

**UNITED STATES OF AMERICA  
DEPARTMENT OF TRANSPORTATION  
FEDERAL AVIATION ADMINISTRATION  
RENTON, WASHINGTON 98057-3356**

In the matter of the petition of

**THE BOEING COMPANY**

for an exemption from §§ 25.810(a)(1)(i) and  
25.810(a)(1)(iii) of Title 14, Code of Federal  
Regulations

**Regulatory Docket No. FAA-2008-0348**

**PARTIAL GRANT OF EXEMPTION**

By letter BDCO-09-01998, dated April 27, 2009, C. M. Thompson, Lead Project Administrator, Development Projects, The Boeing Company, PO Box 3707, Seattle, Washington, 98124, petitioned the Federal Aviation Administration (FAA) for an amendment to Exemption No. 9793 to allow additional relief from the requirements of §§ 25.810(a)(1)(i) and 25.810(a)(1)(iii) of Title 14, Code of Federal Regulations (14 CFR). Also, Boeing requested that Limitation No. 12 of Exemption No. 9793 be revised, limiting its application to only the crew service door. Currently the limitation applies to the crew service door and the overhead hatch.

Additional substantiating information was submitted by letter BDCO-09-02889, dated June 5, 2009, and by three e-mails sent on July 28, 2009; August 10, 2009; and August 11, 2009, respectively. Exemption No. 9793 is a partial grant that permits the carriage of six non-crewmembers (commonly referred to as supernumeraries) in a compartment behind the flight deck on Boeing Model 747-8F airplanes. Exemption No. 9793 also allows these supernumeraries in-flight access to the class E cargo compartment. This proposed amendment would allow the installation of an escape slide that does not automatically deploy and is not long enough to be self-supporting in all landing gear collapse scenarios.

**The petitioner requests relief from the following regulations:**

**Section 25.810(a)(1)(i), at Amendment 25-114**, requires the escape slide to be automatically deployed and deployment must begin during the interval between the time the exit opening means is actuated from inside the airplane and the time the exit is fully opened.

**Section 25.810(a)(1)(iii), at Amendment 25-114**, requires that a self-supporting escape slide or equivalent be provided as the assist means at passenger emergency exits that are more than six (6) feet from the ground with all landing gear extended.

### **Related section of 14 CFR**

Section 121.583(a) contains, in pertinent part, a listing of categories of persons who may be carried aboard an airplane in part 121 service without complying with all the requirements of part 121 pertaining to carriage of passengers.

### **The petitioner supports its request with the following information:**

The following information summarizes the petition submitted by The Boeing Company, with minor edits for clarity. The complete petition is available on the Federal Docket Management System website at [www.regulations.gov](http://www.regulations.gov). The docket number is FAA-2008-0348.

The Model 747-8F is a derivative airplane based on the Model 747-400F. Relative to the 747-400F, the 747-8F is 220 inches longer. The main deck of the airplane is a Class E cargo compartment. The upper deck of the airplane includes the flight deck and the supernumerary seating area. This amendment to Exemption No. 9793, if granted, would allow the installation of an escape slide at the crew service door that is not automatically deployed and is not of sufficient length to be self-supporting in all cases of landing gear collapse. Also, it would change the applicability of Limitation No. 12 to only the crew service door.

The exemption from § 25.810(a)(1)(i) is necessary for the crew service door escape slide because the escape slide is not automatically deployed when the door is opened from inside the airplane. Once the door is opened from the inside a separate action is need to manually deploy the escape slide out the door opening.

The exemption from § 25.810(a)(1)(iii) is necessary for the customer option escape slide installed at the crew service door because the escape slide is not of such length that the lower end is self-supporting on the ground under certain landing gear collapse conditions.

Justification for applying Limitation 12 to only the crew service door

By virtue of the shape of the 747 fuselage and the location of the overhead hatch being on the upper deck and near the airplane's centerline, an evacuee that is preparing to descend from the overhead hatch is physically unable to view the ground contact point. For reference, with all landing gears extended, the closest an evacuee can see the ground is approximately nine feet outboard from the ground contact point. Therefore, adding an emergency light that will illuminate the ground contact point will not result in any measurable improvement in the level of safety being provided because they cannot see the illuminated area prior to starting their descent. Their decision to descend from the overhead must necessarily be made without the benefit of being able to view their ground contact point, whether it is illuminated or not. If they are looking downward during their descent they may be able to view their ground contact point but that will be of little or no help since they are already past the point of no return.

