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FAA-2003-14193-11

Central JAA
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Date
27 March 2003
Contact
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Enclosure(s)
NPA25D-301 + CRD (by e-mail)
Subject
Processing of NPA25D-301 Fuselage Doors

Your reference
07/03-6-2 02L-031dated 2 April 2002
Our reference
-

Dear Yves,

With reference to your letter, you will find enclosed the JARSD&F SG position on the disposal of the related comments made on NPA25D-301 Fuselage Doors. The NPA and CRD will be send to you in electronic form by e-mail.

The NPA is not fully harmonised with the FAA. On January 14, 2003 FAA published the NPRM Docket No. FAA-2003-14193; Notice No. 03-01 Design Standards for Fuselage Doors on Transport Category Aircraft., (which is equivalent to the JAR25 requirements in NPA25D-301 Issue September 2001). This NPA however also includes the ACJ material, where the FAA AC material has not been published at this moment.

The NPA25D-301 Issue January 2003 is the final JAA version at this moment. Further harmonisation and as a consequence of that, amendments to this NPA, may be needed after the FAA has issued the final rule and the AC. In order to minimise the possible amendments to the NPA, as a consequence of the comments received on the NPRM, I would like to request CJAA to send the NPA and the CRD to the FAA as JAA comments to the NPRM. The comment period ends April 14, 2003.

This letter has been sent to you on request of Patrick Mattei, Chairman of the SD&F SG in the meeting no.2 dated 28/29 January 2003 in Toulouse.

Yours sincerely,

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NPA 25D-301
FUSELAGE DOORS
JAR 25.783

Date: January, 2003

SUMMARY

This NPA is sponsored by the JAR D&F Study Group.

This NPA proposes to revise the doors requirements (JAR 25.783) of the Joint Aviation Requirements for Large Aeroplanes (JAR-25) by incorporating changes developed in co-operation with the US Federal Aviation Administration (FAA) and the Aviation Rulemaking Advisory Committee (ARAC). These proposals are intended to achieve common requirements and language between the JAR and FAR requirements and also make some of the requirements more rational, while enhancing the level of safety provided by the current requirements.

INTRODUCTION

The manufacturing, marketing and certification of large aeroplanes is increasingly an international endeavour. In order for European manufacturers to export aeroplanes to other countries, the aeroplane must be designed to comply, not only with the European airworthiness requirements for large aeroplanes (JAR-25), but also with the airworthiness requirements of the countries to which the aeroplane is to be exported.
JAR-25 is developed in a format similar to FAR 25. Many other countries have airworthiness codes that are aligned closely to JAR-25 or to FAR 25, or they use these codes directly for their own certification purposes.
Although JAR-25 is very similar to FAR 25, there are differences in methodologies and criteria that often result in the need to address the same design objective with more than one kind of analysis or test in order to satisfy both JAR-25 and FAR 25 . These differences result in additional costs to the large aeroplane manufacturers and additional costs to the JAA and foreign authorities that must continue to monitor compliance with a variety of different airworthiness codes.

In 1988, the JAA, in co-operation with the FAA and other organisations representing the European and U.S. aerospace industries, began a process to harmonise the airworthiness requirements of the European authorities with the airworthiness requirements of the United States. The objective was to achieve common requirements for the certification of large aeroplanes without a substantive change in the level of safety provided by the requirements. Other airworthiness authorities such as Transport Canada have also participated in this process.

In 1992, the harmonisation effort was undertaken by the Aviation Rulemaking Advisory Committee (ARAC) on the US side.

In 1996, in co-operation and conjunction with ARAC, a working group (General Structures Harmonisation Working Group) comprised of specialists from both industry and aviation regulatory authorities from Europe, the United States, and Canada was established to work on the door requirements of Subpart D of JAR/FAR 25, "Design and Construction".
A co-ordination has been established with the JAA Cabin Safety Study Group to eliminate unnecessary and confusing duplication between the emergency exit requirements and the door design requirements.

The harmonisation effort has now progressed to a point where some specific proposals have been developed by the working group.
This notice contains the proposals necessary to achieve harmonisation for the fuselage doors requirements of JAR/FAR 25.

Because the means of compliance recognised by the JAA to meet the door requirements are complex and in some cases different from those used by the FAA, a harmonised advisory circular/advisory material joint was generated by the working group. The ACJ is included as a part of this notice.

In summary, this notice provides changes to the door requirements (JAR 25.783), the emergency exits requirements (JAR 25.807), the emergency exit arrangement requirements (JAR 25.809), the emergency egress assist means and escape routes requirements which were identified as part of the activities associated with the harmonisation of paragraph JAR 25.783, a new paragraph JAR 25.820 on Lavatory doors and the addition of ACJ 25.783, "Fuselage doors and hatches".

BACKGROUND

Following a major accident in 1974, which involved the opening of a fuselage door on a transport category airplane during flight, the FAA amended the applicable safety standards to provide a higher level of safety for fuselage doors. The FAA issued Amendment 25-54 to 14 CFR part 25 (45 FR 60172, September 11, 1980), the objective of which was to provide a level of safety in doors consistent with the level of safety required for other critical systems on the airplane, such as primary flight controls. This was achieved by requiring redundancy and fail-safe features in the door operating systems, and by providing protection from anticipated human errors. The JAA accepted Amendment 25-54 in JAR 25 Change 10 (December 19, 1983).

In 1989, another wide-body transport category airplane lost a lower lobe cargo door, along with a portion of fuselage structure above the door, during flight. Because of this accident and other similar accidents, the FAA requested the Air Transport Association (ATA) to form an industry task force to review door designs on transport category airplanes. This group was chartered to review the design and operation of doors on the current fleet of transport airplanes, and to recommend actions that would prevent any further inadvertent opening of outward opening doors. The group also was requested to review pertinent current regulations and advisory material, and to provide recommendations for necessary rule changes. The ATA provided its recommendations to the FAA in report entitled, "ATA Cargo Door Task Force Final Report," dated May 15, 1991.

As a result of its investigation of the airplane accident(s) associated with fuselage doors opening during flight, the National Transportation Safety Board (NTSB) also issued the following Safety Recommendations relating to doors on transport category airplanes, for consideration by the FAA:

Safety Recommendation A-89-092: Issue an airworthiness directive (AD) to require that the manual drive units and electrical actuators for Boeing 747 cargo doors have torque-limiting devices to ensure that the lock sectors, modified in accordance with the requirements of AD-88-12-04 [amendment 39-5934 (53 FR 18079, May 20, 1988)], cannot be overridden during mechanical or electrical operation of the latch cams.

Safety Recommendation A-89-093: Issue an airworthiness directive (AD) for non-plug cargo doors on all transport category airplanes requiring the installation of positive indicators to ground personnel and flightcrews confirming the actual position of both the latch cams and locks, independently.

Safety Recommendation A-89-094: Require that fail-safe design considerations for non-plug cargo doors on present and future transport category airplanes account for conceivable human errors in addition to electrical and mechanical malfunctions.

Safety Recommendation A-92-21: Require that the electrical actuating systems for non-plug cargo doors on transport category aircraft provide for the removal of all electrical power from circuits on the door after closure (except for any indicating circuit power necessary to provide positive indication that the door is properly latched and locked) to eliminate the possibility of uncommanded actuator movements caused by wiring short circuits.

The FAA has responded to these safety recommendations by issuing various Airworthiness Directives, applicable to the current fleet of transport category airplanes, and requiring relevant modifications and inspections of the fuselage doors.

PROPOSALS

The scope of this proposal is to revise and reorganize the existing rules in 14 CFR part 25 to provide the following:

1. Clarification of the existing design requirements for doors.
2. Definitive criteria for the door design requirements that are currently covered in the existing rules by general text.
3. Additional fail-safe requirements and detailed door design requirements, based on the recommendations of the NTSB and the ATA, and on current industry practice.

PART I;
PROPOSALS FOR DEFINITIONS

For the purpose of understanding the remainder of this proposal, the following definitions are proposed (ref. ACJ 25.783).

A latch is a movable mechanical element that, when engaged, prevents the door from opening.

A lock is a mechanical element that monitors the latch position, and when engaged, prevents the latch from becoming disengaged.

Latched means the latches are engaged with their structural counterparts and held in position by the latch operating mechanism.

Locked means the locks are engaged and held in position by the lock operating mechanism.

Latching mechanism includes the latch operating mechanism and the latches.

Locking mechanism includes the lock operating mechanism and the locks.

Closed means that the door has been placed within the doorframe in such a position that the latches can be operated to the "latched" condition.

Fully closed means that the door is placed within the doorframe in the position it will occupy when the latches are in the latched condition.

