

Federal Aviation Administration

FAR NPRM

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DEPARTMENT OF TRANSPORTATION
Federal Aviation Administration
14 CFR Part 25
[Docket No. 23792; Notice No. 83-15]

Floor Proximity Emergency Escape Path Marking

AGENCY: Federal Aviation Administration, DOT
ACTION: Notice of Proposed Rulemaking

14 CFR Parts 25 and 121

SUMMARY: This notice proposes new performance standards for floor proximity emergency escape path marking to provide visual guidance for emergency cabin evacuation when all sources of cabin lighting more than 4 feet above the aisle floor are totally obscured by smoke. The proposal results from research and fire tests and would make the standards applicable to future type certification of transport category airplanes, and after a specified date, to airplanes type certificated after January 1, 1958, and operating under Part 121. These proposed standards are intended to improve aircraft fire safety and would be in addition to the emergency lighting standards currently in the regulations.

DATES: Comments must be received on or before February 8, 1984.

ADDRESS: Comments on the proposal are to be marked with "Docket No. 23792" and mailed in duplicate to: Federal Aviation Administration, Office of the Chief Counsel, Attn: Rules Docket [AGC-204], Docket No. 23792, 800 Independence Avenue SW., Washington, D.C. 20591; or delivered in duplicate to: Room 916, 800 Independence Avenue SW., Washington, D.C. Comments may be inspected at Room 916 on weekdays, except Federal holidays, between 8:30 a.m. and 5 p.m.

FOR FURTHER INFORMATION CONTACT: Henri Branting, Technical Analysis Branch (AWS-120), Aircraft Engineering Division, Office of Airworthiness, Federal Aviation Administration, 800 Independence Avenue SW., Washington, D.C. 20591; Telephone (202) 426-8382.

SUPPLEMENTARY INFORMATION:

Comments Invited

Interested persons are invited to participate in this rulemaking by submitting written data, views, or arguments and by commenting on the possible environmental, energy, or economic impact of this proposal. The comment should carry the regulatory document or notice number and be submitted in duplicate to the address above. All comments received as well as a report summarizing any substantive public contact with FAA personnel on this rulemaking will be filed in the docket. The docket is available for public inspection both before and after the closing date for making comments.

Before taking any final action on the proposal, the Administrator will consider any comment made on or before the closing date for comments. The proposal may be changed in light of comments received.

The FAA will acknowledge receipt of a comment if the commenter submits with the comment a self-addressed, stamped postcard on which the following statement is made: "Comments on Docket No. 23792." When the comment is received, the postcard will be dated, time stamped and returned to the commenter.

Availability of NPRM

Any person may obtain a copy of this notice of proposed rulemaking by submitting a request to the Federal Aviation Administration, Office of Public Affairs, Attention: Public Information Center, APA-430, 800 Independence Avenue SW., Washington, D.C. 20591, or by calling (202) 426-8058. Requests should be identified by the docket number of this proposed rule. Persons interested in being placed on a mailing list for future proposed rules should also request a copy of Advisory Circular NO. 1102, Notice of Proposed Rulemaking Distribution System, which describes the application procedure.

Background

This notice is based on findings of the Special Aviation Fire and Explosion Reduction (SAFER) Advisory Committee and the results of research, development, and testing conducted by the Civil Aeromedical Institute (CAMI) and the technical center of the FAA.

As a result of information from public hearings on aircraft fire safety, the FAA established the SAFER Advisory Committee in June 1978, charging the Committee to "examine the factors affecting the ability of the aircraft cabin occupant to survive in the post-crash environment and the range of solutions available." The committee consisted of 24 representatives of a wide range of aviation and general public interests. The Committee technical support groups included approximately 150 of the world's top experts in fire research, accident investigation, materials development, and related fields. The Committee focused primarily on the problems of fuel spill and cabin fire protection and looked into related aspects of post-crash survival, including lighting for emergency evacuation. The Committee found that accident experience indicates smoke from burning fuel and cabin material can obscure overhead emergency lighting and make cabin evacuation difficult. Therefore, the Committee recommended that consideration be given to placing additional sources of lighting at a lower level in the relatively clear air near the floor. The FAA accepted the Committee recommendation and has been conducting research, testing, and design studies necessary to develop this proposed floor proximity marking standard.

Current airworthiness and operating regulations address the problems and the urgency of cabin evacuation immediately following a crash landing. For most airplanes operating under Part 121, the Federal Aviation Regulations require that the emergency evacuation capability of the airplanes be confirmed by a full-scale demonstration in which a full cabin load of typical airline passengers is evacuated in 90 seconds. This demonstration is carried out in simulated dark of the night emergency conditions using only emergency lighting and with one-half of the number of emergency exits rendered unusable. While this particular demonstration does not simulate a smoke-filled cabin, it does consider the possibility that a fire exists on the exterior of the airplane, as reflected in the requirement that half of the exits are assumed blocked either by fire or some other cause.