Justification for the exemption for the crew service door escape slide

The crew service door escape slide installed on all 747-400F airplanes (and some of its predecessors) is the same escape slide that is planned for installation at customer option on the 747-8F. The escape slide does not automatically deploy nor is it of sufficient length to be self-supporting on the ground when the airplane is resting back on its tail. This condition can only occur as a result of losing both body gear while maintaining both wing gear, and when the airplane C.G. [center of gravity] is aft of the wing gear station line. However, an acceptable level of safety is still provided on these airplanes because the inertia reels in the flight deck are of sufficient length for evacuees to safely reach the ground in the rare case of a tail-tipped 747, and the inertia reels can be used from either the overhead hatch or from the crew service door after the escape slide has been deployed.

Regarding egress during a tail tip event on a 747-8F having the optional escape slide installed, supernumeraries are currently required by Exemption No. 9793 to be briefed prior to each flight ...“Inspect the ground to determine whether a safe landing can be achieved before using an assist means.” Based on this instruction, a supernumerary will inspect the ground after deploying the optional escape slide to determine if it is safe for use. In a tail tip

condition, the deployed escape slide will be hanging near vertical from the doorway, and it will therefore appear obviously unsafe to use from the evacuee's perspective due to the fact that the bottom of the escape slide will not be close to touching the ground. When the 747-8F is tipped tail down the resultant sill height of the crew service door is 39 feet above the ground, noticeably higher than it would be if the airplane were sitting on all of its gear (25 feet). In the case where the escape slide's safe use is in question, the supernumeraries would then retrieve their escape harnesses, don them, retrieve an inertia reel from the flight deck, and mechanically connect it to the donned harness. The flightcrew would then instruct the supernumeraries to evacuate from either the overhead hatch or from the crew service door, essentially sliding down the near-vertical escape slide under control due to the fall-arresting nature of the inertia reels.

Regarding the 747-400F escape slide not being of an auto-deploy type and the level of safety being provided, supernumeraries are required by exemption to be afforded a higher level of training in emergency procedures (by comparison to passengers), and are instructed by the flight crew on how to manually deploy the crew service door escape slide on a 747 freighter so equipped. Also, airlines carrying supernumeraries on the Model 747-8F are required by exemption to determine that they are physically fit to carry out all required procedures, including being able to manually deploy the escape slide.

Relative to the requesting relief, no adverse service experience has been reported to Boeing regarding the 747-400F escape slide and its predecessors. This experience spans over 35 years.

#### Public Interest

The 747-8F is a freighter airplane whose primary mission is to deliver goods to a variety of locations throughout the world. Shipping these goods as economically as possible benefits the public as a whole by enabling lower consumer costs for cargo shipped by air. Grant of our petition to amend will enhance the operational flexibility and utilization of the 747-8F aircraft, benefiting aircraft operators, shippers and the consuming public.

Although we are currently in an economic downturn, the worldwide demand for shipment of goods by air cargo continues to grow on a long term basis. The 747-8F is intended to help meet this demand as economically as possible while providing appropriate safety features. Having the necessary supernumeraries

on board and available for cargo care and management will help operators control operational costs, avoiding the need to transport cargo management personnel separately via commercial flights. Additionally by carrying personnel to assist in the handling of certain cargo during ground operations, airlines operating the 747-8F can expect to reduce their airplane turn-around time, a capability that further supports the public's interest as a whole by virtue of lower consumer costs for air cargo shipment due to increased utility of the 747-8F fleet.

