Exemption No. 14821

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 § 25.841(a)(2) and (a)(3) of Title 14, Code of Federal Regulations	**Regulatory Docket No. FAA-2015-3366**

PARTIAL GRANT OF EXEMPTION

By letter no. RA-15- 02563, received June 25, 2015, Mr. Gary E. Nagai, Project Administrator, The Boeing Company, P.O. Box 3707, Seattle, WA 98124-2207, petitioned to exempt the Model 787-10 airplane from the requirements of Title 14, Code of Federal Regulations (14 CFR) 25.841(a)(2) and (a)(3), as amended by Amendment 25-87. If granted, the exemption would relieve these airplanes from the requirement that, during a decompression caused by an uncontained failure of one of the engines, airplane cabin pressure altitude does not exceed 25,000 feet for more than two minutes, or exceed 40,000 feet for any duration. In addition to the materials Boeing submitted, which were posted in the docket, Boeing also provided the FAA additional proprietary information. This information is used in the FAA's analysis of this exemption.

The petitioner requests relief from the following regulations:

> Section 25.841(a)(2) at Amendment 25-87, requires that "The airplane must be designed so that occupants will not be exposed to a cabin pressure altitude that exceeds the following after decompression from any failure condition not shown to be extremely improbable:
>
> > (i) Twenty-five thousand (25,000) feet for more than 2 minutes; or
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> > (ii) Forty thousand (40,000) feet for any duration."
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> **Section 25.841(a)(3)** at Amendment 25-87, requires that "Fuselage structure, engine and system failures are to be considered in evaluating the cabin decompression."

The petitioner supports its request with the following information:

This section summarizes the petitioner's request. The complete petition is available at the Department of Transportation's Federal Docket Management System, on the Internet at http://regulations.gov, in docket no. FAA-2015-3366.

> The Boeing Model 787-10 airplane is designed to operate at a maximum cruise altitude of 41,100 feet pressure altitude. Should an uncontained engine-rotor burst event occur, it is possible that the cabin pressure could exceed the limits contained in current regulations. Boeing offers the following justification in support of its petition for exemption. Some of this justification is based on cabin-decompression evaluations performed and reported by the Mechanical Systems Harmonization Working Group (MSHWG) under the auspices of the Aviation Rulemaking Advisory Committee (ARAC).[1]
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> The Boeing Company requests an exemption from compliance with §§ 25.841(a)(2), and 25.841(a)(3) for cabin depressurization that can occur from uncontained engine-rotor failures that result in large holes in the fuselage. Boeing states that, based on fleet service experience, these events are rare. The Model 787-10 airplane complies with the latest FAA requirements and, therefore, offers a significantly higher basic level of safety than previously certified transport-category airplanes. Modern transport-category airplanes have a 53-year safety record with millions of hours at altitudes similar to the maximum cruise altitude proposed for the Model 787-10 airplane. In addition, Boeing claims that neither the Joint Airworthiness Authorities nor the European Aviation Safety Administration have implemented similar restrictions.
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> Boeing notes that very few, if any, decompression incidents have exposed an airplane cabin to pressure-altitude profiles that pose a risk of injury to passengers. Transport-category-airplane industry history reveals that few cases of catastrophic decompressions at high altitude have occurred, and those that have occurred have typically involved small business jets, according to Boeing. The FAA has cited a few cases of rotor burst in cruise, according to Boeing. In one such instance, the crew of a DC-10 crossing New Mexico reported several cases of initial decompression sickness, apparently with no permanent injuries.
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> In addition, Boeing acknowledges 121 additional fatalities related to hypoxia from the Helios Airways Flight HCY522 accident. However, Boeing correctly states that this accident was not due to a system, structural, or engine-failure event, but a failure of the flightcrew to properly configure the pressurization system, and a subsequent failure to recognize that the airplane was not pressurized after takeoff.
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> Boeing supplied the results of analysis for the Model 787-10 airplane, powered by Rolls-Royce Trent and General Electric GEnx engines, and provided information on the likelihood of various engine-failure events. In its decompression analysis, Boeing included a measure of the severity of exposure for occupants, based on a Depressurization Exposure Integral (DEI) from the Mechanical Systems Harmonization Working Group report on 25.841(a)(2) and (3). Boeing used the relationship between

