DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 121

[Docket No. FAA–2002–13464; Notice No. 02–17]

RIN 2120–AC84

Improved Seats in Air Carrier Transport Category Airplanes

AGENCY: Federal Aviation Administration, DOT.

ACTION: Supplemental notice of proposed rulemaking (SNPRM).

SUMMARY: The Federal Aviation Administration proposes to require that all passenger and flight attendant seats in transport category airplanes used in part 121 passenger-carrying operations meet improved crashworthiness standards. This proposed rule is necessary to provide an increased level of safety for part 121 operations. The intended effect of this proposed rulemaking is to increase passenger protection and survivability in impact-survivable accidents.

DATES: Comments must be received on or before December 3, 2002.

ADDRESSES: Address your comments to the Docket Management System, U.S. Department of Transportation, Room Plaza 401, 400 Seventh Street, NW., Washington, DC 20590–0001. You must identify the docket number FAA 2002–13464 at the beginning of your comments, and you should submit two copies of your comments. If you wish to receive confirmation that FAA has received your comments, include a self-addressed, stamped postcard.

You may also submit comments through the Internet to *http://dms.dot.gov.* You may review the public docket containing comments to these proposed regulations in person in the Docket Office between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays. The Docket Office is on the plaza level of the NASSIF Building at the Department of Transportation at the above address. Also, you may review public dockets on the Internet at *http://dms.dot.gov.*

FOR FURTHER INFORMATION CONTACT: Hal Jensen, Aircraft Certification Service, Aircraft Engineering Division, AIR–120, Federal Aviation Administration, 800 Independence Avenue, SW., Washington, DC 20591; telephone (202) 267–8807; facsimile (202) 267–5340.

SUPPLEMENTARY INFORMATION:

Comments Invited

Interested persons are invited to participate in the making of the proposed rule by submitting such written data, views, or arguments, as they may desire. Comments relating to the environmental, energy, federalism, or economic impact that might result from adopting the proposals in this notice are also invited. Substantive comments should be accompanied by cost estimates. Comments must identify the regulatory docket or notice number and be submitted in duplicative to the DOT Rules Docket address specified above.

All comments received, as well as a report summarizing each substantive public contact with FAA personnel on this rulemaking, will be filed in the docket. The docket is available for public inspection before and after the comment closing date.

All comments received on or before the closing date will be considered by the Administrator before taking action on this proposed rulemaking. Comments filed late will be considered as far as possible without incurring expense or delay. The proposals contained in this notice may be changed in light of the comments received.

Commenters wishing the FAA to acknowledge receipt of their comments submitted in response to this notice must include a pre-addressed, stamped postcard with those comments on which the following statement is made: ''Comments to Docket No. FAA–2002–13464.'' The postcard will be date stamped and mailed to the commenter.

Availability of Rulemaking Documents

You can get an electronic copy using the Internet by taking the following steps:

(1) Go to the search function of the Department of Transportation's electronic Docket Management System (DMS) Web page (*http://dms.dot.gov/search*).

(2) On the search page, type in the last four digits of the docket number shown at the beginning of this notice. Click on ''search.''

(3) On the next page, which contains the docket summary information for the docket you selected, click on the document number of the item you wish to view.

You can also get an electronic copy using the Internet through the FAA's Web page at *http://www.faa.gov/avr/arm/nprm/nprm.html* or the **Federal Register**'s web page at *http://www.access.gpo.gov/su_docs/aces/aces140.html.*

You can also get a copy by submitting a request to the Federal Aviation Administration, Office of Rulemaking, ARM–1, 800 Independence Avenue SW., Washington, DC 20591, or by calling (202) 267–9680. Make sure to identify the docket number, notice number, or amendment number of this rulemaking.

Background

Statutory Requirement

Title III, section 303(b), of the Airport and Airway Safety and Capacity Expansion Act of 1987 (Act of 1987) directs the Secretary of Transportation to initiate rulemaking to consider requiring all seats onboard all air carrier aircraft to meet improved crashworthiness standards based on the best available testing standards for crashworthiness. On May 17, 1988, the FAA published Notice No. 88–8, Retrofit of Improved Seats In Air Carrier Transport Category Airplanes; Notice of Proposed Rulemaking (53 FR 17650). That notice proposed to require all seats of transport category airplanes used under part 121 and part 135 to comply with improved crashworthiness standards. The NPRM proposed to prohibit the operation of these airplanes unless all seats meet the crashworthiness performance standards required by Amendment No. 25–64, Improved Seat Safety Standards; Final Rule (53 FR 17640, May 17, 1988).

Improved Seat Safety Standards—Amendment No. 25–64

Amendment No. 25–64 upgraded the certification standards for occupant protection during emergency landing conditions in transport category airplanes. Based on research, testing, and service experience, the amendment revised the seat and restraint system requirements and defined occupant injury criteria for impact conditions. The improved seating systems provide increased occupant protection in airplanes involved in impact-survivable accidents.

Specifically, Amendment No. 25–64 revised § 25.561(b)(3) to increase the ultimate inertial forces in the upward, sideward, and downward directions, and to add an ultimate inertial force requirement in the aft direction. The ultimate inertial forces prescribed in § 25.561(b)(3) are static load forces, and the type-certificate applicant must show that the airplane, including seating systems and items of mass (and their supporting structure), can withstand these forces. The static load requirements of § 25.561(b)(3) increased the ultimate inertial forces (expressed in multiples of the acceleration of gravity, or g) for emergency landing conditions

from (1) 2.0g to 3.0g in the upward direction; (2) 1.5g to 3.0g on the airframe and 1.5g to 4.0g on seats and seat attachments in the sideward direction; and (3) 4.5g to 6.0g in the downward direction. The amendment also added a 1.5g requirement in the rearward direction. Revised § 25.561(d) requires that seats and items of mass (and their supporting structure) meet the static load requirements without deforming in a manner that would impede rapid evacuation of the occupants from the airplane. The static load factors adopted by Amendment No. 25–64 were selected to reflect industry design practices and to take advantage of existing airframe floor strength.

Amendment No. 25–64 also added § 25.562 to include new dynamic performance standards for seating systems to provide increased occupant protection in airplanes involved in impact-survivable accidents. Specifically, § 25.562 (b)(1) and (b)(2) provide that each seat type design approved for crew or passenger occupancy during takeoff and landing must successfully withstand—(1) a change in downward vertical velocity (ΔV) of not less than 35 feet per second, with the airplane's longitudinal axis canted downward 30 degrees with respect to the horizontal plane and with the wings level. Peak floor deceleration must occur in not more than 0.08 seconds after impact and must reach a minimum of 14g and (2) a change in forward longitudinal velocity (ΔV) of not less than 44 feet per second, with the airplane's longitudinal axis horizontal and yawed 10 degrees either right or left with the wings level. Peak floor deceleration must occur in not more than 0.09 seconds after impact and must reach a minimum of 16g. Where floor rails or floor fittings are used to attach the seating devices to the test fixture, the rails or fittings must be misaligned with respect to the adjacent set of rails or fittings by at least 10 degrees vertically with one rolled 10 degrees.

Section 25.562(c) requires an assessment of certain performance criteria during the dynamic tests described in § 25.562(b)(1) and (b)(2) to assess the potential for serious injury to an occupant. Among these criteria are—(1) the maximum strap tension for upper torso restraints of crewmembers; (2) the maximum compressive load measured between the pelvis and the lumbar column of the anthropomorphic dummy; (3) the positioning criteria for the upper torso restraint straps, where installed, and the lap safety belt; (4) the criterion for preventing serious head injury; and (5) the maximum compressive load in each femur of the test dummy. Additionally, the performance criteria require that the seat remain attached at all points of attachment and not yield under either of the dynamic load tests to the extent rapid evacuation of the airplane would be impeded.

Section 25.785(a), currently § 25.785(b), was revised and requires that each seat, berth, safety belt, harness, and adjacent part of the airplane at each station designated as occupiable during takeoff and landing be designed so that a person making proper use of these facilities will not suffer serious injury in an emergency landing as a result of the inertial forces specified in §§ 25.561 and 25.562.

Retrofit of Improved Seats in Air Carrier Transport Category Airplanes—Notice No. 88–8

In Notice No. 88–8, the FAA proposed to add a new paragraph to §§ 121.311 and 135.169 to prohibit after June 16, 1995, the operation of transport category airplanes under part 121 and part 135 that were type-certificated after January 1, 1958, unless all seats onboard the airplanes are equipped with seats that meet the applicable certification requirements in § 25.785 in effect on June 16, 1988. Even though the Act of 1987 addressed seats on all air carrier aircraft, the development of new crashworthiness standards for seats in normal and transport category rotorcraft had not been completed, and new seat standards for airplanes type certificated in the commuter category had not been proposed. Therefore, Notice No. 88–8 did not propose the retrofit of seats in those categories of aircraft.