PART II:
PROPOSALS (1 THROUGH 11) TO THE REQUIREMENT PERTAINING TO THE PARTICULAR SUBJECT OF FUSELAGE DOORS (§ 25.783)

PROPOSAL 1
The JAA proposes to change the title of the revised § 25.783 to "Fuselage doors" in order to more accurately reflect the applicability of this revised section.

Discussion
The term "doors" as used in the proposed § 25.783 would also include, hatches, openable windows, access panels, covers, etc., on the exterior of the fuselage that do not require the use of tools to open or close. This would also include each door or hatch through a pressure bulkhead, including any bulkhead that is specifically designed to function as a secondary pressure bulkhead under the prescribed failure conditions of JAR 25.

PROPOSAL 2
The JAA proposes to delete the present § 25.783(a). This rule is considered to be obsolete for JAR25 and need not be relocated to § 25.807.The new § 25.783(a) has been added to describe the type of doors for which § 25.783 is applicable.

Discussion
The formatting and portions of the text of proposed § 25.783(a) would be totally revised. The JAA proposes that the new § 25.783(a) would describe the types of doors for which this section of the regulation is applicable and would clarify the fact that the requirements are intended to apply to the unpressurised portions of flight as well as to pressurised flight. Proposed § 25.783(a) would also provide the general design requirements for doors.

These general design requirements are not substantively different from the requirements contained in the existing § 25.783. A reference to the locking requirements contained in § 25.607 ("Fasteners") would be included in paragraph § 25.783(a) since experience has shown that it is advisable to add this reference to ensure it is not overlooked.

PROPOSAL 3
The JAA propose to amend the current § 25.783(b) and relocate the current text related to the opening of the door to § 25.809.

Discussion
Paragraph 25.783(b) would be revised to require safeguards against both inadvertent and deliberate opening of doors during flight. It would clarify the existing requirement that doors must be prevented from opening inadvertently (that is, not deliberately, and without forethought, consideration, or consultation) by persons on board the aeroplane during flight. The intent of this requirement is to protect both the passenger and the airplane from hazards resulting from the unintentional actions by persons on board.

In addition, the proposal would make it clear that the door must be safeguarded against the deliberate opening during flight by persons on board. The proposed text requires that the possibility of deliberate opening be minimized .The intent of this requirement is that, for doors in pressurized compartments, it should not be possible to open the doors after takeoff, when the compartment is pressured to a significant level. (During approach, takeoff, and landing when compartment differential pressure is lower, it is recognized that intentional opening may be possible; however, during these short phases of the flight, all passengers are expected to be seated with seat belts fastened. The exposure to deliberate opening would therefore be minimized). Further guidance on this subject is given in JAR25 Section 2 ACJ.

Further, for doors that can be opened under significant cabin pressure, or for doors in non-pressurized airplanes,

the use of an auxiliary securing means, such as speed- or barometrically-activated devices, may be necessary. Past interpretations of the existing § 25.783(f) have resulted in this type of design requirement being applied to type certification projects. In addition, the proposed § 25.783(b) would require that, if auxiliary devices are used, they be designed so that no single failure or malfunction could prevent more than one exit from opening.

PROPOSAL 4

The JAA proposes to delete the current § 25.783(c), since its text is duplicated in the existing § 25.809(g). The JAA proposes that the new § 25.783(c) would restate the existing requirement § 25.783(f) for a provision to prevent the aeroplane from becoming pressurised if the door is not fully closed, latched and locked.

Discussion

The current requirement states:

"External doors must have provisions to prevent the initiation of pressurization of the airplane to an unsafe level if the door is not fully closed and locked. . . "

However, this proposal would remove the phrase, ". . . the initiation of . . ." from this text because it is inconsistent and confusing with regard to a common method of preventing pressurization that employs vent doors. Mechanical vent doors allow the pressurization system to initiate and a small amount of pressure may exist as the air flows through the vents. The revised text would correct this inconsistency. It also would allow for certain types of doors that can safely and reliably act as their own venting mechanism when not fully closed and latched, or that would automatically close and latch, as appropriate to the door design, before an unsafe level of pressure is reached. For these doors without an independent means, the assessment for a safe and reliable closing would include consideration of single failures and adverse conditions, such as debris in the doorway.

Proposed 25.783(c) also would provide a definitive criterion for the reliability level of the pressurization prevention system that is consistent with the interpretation of the general text of the existing rule, and that also is consistent with current industry practice for new designs. This proposed criterion is not intended to impose a new level of reliability for mechanical vent systems that is more stringent than that established by typical fail-safe designs. However, it would provide a definitive criterion for use in evaluating these vent systems or other systems that may interconnect with the airplane's pressurization system. A pressurization prevention means that would function with a high degree of reliability in spite of operator and flight crew errors, would be consistent with NTSB Safety Recommendation A-89-094, described previously, which recommends fail-safe features that account for conceivable human errors.

PROPOSAL 5

The JAA proposes to delete the current § 25.783(d) and relocate it to a new § 25.809(f). Proposed § 25.783(d) would provide requirements for the detail design and fail-safe features of latching and locking mechanisms.

Discussion

The JAA proposes that the new paragraph 25.783(d) would provide requirements for the detail design and fail-safe features of latching and locking mechanisms. Some of these design features are currently recommended in the existing FAA Advisory Circular (AC) 25.783-1 "Fuselage Doors, Hatches, and Exits," dated December 10, 1986 and the JAA Guidance Material in NPA25D-218 dated June 1996; the proposed rule would make these features mandatory. One provision of this proposed requirement, which would require the removal of all power that could initiate the unlatching and unlocking of the door during flight, is based on NTSB Safety Recommendation A-92-21, discussed previously.

For the most part, the detail design requirements for latches and locks contained in this proposed section are consistent with current industry practice, as applied to doors whose initial movement is not inward. However, the applicability of the proposed requirement would be extended to any door, unless it can be shown that unlatching would not be a hazard.

Proposed § 25.783(d) also would require that the latching mechanism be designed to eliminate forces that would tend to drive the latches to the open position. However, it is recognized that there may still be ratcheting forces that could progressively move the latches to the unlatched position. Therefore, the rule also would require that the latching system be designed such that the latches are positively secured without regard to the position of the locks.

A new provision in this proposed paragraph is the requirement for a fail-safe criterion for the locking system that would apply only to outward opening doors while under pressure. Since all the locks are usually designed as a single locking system, it is possible that single failures in the locking system could result in the unlocking of several or all the latches. Although the latches would continue to be held in the latched position by the latch system securing means, the JAA (and FAA) have determined that, for these more critical designs, during pressurized flight, single failures in the locking system should not cause the number of latches remaining locked to be less than that needed to restrain the door.

PROPOSAL 6
The JAA proposes to revise § 25.783(e) by relocating the current part of § 25.783(e), related to the provision for direct visual inspection of the locking mechanism, to the new § 25.783(f) and by providing additional features to the new § 25.783(e).

Discussion
The JAA proposes that the revised § 25.783(e) would provide the requirements for warning, caution, and advisory indications for doors. These requirements for indication are similar to the current provisions for indication of door status in this section, but provide additional features consistent with NTSB and ATA recommendations. The prescribed "improbable" level for an erroneous indication that the door is fully closed, latched, and locked is proposed to be the same as the requirement of the existing § 25.783(e), except that the applicability would be extended to each door, if unlatching of the door in flight could be a hazard.

Proposed § 25.783(e) also would require an aural warning before takeoff for each door, if opening of the door would not allow safe flight. The JAA/FAA have determined that this requirement is necessary, based on service history. It is intended that this system should function in a manner similar to the takeoff configuration warning systems required by § 25.703 ("Takeoff warning system").

Proposed § 25.783(e) also would require that there be a positive means to display indications and signals to the door operator. This proposed requirement is consistent with NTSB Safety Recommendation A-89-093, discussed previously.

PROPOSAL 7
The JAA proposes that the current §25.783(f) is relocated to the new §25.783(c) and that the current part of §25.783(e), related to the provision for direct visual inspection of the locking mechanism, will become the new §25.783(f).

Discussion
The JAA proposes that the new § 25.783(f) would provide the requirement for direct visual inspections to determine that the door is fully closed, latched and locked. This requirement is similar to the existing rule for visual inspection provisions. It would be extended to cover doors irrespective of the initial movement if the unlatched door could be a hazard.

PROPOSAL 8
The JAA proposes to delete the current § 25.783(g) since all types of cargo and service doors must meet the new § 25.783 rule. The new § 25.783(g) has been added.

Discussion
The JAA proposes that the new § 25.783(g) would provide relief from certain requirements of the current rule that are applicable to access panels not subject to pressurisation and for which unlatching would not have a detrimental effect on safety. In addition, the proposal would provide relief from certain of the current requirements applicable to:

maintenance doors that are not a hazard if unlatched; and

removable emergency exits, because they are not used in normal operation and therefore not subjected to the same level of human error, abuse, and damage as other doors and hatches.

