establishing standards or engaging in related activities that create unnecessary obstacles to the foreign commerce of the United States. Pursuant to these Acts, the establishment of standards is not considered an unnecessary obstacle to the foreign commerce of the United States, so long as the standard has a legitimate domestic objective, such the protection of safety, and does not operate in a manner that excludes imports that meet this objective. The statute also requires consideration of international standards and, where appropriate, that they be the basis for U.S. standards. The FAA has assessed the potential effect of this final rule and determined that it is in accord with the Trade Agreements Act as the rule furthers the legitimate domestic objectives of safety, creates no unnecessary obstacles to foreign commerce, does not exclude imports, and uses European standards as the basis for United States regulation.

D. Unfunded Mandates Assessment

Title II of the Unfunded Mandates Reform Act of 1995 (Public Law 104–4) requires each Federal agency to prepare a written statement assessing the effects of any Federal mandate in a proposed or final agency rule that may result in an expenditure of $100 million or more (in 1995 dollars) in any one year by State, local, and tribal governments, in the aggregate, or by the private sector; such a mandate is deemed to be a ''significant regulatory action.'' The FAA currently uses an inflation-adjusted value of $151 million in lieu of $100 million. This final rule does not contain such a mandate; therefore, the requirements of Title II of the Act do not apply.

E. Paperwork Reduction Act

The Paperwork Reduction Act of 1995 (44 U.S.C. 3507(d)) requires that the FAA consider the impact of paperwork and other information collection burdens imposed on the public. The FAA has determined that there is no new requirement for information collection associated with this final rule.

F. International Compatibility and Cooperation

(1) In keeping with U.S. obligations under the Convention on International Civil Aviation, it is FAA policy to conform to International Civil Aviation Organization (ICAO) Standards and Recommended Practices to the maximum extent practicable. The FAA has reviewed the corresponding ICAO Standards and Recommended Practices and has identified no differences with these regulations.

(2) Executive Order (EO) 13609, Promoting International Regulatory Cooperation (77 FR 26413, May 4, 2012), promotes international regulatory cooperation to meet shared challenges involving health, safety, labor, security, environmental, and other issues and reduce, eliminate, or prevent unnecessary differences in regulatory requirements. The FAA has analyzed this action under the policy and agency responsibilities of Executive Order 13609, Promoting International Regulatory Cooperation. The agency has determined that this action would eliminate differences between U.S. aviation standards and those of other civil aviation authorities by creating a single set of certification requirements for transport category airplanes that would be acceptable in both the United States and Europe.

G. Environmental Analysis

FAA Order 1050.1E identifies FAA actions that are categorically excluded from preparation of an environmental assessment or environmental impact statement under the National Environmental Policy Act in the absence of extraordinary circumstances. The FAA has determined this rulemaking action qualifies for the categorical exclusion identified in paragraph 312f of Order 1050.1E and involves no extraordinary circumstances.

V. Executive Order Determinations

A. Executive Order 13132, Federalism

The FAA has analyzed this final rule under the principles and criteria of Executive Order 13132, Federalism. The agency determined that this action will not have a substantial direct effect on the States, or the relationship between the Federal Government and the States, or on the distribution of power and responsibilities among the various levels of government, and, therefore, does not have Federalism implications.

B. Executive Order 13211, Regulations That Significantly Affect Energy Supply, Distribution, or Use

The FAA analyzed this final rule under Executive Order 13211, Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution, or Use (May 18, 2001). The agency has determined that it is not a ''significant energy action'' under the executive order and it is not likely to have a significant adverse effect on the supply, distribution, or use of energy.

VI. How To Obtain Additional Information

A. Rulemaking Documents

An electronic copy of a rulemaking document may be obtained by using the Internet—

1. Search the Federal eRulemaking Portal (*http://www.regulations.gov*),

2. Visit the FAA's Regulations and Policies Web page at *http://www.faa.gov/regulations_policies/,* or

3. Access the Government Printing Office's Web page at *http://www.gpo.gov/fdsys/.*

Copies may also be obtained by sending a request (identified by notice, amendment, or docket number of this rulemaking) to the Federal Aviation Administration, Office of Rulemaking, ARM–1, 800 Independence Avenue SW., Washington, DC 20591; or by calling (202) 267–9680.