The 1988 proposal was directed at all seats (passenger seats, including divans and sidefacing seats, flight attendant seats, flight crew seats, observer seats, and courier seats), safety belts, harnesses, and adjacent parts of transport category airplanes used in passenger- and cargo-carrying operations under part 121 and scheduled intrastate common carriage under part 135. Notice No. 88–8 did not propose to require an upgrade of the static strength standards for fixed items of mass (other than seats) and their support structures, and did not propose to require modifications to the floor structure.

The FAA received 70 comments to the NPRM during the comment period. Forty-five commenters agreed with the proposal, 14 opposed it, and 11 supported the intent of the proposal but did not agree with all the provisions. The substance of these comments will be discussed later in this document under the section titled New Proposal. The FAA received approximately 16 additional comments to the docket between the close of the NPRM comment period and December 1998.

Based on comments on Notice No. 88–8, the FAA decided that it needed additional information to determine the impact of that proposal on the aviation community. Even though considerable research and development in dynamic testing of seats had been done over the preceding years to support the adoption of the 16g standard in § 25.562, the process of certifying seats to be used in production to the 16g standards was still in its infancy. Furthermore, the dynamic testing requirements for 16g seats represented a monumental increase in sophistication and complexity over the simpler static testing used for 9g seats. Therefore, the aviation industry and the FAA had many issues to iron out in the preparation, execution, and evaluation of a 16g seat dynamic test program for seats to be manufactured in mass production. In 1990, the FAA developed an advisory circular (AC) to provide industry guidance on the dynamic test process (AC 25.562–1, Dynamic Evaluation of Seat Restraint Systems & Occupant Protection on Transport Airplanes, March 6, 1990; superceded by AC 25.562–1A, January 19, 1996). Additionally, the FAA worked with industry through the Society of Automotive Engineers SEAT Committee to develop a standard that would detail the requirements for dynamic testing of a 16g seat. That standard (Aerospace Standard 8049, Performance Standard for Seats in Civil Rotorcraft, Transport Aircraft and General Aviation Aircraft) was incorporated in Technical Standard Order (TSO)–C127 (Rotorcraft, Transport Airplane, and Normal and Utility Airplane Seating Systems) in 1992 and revised in 1998 (TSO–C127a) to include additional clarification.

The FAA's guidance and standards material evolved over several years as the industry transitioned from producing 9g seats to 16g seats that could meet FAA requirements. The FAA never lost sight of the goal of improving the crashworthiness of seats in transport category airplanes. However, industry needed time to work out the technical problems of meeting the 16g seat standard, and the FAA needed time to evaluate specific problems presented by industry and to develop proper guidance material for obtaining 16g seat certification.

The FAA held a public meeting on October 23 and 24, 1995, in Seattle, Washington, to gather information on 16g dynamic seats. The FAA presented

its views and listened to comments from the aviation industry at that meeting. The information gained during this public meeting led the FAA to reconsider the original proposed rule in Notice No. 88–8.

From the mid-to-late 1990s, although industry and the FAA continued to address significant 16g seat issues, enough progress had been made that 16g seats were being produced and certificated on a regular basis. Therefore, the FAA believed it was appropriate to move forward with its proposed rulemaking to improve seats on transport category airplanes. As a result, the FAA held a public meeting on December 8 and 9, 1998, to discuss its proposed revisions to the 1988 proposal and obtain more current information and views.

December 1998 Public Meeting

In the 1998 public meeting proposal, the FAA deleted its proposal to revise part 135 and proposed to add a new paragraph to § 121.311 that would prohibit the operation of any transport category airplane type-certificated after January 1, 1958, on which all passenger and flight attendant seats did not fully meet the requirements of § 25.562. The FAA also indicated it was considering an exception for airplanes operated in all-cargo operations. At that time, the proposed requirements would be effective four years after publication of a final rule, which would have been approximately January 2003.

The FAA also proposed an alternative in another paragraph in § 121.311 that would allow a transport category airplane type-certificated after January 1, 1958, to continue to be operated after four years after the publication of a final rule provided all passenger and flight attendant seats met the requirements of § 25.562 or were properly marked as 16g-compatible. The FAA stated that a seat could properly be marked as 16g-compatible if it was manufactured before the four-year compliance date and underwent a supplemental certification. Under the 1998 proposal, an applicant for a 16g-compatible seat would be required to show that the seat or seat type would withstand the dynamic loads set forth in § 25.562(a) and (b) without structural separation of the seat's primary structure. The applicant also would need to demonstrate that the occupant dummy would remain in the seat during the test and not be entrapped by the test article. In addition, the FAA indicated it would not require the retrofit of seats of aircraft operated under part 135.

Much of the discussion at the public meeting addressed the meaning of 16g-compatible and the process for establishing compatibility. Industry expressed concern about the FAA's ability to handle increased certification projects and the seat manufacturers' ability to produce enough seats in four years to meet the other requirements of the proposal. Furthermore, industry criticized the FAA data used to support the safety benefits of the proposal as outdated and argued that the number of potential lives saved would not warrant the costs associated with the proposal. In addition, comments presented at the public meeting addressed the expense associated with previously adopted regulations addressing accident prevention. Other industry representatives also recommended that regulatory requirements involving significant costs should focus on accident prevention rather than aircraft crashworthiness. Finally, some industry representatives urged that the FAA permit air carriers to replace seats based on business needs.

In addition to comments offered at the public meeting, the FAA reopened the docket for comments through January 8, 1999. The FAA received approximately 40 additional comments by the close of this comment period. The commenters generally opposed certain aspects of the proposal. The substances of these comments are discussed in this SNPRM under the section titled New Proposal.

New Proposal

Based on the comments received in response to Notice No. 88–8 and the 1995 and 1998 public meetings, as well as new survivable accident data and cost-benefit analysis developed following the 1998 public meeting, the FAA has determined that it is appropriate to issue an SNPRM.

The FAA is proposing a two-tiered time table—one that would require newly-manufactured airplanes to be equipped with the improved seats first, and allow more time for the remainder of the fleet to be retrofitted with those seats. In order to ensure that newly-manufactured airplanes—those that will be in the fleet the longest—have the improved seats first, the FAA proposes to prohibit the operation in passenger-carrying service of any transport category airplane manufactured after four years from the effective date of the final rule unless all passenger and flight attendant seats on that airplane meet the requirements of § 25.562. At the outer limit, after 14 years from the effective date of the final rule, no transport category airplane could be operated in passenger-carrying service unless all passenger and flight attendant seats on that airplane meet the requirements of § 25.562. In addition, in order to accelerate the retrofit of the fleet, the FAA is proposing that, after four years from the effective date of the rule, whenever an operator of a transport category airplane replaces an existing passenger or flight attendant seat with a different type of seat, the operator must equip the airplane with seats that meet the requirements of § 25.562 before the airplane could be operated in passenger-carrying service.

For existing airplanes, this SNPRM would give part 121 operators discretion in replacing the existing seats on any airplane with 16g seats for a period of 14 years after the effective date of the final rule. An operator would be required to replace all passenger seats and all flight attendant seats on an airplane only when the operator chooses to replace any passenger seat or flight attendant seat on that airplane. Therefore, an operator could elect to make no seat replacements for up to 14 years. However, after 14 years all passenger seats and all flight attendant seats on all transport category airplanes operated under part 121 must meet the 16g standard as defined in § 25.562. The SNPRM would not apply to the removal and reinstallation of the same seat or an identical seat in the same airplane for the purpose of seat maintenance or cabin interior maintenance. Also, under this SNPRM, the replacement of seat cushions and seat dress covers is not considered seat replacement and upgrading to the 16g standard will not be required. For the purpose of this SNPRM, seat replacement means the removal of an existing seat and the re-installation of a seat other than the one removed or other than an seat identical to the one removed. This allows a spare or new seat to replace a damaged seat provided the part numbers are the same. The intent of this SNPRM is to allow the replacement of a damaged seat without requiring the operator to upgrade the entire airplane with 16g seats.

This proposal was developed after carefully considering the viewpoints presented at the 1998 public meeting. The FAA believes this SNPRM will provide the best solution for upgrading the entire fleet of part 121 transport category airplanes with safer seats in a reasonable timeframe. A wide range of options was considered for seat replacement on existing aircraft that ranged from voluntary replacement to mandatory replacement under several different timeframes of compliance. Evaluations included giving credit for certain era seats believed to be compliant with some parts of § 25.562. The degree to which the replacement seats would have to comply with

§ 25.562 was also evaluated. The issue of ''16g-compatible'' seats presented at the 1998 public meeting has been remedied in this SNPRM by ensuring one level of safety that requires full compliance with § 25.562. The proposals in this SNPRM also would eliminate the need for recertification of existing seats already installed on airplanes to show they were 16g compatible. Some options would have required seats in existing aircraft to be replaced per a fixed accelerated schedule; however, the FAA believes that replacement of the seats based on current business practices will effectively update the existing fleet and allow the airlines flexibility in achieving this goal.