PROPOSAL 9
The JAA proposes to delete the current text of § 25.783(h) and relocate this text to a new § 25.807(k) and to keep in the proposed § 25.783(a)(6)a reference to the new § 25.807(h)) for exits other than emergency exits.
The proposed new § 25.783(h) would prescribe detail design features that a door would need to have if it were to be considered as a door that is "not a hazard" when this phrase is used in other paragraphs of § 25.783.

Discussion
Several of the proposed safety standards are applicable to doors that would be a hazard if they opened or became unlatched in flight. The JAA proposes that the new paragraph 25.783(h) prescribes detail design features that a door would need to fulfil if it were to be considered as a door that would not be a hazard.

PROPOSAL 10
The JAA proposes that the current requirements of § 25.783(i) that apply to the design of air stairs (integral stair installed in a passenger entry door that is qualified as a passenger emergency exit) would be removed from § 25.783 and placed in § 25.810 ("Emergency egress assist means and escape routes") as paragraph § 25.810(e), without change in text.

Discussion
The JAA considers that manufacturers, applicants, and others seeking compliance with rules would be better

served by having these requirements located in the same section of the rules where other related requirements are found.

PROPOSAL 11
The JAA proposes that the special requirement for lavatory doors contained in the existing § 25.783(j) would be removed and set forth without change in a new § 25.820 "Lavatory doors".

Discussion
The JAA considers that less confusion will be caused, and the regulated public will be better served, if all requirements pertaining to this particular subject are located in one separate place.

PART III:
PROPOSALS (12 THROUGH 19) TO REQUIREMENTS PERTAINING TO THE PARTICULAR SUBJECT OF EMERGENCY EXITS (§ 25.807,-809,-810.-820)

Several other provisions currently in § 25.783 would be deleted, since they duplicate the requirements applicable to emergency exit design that are contained in, or would be moved without substantive change to, other sections of JAR-25 (ref. PROPOSALS 2,3,4,5,9,10 and 11). The JAA considers that less confusion would be caused, and that the regulated public would be better served, if all requirements pertaining to a particular subject are located in one place. In this regard, the JAA is proposing specific changes.
Furthermore, several requirements in § 25.809(f) that duplicate the door design requirements in § 25.783 would be deleted.
The arrangements of the paragraphs in the following proposals take into consideration the changes as are proposed in NPA25D-298, issue 2 (12 July 1999) *Type and Number of Passenger Emergency Exits*. This NPA adopts Amendment 88 and 94 to FAR-25.

PROPOSAL 12
The JAA proposes to revise the text of § 25.807(h) as it has been proposed by NPA25D-298. NPA25D-298 adopts FAR 25 Amendment 25-88. As a result of the harmonisation process it revealed that an inadvertent omission was present in Amendment 25-88. The text of this proposal is already existing in JAR § 25.807(d)(6) Change 14, but was inadvertently deleted by the adoption of FAR Amendment 25-88 through NPA25D-298. This omission has been rectified with this proposal.

Discussion
The existing § 25.783 requires that passenger entry doors also meet the airworthiness standards required for emergency exits. In addition, the current JAR 25.807(d)(6), requires that certain other fuselage doors, in addition to passenger entry doors, meet the same standards as emergency exits. Prior to the adoption of amendment 25-88 (61 FR 57956, November 8, 1996), 14 CFR part 25 also contained a requirement similar to that of JAR 25.807; however, that requirement was inadvertently omitted in the adoption of amendment 25-88.
This proposed rule would correct this discrepancy by setting forth this requirement in a revised § 25.807(h), and by proposing § 25.783(a)(6) to refer to that section.
Specifically, the proposed § 25.807(h) would be revised to refer to "other exits" that must meet the applicable emergency exit requirements of §§ 25.809 through 25.812. The reference to § 25.813 has been deleted. The reason to limit the requirements is that § 25.813 is the accessibility requirement, and to require the same accessibility for an exit that is above and beyond the minimum, basically provides a disincentive to have such exits. Those "other exits" include:
Each emergency exit in the passenger compartment in excess of the minimum number of required emergency exits;
Floor-level doors or exits that are accessible from the passenger compartment and larger than a Type II exit, but less than 46 inches wide; and
Ventral or tail cone passenger exits.

PROPOSAL 13
The JAA proposes to revise § 25.807 and to relocate the current text of § 25.783(h) to a new § 25.807(k).

Discussion
See PROPOSAL 9.

PROPOSAL 14
The JAA proposes to revise § 25.809(b) by adding the text of the current § 25.783(b) related to inward opening doors to § 25.809(b).

Discussion
This specific requirement is currently a part of § 25.783(b), but is more appropriate as part of the emergency exit arrangement requirements of § 25.809.

PROPOSAL 15
The JAA proposes to revise § 25.809(b) by adding a new § 25.809(b)(3) to require that each emergency exit must be capable of being opened, when there is no fuselage deformation, "even though persons may be crowded against the door on the inside of the airplane."

Discussion
This specific requirement is currently a part of § 25.783(b), but is more appropriate as part of the emergency exit arrangement requirements of § 25.809.

PROPOSAL 16
The JAA proposes to revise § 25.809(c) to include the requirement that the means of opening emergency exits also must be marked so that it can be readily located and operated, even in darkness.

Discussion
This specific requirement is currently a part of § 25.783(b), but is more appropriate as part of the emergency exit arrangement requirements of § 25.809.

PROPOSAL 17
The JAA proposes to delete the current § 25.809(f) since this specific requirement is now covered in the new § 25.783.
The JAA proposes to add a new § 25.809(f) to require that the external door be located where persons using it will not be endangered by the propellers when appropriate operating procedures are used

Discussion
This specific requirement is currently a part of § 25.783(d), but is more appropriate as part of the emergency exit arrangement requirements of § 25.809.

PROPOSAL 18
The JAA proposes to allocate a new § 25.810(e) for the relocation of the current text of § 25.783(i).

Discussion
See PROPOSAL 10.

PROPOSAL 19
The JAA proposes to allocate a new § 25.820 for the relocation of the current text of § 25.783(j).

Discussion
See PROPOSAL 11.

ECONOMIC IMPACT EVALUATION/ASSESSMENT

The JAA has concluded that the provisions of this proposal would impose relatively small costs and, in some cases, result in minor cost savings. Accordingly, we have not made specific cost estimates, but only have provided qualitative cost indications for each proposed change, as follows:

PROPOSAL 1/2: Paragraph 25.783(a) is descriptive and has no expected cost.
PROPOSAL 3: Paragraph 25.783(b) relates to opening by persons. The requirement to consider deliberate opening is new, but is expected to be accommodated, for the most part, in existing design practices. (Requirements regarding inadvertent opening are not new.)
PROPOSAL 4: Paragraph 25.783(c) covers means to prevent pressurisation. The requirement to consider single failures in the pressurisation-inhibit system is new, but is believed to be already complied with in virtually all cases. Thus, there is likely to be very little, if any, cost for a new design. The provision to permit certain doors to forego this system is actually cost-relieving, and could result in a minor cost reduction in some cases.
PROPOSAL 5: Paragraph 25.783(d) covers latching and locking. Most of these changes are the incorporation of recommendations currently contained in an advisory circular. The vast majority of aeroplanes already comply, and basic design practice is to comply with these requirements. Therefore, these requirements, while new, should have minimal cost impact. The requirement to eliminate forces in the latching mechanism that could load the locks is new, and may not be complied with in all cases currently, but is not expected to add costs. The requirement for each latch to have a lock, which must monitor the latch position, is a formalisation of existing practice. Therefore, while a new rule, it should not impose a substantive cost.
PROPOSAL 6: Paragraph 25.783(e) covers warning, caution, and advisory indications. The reliability of the door indication system will be required to be higher for all doors. This would have only a small cost impact, as would the requirement for an aural warning for certain doors, and the requirement to provide an indication to the

door operator.
PROPOSAL 7: Paragraph 25.783(f) contains the visual inspection provision requirement. The requirement for direct visual inspection is extended to more door types, and may add minor costs in some cases.
PROPOSAL 8: Paragraph 25.783(g) deals with certain maintenance doors, removable emergency exits, and access panels. The current rule does not provide the relief that the proposed rule does, although the AC has indicated that relief is possible. This provision could reduce costs in some cases.
PROPOSAL 9: Paragraph 25.783(h) covers doors that are not a hazard and is intended to provide relief for certain doors, so it could reduce costs.
PROPOSAL 10 through 19: Paragraphs 25.783(i), 25.783(j), 25.809(b), 25.809(c), and 25.809(f) move text to another section.
PROPOSAL 12: Paragraph 25.807 simply corrects an unintended deletion.

