

Federal Aviation Administration – [Regulations and Policies](#)
Aviation Rulemaking Advisory Committee

Occupant Safety Issue Area
Performance Standards Working Group

Task 2 – Emergency Evacuation Requirements

Task Assignment

[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

**Aviation Rulemaking Advisory Committee; Emergency Evacuation Subcommittee;
Performance Standards Working Group--New Task**

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of new task assignment for the Performance Standards Working Group.

SUMMARY: Notice is given of a new task assignment for the Performance Standards Working Group from the Emergency Evacuation Subcommittee of the Aviation Rulemaking Advisory Committee. This notice informs the public of the activities of the Emergency Evacuation Subcommittee of the Aviation Rulemaking Advisory Committee.

FOR FURTHER INFORMATION CONTACT: Mr. William J. (Joe) Sullivan, Executive Director, Emergency Evacuation Subcommittee, Aircraft Certification Service (AIR-3), 800 Independence Avenue, SW., Washington, D.C. 20591, Telephone: (202) 267-9554; FAX: (202) 267-9562.

SUPPLEMENTARY INFORMATION:

The Federal Aviation Administration (FAA) established an Aviation Rulemaking Advisory Committee (56 FR 2190, January 22, 1991) which held its first meeting on May 23, 1991 (56 FR 20492, May 3, 1991). The Emergency Evacuation Subcommittee was established at that meeting to provide advice and recommendations to the Directors, FAA Aircraft Certification and Flight Standards Services, on regulatory standards for the purpose of enhancing the ability of passengers to quickly and safely evacuate an aircraft in an emergency. At its first meeting on May 24, 1991 (56 FR 20492, May 3, 1991), the subcommittee established the Performance Standards Working Group, and assigned it a task (56 FR 31993; July 12, 1991). At the subcommittee meeting held on November 21, 1991 (56 FR 58113; November 11, 1991), at Oklahoma City, OK, the subcommittee assigned an additional task to the Performance Standards Working Group:

Task: The Performance Standards Working Group is charged with making a recommendation to the Emergency Evacuation Subcommittee concerning new or revised emergency evacuation requirements and compliance methods that would eliminate or minimize the potential for injury to full scale demonstration participants.

Reports: The working group will develop and present to the Emergency Evacuation Subcommittee for consideration any combination of the following as it deems appropriate:

1. A draft Notice of Proposed Rulemaking proposing new emergency evacuation requirements with supporting economic and other required analysis, and any other collateral documents the working group determines appropriate; or
2. If new or revised requirements standards or compliance methods are not recommended, a draft report stating the rationale for those recommendations.

The working group chair (or his designee) should: (a) recommend organizational structure(s) and time line(s) for completion of this effort, including rationale, for subcommittee consideration at the meeting scheduled for January 24, 1992; (b) give a status report on this task at each meeting of the subcommittee; and (c) Give a detailed conceptual presentation to the subcommittee of the group's recommendations before proceeding with drafting of documents described in paragraphs 1 and 2 above.

The Performance Standards Working Group will be comprised of experts from those organizations having an interest in the task assigned to it. A working group member need not be a representative of one of the organizations of the parent Emergency Evacuation Subcommittee or of the full Aviation Rulemaking Advisory Committee. An individual who has expertise in the subject matter and wishes to become a member of the working group should write to the person listed under the caption "FOR FURTHER INFORMATION CONTACT" expressing that desire, describing his or her interest in the task, and stating the expertise he or she would bring to the working group. The request will be

reviewed with the subcommittee chair and working group leader, and the individual will be advised whether or not the request can be accommodated.

The Secretary of Transportation has determined that the information and use of the Aviation Rulemaking Advisory Committee and its subcommittees are necessary in the public interest in connection with the performance of duties imposed on the FAA by law. Meetings of the full committee and any subcommittees will be open to the public except as authorized by section 10(d) of the Federal Advisory Committee Act. Meetings of the Performance Standards Working Group will not be open to the public, except to the extent that individuals with an interest and expertise are selected to participate. No public announcement of working group meetings will be made.

Issued in Washington, DC, on January 3, 1992.

/s/

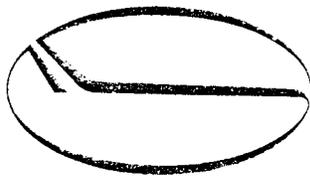
William J. Sullivan

Executive Director

Emergency Evacuation Subcommittee

Aviation Rulemaking Advisory Committee

Recommendation Letter



Air Transport Association

Notice ARAC
20
A. J. Broderick
done

November 18, 1993

Mr. Anthony J. Broderick
Associate Administrator for Regulation & Certification (AVR-1)
Federal Aviation Administration
800 Independence Avenue, S.W.
Washington, D.C. 20591

Dear Tony:

It's a pleasure to forward the attached draft Notice of Proposed Rulemaking to you for consideration as a rulemaking project. The draft, "Revision of Emergency Evacuation Demonstration Procedures to Improve Participant Safety," is the product of the Emergency Evacuation interest area of the Aviation Rulemaking Advisory Committee (ARAC). The draft was unanimously approved at the ARAC meeting held today to discuss Emergency Evacuation issues. A preliminary regulatory evaluation (prepared by APO) and a WP5.1 disk version of the draft are also enclosed.

The Performance Standards Working Group is continuing to develop advisory materials which address certification procedures for emergency evacuations. It is likely that these materials will be available late in 1994.

In a related action, the working group has established a separate task group to begin developing a framework for performance standards for emergency evacuation. We have asked the working group to complete a "concept" version of that framework by summer 1994. We'll keep you apprised of progress.

Sincerely,

Steven R. Erickson
Assistant Chair
Aviation Rulemaking Advisory
Committee
Emergency Evacuation Issues

Attachments

cc: Joe Sullivan, FAA (AIR-3)
Ron Wojnar, FAA (ANM-100)
Lew Lebakken, FAA (ARM-205)
Frank Tiangsing, FAA (ANM-114)
Jay Anema, Boeing
Jim Casey, ATA
Don Collier, ATA

Acknowledgement Letter



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

800 Independence Ave., S.W.
Washington, D.C. 20591

DEC 10 1993

Mr. Steven R. Erickson
Assistant Chairman
Aviation Rulemaking Advisory Committee
Air Transport Association of America
Washington, DC 20004-1707

Dear Steve:

Thank you for your November 18 letter with which you transmitted a recommendation of the Aviation Rulemaking Advisory Committee. You provided a notice of proposed rulemaking (NPRM) concerning "Revision of Emergency Evacuation Demonstration Procedures to Improve Participant Safety." The Federal Aviation Administration (FAA) accepts this recommendation provided there are no legal or other reasons why we cannot adopt it.

The complete rulemaking package will be reviewed and coordinated within the FAA and the Offices of the Secretary of Transportation and Management and Budget. The FAA will publish the NPRM for public comment as soon as the coordination process is complete. We will make every effort to handle this recommendation expeditiously.

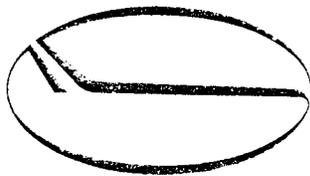
I would like to thank the Aviation Rulemaking Advisory Committee, and particularly the Performance Standards Working Group, for its action on this task.

Sincerely,



Anthony J. Broderick
Associate Administrator for
Regulation and Certification

Recommendation



Air Transport Association

Notice ARAC
20
A. J. Broderick
done

November 18, 1993

Mr. Anthony J. Broderick
Associate Administrator for Regulation & Certification (AVR-1)
Federal Aviation Administration
800 Independence Avenue, S.W.
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Steven R. Erickson
Assistant Chair
Aviation Rulemaking Advisory
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[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

[14 CFR Part 25]

[Docket No. ; Notice No.]

RIN:

Revision of Emergency Evacuation Demonstration Procedures to
Improve Participant Safety

AGENCY: Federal Aviation Administration, DOT.

ACTION: Notice of proposed rulemaking.

SUMMARY: This notice proposes to amend Part 25 of the Federal Aviation Regulations (FAR) by revising Appendix J, Emergency Evacuation to allow certain alternative procedures in conducting full-scale emergency evacuation demonstrations for transport category airplanes. These proposals are in response to recommendations from the Performance Standards Working Group (PSWG) of the Aviation Rulemaking Advisory Committee (ARAC). The proposed changes, which are intended to make full-scale emergency evacuation demonstrations safer for participants and to codify existing practices, would also affect manufacturers and operators of transport category airplanes.

DATE: Comments must be received on or before [insert date 30 days from date of publication].

ADDRESSES: Comments on this notice may be mailed in duplicate to: Federal Aviation Administration, Office of the Chief Counsel, Attention: Rules Docket (AGC-10), Docket No. xxx, 800 Independence Avenue S.W., Washington, D.C. 20591; or delivered in duplicate to: Room 915G, 800 Independence Avenue S.W., Washington, D.C. 20591. Comments delivered must be marked Docket No. xxx. Comments may be examined in Room 915G weekdays, except Federal holidays, between 8:30 a.m. and 5:00 p.m. In addition, the FAA is maintaining an information docket of comments in the Office of the Assistant Chief Counsel (ANM-7), Federal Aviation Administration, Northwest Mountain Region, 1601 Lind Avenue S.W., Renton, Washington 98055-4056. Comments in the information docket may be examined in the Office of the Assistant Chief Counsel weekdays, except Federal holidays, between 7:30 a.m. and 4:00 p.m.

FOR FURTHER INFORMATION CONTACT: Franklin Tiangsing, Regulations Branch, ANM-114, Transport Airplane Directorate, Aircraft Certification Service, FAA, 1601 Lind Avenue S.W., Renton, Washington 98055-4056; telephone (206) 227-2121.

SUPPLEMENTARY INFORMATION:

Comments Invited

Interested persons are invited to participate in this proposed rulemaking by submitting such written data, views,

or arguments as they may desire. Comments relating to any environmental, energy, or economic impact that might result from adopting the proposals contained in this notice are invited. Substantive comments should be accompanied by cost estimates. Commenters should identify the regulatory docket or notice number and submit comments in duplicate to the Rules Docket address above. All comments received on or before the closing date for comments will be considered by the Administrator before taking action on this proposed rulemaking. The proposals contained in this notice may be changed in light of comments received. All comments received will be available in the Rules Docket, both before and after the comment period closing date, for examination by interested persons. A report summarizing each substantive public contact with FAA personnel concerning this rulemaking will be filed in the docket. Persons wishing the FAA to acknowledge receipt of their comments must submit with those comments a self-addressed, stamped postcard on which the following statement is made: "Comments to Docket No. xxx." The postcard will be date stamped and returned to the commenter.

Availability of the NPRM

Any person may obtain a copy of this notice by submitting a request to the Federal Aviation Administration (FAA), Office of Public Affairs, Attention: Public Information Center, APA-430, 800 Independence Avenue S.W.,

Washington, D.C. 20591; or by calling (202) 267-3484. The notice number of this NPRM must be identified in all communications. Persons interested in being placed on a mailing list for future rulemaking documents should also request a copy of Advisory Circular No. 11-2A, Notice of Proposed Rulemaking Distribution System, which describes the application procedure.

Background

Part 25 of the Federal Aviation Regulations (FAR) contains the airworthiness standards for transport category airplanes. Manufacturers of transport category airplanes must show that each airplane they produce complies with the relevant standards of Part 25. These standards apply to airplanes manufactured within the U.S. and to airplanes manufactured in other countries and imported under a bilateral airworthiness agreement. One of the standards that must be met is that of demonstrating that passengers and crewmembers can be evacuated in a timely manner in an emergency. This standard is addressed by the requirements contained in § 25.803 and Appendix J to Part 25. This standard is intended to demonstrate emergency evacuation capability under a consistent set of prescribed conditions but is not intended to demonstrate that all passengers can be evacuated under all conceivable emergency conditions.

History of the Emergency Evacuation Regulations

Amendment 121-2, effective March 3, 1965, first introduced the requirements for an emergency evacuation demonstration to the Federal Aviation Regulations (FAR). Entities operating under Part 121 were required to conduct full-scale emergency evacuation demonstrations using 50 percent of the airplane's exits. Half of the exits were rendered inoperative to simulate the type of emergency where fire, structural, or other adverse condition would prevent those exits from being used. A time limit of 120 seconds was given. The demonstration was required upon initial introduction of a type and model of airplane into passenger carrying operations, an increase of 5 percent or greater in passenger seating capacity, or a major change to the interior arrangement that would affect emergency evacuation. The purposes of the demonstration were to demonstrate the ability of crewmembers to execute established emergency evacuation procedures, and to ensure realistic assignments of crewmember functions.

Amendment 25-15, effective October 24, 1967, introduced the emergency evacuation requirements into Part 25 of the FAR. Newly created § 25.803 required airplane manufacturers to conduct an emergency evacuation demonstration for airplanes with a passenger seating capacity of 44 or more. The purpose of this demonstration was to establish the evacuation capability of the airplane. The time limit for

this demonstration was established at 90 seconds. Concurrently, the time limit for the Part 121 demonstration was reduced to 90 seconds by Amendment 121-30, also effective October 24, 1967. This reduction was primarily attributable to significant gains made in the efficacy of devices, such as inflatable slides, to assist in the evacuation. The purpose of the Part 121 demonstration still focused on crew training and crew procedures so that demonstration conditions remained somewhat different between the two Parts.

Section 25.803(d) listed conditions under which analysis could be used in lieu of a full-scale demonstration to demonstrate compliance with the regulation. The section stated that the full-scale demonstration did not have to be repeated for a change in the interior arrangement, or for an increase in passenger capacity of less than five percent, if it could be substantiated by analysis that all occupants could be evacuated in less than 90 seconds.

Amendment 25-46, effective December 1, 1978, revised § 25.803 to allow means other than actual demonstration to show the evacuation capability of the airplane and to replace the existing Part 25 demonstration conditions with conditions that would satisfy both Part 25 and Part 121. In this way, one demonstration could be used to satisfy both requirements. In addition, Amendment 25-46 revised § 25.803 to allow analysis to be used to substantiate compliance for

an increase in seating capacity of more than five percent. Part 121 was revised, by Amendment 121-149, effective December 1, 1978, to accept the results of demonstrations conducted in compliance with § 25.803 as of Amendment 25-46.

Amendment 25-72, effective August 20, 1990, placed the demonstration conditions previously listed in § 25.803(c) into a new Appendix J to Part 25. This change was done for clarity and editorial consistency with Part 121. In addition, emergency escape route requirements formerly contained in § 25.803(e) were transferred to a new § 25.810(c).

Amendment 25-79, effective September 27, 1993, revised Appendix J to Part 25 by revising the age/gender mix to be used when running an emergency evacuation demonstration, by allowing the use of stands or ramps for descending from overwing exits only when the airplane is not equipped with an off-wing descent means, and by prohibiting the flight crew from taking an active role in assisting in the passenger cabin.

Amendment 121-233, effective September 27, 1993, revised § 121.291 to allow demonstrations in compliance with § 25.803 in effect on or after December 1, 1978, and not just in effect on December 1, 1978, to satisfy the requirements of § 121.291.

The Aviation Rulemaking Advisory Committee

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

There are approximately 60 member organizations on the committee, representing a wide range of interests within the aviation community. Meetings of the committee are open to the public, except as authorized by Section 10(d) of the Federal Advisory Committee Act.

The ARAC establishes working groups to develop proposals to recommend to the FAA for resolving specific issues. Tasks assigned to working groups are published in the Federal Register. Working group meetings are not generally open to the public; however, all interested persons are invited to become working group members when the group is formed. Working groups report directly to ARAC, and the ARAC must adopt a working group proposal before that proposal can be presented to the FAA as an ARAC recommendation.

The activities of the ARAC will not, however, circumvent the public rulemaking procedures. After an ARAC recommendation is received and found acceptable by the FAA, the agency proceeds with the normal public rulemaking procedures. Any ARAC participation in a rulemaking package will be fully disclosed in the public docket.

Activities of the Performance Standards Working Group

On May 23, 1991, the first meeting of the Aviation Rulemaking Advisory Committee was held in Baltimore, Maryland, pursuant to a notification in the Federal Register (56 FR 2190, January 22, 1991).

Members of ARAC interested in issues involving emergency evacuation met on May 24, 1991, in Baltimore. At that meeting the charter for a working group that would report to ARAC was established as well as the group membership, which includes representatives from airplane and parts manufacturers, pilot, flight attendant and machinist unions, airlines, airworthiness authorities, passenger associations and other public interest groups. This diverse working group includes representatives from the United States, Canada, and Europe. The charter of the working group is to recommend to the ARAC whether new or revised emergency evacuation standards can and should be stated in terms of performance standards rather than design standards. The first meeting of the new Performance Standards Working

Group was held on June 26, 1991, and the group has continued to meet on a bi-monthly basis since then.

Following two unsuccessful emergency evacuation demonstrations of an airplane on October 26, 1991, for which increased seating capacity was sought, and during which a participant was seriously injured, the ARAC was tasked by the FAA to work on recommendations for revising the emergency evacuation demonstration requirements and compliance methods to eliminate or minimize the potential for injury to demonstration participants. The ARAC decided to add this task to the charter of the PSWG.

In response to this additional task, the PSWG created a draft report for discussion. The draft report consisted primarily of two significant parts: recommendations of changes that could be made to the current demonstration that would improve participant safety, but that would not alter the basic character of the demonstration; and, recommendations for when analysis could be used in lieu of the full scale demonstration, plus an outlined step-by-step methodology for preparing such an analysis. The former recommendation would require a revision to Appendix J to Part 25, while the latter recommendations would expand FAA guidance now in Advisory Circular 25.803-1, Emergency Evacuation Demonstrations. The report was revised numerous times, over several PSWG meetings, based on comments from PSWG members. Nonetheless, after numerous attempts to

develop a report that was acceptable to all members of the working group, it was determined that a consensus on the full report could not be attained. Areas of disagreement were, however, defined and discussed in an attempt to reach consensus. Representatives of three organizations on the PSWG have written letters stating their objections to the report as finalized. These letters are included as Appendix 2 of the report. In summary, the objectors expressed concern that the committee did not systematically review the causes of injuries in emergency evacuation demonstrations, and thus could not make meaningful recommendations to reduce or eliminate those injuries. Instead, the objectors felt that the committee had concentrated on an approach which would effectively eliminate the full scale demonstration. It should be noted that the comments are primarily aimed at the proposed revisions to the existing advisory circular and not to the revisions to Appendix J of Part 25 contained in this NPRM.

The PSWG accepted the report, although a consensus could not be reached on all issues covered in the report, after discussing all items members raised, including the letters of objection. The report was forwarded to the ARAC on January 28, 1993, and accepted by that body with one negative vote. The vote was taken after an opportunity was given to all members to raise questions or to discuss any item in the report. The ARAC then tasked the PSWG to draft

the appropriate rulemaking document and revise the advisory material as recommended in the report. This NPRM covers the recommended revisions to Part 25 covered in the report, "Emergency Evacuation Requirements and Compliance Methods that Would Eliminate or Minimize the Potential for Injury to Full Scale Evacuation Demonstration Participants." A copy of the report has been placed in the docket for examination by interested parties.

Injuries During Full Scale Emergency Evacuation Demonstrations

Hundreds of people jumping out of an airplane in simulated dark of night conditions onto inflated slides, sliding as many as 25 feet to the ground below, can result in some injuries. As stated in the PSWG report, FAA records ("An FAA Analysis of Aircraft Emergency Evacuation Demonstrations: 1982, Society of Automotive Engineers Technical Paper Series # 821486 by Sharon A. Barthelme") noted 166 injuries to participants in a sampling of seven full scale evacuation demonstrations conducted between 1972 and 1980, involving 2,571 passengers and crewmembers. Additionally, a review of 19 full scale evacuation demonstrations during the 1972-1991 time frame identified 269 injuries among 5,797 passengers and crewmembers. Detailed descriptions of most of the injuries discussed above are not available. Not all the injuries, therefore, could be classified as to their severity. Some injuries

have been serious; however, the majority probably would not be classified as serious (see 49 CFR 830.2 for injury classification definitions). To date, the most serious injury has resulted in paralysis.

