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Location of Passenger Emergency Exits in Transport Category Airplanes; Final Rule

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Parts 21, 25, and 121

[Docket No. 25491; Amdts. Nos. 21-65, 25-67, 121-205]

RIN 2120-AC29

Location of Passenger Emergency Exits in Transport Category Airplanes

June 13, 1989.

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final rule.

SUMMARY: This final rule establishes a new standard that limits the distance between emergency exits on transport category airplanes. This rule prohibits airplane manufacturers and air carriers from increasing the distance between emergency exits to more than 60 feet. Existing regulations do not limit the distance. This rule is intended to ensure an opportunity for safe passenger evacuation during an emergency.

EFFECTIVE DATE: July 24, 1989.

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SUPPLEMENTARY INFORMATION:

Background

Since 1967, the Federal Aviation Administration (FAA) has regulated the location of emergency exits on airplanes by requiring that an exit be provided for every specified number of passengers, that an exit be located where it would allow the most effective means of passenger evacuation, and that exits be distributed as uniformly as practicable taking into account passenger distribution. (14 CFR 25.807) An underlying assumption has been that a uniform distribution of exits accounting for passenger distribution results in reasonable seat-to-exit and exit-to-exit distances.

However, some recent exit configurations have exit distances that are greater than those envisaged when the exit rule was adopted. Of the new wide-body transports that were being designed when the rule was adopted, the Boeing Model 747 had a maximum distance between exits of 44 feet; the McDonnell Douglas Model DC-10, 47 feet; and the Lockheed Model L-1011, 50 feet. (All figures are rounded off.) Basic narrow-body transport models typically had shorter distances. Derivative configurations of these models show an increase in typical distances. Exit-to-exit distance, originally 50 feet in the L-1011-385-1, increased to nearly 70 feet in a later model, the L-1011-385-3. The Boeing 747 showed an increase from 44 feet in the 747-100, -200, and -300 models to nearly 70 feet in the 747-200 and 747-300 models with the No. 3 exits deactivated. A recent certification request proposed a derivative configuration with a distance substantially greater than 80 feet. The FAA denied this request. These recent cases of exit configuration design indicate that the exit distribution requirement of § 25.807(c) alone is ineffective in preventing increases in escape path distances. While the agency recognizes that exit distance considered alone is not dispositive of the conditions which provide for a safe evacuation, under our current state of safety knowledge, this factor is clearly an important variable. As discussed below, however, the agency considers it preferable that a performance standard for evacuation be employed in the future, so as not to artificially constrain design options. With the specific intent of developing the information necessary to propose such a performance standard to replace (among other factors affecting safe evacuation) this artificial exit distance limitation, the agency will gather the best available safety expertise in a formally chartered advisory committee to consider and report on the best means for achieving that end.

The agency's concern over the significance of escape path distance recently increased in connection with type certification activities for a derivative of the Boeing Model 747 (B-747), necessitating this action in the interim, until better knowledge permitting development of a performance standard becomes available. In September 1984, at the request of the Boeing Company (Boeing), the Seattle Aircraft Certification Office (ACO) approved a modification of the B-747 which would deactivate a pair of over-wing exits and reduce the maximum passenger capacity of the main deck by 110, from 550 to 440. The Seattle ACO approved the modification on the basis that such a modification was within the requirements of the regulations at that time. The FAA received many letters from the public objecting to the deactivation of emergency exits. In response to the public objections, the FAA Administrator asked the Office of Airworthiness (presently the Aircraft Certification Service) for a review of the ACO action. The review, dated March 1, 1985, found that the B-747, as modified, fully met all applicable rules and that no exemptions, waivers, or special conditions were granted or considered. Notwithstanding this conclusion, on June 12, 1985, the FAA Administrator wrote a letter to a number of U.S. air carriers strongly encouraging them to maintain the original number of emergency exits on their passenger-carrying Boeing 747 airplanes, because of safety concerns not addressed by the rule.

On June 24, 25, and 26, 1985, the House Subcommittee on Investigations and Oversight heard testimony from witnesses opposed to exit deactivations and from the FAA Administrator. The Administrator promised the committee a review of all issues raised in the letters received by the FAA and in testimony given before the committee. The review was summarized in a report to the Administrator, dated August 5, 1985. It found that the approval for design modifications to B-747 airplanes was technically valid in accordance with the regulations but that issues raised by the public added new emphasis and perspective to the issue of escape path distances. The report concluded that all of the issues raised by the public questioned the efficacy of the rules rather than the validity of the approval. The report stated that the FAA would hold a Public Technical Conference on emergency evacuation. As a result, an Emergency Evacuation Task Force was formed in Seattle, Washington, in September of 1985. The task force consisted of members of the interested public and was chaired by the FAA. The task force reviewed recent design, maintenance, and operational experience of the new generation of narrow- and wide-body transports. It examined the full range of emergency evacuation topics, including passenger emergency exits, cabin configuration, emergency evacuation demonstrations, evacuation slides, crewmember duties and training, and passenger safety information. Although no consensus was reached by the task force, the task force efforts were helpful to the FAA in its own ongoing efforts to improve emergency evacuations. Unfortunately, the task force did not provide any basis for a performance standard to address the concerns raised by increasing exit distances.

The FAA reviewed the issues surrounding the Boeing approval as well as information grained on modifications of other wide-body transport airplanes, information received from flight attendants who are knowledgeable about emergency evacuation

procedures, and information from the public and other interested persons. As a result, the FAA decided that the rule on number and location of passenger emergency exists were not adequate to maintain the original intent of those rules that exists be located to provide an opportunity for passenger evacuation in an emergency, because aircraft designs had significantly changed in the over 20 years since the rule was written.