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[1] The Final Report of the MSHWG, dated August 2003, was approved by a majority of the members of ARAC's Transport Airplane Engine Issues Group (TAEIG). Seven members of TAEIG voted to submit the report as a recommendation to the FAA, two members voted against submitting the report, and one member abstained.

cabin pressure and the Depressurization Severity Indicator (DSI), which is a measure of the partial pressure of oxygen, as was proposed by the Mechanical Systems Harmonization Working Group. The petitioner showed that, for the failure modes reviewed for this exemption, the resultant DSI levels were much less than the critical value specified by the MSHWG. The analysis considers certain design and operational features of the Model 787-10 airplane that would mitigate the effects of an increase in cabin pressure altitude. These design features include redundancy of key systems, such as electrical power, passenger oxygen, cabin pressure control, and spoiler actuation.

The Model 787-10 airplane is designed to fly at cruise altitudes that will maximize fuel efficiency. The reduction in maximum cruise altitude resulting from compliance with §§ 25.841(a)(2) and 25.841(a)(3) for uncontained engine failure is a concern shared by other manufacturers of airplanes with wing-mounted engines seeking new or amended type certification. No transport-category airplane with wing-mounted engines certificated today for operation above 39,000 feet can meet the new cabin altitude limits within the current §§ 25.841(a)(2) and 25.841(a)(3) without an exemption.

The Boeing Company mitigates risk to high cabin-altitude exposure by reasonable design requirements, proven design methodologies, and operational considerations regardless of the cause of the decompression event. It is intended that the proposed exemption addresses the intended concern for safety without imposing the operational economic penalties driven by §§25.841(a)(2) and 25.841(a)(3) as currently written.

Safety enhancement initiatives with respect to critical rotating parts (inspecting for cracks in disks and using continually updated maintenance data to refine disk-inspection criteria), as well as improvement in engine technology, lessons learned, and second- or third-generation engine-design practices, have resulted in a reduction in uncontained engine-failure events. The uncontained engine-failure rates of second- or third-generation engines compared to first-generation engines, have improved by approximately 95 percent based on historical Boeing data on uncontained engine failures.

Restricting airplane operations to lower altitudes will increase traffic congestion. Limiting operation of new generation airplanes to lower altitudes will result in higher traffic density, which, in turn, will result in higher cost of safety to maintain established air-traffic vertical and horizontal separation requirements.

The Model 787-10 airplane will meet the latest amendments in effect at the time of application, except as noted within the Model 787-10 airplane certification basis. The net result is that the Model 787-10 airplane incorporates all the safety advancements as intended within these later amendments. Boeing states that any significant impact to the marketability of the Model 787-10 airplane will, at a minimum, result in a reduced number of airplanes with this higher level of safety as compared with the previous generation of airplanes, or at a maximum, prevent the manufacture of this new generation of airplanes. In either case, Amendment 25-87, according to Boeing, results in a reduced potential for overall aviation safety improvements.

Boeing's petition reiterates that this request for exemption from §§ 25.841(a)(2) and 25.841(a)(3) is limited to only uncontained engine failures. For other sources of rapid depressurization, including system failures and specific structural failures, §§ 25.841(a)(2) and 25.841(a)(3) will be complied with as amended by Amendment 25-

87. All mechanical or functional interfaces that could potentially violate the physiological limits imposed by § 25.841(a) are considered. Robust structural and systems design, and the ability for the airplane to rapidly descend, are key to assuring the safety of airplane occupants and are an inherent part of the Model 787-10 airplane design. The Boeing Company states that its design practices refine the requirements into sub-requirements for systems, structures, aerodynamics, and performance to assure airplane-level compliance.

