

Federal Aviation Administration  
Aviation Rulemaking Advisory Committee

Transport Airplane and Engine Issue Area  
Electrical Systems Harmonization Working Group

**Task 2 – Electrical Bonding and protection Against Lightning and Static  
Electricity**

# **Task Assignment**

[Federal Register: September 11, 1998 (Volume 63, Number 176)]  
[Notices]  
[Page 48781-48783]  
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[DOCID:fr11se98-139]

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DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

Aviation Rulemaking Advisory Committee; Transport Airplane and  
Engine Issues--New Tasks

AGENCY: Federal Aviation Administration (**FAA**), DOT.

ACTION: Notice of new task assignments for the Aviation Rulemaking  
Advisory Committee (ARAC).

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SUMMARY: Notice is given of new tasks assigned to and accepted by the  
Aviation Rulemaking Advisory Committee (ARAC). This notice informs the  
public of the activities of ARAC.

FOR FURTHER INFORMATION CONTACT:

Stewart R. Miller, Transport Standards Staff (ANM-110), Federal  
Aviation Administration, 1601 Lind Avenue, SW., Renton, WA 98055-4056;  
phone (425) 227-1255; fax (425) 227-1320.

SUPPLEMENTARY INFORMATION:

Background

The **FAA** has established an Aviation Rulemaking Advisory Committee  
to provide advice and recommendations to the **FAA** Administrator, through  
the Associate Administrator for Regulation and Certification, on the  
full range of the **FAA**'s rulemaking activities with respect to aviation-  
related issues. This includes obtaining advice and recommendations on  
the **FAA**'s commitment to harmonize its Federal Aviation Regulations  
(FAR) and practices with its trading partners in Europe and Canada.

One area ARAC deals with is Transport Airplane and Engine Issues.  
These issues involve the airworthiness standards for transport category  
airplanes and engines in 14 CFR parts 25, 33, and 35 and parallel  
provisions in 14 CFR parts 121 and 135.

The Tasks

This notice is to inform the public that the **FAA** has asked ARAC to

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provide advice and recommendation on the following harmonization tasks:

## Task 1: Electrical Generating and Distribution System Requirements

Phase I--The following differences between Part 25 and JAR 25 and their associated guidance material have been identified as having a potentially significant impact on airplane design and cost.

1. FAR/JAR 25.1351(b)--FAR 25.1351(b) defines minimum requirements for generating system power sources, distribution busses and cables, and associated control, regulation and protection devices. JAR 25.1351(b), with its related ACJ 25.1351(b)(5), adds accessibility requirements for means to disconnect power sources from the electrical system.

2. FAR/JAR 25.1351(c)--FAR 25.1351(c) defines minimum requirements for connecting external power to the airplane electrical power system. JAR 25.1351(c) introduces additional parameters for external power protection.

3. FAR/JAR 25.1351(d)--FAR 25.1351(d) defines minimum requirements for a standby power system that can enable safe operation in VFR conditions for a period of not less than five minutes to enable engine relight. JAR 25.1351(d), with its related ACJs, requires provision for a high integrity standby power system with a duration for time limited systems compatible with JAR-OPS and ICAO Annex 8. These ACJs also provide Interpretive Material for non-time limited standby power sources and specifies services that must remain powered following loss of normal electrical power.

For each of the above tasks the working group is to review airworthiness, safety, cost, and other relevant factors related to the specified differences, and reach consensus on harmonized Part 25/JAR 25 regulations and guidance material.

The **FAA** expects ARAC to submit its recommendation(s) from Phase I by July 31, 2001.

Phase II--The following additional differences between Part 25 and JAR 25 and their associated guidance material have been identified as having a lesser impact on airplane design and cost:

4. FAR/JAR 25.1353(a) & 25.1431(d)--JAR 25.1353(a) provides an additional sentence for consideration of the effects of interference on systems with associated interpretative material. JAR 25.1431(d) has additional requirements on the survivability of essential electronic equipment during electrical power transients. Such paragraph does not exist in the FAR's. Neither **FAA** advisory nor JAA guidance material currently is available. This guidance material needs to be generated.

5. FAR/JAR 25.1353(c)(5)--JAR 25.1353(c)(5) is different to FAR 25.1353(c)(5) in that it requires any Nickel-Cadmium battery (receiving a direct charge from the aircraft electrical system) to be subjected to this requirement. Past experience has shown that damage has been caused to structure (from defective batteries and their installations) from batteries irrespective of whether utilized for engine or APU starting or not.

6. FAR/JAR 25.1353(c)(6)--See also item 5 above. In addition, interpretative material is provided in JAR's concerning maintenance check intervals for over temperature sensing devices.

7. FAR/JAR 25.1353(d)--JAR 25.1353(d) contains additional paragraphs for electrical cables. Note: Paragraph 1 of ACJ to JAR 25.1301(b) in effect duplicates JAR 25.1353(d)(2) and could be deleted after harmonization of FAR/JAR 25.1353(d).

8. FAR/JAR 25.1355(c)--JAR 25.1355(c) introduces interpretative material concerning segregation of electrical feeders to minimize the possibility of cascade or multiple failures. The ACJ to JAR 25.1355(c)

should be reviewed in conjunction with current ACJ No. 6 to JAR 25.1309 with a view to combining the two ACJs and forming new interpretative material to FAR/JAR 25.1355(c).

9. FAR/JAR 25X1360--Precautions against injury. This JAR requirement and corresponding ACJ was created following reported injuries to service and maintenance personnel.

10. JAR 25X1362--Electrical supplies for emergency conditions. This JAR requirement and corresponding ACJ was created to ensure that electrical supplies are maintained to emergency services (such as fuel and hydraulic shut-off valves) so that these may be closed after the main power sources have been switched off by the Flight Crew.

11. FAR/JAR 25.1363--JAR 25.1363 requires tests to be performed under specific criteria with (ACJ) additional means of compliance.

12. Tasks coming from the System Design and Analysis Harmonization Working Group (SD&A HWG): Harmonize and update 25.1310 (previous 25.1309(e) and (f)) as proposed by the SD&A HWG. Consider also JAA specific AMJ 25.1309(b) on heated domestic appliances and electric overheat protection equipment design/ failures considerations.

For each of the above tasks the working group is to review the current standards of the FAR and JAR requirements concerning electrical generating and distribution system requirements and any associated advisory material, to review also any relevant service experience and consider the increased reliance of aircraft and systems dependent on electrical power and distribution systems. In the light of this review, recommend changes to harmonize the above FAR and JAR requirements and develop related advisory material as necessary.

The **FAA** expects ARAC to submit its recommendation(s) from Phase II by July 31, 2003.

## Task 2: Electrical Bonding and Protection Against Lightning and Static Electricity

JAA regulations include JAR 25X899 and ACJ 25x899 or consideration of electrical bonding and protection against lightning and static electricity. **FAA** regulations do not include this requirement. This initiative will consider the material contained in the JAR and ACJ, revise this information (as appropriate), develop new **FAA** requirements, revise JAA requirements as applicable, including regulations and advisory material, to achieve a harmonized result. Part 23, 27, 29 and 33 requirements will be reviewed to assure consistency in requirements and modified as applicable. The use of the phrase ``as applicable'' provides the responsible working group with the prerogative to recommend changes to any or all identified FAR's, JAR's, or none. Suitable representative from industry and regulatory authorities is necessary to accomplish this assignment.

The **FAA** expects ARAC to submit its recommendation by March 31, 2001.

The **FAA** requests that ARAC draft appropriate regulatory documents with supporting economic and other required analyses, and any other related guidance material or collateral documents to support its recommendations. If the resulting recommendation is one or more notices of proposed rulemaking (NPRM) published by the **FAA**, the **FAA** may ask ARAC to recommend disposition of any substantive comments the **FAA** receives.

ARAC Acceptance of Tasks

ARAC has accepted the tasks and has chosen to establish a new Electrical systems Harmonization Working Group. The working group will serve as staff to ARAC to assist ARAC in the analysis of the assigned task. Working group

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recommendations must be reviewed and approved by ARAC. If ARAC accepts the working group's recommendations, it forwards them to the **FAA** as ARAC recommendations.

#### Working Group Activity

The Electrical Systems Harmonization Working Group is expected to comply with the procedures adopted by ARAC. As part of the procedures, the working group is expected to:

1. Recommend a work plan for completion of the tasks, including the rationale supporting such a plan, for consideration at the meeting of ARAC to consider transport airplane and engine issues held following publication of this notice.