Summary of Benefit and Cost Considerations.

The proposed rule is expected to:
*maintain or provide a slight increase the level of safety, when compared to current industry practice.
*have only a relatively small effect on costs when compared to current industry practice, and
*provide some cost savings to manufacturers by avoiding duplicative testing and reporting that could result from the existence of differing requirements under the current standards.

Therefore, the JAA considers that the proposed rule would be cost-beneficial. This is reinforced by industry's support for the proposal.

PROPOSED NEW REQUIREMENTS (RULE) AND ACCEPTABLE MEANS OF COMPLIANCE AND INTERPRETATIONS (ACJ)

JAR-25 SECTION 1
SUBPART D - DESIGN AND CONSTRUCTION
PERSONNEL AND CARGO ACCOMODATIONS

The text of the existing JAR-25 Paragraph JAR25.783 would be amended to read as follows:

§ 25.783 Fuselage doors.
(See ACJ 25.783)

(a) *General.* This section applies to fuselage doors, which includes all doors, hatches, openable windows, access panels, covers, etc., on the exterior of the fuselage that do not require the use of tools to open or close. This also applies to each door or hatch through a pressure bulkhead, including any bulkhead that is specifically designed to function as a secondary bulkhead under the prescribed failure conditions of part 25. These doors must meet the requirements of this section, taking into account both pressurized and unpressurised flight, and must be designed as follows:
(1) Each door must have means to safeguard against opening in flight as a result of mechanical failure, or failure of each single structural element.
(2) Each door that could be a hazard if it unlatches must be designed so that unlatching during pressurized and unpressurised flight from the fully closed, latched, and locked condition is extremely improbable. This must be shown by safety analysis.
(3) Each element of each door operating system must be designed or, where impracticable, distinctively and permanently marked, to minimize the probability of incorrect assembly and adjustment that could result in a malfunction.
(4) All sources of power that could initiate unlocking or unlatching of each door must be automatically isolated from the latching and locking systems prior to flight and it must not be possible to restore power to the door during flight.
(5) Each removable bolt, screw, nut, pin, or other removable fastener must meet the locking requirements of § 25.607.
(6) Certain doors, as specified by § 25.807(h), must also meet the applicable requirements of §§ 25.809 through 25.812 for emergency exits.

(b) *Opening by persons.* There must be a means to safeguard each door against opening during flight due to inadvertent action by persons. In addition, design precautions must be taken to minimize the possibility for a person to open a door intentionally during flight. If these precautions include the use of auxiliary devices, those devices and their controlling systems must be designed so that:
(i) no single failure will prevent more than one exit from being opened, and
(ii) failures that would prevent opening of the exit after landing are improbable.

(c) *Pressurization prevention means.* There must be a provision to prevent pressurization of the airplane to an unsafe level if any door subject to pressurization is not fully closed, latched, and locked.

(1) The provision must be designed to function after any single failure, or after any combination of failures not shown to be extremely improbable.

(2) Doors that meet the conditions described in § 25.783(h) are not required to have a dedicated pressurization prevention means if, from every possible position of the door, it will remain open to the extent that it prevents pressurization, or safely close and latch as pressurization takes place. This must also be shown with each single failure and malfunction except that:

(i) with failures or malfunctions in the latching mechanism, it need not latch after closing, and

(ii) with jamming as a result of mechanical failure or blocking debris, the door need not close and latch if it can be shown that the pressurization loads on the jammed door or mechanism would not result in an unsafe condition.

(d) *Latching and locking.* The latching and locking mechanisms must be designed as follows:

(1) There must be a provision to latch each door.

(2) The latches and their operating mechanism must be designed so that, under all airplane flight and ground loading conditions, with the door latched, there is no force or torque tending to unlatch the latches. In addition, the latching system must include a means to secure the latches in the latched position. This means must be independent of the locking system.

(3) Each door subject to pressurization, and for which the initial opening movement is not inward, must –

(i) have an individual lock for each latch,

(ii) have the lock located as close as practicable to the latch, and

(iii) be designed so that, during pressurized flight, no single failure in the locking system would prevent the locks from restraining the latches necessary to secure the door.

(4) Each door for which the initial opening movement is inward, and unlatching of the door could result in a hazard, must have a locking means to prevent the latches from becoming disengaged. The locking means must ensure sufficient latching to prevent opening of the door even with a single failure of the latching mechanism.

(5) Each door for which unlatching would not result in a hazard is not required to have a locking mechanism.

(6) It must not be possible to position the lock in the locked position if the latch and the latching mechanism are not in the latched position.

(7) It must not be possible to unlatch the latches with the locks in the locked position. Locks must be designed to withstand the limit loads resulting from –

(i) the maximum operator effort when the latches are operated manually;

(ii) the powered latch actuators, if installed; and

(iii) the relative motion between the latch and the structural counterpart.

(8) Each door that could result in a hazard if not closed, must have means to prevent the latches from being moved to the latched position unless the door is closed.

(e) *Warning, caution, and advisory indications.* Doors must be provided with the following indications:

(1) There must be a positive means to indicate at the door operator's station for each door that all required operations to close, latch, and lock the door have been completed.

(2) There must be a positive means clearly visible from the operator station for each door that could be a hazard if unlatched, to indicate if the door is not fully closed, latched, and locked.

(3) There must be a visual means on the flight deck to signal the pilots if any door is not fully closed, latched, and locked. The means must be designed such that any failure or combination of failures that would result in an erroneous closed, latched, and locked indication is improbable for —

(i) each door that is subject to pressurization and for which the initial opening movement is not inward, or

(ii) each door that could be a hazard if unlatched.

(4) There must be an aural warning to the pilots prior to or during the initial portion of takeoff roll if any door is not fully closed, latched, and locked, and its opening would prevent a safe takeoff and return to landing.

(f) *Visual inspection provision.* Each door for which unlatching could be a hazard must have a provision for direct visual inspection to determine, without ambiguity, if the door is fully closed, latched, and locked. The provision must be permanent and discernible under operational lighting conditions, or by means of a flashlight or equivalent light source.

(g) *Certain maintenance doors, removable emergency exits, and access panels.* Some doors not normally opened except for maintenance purposes or emergency evacuation and some access panels need not comply with certain paragraphs of this section as follows:

(1) Access panels that are not subject to cabin pressurization and would not be a hazard if unlatched during flight need not comply with paragraphs (a) through (f) of this section, but must have a means to prevent inadvertent opening during flight.

(2) Inward-opening removable emergency exits that are not normally removed, except for maintenance purposes or emergency evacuation, and flight deck-openable windows need not comply with paragraphs (c) and (f) of this section.

(3) Maintenance doors that meet the conditions of § 25.783(h), and for which a placard is provided limiting use to maintenance access, need not comply with paragraphs (c) and (f) of this section.

(h) *Doors that are not a hazard.* For the purposes of this section, a door is considered not to be a hazard in the

unlatched condition during flight, provided it can be shown to meet all of the following conditions:

(1) Doors in pressurized compartments would remain in the fully closed position if not restrained by the latches when subject to a pressure greater than 0,035 kg/cm² (½ psi). Opening by persons, either inadvertently or intentionally, need not be considered in making this determination.

(2) The door would remain inside the airplane or remain attached to the airplane if it opens either in pressurized or unpressurized portions of the flight. This determination must include the consideration of inadvertent and intentional opening by persons during either pressurized or unpressurized portions of the flight.

(3) The disengagement of the latches during flight would not allow depressurization of the cabin to an unsafe level. This safety assessment must include the physiological effects on the occupants.

(4) The open door during flight would not create aerodynamic interference that could preclude safe flight and landing.

(5) The airplane would meet the structural design requirements with the door open. This assessment must include the aeroelastic stability requirements of § 25.629, as well as the strength requirements of this subpart.

(6) The unlatching or opening of the door must not preclude safe flight and landing as a result of interaction with other systems or structures.

JAR-25 SECTION 1
SUBPART D - DESIGN AND CONSTRUCTION
EMERGENCY PROVISIONS

The text of the existing JAR-25 Paragraphs JAR25.807, JAR25.809 and JAR25.810 would be amended and a new paragraph JAR25.820 added to read as follows:

Amend § 25.807 by revising sub-paragraph (h) and by adding a new sub-paragraph (k) to read as follows:

§ 25.807 Emergency exits.

* * *

(h) *Other exits.* The following must also meet the applicable emergency exit requirements of §§ 25.809 through 25.812:

(1) Each emergency exit in the passenger compartment in excess of the minimum number of required emergency exits

(2) Any other floor level door or exit that is accessible from the passenger compartment and is as large or larger than a Type II exit but less than 46 inches wide.