Current regulations require that emergency lighting provide specific illumination at seat armrest level. The sources of this emergency illumination are typically located overhead in the cabin ceiling area. Service experience shows that the current regulations effectively ensure that the airplane is capable of sustaining rapid mass evacuation under critical conditions over a reasonable extended period of time.

The SAFER study indicated that the current regulations do not adequately cover the brief interval between the time when the smoke from a spreading fire begins to overwhelm the mass evacuation process and the time when the cabin is not survivable. That is when buoyant hot smoke and gases might begin to fill the cabin down to near floor level, obscuring all overhead

lighting. While this condition is extreme, it is considered desirable to address this in the aircraft design, and safety could be improved through the use of lights, lights and reflectors, or other devices to provide floor proximity emergency escape path marking.

The FAA conducted a series of small-scale laboratory tests and several full-scale evacuation tests and cabin fire tests (in conjunction with the fire protection research) to look into the problems of emergency lighting in conditions of dense smoke and to study practical ways of developing improved lighting systems for transport category airplane cabins. These tests confirmed that in dense smoke conditions, the evacuation capability of a cabin equipped with conventional overhead lighting is reduced more quickly and to a greater extent than that of a cabin with floor proximity markings. Increasing the intensity of overhead lighting to compensate for the smoke proved to be of little effect. The results of the FAA test program are contained in three reports, available from the National Technical Information Service, Springfield, Virginia 22161.

1. Report No. FAA-AM-79-12, Readability of Self-Illuminated Signs in a Smoke-Obscured Environment, dated November 1979 -- This study investigated the ability of people with normal distant visual acuity to identify self-illuminated emergency signs in an environment obscured by white smoke. The results indicate that substantial increases in character sizes in the signs produce only moderate improvement in readability.
2. Report No. FAA-AM-80-13, Readability of Self-Illuminated Signs Obscured by Black Fuel-Fire Smoke, dated July 1980 -- This study, using black fuel-fire generated smoke, is a partial replication of the 1979 study using white smoke. A comparison of the results of the two studies shows both colors of smoke to be approximately equal in their ability to shroud the illuminated signs. Black smoke, however, appears somewhat more effective in obscuring small details at or near the normal visual acuity threshold.
3. Report No. FAA-AM-81-7, Emergency Cabin Lighting Installations: An Analysis of Ceiling vs. Lower Cabin-Mounted Lighting During Evacuation Trials, dated February 1981 -- In this study, full-scale evacuation tests were conducted to compare the evacuation rates with two different emergency lighting systems in an aircraft cabin filled with nontoxic white smoke. Cabin emergency lighting and exit signs mounted below layered smoke in aisle seat armrests, with exit signs mounted at and below the cabin midpoint, provided light directly in the aisle and cross aisle. Results indicated that lights and signs mounted lower in the cabin were more readily visible in smoke and enable subjects to evacuate from a smoke-filled cabin more rapidly than conventional ceiling-mounting lights and signs.

To implement the test findings, a design feasibility and cost study of floor proximity emergency escape path marking was conducted under FAA contract. Eleven candidate systems were considered in this study, and the two most promising systems in terms of performance and practicality were analyzed in detail. The 11 systems studied included incandescent, fluorescent, electroluminescent, and self-illuminated lighting elements. The various lighting elements were studied at different locations and distributions within the cabin, including aisle seat frames, armrests, and panels, cabin sidewall panels, the aisle floor, and overhead baggage racks. While individual systems studied had certain advantages compared to others, no system was so clearly superior to the others that it warranted its establishment through regulation as the signal standard for floor proximity emergency escape path marking in general. Therefore, this notice proposes an objective performance standard rather than requiring a particular system. A performance standard would allow industry the flexibility to choose among the various systems or to develop an acceptable system to mark the emergency escape path to the exits when all sources of illumination above 4 feet from the aisle floor are totally obscured by smoke.

Discussion of Proposal

Based on the studies carried out, this document proposes performance standards for floor proximity emergency escape path marking for transport category airplanes. The standards would establish the level of performance which must be proved under dark of the night conditions. These conditions are the same as those specified in the emergency evacuation demonstration requirements of Section 25.803 and Appendix D to Part 121. The proposal does not include

rotorcraft or the types of airplanes operated under Part 135 because of their relatively smaller cabin sizes and shorter aisle lengths and shorter seat-to-exit distances compared to transport category airplanes. Floor proximity emergency escape path marking would provide guidance when all sources of illumination more than 4 feet above the cabin aisle floor are totally obscured by dense smoke. Although the effective height of clear air would be somewhat less than 4 feet, the choice of 4 feet appears to be a reasonable height based on the studies performed and on accident experience.