B. Comments Submitted to the Docket

Comments received may be viewed by going to *http://www.regulations.gov* and following the online instructions to search the docket number for this action. Anyone is able to search the electronic form of all comments received into any of the FAA's dockets by the name of the individual submitting the comment (or signing the comment, if submitted on behalf of an association, business, labor union, etc.).

C. Small Business Regulatory Enforcement Fairness Act

The Small Business Regulatory Enforcement Fairness Act (SBREFA) of 1996 requires the FAA to comply with small entity requests for information or advice about compliance with statutes and regulations within its jurisdiction. A small entity with questions regarding this document, may contact its local FAA official, or the person listed under the **FOR FURTHER INFORMATION CONTACT** heading at the beginning of the preamble. To find out more about SBREFA on the Internet, visit *http://www.faa.gov/regulations_policies/rulemaking/sbre_act/.*

List of Subjects in 14 CFR Part 25

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

The Amendment

In consideration of the foregoing, the Federal Aviation Administration amends part 25 of title 14, Code of Federal Regulations as follows:

PART 25—AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY AIRPLANES

■ 1. The authority citation for part 25 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701, 44702, and 44704.

■ 2. Amend § 25.331 by revising paragraph (c) introductory text and paragraph (c)(2) to read as follows:

§ 25.331 Symmetric maneuvering conditions.

* * * * *

(c) *Maneuvering pitching conditions.* The following conditions must be investigated:

* * * * *

(2) *Checked maneuver between V_A and V_D.* Nose-up checked pitching maneuvers must be analyzed in which the positive limit load factor prescribed in § 25.337 is achieved. As a separate condition, nose-down checked pitching maneuvers must be analyzed in which a limit load factor of 0g is achieved. In defining the airplane loads, the flight deck pitch control motions described in paragraphs (c)(2)(i) through (iv) of this section must be used:

(i) The airplane is assumed to be flying in steady level flight at any speed between V_A and V_D and the flight deck pitch control is moved in accordance with the following formula:

$\delta(t) = \delta_1 \sin(\omega t)$ for $0 \le t \le t_{max}$

Where—

δ_1 = the maximum available displacement of the flight deck pitch control in the initial direction, as limited by the control system stops, control surface stops, or by pilot effort in accordance with § 25.397(b);

$\delta(t)$ = the displacement of the flight deck pitch control as a function of time. In the initial direction, $\delta(t)$ is limited to δ_1. In the reverse direction, $\delta(t)$ may be truncated at the maximum available displacement of the flight deck pitch control as limited by the control system stops, control surface stops, or by pilot effort in accordance with 25.397(b);

$t_{max} = 3\pi/2\omega$;

ω = the circular frequency (radians/second) of the control deflection taken equal to the undamped natural frequency of the short period rigid mode of the airplane, with active control system effects included where appropriate; but not less than:

$$\omega = \frac{\pi V}{2V_A} \text{ radians per second;}$$

Where

V = the speed of the airplane at entry to the maneuver.

V_A = the design maneuvering speed prescribed in § 25.335(c).

(ii) For nose-up pitching maneuvers, the complete flight deck pitch control displacement history may be scaled down in amplitude to the extent necessary to ensure that the positive limit load factor prescribed in § 25.337 is not exceeded. For nose-down pitching maneuvers, the complete flight deck control displacement history may be scaled down in amplitude to the extent necessary to ensure that the normal acceleration at the center of gravity does not go below 0g.

(iii) In addition, for cases where the airplane response to the specified flight deck pitch control motion does not achieve the prescribed limit load factors, then the following flight deck pitch control motion must be used:

$\delta(t) = \delta_1 \sin(\omega t)$ for $0 \le t \le t_1$

$\delta(t) = \delta_1$ for $t_1 \le t \le t_2$

$\delta(t) = \delta_1 \sin(\omega[t + t_1 - t_2])$ for $t_2 \le t \le t_{max}$

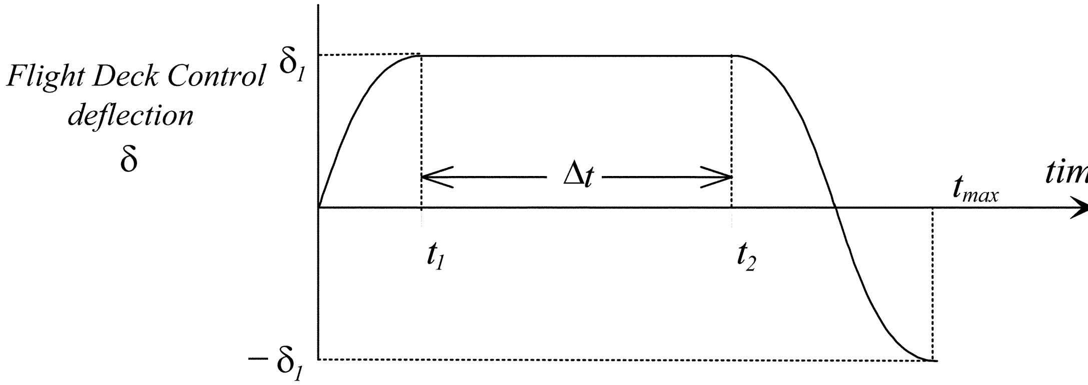
Where—

$t_1 = \pi/2\omega$

$t_2 = t_1 + \Delta t$

$t_{max} = t_2 + \pi/\omega$;

Δt = the minimum period of time necessary to allow the prescribed limit load factor to be achieved in the initial direction, but it need not exceed five seconds (see figure below).



(iv) In cases where the flight deck pitch control motion may be affected by inputs from systems (for example, by a stick pusher that can operate at high load factor as well as at 1g), then the effects of those systems shall be taken into account.

(v) Airplane loads that occur beyond the following times need not be considered:

(A) For the nose-up pitching maneuver, the time at which the normal acceleration at the center of gravity goes below 0g;

(B) For the nose-down pitching maneuver, the time at which the normal acceleration at the center of gravity goes above the positive limit load factor prescribed in § 25.337;

(C) t_{max}..

■ 3. Amend § 25.341 by revising paragraphs (a)(5)(i), (a)(6), and (b), and by adding paragraph (c) to read as follows:

§ 25.341 Gust and turbulence loads.

(a) * * *

* * * * *

(5) * * *

(i) At airplane speeds between V_B and V_C: Positive and negative gusts with reference gust velocities of 56.0 ft/sec EAS must be considered at sea level. The reference gust velocity may be reduced linearly from 56.0 ft/sec EAS at sea level to 44.0 ft/sec EAS at 15,000 feet. The reference gust velocity may be further reduced linearly from 44.0 ft/sec EAS at 15,000 feet to 20.86 ft/sec EAS at 60,000 feet.

* * * * *

(6) * * *

Z_{mo} = Maximum operating altitude defined in § 25.1527 (feet).

* * * * *

(b) *Continuous turbulence design criteria.* The dynamic response of the airplane to vertical and lateral continuous turbulence must be taken into account. The dynamic analysis must take into account unsteady aerodynamic characteristics and all significant structural degrees of freedom including rigid body motions. The limit loads must be determined for all critical altitudes, weights, and weight distributions as specified in § 25.321(b), and all critical speeds within the ranges indicated in § 25.341(b)(3).

(1) Except as provided in paragraphs (b)(4) and (5) of this section, the following equation must be used:

$$P_L = P_{L-1g} \pm U_\sigma \overline{A}$$

Where—

P_L = limit load;

P_{L-1g} = steady 1g load for the condition;

$\overline{A}$ = ratio of root-mean-square incremental load for the condition to root-mean-square turbulence velocity; and

U_σ = limit turbulence intensity in true airspeed, specified in paragraph (b)(3) of this section.

(2) Values of $\overline{A}$ must be determined according to the following formula:

$$\overline{A} = \sqrt{\int_0^\infty \left|H(\Omega)\right|^2 \Phi(\Omega)\, d\Omega}$$

Where—

$H(\Omega)$ = the frequency response function, determined by dynamic analysis, that relates the loads in the aircraft structure to the atmospheric turbulence; and

$\Phi(\Omega)$ = normalized power spectral density of atmospheric turbulence given by—

$$\Phi(\Omega) = \frac{L}{\pi} \frac{1 + \frac{8}{3}(1.339\Omega L)^2}{\left[1 + (1.339\Omega L)^2\right]^{11/6}}$$

Where—

Ω = reduced frequency, radians per foot; and

L = scale of turbulence = 2,500 ft.

(3) The limit turbulence intensities, U_σ, in feet per second true airspeed required for compliance with this paragraph are—

(i) At airplane speeds between V_B and V_C: $U_\sigma = U_{\sigma\rho\varepsilon\phi} F_g$

Where—

$U_{\sigma\rho\varepsilon\phi}$ is the reference turbulence intensity that varies linearly with altitude from 90 fps (TAS) at sea level to 79 fps (TAS) at 24,000 feet and is then constant at 79 fps (TAS) up to the altitude of 60,000 feet.