2. Give a detailed conceptual presentation of the proposed recommendations, prior to proceeding with the work stated in item 3 below.

3. Draft appropriate regulatory documents with supporting economic and other required analyses, and/or any other related guidance material or collateral documents the working group determines to be appropriate; or, if new or revised requirements or compliance methods are not recommended, a draft report stating the rationale for not making such recommendations. If the resulting recommendation is one or more notices of proposed rulemaking (NPRM) published by the **FAA**, the **FAA** may ask ARAC to recommend disposition of any substantive comments the **FAA** receives.

4. Provide a status report at each meeting of ARAC held to consider transport airplane and engine issues.

#### Participation in the Working Group

The Electrical Systems Harmonization Working Group will be composed of technical experts having an interest in the assigned tasks. A working group member need not be a representative of a member of the full committee.

An individual who has expertise in the subject matter and wishes to become a member of the working group should write to the person listed under the caption FOR FURTHER INFORMATION CONTACT expressing that desire, describing his or her interest in the tasks, and stating the expertise he or she would bring to the working group. All requests to participate must be received no later than October 12, 1998. The requests will be reviewed by the assistant chair and the assistant executive director, and the individuals will be advised whether or not the request can be accommodated.

Individuals chosen for membership on the working group will be expected to represent their aviation community segment and participate actively in the working group (e.g., attend all meetings, provide written comments when requested to do so, etc.). They also will be expected to devote the resources necessary to ensure the ability of the working group to meet any assigned deadline(s). Members are expected to keep their management chain advised of working group activities and

decisions to ensure that the agreed technical solutions do not conflict with their sponsoring organization's position when the subject being negotiated is presented to ARAC for a vote.

Once the working group has begun deliberations, members will not be added or substituted without the approval of the assistant chair, the assistant executive director, and the working group chair.

The Secretary of Transportation has determined that the formation and use of ARAC are necessary and in the public interest in connection with the performance of duties imposed on the **FAA** by law.

Meetings of ARAC will be open to the public. Meetings of the Electrical Systems 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 September 4, 1998.

Joseph A. Hawkins,  
Executive Director, Aviation Rulemaking Advisory Committee.  
[FR Doc. 98-24419 Filed 9-10-98; 8:45 am]  
BILLING CODE 4910-13-M

## **Recommendation Letter**

Pratt & Whitney  
400 Main Street  
East Hartford, CT 06108



**Pratt & Whitney**

A United Technologies Company

March 10, 2000

Federal Aviation Administration  
800 Independence Avenue  
Washington, DC 20591

Attention: Thomas McSweeney, Associate Administrator for Regulation and Certification

Subject: ARAC Recommendations

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

Dear Tom:

In accordance with the reference the ARAC Transport Airplane and Engine Issues Group is pleased to forward the following "fast track" reports as recommendations to the FAA:

25.869(a)

25.899

25.1309(b) – Note: It was agreed that this item should remain a "fast track"  
Category 1 project

25.1310

25.1351(b)

25.1351(c)

25.1353(a)

25.1353(c)(5)

25.1353(c)(6)

25.1353(d)

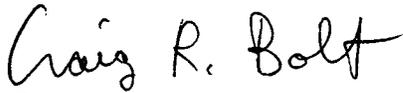
25.1355(c)

25.1357

25.1431(d)

These reports have been prepared by the Electrical Systems Harmonization Working Group.

Sincerely yours,

A handwritten signature in cursive script that reads "Craig R. Bolt".

Craig R. Bolt  
Assistant Chair, TAEIG

cc : Kris Larsen – FAA – NWR  
\*Dorenda Baker – FAA – NWR  
Effie Upshaw – FAA – Washington, DC – ARM  
\*Brian Overhuls – Boeing

\*Letter only

## **Recommendation**

## ARAC ESHWG REPORT 25X899

### **1 - What is underlying safety issue addressed by the FAR/JAR?**

JAR 25X899 addresses the requirement for electrical bonding and protection of the aircraft from the effects of lightning and static electricity.

### **2 - What are the current FAR and JAR standards?**

#### **Current FAR text:**

FAR Text does not exist

#### **Current JAR text:**

JAR 25X899: Electrical Bonding and protection against lightning and static electricity

The electrical bonding and protection against Lightning and Static Electricity systems must be such as to:

- (a) Protect the aeroplane, including its systems and equipment, against the dangerous effects of lightning discharges;
- (b) Prevent dangerous accumulation of Electro-static charge;
- (c) Minimize the risk of electrical shock to crew, passengers and servicing personnel and also to maintenance personnel using normal precaution, from the electricity supply and distribution system;
- (d) Provide an adequate electrical return path under both normal and fault condition, on aeroplanes having earthed electrical systems;
- (e) Reduce to an acceptable level interference from these sources with the function of essential electrically powered or signaled services.

### **3 - What are the differences in the standards and what do these differences result in?**

The JAR 25X899 requirement for electrical bonding and protection from the effects of lightning and static electricity are stated explicitly in the JAR text, with specific Interpretative Material and Acceptable Means of Compliance given in ACJ 25X899.

The FAR provides some equivalent requirements in FAR paragraphs 25.581, 25.954 and 25.1316 for protection from lightning discharges. However, JAR 25X899 and its related ACJ 25X899 have additional requirements relating to protection from electrical shock, fuel vapor ignition or electromagnetic interference caused by accumulation of electrostatic charge and for aircraft having a ground return path through structure. Electrical bonding must be adequate for both normal and fault conditions.

JAR 25X899 and its associated ACJ, as it is currently written, duplicates some of the requirements found in other JAR paragraphs and specifications given for use in assessing adequacy of protection from lightning discharges are out of date.

The differences in the standards of the FAR and JAR result in inconsistency and confusion because compliance for features relating to bonding and protection from effects of lightning discharges and accumulation of static electricity must be shown using different paragraphs in each standard.

#### **4 - What, if any, are the differences in the means of compliance?**

For JAR 25X899, compliance requirements are given by ACJ 25X899 and interim policies. In the FAR, there are other paragraphs that are applicable to much of this subject matter but there are no specific guidelines given to show compliance.

#### **5 - What is the proposed action?**

The ESHWG recommends that the JAR 25X899 should be revised as follows:

"Note add references to ACJ 25.899" or to FAR

- (1) Delete JAR 25X899(a) because it is addressed in FAR/JAR paragraphs 25.581, 25.954 and 25.1316.
- (2) The intent of JAR 25X899(b) should be retained to address protection from the accumulation of static electricity, but it should be rewritten to clearly state the requirement.
- (3) Delete JAR 25X899(c) because it is addressed in JAR 25X1360(a), which will also be adopted into the FAR as part of this harmonization project.
- (4) Move the requirement of JAR 25X899(d) to a new FAR/JAR sub-paragraph 25.1353(e). This will place this requirement with related requirements and provide for improved consistency and coordination of both FAR and JAR.
- (5) Delete JAR 25X899(e) because it is addressed in FAR/JAR 25.1353(a) and JAR 25.1431(d). JAR 25.1431(d) will also be adopted into the FAR as part of this harmonization project.
- (6) Modify ACJ 25X899 to provide specific Interpretative Material and Acceptable Means of Compliance for the new FAR/JAR 25.899, which will address bonding and static electricity. This new ACJ should also reference and be applicable to the other paragraphs that relate to bonding and static electricity.
- (7) There is a reference to ACJ 25X899 in JAR 25.581(a), which should be revised to refer to the new ACJ 25.899. Also, for FAR 25.581(a), a reference to FAR 25.899 or a new AC should be added.

#### **6 - What should the harmonized standard be?**

**The following FAR/JAR paragraphs would be affected by the proposed harmonized standard:**

##### **FAR/JAR 25.899 Electrical Bonding and Protection Against Static Electricity For JAR See ACJ 25.899)**

**(Note: The FAR will not reference the AC)**

- (a) Electrical bonding and protection against static electricity must be designed to minimise accumulation of electrostatic charge, which would cause:
  - (1) Human injury from electrical shock,
  - (2) Ignition of flammable vapours, or
  - (3) Interference with installed electrical/electronic equipment.
- (b) Compliance with sub-paragraph (a) of this paragraph may be shown by
  - (1) Bonding the components properly to the airframe, or
  - (2) Incorporating other acceptable means to dissipate the static charge so as not to endanger the aeroplane, personnel or operation of the installed electrical/electronic systems.