Other threat minimization philosophies employed in the Model 787-10 airplane design include an automatic pressure demand mask (FAA-approved for 45,000 feet) for the pilots, which will be certified to § 25.1441(d); and separation and redundancy of key systems such as electrical power, passenger oxygen, cabin-pressure control, and spoiler actuation.

The petitioner's statement of public interest:

With respect to uncontained engine-failure events, the impact of § 25.841(a), Amendment 25-87, to the aviation industry and the flying public is significant. The "impact" of compliance takes three forms: (1) increase in air traffic congestion, (2) reduced potential for overall safety improvements, and (3) environmental.

1. Restricting airplane operations to lower altitudes will increase traffic congestion. Boeing cited three studies showing that the numbers of transport-category airplane operations above 37,000 feet are significant today and the trend is for newer airplanes to cruise at these altitudes for even longer portions of their mission. Limiting operation of new-generation airplanes to lower altitudes will result in higher traffic density, which, in turn, will result in higher cost of safety to maintain established air-traffic vertical and horizontal separation requirements.

2. Since the release of Amendment 25-87, a number of amendments to 14 CFR part 25 have been released. Each of these amendments has the intent of an increase in aviation safety. The Model 787-10 airplane will meet the latest amendments in effect at the time of application, except as noted in the 787-10 certification basis. The net result is that the Model 787-10 airplane incorporates the safety advancements as intended within these later amendments. Any significant impact to the marketability of the Model 787-10 airplane will, at a minimum, result in a reduced number of airplane with this higher level of safety as compared with the previous generation of airplane, or at a maximum, preclude the manufacture of this new generation of airplane. In either case, Amendment 25-87 results in a reduced potential for overall aviation safety improvements.

3. The restriction to maximum cruise altitude imposed upon the Model 787-10 airplane due to compliance with §§ 25.841(a)(2) and 25.841(a)(3), Amendment 25-87, as relates to uncontained engine failure, has a significant adverse impact on Model 787-10 airplane fuel burn. This additional fuel burn will increase engine emissions, such as CO_2.

Federal Register publication

The FAA has determined that good cause exists for waiving the requirement for *Federal Register* publication for public comment because the request is identical in all material respects to previously granted exemptions; the exemption, if granted, would not set a precedent; and any delay in acting on this petition would be detrimental to Boeing.

The FAA's analysis

The Boeing Company provided the following information to support its application for exemption from §§ 25.841(a)(2)(i) and (ii) and 25.841(a)(3):

- a background of the current rule and recent activities to harmonize it;
- a review of the safety history of high-altitude commercial flight;
- a discussion of hypoxia physiology data upon which recent rulemaking activities are based;
- a discussion of the impact of compliance with uncontained engine-rotor-burst aspects of the existing rule;
- environmental and air traffic considerations; and,
- statements addressing public interest and no adverse impact to safety.

Boeing provided company proprietary data on the estimated cabin pressure altitude and airplane flight-altitude-time history plots that followed decompressions per emergency descent procedures, and a description of the Boeing methodology of evaluating the threat from an uncontained engine-rotor burst.

1. **Need for exemption**

Boeing requests relief from § 25.841(a)(2)(i), which specifies that cabin pressure altitude may not exceed 25,000 feet for more than two minutes after decompression from any failure condition not shown to be extremely improbable. A grant of exemption from this regulation would allow the Model 787-10 airplane, to take longer than two minutes to descend from 41,100 feet to 25,000 feet after such decompression.

Boeing also requests relief from § 25.841(a)(2)(ii), which specifies that cabin pressure altitude may not exceed 40,000 feet for any duration after decompression from any failure condition not shown to be extremely improbable. A grant of exemption from this regulation would allow the Model 787-10 cabin pressure altitude to exceed 40,000 feet after such decompression.