F_g is the flight profile alleviation factor defined in paragraph (a)(6) of this section;

(ii) At speed V_D: U_σ is equal to ½ the values obtained under paragraph (b)(3)(i) of this section.

(iii) At speeds between V_C and V_D: U_σ is equal to a value obtained by linear interpolation.

(iv) At all speeds, both positive and negative incremental loads due to continuous turbulence must be considered.

(4) When an automatic system affecting the dynamic response of the airplane is included in the analysis, the effects of system non-linearities on loads at the limit load level must be taken into account in a realistic or conservative manner.

(5) If necessary for the assessment of loads on airplanes with significant non-linearities, it must be assumed that the turbulence field has a root-mean-square velocity equal to 40 percent of the U_σ values specified in paragraph (b)(3) of this section. The value of limit load is that load with the same probability of exceedance in the turbulence field as $\overline{A}U_\sigma$ of the same load quantity in a linear approximated model.

(c) *Supplementary gust conditions for wing-mounted engines.* For airplanes equipped with wing-mounted engines, the engine mounts, pylons, and wing supporting structure must be designed for the maximum response at the nacelle center of gravity derived from the following dynamic gust conditions applied to the airplane:

(1) A discrete gust determined in accordance with § 25.341(a) at each angle normal to the flight path, and separately,

(2) A pair of discrete gusts, one vertical and one lateral. The length of each of these gusts must be independently tuned to the maximum response in accordance with § 25.341(a). The penetration of the airplane in the combined gust field and the phasing of

the vertical and lateral component gusts must be established to develop the maximum response to the gust pair. In the absence of a more rational analysis, the following formula must be used for each of the maximum engine loads in all six degrees of freedom:

$$P_L = P_{L-1g} \pm 0.85\sqrt{L_V^2 + L_L^2}$$

Where—

P_L = limit load;

P_{L-1g} = steady 1g load for the condition;

L_V = peak incremental response load due to a vertical gust according to § 25.341(a); and

L_L = peak incremental response load due to a lateral gust according to § 25.341(a).

■ 4. Amend § 25.343 by revising paragraph (b)(1)(ii) to read as follows:

§ 25.343 Design fuel and oil loads.

* * * * *

(b) * * *

(1) * * *

(ii) The gust and turbulence conditions of § 25.341(a) and (b), but assuming 85% of the gust velocities prescribed in § 25.341(a)(4) and 85% of the turbulence intensities prescribed in § 25.341(b)(3).

* * * * *

■ 5. Amend § 25.345 by revising paragraph (c)(2) to read as follows:

§ 25.345 High lift devices.

* * * * *

(c) * * *

(2) The vertical gust and turbulence conditions prescribed in § 25.341(a) and (b).

* * * * *

■ 6. Revise § 25.361 to read as follows:

§ 25.361 Engine and auxiliary power unit torque.

(a) For engine installations—

(1) Each engine mount, pylon, and adjacent supporting airframe structures must be designed for the effects of—

(i) A limit engine torque corresponding to takeoff power/thrust and, if applicable, corresponding propeller speed, acting simultaneously with 75% of the limit loads from flight condition A of § 25.333(b);

(ii) A limit engine torque corresponding to the maximum continuous power/thrust and, if applicable, corresponding propeller speed, acting simultaneously with the limit loads from flight condition A of § 25.333(b); and

(iii) For turbopropeller installations only, in addition to the conditions specified in paragraphs (a)(1)(i) and (ii) of this section, a limit engine torque corresponding to takeoff power and propeller speed, multiplied by a factor accounting for propeller control system malfunction, including quick feathering, acting simultaneously with 1g level flight loads. In the absence of a rational analysis, a factor of 1.6 must be used.

(2) The limit engine torque to be considered under paragraph (a)(1) of this section must be obtained by—

(i) For turbopropeller installations, multiplying mean engine torque for the specified power/thrust and speed by a factor of 1.25;

(ii) For other turbine engines, the limit engine torque must be equal to the maximum accelerating torque for the case considered.

(3) The engine mounts, pylons, and adjacent supporting airframe structure must be designed to withstand 1g level flight loads acting simultaneously with the limit engine torque loads imposed by each of the following conditions to be considered separately:

(i) Sudden maximum engine deceleration due to malfunction or abnormal condition; and

(ii) The maximum acceleration of engine.