**FAR/JAR 25.1353 Electrical equipment and installations**

- (e) Electrical bonding must provide an adequate electrical return path under both normal and fault conditions, on aeroplanes having earthed electrical systems (see FAR/JAR 25.899).

**FAR/JAR 25.1360 Precautions against injury**

- (a) Shock. The electrical system must be designed to minimise the risk of electric shock to crew, passengers and servicing personnel and also to maintenance personnel using normal precautions. ( See ACJ 25.1360(a) and FAR/JAR 25.899.)

(Note: The FAR will not reference the AC)

**7 - How does this proposed standard address the underlying safety issue (identified under #1)?**

The proposed standard addresses the underlying safety issue by highlighting the requirement of electrical bonding and static electricity as a full aircraft requirement and by placing cross references within the specific section which deals with electrical systems and lightning protection.

**8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.**

The proposed standard increases the level of safety by decreasing the confusion of redundant requirements and ensuring the requirement of electrical bonding and static protection is addressed as a full aircraft requirement.

**9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.**

The proposed standard maintains the same level of safety because it is believed that the current industry practice is in compliance with the proposed standard.

**10 - What other options have been considered and why were they not selected?**

The following options were considered:

- 1) To adopt the current JAR 25X899; This option was not selected because the current JAR 25X899 is redundant to several other JAR/FAR; Is not specific (i.e. vague) in regard to static electricity requirements and is not addressed properly in the electrical section of the FAR/JAR;
- 2) To delete the current JAR 25X899; This option was not selected because it was felt that the requirement to address electrical bonding and static electricity protection was needed to ensure the safety of the aircraft

**11 - Who would be affected by the proposed change?**

Airplane manufacturers will be affected by the proposed change by requiring compliance to the new sections proposed.

**12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble?**

There is no current advisory material that is proposed to be included in the rule.

**13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?**

The advisory material relating to bonding and static electricity protection is proposed to be a new AC/ACJ as shown below and should be published concurrently with the rule:

**AC/ACJ 25.899 Electrical Bonding and Protection Against Static Electricity**  
**See FAR/JAR 25.899**

**1 Protection against Lightning Discharges.**

Reference: FAR/JAR 25.581; 25.954; 25.1316 and associated Advisory Material

**2 Characteristics of Lightning Discharges**

Reference Advisory Circular 20.XXX: Lightning Environment and Associated Test Waveforms.

**3 Protection against the Accumulation of Static Charges**

- 3.1 General. All items, which by the accumulation and discharge of static charges may cause a danger of electrical shock, ignition of flammable vapours or interference with essential equipment (e.g. radio communications and navigational aids) should be adequately bonded to the main earth systems.
- 3.2 Intermittent Contact. Design should ensure that no fortuitous intermittent contact can occur between metallic and/or metallized parts.
- 3.3 High Pressure Refuelling and Fuel Transfer. Where provision is made for high pressure refuelling and/or for high rates of fuel transfer it should be established, by test, or by consultation with the appropriate fuel manufacturers, that dangerously high voltages will not be induced within the fuel system. If compliance with this requirement involves any restriction on the types of fuel to be used or on the use of additives, this should be established.
- 3.3.1 With standard refuelling equipment and standard aircraft turbine fuels, voltages high enough to cause sparking may be induced between the surface of the fuel and the metal parts of the tank at refuelling rates above approximately 250 gal/min. These induced voltages may be increased by the presence of additives and contaminants (e.g. anti-corrosion inhibitors, lubricating oil, free water), and by splashing or spraying of the fuel in the tank.
- 3.3.2 The static charge can be reduced as follows:
- By means taken in the refuelling equipment such as increasing the diameter of refuelling lines and designing filters to give the minimum of electrostatic charging, or
  - By changing the electrical properties of the fuel by the use of anti-static additives and thus reducing the accumulation of static charge in the tank to negligible amount.
- 3.3.3 The critical refueling rates are related to the aeroplane refueling installations, and the designer should seek the advice of fuel suppliers on this problem.

4. Primary and Secondary Bonding Paths  
(Reference 25.581; 25.954; 25.1316; 25.1353; 25.1360;)
  - 4.1 Primary bonding paths are those paths, which are required to carry lightning discharge currents. These paths should be of as low an electrical impedance as is practicable. Secondary bonding paths are those paths provided for other forms of bonding.
  - 4.2 Where additional conductors are required to provide or supplement the inherent primary bonding paths provided by the structure or equipment, then the cross-sectional area of such primary conductors made from copper should be not less than 3 mm<sup>2</sup> except that, where a single conductor is likely to carry the whole discharge from an isolated section, the cross-sectional area would be not less than 6 mm<sup>2</sup>. Aluminum primary conductors should have a cross-sectional area giving an equivalent surge carrying capacity.
  - 4.3 Primary bonding paths should be used for -
    - a. Connecting together the main earths of separable major components which may carry lightning discharges,
    - b. Connecting engines to the main earth,
    - c. Connecting to the main earth all metal parts presenting a surface on or outside of the external surface of the aeroplane, and
    - d. Conductors on external non-metallic parts.
  - 4.4 Where additional conductors are required to provide or supplement the inherent secondary bonding paths provided by the structure or equipment then the cross-sectional area of such secondary conductors made from copper should be not less than 1 mm<sup>2</sup>. Where a single wire is used its size should be not less than 1.2 mm diameter.
- 5 Resistance and Continuity Measurements. Measurements should be made to determine the efficacy of the bonding and connection between at least the following:
  - 5.1 Primary Bonding Paths.
    - 5.1.1 The extremities of the fixed portions of the aeroplane and such fixed external panels and components where the method of construction and/or assembly leads to doubt as to the repeatability of the bond, e.g. removable panels.
    - 5.1.2 The engines and the main aeroplane earth.
    - 5.1.3 External movable metal surfaces or components and the main aeroplane earth.
    - 5.1.4 The bonding conductors of external non-metallic parts and the main aeroplane earth.
    - 5.1.5 Internal components for which a primary bond is specified and the main aeroplane earth.
  - 5.2 Secondary Bonding Paths.
    - 5.2.1 Metallic parts, normally in contact with flammable fluids, and the main aeroplane earth.
    - 5.2.2 Isolated conducting parts subject to appreciable electrostatic charging and the main aeroplane earth.
    - 5.2.3 Electrical panels and other equipment accessible to the occupants of the aeroplane and the main aeroplane earth.
    - 5.2.4 Earth connections, which normally carry the main electrical supply and the main aeroplane earth. The test on these connections should be such as to ensure that the connections can carry, without risk of fire or damage to the bond, or excessive volt drop, such continuous normal currents and intermittent fault currents as are applicable.
    - 5.2.5 Electrical and electronic equipment and the aeroplane main earth, where applicable, and as specified by the aeroplane constructor.

5.2.6 Static discharger wicks and the main aeroplane structure.

## 6 Electrical Properties of Composite Structure

- 6.1 In the case of lightning protection, for the partial conductors the method of surface protection will vary with the criticality of the structure in question. Deterioration of the means of protection or possible hidden damage to the material which may affect its structural integrity, need to be considered. While such materials provide a measure of electro-magnetic screening, the need for additional measures will be a function of the location of the material in relation to critical equipment and wiring in the aircraft. Particular attention will also have to be given to the protection required near fuel systems - e.g. fuel tanks. For non-conducting materials which have no intrinsic lightning protection or screening properties, the measures taken will again depend on the relative locations of the material and critical systems or fuel and the possible loss of the components due to internal air pressures in the event of a strike.
- 6.2 The partial conducting materials should present no problem in dissipating P-static but problems can arise with the non-conductors. Depending upon the location of the material, protection may be required.
- 6.3 Electrical currents, other than lightning, can flow in some partial conducting materials and means may be required to limit this by provision of alternative current paths if the effect of large voltage drop is important or if such currents can damage the material.
- 6.4 Particular care has to be taken that all joints, permanent and temporary, are capable of carrying any currents which may flow particularly those resulting from lightning strikes. Structural damage and loss of screening capabilities may occur if these are not adequately controlled.
- 6.5 The adequacy of the material in supplying a ground plane for antenna may have to be considered. Again it will vary with the material and the radio frequency of the system.