Boeing has stated that the 787-10 design will meet the requirements of § 25.841(a)(2)(i) and (ii) for all system and structural failures, but not for all types of engine failures. For some uncontained engine-rotor failures that result in pressure-vessel penetration by fragments, the design of the Model 787-10 airplane does not meet the requirements of § 25.841(a)(2)(i) and (ii). A grant of exemption from this regulation would allow the Model 787-10 airplane to operate up to 41,100 feet, which could briefly expose cabin occupants to this altitude in the event of a worst-case decompression: a rotor burst creating a large hole in the fuselage.

Finally, Boeing requests relief from § 25.841(a)(3), which requires that an airplane manufacturer consider fuselage structure, engine, and system failures when evaluating the cabin pressure altitude following a decompression due to one of these failure events. As noted in the preamble to this regulation:

> Possible modes of failure to be evaluated include malfunctions and damage from external sources such as tire burst, wheel failure, uncontained engine failure, engine fan, compressor or turbine multi blade failure, and loss of antennas…

The FAA's analysis shows that Boeing did consider these failures in its analysis. Therefore, the petitioner complies with § 25.841(a)(3), eliminating the need for an exemption from it.

2. Analysis under FAA policy

The FAA reviewed this petition, in the context of the MSHWG Final Report on § 25.841(a)(2) and FAA policy memorandum ANM-03-112-16, dated March 24, 2006, on Amendment 25-87 requirements. The policy applies only to decompression events that are due to uncontained engine-rotor failure. The basis of the policy is data from research on the response of humans and other primates to changes in ambient pressure. Evaluation of this data indicates a direct correlation between the alveolar partial pressure of oxygen time integral and the likelihood of fatalities or permanent physiological damage to those exposed to such pressure changes. That is, as the value of the integral increases, the likelihood of fatalities or permanent physiological damage also increases. The FAA policy contains a table of altitudes and cumulative exposure times in lieu of the pressure-time integral. The values of altitude and time in the table, and the results of the pressure-time integral method, are in agreement.

Accordingly, our policy focuses on minimizing the likelihood that, if a person is exposed to high-altitude cabin pressure from any failure not shown to be extremely improbable, they will suffer permanent physiological damage. To analyze petitions for exemption from § 25.841(a)(2), the FAA requires information about emergency descent rates, any design features that increase such rates, other design features that offset the inherent increased risk of exposure to high-altitude cabin pressure, and operational procedures.

As stated above and in the policy, the FAA acknowledges a lack of relevant data on the effects of exposure to high-altitude cabin pressure following decompression and, particularly, those effects on people of various ages, people with circulatory or respiratory diseases, or certain other medical conditions.

Our review of the Boeing petition indicates that Boeing used the criteria recommended in the FAA's policy. Boeing's design incorporated these limits to ensure airplane descent performance. This methodology is conservative because it assumes a lower partial pressure of oxygen than would likely be present during decompression at 41,100 feet.

Boeing provided descent profiles for the Model 787-10 airplane, based on conservative estimates of descent performance for failure scenarios, as described in the FAA's policy; descent profiles indicate that the Model 787-10 airplane can descend rapidly from 41,100 feet to below 25,000 feet.

Boeing also performed a depressurization analysis on both types of engines used on the Model 787-10 airplane, Rolls-Royce Trent and General Electric GEnx engines, which were based upon maximum cruise flight conditions. It defined the envelope of vulnerability of passengers following failures that result in a decompression. In addition, Boeing identified design and operational features of the Model 787-10 airplane that would mitigate the effects of an increase in cabin pressure altitude.

The decompression analysis used several measures recommended in the MSHWG Final Report. Specifically, Boeing estimated the severity of exposure to high-altitude cabin pressure for occupants, based on calculation of a DEI. The analysis also considered the relationship between cabin pressure and the DSI, a measure of the partial pressure of oxygen. The analysis indicates that the physiological effect of a slight increase in the length of time spent above 25,000 feet is within the uncertainty band of available physiological data. The Boeing analysis also shows that, for the failure modes reviewed for this exemption, resultant DSI levels were much less than the critical value recommended by the MSHWG.