The agency's reassessment of the rules in light of recent aircraft designs and events has confirmed the importance of the distance betewen exists and the potential impact of excessive distance on the chances of passenger survival in an emergency. Accordingly, in the absence of a performance standard which provides acceptable safety, the FAA is amending Parts 21, 25, and 121 of the Federal Aviation Regulations (FAR) to prohibit any passenger emergency exist from being located more than 60 feet from any adjacent passenger emergency exist. The FAA has determined that the specification of the distance between exists along with the existing uniform distribution rule is sufficient to provide the appropriate distance between a passenger seat and an emergency exit, though the preferable alternative would be a performance standard. For the purposes of this rule, the distance between exists is measured along a line parallel to the airplane's longitudinal axis for exits on the same deck and on the same side of the fuselage.

This rulemaking action covers only one of many factors affecting cabin evacuation. The FAA considers evacuation within a systems or "holistic" framework, i.e., a number of interrelated factors affect the success of an evacuation. These factors include: cabin attendant training, fuselage attitude, door design, door reliability, chute design and reliability, chute inflation times, aisle design, seat materials, exist low lighting, aisle lighting, crew check lists passenger safety information, cabin configuration, and other factors.

The FAA is addressing these and other related issues by establishing an emergency evacuation advisory committee to develop recommendations for an evacuation performance standard and appropriate further modifications and additions to the agency's existing evacuation regulations. The committee will include representatives of crewmembers, airlines, manufacturers, and other interested organizations. The committee will provide the FAA with recommendations on areas which concern improved specification of emergency evacuation regulations and other new techniques which should enhance cabin evacuation. Specifically, the committee will be tasked to design a performance standard against which safe evacuation capability of existing and new aircraft designs can be measured in order to replace artificial exist distance limitations and other nonperformance oriented design criteria mandated by this and other regulations. This group will be asked to submit recommendations on airplane evacuation standards by July 1, 1991, and to review all relevant cabin evacuation issues that the FAA asks it to consider, as well as issues raised by passengers, the National Transportation Safety Board, and the Congress. The FAA will use the committee's recommendations as a basis for reformulating the agency's evacuation regulations, if warranted by analysis in accordance with Executive Order 12291. While such a reformulation into an evacuation performance standard is hoped to obviate the need for distance limitations established by this final rule, the FAA finds that, in the interim until such performance standards are available, distance limits between emergency exist doors are necessary in the interest of airline passenger safety.

On October 20, 1987, the FAA published Notice of Proposed Rulemaking No. 87–10 (Notice No. 87–10) (52 FR 39190) which proposed to establish new standard limits on transport category airplanes for the distance between any passenger seat and the nearest emergency exit and the distance between exits. On March 2, 1988, the Administrator testified before the House Committee on Public Works and Transportation, Subcommittee on Investigations and Oversight. In that testimony the Administrator stated that, having reviewed the public comments, the FAA planned to issue a final rule to prescribe a new standard to limit the distance between exists. Comments received on the proposals are described and responded to below.

Discussion of Comments

The FAA received 31 comments on the proposals. Approximately two-thirds of the comments are generally supportive of the FAA proposals. These supportive comments are from associations of airline employees, from individual flight attendants and private citizens, and from an association of airline passengers. In addition to these groups, there are favorable comments from the National Transportation Safety Board (NTSB), The Airworthiness Authorities Steering Committee, Transport Canada, and The Civil Aviation Administration of China.

Although about one-third of the commenters oppose the proposals, none of these comments contains either a supportable alternative performance standard or any additional proof that would convince the FAA that the proposals should be withdrawn. These opposing comments come from foreign air carriers, from airline associations, and from airplane manufacturers.

The discussion of comments is divided into the following categories of issues: (1) Common sense support of the agency's approach; (2) retroactive nature of the agency's action; (3) claimed discriminatory and inconsistent nature of the agency's action; (4) offsetting factors; (5) accident and service experience; (6) actual emergency evacuation conditions versus evacuation demonstrations; (7) sixty-foot determination; (8) economic costs; and (9) comments beyond the scope of the proposals.

Common Sense Support of the Agency's Approach

Most of the supporting commenters agree that, given our present state of knowledge regarding safety matters, exit-to-exit distances affect the outcome of emergency evacuations. Throughout the favorable comments, the common sense assumption is presented that a passenger who is close to an emergency exit has a better chance to escape than a person farther away. A British aeronautical engineer states:

> With the considerable test and operational data available to the FAA it is reassuring to read that they now also support my long held opinion, and that of my colleagues, that the escape path distance can have a major effect on the outcome of the evacuation.

The commenters who support the proposals think that the FAA should address the issues of exit-to-exit distance and seat-to-exit distance as well as other cabin improvements (e.g., smoke hoods and location of cabin attendant stations).

The FAA agrees that distance from a passenger to an exit and distance between exits are relevant factors (though not the only important ones) in emergency evacuations and, therefore, is amending its airworthiness requirements to establish a standard limit on distances between exits, in the absence of a preferable performance standard. For reasons discussed under the heading Rule Clarifications, the FAA is not adopting a specific limit on the distance between a passenger seat and the nearest emergency exit. In recent years, the FAA has completed several

rulemaking actions that addressed other safety features that could increase the likelihood of passenger survival in an emergency evacuation. On July 10, 1986, the FAA issued Amendments 25–61 and 121–189 (51 FR 26206) to upgrade fire safety standards for cabin interior materials in transport category airplanes. On May 29, 1987, the FAA issued Amendment 121–194 (52 FR 21472) to establish new carry-on baggage requirements. The Task Force Report on Emergency Evacuation of Transport Airplanes (discussed in the background section of the preamble of Notice No. 87–10) identified additional areas that are under study within the FAA and that could be the subject of future rulemaking. The agency expects that the emergency evacuation advisory committee to be formed will consider all of these data in its development of a recommended performance standard for emergency evacuations.