Discussion of the Proposals

The FAA proposes amending Appendix J to Part 25, as recommended by the ARAC, to reduce the possibility of injury to participants in a full-scale emergency evacuation demonstration and to codify existing practice regarding airplanes equipped with overwing slides.

Paragraph (a) of Appendix J would be amended to allow exterior light levels of 0.3 foot-candles or less prior to the activation of the airplane emergency lighting system in lieu of the currently required "dark of night" conditions. The proposed light level is approximately the level that would be found in the passenger cabin when the emergency lighting system is the only source of illumination. Allowing this low level lighting outside the airplane will enhance the ability of the demonstration director to see and react more quickly to problems that may develop during the demonstration. While this would not prevent injuries incurred at the onset of the problems, it could result in reducing the number of injuries by halting the demonstration sooner than in the past. Tests were not run to ascertain whether or not such exterior ambient lighting would enhance or detract from evacuation performance, since it was

considered that crew performance, escape system efficiency, and illumination provided by the airplane emergency lighting system have the predominant impact on evacuation performance.

Paragraph (p) would be revised to allow exits with inflatable slides to have the slides deployed and available for use prior to the start of the demonstration timing. If this method is used, the exit preparation time, which would be established in separate component tests, would need to be accounted for in some manner. This change would prevent what has occurred in at least two instances, a participant exiting the airplane before the slide was fully available for use. In both cases, the participant was not seriously injured; however, if this event were to occur again, the potential for serious injury would remain. An additional benefit is that slides being pre-deployed and inflated would not be subject to damage from equipment, such as light stanchions, that is near the airplane only because a demonstration is being run. The predeployment and inflation of slides also allows the proper placement and opportunity for inspection of safety mats around the slide prior to the start of the demonstration. Additionally, the paragraph would be revised to require that the exits that are not used in the demonstration must be clearly indicated once the demonstration has started. This revision to the regulation would contain more general wording than currently in the

rule to accommodate the additional flexibility in exit configuration (slide stowed or pre-deployed and inflated) allowed by this proposal. Finally, the opening sentence in the paragraph would be revised to more succinctly describe the exits that are to be used in the demonstration. The exit pairs in the proposed regulation are as discussed in the passenger seating tables in § 25.807(d). As in the past, exits which are not installed in pairs, typically tail cone or ventral exits, would not be used in the demonstration. This proposal is in response to numerous requests to the FAA for clarification of the existing text.

Paragraph (f) would be revised to remove the requirement that each external door and exit be in the takeoff configuration. This proposal is a result of the proposed change to paragraph (p), noted above, which would allow slides to be deployed and inflated prior to the start of the demonstration. If the option to predeploy the slide is selected by the applicant, an agreement must be reached with the FAA prior to the demonstration regarding how to prevent demonstration participants from determining which exits will be used in the demonstration, as well as when, how, and by whom the covers (a likely solution to the issue) in the doorways will be removed and the impact on the resulting times for each of the used exits. Internal doors would still be required to be in takeoff configuration.

Paragraph (o) would be revised to state more generally the intent of the requirement rather than requiring specific actions. The intent is that participants inside the airplane should not be able to identify, prior to the start of the demonstration, which exits will be used during the demonstration. Although this may be made more difficult by the proposed change to paragraph (p), this change is not specifically related to reducing injuries.

Paragraph (n) would be revised to allow passengers to be briefed on safety procedures that are in place for the particular demonstration, e.g., demonstration abort procedures, or procedures that have to do with the demonstration site, e.g., how to evacuate the building in which the demonstration is being conducted, and to note when that briefing could take place. This briefing would be useful by stopping some participants from adding to an already potential injurious situation in the event of problems, such as a collapsed evacuation slide, occurring during the demonstration, or by providing information that would be helpful in case of a problem at the demonstration site, e.g. a fire in the building. The briefing would have to be carefully constructed so as not to impart any information that would enable the participants to evacuate the airplane faster. Additionally, the appropriate time for the passenger briefing required by § 121.571 has been added.

One of the recommendations, that paragraph (c) be amended to allow the use of stands or ramps for overwing exits only if assist means are not required as part of the airplane type design, is not being proposed because that change has already been implemented by Amendment 25-79.

Another of the recommendations, involving revising the age/gender mix to require using only the age/gender groups least susceptible to injury, is not being proposed at this time, pending research to identify the groups and develop an appropriate mix. A group of participants based on the new mix would have the same evacuation capability as a group based on the existing mix. This possible future proposal would be in addition to the recent change to the mix promulgated by Amendment 25-79.

In addition to the amendments to Part 25 proposed in this notice, revisions to Advisory Circular (AC) 25.803-1, Emergency Evacuation Demonstrations, are proposed in response to the recommendations contained in the ARAC report. Advisory Circular 25.803-1 provides guidelines that the FAA has found acceptable regarding emergency evacuation demonstrations. Public comments concerning the proposed revisions to AC 25.803 are invited by separate notice.

Although this notice does not propose to revise Part 121, there is a minor impact on airlines operating under Part 121 of the FAR. Section 121.291(a) requires that certificate holders must conduct an emergency evacuation

demonstration in accordance with paragraph (a) of Appendix D to Part 121, or in accordance with § 25.803 of Part 25. Section 25.803 incorporates by reference Appendix J of Part 25 which this notice proposes to revise.

Regulatory Evaluation Summary

Proposed changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 directs that each Federal agency shall propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs. Second, the Regulatory Flexibility Act of 1980 requires agencies to analyze the economic impact of regulatory changes on small entities. Finally, the Office of Management and Budget directs agencies to assess the effects of regulatory changes on international trade. In conducting these analyses, the FAA has determined that this rule: (1) would generate benefits that would justify its costs and is not a "significant regulatory action" as defined in the Executive Order; (2) is not significant as defined in DOT's Policies and Procedures; (3) would not have a significant impact on a substantial number of small entities; and (4) would not have a negative impact on international trade. These analyses, available in the docket, are summarized below.

The proposed rule would not necessarily result in additional compliance costs, because it would allow

alternative procedures in conducting demonstrations, rather than mandating them. If manufacturers elect to use the proposed procedures, however, the FAA estimates that there would be incremental costs of approximately \$1,100 per transport airplane certification.

The primary benefit of the proposed rule would be reduced risks of injuries to demonstration participants. Allowing low-level exterior light would enhance the ability of the demonstration director to react more quickly to problems which could develop during the demonstration. Pre-deploying and inflating slides would prevent participants from injuring themselves by exiting the airplane before the slides are fully available for use.

The FAA reviewed 19 demonstrations conducted between 1972 and 1991. Of the 5,797 participants in the demonstrations, 269, or 4.6 percent, were injured. In the seven demonstrations for which there was information on the types of injuries, 13 suffered fractures, 63 sprains or strains, 32 contusions, and 108 suffered lacerations or abrasions, a total of 216 people injured.

In one of these demonstrations, a participant was seriously injured. In general, however, fractures, sprains, strains, contusions, lacerations, and abrasions are generally classified as "minor" or "moderate," according to the abbreviated injury scale (AIS) used by the National Transportation Safety Board (NTSB). The FAA estimates that

the average costs of a minor injury are \$6,900 and the average costs of a moderate injury are \$44,000. Avoiding only one minor injury during an evacuation demonstration would result in cost savings exceeding the estimated \$1,100 incremental costs of the proposed alternative procedures. The FAA has determined, therefore, that the proposed rule would be cost-beneficial.

Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 (RFA) was enacted by Congress to ensure that small entities are not unnecessarily and disproportionately burdened by Federal regulations. The RFA requires a Regulatory Flexibility Analysis if a proposed rule would have a significant economic impact, either positive or negative, on a substantial number of small entities. Based on FAA Order 2100.14A, Regulatory Flexibility Criteria and Guidance, the FAA has determined that the proposed amendments would not have a significant economic impact on a substantial number of small entities because no small entities would be affected.

International Trade Impact Assessment

The proposed rule would not constitute a barrier to international trade, including the export of American airplanes to foreign countries and the import of foreign airplanes into the United States.

Conclusion

Because the proposed changes to revise the emergency evacuation demonstration requirements of Part 25 of the FAR are not expected to result in substantial economic cost, the FAA has determined that this proposed regulation would not be major under Executive Order 12291. Because this is an issue that has not prompted a great deal of public concern, the FAA has determined that this action is not significant under DOT Regulatory Policies and Procedures (44 FR 11034, February 25, 1979). In addition, since there are no small entities affected by this proposed rulemaking, the FAA certifies that the rule, at promulgation, would not have a significant economic impact, positive or negative, on a substantial number of small entities under the criteria of the Regulatory Flexibility Act. A copy of the regulatory evaluation prepared for this project may be examined in the Rules Docket or obtained from the person identified under the caption "FOR FURTHER INFORMATION CONTACT."

List of Subjects in 14 CFR Part 25

Air transportation, Aircraft, Aviation safety, Safety,
The Proposed Amendments

Accordingly, the Federal Aviation Administration (FAA) proposes to amend 14 CFR Part 25 of the Federal Aviation Regulations (FAR) as follows:

PART 25 - AIRWORTHINESS STANDARDS - TRANSPORT CATEGORY

AIRPLANES

1. The authority citation for Part 25 continues to read as follows: Authority: 49 U.S.C. app. 1344, 1354(a), 1355, 1421, 1423, 1424, 1425, 1428, 1429, 1430; 49 U.S.C. 106(g); and 49 CFR 1.47(a).

2. By amending Appendix J to Part 25 by revising paragraphs a, f, n, o, and p as follows:

Appendix J

* * * * *

(a) The emergency evacuation must be conducted with exterior ambient light levels of 0.3 foot-candles or less, prior to the activation of the airplane emergency lighting system. The source(s) of the initial exterior ambient light level may remain active or illuminated during the actual demonstration. There must, however, be no increase in the exterior ambient light level except for that due to activation of the airplane emergency lighting system.

* * * * *

(f) Each internal door or curtain must be in the takeoff configuration.

* * * * *

(n) Prior to entering the demonstration aircraft, the passengers may also be advised to follow directions of crewmembers but not be instructed on the procedures to be followed in the demonstration, except with respect to safety

procedures in place for the demonstration or which have to do with the demonstration site. Prior to the start of the demonstration, the pre-takeoff passenger briefing required by § 121.571 may be given. Flight attendants may assign demonstration subjects to assist persons from the bottom of a slide, consistent with their approved training program.

(o) The airplane must be configured to prevent disclosure of the active emergency exits to demonstration participants in the airplane, until the start of the demonstration.

(p) Exits used in the demonstration will consist of one exit from each exit pair. The demonstration may be conducted with the escape slides, if provided, inflated and the exits open at the beginning of the demonstration. In this case, all exits will be configured such that the active exits are not disclosed to the occupants. If this method is used, the exit preparation time for each exit utilized must be accounted for, and exits that are not to be used in the demonstration must not be indicated before the demonstration has started. The exits to be used must be representative of all of the emergency exits on the airplane and must be designated by the applicant, subject to approval by the Administrator. At least one floor level exit must be used.

* * * * *

Issued in Washington, D.C. on



**PRELIMINARY REGULATORY EVALUATION, INITIAL
REGULATORY FLEXIBILITY DETERMINATION,
AND TRADE IMPACT ASSESSMENT**

**PROPOSED RULE
REVISION OF EMERGENCY EVACUATION DEMONSTRATION
PROCEDURES TO IMPROVE PARTICIPANT SAFETY**

**14 CFR
PART 25 -- APPENDIX J**

**OFFICE OF AVIATION POLICY, PLANS, AND MANAGEMENT ANALYSIS
AIRCRAFT REGULATORY ANALYSIS BRANCH, APO-320**

**Marilyn DonCarlos
September 1993**

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EXECUTIVE SUMMARY

This regulatory evaluation examines the economic impacts of a proposed rule that would revise Appendix J -- Emergency Demonstration -- to part 25 of the Federal Aviation Regulations (FAR). The proposed rule would allow certain alternative procedures in conducting full-scale emergency evacuation demonstrations for transport category airplanes, with the aim of increasing safety to demonstration participants and providing regulatory relief to manufacturers and operators without affecting the results of the demonstrations. The proposed changes include allowing exterior light levels of 0.3 foot-candles or less prior to activation of the airplane emergency lighting system, rather than conducting the demonstration in simulated dark of night conditions, and allowing exits with inflatable slides to be opened with the slides deployed prior to the start of the demonstration timing, rather than prohibiting deployment until after the demonstration begins. Other proposed changes to Appendix J would be conforming, clarifying, or editorial.

The proposed rule would not necessarily result in additional compliance costs, because it would allow alternative procedures in conducting demonstrations, rather than mandate them. If manufacturers elect to use the proposed procedures, however, the FAA estimates that there would be incremental costs of approximately \$1,100 per demonstration. These costs would be insignificant in comparison to the total cost of an evacuation demonstration, estimated to range between \$500,000 and \$1,500,000.

The primary benefit of the proposed rule would be the reduced risks of injuries to demonstration participants. Allowing low-level exterior light would enhance the ability of the demonstration director to react more quickly to problems which could develop during the demonstration. Pre-deploying inflatable slides would prevent participants from injuring themselves by exiting the airplane before the slides are fully deployed. Avoiding only one minor injury during an evacuation demonstration would result in cost savings exceeding the estimated \$1,100 incremental costs of the proposed alternative procedures. The FAA has determined, therefore, that the proposed rule would be cost-beneficial.

The proposed rule would not have a significant economic impact, either positive or negative, on a substantial number of small entities under the Regulatory Flexibility Act, because no small entities would be affected. The proposed rule would not constitute a barrier to international trade, including the export of American airplanes to foreign countries and the import of foreign airplanes into the United States.

I. INTRODUCTION AND BACKGROUND

This document summarizes an economic analysis of a proposed rule that would revise Appendix J -- Emergency Demonstration -- to part 25 of the Federal Aviation Regulations (FAR). The proposed rule is part of a joint effort of the Federal Aviation Administration (FAA) and the Aviation Rulemaking Advisory Committee (ARAC) to increase the safety of participants in full-scale emergency evacuation demonstrations.

Emergency evacuation demonstrations have been required by the FAR since 1965, when part 121 operators were first required to conduct full-scale emergency evacuation demonstrations using half an airplane's exits.

Evacuation demonstration standards were introduced into part 25 in 1967, requiring transport airplane manufacturers to conduct demonstrations for airplanes with a passenger seating capacity of 44 or more. The requirements have been amended since that time, most recently on August 26, 1993, by Amendment Nos. 25-79 and 121-233.

Following two emergency evacuation demonstrations in 1991, both involving injuries and one in which a participant was seriously injured, the FAA tasked the ARAC to recommend revisions to the demonstration requirements and compliance methods that would reduce the potential for injury to demonstration participants. The ARAC, in turn, designated the Performance Standards Working Group (PSWG) to study the issue and make recommendations.

In response to this task, the PSWG developed a draft report¹ that:

1) recommended changes that would improve participant safety without altering the basic character of the demonstration; and 2) recommended when analysis could be used in lieu of full-scale demonstrations and outlined a step-by-step methodology for preparing such an analysis. The former recommendation would require a revision to Appendix J to part 25, while the latter could be incorporated into Advisory Circular (AC) 25.803-1, Emergency Evacuation Demonstrations.

The ARAC accepted the report and tasked the PSWG to draft a Notice of Proposed Rulemaking (NPRM) and a revision to the advisory circular for recommendation and submission to the FAA. The FAA agrees with the ARAC's recommendations and proposes to revise the FAR accordingly.

II. PROPOSED AMENDMENTS AND ESTIMATED COSTS

Part 25 -- Appendix J -- Emergency Demonstration

Appendix J defines the test criteria and procedures that must be used for showing compliance with § 25.803 -- Emergency evacuation. These criteria and procedures are defined in paragraphs (a) through (s). The proposed rule would amend five of these paragraphs.

¹ Performance Standards Working Group, Emergency Evacuation Subcommittee, Aviation Rule-Making Advisory Committee. Emergency Evacuation Requirements and Compliance Methods That Would Eliminate or Minimize the Potential for Injury to Full Scale Evacuation Demonstration Participants. January 1993.

Paragraph (a) would be amended to allow exterior light levels of 0.3 foot-candles or less prior to the activation of the airplane emergency lighting system. This exterior ambient light level could be maintained during the actual demonstration. The current rule requires that the emergency evacuation be conducted during actual or simulated "dark of night" conditions. The low-level lighting permitted in the proposed rule would enhance the ability of the demonstration director to see and react more quickly to problems which may develop during the demonstration (e.g., participants collecting at the bottom of exit slides).

The FAA estimates that it would take two engineers and two technicians 1/2 hour at burdened rates of \$60 and \$45 per hour, respectively, to prepare and adjust the lighting to the proposed level at a cost of \$105.²

The proposed rule would remove the requirement in paragraph (f) that the external doors and exits be in the takeoff configuration. No costs are associated with this proposed change. Depending on airplane design, predeployment of inflatable slides at exits (as proposed in paragraph (p)) might not be possible unless the exit doors are open.

² The estimated burdened labor cost for two engineers and two technicians for 1/2 hour would be $(2 \times \$60 + 2 \times \$45) \times 1/2 = \$105$.

Paragraph (n) would be amended to allow demonstration participants to be briefed only with respect to safety procedures in place for the demonstration or the demonstration site, such as demonstration abort procedures or procedures pertaining to the demonstration site. Flight attendants would be allowed to assign demonstration subjects to assist other participants from the bottom of the slide. The proposed rule would continue to prohibit passengers from being instructed on procedures to be followed in the demonstration. No costs are attributed to these proposed changes.

Paragraph (o) would be revised to require that the airplane be configured so that available emergency exits are not disclosed to participants. This revision states more generally the intent of the requirement rather than specific actions. Associated costs are described in proposed paragraph (p) below.

Paragraph (p) would be revised to allow exits with inflatable slides to be opened with the slides deployed prior to the start of the demonstration timing. The proposed rule would retain the current requirement that all exits would have to be configured so that the usable exits are not disclosed to participants prior to the demonstration. Manufacturers currently cover all windows to prevent participants from determining which exits will be usable in the demonstration. The FAA estimates that, under the proposed rule,

manufacturers would also cover exits with curtains, screens, or other means to prevent disclosure of active exits. These screening devices would cost approximately \$1,000 for labor and materials.³

Summary of Costs

The proposed rule would not necessarily result in additional compliance costs, because it would allow alternative procedures in conducting demonstrations, rather than mandating them. If manufacturers elect to use the proposed procedures, however, there would be an incremental cost of approximately \$1,100 per demonstration. These costs would be insignificant in comparison to the total cost of an evacuation demonstration, estimated to range between \$500,000 and \$1,500,000.

III. BENEFITS OF THE PROPOSED RULE

The primary benefit of the proposed rule would be reduced risks of injuries to demonstration participants. Allowing low-level exterior light would enhance the ability of the demonstration director to react more quickly to problems which could develop during the demonstration. Pre-deploying inflatable slides would prevent participants from injuring

³ Depending on future airplane designs, slides may be able to be deployed without opening the exits they serve. In those cases, there would be no costs for screening devices because it would not be necessary to cover the exit doors to prevent participants from determining which exits would be used.

themselves by exiting the airplane before the slides are fully deployed.

