Transport Airplane Seats and Wheelchairs

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Federal Aviation Administration

FAA’s Mission

Our continuing mission is to provide the safest, most efficient aerospace system in the world

Briefing Outline

- Certification process overview
- Cabin Safety Overview
- Discuss related regulations for transport seats
- Explore possible certification approach for wheelchairs
- Q&A

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Certification - General

The U.S. Congress established a law that authorizes the FAA Administrator to issue Type Certificates, Production Certificates and Airworthiness certificates for an aircraft, aircraft engines or propeller

Section 44704 – Title 49, United State Code

Cabin Safety Agenda

- Definition and Overview
- Post-Crash and In-flight
- Major Cabin Safety Amendments
- Elements of Cabin Safety
- Certification Basis overview
- Type Certification Process

Definition

***Cabin Safety*, the discipline that deals with:**

- Occupant protection/survival
- Providing for a rapid egress from the airplane
- Prolonging the time available for egress from the airplane

The two major areas of Cabin Safety:

- Post-Crash (Crash & Ground Events)
- In-Flight

Post - Crash Cabin Safety

Airframe Capability

- Occupant injury protection and human tolerance
- Adequacy of interior structural features (including seats, galleys, closets, overhead stowage compartments)

Egress

- Systems that provide capability to rapidly evacuate the airplane
- Systems and materials to extend the available evacuation time

Water/Environmental Survival

- Emergency Equipment
- Ditching
- Survival kit

Post-Crash: Egress

Two major concerns regarding egress from the airplane

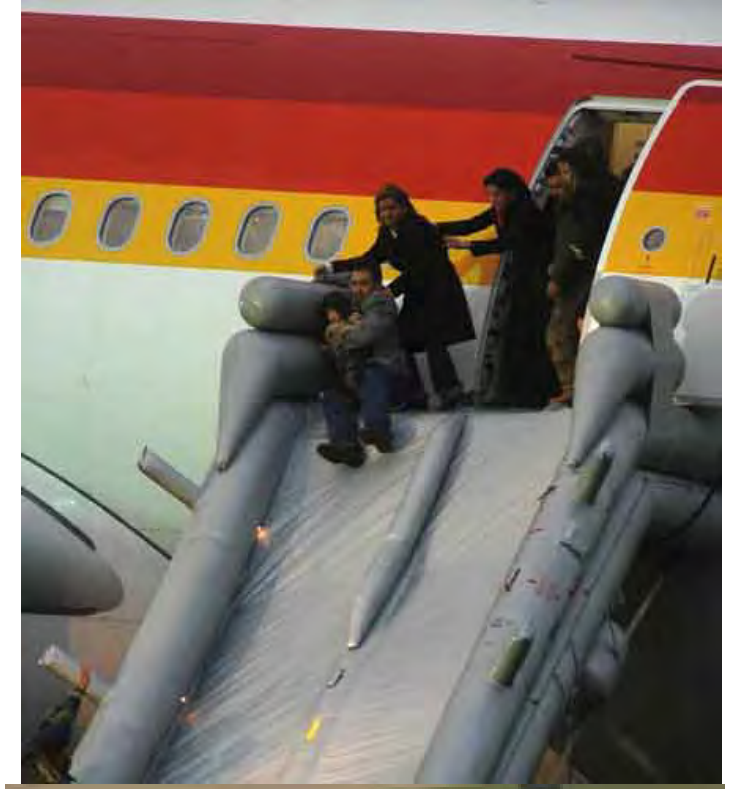
Providing rapid egress

- Hazard assessment of Outside Conditions
- Exit performance
- Escape slide performance
- Interior arrangements etc.
- Issues related to operational procedures

Prolonging the time available for egress

- Improved flammability of materials
- Active fire suppression systems
- Burn-through protection
- Protection of escape systems from the effects of fire
- Enhanced ditching flotation time

2007, accidents involving evacuations



more accidents involving evacuations

more accidents involving evacuations

more accidents involving evacuations

more accidents involving evacuations

In-Flight Cabin Safety

Turbulence

- Primarily an occupant protection issue
- All occupiable areas of the cabin must be considered - *not just those occupied for takeoff and landing*
- Make considerations for both design and procedures

Decompression

- Oxygen systems protect against the effects of decompression
- Structures that tolerate pressure differentials prevent injury

In-Flight Cabin Safety

In-flight Fire Protection

- Smoke Detection / Fire Suppression
- Flammability of materials
- Emergency equipment
- Procedural limitations (e.g., no smoking in lavatories)

Medical Emergencies

- Emergency equipment
  - Oxygen
  - First Aid
- Procedures

Airworthiness vs. Cabin Safety

- **Our prime concern is to <u>prevent</u> accidents via airworthiness regulations, but unfortunately some accidents will still occur.**

- **Cabin safety regulations aim to minimize injuries and fatalities from those incidents & survivable accidents.**

Crash Dynamics

Requirements related to survival of the initial event

- Crash or Ditching

  Sections 25.561, 25.562, 25.785, 25.787, 25.789, 25.801, 25.807

Crash Dynamics

Section 25.561 General (Emergency Landing Conditions)

- Requires protection of each occupant under prescribed emergency landing conditions

- Applies to all structure (most obviously interior structure) which could affect occupants of the airplane, seats, galleys, lavatories, closets, bins, mechanical and electrical equipment, etc.