(3) Any other ventral or tail passenger cone exit.

* * *

(k) Each passenger entry door in the side of the fuselage must qualify as a Type A, Type I, or Type II passenger emergency exit and must meet the requirements of JAR 25.807 to 25.813 that apply to that type of emergency exit.

Amend § 25.809 by revising sub-paragraph (b), by adding a new sub-paragraph (b)(3), and by revising sub-paragraphs (c) and (f) to read as follows:

§ 25.809 Emergency exit arrangement.

(b) * * * * readily accessible to the flight crew area. Inward opening doors may be used if there are means to prevent occupants from crowding against the door to an extent that would interfere with the opening of the door. Each emergency exit must be capable * * * *

(3) Even though persons may be crowded against the door on the inside of the aeroplane.

(c) The means of opening emergency exits must be simple and obvious and may not require exceptional effort and must be arranged and marked so that it can be readily located and operated, even in darkness. Internal exit-opening means involving sequence operations (such as operation of two handles or latches or the release of safety catches) may be used for flight crew emergency exits if it can be reasonably established that these means are simple and obvious to crewmembers trained in their use.

* * * *

(f) Each door must be located where persons using them will not be endangered by the propellers when appropriate operating procedures are used.

* * *

Amend § 25.810 by adding a new paragraph (e) to read as follows:

§ 25.810 Emergency egress assist means and escape routes.

* * * * *

(e) If an integral stair is installed in a passenger entry door that is qualified as a passenger emergency exit, the stair must be designed so that under the following conditions the effectiveness of passenger emergency egress will not be impaired:

(1) The door, integral stair, and operating mechanism have been subjected to the inertia forces specified in § 25.561 (b) (3), acting separately relative to the surrounding structure.

(2) The aeroplane is in the normal ground attitude and in each of the attitudes corresponding to collapse of one or more legs of the landing gear.

Add a new § 25.820 to read as follows:

§ 25.820 Lavatory doors.

All lavatory doors must be designed to preclude anyone from becoming trapped inside the lavatory, and if a locking mechanism is installed, it must be capable of being unlocked from the outside without the aid of special tools.

JAR-25 SECTION 2 - ACCEPTABLE MEANS OF COMPLIANCE AND INTERPRETATIONS - ACJ

Introduce a new Acceptable Means Of Compliance and Interpretations (ACJ 25.783) as follows;-

ACJ 25.783
FUSELAGE DOORS - DESIGN, TEST, ANALYSIS AND CERTIFICATION

1. **PURPOSE.** This Acceptable Means Of Compliance and Interpretations, which is similar to the FAA Advisory Circular AC.783 sets forth acceptable means of compliance with the provisions of Part 25 of the Joint Aviation Requirements (JAR) dealing with the certification requirements for fuselage external doors and hatches.

The means of compliance described in this document is intended to provide guidance to supplement the engineering and operational judgement that must form the basis of any compliance findings relative to the structural and functional safety standards for doors and their operating systems

This document is issued to describe an acceptable means, but not the only means, for demonstrating compliance with the requirements for transport category aeroplanes. 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. **CANCELLATION.** JAR NPA25D-218 Rev. 2 dated May 1992, is cancelled.

3. **RELATED JAR SECTIONS.** The contents of this advisory circular are considered by the JAA in determining compliance of doors with the safety requirements of § 25.783. Other related paragraphs are:

§ 25.571, "Damage-tolerance and fatigue evaluation of structure"
§ 25.607, "Fasteners"
§ 25.703, "Takeoff warning system"
§ 25.809, "Emergency exit arrangement"

4. **DEFINITIONS OF TERMS.**

Inconsistent or inaccurate use of terms may lead to the installation of doors and hatches that do not fully meet the safety objectives of the regulations. To ensure that such installations fully comply with the regulations, the following definitions should be used when showing compliance with § 25.783:

a. *"Door"* includes all doors, hatches, openable windows, access panels, covers, etc. on the exterior of the fuselage which do not require the use of tools to open or close. This also includes each door or hatch through a pressure bulkhead including any bulkhead that is specifically designed to function as a secondary bulkhead under the prescribed failure conditions of JAR 25.

b. *"Initial opening movement,"* refers to that door movement caused by operation of a handle or other door control mechanism which is required to place the door in a position free of structure that would interfere with continued opening of the door.

c. *"Inward"* means having a directional component of movement that is inward with respect to the mean (pressure) plane of the body cut-out.

d. *"Closed"* means that the door has been placed within the door frame in such a position that the latches can be operated to the "latched" condition. *"Fully closed"* means that the door is placed within the door frame in the position it will occupy when the latches are in the latched condition.

e. *"Latches"* are movable mechanical elements that, when engaged, prevent the door from opening.

f. *"Latched"* means the latches are engaged with their structural counterparts and held in position by the latch operating mechanism.

g. *"Latching system"* means the latch operating system and the latches.

h. *"Locks"* are mechanical elements in addition to the latch operating mechanism that monitor the latch positions, and when engaged, prevent latches from becoming disengaged.

i. *"Locked"* means the locks are engaged and held in position by the lock operating mechanism.

j. *"Locking system"* means the lock operating system and the locks.

k. *"Stops"* are fixed structural elements on the door and door frame, which when in contact, limit the directions in which the door is free to move.

l. *"Exit"* is a door designed to allow egress from the aeroplane.

m. *"Emergency exit"* is an exit designated for use in an emergency evacuation.

n. *"Flight"* refers to that time from start of takeoff roll until the aeroplane comes to rest after landing.

o. *"Door operator's station"* means the location(s) where the door closing, latching and locking operations are performed.

p. *"Inadvertent action by persons"* means an act committed without forethought, consideration or consultation.

q. *"Initial inward opening movement"* means in order for a door design to be classified as having an inward initial opening movement, the provisions provided to guide the door inward must have:
1, sufficient rigidity and strength to fulfill their function with a pressure of at least 0,14 kg/cm² (2 psi) applied to the door.
2, sufficient range to maintain the closing component from the pressurization load until the loss of cabin air past the partially open door is such that cabin pressurization greater than 0.035 kg/cm² (0.5 psi) cannot be maintained.
3, design features that ensure that adjustment / wear of the door stops, guides, rollers or associated mechanism cannot negate the means provided to move the door inwards.

5. BACKGROUND.

History of incidents and accidents.

There is a history of incidents and accidents in which doors, fitted in pressurised aeroplanes, have opened during pressurised and unpressurised flight. Some of these inadvertent openings have resulted in fatal crashes. After one fatal accident that occurred in 1974, the FAA and industry representatives formed a design review team to examine the current regulatory requirements for doors to determine if those regulations were adequate to ensure safety. The team's review and eventual recommendations led to the FAA issuing Amendment 25-54 to 14 CFR part 25 in 1980, that was adopted by the JAA in JAR-25 Change 10 in 1983, which significantly improved the safety standards for doors installed on transport category aeroplanes . Included as part of JAR-25 Change 10 (Amendment 25-54) was § 25.783, "Doors," which provides the airworthiness standards for doors installed on transport category airplanes.

Although there have been additional minor revisions to § 25.783 subsequent to the issuance of Change 10 (Amendment 25-54), the safety standards for doors have remained essentially the same since 1980.

Continuing safety problems
In spite of the improved standards brought about in 1980, there have continued to be safety problems, especially with regard to cargo doors. Cargo doors are often operated by persons having little formal instruction in their operation. Sometimes the operator is required to carry out several actions in sequence to complete the door opening and closing operations. Failure to complete all sequences during closure can have serious consequences. Service history shows that several incidents of doors opening during flight have been attributed to the failure of the operator to complete the door closure and locking sequence. Other incidents have been attributable to incorrect adjustment of the door mechanism, or failure of a vital part.

Indication to the flight crew.
Experience also has shown that, in some cases, the flight deck indication system has not been reliable. In other instances, the door indication system was verified to be indicating correctly, but the flight crew, for unknown

reasons, was not alerted to the unsafe condition. A reliable indication of door status on the flight deck is particularly important on airplanes used in operations where the flight crew does not have an independent means readily available to verify that the doors are properly secured.

Large cargo doors as basic airframe structure.
On some airplanes, large cargo doors form part of the basic fuselage structure, so that, unless the door is properly closed and latched, the basic airframe structure is unable to carry the design aerodynamic and inertial loads. Large cargo doors also have the potential for creating control problems when an open door acts as an aerodynamic surface. In such cases, failure to secure the door properly could have catastrophic results, even when the airplane is unpressurised.