For purposes of this regulatory evaluation, the FAA reviewed 19 demonstrations conducted between 1972 and 1991. Of the 5,797 participants in the demonstrations, 269, or 4.6 percent, were injured. Information on the types of injuries was not available for all demonstrations. In seven demonstrations for which there was information, 216 people were injured: 13 suffered fractures, 63 sprains or strains, 32 contusions, and 108 suffered lacerations or abrasions. In one of these demonstrations, a participant was seriously injured.

Under the Abbreviated Injury Scale (AIS),⁴ fractures, sprains, strains, contusions, lacerations, and abrasions are generally classified as "minor" (AIS 1) or "moderate" (AIS 2) injuries. The average unit costs of AIS 1 and AIS 2, expressed in 1993 dollars, are shown in the table below.

⁴ The Abbreviated Injury Scale (AIS) was developed in 1969 by the American Medical Association's Committee on Medical Aspects of Automotive Safety. There are six major AIS categories which measure the severity of individual injuries. Minor injuries (AIS 1) are simple and may not require professional medical treatment. Moderate injuries (AIS 2) almost always require treatment but are not ordinarily life-threatening or permanently disabling.

TABLE 1

| AVERAGE UNIT COSTS OF AIS 1 AND AIS 2 INJURIES | | | |
|--|---|--------------------------|-------------|
| Injury Category | "Willingness-to-Pay" to Avoid Injury ⁵ | Other Costs ⁶ | Total Costs |
| AIS 1 | \$5,000 | \$1,870 | \$6,870 |
| AIS 2 | \$38,750 | \$5,210 | \$43,960 |

These estimates of the average costs of AIS 1 and 2 injuries are subject to variation and the threat to life that the injury makes. The collective willingness of society to pay to avoid fatalities and injuries is the measure used by the Department of Transportation to evaluate regulations and investments that improve transportation safety. These values are based on the findings of several researchers of individual travelers' willingness to pay for safety. Other costs include medical, legal, and other accident-related costs likely to be experienced by the remainder of society (i.e., other than the injured individuals).

Avoiding only one minor injury (i.e., AIS 1) during an evacuation demonstration would result in cost savings exceeding the estimated

⁵ U.S. Department of Transportation. Office of the Secretary of Transportation. Treatment of Value of Life and Injuries in Preparing Economic Evaluations. January 8, 1993.

⁶ U.S. Department of Transportation. Federal Aviation Administration. Office of Aviation Policy and Plans. ECONOMIC VALUES FOR EVALUATION OF FEDERAL AVIATION ADMINISTRATION INVESTMENT AND REGULATORY PROGRAMS. FAA-89-10. October 1989. Tables 9-A and 9-B, updated to 1993 dollars.

\$1,100 incremental costs of the proposed alternative procedures. The FAA has determined, therefore, that the proposed rule would be cost-beneficial.

IV. REGULATORY FLEXIBILITY DETERMINATION

The Regulatory Flexibility Act of 1980 (RFA) was enacted by Congress to ensure that small entities are not unnecessarily and disproportionately burdened by Federal regulations. The RFA requires agencies to review rule which may have "a significant economic impact on a substantial number of small entities." FAA Order 2100.14A⁷ outlines FAA's procedures and criteria for implementing the RFA.

An aircraft manufacturer must employ 75 or fewer employees to be designated as a "small" entity. A substantial number of small entities is defined as a number that is 11 or more and which is more than one-third of the small entities subject to a proposed or final rule. None of the manufacturers of transport category airplanes qualify as small entities under this definition. Therefore, the proposed rule would not have a significant economic impact on a substantial number of small entities.

⁷ Federal Aviation Administration. Regulatory Flexibility Criteria and Guidance. FAA Order 2100.14A. September 16, 1986.

V. INTERNATIONAL TRADE IMPACT ASSESSMENT

The proposed rule would not constitute a barrier to international trade, including the export of American airplanes to foreign countries and the import of foreign airplanes into the United States.

Recommendation Letter

James T. Likes
Director
Airplane Seat Processes
Engineering Division

Boeing Commercial Airplane Group
P.O. Box 3707 MS 07-57
Seattle, WA 98124-2207

August 27, 1997



Mr. Guy Gardner
Associate Administrator for Regulation and Certification (AVR-1)
Department of Transportation
Federal Aviation Administration
800 Independence Avenue Southwest
Washington, D.C. 20591

Dear Mr. Gardner:

I am enclosing a copy of a proposed revision to Technical Standard Order (TSO) C69b, Emergency Evacuation Slides, Ramps & Slide/Raft Combination dated June 5, 1997. This proposed revision to TSO C69b is the result of substantial effort by the Performance Standards Working Group (PSWG) to improve emergency evacuation safety. The focus of this proposed revision was to create an improved standard for all slides and slide/rafts in order to ensure that a more robust escape slide design would remedy some of the shortcomings that have been noted in recent years and incorporate the "lessons learned" into a revised TSO C69b.

This proposed revision was forwarded by the PSWG to the ARAC Emergency Evacuation Issues group. This proposal was unanimously approved at the July 24, 1997 meeting of the Emergency Evacuation Issues group.

It is noteworthy to pass on to you that several of the Issues group members believe slide lighting should be incorporated into the TSO. Specifically they felt that it should include provisions for a minimum lighting level of .01, homogeneity of slide lighting at a ratio of 1:20 and the use of a more appropriate metric, i.e. foot Lambert's, to measure lighting. Even though emergency-light levels and the adequacy of visibility of the escape slide are addressed in FAR 25.812, these Issue group members believe this should be incorporated into the slide TSO C69b. An effort to address this subject is being worked by the PSWG that may result in a proposed revision to FAR 25.812 scheduled for a vote at the EEIG meeting in November 1997.

Another concern was expressed by an Issues group member which involved the TSO process and the scope of minimum performance standards going beyond simply the piece of equipment and involving aircraft interface issues. This member requested that a note similar to the following, be added to the TSO:

Appendix 3, Evacuation Rate Testing, provides a test that is representative of the test criteria provided in FAR Part 25, Appendix J. A successful Appendix J test demonstrates compliance with FAR 25.803 and must account for a typical evacuee response to prevalent lighting under emergency evacuation conditions. While emergency lighting is not a specific requirement of this TSO, the slide dispatch, slide location when extended and material reflectance of the slide can obviously affect aircraft lighting conditions simulated for Appendix J test criteria. TSO holders who are not impacted by the aircraft lighting requirements of FAR 25.812 may choose to submit an alternate test program for FAA approval than that provided by Appendix 3.

The PSWG felt that in order for the TSO to have a meaningful approval, other related issues of interface to the aircraft have to be included. This is true of other items utilizing the TSO process where the complexity of interface is significant to the article being able to perform its safety function. It may be appropriate in the future for this subject to be reviewed and clarified in the TSO process.

In closing, I believe this proposal will provide a standard for equipment approval which improves the safe use and reliability of escape slides during emergency evacuations.

Sincerely,



James T. Likes
Assistant ARAC Chair
Emergency Evacuation Issues

Enclosure

cc: Frank Tiangsing
Joseph Hawkins
William Shook



Acknowledgement Letter



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

800 Independence Ave., S.W.
Washington, D.C. 20591

NOV 12 1997

Mr. James T. Likes
Aviation Rulemaking Advisory Committee
Boeing Commercial Airplane Group
P.O. Box 3707, MS 07-57
Seattle, WA 98124-2207

Dear Mr. Likes:

Thank you for your letter forwarding the Aviation Rulemaking Advisory Committee (ARAC) recommendation for a proposed revision to Technical Standard Order (TSO) C69b, Emergency Evacuation Slides, Ramps & Slide/Raft Combination.

The recommendation was submitted in a format suitable for processing and, therefore, will be presented to FAA management as quickly as possible. If management agrees with the recommendation, it will be published in the Federal Register.

I want to thank the aviation community for its commitment to ARAC and its expenditure of resources to develop this recommendation. We in the FAA pledge to process it expeditiously as a priority action.

Again, let me thank the ARAC Performance Standards Working Group for its action on this task.

Sincerely,

 Guy S. Gardner
Associate Administrator for
Regulation and Certification

Recommendation



Department of Transportation
Federal Aviation Administration
Aircraft Certification Service
Washington, DC

PROPOSED TECHNICAL STANDARD ORDER

Attached is proposed Technical Standard Order (TSO) C69c, Emergency Evacuation Slides, Ramps, and Slide/Raft Combinations, for your review and comment.

Comments submitted must be received on or before April 24, 1998, and must identify the TSO file number shown in the Federal Register notice dated January 21, 1998, Vol. 63, Pages 3181. Send all comments on the proposed TSO to:

Federal Aviation Administration
Technical Programs and Continued Airworthiness
Branch, AIR-120
Aircraft Engineering Division
Aircraft Certification Service - File No. TSO-C69c
800 Independence Avenue, SW.
Washington, DC 20591

**DISTRIBUTION: ZVS-326;A-W(FS)-3;A-X9CD)-4;A-FFS-1,2,7,8(LTD);
A-FAC-0(MAX);AVN-1(2cys)**



Department of Transportation
Federal Aviation Administration
Aircraft Certification Service
Washington, DC

TSO-C69c

Effective
Date: Draft

Technical Standard Order PROPOSED

**Subject: EMERGENCY EVACUATION SLIDES, RAMPS,
AND SLIDE/RAFT COMBINATIONS**

1. PURPOSE: This Technical Standard Order (TSO) prescribes the minimum performance standards (MPS) that emergency evacuation slides, ramps and slide/raft combinations must meet to be identified with the applicable TSO marking:

- Type I- Inflatable Slide
- Type II- Inflatable Slide/Raft
- Type III- Inflatable Exit Ramp
- Type IV- Inflatable Exit Ramp/Slide

2. APPLICABILITY:

a. This TSO is effective for new applications submitted after the effective date of this TSO. All prior revisions of this TSO are no longer effective after the effective date of this TSO. However, applications submitted against the previous version of this TSO will be accepted up to six months after the effective date of this TSO.

b. Emergency evacuation slides, ramps and slide/raft combinations approved under a previous TSO authorization may continue to be manufactured under the provisions of their original approval. However, major design changes to emergency evacuation slides, ramps and slide/raft combinations approved under previous versions of this TSO require a new authorization under this TSO, per 14 CFR 21.611(b).

3. REQUIREMENTS: New models of emergency evacuation slides, ramps and slide/raft combinations that are to be so identified and that are manufactured on or after the effective date of this TSO must meet the MPS set forth in APPENDIX 1, "Federal Aviation Administration Standard for Emergency Evacuation Slides, Ramps and Slide/Raft Combinations."

a. **Functionality.** The standards of this TSO apply to equipment intended to provide emergency evacuation or evacuation/flotation for aircraft occupants.

TSO-C69c

b. Deviations. The FAA has provisions for using alternative or equivalent means of compliance to the criteria set forth in the MPS of this TSO. Applicants invoking these provisions shall demonstrate that an equivalent level of safety is maintained and shall apply for a deviation in accordance with 14 CFR 21.609.

4. MARKING. In accordance with 14 CFR 21.607(d), articles manufactured under this TSO must be marked as follows:

a. At least one major component must be permanently and legibly marked with all of the information listed in 14 CFR Part 21.607(d), except for the option provided in 14 CFR 21.607(d)(3), where the date of manufacture must be used in lieu of the optional serial number. The component also must be marked with the applicable emergency evacuation device type: "Type I, Type II, Type III, or Type IV."

b. In addition to the requirements of 14 CFR 21.607(d), each separate component that is easily removable (without hand tools) and/or is an interchangeable element or a separate sub-assembly of the article must be permanently and legibly marked with at least the name of the manufacturer, manufacturer's part number, and the TSO number.

5. DATA REQUIREMENTS.

a. Application Data. In accordance with 14 CFR 21.605(a)(2), the manufacturer must furnish the Manager, Aircraft Certification Office (ACO), Federal Aviation Administration (FAA), having purview of the manufacturer's facilities, one copy each of the following technical data to support the FAA design and production approval:

(1) Operating instructions and equipment limitations. The limitations shall be sufficient to describe the operational capability of the equipment.

(2) Installation procedures and limitations. The limitations shall be sufficient to ensure that the article, when installed in accordance with the installation procedures, continues to meet the requirements of this TSO. The limitations shall also be sufficient to identify any unique aspects of the installation. The limitations also shall include a note with the following statement:

"The conditions and tests required for TSO approval of this article are minimum performance standards. It is the responsibility of those installing this article either on or within a specific type or class of aircraft to determine that the aircraft installation conditions are within the TSO standards. TSO articles must be approved for installation. The article may be installed only if the installation is performed in accordance with 14 CFR Part 43 or the applicable airworthiness requirements."

(3) Schematic drawings as applicable to the installation procedures.

(4) Wiring diagrams as applicable to the installation procedures.

(5) List of components, by part number, that make up the emergency evacuation slide, ramp or slide/raft combination system complying with the standards prescribed in this TSO.

(6) Instructions for periodic maintenance, calibration and repair which are necessary for continued airworthiness once the emergency evacuation slide, ramp or slide/raft combination is installed, including recommended inspection intervals and service life.

(7) Material and process specifications.

(8) The quality control functional test specification to be used to test each production article to ensure compliance with this TSO, as required by 14 CFR 21.605(a)(3) and 21.143(a).

(9) Manufacturer's TSO qualification test report.

(10) Nameplate drawing.

(11) A drawing list, enumerating all of the drawings and processes that are necessary to define the article's design. In the case of a minor change, any revisions to the drawing list need only be made available upon request.

b. Manufacturer Data. In addition to the data that are to be furnished directly to the FAA, each manufacturer must have available for review by the manager of the ACO having purview of the manufacturer's facilities, the following technical data:

(1) The functional qualification specifications to be used to qualify each production article to ensure compliance with this TSO.

(2) Equipment calibration procedures.

(3) Corrective maintenance procedures within 12 months after TSO authorization.

(4) Schematic drawings.

c. Furnished Data. One copy of the technical data and information specified in paragraphs 5.a.(1) through (6) of this TSO and any other data or information that are necessary for the proper installation, certification and use and/or for continued airworthiness of the emergency evacuation slide, ramp or slide/raft combination must accompany each article manufactured under this TSO.

6. AVAILABILITY OF REFERENCED DOCUMENTS.

a. Appendix 1, "Federal Aviation Administration Standards for Emergency Evacuation Slides, Ramps and Slide/Raft Combinations," of this TSO specifies certain test methods that are contained in the FTMS No. 191 and 191A, unless otherwise noted. These test methods may be obtained or purchased from the General Services Administration, Business Service Center, Region 3, 7th and D Streets, S.W. Washington, DC 20407.

b. Appendix 1, "Federal Aviation Administration Standards for Emergency Evacuation Slides, Ramps and Slide/Raft Combinations," of this TSO specifies certain test methods that are contained in ASTM Standard Test Method D1434-82. This test method may be obtained or purchased from American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

c. Federal Aviation Regulations 14 CFR Part 21, Subpart O, 14 CFR Part 25 and 49 CFR 178 may be purchased from the Superintendent of Documents, Government Printing Office, Washington, DC 20402-9325. Advisory Circular 20-110, Index of Aviation Technical Standard Orders," and AC 20-115 may be obtained from the U.S. Department of Transportation, Utilization and Storage Section, SVC-121.23, Washington, DC 20590.

Abbas Rizvi
Acting Manager, Aircraft Engineering Division
Aircraft Certification Service

**APPENDIX 1. FEDERAL AVIATION ADMINISTRATION STANDARD FOR
EMERGENCY EVACUATION SLIDES, RAMPS, AND
SLIDE/RAFT COMBINATIONS**

1. Purpose. This standard provides the minimum performance standards for inflatable emergency evacuation slides, overwing exit ramps, and slide/raft combinations. However, the deployment and erection characteristics for these devices, as installed on the aircraft, are specified in Title 14 of the Code of Federal Regulations (14 CFR) § 25.810 and must be complied with along with the requirements in this TSO.

2. Scope. This performance standard provides for the following types of emergency evacuation devices:

Type I- Inflatable slide suitable for assisting occupants in descending to the ground from a floor-level aircraft exit or from an aircraft wing.

Type II- Inflatable slide also designed to be used as a liferaft, i.e. a slide/raft.

Type III- Inflatable exit ramp suitable for assisting occupants in descending to an aircraft wing from a certain type of overwing exit.

Type IV- Combination inflatable exit ramp and wing-to-ground slides.

3. Materials. The materials used must be of a quality which experience and/or tests have demonstrated to be suitable for use in emergency evacuation slides, ramps, and slide/raft combinations, i.e. emergency evacuation devices.

3.1 Nonmetallic Materials.

3.1.1 The finished device must be clean and free from any defects that might affect its function.

3.1.2 Coated fabrics and other items such as webbing subject to deterioration must have been manufactured not more than 18 months prior to the date of manufacture of the finished product or requalified per paragraph 5.1, Material Tests, of this appendix.

3.1.3 The materials must not support fungus growth.

3.1.4 Materials used in the construction of flotation chambers and decks for Type II devices must be capable of withstanding the detrimental effects of exposure to fuels, oils, hydraulic fluids, and sea water.

3.1.5 Coated Fabric. Coated fabrics, including seams, which are subject to deterioration and used in the manufacture of the devices, must retain at least 90 percent of their original physical properties after these fabrics have been subjected to the accelerated aging test specified in paragraph 5.1, Material Tests, of this appendix.

3.1.5.1 Strength. Coated fabrics used for these applications must conform to the following minimum strengths after aging:

Tensile Strength (Grab Test)

Warp 190 pounds/inch

Fill 190 pounds

Tear Strength (Trapezoid Test or Tongue Test)

Non walking/sliding surface: 13 x 13 pounds/inch (minimum)

Walking/Sliding surface: 50 x 50 pounds/inch (minimum)

Puncture Strength

Walking/Sliding surface: 67 pounds force

3.1.5.2 Adhesion. In addition to the strength requirements of paragraph 3.1.5.1 above, coated fabrics must meet the following minimum strengths after aging:

Ply Adhesion

5 pounds/inch width at 70 ± 2 degrees F at a separation rate of 2.0 to 2.5 inches/minute

Coat Adhesion

5 pounds/inch width at 70 ± 2 degrees F at a separation rate of 2.0 to 2.5 inches/minute

3.1.5.3 Permeability. For coated fabrics used in the manufacture of inflation chambers, the maximum permeability to helium may not exceed 10 liters per square meter in 24 hours at 77 degrees F, or its equivalent using hydrogen, using either of the permeability test methods specified in paragraph 5.1 of this appendix. The permeameter must be calibrated for the gas used. In lieu of either of these permeability tests, an alternate test may be used provided the alternate test has been approved as an equivalent to this permeability test by the manager of the FAA office to which this TSO data is to be submitted, as required in paragraphs 3.b, Deviations and 5.a, Application Data, of this TSO.

3.1.5.4 Hydrolysis. Pressure holding coated fabrics, including seams, must be shown to be resistant to hydrolysis. It must be shown by tests specified in paragraph 5.1 of this appendix that the porosity of the basic pressure holding material is not increased as a result of the material being subjected to hydrolysis conditioning. Seam strength and coat adhesion must not be reduced more than 20% and still not fall below the minimums prescribed in paragraphs 3.1.5.2 and 3.1.6 of this appendix as a result of hydrolysis conditioning.

3.1.6 Seam Strength and Adhesives. Seams used in the manufacture of the device must meet the following minimum strength requirements:

Shear Strength (Grab Test)

175 pounds/inch width at 75 degrees F

40 pounds/inch width at 140 degrees F

Peel Strength (Peel Test)

5 pounds/inch width at 70 degrees F

3.1.7 Seam Tape. If tape is used for seam reinforcement or abrasion protection of seams or both, the fabric used for the seam tape must have minimum breaking strength (Grab Test) of 40 pounds/inch width in both the warp and fill directions. When applied to the seam area, the adhesion strength characteristics must meet the seam strength requirements in paragraph 3.1.6 above.