Crash Dynamics

Section 25.561 (continued)

- Deformations which result from the application of the loads must be considered to determine whether they would impede a rapid evacuation of occupants
- This includes where shifting of the equipment / cargo would block the emergency exit and/or escape systems
- Note the certification basis when finding compliance with this rule

Section 25.561, Applying Amendment 91

- The local attachments for items of mass which are subject to severe wear and tear through frequent removal (e.g. quick change interior items) require a 1.33 fitting factor
- Applicable to both analysis and test
- Examples of items subject to frequent removal:
  - Passenger and Attendant Handsets
  - Emergency Equipment
  - Flexible Interior Components
  - Any item designed to be easily and/or frequently removed or replaced (If any question, contact FAA)
  - Must consider structural interface if part of retention
- *Seat and restraint system attachments already require a 1.33 fitting factor per § 25.785(f)(3)*

Crash Dynamics

Section 25.562, Emergency Landing Dynamic Conditions

(Note: Occupant injury portion covered in Human Tolerance section)

- Requires that passenger, flight attendant and flight crew/observer seats and restraint systems protect occupants from specified dynamic loading conditions

Crash Dynamics

Section 25.562, (continued)

- A longitudinal and a vertical test are required as a minimum
- Tests are run with an anthropomorphic test dummy as defined by 49 CFR part 572, subpart B, or its equivalent
- Pitch and Roll of the seat attachments are required to simulate the warpage of the floor due to the accident

Crash Dynamics

Test Dummy Family

Section 25.785, Seats, Berths, Safety Belts, and Harnesses

(a) A seat (or berth for a nonambulant person) must be provided for each occupant who has reached his or her second birthday.

(b) Each seat, berth, safety belt, harness, and adjacent part of the airplane at each station designated as occupiable during takeoff and landing must 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 inertia forces specified in Secs. 25.561 and 25.562.

(c) Each seat or berth must be approved.

Section 25.785, Seats, Berths, Safety Belts, and Harnesses

(d) Each occupant of a seat that makes more than an 18° angle with the vertical plane containing the airplane centerline must be protected from head injury by a safety belt and an energy absorbing rest that will support the arms, shoulders, head, and spine, or by a safety belt and shoulder harness that will prevent the head from contacting any injurious object. Each occupant of any other seat must be protected from the head injury by a safety belt and, as appropriate to the type, location, and angle of facing of each seat, by one or more of the following:

(1) A shoulder harness that will prevent the head from contacting any injurious object.

(2) The elimination of any injurious object within striking radius of the head.

(3) An energy absorbing rest that will support the arms, shoulders, head, and spine.

Section 25.785, Seats, Berths, Safety Belts, and Harnesses

(e) Each berth must be designed so that the forward part has a padded end board, canvas diaphragm, or equivalent means, that can withstand the static load reaction of the occupant when subjected to the forward inertia force specified in Sec. 25.561. Berths must be free from corners and protuberances likely to cause injury to a person occupying the berth during emergency conditions.

(f) Each seat or berth, and its supporting structure, and each safety belt or harness and its anchorage must be designed for an occupant weight of 170 pounds, considering the maximum load factors, inertia forces, and reactions among the occupant seat, safety belt, and harness for each relevant flight and ground load condition (including the emergency landing conditions prescribed in Sec. 25.561). In addition--

Section 25.785, Seats, Berths, Safety Belts, and Harnesses

(f)(1) The structural analysis and testing of the seats, berths, and their supporting structures may be determined by assuming that the critical load in the forward, sideward, downward, upward, and rearward directions (as determined from the prescribed flight, ground, and emergency landing conditions) acts separately or using selected combinations of loads if the required strength in each specified direction is substantiated. The forward load factor need not be applied to safety belts for berths.

Section 25.785, Seats, Berths, Safety Belts, and Harnesses

(f)(2) Each pilot seat must be designed for the reactions resulting from the application of the pilot forces prescribed in Sec. 25.395.

(g) Each seat at a flight deck station must have a restraint system consisting of a combined safety belt and shoulder harness with a single-point release that permits the flight deck occupant, when seated with the restraint system fastened, to perform all of the occupant's necessary flight deck functions. There must be a means to secure each combined restraint system when not in use to prevent interference with the operation of the airplane and with rapid egress in an emergency.