In addition, a full grant of exemption is in the public's interest when the airplane is configured with either the optional escape slide as the escape means from the crew service door or with the inertia reels as the escape means because making alternative configurations available will give individual operators the ability to use the most efficient configuration for their respective business needs, taking into consideration cost structure, operational needs and regulatory requirements. The benefit to the carriers and to the public for the configuration with the escape slide installed is the fact that all airline customers of the 747-8F to date also operate other models of the 747 freighter series with the exact same part number escape slide. The benefits to the 747-8F airlines choosing to install an escape slide (and ultimately the benefit to the public by lower air cargo shipping rates) are common escape slide spares, common emergency procedures and common crew training across their extensive 747 freighter fleets. With regard to the airplane configuration without the optional escape slide, the benefit to the carriers and to the public is that airlines choosing this configuration will benefit by having lower operational costs such as the avoidance of the additional fuel burn associated with the weight of the escape slide.

The public's interest will also be advanced by a full grant of exemption since the marketability of cargo airplanes with Class E cargo compartments is enhanced by the allowance of the carriage of persons whose responsibility is to inspect and/or care for certain cargo that requires such attention during flight. The sale of Boeing cargo airplanes contributes positively to the U.S. balance of trade, the U.S. gross domestic product and the economic health of the United States, and therefore also benefits the public as a whole.

The level of safety being provided on Boeing Model 747-8F airplanes will not be compromised by a full grant of exemption, as other freighter airplanes are similarly approved for the carriage of supernumeraries, their access into the main deck cargo

compartment during flight for all cargo modes, the installation of the 747-400F escape slide at the crew service door for those airlines that require an escape slide for their operation (or whose regulatory agency requires such installation), and for those airlines who choose to operate their 747-8F fleet without the optional escape slide. These are all in the public interest and the 747-8F airplane configurations being proposed will maintain an acceptable level of safety for all persons being carried.

In summary, the public interest will be served by a full grant of exemption in this case. The airlines choosing to purchase the 747-8F will have the flexibility of 1) being able to carry supernumeraries, 2) allowing them to enter the main deck cargo compartment in flight to care for certain cargo requiring such care and/or attention, and 3) being able to configure their airplanes with or without an escape slide installed at the crew service door. There are benefits to the airlines (and to the public on a whole) for both configurations being allowed.

### **Federal Register publication**

A summary of this petition was not published in the *Federal Register*. This petition adds additional justification to a previous request but does not change that request. The petitioner's original request was published in the *Federal Register* July 28, 2008 (73 FR 43816) and the only comment received was a supportive comment from an operator.

### **The FAA's analysis**

The FAA considers the petitioner's proposal for the exemption to be in the public interest for the following reasons:

The FAA has granted several exemptions for the carriage of supernumeraries on freighter airplanes;

These supernumeraries are seen as a benefit to airplane safety and efficient operations of air cargo; and

A significant disruption of air commerce could occur if the petition were not granted.

We have reviewed the design and location of the overhead hatch on the 747-8F and the available ground view available by a person using the overhead hatch for evacuation. We agree with Boeing's position that a person using the overhead hatch for evacuation

will not be able to see the point on the ground where he is likely to make first contact until after he has started descending down the outside of the airplane using the inertia reel, and that this point in time is beyond the point of no return for evacuating the airplane. We also agree with Boeing's position that there is little or no benefit to installing emergency lighting to illuminate an area on the ground that cannot be seen by a person using the overhead hatch.

There are three conditions where the crew service door escape slide does not comply with the regulations: (1) The escape slide is not automatically deploying, (2) the escape slide is not self-supporting under airplane tail down condition, and (3) the escape slide is partially blocking the access to the airplane when the crew service door is opened from the outside, which may prevent rescue personnel from rapidly entering the airplane in an emergency. We will discuss each of these conditions separately below.

### **1. The escape slide does not automatically deploy**

We are concerned about the escape slide not automatically deploying during the door opening process because this increases the time required to prepare the exit for evacuation. The baseline configuration for this airplane has inertia reels and harnesses installed as the evacuation assist means for all occupants of the airplane. The additional time required for manually deploying an automatically-inflating escape slide would be similar to the amount of time required for the occupant to don a harness and attach it to the inertia reel. The supernumeraries that are carried on the airplane are required to be physically fit to operate all emergency equipment and are briefed prior to each flight on the use of all emergency equipment, including the crew service door escape slide.