3.1.8 Canopy. Fabrics used for this purpose on Type II slide/rafts must be waterproof and resistant to sun penetration, must not affect the potability of collected water, and must meet the following minimum requirements in the applicable tests prescribed in paragraph 5.1 of this appendix, except that in lieu of meeting the tensile strength requirements, a fabricated canopy erected on the device may be demonstrated to withstand sustained wind velocities of 35-knots and 52-knot gusts:

Tensile Strength (Grab Test)

Warp 75 pounds/inch

Fill 75 pounds/inch

Tear Strength (Tongue or Trapezoid Test)

4 x 4 pounds/inch

Coat Adhesion of Coated Fabrics

3.5 pounds/inch width at 70 ± 2 degrees F at a separation rate of 2.0 to 2.5 inches/minute

3.1.9 Flammability. The device (including carrying case or stowage container) must be constructed of materials which comply with the requirements of 14 CFR 25.853(a), Appendix F, Part I (a)(1)(ii) in effect on March 6, 1995.

3.1.10 Molded Nonmetallic Fittings. Molded nonmetallic fittings must retain their physical characteristics when subjected to temperatures of -65 to +160 degrees F.

3.2 Metallic Parts. All metallic parts must be made of corrosion-resistant material or must be suitably protected against corrosion.

3.3 Protection. All inflation chambers and load carrying fabrics must be protected in such manner that non-fabric parts do not cause chafing or abrasion of the material in either the packed or the inflated condition.

4. Detail Requirements.

4.1 Operation. The operation of the device must be simple enough so that brief, easily understood, posted instructions can be followed by the user.

4.2 Function. The device, including its inflation system, must be capable of functioning when subjected to temperatures from -40 degrees F to +160 degrees F. If the device is intended for installation outside the pressurized cabin, the device must be capable of functioning after being stowed at -65 degrees F. The function of the device must be demonstrated at the temperature extremes noted above. The hot and cold soak test procedures are described in paragraph 5.9 of this appendix.

4.3 Strength.

4.3.1 Inflation Chamber Beam Strength-Type I, II & IV. The structural integrity of the device during and after the dynamic challenge of multiple sand bag loading of the device (to simulate loading by three tightly bunched evacuees entering each lane of the device) must be shown by test to be adequate, as described in paragraph 5.5 of this appendix.

4.3.2 Attachment Means Strength. The means by which the device is attached to the aircraft, typically the girt, must not fail and must remain intact and suitably attached to both the aircraft and the device during and after the severe loading tests simulating normal evacuation. The device must withstand the static tensile load tests defined in this appendix in paragraphs 5.6, for girts, or 5.7, for non-girts, and 5.8, as appropriate, for evacuees inadvertently entering pontoon areas. Separate girt specimens may be used in the two tests required in paragraph 5.6 of this appendix.

4.4 Elimination of Static. The device and its fastening must be so constructed that static electricity will not be generated in sufficient quantity to cause a spark which would create a hazard if there is any fuel spillage nearby.

4.5 Damage Resistance and Usage.

4.5.1 The device must be capable of resisting puncture and tear of the sliding and walking surfaces and supporting structure from objects normally carried or worn by passengers that could result in collapse of the device, prevent the device from performing its intended function, or both.

4.5.2 Type I, II & IV slides must be so constructed as to permit their use as a non-inflatable slide in the event of puncture or tear which may render the slide incapable of holding air and sustaining inflation.

4.5.3 If the device is of a multiple-inflatable compartment construction, loss of any one of these compartments must not render the device totally unusable.

4.6 Length. The slide device must be of such length after full deployment that the lower end is self-supporting on the ground and provides safe evacuation of occupants to the ground when the aircraft is on the ground with the landing gear extended and after collapse of one or more legs of the landing gear.

4.7 Elimination of Encumbrances. Encumbrances which might be grabbed by evacuees must be kept to a minimum consistent with good design for maximum operational efficiency.

4.8 Hardware and Attaching Means Strength. All hardware, webbing and straps used to attach the device to the aircraft and all straps, grips, and handholds not associated with attachment to the aircraft must have a strength not less than 1.5 times the highest design load imposed in showing compliance with the strength requirements of paragraph 4.3 of this appendix and for Type II devices, in establishing the rated capacity under paragraph 4.26.1 of this appendix.

4.9 Use as Re-entry Device. If the device is designed with provisions for use as a means of re-entering the aircraft, these additional provisions must not interfere with the use of the device for evacuation.

4.10 Evacuation Rate.

4.10.1 The device must be shown by tests conducted under the conditions described in paragraph 5.4.1 of this appendix, to be capable of handling evacuees at a rate of at least 70 evacuees per minute per lane. The evacuees must be safely transported to a position from which they can exit the device unassisted.

4.10.2 Evacuation capability under the test conditions shown in paragraph 5.4.3 of this appendix must be demonstrated in order to confirm the acceptability of the device and it and/or the associated airplane's emergency lighting system for use by evacuees under dark-of-night conditions. An evacuation rate based upon the rating of the exit (see paragraph 5.4.3.10 of this appendix) to which the device will be attached must be achieved. A detailed test plan to meet these requirements should be submitted at least 60 days prior to the test to the FAA aircraft certification office to which the TSO data is to be submitted. The test plan shall include, but not be limited to, the test protocol, a description of the test facilities, a description of the measurement and recording equipment and procedures, and the safety provisions for protecting test participants. The test plan must be approved by the manager of that FAA office prior to conduct of the test.

4.11 Inflation.

4.11.1 The device must be demonstrated to meet the applicable automatic inflation requirements of 14 CFR 25.810 (b). See paragraph 4.12 below.

4.11.2 The device shall be designed to prevent its inflation out of proper sequence so as to create an unsafe usage condition.

4.11.3 A manual means of actuating inflation must be provided. The manual means of actuation of the inflation system may be mechanical or electrical. However, the manual inflation actuating means must be neither visible nor presented for use until the device has been deployed.

4.12 Inflation Time.

4.12.1 Type I floor-level exit slides and Type III devices must be automatically erected in 6 seconds after actuation of the automatic or manual inflation controls is begun.

4.12.2 For Type II devices, in addition to meeting the requirements in paragraph 4.12.1 above, if there is a transition from slide mode to raft mode, the transition time must not be more than 10 seconds after actuation of the conversion means.

4.12.3 Type IV devices and Type I, wing-to-ground slides must be erected in not more than 10 seconds after actuation of the inflation controls.

4.13 Extendible Length Slides.

4.13.1 The extension of an extendible length slide must be capable of being inflated at any time after inflation of the basic slide has been initiated.

4.13.2 Inflation of the extension of an extendible length slide must be initiated by separate controls from those for the basic slide.

4.13.3 The junction of the basic slide and the extension of an extendible length slide must not impede evacuation.

4.14 Manual Inflation Actuation Controls.

4.14.1 Inflation actuation controls must be red in color, with a rigid crossmember, with the word "PULL" (or appropriate instruction) in high visibility reflective letters at least 1/2-inch high and of a color contrasting with their immediate background. In addition there must be a placard with the words "PULL TO INFLATE" located as close to the handle as possible.

4.14.2 When the inflation actuation controls are exposed for use, they must be visible to an aircraft occupant, standing at the door sill, under the minimum emergency lighting conditions specified in 14 CFR 25.812 in effect at the time of application.

4.14.3 Unless a rational analysis is provided to locate them elsewhere, inflation actuation controls must be on the right side of the girt as seen by an aircraft occupant looking out of the aircraft door.

4.14.4 Inflation actuation controls must be so designed that the maximum required pulling force will not pull the deployed device back into the doorway. The pulling force required must not exceed 30 pounds.

4.14.5 Cable-type inflation actuation controls must be constructed so they cannot trip or entangle evacuees.

4.15 Inflation System.

4.15.1 The inflation system must be connected to the evacuation device and ready for instant use. The inflation system must minimize leakage due to back pressure after inflation.

4.15.2 If an air aspirator system is used, the aspirator must prevent the ingestion of small foreign objects to prevent failure or malfunction of the system.

4.15.3. Components must meet Department of Transportation (DOT) Specifications 3AA (49 CFR 178.37) or 3HT (49 CFR 178.44) in effect May 30, 1976, FRP-1 (49 CFR 178.AA) in effect February 1987, CFFC (49 CFR 178) in effect November 1996, or an equivalent specification approved by the manager of the FAA office to which this TSO data is to be submitted, as required in paragraph 5.a, **DATA REQUIREMENTS** of this TSO.

4.15.4 For Type II inflation systems, in addition to meeting the above requirements of paragraph 4.15 of this appendix, the inflation system shall be arranged so that failure of one inflatable chamber or manifold will not result in loss of gas from the other chamber. The inflation equipment shall be located so as not to interfere with boarding operations.

4.16 Double Lane Slides.

4.16.1 A double lane slide must provide space for evacuees sliding two abreast. Each sliding surface, if separated by a raised divider, must be at least 20 inches wide. The combined width of two sliding surfaces not separated by a raised divider must be at least 42 inches. The width of a dual lane slide with no raised lane divider must be sufficient to enable evacuees to jump side-by-side into the slide and reach the ground safely.

4.16.2 A double lane slide must resist adverse twisting or deflecting when subjected to maximum unsymmetrical loading determined from the evacuation rate prescribed in paragraph 4.10 of this appendix.

4.16.3 Where used, a raised divider or center median must be constructed so as to prevent injury to evacuees and not to throw from the slide evacuees who jumped into the slide astraddle or partly astraddle the divider or median.

4.17 Side Guards. A single or double lane inflatable device must be equipped with side guards or other means to prevent evacuees from accidentally missing or falling from the device. The means must provide protection for an evacuee who crosses the aircraft emergency exit threshold at a horizontal velocity of approximately 6 feet per second and contacts the device installed at its steepest design angle.

4.18 Emergency Knife Location. If an emergency knife is provided, it must be so installed that it cannot injure persons using the evacuation device in a normal manner.

4.19 Self-illumination Slides.

4.19.1 Self-illumination must be designed so the illumination means is activated automatically during deployment or inflation and the level of illumination meets the appropriate requirements in 14 CFR 25.812 in effect at the time of application.

4.19.2 The illumination means must not interfere with the safe evacuation of persons using the slide in a normal manner.

4.20 Wind. The device must be shown, in 25-knot winds directed from the most critical angle, to deploy and, with the assistance of only one person who has evacuated down the slide, to remain usable after full deployment to evacuate occupants safely to the ground. The device shall be tested while it is properly attached to the exit on the airplane on which installation is intended or equivalent mock-up. To determine the most critical angle, the wind shall be directed at the device from at least the following directions: aft along the centerline of the aircraft (0 degrees position) and then every 45 degrees on the same side of the fuselage as the slide is intended for installation. In addition, for devices which do not deploy perpendicular to the aircraft centerline, wind shall be directed from directions perpendicular to both sides (i.e., the edges of the device parallel to the sliding surface) of the device. For directions which are not tested, a rational analysis shall be presented to show why those directions are less critical than those tested.

4.21 Device Surface.

4.21.1 The surfaces of the device, including its coating, must be suitable and safe for use in any weather condition, including a rainfall of 1 inch per hour.

4.21.2 Each device sliding lane, including its coating, must provide safe and rapid evacuation without detrimental erosion or deterioration for at least 200 adult persons without any rework of the surface. Alternatively, use of a single sliding device to show compliance with the test in paragraph 5.4.1 of this appendix without any re-work to the surface will be acceptable.

4.22 Device Performance. At least five consecutive deployment and erection tests must be demonstrated without failure.

4.23 Pressure Retention Test. The device must maintain adequate pressure to satisfactorily accomplish its intended function throughout an emergency evacuation in which-

4.23.1 The device is installed at its critical angle (with respect to buckling);

4.23.2 The device is inflated by the inflation system designed for that purpose, the initial pressure of which is at the minimum of its design range;

4.23.3 The pressure relief valve(s), if installed, is unrestricted; and

4.23.4 At least 200 persons in no more than 10 separate demonstrations use each slide lane of the device at an average rate of not less than one person per second per lane. Alternatively, use of a single sliding device to show compliance with the test specified in paragraph 5.4.1 of this appendix will be acceptable.

4.24 Overpressure Tests. The device must be shown to withstand the overpressure test requirements of paragraph 5.2.2 of this appendix without damage.

4.25 Leakage Test. The device must be shown to meet the leak test requirements of paragraph 5.2.1 of this appendix.

4.26 Capacity-Type II Slide/Raft Combinations.

4.26.1 Rated Capacity. The rated capacity shall be the usable seating area on the deck/sliding surface of not less than 3.6 ft²/person.

4.26.2 Overload Capacity. The overload capacity shall be the usable seating area on the deck/sliding surface of not less than 2.4 ft²/person.

4.26.3 Capacity, Alternate Rating Methods. In lieu of the rated capacity prescribed in paragraph 4.26.1 above, one of the following methods may be used:

4.26.3.1 The rated capacity of a Type II slide/raft may be determined by the number of seating spaces which can be accommodated within the occupiable area exclusive of the perimeter structure (such as inflation/buoyancy tubes) without overlapping of the occupant seating spaces. The occupant seating spaces may not be less than the following size unless an equivalent size has been approved by the manager of the FAA office to which this TSO data is to be submitted.

39.4 inches

14.7 inches

7.2 inches

4.26.3.2 The rated capacity also may be determined on the basis of a controlled pool or fresh water demonstration which includes conditions prescribed under paragraph 5.2.3 of this appendix and the following:

4.26.3.2.1 The sitting area on the slide/raft deck may not be less than 3.0 ft²/person.

4.26.3.2.2 At least 30 percent but no more than 50 percent of the participants must be female.

4.26.3.2.3 Except as provided below, all participants must select their sitting space without outside placement assistance. A slide/raft commander, acting in the capacity of a crewmember, may direct occupant seating to the extent necessary to achieve reasonable weight distribution within the slide/raft.

4.26.3.2.4 All participants must not have practiced, rehearsed, or have had the demonstration procedures described to them within the past 6 months.

4.27 Buoyancy.

4.27.1 Type I evacuation devices installed at main deck floor level exits shall be designed to have positive buoyancy when extended and shall have a means to readily disconnect the device from the aircraft so that it can be used as an emergency flotation device.

4.27.2 Type II slide/rafts shall have two independent inflatable flotation tubes. If either tube is deflated, the other tube and the slide/raft floor shall be capable of supporting the rated and overload capacities in fresh water.

4.27.2.1 It shall be shown by tests in fresh water that the slide/raft loaded to rated capacity using an average weight of 170 lbs/person has a freeboard of at least :

4.27.2.1.1 Twelve inches with both flotation tubes at minimum raft mode operating pressure; and

4.27.2.1.2 Six inches with the critical flotation tube deflated and the remaining flotation tube at minimum raft mode operating pressure. In lieu of meeting the 6-inch freeboard requirement of this paragraph, the buoyancy provided by the tubes only (disregarding buoyancy derived from the floor and inflatable floor support) shall be capable of supporting the rated capacity based on an average weight of at least 200 lbs/person.

4.27.2.2 It shall be shown by tests in fresh water that the slide/raft loaded to its overload capacity and using an average weight of at least 170 lbs/person has a measurable freeboard with the critical flotation tube deflated. Ballast in the form of sand bags or the equivalent may be used to achieve the 170 lb weight, provided the appropriate distribution within the slide/raft is maintained.

4.28 Disconnect Means.

4.28.1 Type I devices disconnect means must be a readily apparent, flexible cloth/webbing loop capable of being operated by untrained persons and covered until ready for use. The method of disconnecting the device from the aircraft must be conspicuously and clearly indicated by brief instruction placards.

4.28.2 Type II slide/raft release from an aircraft, whether by automatic or manual means, shall not be restricted by the critical conditions of: (a) floor sill height above the water, (b) wind velocity and direction, or (c) occupant load. Devices having aircraft mounted inflation systems shall have means for quick detachment from the inflation system so that separation cannot cause loss of raft buoyancy. Release means shall be a readily apparent flexible cloth/webbing loop capable of being operated by untrained persons and covered until ready for use. The method of disconnecting the device from the aircraft must be conspicuously and clearly indicated by brief instruction placards.

4.29 Mooring Line.

4.29.1 Type I devices must be equipped with a nonrotting mooring line so that the deployed device automatically will remain secured to the aircraft when it is used as an emergency flotation platform. The mooring line shall not endanger the device, cause the device to spill occupants if the aircraft sinks, or interfere with the operation of the device. The mooring line shall have a minimum length of 20 feet and have a knotted breaking strength of not less than 500 lbs. The attachment to the evacuation device shall be stronger than the mooring line. The moored device shall be quickly and easily disconnected from the aircraft. The mooring release means shall be readily apparent and operable by untrained evacuees.

4.29.2 Type II devices, in addition to meeting the above requirements of paragraph 4.29.1, the mooring line shall be capable of keeping the slide/raft, loaded to rated capacity, attached to a floating aircraft. The mooring line shall not endanger the slide/raft or cause the slide/raft to spill the occupants if the aircraft sinks. The line may be equipped with a mechanical release linkage. The breaking strength of the line shall be at least 500 pounds, or 40 times the rated capacity of the slide/raft, whichever is greater, but need not exceed 1,000 pounds.

4.30 Lifeline. Type I and Type II devices shall be equipped with a 3/8 inch diameter or 1/2 inch width .060 minimum thickness non-rotting lifeline of a contrasting color. The lifeline shall be attached along at least 80 percent of the length of both sides provided that the lifeline installation does not adversely compromise its use as a slide. The lifeline and its attachment must be capable of withstanding a minimum load of 500 lbs and must not interfere with the device's inflation.

4.31 Capsizing Resistance-Type II. There shall be water pockets or other means to provide ballast to resist capsizing an empty or lightly loaded raft.

4.32 Righting-Type II. Unless it is shown that there is no tendency for the slide/raft to become inverted during loading and release from the aircraft, the slide/raft must comply with the righting tests specified in paragraph 5.2.3.5 of this appendix.

4.33 Boarding Aids-Type II. Boarding aids shall be provided at two opposing positions on the slide/raft. Boarding aids shall permit unassisted entry from the water into the unoccupied raft and shall not at any time impair either the rigidity or the inflation characteristics of the raft. Puncturing of inflatable boarding aids shall not affect the buoyancy of the raft flotation chambers. Boarding handles and/or stirrups used in conjunction with the boarding aids shall withstand a pull of 500 pounds. Boarding aids must be shown to comply with the test requirements of paragraph 5.2.3.6 of this appendix.

4.34 Heaving-Trailing Line-Type II. At least one floating heaving-trailing line not less than 75 ft in length and at least 250 lbs strength shall be located on the main flotation tube near the sea anchor attachment. The attach point of the line shall withstand a pull force of not less than 1.5 times the line rated strength without damage to the slide/raft.

4.35 Canopy-Type II. A canopy shall be packed with or attached to the slide/raft. The erected canopy shall be capable of withstanding sustained wind velocities of 35 knots and 52 knot gusts in open water. The canopy shall provide adequate headroom, minimum 1 inch clearance, for the 95th percentile male (seated height) and shall provide openings 180 degrees apart. Means shall be provided to make the openings weather tight. If the canopy is not integral with the raft, it shall be capable of being erected by occupants following conspicuously posted, simple instructions. It shall be capable of being erected by one occupant of an otherwise empty slide/raft and by occupants of a slide/raft filled to rated capacity.

4.36 Color-Type II. Except surfaces which have been treated for the purpose of reflecting radiant heat, the color of the slide/raft surfaces, including the canopy surface, visible from the air shall be an International Orange-Yellow or an equivalent high visibility color.