The FAA reviewed information Boeing provided about design features and operational procedures that would mitigate the threat of a high-altitude rapid decompression as it relates to maintaining the descent capability of the Model 787-10 airplane and to ensure occupant survival. We concluded that the design features and operational procedures associated with rapid decompression, followed by an emergency descent, support a finding that granting the exemption would not adversely affect safety.

3. Review of historical data and research

The FAA reviewed databases from its National Aviation Safety Data Analysis Center, covering 1959 to 2012. Approximately 3,000 instances of loss of cabin pressure have occurred since 1959. System failures, such as cabin-pressurization-controller failures and valve failures; and structural failures, such as door-seal failures, have caused the vast majority of these events, which typically have been recognized at low altitude within a few minutes after takeoff. Pilot error has also contributed to the number of events. The majority of these events have not subjected the occupants to exposures above 25,000 feet (an altitude considered physiologically significant). The cabin pressure altitude in most events did not exceed 15,000 feet (the cabin pressure altitude at which passenger oxygen masks are deployed).

Similarly, uncontained engine-rotor-burst failures tend to be very rare. A simple calculation shows that grouping all engines and transport airplanes together yields an average probability of an uncontained engine failure at cruise of approximately 1×10^{-7} per engine hour. New engine designs appear to reduce this probability by an order of magnitude. We found, as noted in the MSHWG report on § 25.841(a), that no fatalities from hypoxia were due to in-flight rapid decompression events as envisioned by Amendment 25-87. The data indicate that decompression is not a significant cause of fatalities. It is because these events are so rare that the FAA considers the risk to be acceptable.

In addition, Boeing provided the FAA with proprietary data from its analysis of uncontained engine-rotor failures, and the size and number of holes in the fuselage resulting from such failures. Using historical service data and theoretical values, Boeing performed decompression analysis for several scenarios. Boeing analyzed the probability of uncontained engine-rotor failure and of penetration of the fuselage of the Model 787-10 airplane from fragments of various sizes, from both engines, resulting from such failures. This analysis was used to assess the threat of such an event to occupants of the airplane. The FAA did not agree with Boeing's exclusion of data in their analysis that concerned large holes in the fuselage causing decompression. However, Boeing's analysis was conducted in a manner consistent with the recommendations within the MSHWG report, and their data showed that even for the largest survivable hole, the Model 787-10 airplane would be able to meet the FAA's policy criteria.

The FAA concurs with the petitioner that uncontained engine-rotor failures are rare events. Furthermore, our analysis in this case is similar to our analysis of an earlier petition for exemption, from a different applicant, for an airplane with an intended cruise altitude of 41,000 feet. The petition submitted by this previous applicant included estimates of the probability of occurrence of an uncontained engine-rotor failure. In that case, the altitude excursion above 40,000 feet was less than 1,000 feet. We concluded that the risk associated with exposure of the occupants to the slightly higher altitude was essentially the same as the risk of exposure at 40,000 feet. In other words, the risk from exposure at altitude was essentially the same with or without the grant of the exemption. Therefore, the rarity of uncontained engine-rotor failures did not significantly enter into consideration regarding the previous grant of exemption.

4. Use of supplemental oxygen

As discussed below, the FAA has analyzed the Boeing petition in the context of the MSHWG recommendations, the part 25 requirements pertaining to supplemental oxygen, and certain technical standards for supplemental-oxygen equipment. Section 25.1441(d) requires approval of oxygen equipment for airplanes that are approved to operate above 40,000 feet altitude. Section 25.1443 specifies the minimum mass flow of supplemental oxygen for flightcrew and passenger oxygen systems up to a cabin altitude of 40,000 feet. Part 25 does not contain standards for oxygen systems above 40,000 feet. However, FAA Technical Standard Orders (TSOs) provide requirements for flightcrew diluter demand pressure breathing regulators (TSO-C89a) and flightcrew demand oxygen masks (TSO-C78a) up to 45,000 feet. In addition, the Society of Automotive Engineers (SAE) Standard AS 8027 provides specifications for diluter demand pressure breathing regulators used by the flightcrew up to 45,000 feet.