The FAA has chosen a final compliance timeframe that is quite liberal in allowing airlines to exercise their own discretion in seat replacement and yet ensures that the transport fleet will be upgraded to the 16g standard.

This SNPRM reduces the overall cost compared to other proposed rule options since operators are not locked into accelerated seat replacement schedules for their existing aircraft. However, this SNPRM ensures that when the operators elect to replace their seats, the new seats will be ''full'' 16g (*i.e.*, must meet all requirements of § 25.562) and one level of safety for seats will be developed throughout the fleet. This SNPRM also was chosen because it would mandate that the newly manufactured airplanes, or those airplanes that will be in the fleet the longest, will be required to meet full 16g seat certification the soonest.

Compliance Schedule

Notice No. 88–8 proposed that all transport category airplanes must meet the requirements proposed by June 16, 1995, which gave operators 7 years to comply. The 1998 public meeting proposed that all transport category airplanes meet the newly proposed requirements four years after publication of the final rule.

The following compliance table summarizes what this SNPRM proposes:

Timeframe affected aircraft	4 years after effective date of final rule	14 years after effective date of final rule
Existing Airplanes (airplanes manufactured before 4 years after effective date of final rule).	Compliance to 25.562 is required for the airplane when its seats are replaced.	Compliance to 25.562 is required for all airplanes.
Newly Manufactured Airplanes (airplanes manufactured after 4 years after effective date of final rule).	Compliance to 25.562 required	Compliance to 25.562 required.

Numerous commenters to Notice No. 88–8 indicated that the 7-year time period for compliance as proposed was too long and would unnecessarily reduce safety, and they recommended a compliance period anywhere from 2 to 5 years after publication of the final rule. Certain airplane manufacturers, seat manufacturers, and air carriers stated that the 7-year compliance date in Notice No. 88–8 was too soon. Service experience has shown that the life of an airplane passenger seat is greater than the service life used as the basis for the proposal. Several commenters indicated that the typical replacement age of seats is between 10 and 21 years, with an average seat life being 14 years. Furthermore, two commenters to the 1998 public meeting proposal indicated that the average age of their retired airplanes is 23 and 42 years, and one commenter indicated that it has no airplanes older than 25 years.

Some commenters to Notice No. 88–8 suggested that there should be two compliance periods: one for newly manufactured airplanes and one for existing airplanes. The commenters indicated that newly manufactured airplanes should have 16g seats installed by a specific time and that air carriers should accomplish retrofit during the first complete refurbishment of the cabin or seats. The commenters also suggested that retrofit should not be required when seats are removed and replaced during normal maintenance cycles. Other commenters supported the current voluntary program for installing 16g seats. However, several commenters did not support the retrofit of 16g seats. These commenters indicated that most transport category airplanes will have 16g seats by 2001 to 2005, there are no certification standards for 16g seats, and it is unfair to retrofit an airplane to a standard that was not in effect when the airplane was certificated, bought, or leased.

After considering the numerous comments and taking into account seat manufacturing and replacement practices, the FAA has determined that a four-year compliance period is sufficient to ensure seat manufacturers will be able to provide 16g seats for these airplanes. Furthermore, the FAA has established two compliance schedules: one for newly manufactured airplanes and one for existing airplanes. For newly manufactured airplanes, this proposal is consistent with the proposal discussed at the 1998 public meeting. This SNPRM would ensure that 16g seats are installed on the newest airplanes, which will be in the fleet the longest amount of time.

16g Seats

Notice No. 88–8 applied to all seats occupiable during takeoff and landing. Those seats included passenger, flight attendant, flightcrew, observer, and courier seats. The 1998 public meeting proposal applied only to all passenger and flight attendant seats. Similarly, the FAA notes that this SNPRM applies only to passenger and flight attendant seats; flight deck, observer, and courier seats are not included. Numerous commenters, including passengers, supported the requirement for 16g seats and indicated that passengers would be willing to pay for increased ticket prices attributable to the cost of the retrofit.

Two commenters to Notice No. 88–8 indicated that the proposal should apply to flight deck seats. However, numerous other commenters did not support improved flight deck seats contending that flight deck seats are unique to each airplane model, are not track mounted, and typically last the life of the airplane. Furthermore, these commenters indicated that they are not aware of any statistics relating to fatalities or serious injuries where flight deck seats were involved and that all the test data referenced in Notice No. 88–8 applied only to passenger seats.

The FAA is unable to conclude that upgrading the survivability aspect of flight deck seats would result in a significant, overall improvement in safety. In fact, there is evidence to the contrary. The FAA determined that the flight deck seat structure differs significantly from the structure of passenger seats. The flight deck floor structure is heavier and far more rigid than the floor structure in much of the passenger compartment. As part of the evaluation of comments on flight deck seats, the FAA reviewed post-1983 transport category airplane accident data. One of the accidents reviewed confirmed the differences between airframe structural performance and failure modes of flight deck seats and

passenger seats. In that accident, the floor structure surrounding the pilot's seat separated from the airplane with the seat intact. Neither the pilot seat nor its floor attachments had failed. Throughout the remainder of the cabin, however, passenger seats consistently exhibited typical floor attachment and leg failures, which are the failure modes this regulatory action seeks to mitigate. For the reasons stated above, the FAA concludes that there is insufficient basis to consider flight deck seats in the retrofit requirement.

Four commenters contended that because flight attendants perform critical functions in the post-accident time frame, flight attendant seats should be included in the proposal. However, other commenters did not believe flight attendant seats should be included because they are unique to the specific airplane model and are not track mounted. These commenters further stated that the proposal in Notice No. 88–8 is based on data collected for passenger-seat weights, prices, replacement times, and passenger fatalities. These commenters suggest a separate analysis be conducted for flight attendant seats.

After reviewing the comments, the FAA finds that flight attendants have critical life-saving duties to perform following an emergency landing and has determined that flight attendant seats will be included in this SNPRM. The FAA notes that flight attendants must assist passengers with emergency egress through emergency exits to safety outside the airplane. Therefore, flight attendant seats are located in the passenger compartment. Therefore, it is imperative that flight attendant seats provide impact protection comparable to passenger seats to ensure flight attendants will not be incapacitated by an emergency landing and will be available to assist in emergency evacuations.

Several commenters indicated that the airplane structures might not be compatible with the 16g load requirement and noted that structural modifications may be required to take advantage of 16g seats. One commenter stated that not all of the floors of all in-service transport category airplanes are compatible with the 16g dynamic load standards. Several commenters indicated that the FAA should address airplanes with weak tracks. A commenter stated that even though a seat may stay attached to a representative track during dynamic testing, other components of the system (the floors, beams, and fuselage) may fail; therefore, the load imposed on the seat tracks during dynamic testing should not exceed the ultimate allowable floor strength.

The 16g dynamic standard (14 CFR 25.562) that became effective in 1988 was developed to be compatible with the floor strength of existing aircraft. The current static requirements for seats (14 CFR 25.561) include a 9g forward load, originally adopted in 1956, and were the basis for evaluating seat to floor strength issues when § 25.562 was added. The 16g standard was added knowing that seat design had progressed to the point that the energy from a 16g impact could be attenuated in the seat structure without exceeding prevalent seat track and floor strengths. This SNPRM addresses only the replacement of seats and does not require the modification of the floor structure of existing airplanes or of airplanes manufactured under existing type certificates. It was stated in the NPRM that transport category airplane structure remains substantially intact and provides a livable volume for occupants throughout a survivable impact accident. To take advantage of existing floor strength without requiring significant structural modifications or weight increases, the FAA selected the static load factors adopted in Amendment No. 25–64. Additionally, the FAA had an objective to ensure that seats complying with improved crashworthiness standards could be effectively used in existing and newly manufactured airplanes. This will be achieved if the seats are designed properly. The FAA also points out that an airplane with light duty tracks also would have low track loads created by multiple seat legs as opposed to an airplane in which heavy duty tracks are used to compensate for fewer seat legs.

Five commenters to Notice No. 88–8 indicated that the FAA underestimated the additional weight of the improved seats. The commenters noted that the weight increase could be double what the FAA indicated in Notice No. 88–8. The commenters added that the FAA based its weight estimate on new materials that are not proven. One commenter indicated that there are no specific cases where the new 16g seats were lighter in weight than the seats they replaced. A participant at the 1998 public meeting indicated that a 16g seat weighs approximately 10 pounds more than a 9g seat; another commenter indicated an increase of 3 kilograms per seat; and a third commenter indicated an increase of 400 pounds per airplane.