### **14 - How does the proposed standard compare to the current ICAO standard?**

The proposal is in line with ICAO standards

### **15 - Does the proposed standard affect other HWG's?**

No

### **16 - What is the cost impact of complying with the proposed standard?**

The cost impact of complying with the proposed standard should be insignificant due to the fact that current industry standards result in compliance with this proposed change.

### **17 - Does the HWG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?**

Yes. In addition, the ESHWG would like to review the draft advisory material.

### **18 - In light of the information provided in this report, does the HWG consider that the "Fast Track" process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process. Explain.**

The "Fast Track" process is appropriate for this rulemaking. All affected sections are under the control of this working group.

400 Main Street  
East Hartford, Connecticut 06108



**Pratt & Whitney**  
A United Technologies Company

April 4, 2000

Federal Aviation Administration  
800 Independence Avenue, SW  
Washington, DC 20591

Attention: Mr. Thomas McSweeney, Associate Administrator for Regulation and Certification

Subject: ARAC Recommendations

Reference: 1) ARAC Tasking, Federal Register, November 19, 1999  
2) TAEIG Letter to FAA, dated March 10, 2000

Dear Tom,

The Transport Airplane and Engine Issues Group is pleased to submit the following "Fast Track" reports as recommendations to the FAA in accordance with the Reference 1 tasking. These reports have been prepared by the Electrical Systems HWG.

- 25X899 - Corrected report, previously submitted per Reference 2
- 25X1360 - #3
- 25.1351d #1
- 25.1363 #3

Sincerely yours,

Craig R. Bolt  
Assistant Chair, TAEIG

Attachments

Copy: Kris Carpenter - FAA-NWR  
\*Brian Overhuls - Boeing  
\* Effie Upshaw - FAA Washington, DC

\*letter only

CRB08\_040400

*Be  
#2*

## ARAC ESHWG REPORT 25X899

### **1 - What is underlying safety issue addressed by the FAR/JAR?**

JAR 25X899 addresses the requirement for electrical bonding and protection of the aircraft from the effects of lightning and static electricity.

### **2 - What are the current FAR and JAR standards?**

#### **Current FAR text:**

FAR Text does not exist

#### **Current JAR text:**

#### **JAR 25X899: Electrical Bonding and protection against lightning and static electricity**

The electrical bonding and protection against Lightning and Static Electricity systems must be such as to:

- (a) Protect the aeroplane, including its systems and equipment, against the dangerous effects of lightning discharges;
- (b) Prevent dangerous accumulation of Electro-static charge;
- (c) Minimize the risk of electrical shock to crew, passengers and servicing personnel and also to maintenance personnel using normal precaution, from the electricity supply and distribution system;
- (d) Provide an adequate electrical return path under both normal and fault condition, on aeroplanes having earthed electrical systems;
- (e) Reduce to an acceptable level interference from these sources with the function of essential electrically powered or signaled services.

### **3 - What are the differences in the standards and what do these differences result in?**

The JAR 25X899 requirement for electrical bonding and protection from the effects of lightning and static electricity are stated explicitly in the JAR text, with specific Interpretative Material and Acceptable Means of Compliance given in ACJ 25X899.

The FAR provides some equivalent requirements in FAR paragraphs 25.581, 25.954 and 25.1316 for protection from lightning discharges. However, JAR 25X899 and its related ACJ 25X899 have additional requirements relating to protection from electrical shock, fuel vapor ignition or electromagnetic interference caused by accumulation of electrostatic charge and for aircraft having a ground return path through structure. Electrical bonding must be adequate for both normal and fault conditions.

JAR 25X899 and its associated ACJ, as it is currently written, duplicates some of the requirements found in other JAR paragraphs and specifications given for use in assessing adequacy of protection from lightning discharges are out of date.

The differences in the standards of the FAR and JAR result in inconsistency and confusion because compliance for features relating to bonding and protection from effects of lightning discharges and accumulation of static electricity must be shown using different paragraphs in each standard.

#### **4 - What, if any, are the differences in the means of compliance?**

For JAR 25X899, compliance requirements are given by ACJ 25X899 and interim policies. In the FAR, there are other paragraphs that are applicable to much of this subject matter but there are no specific guidelines given to show compliance.

#### **5 – What is the proposed action?**

The ESHWG recommends that the JAR 25X899 should be revised as follows:

“Note add references to ACJ 25.899” or to FAR

- (1) Delete JAR 25X899(a) because it is addressed in FAR/JAR paragraphs 25.581, 25.954 and 25.1316.
- (2) The intent of JAR 25X899(b) should be retained to address protection from the accumulation of static electricity, but it should be rewritten to clearly state the requirement.
- (3) Delete JAR 25X899(c) because it is addressed in JAR 25X1360(a), which will also be adopted into the FAR as part of this harmonization project.
- (4) Move the requirement of JAR 25X899(d) to a new FAR/JAR sub-paragraph 25.1353(e). This will place this requirement with related requirements and provide for improved consistency and coordination of both FAR and JAR.
- (5) Delete JAR 25X899(e) because it is addressed in FAR/JAR 25.1353(a) and JAR 25.1431(d). JAR 25.1431(d) should also be adopted into the FAR as part of this harmonization project.
- (6) Modify ACJ 25X899 to provide specific Interpretative Material and Acceptable Means of Compliance for the new FAR/JAR 25.899, which will address bonding and static electricity. This new ACJ should also reference and be applicable to the other paragraphs that relate to bonding and static electricity.
- (7) There is a reference to JAR 25X899 in JAR 25.581(a), which should be revised to refer to the new JAR 25.899. Also, for FAR 25.581(a), a reference to FAR 25.899 or a new AC should be added.

In addition, FAA and JAA should request SAE and EUROCAE committees to prepare updated technical guidance on bonding, which may be considered for a future revision to AC/ACJ 25.899.

#### **6 - What should the harmonized standard be?**

The following FAR/JAR paragraphs would be affected by the proposed harmonized standard:

##### **FAR/JAR 25.899 Electrical Bonding and Protection Against Static Electricity**

For JAR See ACJ 25.899)

(Note: The FAR will not reference the AC)

- (a) Electrical bonding and protection against static electricity must be designed to minimise accumulation of electrostatic charge, which would cause:
  - (1) human injury from electrical shock,
  - (2) ignition of flammable vapours,
  - (3) or interference with installed electrical/electronic equipment.
- (b) Compliance with sub-paragraph (a) of this paragraph may be shown by
  - (1) bonding the components properly to the airframe or

- (2) incorporating other acceptable means to dissipate the static charge so as not to endanger the aeroplane, personnel or operation of the installed electrical/electronic systems.

#### **FAR/JAR 25.1353 Electrical equipment and installations**

- (e) Electrical bonding must provide an adequate electrical return path under both normal and fault conditions, on aeroplanes having earthed electrical systems (see FAR/JAR 25.899).

#### **FAR/JAR 25.1360 Precautions against injury**

- (a) Shock. The electrical system must be designed to minimise the risk of electric shock to crew, passengers and servicing personnel and also to maintenance personnel using normal precautions. ( See ACJ 25.1360(a) and FAR/JAR 25.899.)  
(Note: The FAR will not reference the AC)

#### **7 - How does this proposed standard address the underlying safety issue (identified under #1)?**

The proposed standard addresses the underlying safety issue by highlighting the requirement of electrical bonding and static electricity as a full aircraft requirement and by placing cross references within the specific section which deals with electrical systems and lightning protection.

#### **8 - Relative to the current FAR, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.**

The proposed standard increases the level of safety by decreasing the confusion of redundant requirements and ensuring the requirement of electrical bonding and static protection is addressed as a full aircraft requirement.

#### **9 - Relative to current industry practice, does the proposed standard increase, decrease, or maintain the same level of safety? Explain.**

The proposed standard maintains the same level of safety because it is believed that the current industry practice is in compliance with the proposed standard.

#### **10 - What other options have been considered and why were they not selected?**

The following options were considered:

- 1) To adopt the current JAR 25X899; This option was not selected because the current JAR 25X899 is redundant to several other JAR/FAR; Is not specific (i.e. vague) in regard to static electricity requirements and is not addressed properly in the electrical section of the FAR/JAR;
- 2) To delete the current JAR 25X899: This option was not selected because it was felt that the requirement to address electrical bonding and static electricity protection was needed to ensure the safety of the aircraft

#### **11 - Who would be affected by the proposed change?**

Airplane manufacturers will be affected by the proposed change by requiring compliance to the new sections proposed.