As part of the certification for the Model 787-10 airplane, Boeing must substantiate the adequacy of the flightcrew supplemental-oxygen system for operation above 40,000 feet.

Flightcrew pressure-breathing equipment is generally used to provide hypoxia protection at high cabin pressure altitudes and requires training to ensure effective use. Pressure breathing requires physical effort to exhale and minimal effort to inhale. This reversal of the normal breathing cycle can lead to hyperventilation. The FAA considers the training of passengers to use pressure breathing equipment safely to be impractical. The FAA determined that an acceptable means of compliance for the fixed and portable oxygen systems used by flight attendants and passengers would be to install oxygen equipment that is certificated to 40,000 feet and limit exposure to the reduced pressure environment above 40,000 feet via airplane-descent performance. The FAA believes that, ultimately, occupant survival during a decompression event depends upon swift descent to a lower altitude. In its review of the petitioner’s airplane-descent profile, the FAA finds that the Model 787-10 airplane can descend at acceptable rates.

5. Conclusion of FAA analysis

Permitting airplanes to fly above 40,000 feet offers real and tangible benefits to the aerospace industry, the traveling public, and the U.S. economy by reducing congestion, improving fuel economy, and reducing pollution. If compliance with § 25.841 at Amendment 25-87 were to limit airplane operations to a maximum altitude of 40,000 feet, it would impose a significant disadvantage on newly designed airplanes that have many safety advantages over older airplanes currently allowed to operate at higher altitudes. This would delay the introduction of these airplanes and the safety benefits of their more-advanced technology.

Based upon evaluation of the data and analysis Boeing provided, the FAA has determined that granting this exemption would not adversely affect safety, is in the public interest, and therefore that there is sufficient justification for a partial grant of exemption from § 25.841(a)(2)(i) and (ii).

This partial grant of exemption does not provide relief from 14 CFR 25.841(a) for any other system and structural failure events not shown to be extremely improbable. The petitioner must demonstrate compliance for those failure events, and this partial grant is predicated on the condition that the petitioner successfully demonstrates compliance for the Boeing Model 787-10 airplane. As noted in the MSHWG report on § 25.841(a), a tire burst in flight is not extremely improbable, as demonstrated by historic data. The ground loads for tires are not applicable in flight and for this condition tires are extremely robust. According to the preamble of § 25.729(f)(1) and historic data, tire bursts occur in flight. It is very difficult to demonstrate that tires cannot be burst in case of overheat. It cannot be demonstrated that tires do not burst in high-altitude flight. Therefore, the tire-burst event must be considered in the depressurization analysis.

In addition, pressure-vessel openings resulting from loss of antennas or stall warning vanes, or any system failure conditions that are not shown to be extremely improbable, must be considered. The effects of such damage, while operating under maximum normal cabin pressure differential, must be evaluated. Also, structural cracks must be addressed as per the existing Amendment 25-87 preamble, i.e.,

> The maximum pressure-vessel opening resulting from an initially detectable crack propagating for a period encompassing four normal inspection intervals. Mid panel cracks and cracks through skin stringer and skin frame combinations must be evaluated.

In addition, this partial grant of exemption is predicated on the requirement that the Boeing Model 787-10 airplane successfully demonstrates compliance to §§ 25.1441, 25.1443, 25.1445, 25.1447 and 25.1449.

This partial grant of exemption takes into account operating rules in 14 CFR parts 91, 121, and 135 which require (a) that one pilot wear and use an oxygen mask when operating above 41,000 feet altitude and (b) that an adequate quantity of oxygen is provided for crew operations.

This partial grant of exemption is also premised on the conditions that:

1. The certification flight test conducted, to provide data that corroborate the descent profiles used in the applicant's analysis, and to show that, after decompression at an airplane indicated operating pressure altitude of 41,100 feet, the cabin pressure altitude will not exceed 25,000 feet for more than 3 minutes or 40,000 feet for more than 1 minute, should be conducted with the engine-power setting of the failed engine set at idle. Due to the uncertainty of the state of an engine following an uncontained engine failure, it is not possible to accurately simulate the resulting aerodynamic engine-nacelle drag as would occur in flight. Rather than require multiple flight tests or analyses to address this issue, the FAA has determined that setting the failed engine to idle thrust provides an acceptable configuration.