There may be any number of acceptable combinations of point lighting, flood lighting, strip lighting, markers, signs, reflective materials, and other components that could meet the performance objectives of this proposal. The approval of radioactive light sources would be subject to applicable requirements of the U.S. Nuclear Regulatory Commission. Although the design feasibility and cost study on which the economic analysis is based took into consideration self-illuminated lighting components containing tritium, the standard proposed in this notice would provide industry the flexibility and latitude to design simplified systems of comparable performance and cost using nonradioactive components. Comments and data on marking systems capable of meeting the proposed performance standards are particularly sought and would be considered in the publication of advisory material on acceptable means of compliance.

The proposal would require that airplanes type certificated after January 1, 1958, and operating under Part 121 comply with the new standards within 2 years after the standards become effective. The limited number of airplanes type certificated before January 1, 1958, which are operating under Part 121 are not included because the relatively advanced age and smaller sizes of these airplanes make compliance with the proposed requirements impractical from an economic standpoint. The 2-year period is intended to allow air carriers lead time to schedule the modifications necessary for compliance to coincide with major maintenance inspections and, therefore, avoid an undue burden. The FAA requests comments on this issue and will consider all responses in establishing the implementation period in the final rule.

Economic Analysis

Under contract, the FAA conducted a detailed cost analysis of two emergency light and exit sign systems for improved passenger evacuation and dense cabin smoke conditions. The two systems that were evaluated are (1) self-illuminated markers on each aisle seat and self-illuminated signs beside each exit, and (2) incandescent lights under each aisle seat, on one side of the aisle, and self-illuminated lights beside each exit. Both of these systems supplement the existing emergency lighting system. The increased illumination provided by the markers and signs is negligible, but awareness of the escape route is sufficient to aid the passenger during evacuation in dense cabin smoke conditions. The system utilizing incandescent lights and self-illuminated exit signs costs more than four times as much as the self-illuminated marker and exit sign system. Because each concept is likely to meet the requirements of the proposed rule, the FAA developed cost estimates for floor proximity emergency lighting based on a self-illuminated marker and exit sign system which is the least expensive system in the calculation of potential cost to industry. Using this type of system, the cost of retrofitting an individual aircraft is estimated at \$5,500 for a DC-9 and at \$17,400 for a B747. The cost to install a system of this type in a new aircraft is estimated to be 10 percent less than the retrofitting cost.

The weight added with the addition of this lighting system is estimated at 8 pounds for the DC-9 and 17 pounds for the DC-10. Because the weight change is nominal, the payload should not be affected, and the cost impact would be that for additional fuel.

For the 1983 fleet of 2,600 aircraft, the cost to retrofit is estimated at \$18.24 million and the cost of additional fuel for carrying the additional weight is estimated at \$468,000 per year.

An obvious benefit of the floor proximity emergency escape path marking is the savings of lives and the injuries prevented. Since 1965, 914 fatalities occurred in accidents involving fires. Some of those fatalities resulted from trauma or other causes and could not have been averted by floor proximity emergency escape path marking. However, based on available information, it is estimated that the proposed marking system alone could have helped to prevent 20 percent of these fatalities.

To project the casualty loss over the next 10-year period, the number of enplanements and the fire casualty losses have been estimated. The benefits from 1983 through 1993 are estimated to be more than twice the cost of retrofitting the fleet.

Trade Impact

There would be little or no impact on U.S. or foreign trade if this proposal were adopted. In the United States, both foreign and domestic manufacturers would have to meet the proposed requirements, and there would be no competitive advantage to either. In foreign countries, there would be a minor cost advantage only if the foreign country did not require the floor proximity emergency escape path marking system. Since the cost of the marking system is negligible compared to the total costs of new aircraft, there is essentially no impact on trade.

List of Subjects

14 CFR Part 25

Air transportation, Aircraft, Aviation safety, Safety, Tires.

14 CFR Part 121

Aviation safety, Safety, Air carriers, Air Traffic control, Air transportation, Aircraft, Aircraft pilots, Airmen, Airplanes, Airports, Airspace, Airworthiness directives and standards, Beverages, Cargo, Chemicals, Children, Narcotics, Flammable materials, Handicapped, Hazardous materials, Hours of work, Infants, Liquor, Mail, Drugs, Pilots, Smoking, Transportation, Common carriers.