**12 - To ensure harmonization, what current advisory material (e.g., ACJ, AMJ, AC, policy letters) needs to be included in the rule text or preamble?**

There is no current advisory material that is proposed to be included in the rule.

**13 - Is existing FAA advisory material adequate? If not, what advisory material should be adopted?**

The advisory material relating to bonding and static electricity protection is proposed to be a new AC/ACJ as shown below and should be published concurrently with the rule:

**AC/ACJ 25.899 Electrical Bonding and Protection Against Static Electricity**  
**See FAR/JAR 25.899**

**1 Protection against Lightning Discharges.**

Reference: FAR/JAR 25.581; 25.954; 25.1316 and associated Advisory Material

**2 Characteristics of Lightning Discharges**

Reference Advisory Circular 20.XXX: Lightning Environment and Associated Test Waveforms.

**3 Protection against the Accumulation of Static Charges**

3.1 General. All items, which by the accumulation and discharge of static charges may cause a danger of electrical shock, ignition of flammable vapours or interference with essential equipment (e.g. radio communications and navigational aids) should be adequately bonded to the main earth systems.

3.2 Intermittent Contact. Design should ensure that no fortuitous intermittent contact can occur between metallic and/or metallized parts.

3.3 High Pressure Refuelling and Fuel Transfer. Where provision is made for high pressure refuelling and/or for high rates of fuel transfer it should be established, by test, or by consultation with the appropriate fuel manufacturers, that dangerously high voltages will not be induced within the fuel system. If compliance with this requirement involves any restriction on the types of fuel to be used or on the use of additives, this should be established.

3.3.1 With standard refuelling equipment and standard aircraft turbine fuels, voltages high enough to cause sparking may be induced between the surface of the fuel and the metal parts of the tank at refuelling rates above approximately 250 gal/min. These induced voltages may be increased by the presence of additives and contaminants (e.g. anti-corrosion inhibitors, lubricating oil, free water), and by splashing or spraying of the fuel in the tank.

3.3.2 The static charge can be reduced as follows:

- a. By means taken in the refuelling equipment such as increasing the diameter of refuelling lines and designing filters to give the minimum of electrostatic charging, or

- b. By changing the electrical properties of the fuel by the use of anti-static additives and thus reducing the accumulation of static charge in the tank to negligible amount.
  - 3.3.3 The critical refueling rates are related to the aeroplane refueling installations, and the designer should seek the advice of fuel suppliers on this problem.
- 4. Primary and Secondary Bonding Paths  
(Reference 25.581; 25.954; 25.1316; 25.1353; 25.1360;)
  - 4.1 Primary bonding paths are those paths, which are required to carry lightning discharge currents. These paths should be of as low an electrical impedance as is practicable. Secondary bonding paths are those paths provided for other forms of bonding.
  - 4.2 Where additional conductors are required to provide or supplement the inherent primary bonding paths provided by the structure or equipment, then the cross-sectional area of such primary conductors made from copper should be not less than 3 mm<sup>2</sup> except that, where a single conductor is likely to carry the whole discharge from an isolated section, the cross-sectional area would be not less than 6 mm<sup>2</sup>. Aluminum primary conductors should have a cross-sectional area giving an equivalent surge carrying capacity.
  - 4.3 Primary bonding paths should be used for -
    - a. Connecting together the main earths of separable major components which may carry lightning discharges,
    - b. Connecting engines to the main earth,
    - c. Connecting to the main earth all metal parts presenting a surface on or outside of the external surface of the aeroplane, and
    - d. Conductors on external non-metallic parts.
  - 4.4 Where additional conductors are required to provide or supplement the inherent secondary bonding paths provided by the structure or equipment then the cross-sectional area of such secondary conductors made from copper should be not less than 1 mm<sup>2</sup>. Where a single wire is used its size should be not less than 1.2 mm diameter.
- 5 Resistance and Continuity Measurements. Measurements should be made to determine the efficacy of the bonding and connection between at least the following:
  - 5.1 Primary Bonding Paths.
    - 5.1.1 The extremities of the fixed portions of the aeroplane and such fixed external panels and components where the method of construction and/or assembly leads to doubt as to the repeatability of the bond, e.g. removable panels.
    - 5.1.2 The engines and the main aeroplane earth.
    - 5.1.3 External movable metal surfaces or components and the main aeroplane earth.
    - 5.1.4 The bonding conductors of external non-metallic parts and the main aeroplane earth.
    - 5.1.5 Internal components for which a primary bond is specified and the main aeroplane earth.
  - 5.2 Secondary Bonding Paths.
    - 5.2.1 Metallic parts, normally in contact with flammable fluids, and the main aeroplane earth.
    - 5.2.2 Isolated conducting parts subject to appreciable electrostatic charging and the main

aeroplane earth.

5.2.3 Electrical panels and other equipment accessible to the occupants of the aeroplane and the main aeroplane earth.

5.2.4 Earth connections, which normally carry the main electrical supply and the main aeroplane earth. The test on these connections should be such as to ensure that the connections can carry, without risk of fire or damage to the bond, or excessive volt drop, such continuous normal currents and intermittent fault currents as are applicable.

5.2.5 Electrical and electronic equipment and the aeroplane main earth, where applicable, and as specified by the aeroplane constructor.

5.2.6 Static discharger wicks and the main aeroplane structure.

## 6 Electrical Properties of Composite Structure

- 6.1 In the case of lightning protection, for the partial conductors the method of surface protection will vary with the criticality of the structure in question. Deterioration of the means of protection or possible hidden damage to the material which may affect its structural integrity, need to be considered. While such materials provide a measure of electro-magnetic screening, the need for additional measures will be a function of the location of the material in relation to critical equipment and wiring in the aircraft. Particular attention will also have to be given to the protection required near fuel systems - e.g. fuel tanks. For non-conducting materials which have no intrinsic lightning protection or screening properties, the measures taken will again depend on the relative locations of the material and critical systems or fuel and the possible loss of the components due to internal air pressures in the event of a strike.
- 6.2 The partial conducting materials should present no problem in dissipating P-static but problems can arise with the non-conductors. Depending upon the location of the material, protection may be required.
- 6.3 Electrical currents, other than lightning, can flow in some partial conducting materials and means may be required to limit this by provision of alternative current paths if the effect of large voltage drop is important or if such currents can damage the material.
- 6.4 Particular care has to be taken that all joints, permanent and temporary, are capable of carrying any currents which may flow particularly those resulting from lightning strikes. Structural damage and loss of screening capabilities may occur if these are not adequately controlled.
- 6.5 The adequacy of the material in supplying a ground plane for antenna may have to be considered. Again it will vary with the material and the radio frequency of the system.

### **14 - How does the proposed standard compare to the current ICAO standard?**

The proposal is in line with ICAO standards

### **15 - Does the proposed standard affect other HWG's?**

This proposal reflects agreement between ESHWG and EEHWG to revise and adopt FAR/JAR 25.581.

### **16 - What is the cost impact of complying with the proposed standard?**

The cost impact of complying with the proposed standard should be insignificant due to the fact that current industry standards result in compliance with this proposed change.

### **17 - Does the HWG want to review the draft NPRM at "Phase 4" prior to publication in the Federal Register?**

Yes. In addition, the ESHWG would like to review the draft advisory material.

**18 – In light of the information provided in this report, does the HWG consider that the “Fast Track” process is appropriate for this rulemaking project, or is the project too complex or controversial for the Fast Track Process. Explain.**

The “Fast Track” process is appropriate for this rulemaking. All affected sections are under the control of this working group.