NTSB (USA) recommendations.
After two accidents occurred in 1989 that were related to the failure of cargo doors on transport category airplanes, the FAA chartered the Air Transport Association (ATA) of America to study the door design and operational issues again for the purpose of recommending improvements. The ATA concluded its study in 1991 and made recommendations to the FAA for improving the design standards of doors. Those recommendations and additional recommendations from the National Transportation Safety Board (NTSB) were considered in the development of improved standards for doors adopted by Amendment 25-XXX (JAR-25 Change-XX).

6. DISCUSSION OF THE CURRENT REQUIREMENTS.

Service history has shown that to prevent doors from becoming a hazard by opening in flight, it is necessary to provide multiple layers of protection against failures, malfunctions, and human error. Section 25.783 addresses these multiple layers of protection by requiring:

- a latching system
- a locking system,
- indication systems,
- a pressure prevention means.

These features provide a high degree of tolerance to failures, malfunctions, and human error. Section 25.783 intends that the latching system be designed so that it is inherently or specifically restrained from being back-driven from the latches; but even so, the latches are designed to eliminate, as much as possible, all forces from the latch side that would tend to unlatch the latches. In addition to these features that prevent the latches from inadvertently opening, a separate locking system is required for doors that could be a hazard if they become unlatched. Notwithstanding these safety features, it could still be possible for the door operator to make errors in closing the door, or for mechanical failures to occur during or after closing; therefore, an indicating system is required that will signal to the flight crew if the door is not fully closed, latched, and locked. However, since it is still possible for the indication to be missed or unheeded, a separate system is required that prevents pressurization of the airplane to an unsafe level if the door is not fully closed, latched, and locked.

The following material restates the requirements of § 25.783 *in italicized text* and, immediately following, provides a discussion of acceptable compliance criteria.

§25.783(a) General Design Considerations.

This section applies to fuselage doors, which includes all doors, hatches, openable windows, access panels, covers, etc., on the exterior of the fuselage that do not require the use of tools to open or close. This also applies to each door or hatch through a pressure bulkhead, including any bulkhead that is specifically designed to function as a secondary bulkhead under the prescribed failure conditions of part 25. These doors must meet the requirements of this section, taking into account both pressurized and unpressurised flight, and must be designed as follows:

(a)(1) Each door must have means to safeguard against opening in flight as a result of mechanical failure, or failure of a single structural element.

Failures that should be considered when safeguarding the door against opening as a result of mechanical failure or failure of a single structural element include those caused by wear, excessive backlash, excessive friction, jamming, incorrect assembly, incorrect adjustment and parts becoming loose, disconnected, or unfastened, in addition to failures due to parts breaking, fracturing, bending or flexing beyond that intended.

(a)(2) Each door that could be a hazard if it unlatches must be designed so that unlatching during pressurized and unpressurised flight from the fully closed, latched, and locked condition is extremely improbable. This must be shown by safety analysis .

All doors should incorporate features in the latching mechanism that provide a positive means to prevent the door from opening as a result of vibrations, structural loads and deflections, positive and negative pressure

loads, positive and negative 'g' loads, aerodynamic loads etc. The means should be effective throughout the approved operating envelope of the aeroplane including the unpressurized portions of flight.

The safety assessment required by this regulation may be a qualitative or quantitative analysis, or a combination as appropriate to the design. In evaluating a failure condition that results in total failure or inadvertent opening of the door, all contributing events should be considered, including failure of the door and door supporting structure, flexibility in structures and linkages, failure of the operating system, erroneous signals from the door indication systems and likely errors in operating and maintaining the door.

(a)(3) Each element of each door operating system must be designed or, where impracticable, distinctively and permanently marked, to minimise the probability of incorrect assembly and adjustment that could result in a malfunction.

Experience has shown that the level of protection against mechanical failure can be significantly improved by careful attention to detail design. The following points should therefore be taken into account:

(a) To minimize the risk of incorrect assembly and adjustment, parts should be designed to prevent incorrect assembly if, as a result of such incorrect assembly, door functioning would be adversely affected. "Adverse effects" could be such things as preventing or impeding the opening of the door during an emergency, or reducing the capability of the door to remain closed. If such designs are impracticable and marking is used instead, the marking should remain clearly identifiable during service. In this respect, markings could be made using material such as permanent ink, provided it is resistant to typical solvents, lubricants, and other materials used in normal maintenance operations.

(b) To minimize the risk of the door operating mechanism being incorrectly adjusted in service, adjustment points that are intended for "in-service" use only should be clearly identified, and limited to a minimum number consistent with adequate adjustment capability. Any points provided solely to facilitate adjustment at the initial build and not intended for subsequent use, should be made non-adjustable after initial build, or should be highlighted in the maintenance manual as a part of the door mechanism that is not intended to be adjusted.

(a)(4) All sources of power that could initiate unlocking or unlatching of each door must be automatically isolated from the latching and locking systems prior to flight and it must not be possible to restore power to them during flight.

For doors that use electrical, hydraulic, or pneumatic power to initiate unlocking or unlatching, those power sources must be automatically isolated from the latching and locking systems before flight, and it should not be possible to restore power to them during flight. It is particularly important for doors with powered latches or locks to have all power removed that could power these systems or that could energize control circuits to these systems in the event of electrical short circuits. This does not include power to the door indicating system, auxiliary securing devices if installed, or other systems not related to door operation. Power to those systems should not be sufficient to cause unlocking or unlatching unless each failure condition that could result in energizing the latching and locking systems is extremely improbable.

(a)(5) Each removable bolt, screw, nut, pin, or other removable fastener must meet the locking requirements of § 25.607. [Fasteners] .

Refer to ACJ 25.607 for guidance on complying with § 25.607.

(a)(6) Certain fuselage doors, as specified by 25.807(h), must also meet the applicable requirements of §§25.809 through 25.812 for emergency exits.

§25.783(b) Opening by persons.

There must be means to safeguard each door against opening during flight due to inadvertent action by persons.

The door should have inherent design features that achieve this objective. It is not considered acceptable to rely solely on cabin pressure to prevent inadvertent opening of doors during flight, because there have been instances where doors have opened during unpressurized flight, such as during landing. Therefore all doors should incorporate features to prevent the door from being opened inadvertently by persons on board.

In addition, design precautions must be taken to minimise the possibility for a person to open a door intentionally during flight. If these precautions include the use of auxiliary devices, those devices and their controlling systems must be designed so that:

(i) no single failure will prevent more than one exit from being opened, and

(ii) failures that would prevent opening of the exit after landing are improbable.

The intentional opening of a door by persons on board while the aeroplane is in flight should be considered. This rule is intended to protect the aircraft and passengers but not necessarily the person who intentionally tries to open the door. Suitable design precautions should therefore be taken; however, the precautions should not compromise the ability to open an emergency exit in an emergency evacuation. The following precautions should be considered:

(a) For doors in pressurised compartments: it should not normally be possible to open the door when the compartment differential pressure is above 0.14 kg/cm² (2 psi). The ability to open the door will depend on the door operating mechanism and the handle design, location and operating force. Operating forces in excess of 136 kg (300 pounds) should be considered sufficient to prevent the door from being opened. During approach, takeoff and landing when the compartment differential pressure is lower, it is recognised that intentional opening may be possible; however, these phases are brief and all passengers are expected to be seated with seat belts fastened. Nevertheless flight experience has shown that cabin staff may cycle the door handle during takeoff in an attempt to ensure that the door is closed, resulting in door opening in flight. For hazardous doors §25.783(e)(2) intends to provide a positive means to indicate to the door operator after closure of the door on the ground, that the door is not properly closed, latched and locked. §25.783(e)(2) will minimise, but can not prevent the deliberate cycling of the door handle by the cabin staff during takeoff.

(b) For doors that cannot meet the guidance of 6.b.(2)(a), above, and for doors in non-pressurised aeroplanes: The use of auxiliary devices (for example, a speed-activated or barometrically-activated means) to safeguard the door from opening in flight should be considered. The need for such auxiliary devices should depend upon the consequences to the aeroplane and other occupants if the door is opened in flight.

(c) If auxiliary devices are installed on emergency exits: The failure of an auxiliary device should normally result in an unsecured position of the device. Failures of the device that would prevent opening of the exit after landing should be improbable. Where auxiliary devices are controlled by a central system or other more complex systems, a single failure criterion for opening may not be sufficient. The criteria for failure of the auxiliary devices to open after landing should include consideration of single failures and all failure conditions that are not improbable. Dormant failures should be excluded from this assessment.

§25.783(c) Pressurisation prevention means.

There must be a provision to prevent pressurisation of the aeroplane to an unsafe level if any door subject to pressurisation is not fully closed, latched, and locked.

(c)(1) The provision must be designed to function after any single failure, or after any combination of failures not shown to be extremely improbable.