As the FAA stated in Notice No. 88–8, although reduced weight is not guaranteed, it is still likely. The FAA also points out that it did not imply there were improved seats weighing less than seats currently used in air transportation. The FAA notes that it consistently used a 0.6-pound weight increase estimate for analysis purposes in Notice No. 88–8 and Amendment 25–64. Furthermore, based on current information from seat manufacturers, the FAA maintains there is not a significant increase in weight between a 9g passenger seat and a 16g passenger seat. Therefore, the FAA used a 0-pound increase for passenger seats and a 0.5-pound weight increase for flight attendant seats in the current cost analysis in this SNPRM. The FAA maintains that the current trend of installing additional equipment on seats for passenger convenience and entertainment, primarily causes seat weight increases. Devices like telephones and video screens are common additions to seats that, along with their supporting structure, increase seat weight. The FAA maintains that if any increases in weight between a 9g seat without extra features and a 16g seat without extra features exist, they are small and the resultant increase in safety is justified. In addition, if the airlines find that seat weight increases from added devices pose a significant operational cost, they have the option of removing or modifying the non-required equipment currently installed on the seat.

16g-Compatible Seats

In its 1998 public meeting proposal, the FAA proposed an alternative that would allow the use of seats that are properly marked as ''16g-compatible.'' The FAA stated that a seat could be marked as 16g-compatible if it is manufactured before the four-year compliance date and the Administrator has determined the seat type to be capable of carrying the resultant dynamic loads required in § 25.562 (a) and (b) without structural separation of primary attachments.

As previously noted, the FAA did not adopt its 1998 proposal regarding 16g-compatible seats. The commenters from the 1998 public meeting indicated that the FAA underestimated the number of seat model certifications needed. The commenters further noted that the FAA did not consider the costs associated with the complete 16g-compatible seat verification process. The FAA agrees with the commenters and has abandoned the proposal for certification of seats as 16g-compatible because it would be impractical. Therefore, this SNPRM does not contain the 1998 public meeting 16g-compatible alternative. As noted at the public meeting and in the comments, the process for establishing seats as 16g-

compatible could prove to be too burdensome for the operators and the FAA.

Requirements of § 25.562

Amendment No. 25–64 added section 25.562 that defines emergency landing dynamic conditions with which transport category airplane seats and restraint systems must comply. The conditions include two dynamic tests of the seat and restraint system; one is a simulated combined vertical/longitudinal crash condition reaching at least 14g's and the other test is a simulated longitudinal crash condition reaching at least 16g's. The seats must demonstrate the capability of providing protection of their occupants when exposed to the loads of these tests. That protection includes insuring the seat system remains attached to the airplane as intended and that none of several occupant protection criteria are exceeded. Those occupant protection criteria significantly improve the likelihood that the occupant survives the impact and does not suffer an injury to a degree that would make evacuation from the airplane unlikely. Finally the criteria under § 25.562 insure that the seat does not deform during the crash conditions to an extent that would impede rapid evacuation from the airplane.

Notice No. 88–8 required all seats to meet the applicable standards in § 25.785. The 1998 public meeting proposal required seats to meet the requirements in § 25.562. The FAA notes that § 25.785 references the requirements in § 25.562, which addresses crashworthiness standards. However, the FAA points out that the requirements in § 25.785 address more than crashworthiness standards and those requirements are not included in this proposed rulemaking. Therefore, this proposal has been revised to reference § 25.562 instead of § 25.785.

Commenters noted that the FAA should provide uniform and standardized guidance procedures for the dynamic testing required under § 25.562. One commenter to Notice No. 88–8 indicated that neither the FAA nor members of the Society of Automotive Engineers (SAE) committee had been able to define a workable statement of deformation limits. That commenter also stated that the floor warping definition in § 25.562(b)(2) does not adequately define a warped floor plane. The commenters further noted that the FAA should define the maximum seat encroachment allowed.

A commenter to the 1998 public meeting stated that no seat manufacturers had achieved satisfactory results for front row head injury criteria (HIC). Another commenter to Notice No. 88–8 requested that Federal Motor Vehicle Safety Standard No. 208 (49 CFR 571.208) be used for HIC measurements and limited to a 36 millisecond duration. The commenter also opposed testing for HIC during a double row test with floor deformation of the forward seat. Furthermore, the commenter stated that HIC limits should not be applicable to bulkheads, partitions, and dividers used in currently certificated airplanes. Commenters to the 1998 public meeting indicated that to comply with the front-row HIC requirements they would have to sacrifice seat pitch (the distance along the airplane's longitudinal axis from a point on one seat to the identical point on the next seat) in the back rows, remove the first row of seats, add y-belts (a lap belt that uses two load paths and anchor points for each half of the belt) or airbags, or make bulkhead modifications. The commenters indicated that removing a row of seats is the only way to comply with HIC if they do not want to sacrifice seat pitch.

The FAA points out that the new crashworthiness standards are in effect and seats are certificated to those performance standards. The criteria for the improved crashworthiness standards have been verified through research testing by the FAA and static and dynamic testing by seat manufactures to demonstrate compliance with the provisions of Amendment 25–64. The FAA agrees that appropriate guidance is necessary to make the certification process easier for all concerned. That guidance is provided in Advisory Circular 25.562–1A, Dynamic Evaluation of Seat Restraint Systems and Occupant Protection on Transport Airplanes, revised on January 1, 1996; SAE Aerospace Standard 8049, issued in July 1990; and Technical Standard Order (TSO) C127a, Rotorcraft, Transport Airplane, and Normal and Utility Airplane Seating Systems, revised on August 21, 1998.

Applicability

Notice No. 88–8 proposed changes to all transport category airplanes operated under part 121 and part 135. The FAA's 1998 public meeting proposal applied to transport category airplanes operated under part 121. Similarly, this SNPRM would not affect airplanes currently operated under part 135. Numerous commenters to Notice No. 88–8 opposed the inclusion of part 135 on-demand operators. However, several commenters indicated that the proposal should apply to on-demand operators because of the increasing number of such operations.

At the time Notice No. 88–8 was published, a significant number of transport category airplanes were operated under part 135. Accordingly, Notice No. 88–8 proposed that seats on transport category airplanes operated under part 135 in air carrier operations or scheduled intrastate common carriage meet the same standards as seats on transport category airplanes operated under part 121. In 1995 the FAA issued Amendment Nos. 119, 121–251, and 135–58, Commuter Operations and General Certification and Operations Requirements; Final Rule (60 FR 65832; December 20, 1995) (the commuter rule). The commuter rule requires all operators conducting scheduled passenger-carrying operations in airplanes that have passenger seating configurations of 10 through 30 seats (excluding crewmember seats) and in turbojet airplanes regardless of seating configuration that formerly conducted operations under part 135, to conduct operations under part 121. As a consequence of the commuter rule, the operation of some nontransport category airplanes now comes under the purview of part 121 as do some transport category airplanes that used to be operated under part 135. Only nonscheduled, on-demand operations remain in part 135.

Several commenters questioned the need to require improved passenger seats on all-cargo airplanes and airplanes with convertible or combination configurations. The FAA notes that this SNPRM does not apply to airplanes used in all-cargo operations because these airplanes do not carry passengers for compensation or hire. However, transport category airplanes type certificated after January 1, 1958, that have convertible or combination configurations would be required to meet the same seat standards required for all-passenger carrying transport category airplanes operated under part 121 because those airplanes carry passengers.

The FAA also notes that an improved seat need not be provided for the carriage of a person listed in § 121.583. Therefore, this proposal also amends § 121.583(a) to add § 121.311(j) and (k) to the list of sections excluded from compliance.

In Notice No. 88–8, the FAA requested comments on whether improved seats should be required in rotorcraft. Two helicopter manufacturers noted that the retrofit of 16g seats in rotorcraft would necessitate airframe modifications that would increase the weight and decrease the

payload and productivity of the aircraft. The FAA agrees with the commenter that the necessary airframe modifications for existing rotorcraft are not feasible. It has never been the intent of a rulemaking to improve the crashworthiness of seats on any type of aircraft to require modifications below the seat-to-floor interface, and therefore airframe modifications would not be included. A fundamental concept when developing regulations for improved seat crashworthiness (eg. § 25.562) has been to match the proposed increases in seat strength to the existing aircraft floor strengths to preclude the need for additional reinforcement of the airframe. Since the NPRM, the FAA has developed improved crashworthiness standards for rotorcraft type certificated after November 13, 1998. Amendment Nos. 27–25 and 29–29 (54 FR 47318; November 13, 1998) incorporate these standards in 14 CFR parts 27 and 29. However, the FAA points out that they were not in effect when Notice No. 88–8 was published on May 17, 1988; therefore, this SNPRM does not include rotorcraft.

Torso Restraint

An association noted that Notice No. 88–8 did not address lap belt restraint capability in forward facing seats and is concerned because the head and upper body is unrestrained.

The FAA points out that the intent of Notice No. 88–8 and this SNPRM is to require the installation of improved seats to provide increased passenger and flight attendant safety resulting from fewer seat failures. The intent is not to require restraints for the upper torso. While the comment may have merit, the focus of Notice No. 88–8 and this SNPRM is on improved seats.