4.37 Sea Anchor-Type II. A sea anchor, or anchors, or other equivalent means must be provided to maintain the raft, with rated capacity and canopy installed, on a substantially constant heading relative to the wind and have the ability to reduce the drift to 2 knots when subjected to winds of 17 to 27 knots. Unless analysis and/or test data substantiating the adequacy of a lower breaking strength is approved by the manager of the FAA office to which this TSO data is to be submitted as required in paragraph 5.a, **DATA REQUIREMENTS**, the line securing a sea anchor to the slide/raft shall have a breaking strength of 500 lbs or 40 times the rated capacity of the raft, whichever is greater. The attachment of the line to the raft shall be capable of withstanding a load of 1.5 times the line-rated strength without damaging the slide/raft. The line shall be at least 25 feet in length and shall be protected to prevent it from being inadvertently cut by raft occupants.

4.38 Emergency Inflation Equipment-Type II. A means readily accessible to occupants of the slide/raft shall be provided to manually inflate the device and maintain the raft mode minimum operating pressure. The emergency inflation means must have a displacement of at least 32 cubic inches per full stroke. Manual inflation valves, with a non-return opening adequate for the size and capacity of the inflation means, shall be located to permit inflation of all chambers. The inflation means and valves shall have provisions to prevent inadvertent removal and loss when either stowed or in use.

4.39 Knife-Type II. A hook-type knife secured by a retaining line shall be sheathed and attached to the slide/raft adjacent to the point of mooring line attachment.

4.40 Placards. Suitable placards shall be provided in contrasting colors in waterproof paint which is not detrimental to the fabric, that denote use and location of the inflation systems, raft equipment, boarding aids, and righting aids. The letters used for such placarding shall be at least 2 inches high, except the details and miscellaneous instructions may be of smaller lettering. Applicable placarding shall take into account persons boarding or righting the raft from the water.

4.41 Emergency Lights-Type II. At least one TSO-C85a, or the latest revision, approved survivor locator light shall be provided. The light shall be automatically activated upon slide/raft inflation in the water and shall be visible from any direction by persons in the water. The light shall be located at or near a boarding station.

4.42 Actuation Means-Type II. If the device as a slide requires an additional operation to make it usable as a raft, the means for initiating the additional operation shall be designed to preclude inadvertent actuation but be readily available for use. If a pull motion is used, the force required must not be more than 30 pounds.

4.43 Sea Performance-Type II. The slide/raft shall meet the seaworthiness requirements in paragraph 5.2.4 of this appendix and shall be capable with its equipment of withstanding a saltwater marine environment for a period of at least 15 days.

5. Tests.

5.1 Material Tests. Testing the material properties specified in paragraph 3, Materials, of this appendix must be conducted in accordance with the following test methods or other approved equivalent methods:

| | |
|--------------------------------|--|
| Accelerated Age | (1.)-Method 5850 (2.) |
| Tensile Strength (Grab Test) | (1.)-Method 5100 (8.) |
| Tear Strength (Trapezoid Test) | (1.)-Method 5136 (6.) |
| Tear Strength (Tongue Test) | (1.)-Method 5134 (Alternate to Trapezoid Test paragraph 3.1.5.1) |
| Ply Adhesion | (1.)-Method 5960 (4.) |
| Coat Adhesion | (1.)-Method 5970 (9.) |
| Permeability | (6.)-Method 5460 (7.) |
| Seam Shear Strength | (.1)(3.) |
| Seam Peel Strength | (1.)-Method 5960 (4.) |
| Puncture Strength | (10.) |
| Hydrolysis Conditioning | (11.) |
| Porosity Test (Hydrolysis) | (12.) |
| Flammability | 14 CFR 25, Appendix F, Part I(a)(1)(ii) Vertical Burn Rate (5.) |

NOTES:

- (1.) Federal Test Method Standard (FTMS) No. 191A dated July 20, 1978.
- (2.) Samples for the accelerated aging tests must be exposed to a temperature of 158 ± 5 degrees F for not less than 168 hours. After exposure, the samples must be allowed to cool to 70 ± 2 degrees F for neither less than 16 hours nor more than 96 hours before determining their physical properties in accordance with paragraph 3.1 of this Appendix.
- (3.) Each sample shall consist of two strips 2 inches maximum width by 5 inches maximum length bonded together with an overlap of 3/4 inches maximum. The free ends must be placed in the testing machine described in FTMS 191A, Method 5100 and separated at a rate of 12 ± 0.5 inches/minute. The average value of a minimum of three samples must be reported. Samples may be multilayered to ensure against premature material failure. Samples may be gripped across the full two inches of width.
- (4.) Separation rate must be 2.0 to 2.5 inches/minute. Sample width shall be one inch.

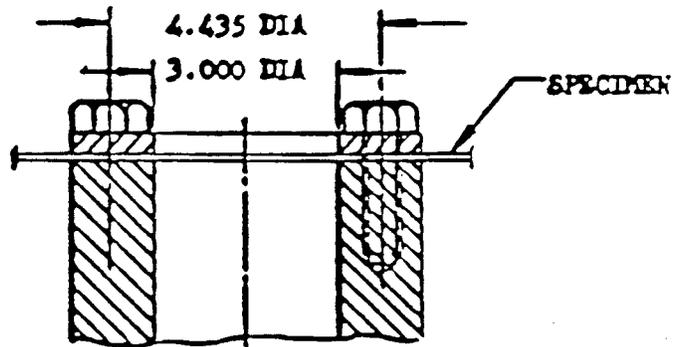
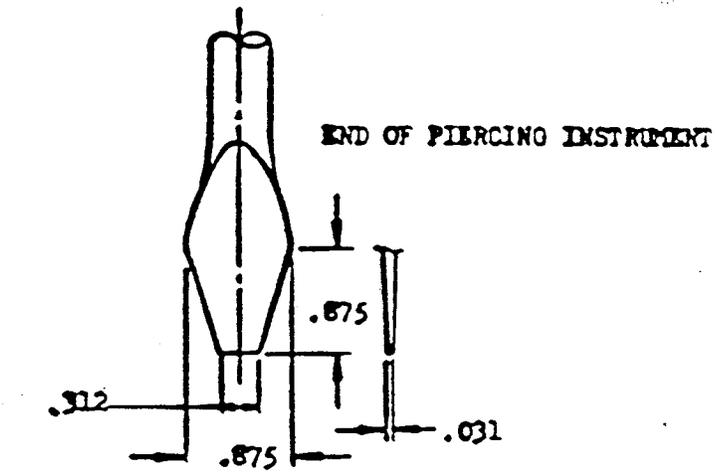
- (5.) The material must meet the flammability requirements of 14 CFR 25.853(a)(1)(ii) in effect March 6, 1995.
- (6.) FTMS No. 191 in effect December 31, 1968.
- (7.) ASTM Method D1434-82, Procedure V, approved July 30, 1982, is an acceptable alternate method.
- (8.) Use of pneumatic grips for holding test samples is an acceptable alternate to the mechanical grips described in Method 5100.
- (9.) The sample shall be prepared using the adhesive and construction methods used to manufacture the evacuation slide. Separation rate must be 2.0 to 2.5 inches/minute.
- (10.) The fabric shall be tested in a specimen holder constructed in accordance with Figure 1. The fabric shall be clamped tightly in the specimen holder to present a wrinkle-free surface and prevent slippage during the test. A piercing instrument with its end conforming to Figure 1 shall be forced against the fabric at approximately the center of the area enclosed by the specimen holder. The force required to puncture the specimen shall not be less than the specified 67 pounds. The test shall be run using a crosshead speed of 12 inches/minute.
- (11.) Each sample shall be exposed to a temperature of 58 ± 2 degrees C and a relative humidity of 95 ± 4 percent for a period of 50 days.
- (12.) Porosity testing conducted for hydrolysis resistance shall be conducted with the test apparatus specified in paragraph 5.3 or an equivalent test method approved by the responsible aircraft certification office. Note specimen size and mounting information of paragraphs 5.3.3.1 and 5.3.4.5 of this appendix. Tests should be conducted at slide nominal operating pressure for a duration of 30 minutes. Porosity is indicated by a loss in chamber pressure during testing. Pressure loss for material specimens after hydrolysis conditioning shall not be greater than the pressure loss for the material before conditioning.

5.2 Functional Tests.

5.2.1 Pressure Retention. Under static conditions and when inflated and stabilized at the nominal operating pressure, the pressure in each inflatable chamber of a Type II device must not fall below the minimum raft mode operating pressure in less than 24 hours. The minimum raft mode operating pressure is the pressure required to meet the minimum design buoyancy requirements of paragraph 4.27.2 of this appendix. For Type I, III & IV devices, the pressure in each inflatable chamber must not fall below 50 percent of the nominal operating pressure in less than 12 hours.

9/19/97

TSO-C69c
Appendix 1



SPECIMEN HOLDER

DIMENSION IN INCHES

FIGURE 1. PIERCING INSTRUMENT AND SPECIMEN HOLDER

5.2.2 Overpressure Tests.

5.2.2.1 The device must withstand a pressure at least 1.5 times the maximum operating pressure for at least 5 minutes without sustaining damage.

5.2.2.2 At least one specimen of the inflatable device model must be shown by test to withstand a pressure at least 2 times the maximum operating pressure without failure for at least 1 minute. Devices so tested must be clearly identified.

5.2.3 Water Tests-Type II. In either a controlled pool or fresh water, the capacity and buoyancy must be demonstrated as follows:

5.2.3.1 Both rated and overload capacities established in accordance with the requirements of paragraph 4.26 of this appendix must be demonstrated with inflation tubes at minimum raft mode operating pressure and with the critical buoyancy chamber deflated. The resultant freeboard in each case must meet the requirements of paragraph 4.27.2 of this appendix.

5.2.3.2 Persons used in the demonstration must have an average weight of not less than 170 pounds. Ballast in the form of sand bags or equivalent may be used to achieve proper loading provided the appropriate weight distribution within the device is maintained.

5.2.3.3 Persons used in the demonstration must wear FAA approved life preservers with at least one chamber inflated.

5.2.3.4 The required raft equipment, including one emergency locator transmitter or a weight simulating a transmitter, must be aboard the device.

5.2.3.5 The slide/raft must be demonstrated to be self-righting or can be righted by one person in water, or while inverted can be boarded and provide flotation for the normal rate capacity.

5.2.3.6 It must be demonstrated that the boarding aids are adequate for the purpose intended and that it is possible for an adult wearing an inflated life preserver to board the raft unassisted.

5.2.4 Sea Trials. The slide/raft must be demonstrated by tests or analysis, or a combination of both, to be seaworthy in an open sea condition with maximum sustained winds of 17 to 27 knots and waves of 6 to 10 feet. In tests, ballast in the form of sand bags or equivalent may be used to achieve proper loading provided the appropriate weight distribution within the slide/raft is maintained. If analysis is used, the analysis must be approved by the manager of the FAA office to which the TSO data is to be submitted as required in paragraph 5.a, **DATA REQUIREMENTS**. For this seaworthiness demonstration, the following apply -

5.2.4.1 The raft must be boarded by the rated number of occupants to demonstrate the method of loading from a simulated aircraft sill installation.

5.2.4.2 The proper functioning of the means to separate the raft from the simulated aircraft installation must be demonstrated.

5.2.4.3 All required equipment must be aboard and the proper functioning of each item of equipment must be demonstrated.

5.2.4.4 The canopy must be erected for a sufficient time to assess its resistance to tearing and the protection it affords. The method of erection must be shown to be accomplished by one occupant of an otherwise empty raft and by occupants of a raft filled to rated capacity.

5.2.4.5 The stability of the raft must be demonstrated when occupied at normal rated capacity and at 50 percent rated capacity.

5.3 Radiant Heat Test. The pressure holding materials in the emergency evacuation inflatable device shall be tested for resistance to radiant heat in accordance with this standard. If any of the outer surface of the pressure holding material is altered by marking, by lettering, by affixed overlay material, or in any other manner which affects radiant heat resistance, the altered material shall also be tested.

5.3.1 Criteria for Acceptance. For each material which requires testing, at least three specimens shall be tested at $1.5 \text{ Btu/ft}^2\text{-sec}$, and the resulting times to failure averaged. The average time to failure may not be less than 180 seconds with no value less than 90 seconds. Time to failure is the time between first application of heat to the specimen and first drop in pressure below the maximum pressure attained in the test cylinder during the test.

5.3.2 Test Apparatus. The tests shall be conducted using the FAA Slide Material Radiant Heat Apparatus, or another equivalent test apparatus and test method approved by the manager of the FAA office to which this TSO data is to be submitted as required in paragraph 5.a, **DATA REQUIREMENTS**. The apparatus consists of a horizontally mounted cylinder closed at one end and fitted with a source of air pressure and pressure measurement. A specimen holder clamped over the open end seals the cylinder air tight with the material specimen acting as a pressure holding diaphragm. The cylinder and specimen holder are mounted on a pivot and slide bar, and can be positioned at varying distances from a 3-inch diameter electric radiant heat furnace and a calorimeter. The test apparatus is described in Figure 2 through 5 and paragraphs 5.3.2.1 through 5.3.2.6 of this appendix.

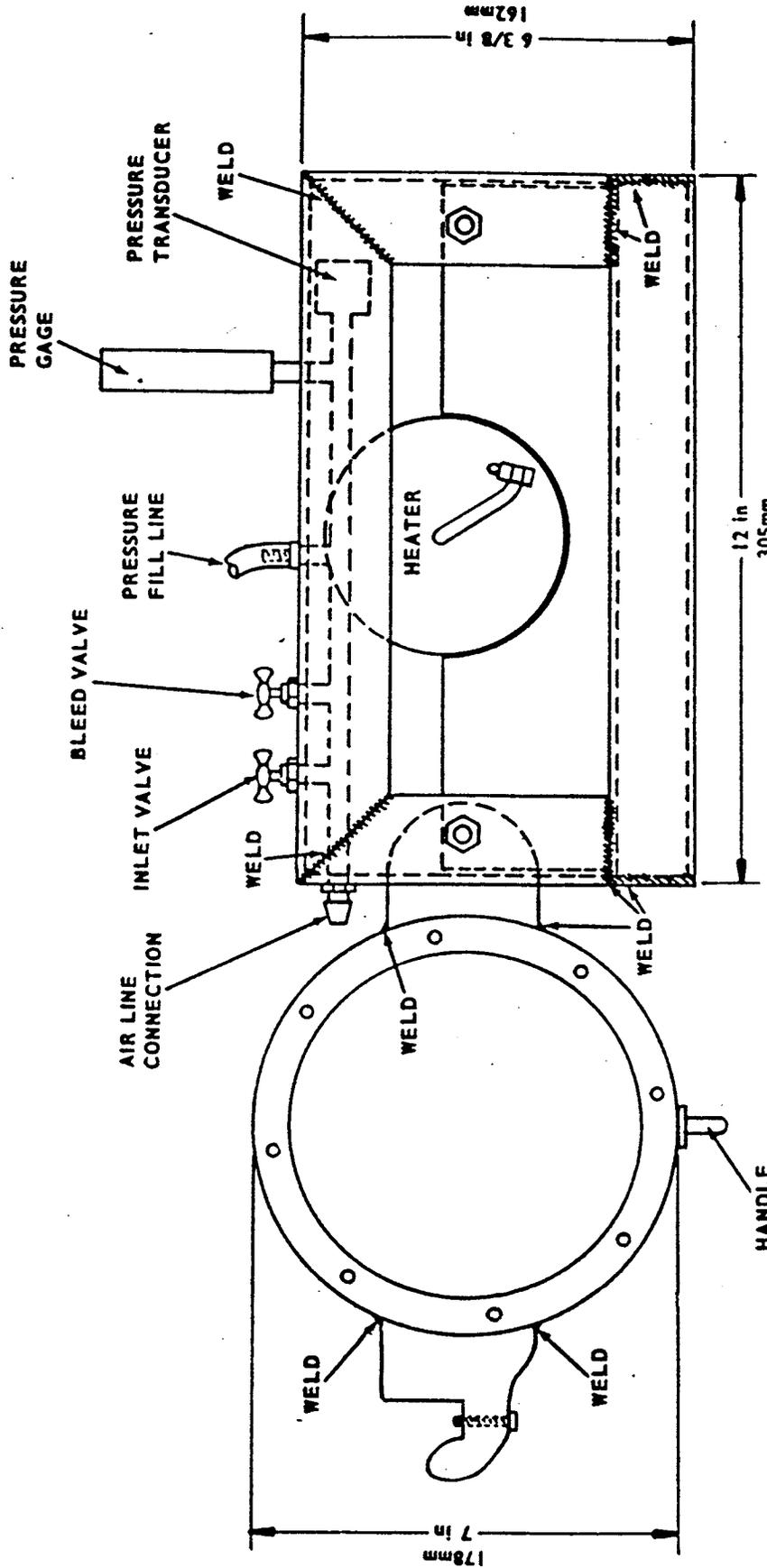


FIGURE 3. LABORATORY TEST (SIDE VIEW)

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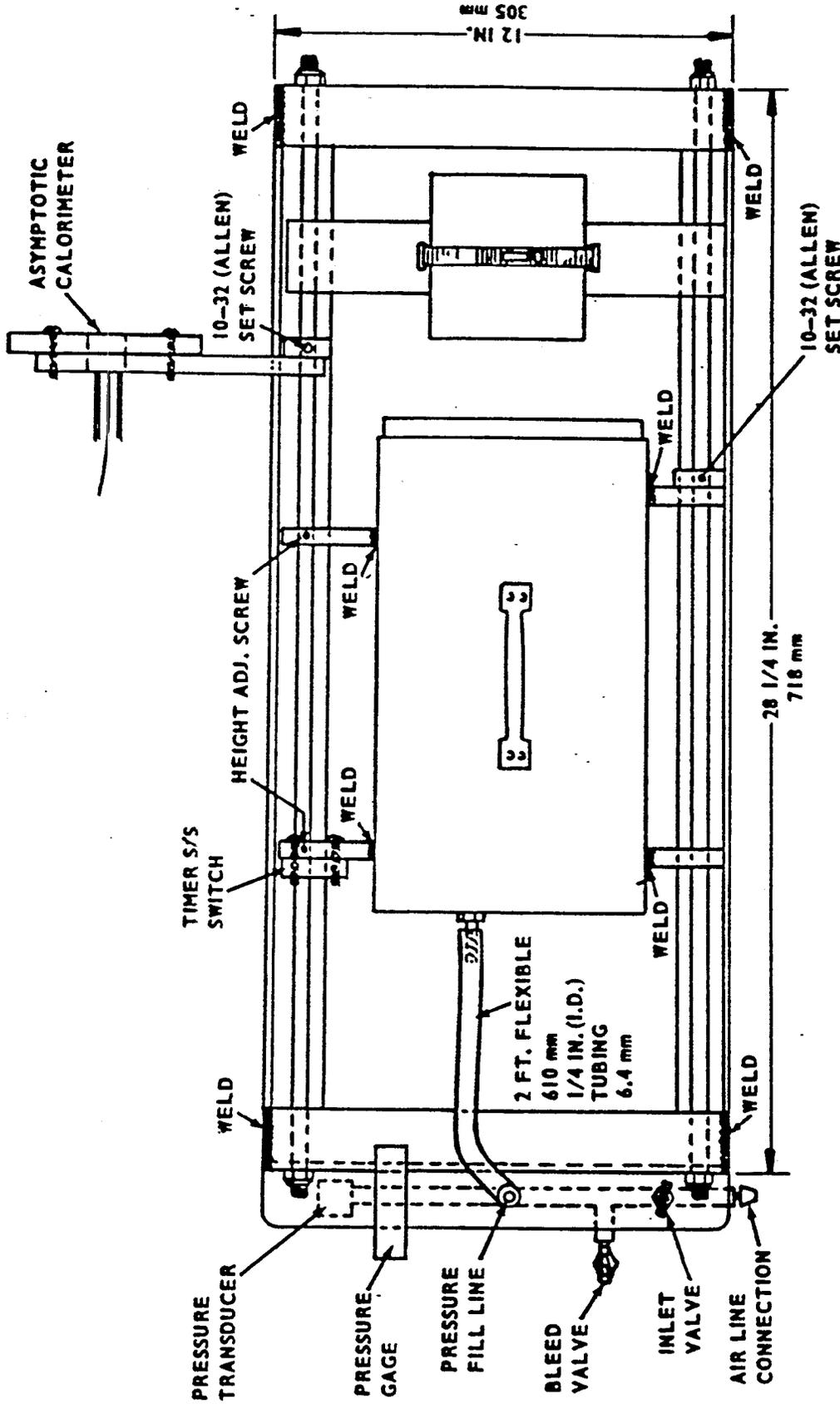
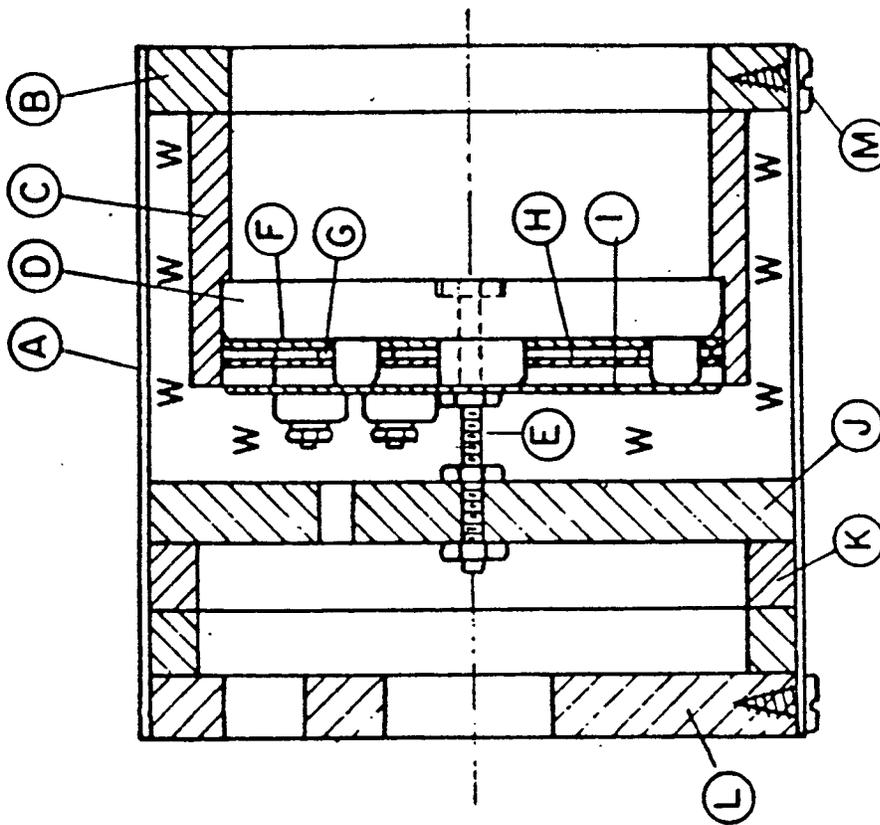