Retroactive Nature of the Agency's Action

Several commenters state that the FAA is attempting by general rulemaking to disapprove, retroactively, a particular emergency exit design that the FAA admits is legal under existing regulations. Specifically, The Boeing Company describes three ways that this rule would be applied retroactively.

(1) It would apply to applications for supplemental type certificates (STC) or for amendments to type certificates that were submitted to the FAA before October 16, 1987 (§ 25.2).

(2) It would apply to airplanes that already have STC's or amended type certificates but have not yet received standard airworthiness certificates (§ 21.183(f)).

(3) It would prevent airplanes that are already in service from being modified in a way that was legal under the certification rules that applied to those airplanes when they were manufactured (§ 121.310(m)).

Only one commenter specifically criticizes the agency's intention to make §§ 21.183(f) and 121.310(m) applicable as of the date of issuance of the proposals.

Boeing states that the FAA does not have discretion to change the rules in the ways described above. Boeing also states that once the FAA has approved a type design and issued a production certificate the manufacturer is entitled under § 21.183(a) to a standard airworthiness certificate without further showing. Boeing states that the FAA cannot change the automatic nature of § 21.183(a) because it maintains that § 21.183(a) is taken directly from the agency's statutory mandate. Section 603(c) of the Federal Aviation Act of 1958 (Act), 49 U.S.C. 1423(c), provides:

> If the Administrator finds that the aircraft conforms to the type certificate therefor, and, after inspection, that the aircraft is in condition for safe operation, he shall issue an airworthiness certificate.

Boeing further states that Congress passed legislation giving the FAA specific authority to issue retroactive regulations relating to aircraft noise and sonic boom which shows that the FAA does not otherwise have the authority to issue retroactive regulations under the Act.

Boeing's description of how the new rule is applied retroactively is correct; however, Boeing and other commenters are incorrect in claiming that the FAA does not have any authority to apply airworthiness certification rules retroactively.

The basic scheme of the type certification regulations is set out in § 21.17. Paragraph (a) of § 21.17 reads as follows:

> (a) Except as provided in § 23.2, § 25.2 and in Part 36 of this chapter, an applicant for a type certificate must show that the aircraft, aircraft engine, or propeller concerned meets—
>
> (1) The applicable requirements of this subchapter that are effective on the date of application for that certificate unless—
>
> (i) Otherwise specified by the Administrator, or
>
> (ii) Compliance with later effective amendments is elected or required under this section, and
>
> (2) Any special conditions prescribed by the Administrator.

Section 21.17(a) has described for many years four methods by which an applicant for a type certificate could be required to comply with regulations that are not the applicable requirements that are effective on the date of application for the type certificate. First, retroactive regulations could be applicable under § 25.2. Second, under § 21.17(a)(1)(i), the applicable regulations could be otherwise specified by the Administrator. Third, under § 21.17(a)(1)(ii), compliance with later effective regulations could be required. Fourth, under § 21.17(a)(2), special conditions could be prescribed by the Administrator.

In addition, airplane manufacturers have always been affected by either special airworthiness requirements of instrument and equipment requirements that have been included in the applicable operating rules (e.g., Subparts J and K of Part 121). Even though an airplane fully met the type certification requirements, an airline could not operate the airplane unless it also met the special airworthiness or instrument and equipment requirements that apply to that airline.

Thus, for many years, the FAA has had the authority to upgrade applicable type certification and airworthiness requirements as needed to ensure that the appropriate level of safety is maintained. This authority to apply rules in a manner that has certain retroactive effects has been exercised by the FAA on many occasions and applies to supplemental type certificates and to amendments to type certificates. The language in section 603(c) of the Act in no way limits the above-described authority since the issuance of an airworthiness certificate becomes automatic only after the Administrator has found full compliance with the type certificate or production certificate, as applicable. (See § 21.183)

Therefore, the fact that the FAA was given specific authority in section 611 of the Act to issue retroactive rules relating to aircraft noise and sonic boom does not lead to Boeing's conclusion. As described above, the authority to promulgate retroactive requirements to address safety issues is consistent with the proper exercise of the agency's safety rulemaking authority, and exists independently from the authority to promulgate standards to address the control and abatement of noise and sonic boom. Therefore, the enactment of section 611 in no way diminishes the authority of the FAA under the Act to adopt the standard described herein.

Claimed Discriminatory and Inconsistent Nature of the Agency's Action

Boeing states that the proposed Part 121 amendment is arbitrary and capricious and discriminates against Boeing because it is specifically targeted at the B–747. Boeing's basic argument is that if safety is the justification for the operating rule, then all airplanes that do not meet the 30-foot/60-foot requirements would have to be barred from future Part 121 operations. According to Boeing, however, § 121.310(m), as proposed, would permit Lockheed Model L–1011–500 (L–1011–500) airplanes that are presently operating under Part 121 to continue to operate under that part even though they do not meet the 30 foot/60-foot requirements while prohibiting operation of comparably modified or newly-manufactured B–747 airplanes. Boeing and other commenters state that the FAA position is inconsistent in the following ways:

(1) A 10-door B–747 would be considered safe for 550 passengers on the main deck while an 8-door B–747 would not be considered safe for 400

passengers or even for substantially lower maximum seating configurations.

(2) L–1010–500 airplanes with emergency exits that are 65.6 feet apart would continue to be legal under Part 121.

(3) Foreign air carriers could continue to operate their previously-modified 8-door B–747's into and out of the United States but could not sell a modified B–747 to a Part 121 certificate holder unless the over-the-wing exits were reactivated.

The Lockheed Corporation (Lockheed) states that the regulatory evaluation prepared for the proposals is inconsistent with the proposed rule language because, while the regulatory evaluation states that the L–1011–500 airplanes would not be impacted by the proposed rule, the language of proposed § 121.310(m) would prevent such airplanes now owned by foreign operators from being sold to U.S. airlines.