Reference Material

A Benefit Analysis for Aircraft 16g Dynamic Seats (Report DOT/FAA/AR–00/13/April 2000) predicted the benefits for accidents studied from 1984 to 1998 if 16g seats had been installed in the airplanes. This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161. It can also be accessed through the FAA's William J. Hughes Technical Center Full Text Technical Reports Internet site at *http://www.fire.tc.faa.gov/reports/report2.stm* in Adobe Acrobat Portable Document Format (PDF).

Related Activity

The FAA tasked the Aviation Rulemaking Advisory Committee (ARAC) to provide advice and recommendations on harmonizing with the JAA and Transport Canada requirements for passenger seats. (63 FR 46272, August 31, 1998). The FAA stated that the objective was to harmonize test article selection and other methods of compliance with § 25.562, including pass/fail criteria and test methodology.

ARAC assigned the task to the existing Seat Testing Harmonization Working Group. If adopted by the FAA, the ARAC recommendations regarding a simplification of the test article selection process and pass/fail criteria should provide a much shorter test plan approval cycle and reduce the number of tests required.

On April 6, 2000, the Wendel H. Ford Aviation Investment and Reform Act (HR 1000) was enacted into law. Section 757 of Public Law 106–81 contains information directing the Administrator (FAA) to take specific measures aimed at streamlining the seats and restraint systems certification process and 16g dynamic testing requirements.

In August 2000, the FAA formed a joint government/industry team that consisted of FAA, JAA, airlines, seat manufacturers, airframe manufacturers, and the Association of Flight Attendants. This Charter Team looked at the various initiatives that were already underway that, if implemented, would streamline or otherwise improve the seat and restraint system certification process. The Charter Team identified issues in the current seat certification process that, if effectively resolved, may reduce the time and cost of seat certification programs by as much as 50 percent. With that goal in mind, the Charter Team agreed to a plan of action that focuses on four areas in seat certification: policy related to seat certification, the Technical Standard Orders (TSO) for seats (i.e., TSO C39b and TSO C127a), utilization of local authorities (both domestic and foreign) in seat certification, and alternative methods for seat certification. The specific tasks within each of these areas have been determined and are being worked by both industry and FAA members of the Charter Team.

The first part of the plan requires a review of existing policy on seat certification by both industry and the FAA. The review will identify policy that is not clear, inappropriately applied, or is inconsistent or conflicts with other policy. Industry will identify to the FAA key seat certification issues that have proven problematic and relevant policy, if it exists, will be reviewed. Additionally, both industry and the FAA can identify areas where development of new policy could simplify seat compliance. In each case, the goal is to clarify or interpret current policy or develop new policy to address the specific issue.

The second part of the plan focuses on the TSO program for seats. Tasks within the plan have been set to ensure that the TSO remains a valid approval basis for seats and is recognized as such. Tasks are also in place to provide clarification and standardization on the extent that the TSO approval or activities associated with obtaining that approval can be utilized to demonstrate compliance with the airworthiness requirements of part 25 of the Federal Aviation Regulations. In addition, the TSOs will be developed to maximize the amount of data that can be obtained during the TSO process that can also be used to meet airworthiness requirements.

The third part of the plan involves use of local authorities to maximize use of foreign and domestic regional approvals to improve the seat certification process. The plan calls for development of agreements between seat suppliers and the regulatory offices (e.g., aircraft certification offices in the U.S.) overseeing the suppliers. The agreement provides a roadmap for all stakeholders to understand responsibilities and relationships in the certification process and defines a process for resolving problems when they occur. Great benefit will be gained by mapping out this process which provides opportunities to identify potential problems early in the program and to avoid similar problems in subsequent programs. The plan also addresses inconsistencies between how domestic seat approvals and foreign seat approvals are made. The goal is to ensure that methods to facilitate seat approvals are equivalent without compromising safety standards.

The fourth and final part of the Charter Team plan looks at alternative methods from more traditional ways of approving seats for use in aircraft. This area has concentrated on the use of analytical modeling in seat certification as well as systems that simulate a portion of the dynamic testing process (''component testers'') without the necessity of a complete test. A specific task is to issue guidance for the use of computer simulation in lieu of full scale testing. Other tasks include guidance on the use of specific component testers to address occupant injury criteria in lieu of full scale testing.

The four elements of the Charter Team plan are being worked concurrently with continuous review by industry and the FAA for progress towards implementation and to refine the plan as mutually agreed upon.

The FAA requests comment on the plan as outlined above as well as other suggestions for making the approval of seats more efficient while maintaining required safety standards.

Paperwork Reduction Act

The Paperwork Reduction Act of 1995 (44 U.S.C. 3507(d)) requires that the FAA consider the impact of paperwork and other information collection burdens imposed on the public. We have determined that there are no new information collection requirements associated with this proposed rule.

International Compatibility

In keeping with U.S. obligations under the Convention on International Civil Aviation, it is FAA policy to comply with International Civil Aviation Organization (ICAO) Standards and Recommended Practices to the maximum extent practicable. The FAA determined that there are no ICAO Standards and Recommended Practices that correspond to these proposed regulations.

Economic Evaluation Summary

Changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 directs each Federal agency proposing or adopting a regulation to first make a reasoned determination that the benefits of the intended regulation justify its costs. Second, the Regulatory Flexibility Act of 1980 requires agencies to analyze the economic impact of regulatory changes on small entities. Third, the Trade Agreements Act prohibits agencies from setting standards that create unnecessary obstacles to the foreign commerce of the United States. In developing U.S. standards, this act requires agencies to consider international standards, and use them where appropriate as the basis of U.S. standards. Fourth, the Unfunded Mandates Reform Act of 1995 requires agencies to prepare a written assessment of the costs and benefits and other effects of proposed and final rules. An assessment must be prepared only for rules that impose a Federal mandate on State, local or tribal governments, or on the private sector, likely to result in a total expenditure of $100 million or more in any one year (adjusted for inflation.)

In conducting these analyses, the FAA has determined this rule: (1) Has benefits that do justify its costs, (2) is a significant regulatory action; (3) would not have a significant impact on a substantial number of small entities; (4) would have neutral impact on international trade; and (5) does not impose an unfunded mandate on state, local, or tribal governments, or on the private sector. The FAA has placed these analyses in the docket and summarized them below.

The economic evaluation of this proposed rulemaking is based primarily on a November 2000 study titled ''Improved Seats in Transport Category Airplanes: Analysis of Options,'' prepared by the FAA's Office of System Safety (ASY).) The report is hereinafter referred to as the ASY 16g-seat options study, or in short, the ''ASY 16g-seat study.'' The study evaluated costs and benefits for the period 2000–2020 (although the final rule probably would not be implemented until 2002, the benefit/cost relationship would essentially be the same). A modified option 5 of that analysis is the basis of the new requirements proposed in this SNPRM. The SNPRM incorporates a 14-year deadline date beyond which all airplanes must be in compliance; as a result, the cost/benefit data in this analysis differ somewhat from option 5 in the study cited. The study has been placed in FAA's docket file associated with this rulemaking. Besides incorporating a 14-year deadline date for compliance, the subject evaluation differs from the ASY 16g-seat study in that it uses $3 million for a fatality averted (vs. $2.7 million).

Regulatory Evaluation

This section explains and summarizes the relevant data used in this analysis and describes the methodology used to calculate benefits and costs. Total estimated dollar benefits and costs are presented in the Benefit/Cost Summary at the end of the section.

To estimate the potential benefits and costs of this new proposal, it was first necessary to divide seat installations into three broad ''compliance'' categories: (1) ''Full 16g'' seat installations are compliant with 14 CFR 25.562 (a), (b), and (c). (2) ''Partial 16g'' seat installations are compliant with some of 14 CFR 25.562 (a), (b), and (c) but have not been tested to meet all occupant injury criteria. (3) ''9g'' seat installations refer to older vintages of seats that meet 9g structural requirements only.

In addition, the projected population of seats was divided into five different groups depending on the date of aircraft manufacture and the projected date of seat replacement. Replacement seats are assumed to be distributed according to the estimated proportion of full 16g-, partial 16g-, and 9g-seat certification programs. For example, if 10% of seat certification programs are for 9g-seats, it is assumed approximately 10% of seats installed or replaced will be 9g-seats.

The analysis projected the distribution of seats in the absence of regulatory action. The distribution was based on the following assumptions:

1. Part 121 airplanes are retired after 42 years of service.
2. Seat replacement uniformly distributed with mean seat life of 14 years.
3. Fleet/seat growth based on *FAA Aerospace Forecast.*
4. Relationship of full 16g- to partial 16g-seats stays the same.