(a) The provisions for preventing pressurisation must monitor the closed, latched and locked condition of the door. If more than one lock system is used, each lock system must be monitored. Examples of such provisions are vent panels and pressurisation inhibiting circuits. Pressurisation to an unsafe level is considered to be prevented when the pressure is kept below 0,035 kg/cm² (1/2 psi). These systems are not intended to function to depressurize the aeroplane once the fully closed latched and locked condition is established and pressurisation is initiated.

(b) If a vent panel is used, it should be designed so that, in normal operation or with a single failure in the operating linkage, the vent panel cannot be closed until the door is latched and locked. The vent panel linkage should monitor the position of each door lock.

(c) If automatic control of the cabin pressurisation system is used as a means to prevent pressurisation, the control system should monitor each lock. Because inadvertent depressurization at altitude can be hazardous to the occupants, this control system should be considered in showing compliance with the applicable pressurisation system reliability requirements. Normally, such systems should be automatically disconnected from the aeroplane's pressurisation system after the aeroplane is airborne, provided no prior unsafe condition was detected.

(d) It should not be possible to override the pressurisation prevention system unless a procedure is defined in the Master Minimum Equipment List (MMEL) that confirms a fully closed, latched and locked condition. In order to prevent the override procedure from becoming routine, the override condition should not be achievable by actions solely on the flight deck and should be automatically reset at each door operational cycle.

(c)(2) Doors that meet the conditions described in § 25.783(h) are not required to have a dedicated pressurization prevention means if, from every possible position of the door, it will remain open to the extent that it prevents pressurization, or close and latch as pressurization takes place. This must also be shown with each single failure or malfunction except that:

(i)) with failures or malfunctions in the latching mechanism, it need not latch after closing, and

(ii)jamming as a result of mechanical failure or blocking debris, the door need not close and latch if it can be shown that the pressurization loads on the jammed door or mechanism would not result in an unsafe condition.

As specified in § 25.783(d)(5), each door for which unlatching would not result in a hazard is not required to have a locking mechanism; those doors also may not be required to have a dedicated pressurization prevention means. However, this should be determined by demonstrating that an unsafe level of pressurization cannot be achieved for each position that the door may take during closure, including those positions that may result from single failures or jams.

- Excluding jamming and excluding failures and malfunctions in the latching system, for every possible

position of the door, it must either remain open to the extent that it prevents pressurization, or safely close and latch as pressurization takes place.

- With single failures of the latching system or malfunctions in the latching system the door may not necessarily be capable of latching, but it should either remain open to the extent that it prevents pressurization, or safely move to the closed position as pressurization takes place; and

- With jamming as a result of mechanical failure in the latching system or blocking debris, the pressurization loads on the jammed door or mechanism may not result in damage to the door or airframe that could be detrimental to safe flight (both the immediate flight or future flights). In this regard, consideration should be given to jams or non-frangible debris that could hold the door open just enough to still allow pressurization, and then break loose in flight after full pressurization is reached.

§25.783(d) Latching and locking

The latching and locking mechanisms must be designed as follows:

(d)(1) There must be a provision to latch each door.

Latches are movable mechanical elements that, when engaged, prevent the door from opening.

(a) The definitions of latches and locks are redefined in chapter 4 [Definitions], particularly in regard to mechanical and structural elements of inward-opening plug doors. In this regard, fixed stops are not considered latches. The movable elements that hold the door in position relative to the fixed stops are considered latches. These movable elements prevent the door from opening and will support some loads in certain flight conditions, particularly when the aeroplane is unpressurized.

(b) For all doors, paragraph 25.783(d)(2) requires that the latching system employ a securing means other than the locking system. The separate locking system may not be necessary for certain inward-opening plug doors [see § 25.783(d)(5)].

(d)(2) The latches and their operating mechanism must be designed so that, under all aeroplane flight and ground loading conditions, with the door latched, there is no force or torque tending to unlatch the latches. In addition, the latching system must include a means to secure the latches in the latched position. This means must be independent of the locking system.

The latches of doors for which the initial opening movement is outward are typically subject to vibrations; structural loads and deflections; positive and negative pressure loads; positive and negative 'g' loads; aerodynamic loads; etc. The latches of doors for which the initial opening movement is inward typically share some of these loads with fixed stops. Doors for which the initial opening movement is inward tend to be resistant to opening when the aircraft is pressurized since a component of the pressure load tends to hold the door closed.

(a) Latch design. The design of the latch should be such that with the latch disconnected from its operating mechanism, the net reaction forces on the latch should not tend to unlatch the latch during both pressurised and unpressurised flight throughout the approved flight envelope. The effects of possible friction in resisting the forces on the latch should be ignored when considering reaction forces tending to unlatch the door. The effects of distortion of the latch and corresponding structural attachments should be taken into account in this determination. Any latch element for which 'g' loads could result in an unlatching force should be designed to minimise such forces.

(b) Latch securing means. Even though the principal back-driving forces should be eliminated by design, it is recognised that there may still be ratcheting forces that could progressively move the latches to the unlatched position. Therefore, each latch should be positively secured in the latched position by its operating mechanism, which should be effective throughout the approved flight envelope. The location of the operating system securing means will depend on the rigidity of the system and the tendency for any forces (such as ratcheting, etc.) at one latch to unlatch other latches.

(c) Overcenter features in the latching mechanism are considered to be an acceptable securing means, provided that an effective retaining feature that functions automatically to prevent back-driving is incorporated. If the design of the latch is such that it could be subject to ratcheting loads which might tend to unlatch it, the securing means should be adequate to resist such loads.

(d) Back-driving effect of switches. In those designs that use the latch to operate an electrical switch, any back-driving effect of the switch on the latch is permissible, provided that the extent of any possible movement of the switch

- is insufficient to unlatch it, and

- will not result in the latch being subjected to any other force or torque tending to unlatch it.

(e) The latch securing means must be independent of the locking means. However, the latching and locking functions may be fulfilled by a single operating means, provided that it is not possible to back-drive the locks via the latch mechanism when the door locks are engaged with the latch mechanism.

(d)(3) Each door subject to pressurisation, and for which the initial opening movement is not inward must --

(i) have an individual lock for each latch,
(ii) have the lock located as close as practicable to the latch, and
(iii) be designed so that in pressurised flight, no single failure in the locking system would prevent the locks from restraining the latches necessary to secure the door.

(a) To safeguard doors subject to pressurisation and for which the initial opening movement is not inward, each latch must have an individual lock. The lock should directly lock the latch. In this regard, the lock should be located directly at the latch to ensure that, in the event of a single failure in the latch operating mechanism, the lock would continue to restrain the latch in the latched position. Even in those cases where the lock cannot be located directly at the latch, the same objective should be achieved. In some cases, a pair of integrally-connected latches may be treated as a single latch with respect to the requirement for a lock provided that:

1 the lock reliably monitors the position of at least one of the load carrying elements of the latch, and
2 with any one latch element missing, the aeroplane can meet the full requirements of JAR-25 as they apply to the unfailed aeroplane, and
3 with the pair disengaged, the aeroplane can achieve safe flight and landing, and meet the damage tolerance requirements of § 25.571[Damage-tolerance and fatigue evaluation of structure].

(b) In some designs more latches are provided than necessary to meet the minimum design requirements. The single failure requirement for the locking system is intended to ensure that the number and combination of latches necessary to secure the door will remain restrained by the locking mechanism. Only those latches needed to meet the minimum design requirements need to remain restrained after the single failure.

(c) In meeting this requirement, the indirect locking provided through the latch system by the locks at other latches may be considered. In this case, the locking system and the latching system between the locked latch and the unlocked latch should be designed to withstand the maximum design loads discussed in paragraph 6.d.(7) of this ACJ, below, as appropriate to pressurised flight.

(d)(4) Each door for which the initial opening movement is inward, and unlatching of the door could result in a hazard, must have a locking means to prevent the latches from becoming disengaged. The locking means must ensure sufficient latching to prevent opening of the door even with a single failure in the latching mechanism.

On these doors, the locking means should monitor the latch securing means, but need not directly monitor and lock each latch. Additionally, the locking means could be located such that all latches are locked by locking the latching mechanism. With any single failure in the latching mechanism, the means must still lock a sufficient number of latches to ensure that the door remains safely latched.

(d)(5) Each door for which unlatching would not result in a hazard is not required to have a locking mechanism.

See paragraph 6.(h) of this ACJ, below, for a description of the kinds of doors for which unlatching is considered not to result in a safety hazard.

(d)(6) It must not be possible to position the lock in the locked position if the latch and the latching mechanism are not in the latched position.