FIGURE 4. LABORATORY TEST (TOP VIEW)



- A - STAINLESS STEEL TUBE
- B - ASBESTOS BOARD
- C - CERAMIC TUBE
- D - HEATING ELEMENT, 525 W
- E - STAINLESS STEEL SCREW
- F - ASBESTOS PAPER GASKET
- G - STAINLESS STEEL SPACING WASHERS (3)
- H - STAINLESS STEEL REFLECTOR
- I - STAINLESS STEEL REFLECTOR
- J - ASBESTOS BOARD
- K - ASBESTOS BOARD RINGS
- L - ASBESTOS BOARD COVER
- M - SHEET METAL SCREWS
- W - PYREX GLASS WOOL

FIGURE 5. FURNACE SECTION

5.3.2.1 The pressure cylinder and specimen holder, as shown in Figures 2, 3, and 4 of this appendix, consist of a 7-inch outside diameter (O.D.) by 6 1/2-inch inside diameter (I.D.) by 12 3/8-inch long aluminum tube. On one end of the tube is welded a 1/2-inch thick aluminum plate, drilled and tapped for a 1/4-inch American national pipe taper thread to facilitate air pressure and pressure recording hookups. On the other end of the tube is welded a 7-inch O.D. by 5 1/2-inch I.D. ring of 1/2-inch thick aluminum. This ring is drilled and tapped for 10-32 by 7/8-inch long studs. Another 6 3/4-inch O.D. by 5 1/2-inch I.D. by 1/2-inch thick aluminum ring and two neoprene rubber gaskets with matching clearance holes to fit over the studs provide a means for clamping and sealing the test specimen in place. Hinges and adjustable stops are welded to the sides of the cylinder, shown in Figures 2, 3, and 4.

5.3.2.2 The electric furnace, shown in Figure 5 of this appendix, with a 3-inch diameter opening is used to provide a constant irradiance on the specimen surface. The National Institute of Standards Technology smoke chamber radiant heat furnace, available from Superpressure Inc., 8030 Georgia Avenue, Silver Spring, Maryland 20910, is recommended.

5.3.2.3 A 0-5 Btu/ft²-sec Hy-Cal calorimeter, Model C-1300-A, available from Hy-Cal Engineering, 12105 Los Nietos Road, Sante Fe Springs, California 90670, is used. The calorimeter is mounted in a 4 1/2-inch diameter by 3/4-inch insulating block and is hinged to one of the sliding bars of the framework. The surface of the calorimeter is flush with the surface of the insulating block and centered with the furnace. See Figure 4 of this appendix.

5.3.2.4 The pressure cylinder, calorimeter, and furnace are mounted on a framework as detailed in Figure 4 of this appendix. Adjustable sliding stops are located on each of the bars for setting the cylinder and calorimeter at the desired distance from the opening of the furnace.

5.3.2.5 Compressed air is connected to the cylinder through a needle valve attached to the end of the framework. A tee on the outlet side of the valve provides for a 0-5 psig pressure gage, transducer, and flexible tube to supply air to the rear plate of the pressure cylinder, as shown in Figure 2 of this appendix.

5.3.2.6 The outputs of the calorimeter and pressure transducer are measured and recorded using a recording potentiometer or other suitable instrument capable of measurement over the range required.

5.3.3 Test Specimens.

5.3.3.1 Test specimens 7 inches (178mm) in diameter with 1/4-inch (6mm) holes punched in the material to match the studs in the pressure cylinder must be cut from the material to be tested.

5.3.3.2 Test specimens must be conditioned at 70 ± 3 degrees F and 50 ± 5 percent relative humidity for at least 24 hours prior to testing.

5.3.4 Test Procedures.

5.3.4.1 All tests must be conducted in a draft free room or enclosed space.

5.3.4.2 After turning on the radiant heat furnace and other required instrumentation, allow 1/2 to 3/4 hour to stabilize heat output and for instrumentation warmup.

5.3.4.3 Adjust transformer to produce a radiant heat flux of $2 \text{ Btu/ft}^2\text{-sec}$, when the calorimeter is positioned 1 1/2 inches (38mm) in front of the radiant heat furnace.

5.3.4.4 Find the location in front of the furnace for the test heat flux of $1.5 \text{ Btu/ft}^2\text{-sec}$, by sliding the calorimeter on the horizontal bar and fixing the position with the sliding stop. Swing the calorimeter out of position.

5.3.4.5 Mount the specimen on the open end of the cylinder with a neoprene gasket on each side of the specimen with the reflective surface of the material facing the furnace. Place the aluminum ring on the studs and tighten the nuts so that an airtight seal is made.

5.3.4.6 Pressurize the cylinder to the device nominal operating pressure. Check for leakage.

5.3.4.7 Check the distance from the radiant heat furnace to the surface of the test specimen. This distance is the same as the distance to the surface of the calorimeter.

5.3.4.8 Place the calorimeter in front of the radiant heat furnace and record the heat flux. An acceptable heat flux is $1.5 \text{ Btu/ft}^2\text{-sec}$. Remove calorimeter.

5.3.4.9 Place the pressure cylinder and test specimen in front of the radiant heat furnace. Start timer or note starting time on the recorder.

5.3.4.10 Pressure is monitored from the time the specimen is placed in front of the furnace until initial pressure loss is observed.

5.4 Evacuation Rate Tests.

5.4.1 Basic Test Conditions. The following test conditions shall be applicable to tests run for showing compliance with paragraph 4.10.1 of this appendix:

5.4.1.1 The device shall be tested at two sill heights: normal and minimum.

5.4.1.2 At each sill height, the device shall be tested at three different inflation pressures: minimum operating, maximum operating, and the nominal operating pressure.

5.4.1.3 The surface of the device shall be dry.

5.4.1.4 The test area may be illuminated to any level suitable for safe conduct of the test.

5.4.1.5 The evacuees may be of any age, gender, weight, or experience level suitable for safe conduct of the test, but each evacuee group must average a minimum of 170 pounds per person. Evacuees may participate in more than one test run.

5.4.1.6 Each device lane shall be traversed by a minimum of 20 evacuees per lane for each test run (i.e., a minimum of at least 120 evacuees per lane over the 6 required test runs).

5.4.1.7 All test runs shall be on the same test article.

5.4.1.8 Each test run must have a rate of 60 evacuees/minute per lane or higher.

5.4.1.9 The combined average rate of all test runs at a specific sill height must be 70 evacuees/minute per lane or higher. If different numbers of evacuees are used among the different test runs, the rates for each test run shall be mathematically weighted to ensure proper averaging.

5.4.2 Maximum Sill Height Conditions. In addition to the tests in paragraph 5.4.1 above, the device shall be tested at the maximum sill height. Three test runs shall be conducted on the same test article, one each at minimum operating, maximum operating, and the nominal operating pressure of the normal conditions pressure range. A minimum of five evacuees per lane per run shall use the device and be conveyed safely to the ground. The evacuees shall meet the same requirements as in paragraph 5.4.1.5 of this appendix. No specific evacuation rate is required for this test.

5.4.3 Emergency Lighting Test Conditions. The following test conditions shall be applicable to tests run for showing compliance with paragraph 4.10.2 of this appendix:

5.4.3.1 The test shall be run on the airplane on which installation is intended or a suitable mock-up.

5.4.3.2 The sill height used shall represent normal conditions for the airplane.

5.4.3.3 For mock-ups, the exit cutout and the door shall be representative of the airplane. The passageway to the exit should be no greater than the minimum specified in 14 CFR 25.813, e.g., 36 inches wide for a Type A or B exit, or 20 inches wide for a Type I, II or C exit. The assist space shall be per current FAA guidance contained in AC 25-17. Cabin features such as doors, cabinets, monuments, door hinges, or other impediments intruding into the exit path which may influence the evacuation rate shall be realistically simulated.

5.4.3.4 The device shall be installed, inflated to its nominal operating pressure, and ready for use. Note: Emergency lights mounted on the device shall not be illuminated until test initiation.

5.4.3.5 The device shall be hidden from view of the evacuees prior to test initiation.

5.4.3.6 The surface of the device shall be dry.

5.4.3.7 For a period of 5 minutes prior to the initiation of the test, the area holding the evacuees, i.e., the "cabin interior", shall be illuminated to a minimum level of 5 foot-candles, which is representative of typical cabin lighting. The illumination outside the test area visible to the test subjects shall not exceed 0.005 foot-candles where an evacuee would normally make first contact with the ground.

5.4.3.8 Upon test initiation, the illumination of the "cabin interior" shall be reduced to the nominal light level provided by the airplane emergency lighting system with fully charged batteries as measured as incident light on the centerline of the passageway floor, one foot inboard of the exit sill. The outside test area illumination may be increased by any additional illumination representative of the emergency lighting system of the aircraft and/or provided by the slide.

5.4.3.9 The evacuees shall not have participated in any test or demonstration involving airplane evacuation devices within the past year.

5.4.3.10 The evacuee group size shall be per the following table:

| <u>Exit type</u> | <u>Rating</u> | <u>Evacuees(n-1)*</u> | <u>Pass/fail criterion</u> |
|------------------|---------------|-----------------------|----------------------------|
| A | 110 | 44 (22 per lane) | 30 seconds |
| B | 75 | 44 (22 per lane) | 45 seconds |
| C | 55 | 22 | 30 seconds |
| I | 45 | 27 | 45 seconds |
| II | 40 | 24 | 45 seconds |
| III | 35 | 21 | 45 seconds |
| III (dual) | 70 (max.) | 42 (21 per III) | 45 seconds |

* The group size, n, is one more than listed above.

5.4.3.11 The age/gender mix of the evacuee group shall be as follows:

5.4.3.11.1 As defined in the current version of Appendix J of
14 CFR 25, or,

5.4.3.11.2 As defined below:

5.4.3.11.2.1 At least one third of the group shall be at
least 45 years of age.

5.4.3.11.2.2 At least 50 percent of the total group shall
be female and at least 40 percent of those above the age of 45 shall be female.

5.4.3.11.2.3 No evacuee shall possess special athletic
skills, e.g., trained gymnast.

5.4.3.12 For floor level exits, a person representing a flight attendant shall direct
the evacuation from an assist space provided for the aircraft and may also stop the test if
conditions warrant.

5.4.3.12.1 If the person is an active flight attendant who has been
trained to an FAA approved evacuation training program, he/she should use procedures or
techniques consistent with his/her airline training.

5.4.3.12.2 Otherwise, he/she should use procedures or techniques
approved by the manager of the FAA office to which the TSO data is to be submitted.

5.4.3.13 The following information may be given to participants and the
following procedures may occur during the briefings identified below:

5.4.3.13.1 Recruiting briefing:

- Describe purpose of the test.
- Identify possible hazards of the test.
- Identify benefits for test participants.
- Identify benefits to airline passengers.
- Describe types of clothing/footwear required.

5.4.3.13.2 Orientation briefing:

- Get subject characteristics.
- Prepare paperwork (medical forms, etc.).
- Give building safety information (fire evacuation plan, etc).
- Describe test and procedures.
- Show pictures of the device from ground level in daylight.
- Describe how to enter the device using pictures from ground level, if desired.
- Get informed consent.

5.4.3.13.3 Final briefing:

- Escort to test area.
- Escort into test mock-up (also known as test module) to prepare for test.
- Describe test procedures again.
- Stage (position) evacuees for the test.
- Begin test protocol.

5.5 Beam Strength Tests-Except Type III.

5.5.1 The bottom of the sliding surface(s) shall not contact the ground when subjected to the following test nor shall the device deflect to a position which causes a sustained pile-up of the sand bags at the lower end of the device when the test is conducted. Additionally, the device, without repair, shall meet the requirements of paragraph 4.10.1 of this appendix after being subjected to this test.

5.5.2 The beam strength test shall be conducted with the device adjusted to its normal sill height and inflated to the nominal operating pressure. For each lane of the device, sand bags encased in canvas, or equivalent, with a combined minimum weight of 510 pounds, spread evenly over an area not to exceed 7.5 feet by 2 feet, shall be placed on a rigid inclined surface (covered with device sliding surface material) above, and in contact with, the top of the sliding surface. The length of the inclined surface shall not exceed 8 feet. The angle of inclination shall be sufficient to allow the sand bags to slide down slowly when released. All test article surfaces shall be dry. To initiate the test the sand bags shall be released simultaneously and allowed to slide down the inclined surface, unaided except for the effects of gravity, onto the sliding surface of the device.

5.5.3 A series of 3 successful tests shall be run on each device, as described in paragraph 5.4 of this appendix. To be successful, each test must result in (1) all of the sand bags exiting the end of the device, or deemed to be likely to exit if not obstructed by bags which are partially on the ground and partially on the slide, and, (2) the underside of the sliding surface not contacting the ground at any time. Crossover of sand bags from one lane to another on a multiple lane device is acceptable.

5.6 Attachment Means Tests - Girt (See Figure 6 of this Appendix).

5.6.1 Symmetric Girt Tensile Load Test. A representative production configuration girt including attachments to the device and the aircraft shall be installed to produce a symmetric load in a tensile test machine. The girt shall be attached on one end using the girt bar, or equivalent, and on the other end to the normal girt attachment means to the inflatable slide. The slide fabric to which the girt attachment is bonded shall be fastened to a steel plate or around a cylinder designed to represent the inflatable to which the girt is attached (See figure 6 of this appendix). The girt shall be able to withstand a test load which is equal to the maximum expected in-use load multiplied by a factor of 1.5 (as required by paragraph 4.8 of this appendix). The in-use load is a combination of all the loads acting on the girt attachments during any individual test run. The loads shall be established by instrumenting the girt attachment(s) to the aircraft and measuring the forces transmitted to the attachment(s) during deployment and use of the device. (The means for measuring the peak loads must be shown to be reliable, accurate, in calibration, and appropriate for the type of testing. If the means is a data acquisition system utilizing an analog-to-digital converter, see appendix 3 of this TSO for guidance.) The use conditions shall include, but not be limited to, those encountered in demonstrating compliance with the requirements of paragraphs 4.3.1, 4.10, 4.11, 4.12, 4.13, 4.20, 4.21, 4.22, 4.23, 4.28, 5.2.4 and 5.8 of this appendix. The test load shall be applied to the girt for 60 seconds. During the test, tearing of the girt is not acceptable. Deformation of the girt is acceptable if it would not prevent continued safe use of the device in an actual evacuation.