The distribution of seat types is as follows:

- Group I: Airplanes manufactured before 1992 having seats installed before 1992. While 16g-seats were being installed before this date, the majority of these seats are 9g.
- Group II: Airplanes manufactured before 1992 having replacement seats installed after 1991. Some (unknown) proportion of seats in this group may have partial 16g performance although no airplane model in this group is 16g-certificated. Note that the sum of Group I and Group II declines over time as these airplanes/seats are retired from passenger service.
- Group III: Airplanes manufactured after 1991. Some (unknown) proportion of seats in this group may have partial 16g performance.
- Group IV: Airplanes manufactured after 1992 and compliant with some parts of 14 CFR 25.562 (certificated partial 16g capability).
- Group V: Airplanes manufactured after 1992 and fully compliant with 14 CFR 25.562 (e.g. certification basis includes Amendment 25–64, or full 16g testing was performed voluntarily). If this proposal were in effect, Group V seats would be projected to increase from approximately 23,000 at year end 1999 to 1.8 million in 2020 (versus approx. 560,000 in 2020 under the ''baseline'' assumption).

Two critical questions are: (1) What is the performance of Group II/III seat installations relative to full 16g and partial 16g installations? (2) How will the composition of Group II/III installations change over time? Will operators continue to upgrade these seats in the absence of rulemaking?

Projected (2000–2020) fatality and serious injury rates are equal to the fatality and injury rates for U.S. 14 CFR part 121 (scheduled and nonscheduled) operations for the period 1984–1998, which is the time period used in Report DOT/FAA/AR–00/13/April 2000, ''A Benefit Analysis for Aircraft 16g Dynamic Seats'' (which has also been placed in the docket and is hereinafter

termed the ''DOT/FAA report''). Although the report evaluated worldwide accidents to determine the degree to which 16g-seats would reduce casualties in a typical accident (note that a typical U.S. accident is not significantly different from a typical non-U.S. accident in terms of accident outcomes), it is important to emphasize that the benefits in this regulatory evaluation are based on the U.S. part 121 accident rate.

The Benefits Section explains the method used to estimate benefits, constructs baseline estimates of the population of affected airplanes, projects the distribution of part 121 seat types for the period 2000–2020 (assuming no future regulatory action), and forecasts future fatality and serious injury rates. The Cost Section explains the methods used to estimate costs and constructs baseline cost estimates for passenger and flight attendant (hereinafter, ''FA'') seats.

A. Benefits Model

Estimates of the safety benefits of 16g-seats are based on a study of 25 impact-related accidents involving airplanes operating under 14 CFR part 121 (or equivalent) during the period 1984–1998. The DOT/FAA report projects that the baseline fatality and serious injury rates for the period 2000–2020 will be 0.2868 and 0.0436 per million enplanements, respectively. (See also Section II of the ASY 16g-seat study.)

Based on engineering assessments of the possible effects of full 16g-seats, Monte Carlo simulations were used to assess a high, median, and low value for the total achievable (net) reduction in fatalities and serious injuries for each accident/scenario. Risk reduction benefits for the U.S. part 121 fleet, then, were estimated in three ways:

First, the DOT/FAA report estimated the number of averted U.S. casualties by assuming that the ratio of U.S./World casualties averted is proportional to the ratio of U.S./World accidents (see Table II.4 in the ASY 16g-seat study). Second, it estimated the number of U.S. casualties averted strictly based on the part 121 accidents studied (Table II.5 in the ASY study). Third, it extrapolated the U.S.-specific data, to U.S. part 121 ground-impact accidents that were not studied.

Baseline risk estimates are computed as follows:

• *Construct an estimate of the future number of domestic enplanements.* Estimates of the number of future enplanements were derived from the FAA Aerospace Forecasts, Fiscal Years 1999–2010; enplanements are projected to increase from 676.9 million in 2000 to 1,450.3 million in 2020. Enplanement totals are then combined with fatality/serious-injury rates and seat distribution to assess risk reduction potential per seat type (see below).

• *Construct a baseline estimate of the distribution of seat types.* This analysis divides the projected population of seats into different groups (see the discussion below) depending on the date of aircraft manufacture and the projected date of seat replacement. The distribution of enplanements across seat groups is assumed to be proportional to the number of seats in each group. Replacement seats are assumed to be distributed according to the estimated proportion of full 16g-, partial 16g-, and 9g-seat certification programs. For example, if 10% of seat certification programs are for 9g-seats, it is assumed approximately 10% of seats installed or replaced will be 9g-seats.

• *Forecast fatality and serious injury rates.* This analysis postulates that the projected rates of fatalities and serious injuries per enplanement during the forecast period are equal to the rates observed during the period 1984 to 1998 (U.S. 14 CFR part 121 fleet only). Key assumptions: (1) The rate is assumed to reflect a 9g baseline, (2) no improvements in historical fatality or injury rates are expected to occur during the forecast period, and (3) the risk reduction potential of 16g-seats is not expected to improve (e.g., due to the introduction of additional cabin safety measures). *Example:* Three-hundred-and-twenty-nine (329) serious injuries were recorded during 14 CFR part 121 operations during the study period 1984 to 1998 (see Table II.3 of the ASY 16g-seat study). In the same period, part 121 operators accumulated 7,540.9 million enplanements. Therefore, the historical (and projected) rate of serious injuries is $329 \div 7{,}540.9 = 0.0436$ per million enplanements.

• *Estimate the reduction in fatalities and serious injuries during the study period (1984–1998). Example:* Based on the DOT/FAA report (part 121 benefits based on worldwide fleet accident characteristics), the fleetwide use of full 16g-seats would have averted 68 fatalities and 79 serious injuries (net) during the study period.

• *Estimate the percentage reduction in fatalities and serious injuries during the study period.* The number of fatalities averted due to 16g-seats divided by the total number of fatalities during the study period yields an estimate of the percentage reduction in fatalities that would be achieved by requiring 16g-seats. Similarly, the number of serious injuries averted due to 16g-seats divided by the total number of serious injuries yields an estimate of the percentage reduction in injuries that would be achieved by requiring 16g-seats. *Example:* There were a total of 329 injuries during the study period (U.S. 14 CFR part 121). According to the DOT/FAA report, 79 serious injuries could have been averted had 16g-seats been installed in the part 121 fleet. Therefore, a 16g-seat requirement could have averted 79/329 = 24% of serious injuries during the study period.

• *Determine adjustment factors for each seat group.* The degree to which a new seat reduces fatality and injury risks is a function of the vintage of seat it is replacing. As noted elsewhere in this study, however, the DOT/FAA report did not estimate the relative performance of full and partial 16g-seats. Aircraft Certification Service engineers provided subjective estimates of the performance of seats in Groups I–V (see discussion below). *Example:* A Group V seat (full compliance with 14 CFR 25.562) has an effectiveness rating of 1.0. Therefore, this type of seat is expected to reduce serious injuries by $1.0 \times 24\% = 24\%$ relative to a 9g-seat. A Group II seat (i.e., does not meet occupant injury criteria) has an effectiveness rating of 0.1, or 10% of the effectiveness of a full 16g-seat. Therefore, Group II seats are expected to reduce serious injuries by $.1 \times 24\% = 2.4\%$ relative to a 9g-seat.

• *Forecast baseline fatality and serious injury rates.* Baseline estimates of the numbers of fatalities and serious injuries for the forecast period are obtained by combining: (1) The baseline (9g) fatality and serious injury rates; (2) the baseline distribution of seat types and enplanements; (3) the risk reduction potential of 16g-seats; and (4) the adjustment factors.

• *Forecast the effect of each option on the distribution of seats.* Potential benefits, then, reflect the degree to which any option alters the future distribution of seat types (relative to the projected baseline distribution). That is, the more the distribution shifts to full 16g- and partial 16g-seats, the lower the expected future rates of fatalities and serious injuries.

The steps outlined above are used to derive baseline estimates of fatalities and serious injuries. The baseline estimates, then, are compared to fatality/serious-injury estimates based on the expected distribution of seats following full implementation of the rule.

Passenger seat benefits—Over the 2000–2020 period of analysis, the proposed requirements would avert 112.1 fatalities and 130.2 serious injuries. Using $3.0 million as the

monetary equivalent of a statistical fatality averted and $0.5 million per serious injury averted, this is equivalent to a benefit of $401.4 million undiscounted, or $131.9 million discounted.

Flight attendant seat benefits—Over the 2000–2020 period, the proposed requirements would avert 2.3 FA fatalities and 2.7 FA serious injuries; this equates to $8.2 million undiscounted, or $2.7 million discounted. However, as delineated below, the FAA believes the direct quantified benefits of averted FA casualties could lead to significant additional benefits in terms of averted passenger casualties (*i.e.,* the value of trained FAs in assisting passengers in emergency egress situations).

B. Determination of Costs

The analysis presented at the 1998 public meeting considered a proposal that would have required full 16g compliance for newly manufactured airplanes and complete retrofit with 16g compatible seats for in-service airplanes (see Table ES–1 in ASY 16g-seat study). Seat replacement costs associated with that proposal would have exceeded significantly those of this SNPRM as a result of incremental costs to recertify seats already installed on aircraft, which would have been required under ''16g-compatibility.'' In addition, the current proposal includes more accurate (in this case, lower) estimates of seat certification costs. The regulatory evaluation for the original 1988 NPRM identified seat weight, seat replacement, and seat certification as the largest sources of incremental costs.

