Exemption No. 10944

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

In the matter of the petition of **Bombardier Aerospace Company** for an exemption from § 25.841(a)(2) of Title 14, Code of Federal Regulations	**Regulatory Docket No. FAA-2012-1146**

PARTIAL GRANT OF EXEMPTION

By letter no. AW-BD5/12/760 received November 9, 2012, Mr. Keith Barnett, CSeries Airworthiness Manager, Bombardier Aerospace Company, 400 Cote-Vertu Road West, Dorval, Quebec, Canada H4S 1Y9, petitioned to exempt the CSeries Model BD-500-1A10 (CS100) and BD-500-1A11 (CS300) airplanes from the requirements of § 25.841(a)(2), at Amendment 25-87, of Title 14, Code of Federal Regulations (14 CFR). An exemption would relieve these airplanes from the requirement that, during a decompression caused by a failure of one of the engines, airplane cabin pressure altitude not exceed 25,000 feet for more than two minutes, or exceed 40,000 feet for any duration. In addition, the FAA received, on August 12, 2013, supplemental material proprietary to Bombardier Aerospace Company that addressed specific questions pertaining to their petition. This information was used in the FAA's analysis for this exemption.

The petitioner requests relief from the following regulation:

> **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:
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> (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.

The petitioner supports their request with the following information:

This section summarizes and quotes, with minor edits for clarity, the relevant information from the petitioner's request. Their 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-2012-1146.

The Bombardier Aerospace Company (BA) Model CS100 and CS300 airplanes are designed to operate at a maximum cruise altitude of 41,000 feet pressure altitude. Should an uncontained

engine-rotor burst (UEF) event occur, it is possible that the cabin pressure could exceed the limits contained in current regulations. BA 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] in which Bombardier participated. Per BA's petition:

> The CSeries design will meet the requirements of 14 CFR § 25.841(a)(2)(i) and (ii) for all system and structural failures but not for all types of engine failures: for some UEFs that result in pressure vessel penetration by fragments causing a very large hole, the design of the CSeries does not meet the requirements of 14 CFR § 25.841(a)(2)(i) and (ii). Therefore, BA requests the exemption be granted for altitudes up to the CSeries maximum cruise altitude of 41,000 ft. A grant of exemption from this regulation would allow the CSeries to operate up to 41,000 ft, which could briefly expose cabin occupants to this altitude in the event of a worst-case decompression.
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> …the CSeries complies with the latest Canadian, US, and European requirements and therefore offers a significantly higher basic level of safety than previously certified transport category aircraft. Furthermore UEFs are rare events, and UEFs causing rapid depressurization are even rarer. BA believes, based on fleet service experience, that UEFs are rare events.

BA points out that modern transport-category airplanes have a 45-year safety record with millions of flight hours, and more than 30 years at altitudes similar to the maximum cruise altitude proposed for the CSeries. In addition, BA states that the European Aviation Safety Administration has not implemented similar restrictions.

BA states that other airplane manufacturers have had similar difficulties meeting this certification requirement and that no airplane designs, which incorporate a wing-mounted engine configuration, have been certified to fully comply with this certification requirement (e.g., Airbus A380, Boeing 787-8, and Embraer ERJ-170). These manufacturers have elected to request an exemption when § 25.841(a), at Amendment 25-87, has been in the certification basis.

BA notes that very few, if any, rapid depressurization events have exposed an airplane cabin to pressure altitude profiles that pose a risk of injury to occupants. 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. BA observes that the FAA has cited a few cases of UEFs in cruise. 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. However, the UEF in that case was believed to have been induced by crew action. BA's petition further states:

> Aerospace hypoxia physiology data shows no difference between 40,000 feet or 41,000 feet: Several research papers have been circulated in the aerospace medical community generating controversy regarding the absolute physiological limits to occupants following cabin depressurization. However, the consensus is that the physiological limits are not significantly affected if cabin depressurization occurs at 40,000 feet or 41,000 feet.

[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.

BA adds that the Model CS100 and CS300 airplanes are designed to fly at cruise altitudes that will maximize fuel efficiency. A reduction in maximum cruise altitude resulting from compliance with § 25.841(a)(2) for UEF 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-pressure-altitude limits, within the current requirements of § 25.841(a)(2), without an exemption.