KLM Royal Dutch Airlines (KLM) suggests that because the agency's distinctions may not be understandable to the public, airlines like KLM might be forced to reactivate exits so that they would not have internal inconsistencies in their operations.

That airplanes will be flying side by side in air carrier operations even though they neither meet the same requirements nor possess the same characteristics is in no way a new concept. At times the FAA has adopted retrofit rules that apply to all airplanes operating under a particular operating rule, and at other times it has allowed certain airplanes to continue operating until they are retired.

Under this rule there would continue to be inconsistencies in the seat-to-exit ratios of various airplane types. Under the current rules, airlines have chosen to configure their cabin space in various ways and many airplanes do not have as many seats as would be allowed for that airplane under § 25.807; however, this rulemaking addresses exit-to-exit distance as a separate issue from seat-to-exit ratios. The current seat-to-exit ratios in § 25.807 are not changed by this rulemaking. Perhaps the emergency evacuation advisory committee will develop recommendations for a performance standard which accommodates the change implied by this comment.

The statement from the regulatory evaluation referenced in the Lockheed comment did not mean that L–1011–500 airplanes would be excluded from the effect of proposed § 121.310(m). The statement referred to the fact that, since Lockheed is no longer manufacturing the L–1011–500, there would be no direct economic impact on Lockheed. Under new § 121.310(m), no existing foreign-owned airplane (whether a L–1011–500 or a modified B–747 or any other transport category airplane) that exceeds the exit-to-exit limit can be obtained by a U.S. airline to be operated under Part 121.

This rule is intended to "hold the line" on growth of exit distance until an adequate performance standard can be developed. The overall effect of this final rule is threefold:

(1) No operator of U.S.-registered airplanes can modify one of its existing airplanes to exceed the exit-to-exit limit established by this rulemaking under Part 121.

(2) No operator can purchase from a foreign air carrier and operate under Part 121 any existing airplane that exceeds the exit-to-exit limit established by this rulemaking.

(3) No airplane manufactured after October 16, 1987, that exceeds the exit-to-exit limit will receive a U.S. standard airworthiness certificate.

Thus, while this rule contains the above-mentioned effects, this rule does not require any operator of a U.S.-registered airplane to expend any resources to retrofit any airplane that was in its fleet as of October 16, 1987. These effects clearly are associated with no direct costs.

Offsetting Factors

Several commenters state that improvements to emergency exit slide design and maintenance and to emergency exit door maintenance and actual seating configurations are offsetting factors which would allow faster and safer evacuations with fewer exits. This, is fact, might be true and could be a factor to be considered by the emergency evacuation advisory committee in its attempts to develop a suitable performance standard.

Boeing cites specific emergency exit and slide design improvements for the B–747 in the following areas: (1) Reduced inflation time of up to 50 percent; (2) use of higher strength, tear, and puncture-resistant sliding surface materials; (3) improve 25-knot wind performance; (4) an escape slide design with improved load-bearing capacity; and (5) lengthening the No. 2 door escape slide so that it can be usable for a wider range of conditions.

Virtually all of the foreign air carriers state that the FAA failed to consider that the standard seating configuration for the main deck of their B–747's ranged from 322 passengers to 384 passengers, all well below the 440 that would be the maximum under the present rules for an 8-door configuration. British Airways suggests as an alternative to the FAA proposals a 10-percent reduction in the present limit of 440 passengers to 396 for the 8-door configuration.

While the FAA recognizes that there have been improvements in emergency evacuation equipment and maintenance in recent years, in the absence of an accepted and validated performance standard against which to measure these factors and their contribution to evacuation success, these improvements do not offset the need to place a limit on the distance between exits until the performance standard is developed. Furthermore, as one commenter notes, a large proportion of the world fleet is not yet fitted with the inflatable slides which incorporate the latest safety advances. Also, this commenter notes that, despite improvements in emergency evacuation procedures for wide-bodied transports, the time necessary to evacuate these types of airplanes in full-scale demonstrations remains close to the time necessary to evacuate narrow-bodied airplanes.

The FAA is not addressing seat-to-exit ratios in this rulemaking. As discussed previously, this rulemaking is needed to hold the line on maximum exit-to-exit distance to provide the appropriate level of safety until a performance standard can be developed. This requirement will work together with present seat-to-exit ratio requirements, uniform distribution requirements, and improvements in evacuation equipment to increase the likelihood that passengers will survive in emergencies involving fire where evacuation is necessary.

Accident and Service Experience

Boeing and others point to actual evacuations in emergency situations in which 8-door B–747's were evacuated safely. British Airways describes its own experience in two emergency evacuations (Azores, 1985, and Los Angeles, 1987) where 334 and 370 passengers, respectively, plus crewmembers evacuated with only a few minor injuries to passengers.

The examples cited by commenters do not contradict the proposed rule changes. The main objective of the 60-foot exit-to-exit distance requirement is to prevent any further increase in exit-to-exit distances until an adequate performance standard can be developed.

While the evacuation situations described by British Airways are both examples of successful actual emergency evacuations, neither involved crash conditions. The evacuations involved neither fire nor

smoke, and all emergency exits were operable. In accidents studied where some passengers survived and some did not, evidence indicates that proximity to an exit increased the likelihood of survival. (See the following discussion.)

Actual Emergency Evacuation Conditions Versus Evacuation Demonstrations

Positions vary on the question of whether distance to exits is as important as other factors in evacuation. The Association of Flight Attendants (AFA) states that distance to exits is as important as other factors. In support of its position, the AFA provides quotes from two earlier FAA reports. A 1964 report entitled "Human Factors of Emergency Evacuation" state that no passenger should be more than 22 feet from an exit. (AM 65–7, p. 8, Mohler, Swearingen, McFadden, and Garner). A 1970 FAA report entitled "Survival In Emergency Escape From Passenger Aircraft," stated:

> In all three accidents, the distance between initial seat location and the nearest usable exit tended to be greater among fatalities than survivors. This leads to the not unsurprising conclusion that it is better to sit closer to an exit than farther away.
> (AM–70–16, p. 55, Snow, Carroll, and Allgood)

The AFA also states that testimony of flight attendants who had been in crashes confirms that distance to exit doors is important in escaping.