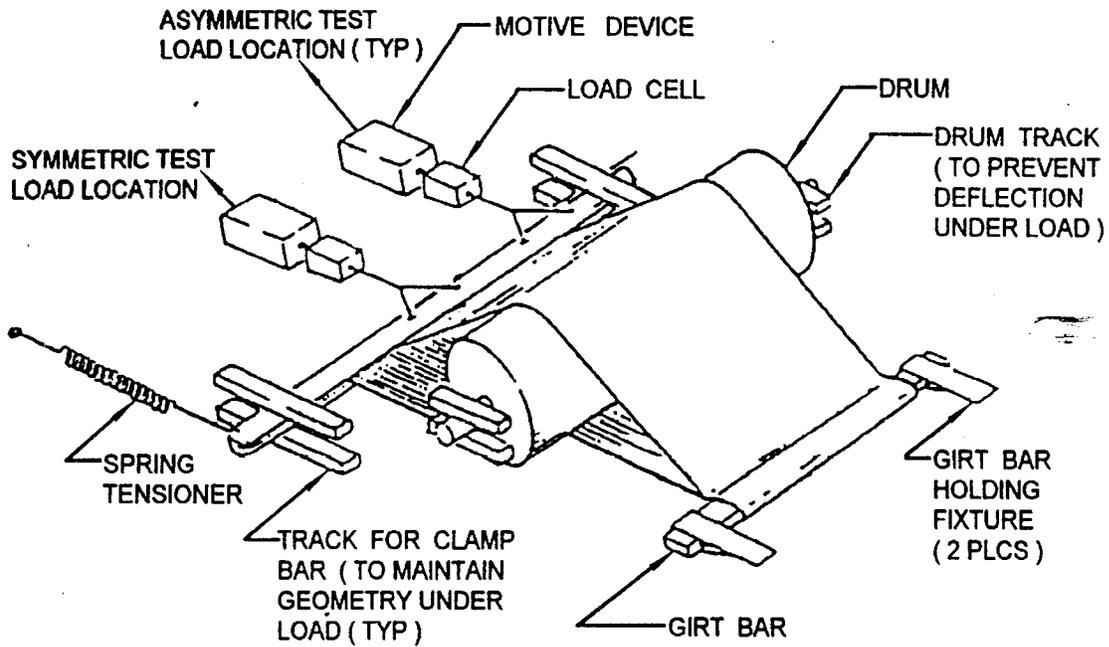
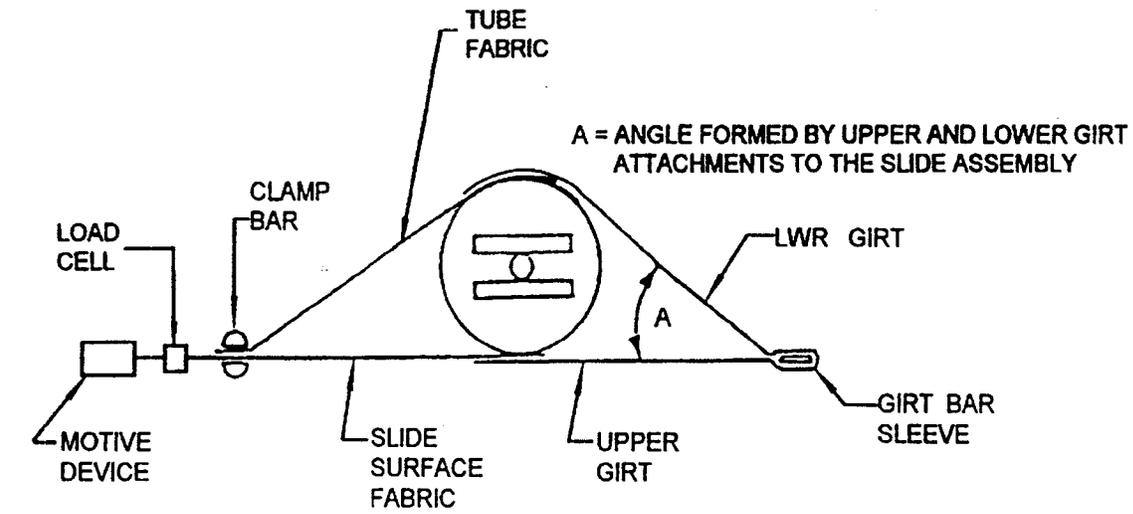


Figure 6 - Typical Girt Loading Test Set-Up

5.6.2 Asymmetric Girt Tensile Load Test. A representative production configuration girt shall be installed to produce an asymmetric load in a tensile test machine and an asymmetric load shall be applied. The girt shall be attached on one end using the girt bar, or equivalent, and on the other end to the normal girt attachment means to the inflatable slide. The slide fabric to which the girt attachment is bonded shall be fastened to a steel plate designed to represent the inflatable to which the girt is attached (See figure 6 of this appendix). The girt shall be able to withstand a test load applied asymmetrically by pulling the steel plate away from the secured girt bar at a point even with the edge of the girt. The test shall be repeated for each side of the device girt. The test load(s) is equal to the maximum expected in-use load multiplied by a factor of 1.5 (as required by paragraph 4.8 of this appendix). The in-use load shall be established by instrumenting each girt attachment to the aircraft and measuring the forces transmitted to the attachment during deployment and use of the slide. (The means for measuring the peak loads must be shown to be reliable, accurate, in calibration, and appropriate for the type of testing. If the means utilizes an analog to digital converter, see Appendix 3 of this TSO for guidance.) The use conditions shall include, but not be limited to, those encountered in demonstrating compliance with the requirements of paragraphs 4.20, 4.21, 4.28, 5.2.4 and 5.8 of this appendix. The test load shall be applied to the edge of the girt for 60 seconds. During the test, tearing of the girt is not acceptable. Deformation of the girt is acceptable if it would not prevent continued safe use of the device in an actual evacuation.

5.7 Attachment Means Tests - Other Than a Girt. When the attachment means is other than a girt, e.g., a number of narrow straps attached at different locations on the aircraft, only the straight tensile test is necessary for each of the straps. A representative production configuration of each of the straps, including its attachment to the device and to the airplane, shall be individually installed to produce a symmetric load in a tensile test machine. Each strap shall be able to withstand a test load which is equal to the maximum expected in-use load multiplied by a factor of 1.5 (as required by paragraph 4.8 of this appendix). The in-use load shall be established by instrumenting each strap attachment to the aircraft and measuring the forces transmitted to that attachment during deployment and use of the device. The use conditions shall include, but not be limited to, those encountered in demonstrating compliance with the requirements of paragraphs 4.3.1, 4.10, 4.11, 4.12, 4.13, 4.20, 4.21, 4.22, 4.23, 4.28, 5.2.4 and 5.8 of this appendix. The test load shall be applied to the strap for 60 seconds. During the test, tearing of the strap is not acceptable. Deformation of the strap is acceptable, if it would not prevent continued safe use of the device in an actual evacuation.

5.8 Attachment Means - Pontoon Loading Tests. If the device is equipped with outrigger pontoons (also known as sponsons) which can be inadvertently entered by evacuees during an emergency evacuation, the following test shall be conducted on each side:

5.8.1 The device shall be installed at normal sill height and inflated to the minimum value of the normal conditions pressure range.

5.8.2 Weights that represent 170 pound individuals shall be placed in the pontoon(s) at the bottom outside area on one side of the device . The number of individuals to be simulated shall be based on the length, in feet, of the occupiable portion of the pontoon divided by 4.5. Any remainder from the division may be discarded.

5.8.3 An evacuee group of twenty persons shall jump into the device at an average rate of 70 per minute (after the first jumper, the last 19 have 16 seconds to jump into the device). The evacuee group shall average at least 170 pounds per person. In the case of multi-lane devices, the evacuees will jump only into the lane adjacent to the loaded pontoon. The evacuees may be of any age, gender, and experience level.

5.8.4 To pass this test, the means of attachment to the aircraft shall not tear or rip, and no evacuee shall enter the pontoon area or fall off the device.

5.9 Hot & Cold Soak Test Protocol.

5.9.1 Stabilize the normally charged stored gas bottle to a temperature of 70 degrees F, plus or minus 5 degrees F, then for the cold test only, reduce the stored gas bottle pressure to the minimum dispatch pressure.

5.9.2 For components of devices installed within the pressurized cabin of the airplane, hot or cold soak the components for at least 16 hours at a minimum temperature of +160 degrees F or a maximum temperature of -40 degrees F, respectively. For components of any devices installed outside of the pressurized cabin of the airplane, cold soak the components for at least 16 hours at a maximum temperature of -65 degrees F.

5.9.3 Deploy the device into ambient temperature conditions (typically defined as between 65 and 85 degrees F) from the appropriate airplane door or a suitable airplane door mock-up or module, within 10 minutes after removal from the cold soak chamber.

5.9.4 To be considered acceptable, the unit should achieve minimum operating pressure in all inflation chambers but should not exceed the specified maximum operating pressure to achieve the evacuation rate specified in paragraph 4.10.1 of this appendix. The pressure reading should be taken as soon as possible but no later than one minute after deployment.

APPENDIX 2. GLOSSARY OF TERMS

dark of night conditions - exterior lighting conditions in which the illumination measured normal to the direction of the incident light does not exceed 0.005 foot-candles.

girt - the typical means by which a device is attached to an airplane. It consists of a strong fabric wrapped around a girt bar which is usually installed at the sill of the exit. The girt may be attached to more than one of the device tubes.

maximum operating pressure - maximum pressure, including transients, (in each/every chamber) determined during the device developmental process under all conditions.

maximum sill height - the maximum height above the ground of the exit sill with the collapse of one or more of the aircraft landing gear legs. Typically this is calculated using rational analysis.

minimum dispatch pressure - minimum actual pressure required in the inflation system for dispatch of the airplane. This inflation system pressure will inflate the device to at least minimum operating pressure under the cold soak conditions described in paragraph 5.9.2 of appendix 1 of this TSO.

minimum operating pressure - minimum pressure (in each/every chamber) at which the evacuation rate requirement of paragraph 4.10.1 of appendix 1 of this TSO can be met.

minimum raft mode operating pressure - minimum pressure required to meet the minimum design buoyancy requirements of paragraph 4.27.2 of appendix 1 of this TSO.

minimum sill height - lowest height above the ground of the exit sill with the collapse of one or more of the aircraft landing gear legs. Typically this is calculated using rational analysis.

most critical angle (wind) - the angle at which winds have the greatest adverse effect upon the slide's ability to convey evacuees safely to the ground, e.g., where there is the greatest lateral and/or torsional displacement or buckling.

nominal operating pressure - the mid-point of the normal conditions pressure range.

normal conditions pressure range (design pressure range) - the range of pressures attained during typical deployments conducted in accordance with paragraph 5.b.(1) of this TSO. The lower limit must not be lower than the minimum operating pressure. The upper limit must not be more than the maximum operating pressure.

normal sill height - the height of the exit sill above the ground with all aircraft landing gear extended.

APPENDIX 3. MEASUREMENT OF LOADS ON THE ATTACHMENT(S) TO THE AIRPLANE

Data acquisition systems which utilize an analog-to-digital (A/D) converter to process the electronic signals from load cells must be configured to accurately record loads during a test. The following parameters are recommended for recording with an A/D converter system:

1. Sample Rate 20 Hz minimum
2. Resolution 12 bits minimum
3. Anti-aliasing pre-filter 5 Hz low pass (0 to -4 dB at 5 Hz),
 -20 dB/decade rolloff at frequencies above 10 Hz

The signal amplifier should provide sufficient gain so that the expected full-scale, or highest anticipated value to be recorded, is at least 70% of the maximum input range of the analog-to-digital converter (A/D). No post acquisition digital filter, smoothing, or averaging algorithm may be applied to the data.

APPENDIX 4. DESCRIPTION OF REVISION "c" CHANGES

1. The TSO and Appendix 1 have been completely reformatted and editorially revised.
2. Paragraph 4.3 was revised to include specific tests in a new paragraph 4.3.2 needed to ensure adequate device strength and to evaluate the potential for evacuees contacting the ground prior to exiting the device. The beam strength tests of a new paragraph 5.5 are intended to simulate the loading caused by three persons entering one lane of a device virtually as a single mass. The test is designed to use sandbags in order to prevent injury to test subjects and to enhance consistency of test results. Additionally, specific tests were added in a new paragraph 5.6 to verify the strength of the means of attaching the device to the aircraft. Two tests are specified in a new paragraph 5.6 if a traditional girt is used; another test is specified in a new paragraph 5.7 if other means are used, such as individual straps. The asymmetric girt tensile load test in new paragraph 5.6.2 is intended to address wind effects (primarily cross-winds) and, when applicable, wave effects and the effects of pontoon loading. Pontoon loading requirements are contained in a new paragraph 5.8.
3. Paragraph 4.10 was revised to add a second evacuation rate test which would indicate the usability of the device under dark-of-night conditions. The test in new paragraph 4.10.2 has the benefit of indicating, during the development of the device, whether or not the lighting is adequate. Additionally, this will ensure testing with human subjects under dark-of-night conditions should 14 CFR 25, Appendix J, be revised to eliminate full-scale evacuation demonstrations under dark-of-night conditions. Further, the standard rate test of paragraph 4.10.1 was revised to require an increase in the device performance to handle 70 adults per minute per lane rather than 60 adults per minute per lane. This revision addresses the issue of higher evacuee flow rates that have sometimes been achieved in full-scale demonstrations. The test specifics are included in a new paragraph 5.4.
4. Paragraph 4.20 was revised to codify existing practice and to add requirements for additional testing to ensure particular wind loading directions are added for devices which do not deploy perpendicular to the aircraft centerline.
5. Paragraph 5.4 was added to list the specific test conditions required by the tests called for in paragraph 4.10. A new paragraph 5.4.1, which requires a minimum of 120 total evacuees per lane in six different tests, deletes the former requirement of "for a duration of 70 seconds." The new paragraph 5.4.3 test will ensure that during the device development process the issue of naive passenger reaction to the device and device lighting combination under dark-of-night conditions will be addressed. The number of evacuees per exit time is based on there being approximately 75 seconds available for evacuee flow out of the 90 seconds allowed in the emergency evacuation demonstration. The 75 seconds is then broken down into five 15-second intervals. The rating of each exit is divided by 5 to determine the average flow per 15-second interval in order to meet the rating of the exit. The number of 15-second intervals, typically two or three, is selected which will result in an n-1 number of at least 20 evacuees. The number of evacuees, n, is one more than in the table since the first evacuee off the device starts the timing clock.

Note: The test protocol contained in paragraph 5.4.3 is not intended in any way to represent a protocol designed to establish the rating of a new exit type. It is only appropriate for testing suitability of new slides and lighting installations for already approved exit types.

6. Paragraph 5.9 was added to provide a functional performance test criteria for hot and cold soak operations of these devices to further define the requirements of paragraph 4.1.

7. Appendix 2 was added to ensure standardized definitions for commonly used terms associated with descent devices.

8. Appendix 3 was added to provide guidance on the proper means of obtaining data on the forces acting on the means for attaching the descent device to the airplane when the data acquisition system utilizes an analog-to-digital converter.

9. Appendix 4 was added to provide a short background on the changes contained in the latest revision to the TSO, the intent of the revisions, and other related information.

FAA Action

DEPARTMENT OF TRANSPORTATION**Federal Aviation Administration****14 CFR Parts 25 and 121**

[Docket No. 28272; Notice No. 95-9]

RIN 2120-AF21

Revision of Emergency Evacuation Demonstration Procedures To Improve Participant Safety

AGENCY: Federal Aviation Administration, DOT.

ACTION: Notice of proposed rulemaking.

SUMMARY: This notice proposes to revise the emergency evacuation demonstration procedures requirements for transport category airplanes to allow certain alternative procedures in conducting full-scale emergency evacuation demonstrations. These proposals are in response to recommendations from the Performance Standards Working Group (PSWG) of the Aviation Rulemaking Advisory Committee (ARAC). Additionally, the operational requirements for domestic, flag, and supplemental air carriers and commercial operators of large airplanes would be revised to require each operator to conduct a partial demonstration of emergency evacuation procedures upon initial introduction of a type of model of airplane into passenger-carrying operation. The proposed changes are intended to make full-scale emergency evacuation demonstrations safer for participants, to codify existing practices, and to ensure that each operator demonstrates the effectiveness of crewmember training by conducting at least a partial evacuation demonstration. These proposed changes would affect manufacturers and operators of transport category airplanes.

DATES: Comments must be received on or before October 16, 1995.

ADDRESSES: Comments on this notice may be mailed in triplicate to: Federal Aviation Administration, Office of the Chief Counsel, Attention: Rules Docket (AGC-200), Docket No. 28272, 800 Independence Avenue SW., Washington, DC 20591; or delivered in triplicate to: Room 915G, 800 Independence Avenue SW., Washington, DC 20591. Comments delivered must be marked Docket No. 28272. Comments may be examined in Room 915G weekdays, except Federal holidays, between 8:30 a.m. and 5:00 p.m. In addition, the FAA is maintaining an information docket of comments in the Transport Airplane Directorate (ANM-100), Federal

Aviation Administration, 1601 Lind Avenue SW., Renton, WA 98055-4056. Comments in the information docket may be examined weekdays, except Federal holidays, between 7:30 a.m. and 4:00 p.m.

FOR FURTHER INFORMATION CONTACT: Franklin Tiangsing, Regulations Branch, ANM-114, Transport Airplane Directorate, Aircraft Certification Service, FAA, 1601 Lind Avenue SW., Renton, WA 98055-4056; telephone (206) 227-2121.

SUPPLEMENTARY INFORMATION:**Comments Invited**

Interested persons are invited to participate in this proposed rulemaking by submitting such written data, views, or arguments as they may desire. Comments relating to any environmental, energy, or economic impact that might result from adopting the proposals contained in this notice are invited. Substantive comments should be accompanied by cost estimates. Commenters should identify the regulatory docket or notice number and submit comments in triplicate to the Rules Docket address above. All comments received on or before the closing date for comments will be considered by the Administrator before taking action on this proposed rulemaking. The proposals contained in this notice may be changed in light of comments received. All comments received will be available in the Rules Docket, both before and after the comment period closing date, for examination by interested persons. A report summarizing each substantive public contact with FAA personnel concerning this rulemaking will be filed in the docket. Persons wishing the FAA to acknowledge receipt of their comments must submit with those comments a self-addressed, stamped postcard on which the following statement is made: "Comments to Docket No. 28272." The postcard will be date stamped and returned to the commenter.

Availability of the NPRM

Any person may obtain a copy of this notice by submitting a request to the Federal Aviation Administration (FAA), Office of Public Affairs, Attention: Public Inquiry Center, APA-230, 800 Independence Avenue SW., Washington, DC 20591; or by calling (202) 267-3484. The notice number of this notice of proposed rulemaking (NPRM) must be identified in all communications. Persons interested in being placed on a mailing list for future rulemaking documents should also

request a copy of Advisory Circular No. 11-2A, Notice of Proposed Rulemaking Distribution System, which describes the application procedure.

Background

Part 25 of Title 14 of the Code of Federal Regulations (CFR) contains the airworthiness standards for transport category airplanes. Manufacturers of transport category airplanes must show that each airplane they produce complies with the relevant standards of part 25. These standards apply to airplanes manufactured within the U.S. and to airplanes manufactured in other countries and imported under a bilateral airworthiness agreement. One of the standards that must be met is that of demonstrating that passengers and crewmembers can be evacuated in a timely manner in an emergency. This standard is addressed by the requirements contained in § 25.803 and Appendix J to part 25. This standard is intended to demonstrate emergency evacuation capability under a consistent set of prescribed conditions but is not intended to demonstrate that all passengers can be evacuated under all conceivable emergency conditions.

Part 121 contains the requirements governing the operations of domestic, flag, and supplemental air carriers, and commercial operators of large airplanes. One of the requirements is that the certificate holder must demonstrate the effectiveness of the crewmember training and operating procedures in opening floor level and non floor level exits and deploying the evacuation slides, if installed, in a timely manner.

History of the Emergency Evacuation Regulations

Amendment 121-2, effective March 3, 1965, first introduced the requirements for an emergency evacuation demonstration to the FAA regulations. Entities operating under part 121 of Title 14 of the CFR were required to conduct full-scale emergency evacuation demonstrations using 50 percent of the airplane's exits. Half of the exits were rendered inoperative to simulate the type of emergency where fire, structural, or other adverse condition would prevent those exits from being used. A time limit of 120 seconds was given. The demonstration was required upon initial introduction of a type and model of airplane into passenger carrying operations, an increase of 5 percent or greater in passenger seating capacity, or a major change to the interior arrangement that would affect emergency evacuation. The purposes of the demonstration were to demonstrate the ability of crewmembers

to execute established emergency evacuation procedures, and to ensure realistic assignments of crewmember functions.

Amendment 25-15, effective October 24, 1967, introduced the emergency evacuation requirements into part 25. Newly created § 25.803 required airplane manufacturers to conduct an emergency evacuation demonstration for airplanes with a passenger seating capacity of 44 or more. The purpose of this demonstration was to establish the evacuation capability of the airplane. The time limit for this demonstration was established at 90 seconds.

Concurrently, the time limit for the part 121 demonstration was reduced to 90 seconds by Amendment 121-30, also effective October 24, 1967. This reduction was primarily attributable to significant gains made in the efficacy of devices, such as inflatable slides, to assist in the evacuation. The purpose of the part 121 demonstration still focused on crew training and crew procedures so that demonstration conditions remained somewhat different between the two parts.

Section 25.803(d) listed conditions under which analysis could be used in lieu of a full-scale demonstration to demonstrate compliance with the regulation. The section stated that the full-scale demonstration did not have to be repeated for a change in the interior arrangement, or for an increase in passenger capacity of less than five percent, if it could be substantiated by analysis that all occupants could be evacuated in less than 90 seconds.

Amendment 25-46, effective December 1, 1978, revised § 25.803 to allow means other than actual demonstration to show the evacuation capability of the airplane and to replace the existing part 25 demonstration conditions with conditions that would satisfy both part 25 and part 121. In this way, one demonstration could be used to satisfy both requirements. In addition, Amendment 25-46 revised § 25.803 to allow analysis to be used to substantiate compliance for an increase in seating capacity of more than five percent. Part 121 was revised, by Amendment 121-149, effective December 1, 1978, to accept the results of demonstrations conducted in compliance with § 25.803 as of Amendment 25-46.