FAA Action: Fire Protection of Electrical System Components on Transport Category Airplanes; NPRM -- [FAA-2001-9637](#)  
and  
Electrical Installation, Nickel Cadmium Battery Installation, and Nickel Cadmium Battery Storage; NPRM -- [FAA-2001-9634](#)



# Federal Register

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**Tuesday,  
March 16, 2004**

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## **Part IV**

# **Department of Transportation**

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**Federal Aviation Administration**

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**14 CFR Part 25**

**Electrical Equipment and Installations,  
Storage Battery Installation; Electronic  
Equipment; and Fire Protection of  
Electrical System Components on  
Transport Category Airplanes; Final Rule**

**DEPARTMENT OF TRANSPORTATION**  
**Federal Aviation Administration**

**14 CFR Part 25**

[Docket No. FAA-2001-9634, FAA-2001-9633, FAA-2001-9638, FAA-2001-9637; Amendment No. 25-113]

RIN 2120-AI21

**Electrical Equipment and Installations, Storage Battery Installation; Electronic Equipment; and Fire Protection of Electrical System Components on Transport Category Airplanes**

**AGENCY:** Federal Aviation Administration (FAA), DOT.

**ACTION:** Final rule.

**SUMMARY:** The FAA amends the regulations governing airworthiness standards for transport category airplanes concerning: electrical equipment; nickel cadmium battery installation and storage; electrical cables; design and installation of electronic equipment; and fire protection of electrical system components. Adoption of these amendments eliminates significant regulatory differences between the airworthiness standards of the U.S. and the Joint Aviation Requirements of Europe, without affecting current industry design practices.

**DATES:** This amendment becomes effective April 15, 2004.

**FOR FURTHER INFORMATION CONTACT:** Stephen Slotte, FAA, Airplane and Flight Crew Interface Branch, ANM-111, Federal Aviation Administration, Transport Airplane Directorate, Aircraft Certification Service, 1601 Lind Avenue SW., Renton, WA 98055-4056; telephone 425-227-2315; facsimile 425-227-1320, e-mail [steve.slotte@faa.gov](mailto:steve.slotte@faa.gov).

**SUPPLEMENTARY INFORMATION:**

**How Can I Obtain a Copy of This Final Rule?**

You can get an electronic copy using the Internet by:

- (1) Searching the Department of Transportation's electronic Docket Management System (DMS) web page (<http://dms.dot.gov/search>);
- (2) Visiting the Office of Rulemaking's web page at <http://www.faa.gov/avr/arm/index.cfm>; or
- (3) Accessing the Government Printing Office's web page at [http://www.access.gpo.gov/su\\_docs/aces/aces140.html](http://www.access.gpo.gov/su_docs/aces/aces140.html).

You can also request a copy from the Federal Aviation Administration, Office of Rulemaking, ARM-1, 800 Independence Avenue SW., Washington, DC 20591 [(202) 267-9680]. Be sure to identify the amendment number or docket number of this rulemaking.

**Small Business Regulatory Enforcement Fairness Act**

The Small Business Regulatory Enforcement Fairness Act (SBREFA) of 1996 requires FAA to comply with small entity requests for information or advice about compliance with statutes and regulations within our jurisdiction. If you are a small entity and you have a question regarding this document you may contact your local FAA official or the person listed under **FOR FURTHER INFORMATION CONTACT**. You can find out more about SBREFA on the Internet at <http://www.faa.gov/avr/arm/sbrefa.htm>, or by e-mailing us at [9-AWA-SBREFA@faa.gov](mailto:9-AWA-SBREFA@faa.gov).

**Background**

This final rule responds to recommendations of the Aviation Rulemaking Advisory Committee (ARAC) submitted under the FAA's Fast Track Harmonization Program. It amends six sections of the regulations governing airworthiness standards for transport category airplanes concerning: electrical installation, nickel cadmium battery installation and storage; electrical cables; design and installation of electronic equipment; and fire protection of electrical system components. The FAA proposed these changes in four notices of proposed rulemaking (NPRM). The notices and the affected sections are listed in the table below.

Change No.	14 CFR section No.	Section title	Notice No.	Federal Register publication/publication date
1 .....	§ 25.1353(a) .....	Electrical equipment and installations .....	01-04	66 FR 27582, 05/17/2001.
2 .....	§ 25.1353(c)(5) .....	Storage batteries		
3 .....	§ 25.1353(c)(6) .....	Storage batteries		
4 .....	§ 25.1353(d) .....	Electrical cables and cable installations .....	01-03	66 FR 26942, 05/15/2001.
5 .....	§ 25.1431(d) .....	Electronic equipment .....	01-07	66 FR 26956, 05/15/2001.
6 .....	§ 25.869(a)(4) .....	Fire protection systems .....	01-06	66 FR 26964, 05/15/2001.

In these notices you will find a history of the problems and discussions of the safety considerations supporting our course of action. You also will find a discussion of the current requirements and why they do not adequately address the problem. We also refer to the recommendations of the ARAC we relied on in developing the proposed rule. The NPRMs also discuss each alternative that we considered and the reasons for rejecting the ones we did not adopt.

The background material in the NPRM also contains the basis and rationale for these requirements and, except where we have specifically expanded on the background elsewhere in this preamble, supports this final rule

as if it were contained here. That is, any future discussions regarding the intent of the requirements may refer to the background in the NPRM as though it was in the final rule itself. It is therefore not necessary to repeat the background in this document.

*History*

In the United States, Title 14, Code of Federal Regulations (CFR) part 25 contains the airworthiness standards for type certification of transport category airplanes. Manufacturers of transport category airplanes must show that each airplane they produce of a different type design complies with the appropriate part 25 standards.

In Europe, Joint Aviation Requirements (JAR)-25 contains the

airworthiness standards for type certification of transport category airplanes. The Joint Aviation Authorities (JAA) of Europe developed these standards, which are based on part 25, to provide a common set of airworthiness standards within the European aviation community. Thirty-seven European countries accept airplanes type certificated to the JAR-25 standards, including airplanes manufactured in the U.S. that are type certificated to JAR-25 standards for export to Europe.

Although part 25 and JAR-25 are similar, they are not identical in every respect. When airplanes are type certificated to both sets of standards, the differences between part 25 and JAR-25

can result in substantial added costs to manufacturers and operators. These added costs, however, often do not bring about an increase in safety.

Recognizing that a common set of standards would not only benefit the aviation industry economically but also preserve the necessary high-level of safety, the FAA and the JAA began an effort in 1988 to “harmonize” their respective aviation standards.

After beginning the first steps towards harmonization, the FAA and JAA soon realized that traditional methods of rulemaking and accommodating different administrative procedures was neither sufficient nor adequate to make noticeable progress towards fulfilling the harmonization goal. The FAA identified the ARAC as an ideal vehicle for helping to resolve harmonization issues, and in 1992, the FAA tasked ARAC to undertake the entire harmonization effort.

Despite the work that ARAC has undertaken to address harmonization, there remain many regulatory differences between part 25 and JAR-25. The current harmonization process is costly and time-consuming for industry, the FAA, and the JAA. Industry has expressed a strong desire to finish the harmonization program as quickly as possible to alleviate the drain on their resources and finally to establish one acceptable set of standards.

Recently, representatives of the FAA and JAA proposed an accelerated process to reach harmonization, the “Fast Track Harmonization Program.” The FAA initiated the Fast Track Harmonization Program on November 26, 1999 (64 FR 66522). This rulemaking has been identified as a “fast track” project.

Further details on ARAC, and its role in the harmonization rulemaking activity, and the Fast Track Harmonization Program can be found in the tasking statement (64 FR 66522, November 26, 1999) and the first NPRM published under this program, Fire Protection Requirements for Powerplant Installations on Transport Category Airplanes (65 FR 36978, June 12, 2000).

#### Related Activity

The new European Aviation Safety Authority (EASA) was established and formally came into being on September 28, 2003. The JAA worked with the European Commission (EC) to develop a plan to ensure a smooth transition from JAA to the EASA. As part of the transition, the EASA will absorb all functions and activities of the JAA, including its efforts to harmonize JAA regulations with those of the U.S. This rule is a result of the FAA and JAA

harmonization rulemaking activities. It adopts the more stringent requirements of the JAR standards. These JAR standards have already been incorporated into the EASA “Certification Specifications for Large Aeroplanes” CS-25, in similar if not identical language. The EASA CS-25 became effective on October 17, 2003.

#### Discussion of the Comments

*Electrical Installation, Nickel Cadmium Battery Installation, and Nickel Cadmium Battery Storage, RIN 2120-AH27*

On May 17, 2001, the FAA published a notice of proposed rulemaking (Notice No. 01-04, 66 FR 27582) entitled, “Electrical Installation, Nickel Cadmium Battery Installation, and Nickel Cadmium Battery Storage.” In the NPRM, the FAA proposed to amend three sections of 14 CFR part 25 regarding airworthiness standards for transport category airplanes concerning electrical equipment and installations to harmonize the standards with those of the associated JAR-25. In the NPRM, the proposed title of § 25.1353 is incorrect. This final rule corrects the title of § 25.1353 to read “Electrical equipment and installations.” For electrical equipment installations, the FAA proposed to add text from the associated JAR to harmonize the requirements, and to clarify the intent of this regulation. For nickel cadmium batteries, the FAA proposed to expand the applicability of the regulation to all nickel cadmium battery sizes, regardless of their capabilities. In addition, the FAA proposed to adopt the associated JAR Advisory Circular Joint (ACJ) material for both electrical equipment and nickel cadmium battery installations.