In addition, BA states that specific features have been incorporated into the CSeries airplane design to mitigate the safety risk to occupants due to a decompression resulting from an UEF. According to BA, the CSeries uses state-of-the-art, 3rd-generation, Pratt & Whitney PurePower® PW1500G series Geared Turbofan™ (GTF) engines that incorporate improvements in engine technology (e.g. enhanced vibration/trend monitoring) and state-of-the-art, 3rd-generation engine-design practices that apply lessons learned with respect to UEFs, all of which can be expect to further increase the reliability and decrease the risk of UEFs for the CSeries airplanes.

BA adds that restricting airplane operations to lower altitudes, to meet § 25.841(a)(2) requirements, will increase traffic congestion. Limiting operation of new-generation airplanes to lower altitudes will result in higher traffic density that, in turn, will result in higher cost of safety to maintain established air-traffic vertical and horizontal separation requirements.

BA confirms that the Model CS100 and CS300 airplanes will meet the latest amendments in effect at the time of application, except as noted within their certification basis. The net result is that the Model CS100 and CS300 airplanes incorporate all the safety advancements, as intended, within these later amendments. Any significant impact to the marketability of the Model CS100 and CS300 airplanes 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, preclude the manufacture of this new generation of airplanes. In either case, Amendment 25-87 results in a reduced potential for overall aviation safety improvements. BA's petition continues:

> Furthermore, the CSeries design ensures separation and redundancy of key systems that are required for the emergency descent, such as electrical power, flight crew and passenger oxygen, cabin pressure control, and spoiler actuation... Other threat minimization philosophies employed on the CSeries include an automatic pressure demand mask (FAA approved for 41,000 ft) for the pilots which will be certified to comply with 14CFR § 25.1441(d); The CSeries will have an Emergency Descent Mode (EDM) which will provide an additional margin of safety by initiating a descent automatically if there is no flight crew action following a loss of cabin pressure or when the flight crew pushes the EDM button. This feature will be shown to comply with all applicable certification requirements, however the CSeries will fully comply with the latest airworthiness standards including AWM 525.841(a)(2) and (3) for rapid depressurization without taking certification credit for this feature.
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> **Statement of public interest**
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> Permitting the CSeries to fly above 40,000 ft does offer real and tangible benefits to the aerospace industry, the traveling public, and the economy, and is therefore in the public interest:

a) Three separate studies have shown that the number of operations above 37,000 ft 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 in order to maintain established air traffic vertical and horizontal separation requirements, which is not in the public interest. Conversely, the cost of maintaining the level of safety within the existing air traffic management system will not be adversely impacted by continuing to allow operation in the less congested altitudes, typically well above 37,000 ft.

b) The CSeries uses state-of-the-art 3rd generation Pratt & Whitney PurePower® PW1500G series Geared Turbofan™ (GTF) engines which have been designed to offer double-digit improvements in fuel burn at higher altitudes, and associated lower operating costs. In fact, initial fuel burn improvements–gate-to-gate–have been estimated at 16% versus today's best 2nd generation turbofan engines. With the benefits of a new, advanced airplane such as the CSeries, the fuel burn benefit can be even greater–over 20% versus today's best aircraft. That can be a significant savings to airlines and airline passengers. Therefore, granting this exemption is clearly in the interest of the public since it allows the CSeries to operate on routes and generate significantly lower emissions and noise than other aircraft types that are currently operating on those same routes.

   Furthermore, limiting CSeries operations to lower than 40,000 ft will result in significantly increased fuel burn since operations at lower altitudes in certain environmental conditions are not optimum for these aeroplanes and engines. Since additional fuel is required for an otherwise identical route, this ultimately increases CSeries operating costs, which is clearly not in the interest of airlines and airline passengers.

c) The CSeries uses state-of-the-art 3rd generation Pratt & Whitney PurePower PW1500G series GTF engines which have been designed to offer double-digit improvements in environmental emissions (e.g. CO_2, NOx) and noise when compared to current 2nd generation turbo-fan engines. In fact, the use of those engines on the CSeries cuts carbon emissions by over 3,000 metric tonnes — equal to planting over 700,000 trees — per aircraft per year, and slashes aircraft noise footprints by up to 75% — a big relief to communities. At up to 20 decibels below today's most stringent standard, it is the quietest engine in its class: meaning lower noise fees, shorter flight tracks, extended curfew operation, and quieter cabins: this is clearly in the interest of airlines and passengers. In addition, Pratt & Whitney's TALON X combustor slashes NOx exhaust gases 50% below CAEP/6. Since preserving a clean atmosphere, reducing greenhouse gas emissions, and lowering community noise is in everyone's best interest, granting this exemption is clearly in the interest of the public since it allows the CSeries to operate on routes and generate significantly lower emissions and noise than other aircraft types that are currently operating on those same routes.