Many commenters who think that the FAA is overemphasizing distance to exits appear to agree with one commenter who states that the time needed to evacuate airplanes in emergencies is a function of both distance to the nearest emergency exit and the time to evacuate. This commenter suggests that with shorter distances, lines may form and that the piling up or queuing of passengers in emergency evacuations may actually impede the ability to evacuate airplanes because passengers could be more prone to panic if they are lined up and waiting.

Most of the opposing commenters also appear to believe that the FAA is not giving adequate recognition to the numerous emergency evacuation demonstrations that have proven that airplanes, such as models of the B–747 with 8 doors on the main deck, could be evacuated within less than 90 seconds with 50 percent of the exits blocked along with the other simulated emergency conditions required by the rules.

As noted in Notice No. 87–10, the evacuation demonstration required by § 25.803 neither establishes a maximum escape path distance nor demonstrates that escape path distance is not a major factor in actual emergencies. That demonstration is conducted to provide a benchmark against which the FAA can consistently evaluate emergency exit performance with various internal seating and emergency exit configurations. It does not simulate actual post-crash emergency evacuation conditions, nor could it reasonably do so. It is not an acceptable evacuation performance standard.

As explained in Notice No. 87–10, with present designs, excessive escape path distance can be a major impediment to evacuation in a number of situations which service experience has shown might occur during an actual emergency. The typical passenger cabin with a single aisle feeds evacuees to pairs of exits, one exit on each side of the cabin (or dual aisles to dual lane exits in typical wide-body cabins). In an actual emergency evacuation, exits at one end of the cabin might be made unusable by fire, smoke, structural damage, water submersion, landing gear collapse, or other causes, leaving one or more pairs of usable exits in the remainder of the cabin. This is commonly the case in a pool fire accident, where escape time differences of only a few seconds can be critical. In this situation, the aisle cannot feed evacuees to a pair of typical floor level exits fast enough to use the full evacuation capability of the exit pair. The flow rate of the aisle is less than that of the exit pair, making the aisle itself the critical impediment which determines the time required for passengers to escape the airplane. Similarly, dual aisles inadequately feed pairs of exits equipped with dual-lane evacuation slides.

In the situation where one exit in a pair of exits is unusable, as in an evacuation demonstration, the aisle is not the critical impediment to evacuation. In this case the aisle can feed more evacuees to the remaining single exit than that exit can handle. This results in passenger queues at exits. The limited flow rate of the single exit is the impediment which determines evacuation time. This is the situation which some commenters contend demonstrates that aisle length has no effect on evacuation time. The FAA acknowledges that in evacuation demonstrations, aisle distance may not be as critical a factor in evacuation time as it is in real accident emergencies where the aisle may be barely passable. The agency expects that these variables will be more appropriately accounted for in a performance standard developed by the emergency evacuation advisory committee.

Sixty-Foot Determination

A number of commenters address the proposed maximum distance between emergency exits. Several commenters who support the proposed maximum distance between exits cite the historical increase in distance between exits as described in Notice No. 87–10. These commenters agree with the FAA position that earlier improvements in crashworthiness safety regulations had not focused on the distance between exits because as a practical matter those distances were all within a range generally agreed to be acceptable. Some of these commenters suggest that while they think a distance of less than 60 feet could be justified, they will accept the agency's proposal of 60 feet.

Virtually all of the commenters who oppose the proposal state that there is no basis for the 60-foot maximum distance requirement. Typical of these commenters is KLM Royal Dutch Airlines' statement that the 60-foot limit between emergency exits was and is an arbitrary figure, not supported by objective evidence or analysis. KLM states that the 60-foot limit was a subjective opinion expressed by airline cabin crew delegations at the 1985 Evacuation Technical Conference in Seattle. KLM and other commenters urge the FAA to consider other factors besides exit distance: factors such as dual aisles versus single aisles and the number of people who have been evacuated within the 90-second limit in demonstrations of emergency evacuation procedures under Part 121.

Several commenters assume that the primary justification for the proposed 60-foot maximum distance is the tests discussed in Notice No. 87–10 that were conducted in the emergency evacuation simulator at the FAA Civil Aeromedical Institute (CAMI). These commenters specifically dispute the statement made in Notice No. 87–10 that the CAMI tests indicate that a reduction in aisle flow by about one-third could be reasonably expected when the floor is inclined because of, for example, gear collapse.

Boeing contends that the FAA selectively used the CAMI data. British Airways states that it disagrees with the conclusions drawn by the FAA on flow rates and has not been able to support it in its reading of the appropriate CAMI report.

As the discussion in Notice No. 87–10 clearly indicated, the justification for the maximum 60-foot distance between exits is not based on specific empirical research (CAMI's or other), success or

failure of evacuation demonstrations, or anecdotal evidence from actual crash evacuations. However, testing, historical data, analysis, and informed engineering judgment lead the FAA to conclude that, in the absence of a preferable but presently unavailable evacuation performance standard, it would not be prudent to allow distances between emergency exits to increase without providing a limit. As Notice No. 87–10 stated, the issue of maximum distance between exits was not addressed in the major crashworthiness regulations in the 1960's because even the new wide-bodied transports then being designed had a maximum exit-to-exit distance ranging from 44 feet to 50 feet. Before Notice No. 87–10 was issued, one designer of a derivative version of an existing airplane proposed exit-to-exit distances substantially exceeding 80 feet. This is not acceptable, for reason of safety, in present designs.