The Proposed Amendment

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

PART 25 -- AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY AIRPLANES

Section 25.812 [Amended]

1. By amending Section 25.812(a)(1) by removing the phrase "and interior lighting in emergency exit areas" and inserting, in its place, the phrase "interior lighting in emergency exit areas, and floor proximity escape path marking".
2. By amending Section 25.812 by redesignating present paragraphs (e) through (k) as paragraphs (f) through (l).
3. By amending Section 25.812 by adding a new paragraph (e) as follows:

Section 25.812 Emergency lighting.

* * * * *

(e) Floor proximity emergency escape path marking must provide emergency evacuation guidance for passengers when all sources of illumination more than 4 feet above the cabin aisle floor are totally obscured. In the dark of the night, the floor proximity emergency escape path marking must enable each passenger to--

- (1) Visually identify the emergency escape path along the aisle of the cabin floor after leaving a cabin seat; and
- (2) Readily identify each exit from the emergency escape path by reference only to markings and visual features not more than 4 feet above the cabin floor.

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4. By changing the reference in redesignated paragraph (f) of Section 25.812 from "paragraph (g)" to "paragraph (h)".

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

5. By amending Section 121.310 by revising paragraph (c) to read as follows:

Section 121.310 Additional emergency equipment.

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(c) Lighting for interior emergency exit markings. Each passenger-carrying airplane must have an emergency lighting system, independent of the main lighting system. However, sources of general cabin illumination may be common to both the emergency and the main lighting systems if the power supply to the emergency lighting system is independent of the power supply to the main lighting system. The emergency lighting system must--

- (1) Illuminate each passenger exit marking and locating sign;
- (2) Provide enough general lighting in the passenger cabin so that the average illumination when measured at 40-inch intervals at seat armrest height, on the centerline of the main passenger aisle, is at least 0.05 foot-candles; and
- (3) For airplanes type certificated after January 1, 1958, after (a date 2 years after the effective date of this regulation), include floor proximity emergency escape path marking which meets the requirements of Section 25.812(e) of this chapter in effect on (the effective date of this regulation).

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6. By changing the reference in paragraph (d) of Section 121.310 from "Section 25.812(g)" to "Section 25.812(h)".

(Secs. 313(a), 314(a), 601 through 610, and 1102, Federal Aviation Act of 1958 (49 U.S.C. 1354(a), 1355(a), 1421 through 1430, and 1502); 49 U.S.C. 106(g) (Revised, Pub. L. 97-449, January 12, 1983); 14 CFR 11.45).

This proposal was developed jointly by, and is issued on behalf of, the Office of Airworthiness, Washington, D.C., responsible for issuance of Part 121 rulemaking proposals; and the Transport Airplane Certification Directorate, Seattle, Washington, responsible for issuance of Part 25 rulemaking proposals. Recommendations for final rulemaking will be made to the Administrator jointly by these offices after their review and consideration of all comments received.

Note -- Under the terms of the Regulatory Flexibility Act (the Act), the FAA has reviewed this proposal to determine what impact it might have on small entities. Since the projected cost of compliance could be between \$5,500 and \$17,400 for each aircraft in the Part 121 fleet, the FAA has determined that this rule, if adopted, may have a significant economic impact on a substantial number of small entities. Consequently, an initial regulatory flexibility analysis and regulatory evaluation has been prepared. It is contained in the docket and is open to public inspection at the place and time stated at the beginning of this document. A copy of the evaluation may be obtained by contacting the person identified under the caption 'FOR FURTHER INFORMATION CONTACT.'

As required by the Act, various regulatory alternatives were considered, such as: Making the requirements applicable only to new airplanes, having different standards based on the size of the air carrier, letting the market decide whether to use the new systems, and requiring all airplanes operating under Part 121 to come into compliance with the requirements within a certain time period. Safety needs are such that the FAA has selected the latter alternative set forth in this proposal.

This proposal, if adopted, is not likely to result in an annual effect on the economy of \$100 million or more or a major increase in costs for consumers; industry; or Federal, State, or local government agencies. In addition, this proposal, if adopted would have little or no impact on trade opportunities for U.S. firms doing business overseas or for foreign firms doing business in the United States. Accordingly, it has been determined that this is not a major regulation under Executive Order 12291. In addition, the FAA has determined that this action is significant under

Department of Transportation Regulatory Policy and Procedures (44 FR 11034, February 26, 1979).

Issued in Washing, D.C., on August 23, 1983.
Walter S. Luffsey,
Associate Administrator for Aviation Standards.
[FR Doc. 83-27485 Filed 10-7-83; 8:45 am]
BILLING CODE 4910-10-M

Other Notice of Proposed Rulemaking Actions:

Not Applicable.

Final Rule Actions:

Final Rule. Docket No. 23792; Issued on 10/22/84.