The FAA has chosen a final compliance timeframe in this SNPRM that allows airlines to exercise their own discretion in seat replacement up to 14 years after the rule is enacted, but then ensures that the transport fleet will be upgraded to the 16g-standard. New information provided by seat manufacturers indicates that, at least with respect to passenger seats, the weight and costs of 16g-seats are the same as 9g-seats; in fact, current 16g-seats are in some cases lighter than older seats. In addition, the options considered in this analysis emphasize ''discretionary replacement.'' That is, requiring compliance for in-service aircraft only when operators choose to replace seats (rather than stipulating a short-term mandatory retrofit period). The data show that only about 7.5% of seats would require premature replacement at the end of the 14-year ''discretionary'' period. This results in approximately a two percent increase in costs over that estimated without the 14-year deadline. The FAA requests specific comments on the compliance timeframe proposed for seat replacement. Substantive comments should be accompanied by cost estimates, to the extent possible.

The following discussion outlines the process used to determine baseline passenger and FA seat costs.

The current number of seat certification programs and the current distribution of seat certification programs (9g, partial 16g, full 16g) both based on FAA data, were extrapolated forward using the same rate of growth as the number of seat replacements and installations. That is, the number of seat certification programs in the future is assumed to be a constant fraction of the number of seats projected to be installed/replaced. Information on the average cost of a certification program was obtained from industry sources; these costs were projected into the future under each alternative option and compared to the baseline (*i.e.* voluntary industry action) to determine incremental certification costs.

Passenger seat costs. Industry data indicates an average incremental 16g-seat certification cost of $300,000, which may be amortized over several aircraft types with the same installations; on average, one certification would be applicable to approximately 1,200 seats. The proposed requirement entails no incremental seat replacement costs, since the cost of a new upgraded seat and its installation is the same as for a non-upgraded seat. Current data show that approximately 44% of current programs are for full 16g-, 55% are for partial 16g-, and one percent of programs are for 9g-seats.

Over the 2000–2020 period of analysis, total costs attributable to upgrading passenger seats equal $232.9 million undiscounted, or $105.4 million discounted.

Flight attendant seat costs. The same process used to estimate incremental passenger seat certification costs was used to estimate incremental FA seat certification costs.

Current and projected number of certification programs. The current number of FA seat certification programs was estimated from industry sources and extrapolated using the process described above. As before, the ratio of certification programs to seats installed/replaced is assumed to be roughly constant during the 2000–2020 forecast period. Following the assumption used in the 1998 regulatory evaluation, the number of FA seats are assumed to equal two percent of passenger seats; that is, one FA seat per 40–50 passenger seats.

Current and projected distribution of FA seat certification programs. The current distribution of FA seat certification programs was determined from data obtained from industry: (1) Full 16g, approximately 33%; (2) partial 16g, approximately 42%; (3) 9g, approximately 25%. Again, in the absence of additional rulemaking, this distribution is assumed to be constant during the forecast period.

Full 16g-certification program costs for FA seats are approximately $250,000 per program. The average replacement cost is $5,400 per seat and $85 for installation. This analysis assumes that FA seats are rarely replaced, since they usually last the life of the airframe. Additional fuel costs associated with increased weight equals approximately $13 per seat per year.

Over the 2000–2020 period of analysis, total costs attributable to upgrading FA seats equal $285.7 million undiscounted, or $139.3 million discounted.

Upcoming FAA Certification-Streamlining Efforts

As outlined in the Related Activity section of this SNPRM, the FAA is initiating changes to the airplane seat certification process that are expected to result in reductions in required testing for both passenger and FA seats. These streamlining efforts may eliminate some dynamic seat tests and make other tests simpler to perform. For example, in-service changes or variation in design that currently require a full-scale test may instead be substantiated through a component level test(s). Such tests are currently being developed and evaluated to address both lumbar and head injury criteria (HIC), which may have relevance for FA seat programs in particular. In either of these cases, the scope of the test program would be reduced as would the associated costs.

Part of the overall objective of the streamlining program is to capitalize on the work and expertise of the seat manufacturers, and prevent duplicate review by the FAA or airframe manufacturer(s). The current process often results in Technical Standard Order (TSO) qualification and installation qualification requiring separate, rather than complementary, effort. This administrative cost is significant and, if reduced or eliminated, would reduce the overall certification burden. Note that in addition to reducing specific certification (*e.g.* testing) costs, streamlining would reduce the time required to gain seat approval, which

often is cited as a major component of certification costs.

The aforementioned benefits expected to accrue from the streamlining initiatives would be more heavily weighted to passenger seat programs than to FA seat programs, since the latter tend to have fewer tests per program. However, all the reductions in certification procedures specified would also benefit FA seat programs and would have a substantive effect on reducing costs of those programs as well. Once streamlining is implemented, the FAA believes a significant reduction in tests for both FA seats and passenger seats would be achieved. Although a definitive estimate of the cost savings that a reduction in testing translates to is not yet determinable, the FAA believes it could potentially result in a considerable reduction in nonrecurring certification program costs.

The FAA requests specific comments on how we might streamline certification costs. Substantive comments should be accompanied by cost estimates to the extent possible.

Benefit/Cost Summary

As previously stated, the FAA estimates that this proposed rule to require upgraded passenger and FA seats for both new and in-service airplanes would statistically avert approximately 114 fatalities and 133 serious injuries during a 20-year period following the effective date of the rule. At $3.0 million per statistical fatality averted and $0.5 million per statistical serious injury averted, the estimated benefits equal $409.6 million, or $134.6 million at present value (year 2000 dollars). The total associated costs are approximately $518.6 million, or $244.7 million at present value. These costs are based on current certification programs and testing methods. Implementation of the streamlining procedures previously noted would no doubt reduce the estimated costs.

Of the $518.6 million in undiscounted total costs for the proposed rule, $285.7 million, or 55%, are attributed to upgrading FA seats. Compared to passenger seats, FA seats have relatively high certification costs, as well as significant variable costs to replace. The high replacement costs of FA seats occurs because the proposed rule would require these seats to be upgraded at the same time as passenger seats, whereas FA seats normally last the life-time of the airplane. However, the higher costs are offset by increased per-seat benefits since the seats prevent injury to the FA and therefore permit them to perform safety functions and help save the lives of passengers (see further discussion below on the benefits attributable to FAs).

The proposed rule allows passenger seats to be upgraded at a normal replacement time up to 14 years after the publication of the rule. Due to technological improvements, there is essentially no difference in weight or cost between a 9g- and 16g-passenger seat. The only additional cost of upgrading passenger seats in the normal replacement period is the higher expense of a 16g-certification program. Unlike the passenger seat upgrade, the entire cost of upgrading FA seats is attributed to the rule. The cost of replacing FA seats includes seat certification, procurement, installation, and increased fuel burn because of the higher operating weight.

Because slightly more than half of the estimated cost of this proposal is attributed to upgrading FA seats, the FAA considered an alternative that would have required upgrading only passenger seats at the normal replacement time. The FAA rejected that alternative, as it would have resulted in FA seats being less safe than passenger seats. FAs have the critical responsibility to perform life-saving duties in precisely the kind of impact-accident wherein 16g-seats enhance the survivability of passengers.

The FAA estimated the additional number of passenger-averted-fatalities (i.e., those attributable to the actions of FA's who survived impact as a result of improved 16g-seats) required to increase the value of benefits sufficient to equal costs. In the data presented above, the undiscounted costs exceed benefits by $109 million. As noted in the benefits section, the proposed requirements would avert 2.3 FA fatalities and 2.7 FA serious injuries, resulting in five additional functioning FAs. If those five FAs assist 36 passengers, thus averting 36 potential fatalities (or, seven per FA), the estimated benefits would equal the costs (i.e., $109 million divided by $3 million (value of averted fatality) = approximately 36 averted fatalities).

The evidence supports the FAA position that the actions of five additional functioning FAs can avert at least an additional 36 fatalities in one or more survivable accidents. A majority (perhaps 60–70 percent) of the 25 total accidents evaluated were survivable in that the initial impact did not kill or severely incapacitate all occupants onboard the aircraft. In 11 of the survivable accidents, FAs were instrumental in assisting passengers and/or shouting instructions to passengers during the emergency evacuation(s). After excluding three accidents in which the accident reports only generalized the FA's actions, the FAA evaluated eight accidents to determine how many additional passengers were saved from fatal or serious injury by the actions of able-bodied FAs. One accident in particular clearly illustrates the FAs crucial role(s). In that accident, nearly three quarters of the passengers survived the initial impact, but most were seriously injured. As noted on pg. A–179 of the DOT/FAA report: ''The prompt and successful evacuation of 63 persons out of the passenger cabin during increasing smoke and extensive fire was directly due to the behavior of the cabin crew, in spite of their injuries. The two active cabin attendants played a significant and unquestionable role in preventing the panic and organizing the movement of passengers to the exits.'' In fact, in the eight sample accidents, 13 FAs were responsible for the safe egress of approximately 140 passengers, or about 11 passengers per FA.