For the FAA to determine that 60 feet is the maximum allowable distance between exits, the FAA does not have to conclude, as Boeing and many other commenters seem to assume, that 65 feet or 75 feet or even 85 feet would never under any circumstance be safe. A survivable crash situation in which upwards of 400 people safely evacuate an airplane with exits more than 60 feet apart is certainly possible. But, as other commenters note, there also have been survivable crashes in which many people died or were injured because some or nearly all of the available exits were unusable. As the FAA has stated on numerous occasions, Part 25 of the FAR contains many requirements for built-in redundance because it would be imprudent to allow otherwise. For instance, three-engine transport category airplanes must be capable of maintaining safe flight with two engines inoperable, not because such flight is desirable but because such capability may be necessary, although rarely, to avoid a catastrophe.

Therefore, the decision to establish a maximum distance of 60 feet between exits is not a decision based on specific provable data. Rather, in the absence of a technically acceptable evacuation performance standard, it is a decision based on a balancing of door distance in the total equation of cabin evacuation, that is, how door distance interrelates with aisle design, exit row lighting, door design, chute inflation time, and other factors that go into the cabin evacuation scenario, given our present understanding of the interrelationship of these variables. The FAA finds that the selection of a maximum 60/foot distance between exits is a prudent and necessary safety decision consistent with its mandate under the Act and in the absence of an acceptable performance standard.

The agency has placed in the public docket (No. 25191) an explanation of its analysis and use of the CAMI tests in arriving at the one-third reduction in flow rate mentioned in Notice No. 87–10. These tests were just one factor in the agency's decision. The primary technical basis for the difference between the one-third reduction and lesser figures mentioned by commenters is the emphasis given to different parameters in the tests.

Economic Costs

Many foreign air carriers and Boeing comment that the agency's regulatory evaluation did not consider potential revenue loss to air carriers because they could not increase their passenger capacity. These commenters state that with 8 emergency exits on the main deck, it would be possible to increase the seating capacity by 6 to 12 seats while maintaining an interior layout consistent with the current layout (a mix of first class, business class, and coach seating; seat pitch and width; and interior service areas such as closets, galleys, and lavatories). Commenters provide a range of estimates of the annual value of these seats to air carriers in additonal passenger revenues.

The loss of potential revenue because an air carrier cannot increase its passenger capacity should not be considered as an impact of this rulemaking. Airlines are currently operating B–747's well below the type certificated maximum seating capacities: 440 with 8 exits and 550 with 10 exits on the main deck. This rulemaking does not prohibit an airline from increasing passenger seating capacity to the maximum allowed. Although allowing deactivation of two of the exit doors could potentially provide air carriers with an opportunity to increase passenger seating capacity without changing the present interior layout, it is not a cost directly related to this rulemaking. It is a cost resulting from air carrier management decisions regarding cabin configuration and passenger service.

Only foreign air carriers and Boeing raised the issue of increasing passenger seating capacity. The Air Transport Association of America (ATA), which represents U.S. air carriers, states in its comments, "Few ATA member airlines are directly affected by the proposed limitations on seat/exit locations; those which are directly affected have, for reasons of their own, elected to restrict their future airplane seat/exit configurations to those which comply with the proposed limits." Consequently, this rulemaking does not have a substantial impact on U.S. air carriers.

The cost figures submitted regarding lost opportunity are inaccurate. For example, both Boeing and Korean Airlines assume that the present passenger load factor would apply to the additonal seats gained by deactivation of the exit doors; however, if the current passenger load factor is about 70 percent on an airplane with 350 seats, the additonal 6–12 seats would be used only when flights were full or nearly full. The additional seats would more accurately have a load factor of about 10 percent. Such an adjustment would significantly reduce the lost opportunity costs of the air carriers.

KLM Royal Dutch Airlines expresses concern that it would be forced to reactivate exit doors in its 8-door B–747's because the public may think the airplanes with 8 doors on the main deck are unsafe. KLM states that reactivating the doors would cost $450,000 per airplane. The FAA is not requiring exit doors to be reactivated as a condition for continued airworthiness. As stated previously, the FAA is prohibiting air carriers and manufacturers from increasing exit-to-exit distances beyond the limitations in this rule because the preferable alternative of a performance standard cannot now be exercised. As a result of this rulemaking, airlines may voluntarily reactivate exit doors in the interest of safety. These costs would be voluntary and, therefore, are not being considered.

The Orient Airlines Association and Korean Airlines state that orders for 8-door B–747's have been placed with Boeing. In anticipation of delivery of these airplanes, the airlines have made plans; to change these plans, as the final rule would require, would involve incurring added costs. The FAA recognizes that inconvenience may be involved for foreign air carriers that had placed orders. However, any such lost opportunity costs are not considered except as they relate to U.S. trade (discussed in the International Trade Impact Assessment).

Boeing submitted cost estimates on fuel costs associated with additional weight and maintenance cost of the equipment for the two exits. These avoided costs were considered in the regulatory evaluation for the proposed rule. The estimated cost impact is $8,300 per B–747 per year operated. This consists of $6,800 in avoided fuel costs and $1,500 in avoided maintenance expenses. Boeing estimates an annual

cost increase of $4,780 per B–747. This consists of fuel costs of $1,080 and maintenance costs of $3,700. In light of these figures, an appropriate range of the potential per airplane annual cost increase of this final rule is from $5,000 to $8,000.

In summary, no additional cost/benefit information, which significantly alters the agency's original assessment of the proposed rule, was submitted in response to Notice No. 87–10.