#### General Comment

The FAA received four comments in response to the proposed rule. Two of the four commenters support the proposed changes. The other two commenters disagreed with the cost estimates in the proposal, as discussed below.

*Comment:* The third and fourth commenters submitted their comments through the Air Transport Association of America (ATA). The ATA provided comments that “indicate the cost estimates in the proposal are flawed because they do not address the cost of compliance when installing new equipment in existing airplanes.”

*FAA Reply:* The FAA does not concur. The cost and technical impacts on existing aircraft due to harmonization of these rules are expected to be minimal because of the following:

1. These harmonized rules will, in general, not be applicable to existing airplanes or modifications to existing airplanes that were certified to earlier amendment levels as defined on the Type Certificate Data sheet. An exception may be new derivative airplane models or modifications to existing models that are deemed significant enough to require application of later amendment levels per 14 CFR 21.101.

2. It is anticipated that any modifications or retrofit changes that require a showing of compliance to the harmonized rules for nickel cadmium batteries §§ 25.1353(c)(5) and (c)(6) will, in general, not require compliance to later amendments.

3. The requirements for temperature sensing, monitoring, and warning, in general apply to batteries that have high enough energy sources to be a hazard, and are typically main airplane batteries or APU start type batteries. Main airplane batteries (which have engine ignition as a stand-by load) or APU start batteries already are required to have this sensing and monitoring functionality.

4. This regulation will not be applicable to flashlights or emergency lighting equipment (dry cell type batteries as they generally have low energy-charging type systems (trickle charge)); unless there were to be new designs or new technologies that warrant this type of battery monitoring and sensing due to potentially hazardous effects.

5. Harmonization of § 25.1353(a) with JAR 25.1353(a) provides consistency with existing rules, § 25.1431, and with the harmonized § 25.1309. The intent of both rules is the same in that the airplane is required to be designed with electrical interference effects that have no unsafe effects on the airplane, systems, or occupants. This rule provides further definition in terms of the level of safety or probability of failure that is required. The main difference between § 25.1353(a) and JAR 25.1353(a) is the use of the term “extremely remote,” which is defined as follows:

*Extremely Remote Failure Condition:* a failure condition that is not anticipated to occur to each airplane during its total life, but which may occur a few times when considering the total operational life of all airplanes of the type. [Note: The term “extremely remote” has been used previously within 14 CFR part 25 to describe a condition so remote that it is not anticipated to occur in service on any transport category airplane (i.e., “extremely improbable”). However, for the purposes of this regulation, the term “extremely remote” will have the meaning specified above.]

This is further supported by the Advisory Circular Joint (ACJ) 25.1353(a), "Acceptable Means of Compliance and Interpretation," Section Two of the Joint Aviation Requirements (JAR-25).

The FAA has adopted the JAR ACJ material as an acceptable means of showing compliance with the revision to § 25.1353(a) and has developed an Advisory Circular (AC). The FAA will publish a Notice of Availability in the **Federal Register** after the AC is issued.

*Changes:* No changes were made as a result of this comment.

*FAA Disposition of Comments:* The FAA adopts the changes as proposed in the NPRM, Notice No. 01-04.

#### *Electrical Cables, RIN 2120-AH29*

On May 15, 2001, the FAA published a notice of proposed rulemaking (Notice No. 01-03, 66 FR 26942) entitled, "Electrical Cables." In the NPRM, the FAA proposed harmonizing the standards by revising the regulation to adopt the text of the associated JAR-25. The proposed revision would specify a design action to be taken, and remove the possibility that a designer may not consider a critical installation design condition.

#### General Comment

The FAA received one comment to both Notice No. 01-03 and Notice No. 01-07. The commenter fully supports the proposal.

*Comment:* The commenter fully supports the adoption of these amendments to reduce the differences between part 25 and JAR-25. Further, the commenter states that the fruits of the ARAC's considerable efforts should enable the FAA to complete this rulemaking quickly.

*Changes:* No changes were made as a result of this comment.

*FAA Disposition of Comment:* The FAA adopts the changes as proposed in the NPRM, Notice No. 01-03.

#### *Design and Installation of Electronic Equipment on Transport Category Airplanes, RIN 2120-AH28*

On May 15, 2001, the FAA published a notice of proposed rulemaking (Notice No. 01-07, 66 FR 26956) entitled, "Design and Installation of Electronic Equipment on Transport Category Airplanes." In the NPRM, the FAA proposed to revise § 25.1431 to add a new paragraph (d) that would be parallel to JAR-25.1431(d). The proposal would provide one location in the regulations that explicitly addresses requirements related to electrical power supply transients, clarify the objective of the other related regulations in part

25, and harmonize 14 CFR part 25 with the associated JAR-25.

#### General Comment

The FAA received one comment to both Notice No. 01-03 and Notice No. 01-07. The commenter fully supports the proposal.

*Comment:* See Comment under "Electrical Cables" above.

*Changes:* No changes to the rule as proposed are necessary.

*FAA Disposition of Comment:* The FAA adopts the changes as proposed in the NPRM, Notice No. 01-07.

#### *Fire Protection of Electrical System Components on Transport Category Airplanes, RIN 2120-AG92.*

On May 15, 2001, the FAA published a notice of proposed rulemaking (Notice No. 01-06, 66 FR 26964) entitled, "Fire Protection of Electrical System Components on Transport Category Airplanes." In the NPRM, the FAA proposed to revise § 25.869(a), concerning the protection of electrical system components, to adopt the more stringent language in the parallel JAR-25.

#### General Comment

The FAA received three comments in response to the proposed rule. Two of the commenters agree with the proposal and recommend its adoption. The third commenter suggested a change to the applicability of the rule, as discussed below.

*Comment:* The commenter states, "Regulatory changes should apply to airplanes or electrical components manufactured after the date the CFR is changed. The CFR change should not be retroactive to airplanes manufactured before this new regulation is enacted."

*FAA Reply:* The harmonized § 25.869(a) and JAR 25.869(a) will be incorporated into later revisions of 14 CFR part 25 and are not retroactive. Therefore, these harmonized rules will, in general, not be applicable to existing airplanes or electrical components that were certified to earlier amendment levels as defined on the Type Certificate Data sheet for the airplane models in question. An exception may be new derivative airplane models or modifications to existing models that are deemed significant enough to require application of later amendment levels per 14 CFR 21.101.

There is currently no FAA advisory material related to the standard. However, the FAA has developed AC 25.869-1X, "Electrical System Fire and Smoke Protection." It contains guidance on this subject and includes, with some modification, the material currently in

the JAA's ACJ 25.869. The FAA will publish a Notice of Availability in the **Federal Register** after the AC is issued.

*Changes:* No changes were made as a result of this comment.

*FAA Disposition of Comment:* The FAA adopts the changes as proposed in the NPRM, Notice No. 01-06.

#### **What Regulatory Analyses and Assessments Has the FAA Conducted?**

##### *Economic Evaluation, Regulatory Flexibility Determination, Trade Impact Assessment, and Unfunded Mandates Assessment*

Changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 directs each Federal agency to 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 impact of regulatory changes on small entities. Third, the Trade Agreements Act (19 U.S.C. section 2531-2533) prohibits agencies from setting standards that create unnecessary obstacles to the foreign commerce of the United States. In developing U.S. standards, this Trade Act also 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 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 final rule:

1. Has benefits that do justify its costs, is not a "significant regulatory action" as defined in the Executive Order, and is not "significant" as defined in DOT's Regulatory Policies and Procedures;
2. will not have a significant economic impact on a substantial number of small entities;
3. reduces barriers to international trade; and,
4. imposes no unfunded mandates on State, local, or tribal governments, or the private sector.

The (DOT) Order 2100.5, "Regulatory Policies and Procedures," prescribes policies and procedures for simplification, analysis, and review of regulations. If it is determined that the expected impact is so minimal that the rule does not warrant a full evaluation, a statement to that effect and the basis

for it is included in the regulation. We provide the basis for this minimal impact determination below. We received no comments that conflicted with the economic assessment of minimal impact published in the notices of proposed rulemaking for this action. Given the reasons presented below, we have determined that the expected impact of this rule is so minimal that the final rule does not warrant a full evaluation.