Taking all of these factors into consideration, and the limitations contained in this exemption, we agree with Boeing's petition for exemption to allow the installation of a manually deployed escape slide at the crew service door.

### **2. The escape slide is not self-supporting in an airplane tail down scenario**

There is one scenario of landing gear collapse where the airplane tips tail down, resulting in a distance of 39 feet from the ground to the sill of the crew service door. In this position the proposed optional crew service door escape slide is not self-supporting on the ground and is not safe for use as the assist means for this exit. For the crew service door, prior to each flight, the occupants are instructed that, in an emergency, they would deploy the escape slide and determine if it is safe to use for evacuation. In the tail down scenario, the deployed escape slide would be hanging almost vertical and occupants would see from the doorway that the escape slide is not useable. After making this determination, the occupants would need to use the inertia reels and harnesses to evacuate out of the crew service door. For this scenario of landing gear collapse resulting in the airplane tail down position, the start of the evacuation would be delayed by the time required to manually deploy the escape slide, inflation time of the escape slide, and the time required to determine whether the escape slide is not safe to use, compared to the baseline airplane that does not have the escape slide. This time delay is estimated at between 10 and 20 seconds. In all other scenarios of landing gear collapse, and the

scenario of all landing gear extended, there would not be a delay in the starting of the evacuation with the optional escape slide installed.

Taking all of these factors into consideration, and the limitations contained in this exemption, we agree with Boeing's petition for exemption to allow the optional installation of an escape slide at the crew service door. With the exception of the tail down scenario, it takes about the same amount of time to use the escape slide as it does the inertia reel and harness.

### **3. The escape slide blocks access into the airplane from the outside**

If the optional escape slide is installed at the crew service door and that door is opened from the outside of the airplane, the escape slide partially blocks access into the airplane. It is estimated this escape slide blocks the lower half of the projected exit opening. The resulting clear projected opening of the exit is less than a Type III exit (20 inches wide and 36 inches high). Boeing proposed that the rescue personnel could step over the escape slide to gain access to the airplane. Having rescue personnel step over the escape slide in an emergency reduces the effectiveness of the exit as a means to enter the airplane. The current design of the optional escape slide does not include instructions on the outboard side of the escape slide assembly indicating how to move the slide so it does not block the exit. On the inboard side there are instructions on how to move the slide aft to clear the exit opening.

The proposal for the rescue personnel to step over the escape slide is not acceptable. Boeing must develop instructions for sliding the escape slide aft to clear the projected opening of the exit from the outside. These instructions must be added to the outside of the airplane so that rescue personnel can read them and move the escape slide out of the way. These instructions must be demonstrated to be effective for rescue personnel.

### **The FAA's decision**

In consideration of the foregoing, I find that an amendment to Exemption No. 9793 is in the public interest. Therefore, pursuant to the authority contained in 49 U.S.C. §§ 40113 and 44701, delegated to me by the Administrator, The Boeing Company is hereby granted an amendment to Exemption No. 9793 from 14 CFR 25.810(a)(1)(i) and 25.810(a)(1)(iii) to the extent necessary to allow type certification of Boeing Model 747-8F series airplanes with provisions for the carriage of supernumeraries. The applicability of Limitation No. 12 has been modified so it no longer pertains to the overhead hatch. Limitation No. 16 has been added and is applicable to airplanes with the optional escape slide installed at the crew service door. For clarity, all other limitations from Exemption No. 9793 have been repeated below. The following limitations apply and Limitation Nos. 1-6 and 10-11 must be documented in the Limitations Section of the Boeing Model 747-8F Airplane Flight Manual:

1. A maximum of six supernumeraries may occupy the area just aft of the flight deck. The total maximum occupancy of the airplane is limited to eight persons, including the flightcrew.
2. The supernumeraries are limited to the categories specified in §§ 121.583(a)(1) through 121.583(a)(7).
3. Main Deck Class E Cargo Compartment Access Limitations:
  - a. Supernumeraries are prohibited from being in the cargo area during taxi, take-off, and landing. The pre-flight briefing must inform supernumeraries of this requirement.
  - b. Access into the main deck Class E cargo compartment in-flight is allowed for only three types of operation. They are:
    - Carriage of live animals requiring care/attention during flight and associated material only, no other cargo. The maximum number of supernumeraries allowed in the main deck Class E cargo compartment is six.
    - Cargo only, no live animal requiring care/attention during flight. The maximum number of supernumeraries allowed in the main deck Class E cargo compartment is three.
    - Carriage of live animals requiring care/attention during flight and other cargo. The maximum number of supernumeraries allowed in the main deck Class E cargo compartment is six.
4. Prior to each flight, a flightcrew member must brief the supernumeraries on the following:
  - the use of exits, including instructions to inspect the ground to determine whether a safe landing can be achieved before using an assist means.
  - location and use of emergency equipment.
  - the prohibition from being in the cargo area during taxi, take-off, and landing.
  - the aural and visual decompression alerting system and what actions they are required to take.
  - the visual turbulence alerting system and the requirement that persons must return to their seats.

- the aural and visual fire or smoke alerting system and what actions they are required to take.
  - that access is limited to the care and handling of animals and cargo only.
  - that access is limited to a maximum of three unless live animals requiring care/attention in-flight and associated material are being carried.
  - that access is limited to a maximum of six when live animals requiring care/attention in-flight are being carried.
  - that the smoke barrier must be secured (i.e., the door or curtain must be closed) except when entering or leaving the cargo compartment.
  - that a portable oxygen bottle (with full face mask attached) must be carried at all times when accessing the cargo compartment by each person entering the cargo compartment.
  - that smoking is not allowed within the cargo compartment.
  - that the compartment must not be entered in case of fire/smoke being detected inside the Class E cargo compartment.
5. The operator must determine that each supernumerary is physically able and trained to accomplish the necessary emergency procedures.
6. Supernumeraries Portable Oxygen:
- a. There must be at least one portable oxygen unit with a mask attached to it provided for each supernumerary allowed to enter the main deck Class E cargo compartment during flight. The unit must provide an indication to the user that oxygen is flowing.
  - b. The portable oxygen unit must meet the performance requirements of § 25.1443(a) or § 25.1443(b), or the equipment must be shown to protect the supernumerary from hypoxia at an activity level required to return to his or her seat following a rapid decompression to 25,000 feet cabin altitude.
  - c. During flight, the supernumerary must carry the portable oxygen unit whenever he or she is in the Class E cargo compartment.
  - d. The supernumeraries must be trained in the use of the oxygen units. The supernumeraries must also be trained in making the determination whether oxygen is being delivered to the dispensing units.

- e. The oxygen units must be sized adequately for continuous and uninterrupted use during worst-case flight duration following decompression, or must be of sufficient duration to allow the supernumeraries to return to their seats where oxygen is readily accessible for the remainder of the decompression.
  - f. Additionally, since the petitioner has decided to provide the same alert for both decompression and smoke/fire, the oxygen unit must meet the protective breathing equipment (PBE) requirements in §§ 25.1439(b)(1), (2)(i), and (4), and the equipment and system must be designed to prevent any inward leakage to the inside of the device and prevent any outward leakage causing significant increase in the oxygen content of the local atmosphere (i.e., full face mask type.)
7. An automatically activated aural and visual decompression alerting system must be present and immediately recognizable in accessible areas of the Class E cargo compartment to notify supernumeraries when to don oxygen masks. If there are two or more alerts that a supernumerary may hear or is expected to respond to there must be an automatic visual alert in addition to the automatic aural alert. The pre-flight briefing must include training in the sound of the alerting system, the meaning of the alerting system, and the response to the signal (i.e., procedures for donning the masks and activating the flow of oxygen).
8. Turbulence Alert:

A flightcrew operated visual alerting system, which is recognized in accessible areas in the Class E cargo compartment, must be installed to indicate, during turbulence, that persons must return to their seats. Appropriate procedures and limitations must be established to ensure that the flightcrew alerting systems notify the supernumeraries to return to their seats at the onset of turbulence and prior to landing. The pre-flight briefing must explain this alerting system to the supernumeraries.