The lock should be an effective monitor of the position of the latch such that, if any latch is unlatched, the complete locking system cannot be moved to the locked position. Although an overcenter feature may be an adequate means of securing the latching mechanism, it is not considered to be the locking means for the latches.

(d)(7) It must not be possible to unlatch the latches with the locks in the locked position. Locks must be designed to withstand the limit loads resulting from --

(i) the maximum operator effort when the latches are operated manually;
(ii) the powered latch actuators, if installed; and
(iii) the relative motion between the latch and the structural counterpart.

Although the locks are not the primary means of keeping the latches engaged, they must have sufficient strength to withstand any loads likely to be imposed during all approved modes of door operation. The operating handle loads on manually-operated doors should be based on a rational human factors evaluation. However, the application of forces on the handle in excess of 136 kg (300 pounds) need not be considered. The loads

imposed by the normal powered latch actuators are generally predictable; however, loads imposed by alternate drive systems are not. For this reason the locks should have sufficient strength to react the stall forces of the latch drive system. Load-limiting devices should be installed in any alternate drive system for the latches in order to protect the latches and the locks from overload conditions. If the design of the latch is such that it could be subject to ratcheting loads which might tend to unlatch it, the locks should be adequate to resist such loads with the latch operating system disconnected from the latch.

(d)(8) Each door that could result in a hazard if not closed, must have means to prevent the latches from being moved to the latched position unless the door is closed.

Existing door designs may incorporate features that prevent the latches from moving to the latched position if the door is not closed. The importance of such a feature is that it prevents the latched and locked functions from being completed when the door is not closed, while at the same time providing a safe door impression to the door operator. In that case the only safeguard against dispatch with an open door may depend on one (door in aperture) switch in the indication system. For door security however it is good basic design philosophy not to rely on the indication system, but to provide independent integrity in the closing, latching and locking functions.

§25.783(e) Warning, caution and advisory indications.

Doors must be provided with the following indications:

(e)(1) There must be a positive means to indicate at the door operator's station for each door that all required operations to close, latch, and lock the door have been completed.

In order to minimise the probability of incomplete door operations, it should be possible to perform all operations for each door at one station. If there is more than one operator's station for a single door, appropriate indications should be provided at each station. The positive means to indicate at the door operator's station that all required operations have been completed are such things as final handle positions or indicating lights. This requirement is not intended to preclude or require a single station for multiple doors.

(e)(2) There must be a positive means clearly visible from the door operator's station for each door that could be a hazard if unlatched, to indicate if the door is not fully closed, latched, and locked. .

A single indication that directly monitors the door in the closed, latched and locked conditions should be provided, unless the door operator has a visual indication that the door is fully closed latched and locked. This indication should be obvious to the door operator. For example, a vent door or indicator light that monitors the door locks and is located at the operator's station may be sufficient. In case of an indicator light, it should not be less reliable than the visual means in the cockpit as required per 25.783(e)(3). Preferably the same sensors should be used for both indications in order to prevent any discrepancy between the indications.

(e)(3) There must be a visual means on the flight deck to signal the pilots if any door is not fully closed, latched, and locked. The means must be designed such that any failure or combination of failures that would result in an erroneous closed, latched, and locked indication is improbable for —

(i) each door that is subject to pressurization and for which the initial opening movement is not inward, or

(ii) each door that could be a hazard if unlatched.

The visual means may be a simple amber light or it may need to be a red warning tied to the master warning system depending on the criticality of the door. The door closed, latched and locked functions must be monitored, but only one indicator is needed to signal the door closed, latched and locked condition. Indications should be reliable to ensure they remain credible. The probability of erroneous closed, latched, and locked indication should be no greater than $1x10^{-5}$ for

- each door subject to pressurisation and for which the initial opening movement is not inward and for
- each door that could be a hazard if unlatched.

(e)(4) There must be an aural warning to the pilots prior to or during the initial portion of takeoff roll if any door is not fully closed, latched, and locked and its opening would prevent safe takeoff and return to landing.

Where an unlatched door could open and prevent a safe takeoff and return to landing, a more conspicuous aural warning is needed . It is intended that this system should function in a manner similar to the takeoff configuration warning systems of § 25.703 [Takeoff Warning system]. The visual display for these doors may be either a red light or a display on the master warning system. Examples of doors requiring these aural warnings are

- doors for which the structural integrity of the fuselage would be compromised if the door is not fully closed, latched and locked, or

- doors that, if open, would prevent rotation or interfere with controllability to an unacceptable level.

§25.783(f) Visual inspection provision.

Each door, for which unlatching could be a hazard, must have provisions for direct visual inspection to determine, without ambiguity, if the door is fully closed, latched, and locked. The provision must be permanent and discernible under operational lighting conditions or by means of a flashlight or equivalent light source.

A provision is necessary for direct visual inspection of the closed position of the door and the status of each of the latches and locks, because dispatch of an aeroplane may be permitted in some circumstances when a flight deck or other remote indication of an unsafe door remains after all door closing, latching and locking operations have been completed. Because the visual indication is used in these circumstances to determine whether to permit flight with a remote indication of an unsafe door, the visual indication should have a higher level of integrity than, and be independent of, the remote indication.

(a) The provisions should:

1 allow direct viewing of the position of the locks to show, without ambiguity, whether or not each latch is latched and each lock is in the locked position. For doors which do not have a lock for each latch, direct viewing of the position of the latches and restraining mechanism may be necessary for determining that all the latches are latched. Indirect viewing, such as by optical devices or indicator flags, may be acceptable provided that there is no failure mode that could allow a false latched or locked indication.

2 preclude false indication of the status of the latches and locks as a result of changes in the viewing angle. The status should be obvious without the need for any deductive processes by the person making the assessment.

3 be of a robust design so that, following correct rigging, no unscheduled adjustment is required. Furthermore, the design should be resistant to unauthorised adjustment.

4 preclude mis-assembly that could result in a false latched and locked indication.

(b) If markings are used to assist the identification of the status of the latches and locks, such markings must include permanent physical features to ensure that the markings will remain accurately positioned.

(c) Although the visual means should be unambiguous in itself, placards and instructions may be necessary to interpret the status of the latches and locks.

(d) If optical devices or windows are used to view the latches and locks, it should be demonstrated that they provide a clear view and are not subject to fogging, obstruction from dislodged material or giving a false indication of the position of each latch and lock. Such optical devices and window materials should be resistant to scratching, crazing and any other damage from all materials and fluids commonly used in the operation and cleaning of aeroplanes.

§25.783(g) Certain maintenance doors, removable emergency exits, and access panels.

Some doors not normally opened except for maintenance purposes or emergency evacuation and some access panels need not comply with certain paragraphs of this section as follows:

(1) Access panels that are not subject to cabin pressurization and would not be a hazard if unlatched during flight need not comply with paragraphs (a) through (f) of this section, but must have a means to prevent inadvertent opening during flight.

(2) Inward-opening removable emergency exits that are not normally removed, except for maintenance purposes or emergency evacuation, and flight deck-openable windows need not comply with paragraphs (c) and (f) of this section.

(3) Maintenance doors that meet the conditions of § 25.783(h), and for which a placard is provided limiting use to maintenance access, need not comply with paragraphs (c) and (f) of this section.

Some doors not normally opened except for maintenance purposes or emergency evacuation and some access panels are not required to comply with certain paragraphs of § 25.783 as described in § 25.783(g). This generally pertains to access panels outside pressurised compartments whose opening is of little or no consequence to safety and doors that are not used in normal operation and so are less subject to human errors or operational damage.

§25.783(h) Doors that are not a hazard.

For the purpose of this section, a door is considered not to be a hazard in the unlatched condition during flight, provided it can be shown to meet all of the conditions as mentioned in §25.783(h).

JAR 25.783 recognizes four categories of doors:

- Doors for which the initial opening is not inward, and are presumed to be hazardous if they become unlatched.
- Doors for which the initial opening is inward, and could be a hazard if they become unlatched.
- Doors for which the initial opening is inward, and would not be a hazard if they become unlatched.
- Small access panels outside pressurized compartments for which opening is of little or no consequence to safety.

JAR 25.783(h) describes those attributes that are essential before a door in the normal (unfailed) condition can be considered not to be a hazard during flight.

7. STRUCTURAL REQUIREMENTS.

"In accordance with §25.571, the door structure, including its mechanical features (such as hinges, stops, and latches), that can be subjected to airframe loading conditions, must be designed to be damage tolerant. In assessing the extent of damage under §25.571 and §25.783 consideration should be given to single element failures in the primary door structure, such as frames, stringers, intercostals, latches, hinges, stops and stop supports.
The skin panels on doors should be designed to be damage tolerant with a high probability of detecting any crack before the crack causes door failure or cabin decompression."