2. If dispatch is deemed appropriate with a malfunctioning system that is required to ensure that the airplane is capable of performing an emergency descent (i.e., spoilers fully deployed, if appropriate; maximum descent rate; maximum operating limit V_{MO}/M_{MO} speed), the Master

Minimum Equipment List (MMEL) must limit dispatch to a maximum flight altitude of 40,000 feet, unless other regulations or limitations require a lower altitude.

Though V_{MO}/M_{MO} is normally the best speed for a rapid decompression descent, the pilots should follow the recommended emergency descent procedures in the Airplane Flight Manual (AFM). Rather than place an MMEL dispatch limitation as an explicit condition of granting the exemption, the FAA has determined that it is appropriate for the FAA Flight Operations Evaluation Board to evaluate the matter of dispatch with a malfunctioning system that is required to ensure that the airplane is capable of performing an emergency descent.

3. The applicable rapid decompression procedures for the flightcrew must be included in the emergency procedures section of the AFM. This information should also be included in the Boeing Flight Crew Operating Manual. Note that initial and recurrent emergency training for all crewmembers, in accordance with §§ 121.397, 121.417, and 121.427, must include training for a rapid decompression and donning of oxygen masks.

Regarding the provisions of § 25.841(a)(3), the petitioner included in its analysis consideration of engine failures. In addition, as part of the normal certification process, the petitioner will consider fuselage structure and system failures. Therefore, relief from this requirement is not necessary.

The partial grant of exemption from § 25.841(a)(2)(ii) permits cabin pressure altitude to exceed 40,000 feet for one minute (but not to exceed 41,100 feet for any duration) after decompression from any uncontained engine failure condition not shown to be extremely improbable. The partial grant of exemption from § 25.841(a)(2)(i) permits cabin pressure altitude to exceed 25,000 feet for more than 2 minutes (but not more than three minutes) after decompression from any uncontained engine-failure condition not shown to be extremely improbable, allowing time for the airplane to descend from an altitude of 41,100 feet to 25,000 feet.

The FAA’s decision

In consideration of the foregoing, I find that a partial grant of exemption is in the public interest regarding 14 CFR 25.841(a)(2)(i) and 25.841(a)(2)(ii), as amended by Amendment 25-87. Therefore, pursuant to the authority contained in 49 U.S.C. 40113 and 44701, delegated to me by the Administrator, the petition of Boeing for an exemption from the requirements of §§ 25.841(a)(2)(i), and 25.841(a)(2)(ii), as amended by Amendment 25-87, is granted for Boeing Model 787-10 airplanes.

This partial grant of exemption is subject to the following conditions:

1. The Airplane Flight Manual for the Boeing Model 787-10 airplane must indicate that the maximum indicated operating pressure altitude is 41,100 feet.

2. The Airplane Flight Manual must contain applicable flightdeck crew procedures for a rapid decompression event. The section of the Airplane Flight Manual for the Boeing Model 787-10 airplane, which pertains to actions in the event of a decompression, must state that the flightdeck crew should initiate a descent at the maximum rate of descent and safe descent speed, which is typically the maximum operating speed (V_{MO}/M_{MO}), assuming structural integrity of the airplane.

3. The petitioner must submit certification flight-test data for the Boeing Model 787-10 that corroborate the descent profiles used in the analysis, to show that after decompression at an airplane indicated operating pressure altitude of 41,100 feet, the cabin pressure altitude will not exceed 25,000 feet for more than 3 minutes or 40,000 feet for more than 1 minute.

Issued in Renton, Washington, on February 12, 2016.

/s/

Michael Kaszycki
Acting Manager, Transport Airplane Directorate
Aircraft Certification Service