Comments Beyond the Scope of the Proposals

The following are a number of comments that while relating to the overall issue of emergency evacuation are beyond the scope of this rulemaking:

- One commenter recommends a separate proposal to resolve the shortcomings and controversial aspects of simulated emergency evacuation demonstrations.
- British Airways recommends further evacuation testing to establish supportable, repeatable criteria rather than the subjective opinions expressed in Notice No. 87–10.
- McDonnel Douglas states that the issue is more complex than just distance alone and that the FAA should consider seat pitch, aisle width, door size, and seat density.
- ALPA states that the FAA should correlate distance to size of exit. For example, for less than a Type A exit, the maximum distance between exits should be 50 feet.
- Several commenters suggest that a flight attendant be required at each Type A emergency exit.

As stated earlier, this rulemaking focuses on exit-to-exit distances because an acceptable performance standard has not yet been developed. The FAA may address related issues, such as emergency evacuation demonstrations, cabin configuration, and location of flight attendants in other actions and in the deliberations of the emergency evacuation advisory committee. The recommendation by British Airways to conduct further evacuation testing before establishing criteria would only allow for a continuing increase in exit-to-exit distances. The FAA will continue to conduct research in emergency evacuations and will use such research results to increase the likelihood of passenger survival in emergencies. The FAA will also fully support and aggressively address the recommendations of the emergency evacuation advisory committee regarding proposal and adoption of a regulation implementing an evacuation performance standard.

Rule Clarifications

In addition to minor editorial corrections, the following specific changes have been made to the proposed rule language that appears in Notice No. 87–10.

Section 25.2

The phrase, "involving an increase in distance between any adjacent passenger emergency exits," in proposed § 25.2(b) has been replaced with the words "for an airplane manufactured after October 16, 1987,". This change makes the language of § 25.2 consistent with § 21.183(f) and clarifies the intent that § 25.2(b) applies only to newly-manufactured airplanes.

Sections 25.807(c)(7) and 121.310(m)

One commenter notes that the distance from the furthest upper deck seat (down the staircase) to a main deck exit in the B–747 is greater than 30 feet. This commenter recommends that the distance to the exit on the upper deck should be allowed to meet the rule. Two other commenters emphasize that both distances (seat-to-exit and exit-to-exit) should be measured parallel to an airplane's longitudinal centerline axis.

The intent is for each distance to be measured along a line parallel to an airplane's longitudinal axis for exits on the same deck and on the same side of the fuselage. The wording in the rule has been changed to accommodate these concerns, to clarify that adjacent exits are on the same side of the same deck, and to set a limit on exit-to-exit distance only on the same side of the same deck.

In addition, proposed §§ 25.807(c)(7) and 121.310(m)(1) have been withdrawn because they are redundant with respect to existing requirements. (Proposed § 25.807(c)(8) has been renumbered § 25.807(c)(7) in this final rule.) Section 25.807(c) currently requires that at least one floor level exit per side be located near each end of the cabin. Therefore, for a passenger seat located aft of the aft-most exit or forward of the forward-most exit, the escape path distance will not be excessive.

Regulatory Evaluation Summary

The regulatory evaluation prepared for this rule considers costs and benefits associated with amendments to Parts 21, 25, and 121 to limit passenger emergency escape path distance by establishing a standard that limits the distance any exit may be from an adjacent exit (no more than 60 feet).

The potential impact of this rule falls primarily on U.S. airline operators of B–746 airplanes. Although no B–747 airplane currently in use by U.S. air carriers has an exit-to-exit distance greater than 60 feet, a loss of potential revenues could occur if any U.S. air carrier intended to deactivate two exit doors from B–747 airplanes thereby increasing exit-to-exit distances beyond the standard limit established in this rulemaking.

This rule could have a potential impact on operators of Lockheed Model L–1011–385–3 (L–1011–500) airplanes. These airplanes are no longer in production and those currently in existence in U.S. air carrier service have been excluded from the requirements of this rulemaking. Noncomplying L–1011–500's may not enter Part 121 operations after October 16, 1987. The L–1011–500's owned by foreign operators before October 16, 1987, cannot be used by a Part 121 operator unless they are modified to comply with the exit distance requirements. To modify such an airplane is prohibitively expensive.

After reviewing the comments received on Notice No. 87–10, the FAA has revised its regulatory evaluation of this final rule. No U.S. air carrier indicated any interest in deactivating emergency exits on its existing B–747 airplanes or ordering new airplanes with exits deactivated even if regulations allowed such deactivation. The ATA, which represents U.S. air carriers, stated in its comments, "Few ATA members are directly affected by the proposed limitations on seat/exit locations; those which are directly affected have, for reasons of their own, elected to restrict their future airplane seat/exit locations to those which comply with the proposed limits." Therefore, the FAA concludes that the final rule will not have an effect on the revenues of U.S. air carriers because it incorporates current industry practice into regulation.

There may be some unquantifiable safety or cost effects on firms which produce executive configurations of airline transport category airplanes. Some of these newly-manufactured airplanes may be affected by the final rule. However, since most executive conversions are destined for overseas customers, any such airplanes which did not meet the final rule could be accommodated under the deviation authority of Part 21.

A benefit of the final rule is that it will ensure that the current level of safety of B–747 airplanes used in Part 121 operations is maintained by precluding the deactivation of emergency exits. The rule also will prevent any decrease in safety related to emergency exit distances in future airplane designs when compared to current airplanes by establishing an exit-to-exit distance standard.

Regulatory Flexibility Determination

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

This final rule will not have a significant economic impact, positive or negative, on a substantial number of small entities. This regulation will potentially impact primarily two types of entities: the manufacturer of B–747 airplanes and airline operators whose fleets contain B–747 airplanes.

The FAA size threshold for determination of a small entity for aircraft manufacturers is 75 employees; that is, any aircraft manufacturer with more than 75 employees is considered not to be a small entity. The Boeing Company, manufacturer of the B–747 airplane, is not a small entity.