Amendment 25-72, effective August 20, 1990, placed the demonstration conditions previously listed in § 25.803(c) into a new Appendix J to part 25. This change was done for clarity and editorial consistency with part 121. In addition, emergency escape route requirements formerly contained

in § 25.803(e) were transferred to a new § 25.810(c).

Amendment 25-79, effective September 27, 1993, revised Appendix J to part 25 by revising the age/gender mix to be used when conducting an emergency evacuation demonstration, by allowing the use of stands or ramps for descending from overwing exits only when the airplane is not equipped with an off-wing descent means, and by prohibiting the flight crew from taking an active role in assisting in the passenger cabin.

Amendment 121-233, effective September 27, 1993, revised § 121.291(a), (a)(1), and (a)(2) to remove the requirement that the certificate holder conduct a full-scale evacuation demonstration if the airplane type and model had been shown to be in compliance with § 121.219(a) in effect on or after October 24, 1967, or, if during type certification the airplane had been shown to be in compliance with § 25.803 in effect on or after December 1, 1978. Additionally, an actual demonstration could be conducted in accordance with Appendix D to part 121 in effect on or after September 27, 1993, or in accordance with § 25.803 in effect on or after that date.

The Aviation Rulemaking Advisory Committee

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

There are approximately 60 member organizations on the committee, representing a wide range of interests within the aviation community. Meetings of the committee are open to the public, except as authorized by Section 10(d) of the Federal Advisory Committee Act.

The ARAC establishes working groups to develop proposals to recommend to the FAA for resolving specific issues. Tasks assigned to working groups are published in the *Federal Register*. Working group meetings are not generally open to the public; however, all interested persons are invited to become working group members when the group is formed. Working groups report directly to ARAC, and the ARAC

must adopt a working group proposal before that proposal can be presented to the FAA as an ARAC recommendation.

The activities of the ARAC do not, however, circumvent the public rulemaking procedures. After an ARAC recommendation is received and found acceptable by the FAA, the agency proceeds with the normal public rulemaking procedures. Any ARAC participation in a rulemaking package will be fully disclosed in the public docket.

Activities of the Performance Standards Working Group

On May 23, 1991, the first meeting of the ARAC was held in Baltimore, Maryland, pursuant to a notification in the *Federal Register* (56 FR 2190, January 22, 1991).

Members of the ARAC interested in issues involving emergency evacuation met on May 24, 1991, in Baltimore. At that meeting the charter for a working group that would report to ARAC was established as well as the group membership, which includes representatives from airplane and parts manufacturers, pilot, flight attendant and machinist unions, airlines, airworthiness authorities, passenger associations and other public interest groups. This diverse working group includes representatives from the United States, Canada, and Europe. The charter of the working group is to recommend to the ARAC whether new or revised emergency evacuation standards can and should be stated in terms of performance standards rather than design standards. The first meeting of the new PSWG was held on June 26, 1991, and the group has continued to meet on a bi-monthly basis since then.

Following two unsuccessful emergency evacuation demonstrations of an airplane on October 26, 1991, for which increased seating capacity was sought, and during which a participant was seriously injured, the ARAC was tasked by the FAA to work on recommendations for revising the emergency evacuation demonstration requirements and compliance methods to eliminate or minimize the potential for injury to demonstration participants. The ARAC decided to add this task to the charter of the PSWG.

In response to this additional task, the PSWG created a draft report for discussion. The draft report consisted primarily of two significant parts: recommendations of changes that could be made to the current demonstration that would improve participant safety, but that would not alter the basic character of the demonstrations; and, recommendations for when analysis

could be used in lieu of the full scale demonstration, plus an outlined step-by-step methodology for preparing such an analysis. The former recommendation would require a revision to Appendix J to part 25, while the latter recommendations would expand FAA guidance now in Advisory Circular 25.803-1, Emergency Evacuation Demonstrations. The report was revised numerous times, over several PSWG meetings, based on comments from PSWG members. Nonetheless, after numerous attempts to develop a report that was acceptable to all members of the working group, it was determined that a consensus on the full report could not be attained. Areas of disagreement were, however, defined and discussed in an attempt to reach consensus. Representatives of three organizations on the PSWG have written letters stating their objections to the report as finalized. These letters are included as Appendix 2 of the report. In summary, the objectors expressed concern that the committee did not systematically review the causes of injuries in emergency evacuation demonstrations, and thus could not make meaningful recommendations to reduce or eliminate those injuries. Instead, the objectors felt that the committee had concentrated on an approach which would effectively eliminate the full scale demonstration. It should be noted that the comments are primarily aimed at the proposed revisions to the existing advisory circular and not to the revisions to Appendix J of part 25 contained in this NPRM.

The PSWG accepted the report, although a consensus could not be reached on all issues covered in the report, after discussing all items members raised, including the letters of objection. The report was forwarded to the ARAC on January 28, 1993, and accepted by that body with one negative vote. The vote was taken after an opportunity was given to all members to raise questions or to discuss any item in the report. The ARAC then tasked the PSWG to draft the appropriate rulemaking document and revise the advisory material as recommended in the report. This NPRM covers the recommended revisions to part 25 covered in the report, "Emergency Evacuation Requirements and Compliance Methods that Would Eliminate or Minimize the Potential for Injury to Full Scale Evacuation Demonstration Participants." A copy of the report has been placed in the docket for examination by interested parties.

Harmonization With the Joint Aviation Authorities (JAA)

This document has not been formally harmonized with the JAA in that the JAA has not agreed, as yet, to proceed with parallel rulemaking. A representative of the JAA, however, has been involved with the PSWG since its inception; and the views of the JAA representative have been considered in the development of this notice. Additionally, a representative of the JAA participated as a member of the PSWG writing group, which produced the report noted above upon which this notice is based.

Injuries During Full Scale Emergency Evacuation Demonstrations

Hundreds of people jumping out of an airplane in simulated dark of night conditions onto inflated slides, sliding as many as 25 feet to the ground below, can result in some injuries. As stated in the report, FAA records ("An FAA Analysis of Aircraft Emergency Evacuation Demonstrations: 1982, Society of Automotive Engineers Technical Paper Series #821486 by Sharon A. Barthelmess) noted 166 injuries to participants in a sampling of seven full scale evacuation demonstrations conducted between 1972 and 1980, involving 2,571 passengers and crewmembers. Additionally, a review of 19 full scale evacuation demonstrations during the 1972-1991 time frame identified 269 injuries among 5,797 passengers and crewmembers. Detailed descriptions of most of the injuries discussed above are not available. Not all the injuries, therefore, could be classified as to their severity. Some injuries have been serious; however, the majority probably would not be classified as serious (see 49 CFR 830.2 for injury classification definitions). To date, the most serious injury has resulted in paralysis.

Discussion of the Proposals

The FAA proposes amending Appendix J to part 25, as recommended by the ARAC, to reduce the possibility of injury to participants in a full-scale emergency evacuation demonstration and to codify existing practice regarding airplanes equipped with overwing slides.

Paragraph (a) of Appendix J would be amended to allow exterior light levels of 0.3 foot-candles or less prior to the activation of the airplane emergency lighting system in lieu of the currently required "dark of night" conditions. The proposed light level is approximately the level that would be found in the passenger cabin when the emergency

lighting system is the only source of illumination. Allowing this low level lighting outside the airplane will enhance the ability of the demonstration director to see and react more quickly to problems that may develop during the demonstration. While this would not prevent injuries incurred at the onset of the problems, it could result in reducing the number of injuries by halting the demonstration sooner than in the past. Tests were not run to ascertain whether or not such exterior ambient lighting would enhance or detract from evacuation performance, since it was considered that crew performance, escape system efficiency, and illumination provided by the airplane emergency lighting system have the predominant impact on evacuation performance.

Paragraph (p) would be revised to allow exits with inflatable slides to have the slides deployed and available for use prior to the start of the demonstration timing. If this method is used, the exit preparation time, which would be established in separate component tests, would need to be accounted for in some manner. This change would prevent what has occurred in at least two instances, a participant exiting the airplane before the slide was fully available for use. Neither participant was seriously injured; however, if this were to occur again, the potential for serious injury would remain. An additional benefit is that slides being pre-deployed and inflated would not be subject to damage from equipment, such as light stanchions, that is near the airplane only because a demonstration is being run. The predeployment and inflation of slides also allows the proper placement and opportunity for inspection of safety mats around the slide prior to the start of the demonstration. Additionally, the paragraph would be revised to require that the exits that are not used in the demonstration must be clearly indicated once the demonstration has started. This revision to the regulation would contain wording more general than currently in the rule to accommodate the additional flexibility in exit configuration (slide stowed or pre-deployed and inflated) allowed by this proposal. Finally, the opening sentence in the paragraph would be revised to more succinctly describe the exits that are to be used in the demonstration. The exit pairs in the proposed regulation are as required in the passenger seating tables in § 25.807(d). As in the past, exits that are not installed in pairs, typically tail cone or ventral exits, would not be used in the demonstration. This proposal is in

response to numerous requests to the FAA for clarification of the existing text.

Paragraph (f) would be revised to remove the requirement that each external door and exit be in the takeoff configuration. This proposal is a result of the proposed change to paragraph (p), noted above, which would allow slides to be deployed and inflated prior to the start of the demonstration. If the option to predeploy the slide is selected by the applicant, an agreement must be reached with the FAA prior to the demonstration regarding how to prevent demonstration participants from determining which exits will be used in the demonstration, as well as when, how, and by whom the covers (a likely solution to the issue) in the doorways will be removed and the impact on the resulting times for each of the used exits. Internal doors would still be required to be in takeoff configuration.

Paragraph (o) would be revised to state more generally the intent of the requirement rather than requiring specific actions. The intent is that participants inside the airplane should not be able to identify, prior to the start of the demonstration, which exits will be used during the demonstration. Although this may be made more difficult by the proposed change to paragraph (p), this change is not specifically related to reducing injuries.

Paragraph (n) would be revised to allow passengers to be briefed on safety procedures that are in place for the particular demonstration, e.g., demonstration abort procedures, or procedures that have to do with the demonstration site, e.g., how to evacuate the building in which the demonstration is being conducted, and to note when that briefing could take place. This briefing would be useful by stopping some participants from adding to an already potential injurious situation in the event of problems, such as a collapsed evacuation slide, occurring during the demonstration, or by providing information that would be helpful in case of a problem at the demonstration site, e.g., a fire in the building. The briefing would have to be carefully constructed so as not to impart any information that would enable the participants to evacuate the airplane faster. Additionally, the appropriate time for the passenger briefing required by § 121.571 has been added.

One of the ARAC recommendations, that paragraph (c) be amended to allow the use of stands or ramps for overwing exits only if assist means are not required as part of the airplane type design, is not being proposed because that change has already been implemented by Amendment 25-79.

Another of the recommendations, involving revising the age/gender mix to require using only the age/gender groups least susceptible to injury, is not being proposed at this time, pending research to identify the groups and develop an appropriate mix. A group of participants based on the new mix would have the same evacuation capability as a group based on the existing mix. This possible future proposal would be in addition to the recent change to the mix promulgated by Amendment 25-79.

In addition to the amendments to part 25 proposed in this notice, revisions to Advisory Circular (AC) 25.803-1, Emergency Evacuation Demonstrations, are proposed in response to the recommendations contained in the ARAC report. Advisory Circular 25.803-1 provides guidelines that the FAA has found acceptable regarding emergency evacuation demonstrations. Public comments concerning the proposed revisions to AC 25.803 will be invited by separate notice.

Finally, although not recommended by the ARAC, the FAA has determined that a revision to § 121.291(b)(1) is necessary to accommodate the revision to § 121.291(a), (a)(1), and (a)(2) promulgated by Amendment 121-233, and the proposed change to paragraph (p) of Appendix J to part 25 contained herein. Amendment 121-233 allows a certificate holder to conduct a full-scale emergency evacuation demonstration in accordance with § 25.803 in effect on or after September 27, 1993. The proposed revision to paragraph (p) of Appendix J to part 25 would allow the full-scale emergency evacuation to be run with exits opened and slides deployed and inflated prior to the start of the demonstration. If this proposal were to be incorporated into part 25, it would then be possible for a certificate holder to conduct a full-scale emergency evacuation demonstration without having to have the flight attendants open the exits and deploy the exit slides, if installed. The efficacy of the certificate holder's training and line operating procedures regarding the exits and slides would, therefore, not be demonstrated.

The FAA proposes to remove the qualifying phrase "if the certificate holder has not conducted an actual demonstration under paragraph (a) of this section" from § 121.291(b)(1), thereby requiring each certificate holder to conduct at least a partial demonstration of emergency evacuation procedures for each new type and model of airplane placed into passenger-carrying service. The FAA considers this a necessary and significant

demonstration that must be accomplished prior to any new airplane type and model being placed into passenger-carrying service by every certificate holder. This proposal would require a certificate holder to conduct a partial demonstration, even if the certificate holder ran a full-scale evacuation demonstration with the exits in the takeoff and landing configuration. It is extremely unlikely that a certificate holder would voluntarily choose to conduct a full-scale demonstration in lieu of utilizing the results of the airplane manufacturer's demonstration as part of showing compliance with § 25.803, considering the considerable expense of a full-scale evacuation demonstration versus the minimal expense of a partial evacuation demonstration.

Regulatory Evaluation Summary

Proposed changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 directs that each Federal agency shall propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs. Second, the Regulatory Flexibility Act of 1980 requires agencies to analyze the economic impact of regulatory changes on small entities. Third, the Office of Management and Budget directs agencies to assess the effect of regulatory changes on international trade. In conducting these analyses, the FAA has determined that this rule: (1) would generate benefits that would justify its costs, but is a "significant regulatory action" as defined in the Executive Order; (2) is "significant" as defined in DOT's Policies and Procedures; (3) would not have a significant impact on a substantial number of small entities; and (4) would not have a negative impact on international trade. These analyses, available in the docket, are summarized below.

The proposed rule would not necessarily result in additional compliance costs, because it would allow alternative procedures in conducting demonstrations, rather than mandating them. If manufacturers elect to use the proposed procedures, however, the FAA estimates that there would be incremental costs of approximately \$1,100 per transport airplane certification.

The primary benefit of the proposed rule would be reduced risks of injuries to demonstration participants. Allowing low-level exterior light would enhance the ability of the demonstration director to react more quickly to problems which

could develop during the demonstration. Pre-deploying and inflating slides would prevent participants from injuring themselves by exiting the airplane before the slides are fully available for use.

The FAA reviewed 19 demonstrations conducted between 1972 and 1991. Of the 5,797 participants in the demonstrations, 269, or 4.6 percent, were injured. In the seven demonstrations for which there was information on the types of injuries, 13 suffered fractures, 63 sprains or strains, 32 contusions, and 108 suffered lacerations or abrasions, a total of 216 people injured.

In one of these demonstrations, a participant was seriously injured. In general, however, fractures, sprains, strains, contusions, lacerations, and abrasions are generally classified as "minor" or "moderate," according to the abbreviated injury scale (AIS) used by the National Transportation Safety Board (NTSB). The FAA estimates that the average costs of a minor injury are \$6,900 and the average costs of a moderate injury are \$44,000. Avoiding only one minor injury during an evacuation demonstration would result in cost savings exceeding the estimated \$1,100 incremental costs of the proposed alternative procedures. The FAA has determined, therefore, that the proposed rule would be cost-beneficial.

Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 (RFA) was enacted by Congress to ensure that small entities are not unnecessarily and disproportionately burdened by Federal regulations. The RFA requires a Regulatory Flexibility Analysis if a proposed rule would have a significant economic impact, either positive or negative, on a substantial number of small entities. Based on FAA Order 2100.14A, Regulatory Flexibility Criteria and Guidance, the FAA has determined that the proposed amendments would not have a significant economic impact on a substantial number of small entities because no small entities would be affected.

International Trade Impact Assessment

The proposed rule would not constitute a barrier to international trade, including the export of American airplanes to foreign countries and the import of foreign airplanes into the United States.

Federalism Implications

The regulations proposed herein would 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 proposal does not have sufficient federalism implications to warrant the preparation of a Federalism Assessment.

Conclusion

Although the proposed changes to revise the emergency evacuation demonstration requirements of part 25 of the FAR are not expected to result in substantial economic cost, the FAA has determined that this proposed regulation would be "significant" under Executive Order 12866, and "significant" under DOT Regulatory Policies and Procedures (44 FR 11034, February 25, 1979) because of the public interest involved. Since there are no small entities affected by this proposed rulemaking, the FAA certifies that the rule, at promulgation, would not have a significant economic impact, positive or negative, on a substantial number of small entities under the criteria of the Regulatory Flexibility Act. A copy of the regulatory evaluation prepared for this project may be examined in the Rules Docket or obtained from the person identified under the caption FOR FURTHER INFORMATION CONTACT.

List of Subjects

14 CFR Part 25

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

14 CFR Part 121

Air carriers, Aircraft, Airmen, Aviation safety, Reporting and recordkeeping requirements, Safety, Transportation.

The Proposed Amendments

Accordingly, the Federal Aviation Administration (FAA) proposes to amend 14 CFR parts 25 and 121 of the Federal Aviation Regulations (FAR) as follows:

PART 25—AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY AIRPLANES

1. The authority citation for part 25 is revised to read as follows:

Authority: 49 U.S.C. 106(g), 40110, 40113, 44701, 44702, 44711, 44713; 49 CFR 1.47(a).

2. By amending Appendix J to part 25 by revising paragraphs (a), (f), (n), (o), and (p) to read as follows:

Appendix J to Part 25—Emergency Evacuation

* * * * *

(a) The emergency evacuation must be conducted with exterior ambient light levels of 0.3 foot-candles or less, prior to the evacuation of the airplane emergency lighting system. The source(s) of the initial exterior ambient light level may remain active or illuminated during the actual demonstration. There must, however, be no increase in the exterior ambient light level except for that due to activation of the airplane emergency lighting system.

* * * * *

(f) Each internal door or curtain must be in the takeoff configuration.

* * * * *

(n) Prior to entering the demonstration aircraft, the passengers may also be advised to follow directions of crewmembers but not be instructed on the procedures to be followed in the demonstration, except with respect to safety procedures in place for the demonstration or that have to do with the demonstration site. Prior to the start of the demonstration, the pre-takeoff passenger briefing required by § 121.571 of this chapter may be given. Flight attendants may assign demonstration subjects to assist persons from the bottom of a slide, consistent with their approved training program.

(o) The airplane must be configured to prevent closure of the active emergency exits to demonstration participants in the airplane, until the start of the demonstration.

(p) Exits used in the demonstration will consist of one exit from each exit pair. The demonstration may be conducted with the escape slides, if provided, inflated and the exits open at the beginning of the demonstration. In this case, all exits will be configured such that the active exits are not disclosed to the occupants. If this method is used, the exit preparation time for each exit utilized must be accounted for, and exits that are not to be used in the demonstration must not be indicated before the demonstration has started. The exits to be used must be representative of all of the emergency exits on the airplane and must be designated by the applicant, subject to approval by the Administrator. At least one floor level exit must be used.

* * * * *

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

3. The authority citation for part 121 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40101, 40105, 40113, 44701-44702, and 44704-44705.

4. By amending § 121.291 by revising paragraph (b)(1) to read as follows:

§ 121.291 Demonstration of emergency evacuation procedures.

* * * * *

(b) * * *

(1) Initial introduction of a type and model of airplane into passenger-carrying operation;

* * * * *

Issued in Washington, D.C. on July 11,
1995.

Thomas E. McSweeney,

Director, Aircraft Certification Service.

[FR Doc. 95-17392 Filed 7-17-95; 8:45 am]

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