Currently, airplane manufacturers must satisfy both the 14 CFR and the European JAR certification standards to market transport category airplanes in both the United States and Europe. Meeting two sets of certification requirements raises the cost of developing new transport category airplanes often with no increase in safety. In the interest of fostering international trade, lowering the cost of airplane development, and making the certification process more efficient, the FAA, JAA, and airplane manufacturers have been working to create, to the maximum possible extent, a single set of certification requirements accepted in both the United States and Europe. As discussed previously, these efforts are referred to as harmonization. This final rule results from the FAA's acceptance of ARAC harmonization working group recommendations. Members of the ARAC working groups agreed that the requirements of this rule will not impose additional costs to U.S. manufacturers of part 25 airplanes.

Specifically, this final rule requires:

1. Revising §§ 25.1353(a), (c)(5), and (c)(6), and 25.869(a) to adopt the "more stringent" requirements currently in those same sections of JAR-25;
2. adding § 25.1353(d) to adopt JAR 25.1353(d) in its entirety; and,
3. adding a new § 25.1431(d) to incorporate the "more stringent" requirement of paragraph 25.1431(d) of the JAR.

We consider that this rule will neither reduce nor increase the requirements beyond those that are already met by U.S. manufacturers to satisfy European airworthiness standards.

As this rule neither increases nor decreases certification requirements beyond those already in existence, we have determined there will be no cost associated with this rule to part 25 manufacturers. We have not tried to quantify the benefits of this amendment beyond identifying the expected harmonization benefit. This amendment eliminates an identified significant regulatory difference (SRD) between part 25 and JAR-25 wording. Eliminating the SRD will provide for a more consistent interpretation of the

rules and, thus, is an element of the potentially large cost savings of harmonization.

#### *Regulatory Flexibility Determination*

The Regulatory Flexibility Act of 1980 (RFA) directs the FAA to fit regulatory requirements to the sale of the business, organizations, and governmental jurisdictions subject to regulation. We are required to determine whether a proposed or final action will have a "significant economic impact on a substantial number of small entities" as defined in the Act.

If we find the action will have a significant impact, we must do a "regulatory flexibility analysis." If, however, we find the action will not have a significant economic impact on a substantial number of small entities, we are not required to do the analysis. In this case, the Act requires that we include a statement that provides the factual basis for our determination.

We have determined that this amendment will not have a significant economic impact on a substantial number of small entities for two reasons:

First, the net effect of the final rule is regulatory cost relief. The amendment requires that new transport category airplane manufacturers meet just the "more stringent" European certification requirement, rather than both the United States and European standards. Airplane manufacturers already meet or expect to meet this standard as well as the existing part 25 requirements.

Second, all United States manufacturers of transport category airplanes exceed the Small Business Administration small-entity criteria of 1,500 employees for airplane manufacturers. Those U.S. manufacturers include: The Boeing Company, Cessna Aircraft Company, Gulfstream Aerospace, Learjet (owned by Bombardier Aerospace), Lockheed Martin Corporation, McDonnell Douglas (a wholly owned subsidiary of The Boeing Company), Raytheon Aircraft, and Sabreliner Corporation.

The FAA received no comments that differed with the assessment given in this section. Since this final rule is cost relieving and there are no small entity manufacturers of part 25 airplanes, the FAA Administrator certifies that this final rule will not have a significant economic impact on a substantial number of small entities.

#### *Trade Impact Assessment*

The Trade Agreement Act of 1979 prohibits Federal agencies from establishing any standards or engaging in related activities that create

unnecessary obstacles to the foreign commerce of the United States. Legitimate domestic objectives, such as safety, are not considered unnecessary obstacles. The statute also requires consideration of international standards and, where appropriate, that they be the basis for U.S. standards.

This rule is consistent with the Trade Agreement Act as the European standards are the basis for these U.S. regulations.

#### *Unfunded Mandates Assessment*

The Unfunded Mandates Reform Act of 1995 (the Act), is intended, among other things, to curb the practice of imposing unfounded Federal mandates on State, local, and tribal governments. Title II of the Act 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 the expenditure of \$100 million or more (adjusted annually for inflation) 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."

This final rule does not contain such a mandate. The requirements of Title II of the Act, therefore, do not apply.

#### **What Other Assessments Has the FAA Conducted?**

##### *Paperwork Reduction Act*

Under the provisions of the Paperwork Reduction Act of 1995, there are no current or new requirements for information collection associated with this final rule.

##### *International Compatibility*

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 has determined that there are no ICAO Standards and Recommended Practices that correspond to these regulations.

##### *Executive Order 13132, Federalism*

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

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 final rule applies to the certification of future designs of transport category airplanes and their subsequent operation, it could affect intrastate aviation in Alaska. Because no comments were received regarding this regulation affecting intrastate aviation in Alaska, we will apply the rule in the same way that it is being applied nationally.

Plain Language

Executive Order 12866 (58 FR 51735, Oct. 4, 1993) requires each agency to write regulations that are simple and easy to understand. We invite your comments on how to make these regulations easier to understand, including answers to questions such as the following:

- Are the requirements in the regulations clearly stated?
• Do the regulations contain unnecessary technical language or jargon that interferes with their clarity?
• Would the regulations be easier to understand if they were divided into more (but shorter) sections?
• Is the description in the final rule preamble helpful in understanding the regulations?

Please send your comments to the address specified in the FOR FURTHER INFORMATION CONTACT section.

Environmental Analysis

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

Energy Impact

The FAA has assessed the energy impact of this final rule in accordance

with the Energy Policy and Conservation Act (EPCA) and Public Law 94-163, as amended (43 U.S.C. 6362), and FAA Order 1053.1. We have determined that the final rule is not a major regulatory action under the provisions of the EPCA.

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 § 25.869 by revising paragraph (a)(4) to read as follows:

§ 25.869 Fire protection: systems.

(a) \* \* \*
(4) Insulation on electrical wire and electrical cable installed in any area of the airplane must be self-extinguishing when tested in accordance with the applicable portions of part I, appendix F of this part.

\* \* \* \* \*

3. Amend § 25.1353 by revising paragraphs (a), (c)(5), and (c)(6), and by adding a new paragraph (d) to read as follows:

§ 25.1353 Electrical equipment and installations.

(a) Electrical equipment, controls, and wiring must be installed so that operations of any one unit or system of units will not adversely affect the simultaneous operation of any other electrical unit or system essential to the safe operation. Any electrical interference likely to be present in the airplane must not result in hazardous effects upon the airplane or its systems except under extremely remote conditions.

\* \* \* \* \*

(c) \* \* \*

(5) Each nickel cadmium battery installation must have provisions to prevent any hazardous effect on structure or essential systems that may be caused by the maximum amount of heat the battery can generate during a short circuit of the battery or of individual cells.

(6) Nickel cadmium battery installations must have—

(i) A system to control the charging rate of the battery automatically so as to prevent battery overheating; or

(ii) A battery temperature sensing and over-temperature warning system with a means for disconnecting the battery from its charging source in the event of an over-temperature condition; or

(iii) A battery failure sensing and warning system with a means for disconnecting the battery from its charging source in the event of battery failure.

(d) Electrical cables and cable installations must be designed and installed as follows:

(1) The electrical cables used must be compatible with the circuit protection devices required by § 25.1357 of this part, such that a fire or smoke hazard cannot be created under temporary or continuous fault conditions.

(2) Means of permanent identification must be provided for electrical cables, connectors and terminals.

(3) Electrical cables must be installed such that the risk of mechanical damage and/or damage caused by fluids, vapors, or sources of heat, is minimized.

4. Amend § 25.1431 by adding a new paragraph (d) to read as follows:

§ 25.1431 Electronic equipment.

\* \* \* \* \*

(d) Electronic equipment must be designed and installed such that it does not cause essential loads to become inoperative as a result of electrical power supply transients or transients from other causes.

Issued in Renton, Washington, on March 9, 2004.

Franklin Tiangsing,

Acting Manager, Transport Airplane Directorate, Aircraft Certification Service.

[FR Doc. 04-5892 Filed 3-15-04; 8:45 am]

BILLING CODE 4910-13-P