(b) For auxiliary power unit installations, the power unit mounts and adjacent supporting airframe structure must be designed to withstand 1g level flight loads acting simultaneously with the limit torque loads imposed by each of the following conditions to be considered separately:

(1) Sudden maximum auxiliary power unit deceleration due to malfunction, abnormal condition, or structural failure; and

(2) The maximum acceleration of the auxiliary power unit.

■ 7. Add § 25.362 to read as follows:

§ 25.362 Engine failure loads.

(a) For engine mounts, pylons, and adjacent supporting airframe structure, an ultimate loading condition must be considered that combines 1g flight loads with the most critical transient dynamic loads and vibrations, as determined by dynamic analysis, resulting from failure of a blade, shaft, bearing or bearing support, or bird strike event. Any permanent deformation from these ultimate load conditions must not prevent continued safe flight and landing.

(b) The ultimate loads developed from the conditions specified in paragraph (a) of this section are to be—

(1) Multiplied by a factor of 1.0 when applied to engine mounts and pylons; and

(2) Multiplied by a factor of 1.25 when applied to adjacent supporting airframe structure.

■ 8. Revise § 25.371 to read as follows:

§ 25.371 Gyroscopic loads.

The structure supporting any engine or auxiliary power unit must be designed for the loads, including gyroscopic loads, arising from the conditions specified in §§ 25.331, 25.341, 25.349, 25.351, 25.473, 25.479, and 25.481, with the engine or auxiliary power unit at the maximum rotating speed appropriate to the condition. For the purposes of compliance with this paragraph, the pitch maneuver in § 25.331(c)(1) must be carried out until the positive limit maneuvering load factor (point A_2 in § 25.333(b)) is reached.

■ 9. Amend § 25.373 by revising paragraph (a) to read as follows:

§ 25.373 Speed control devices.

* * * * *

(a) The airplane must be designed for the symmetrical maneuvers prescribed in §§ 25.333 and 25.337, the yawing maneuvers in § 25.351, and the vertical and lateral gust and turbulence conditions prescribed in § 25.341(a) and (b) at each setting and the maximum speed associated with that setting; and

* * * * *

■ 10. Amend § 25.391 by revising the introductory text to read as follows:

§ 25.391 Control surface loads: General.

The control surfaces must be designed for the limit loads resulting from the flight conditions in §§ 25.331, 25.341(a) and (b), 25.349, and 25.351, considering the requirements for—

* * * * *

■ 11. Amend § 25.395 by revising paragraph (b) to read as follows:

§ 25.395 Control system.

* * * * *

(b) The system limit loads of paragraph (a) of this section need not exceed the loads that can be produced by the pilot (or pilots) and by automatic or power devices operating the controls.

* * * * *

■ 12. Revise § 25.415 to read as follows:

§ 25.415 Ground gust conditions.

(a) The flight control systems and surfaces must be designed for the limit loads generated when the airplane is subjected to a horizontal 65-knot ground gust from any direction while taxiing and while parked. For airplanes equipped with control system gust locks, the taxiing condition must be evaluated with the controls locked and unlocked, and the parked condition must be evaluated with the controls locked.

(b) The control system and surface loads due to ground gust may be assumed to be static loads, and the hinge moments H must be computed from the formula:

$$H = K\,(1/2)\,\rho_o\,V^2\,c\,S$$

Where—

K = hinge moment factor for ground gusts derived in paragraph (c) of this section;
ρ_o = density of air at sea level;
V = 65 knots relative to the aircraft;
S = area of the control surface aft of the hinge line;
c = mean aerodynamic chord of the control surface aft of the hinge line.

(c) The hinge moment factor K for ground gusts must be taken from the following table:

Surface	K	Position of controls
(1) Aileron	0.75	Control column locked or lashed in mid-position.
(2) Aileron	*±0.50	Ailerons at full throw.
(3) Elevator	*±0.75	Elevator full down.
(4) Elevator	*±0.75	Elevator full up.
(5) Rudder	0.75	Rudder in neutral.
(6) Rudder	0.75	Rudder at full throw.

* A positive value of K indicates a moment tending to depress the surface, while a negative value of K indicates a moment tending to raise the surface.

(d) The computed hinge moment of paragraph (b) of this section must be used to determine the limit loads due to ground gust conditions for the control surface. A 1.25 factor on the computed hinge moments must be used in calculating limit control system loads.