Section 25.785, Seats, Berths, Safety Belts, and Harnesses

(h) Each seat located in the passenger compartment and designated for use during takeoff and landing by a flight attendant required by the operating rules of this chapter must be:

[(1) Near a required floor level emergency exit, except that another location is acceptable if the emergency egress of passengers would be enhanced with that location. A flight attendant seat must be located adjacent to each Type A or B emergency exit. Other flight attendant seats must be evenly distributed among the required floor-level emergency exits to the extent feasible.]

(2) To the extent possible, without compromising proximity to a required floor level emergency exit, located to provide a direct view of the cabin area for which the flight attendant is responsible.

(3) Positioned so that the seat will not interfere with the use of a passageway or exit when the seat is not in use.

Section 25.785, Seats, Berths, Safety Belts, and Harnesses

(h) (continued)

(4) Located to minimize the probability that occupants would suffer injury by being struck by items dislodged from service areas, stowage compartments, or service equipment.

(5) Either forward or rearward facing with an energy absorbing rest that is designed to support the arms, shoulders, head, and spine.

(6) Equipped with a restraint system consisting of a combined safety belt and shoulder harness unit with a single point release. There must be means to secure each restraint system when not in use to prevent interference with rapid egress in an emergency.

Section 25.785, Seats, Berths, Safety Belts, and Harnesses

(i) Each safety belt must be equipped with a metal to metal latching device.

(j) If the seat backs do not provide a firm handhold, there must be a handgrip or rail along each aisle to enable persons to steady themselves while using the aisles in moderately rough air.

(k) Each projecting object that would injure persons seated or moving about the airplane in normal flight must be padded.

(l) Each forward observer's seat required by the operating rules must be shown to be suitable for use in conducting the necessary enroute inspection.

Section 25.785, Seats, Berths, Safety Belts, and Harnesses

- Seats must be designed for the critical load conditions of the airplane not just for the static loads in TSO-C39 or C127
- Airplane gust loads are often higher in at least one direction
- There must be a handhold to allow persons to steady themselves while using the aisle in moderately rough air
- This includes expected and unexpected turbulence

Cabin Safety considerations for wheelchairs

- **Other than the tie in of the DOT 382, the 14 CFR part 25 design standards for transport airplanes to not have considerations for wheelchairs**
- **The introduction of wheelchairs in the cabin could have a negative impact on evacuation**
- **Conditions and limitations would need to be considered to maintain an acceptable level of safety**

Cabin Safety considerations for wheelchairs

- **The most likely path forward from a regulatory perspective is to petition for an exemption from the seat related regulations**
- **Exemptions granted must be shown to be in the public interest**
- **Exemptions impose appropriate conditions and limitations to maintain an acceptable level of safety**
- **The FAA has several exemptions for medical stretchers**

Cabin Safety considerations for wheelchairs

- **The background of the legal regulatory basis for these exemptions – see 14CFR part 11.**

- http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgEX.nsf/0/e4cb9301e4e6943186257822006945 1b/$FILE/10197.pdf
- http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgEX.nsf/0/9005df7dfb0613c7862579b10050a130/$FILE/10457%20correction-1.pdf

Cabin Safety considerations for wheelchairs

- Sec. 11.81

  What information must I include in my petition for an exemption?

  You must include the following information in your petition for an exemption and submit it to FAA as soon as you know you need an exemption.
  (a) Your name and mailing address and, if you wish, other contact information such as a fax number, telephone number, or e-mail address;
  (b) The specific section or sections of 14 CFR from which you seek an exemption;
  (c) The extent of relief you seek, and the reason you seek the relief;
  (d) The reasons why granting your request would be in the public interest; that is, how it would benefit the public as a whole;

Cabin Safety considerations for wheelchairs

- Sec. 11.81(cont.)

(e) The reasons why granting the exemption would not adversely affect safety, or how the exemption would provide a level of safety at least equal to that provided by the rule from which you seek the exemption;
(f) A summary we can publish in the Federal Register, stating:
(1) The rule from which you seek the exemption; and
(2) A brief description of the nature of the exemption you seek;
(g) Any additional information, views or arguments available to support your request; and
(h) If you want to exercise the privileges of your exemption outside the United States, the reason why you need to do so.

Cabin Safety considerations for wheelchairs

- **Possible conditions and limitations for Wheelchair exemption**
  - Relief from 25.562 dynamic tests
  - Restraint system part of the airplane not the wheelchair
    - Comply with 25.561 static tests
    - Designed to accommodate various wheelchair designs
  - Operational procedures
    - Normal, Emergency
      - Boarding, In-flight, Turbulence, Fire, Evacuation, etc.

Cabin Safety considerations for wheelchairs

Thank you and questions

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Transport Airplane Cabin Safety

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