#### 9. Smoke/Fire Alert:

A flightcrew activated aural and visual alerting system, which is recognized in the Class E cargo compartment, must be installed. This aural or visual alerting system is to indicate that, in the event of fire or smoke in the Class E cargo compartment, persons must return to their seats and ensure that the smoke barrier is secured (i.e., the door or curtain is closed). Appropriate procedures and limitations must be established to ensure that, at the onset of a fire or smoke event, the flightcrew alerting systems the supernumeraries to return to their seats and secure the smoke barrier. The pre-flight briefing must explain these alerting systems to the supernumeraries.

#### 10. Placards:

Placards are to be located in the supernumerary area, in a conspicuous location either on or adjacent to the smoke barrier doors. The placards must indicate the following:

- Access is limited to the care and handling of animals and cargo only.
- Access is limited to a maximum of three supernumeraries unless live animals requiring care/attention in-flight and associated material are being carried.
- The smoke barrier must be secured (i.e., the door or curtain must be closed) except when entering or leaving the cargo compartment.
- A portable oxygen bottle (with full face mask attached) must be carried at all times when accessing the cargo compartment by each person entering the cargo compartment.
- Smoking is not allowed within the cargo compartment.
- The compartment must not be entered in case of fire/smoke being detected inside the Class E cargo compartment.
- Do not occupy the Class E cargo compartment during taxi, takeoff, and landing.

#### 11. Alerting requirements:

- Must be distinctive and effective.

- Visual alerts must be visible from all occupant locations and orientations, during all expected operational conditions including a rapid decompression where moisture in the air may condense.
  - Aural alerts must be loud enough to be heard during all expected operational conditions including a rapid decompression where the ambient noise level will increase.
12. For the crew service door emergency lighting must provide adequate illumination at the ground end of the assist means, where an evacuee would normally make first contact with the ground, with the airplane in each of the attitudes corresponding to the collapse of one or more legs of the landing gear and worse case center of gravity location. This condition does not apply to the overhead hatch.
  13. There must be eight inertia reels and harnesses installed on the flight deck. No flight deck door may be installed between the supernumerary compartment and the flightdeck that would prevent access to the overhead hatch and eight inertia reels and harnesses. In accordance with FAA-approved test plan(s), the intended inertia reels and harnesses must be demonstrated to be a suitable assist means for the expeditious and safe evacuation of the maximum number of trained occupants allowed by approved seating. This/these demonstration(s) should also address to the satisfaction of the FAA the capability of trained occupants to utilize the intended inertial reels and harnesses to safely and expeditiously evacuate incapacitated occupants. Additionally, this/these demonstration(s) should also address to the satisfaction of the FAA the suitability of the intended devices from both high and low sill heights representative of § 25.810(a)(1)(iii) gear-collapse conditions including worse case center of gravity location.
  14. For all cargo or mixed cargo and live animal operations involving four or more supernumeraries, a portable system that protects against smoke inhalation must be provided. A portable system (e.g., smoke hood, full face mask oxygen system, etc.) that affords protection from smoke inhalation must be carried at all times when accessing the cargo compartment. Note that a single system that meets both protection from smoke inhalation and hypoxia could be used (e.g., a full face mask with oxygen unit).
  15. Flight tests must be conducted to show compliance with the provisions of § 25.857 concerning the entry of hazardous quantities of smoke into compartments occupied by the crew or passengers. The amount of time that the smoke barrier is open, as a result of the supernumeraries evacuating the main deck cargo compartment, must be accounted for in the testing.
  16. For airplanes with the optional escape slide installed at the crew service door Boeing must develop instructions for moving the escape slide aft to clear the

projected opening of the exit from outside the airplane. These instructions must be added to the outboard side of the escape slide assembly so that rescue personnel can read the instructions and move the escape slide out of the way. These instructions must be demonstrated to be effective for rescue personnel.

Note: The briefings and associated procedures in Limitations 7, 8, and 9 are not required if an Airplane Flight Manual limitation is established to prohibit supernumeraries in the Class E cargo compartment during flight. If access is prohibited, placards must be revised to indicate this limitation.

Issued in Renton, Washington, on October 2, 2009.

*Signed by Ali Bahrami*

Ali Bahrami  
Manager, Transport Airplane Directorate  
Aircraft Certification Service