The FAA size threshold for a determination of a small entity for aircraft operators is 9 owned aircraft; that is, any operator with more than 9 owned aircraft is considered not to be a small entity. The FAA threshold for a substantial number of small entities is one third and at least eleven of the small entities must be impacted. There are less than eleven small entities that own B–747 airplanes.

International Trade Impact Assessment

This rule is not expected to have any measurable impact on international trade. Although some foreign operators could modify their airplanes by deactivating exit doors, such an action would not result in any serious competitive disadvantages for U.S. operators doing business abroad. This assessment is based on the fact that some foreign operators have already deactivated exit doors and this practice is not expected to continue to any great extent because virtually all of the world fleet operators, on average, are flying below their maximum seating capacity. Thus, this rule is expected to have no measurable impact on the trade opportunities for U.S. operators doing business abroad or for foreign operators doing business in the United States.

Federalism Implications

These regulations are issued under the authority of the Federal Aviation Act (Act) of 1958, as amended (49 U.S.C. 1301 et seq.).

The regulations adopted herein will not have substantial direct effects on the states, on the relationship between the national government and the states, or on the distribution of power and responsibilities among the various levels of government. Thus, in accordance with Executive Order 12612, it is determined that this final rule will not have sufficient federalism implications to warrant the preparation of a Federalism Assessment.

Conclusion

For the reasons discussed in this preamble and based on the findings in the Regulatory Flexibility Determination and the International Trade Impact Assessment, the FAA has determined that this regulation is not major under Executive Order 12291. In addition, it is certified that this rule will not have a significant economic impact, positive or negative, or a substantial number of small entities under the criteria of the Regulatory Flexibility Act. This rule is considered significant under DOT Regulatory Policies and Procedures (44 FR 11034; February 26, 1979). A regulatory evaluation of the rule, including a Regulatory Flexibility Determination and Trade Impact Assessment, has been placed in the docket. A copy may be obtained by contacting the person identified under **"FOR FURTHER INFORMATION CONTACT."**

List of Subjects

14 CFR Part 21

Air transportation, Aircraft, Aviation Safety, Safety.

14 CFR Part 25

Air transportation, Aircraft, Aviation safety, Safety.

14 CFR Part 121

Air carriers, Air transportation, Aircraft, Airplanes, Airworthiness directives and standards, Aviation safety, Common carriers, Crashworthiness, Emergency evacuation, Safety, Transportation.

The Rule

Accordingly, the Federal Aviation Administration amends Parts 21, 25, and 121 of the Federal Aviation Regulations (14 CFR Parts 21, 25, and 121) as follows:

PART 21—CERTIFICATION PROCEDURES FOR PRODUCTS AND PARTS

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

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

2. By amending § 21.183 by adding a new paragraph (f) to read as follows:

§ 21.183 Issue of standard airworthiness certificates for normal, utility, acrobatic, commuter, and transport category aircraft; manned free balloons; and special classes of aircraft.

* * * * *

(f) *Passenger emergency exit requirements.* Notwithstanding all other provisions of this section, each applicant for issuance of a standard airworthiness certificate for a transport category airplane manufactured after October 16, 1987, must show that the airplane meets the requirements of § 25.807(c)(7) in effect on July 24, 1989. For the purposes of this paragraph, the date of manufacture of an airplane is the date the inspection acceptance records reflect that the airplane is complete and meets the FAA-approved type design data.

PART 25—AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY AIRPLANES

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

Authority: 49 U.S.C. 1344, 1354(a), 1355, 1421, 1423, 1424, 1425, 1428, 1429, 1430; 49 U.S.C. 106(g) (Revised Pub. L. 97–449, January 12, 1983); and 49 CFR 1.47(a).

4. By amending § 25.2 by redesignating the introductory text as paragraph (a), redesignating paragraphs (a), (b), (c) and (d) as paragraphs (a)(1), (a)(2), (a)(3) and (a)(4), respectively, and adding a new paragraph (b) to read as follows:

§ 25.2 Special retroactive requirements.

* * * * *

(b) Irrespective of the date of application, each applicant for a supplemental type certificate (or an amendment to a type certificate) for an airplane manufactured after October 16, 1987, must show that the airplane meets the requirements of § 25.807(c)(7) in effect on July 24, 1989.

5. By amending § 25.807 by adding a new paragraph (c)(7) to read as follows:

§ 25.807 Passenger emergency exits.

* * * * *

(c) * * *

(7) For an airplane that is required to have more than one passenger emergency exit for each side of the fuselage, no passenger emergency exit shall be more than 60 feet from any adjacent passenger emergency exit on the same side of the same deck of the fuselage, as measured parallel to the airplane's longitudinal axis between the nearest exit edges.

* * * * *

PART 121—CERTIFICATION AND OPERATIONS: DOMESTIC, FLAG, AND SUPPLEMENTAL AIR CARRIERS AND COMMERCIAL OPERATORS OF LARGE AIRCRAFT

6. The authority citation for Part 121 continues to read as follows:

Authority: 49 U.S.C. 1354(a), 1355, 1356, 1357, 1401, 1421 through 1430, 1472, 1485, and 1502; 49 U.S.C. 106(g) (Revised Pub. L. 97-449, January 12, 1983); and 49 CFR 1.47(a).

7. By amending § 121.310 by adding a new paragraph (m) to read as follows:

§ 121.310 Additional emergency equipment.

* * * * *

(m) Except as provided by § 121.627(c) and except for an airplane used in operations under this part on October 16, 1987, and having an emergency exit configuration installed and authorized for operation prior to October 16, 1987, for an airplane that is required to have more than one passenger emergency exit for each side of the fuselage, no passenger emergency exit shall be more than 60 feet from any adjacent passenger emergency exit on the same side of the same deck of the fuselage, as measured parallel to the airplane's longitudinal axis between the nearest exit edges.

Issued in Washington, DC, on June 16, 1989.

Robert E. Whittington,

Acting Administrator.

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