The DOT/FAA report provides additional evidence of the implicit value of FAs, but from the opposite perspective, i.e., passenger-survival outcomes in accidents wherein FAs were incapacitated. In the report, there were three U.S. survivable accidents in which six FAs died or were seriously injured from impact; and, in these accidents, 44 passengers died primarily from fire or smoke inhalation. The FAA cannot state with certainty how many of these passengers could have been saved by the FAs had the latter survived initial impact(s); however, in the light of the survival outcomes described above (with able-bodied FAs) the FAA believes most of the cited 44 passenger fatalities could have been averted. And, with the incorporation of current fire protection standards into new-production airplanes (increasing time-margins for safe egress), surviving able-bodied FAs could save even more lives in future accidents.

Based on the accident circumstances just described, the FAA strongly believes the projected five additional FAs would save at least an additional 36 passengers (*i.e.*, seven per FA) in future accidents over the next 20 years. Consequently, the costs of retrofitting the FA seats are justified. The FAA maintains this is a reasonable contention, given the conservative methodology applied-*i.e.* including only those survivable accidents in which FA's actions and/or their ''capability-states'' were clearly described or determined.

The FAA is aware of some studies demonstrating the value of cabin crew during emergency evacuations and

request comments with documented evidence regarding the value of FAs in airplane evacuations.

In conclusion, since the 16g-seat-derived benefits of averted passenger and FA casualties combined with the additional passenger lives saved by able-bodied FAs exceed the total seat-replacement costs, the FAA deems this SNPRM to be cost-beneficial.

Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 (RFA) establishes ''as a principle of regulatory issuance that agencies shall endeavor, consistent with the objective of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of the business, organizations, and governmental jurisdictions subject to regulation.'' To achieve that principle, the Act requires agencies to solicit and consider flexible regulatory proposals and to explain the rationale for their actions. The Act covers a wide-range of small entities, including small businesses, not-for-profit organizations, and small governmental jurisdictions.

Agencies must perform a review to determine whether a proposed or final rule will have a significant economic impact on a substantial number of small entities. If the determination is that it will, the agency must prepare a regulatory flexibility analysis as described in the Act. However, if an agency determines that a proposed or final rule is not expected to have a significant economic impact on a substantial number of small entities, section 605(b) of the 1980 act provides that the head of the agency may so certify and a regulatory flexibility analysis is not required. The certification must include a statement providing the factual basis for this determination, and the reasoning should be clear.

There are approximately 100 part 121 operators in the potential pool of small entities. The FAA performed a detailed analysis of the economic impacts on 33 of these operators who clearly: (1) Had less than 1,500 employees (the size threshold for classification as a small entity); (2) were not subsidiaries of larger organizations; and, (3) reported operating revenue to the Department of Transportation. The FAA believes these 33 are representative of the affected small firms.

The FAA's methodology in assessing economic impact for small entities for this proposed rule is as follows. Recent data indicates that airplane seats are replaced about every 14 years. The FAA assumed that the current fleet inventory of passenger seats (and now, by virtue of this proposal, flight attendant seats also) would, on average, need replacement in seven years (for cost analysis purposes, operators on average would need to retrofit halfway into the 14-year replacement cycle; this is obviously a conservative assumption). These retrofit costs were then annualized using the sinking-fund methodology whereby an annual amount is set aside each year for the relevant number of years (in this case, seven years) accumulating to the required capital expenditure. The FAA then compared each firm's required annual seat replacement cost to the firm's annual operating revenue. The calculated annual-cost(s)-as-a-percent-of-annual-operating-revenue(s) ranged from lows of less than one-tenth of one percent (in 14 of the firms) to a maximum of only 1.1 percent (in one firm). Based on the described expense/revenue relationships, the FAA believes that the proposed rule would ''not have a significant economic impact on a substantial number of small entities.'' The FAA invites comments on the estimated small entity impact from interested and affected parties.

International Trade Impact Assessment

Consistent with the Administration's belief in the general superiority, desirability, and efficacy of free trade, it is the policy of the Administrator to remove or diminish, to the extent feasible, barriers to international trade, including both barriers affecting the export of American goods and services to foreign countries and those affecting the import of foreign goods and services into the United States. The net effect of this SNPRM is to raise the cost and value of exported and imported compliant transport category airplanes. The FAA believes the costs are offset by the value and thus the rule has a neutral impact on international trade.

Unfunded Mandates Reform Act

Title II of the Unfunded Mandates Reform Act of 1995 (the Act), enacted as Public Law 104–4 on March 22, 1995, requires each Federal agency, to the extent permitted by law, to prepare a written assessment of the effects of any Federal mandate in a proposed or final agency rule that may result in the expenditure by State, local, and tribal governments, in the aggregate, or by the private sector, of $100 million or more (adjusted annually for inflation) in any one year. Section 204(a) of the Act, 2 U.S.C. 1534(a), requires the Federal agency to develop an effective process to permit timely input by elected officers (or their designees) of State, local, and tribal governments on a proposed ''significant intergovernmental mandate.'' A ''significant intergovernmental mandate'' under the Act is any provision in a Federal agency regulation that will impose an enforceable duty upon State, local, and tribal governments, in the aggregate, of $100 million (adjusted annually for inflation) in any one year. Section 203 of the Act, 2 U.S.C. 1533, which supplements section 204(a), provides that before establishing any regulatory requirements that might significantly or uniquely affect small governments, the agency shall have developed a plan that, among other things, provides for notice to potentially affected small governments, if any, and for a meaningful and timely opportunity to provide input in the development of regulatory proposals.

The FAA determines that this proposed rule does not contain a significant intergovernmental mandate.

Regulations Affecting Interstate Aviation in Alaska

Section 1205 of the FAA Reauthorization Act of 1996 (110 Stat. 3213) requires the Administrator, when modifying regulations in title 14 of the CFR in manner affecting interstate aviation in Alaska, to consider the extent to which Alaska is not served by transportation modes other than aviation, and to establish such regulatory distinctions as he or she considers appropriate. Because this proposed rule would apply to transport category airplanes and their subsequent operation, it could, if adopted, affect interstate aviation in Alaska. The FAA therefore specifically requests comments on whether there is justification for applying the proposed rule differently in interstate operations in Alaska.

Executive Order 13132, Federalism

The FAA has analyzed this proposed rule under the principles and criteria of Executive Order 13132, Federalism. We determined that this action would not have a substantial direct effect 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. Therefore, we determined that this notice of proposed rulemaking would not have federalism implications.

Environmental Analysis

FAA Order 1050.1D defines FAA actions that may be categorically excluded from preparation of a National Environmental Policy Act (NEPA) environmental impact statement. In

accordance with FAA Order 1050.1D, appendix 4, paragraph 4(j), this proposed rulemaking action qualifies for a categorical exclusion.

Energy Impact

The energy impact of the proposed rulemaking has been assessed in accordance with the Energy Policy and Conservation Act (EPCA) Pub. L. 94–163, as amended (42 U.S.C. 6362) and FAA Order 1053.1. It has been determined that this proposed rulemaking is not a major regulatory action under the provisions of the EPCA.

List of Subjects in 14 CFR Part 121

Air carriers, Aircraft, Aviation safety, Safety, Transportation.

The Proposed Amendment

In consideration of the foregoing, the Federal Aviation Administration proposes to amend part 121 of Title 14, Code of Federal Regulations (14 CFR part 121) as follows:

PART 121—OPERATING REQUIREMENTS: DOMESTIC, FLAG, AND SUPPLEMENTAL OPERATIONS

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

Authority: 49 U.S.C. 106(g), 40113, 40119, 44101, 44701–44702, 44705, 44709–44711, 44713, 44716–44717, 44722, 44901, 44903–44904, 44912, 46105.

2. Amend § 121.311 by adding paragraphs (j) and (k) to read as follows:

§ 121.311 Seats, safety belts, and shoulder harnesses.

* * * * *

(j) On and after [insert date four years after effective date of final rule], no person may operate a transport category airplane type certificated after January 1, 1958, in passenger-carrying operations under this part unless—

(1) For airplanes manufactured on and after [insert date four years after the effective date of final rule], all passenger and all flight attendant seats on the airplane meet the requirements of § 25.562 of this chapter in effect on June 16, 1988.

(2) For airplanes manufactured before [insert date four years after the effective date of final rule], all passenger seats and all flight attendant seats on the airplane meet the requirements of § 25.562 of this chapter in effect on June 16, 1988, after any passenger seat or any flight attendant seat on that airplane is replaced.

(k) On and after [insert date 14 years after the effective date of final rule], no person may operate a transport category airplane type certificated after January 1, 1958, in passenger-carrying operations under this part unless all passenger and all flight attendant seats on the airplane meet the requirements of § 25.562 of this chapter in effect on June 16, 1988.

Issued in Washington, DC, on September 26, 2002.

John J. Hickey,

Director, Aircraft Certification Service.

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