(e) Where control system flexibility is such that the rate of load application in the ground gust conditions might produce transient stresses appreciably higher than those corresponding to static loads, in the absence of a rational analysis substantiating a different dynamic factor, an additional factor of 1.6 must be applied to the control system loads of paragraph (d) of this section to obtain limit loads. If a rational analysis is used, the additional factor must not be less than 1.2.

(f) For the condition of the control locks engaged, the control surfaces, the control system locks, and the parts of any control systems between the surfaces and the locks must be designed to the resultant limit loads. Where control locks are not provided, then the control surfaces, the control system stops nearest the surfaces, and the parts of any control systems between the surfaces and the stops must be designed to the resultant limit loads. If the control system design is such as to allow any part of the control system to impact with the stops due to flexibility, then the resultant impact loads must be taken into account in deriving the limit loads due to ground gust.

(g) For the condition of taxiing with the control locks disengaged, or where control locks are not provided, the following apply:

(1) The control surfaces, the control system stops nearest the surfaces, and the parts of any control systems between the surfaces and the stops must be designed to the resultant limit loads.

(2) The parts of the control systems between the stops nearest the surfaces and the flight deck controls must be designed to the resultant limit loads, except that the parts of the control system where loads are eventually reacted by the pilot need not exceed:

(i) The loads corresponding to the maximum pilot loads in § 25.397(c) for each pilot alone; or

(ii) 0.75 times these maximum loads for each pilot when the pilot forces are applied in the same direction.

■ 13. Revise 25.1517 to read as follows:

§ 25.1517 Rough air speed, $V_{RA.}$

(a) A rough air speed, $V_{RA,}$ for use as the recommended turbulence penetration airspeed, and a rough air Mach number, M_{RA}, for use as the recommended turbulence penetration Mach number, must be established. V_{RA}/M_{RA} must be sufficiently less than V_{MO}/M_{MO} to ensure that likely speed variation during rough air encounters will not cause the overspeed warning to operate too frequently.

(b) At altitudes where V_{MO} is not limited by Mach number, in the absence of a rational investigation substantiating the use of other values, V_{RA} must be less than V_{MO}—35 KTAS.

(c) At altitudes where V_{MO} is limited by Mach number, M_{RA} may be chosen to provide an optimum margin between low and high speed buffet boundaries.

Appendix G to Part 25 [Removed and Reserved]

■ 14. Remove and reserve appendix G to part 25.

Issued under authority provided by 49 U.S.C. 106(f) and 44701(a) in Washington, DC, on November 14, 2014.

Michael P. Huerta,

Administrator.

[FR Doc. 2014–28938 Filed 12–10–14; 8:45 am]

BILLING CODE 4910–13–P

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 25

[Docket No. FAA–2014–0668; Special Conditions No. 25–572–SC]

Special Conditions: AAR Engineering Services, Boeing 757–200 Series Airplane; Seats With Non-Traditional, Large, Non-Metallic Panels

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final special condition; request for comments.

SUMMARY: These special conditions are issued for the Boeing 757–200 series airplane. This airplane, as modified by AAR Engineering Services, will have novel or unusual design features when compared to the state of technology envisioned in the airworthiness standards for transport-category airplanes. This design feature includes seats with non-traditional, large, non-metallic panels on Boeing 757–200 series airplanes. The applicable airworthiness regulations do not contain adequate or appropriate safety standards for this design feature. These special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

DATES: This action is effective on AAR Engineering Services on December 11, 2014. We must receive your comments by January 26, 2015.

ADDRESSES: Send comments identified by docket number FAA–2014–0668 using any of the following methods:

- *Federal eRegulations Portal:* Go to *http://www.regulations.gov/* and follow the online instructions for sending your comments electronically.
- *Mail:* Send comments to Docket Operations, M–30, U.S. Department of Transportation (DOT), 1200 New Jersey Avenue SE., Room W12–140, West Building Ground Floor, Washington, DC 20590–0001.
- *Hand Delivery or Courier:* Take comments to Docket Operations in Room W12–140 of the West Building Ground Floor at 1200 New Jersey Avenue SE., Washington, DC, between 8 a.m. and 5 p.m., Monday through Friday, except federal holidays.
- *Fax:* Fax comments to Docket Operations at 202–493–2251.

Privacy: The FAA will post all comments it receives, without change, to *http://www.regulations.gov/,* including any personal information the commenter provides. Using the search