d) A reduction in maximum cruise altitude would also adversely impact the ability of the CSeries to compete with previously certificated airplanes which can operate at the more economical cruise altitudes typically in excess of 37,000 ft. If compliance with 14CFR § 25.841(a) limited airplanes operations to a maximum altitude of 40,000 ft, this 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 benefits of their more advanced technology. Therefore, denial of this petition would deny the public some of the benefits of a new family of airplanes. The CSeries family of airplanes will incorporate new technology, lessons learned from previous and current production airplanes, and comply with the latest airworthiness standards throughout to provide a safer, more efficient transportation option for airlines and airline passengers.

e) The CSeries will provide industry-leading operating economics, and environmental improvements. Granting this petition of exemption is in the public interest because it will improve safety relative to previously certificated airplanes, while reducing noise, emissions, operational costs (fuel burn due to better engines, air traffic management service fees for airlines due to less crowded airspace), and ultimately making air transport more accessible, more efficient, and less costly for the travelling public.

Federal Register publication

A summary of the petition was published in the Federal Register on May 28, 2014 [79 FR 30684]. No comments were received.

The FAA's analysis

Bombardier Aerospace Company provided the following information to support its petition for exemption from § 25.841(a)(2)(i) and (ii):

- 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

In response to FAA inquiries, BA subsequently provided estimated cabin-pressure-altitude and airplane-flight-altitude time history plots following decompressions-per-emergency-descent procedures, and a description of the BA methodology of evaluating the threat from uncontained engine-rotor burst.

1. Need for exemption

Section 25.841(a)(2) at Amendment 25-871 requires that the cabin altitude does not exceed the limits specified in the sub-parts following various failures conditions, and § 25.841(a)(3) at Amendment 25-87 further requires additional considerations for a UEF that punctures and/or tears the fuselage creating a very large hole (bigger than the critical hole size).

The Model CS100 and CS300 airplanes are designed to cruise at a maximum altitude of 41,000 feet pressure altitude. Should a UEF occur at the maximum cruising altitude, it is possible that

the cabin pressure could exceed the limits contained in current regulations because the fuselage-hole size the engine debris creates will exceed the allowable cabin altitudes, making it non-compliant to the above-mentioned certification requirements.

The FAA recognizes that other airplane manufacturers have had similar difficulties meeting this certification requirement. No airplanes that incorporate a wing-mounted engine design have been certified to fully comply with this certification requirement, and each manufacturer of such designs has elected to request an exemption for airplanes where § 25.841(a)(2) at Amendment 25-87 has been in the basis of certification.

BA 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 CS100 and CS300 airplanes' cabin pressure altitude to exceed 40,000 feet after such decompression.

BA adds that the Model CS100 and CS300 airplanes' 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 UEFs that result in pressure-vessel penetration by fragments, the design of the Model CS100 and CS300 airplanes does not meet the requirements of § 25.841(a)(2)(i) and (ii). A grant of exemption from this regulation would allow the Model CS100 and CS300 airplanes to operate up to 41,000 feet, which could briefly expose cabin occupants to this altitude in the event of a worst-case decompression (a rotor burst that would cause a 16-in. diameter hole in the fuselage).

2. Conformance with applicable FAA policy

The FAA reviewed this petition in the context of the MSHWG Final Report on § 25.841(a)(2) and (a)(3), in which Bombardier participated, and of our Interim Policy on Amendment 25-87 Requirements. The interim policy applies only to those decompression events which are due to uncontained engine-rotor failure. The basis of the interim 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 has issued a final version of our interim policy which uses 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 interim 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 our interim 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, and people with circulatory or respiratory diseases or certain other medical conditions.

Our review of the BA petition indicates that BA used the criteria recommended in the FAA's interim policy. BA's design incorporates these limits to ensure airplane-descent performance. The FAA believes that this methodology is conservative in the sense that it assumes a lower partial pressure of oxygen than would likely be present during decompression at 41,000 feet.

BA provides descent profiles for the Model CS100 and CS300 airplanes, based on conservative estimates of descent performance for failure scenarios, as described in the FAA's interim policy. The descent profiles indicate that the Model CS100 and CS300 airplanes can descend rapidly from 41,000 feet altitude to below 25,000 feet.

BA also performed a depressurization analysis, which was based upon maximum cruise-flight conditions. It defined the envelope of vulnerability of passengers following failures that result in a decompression. In addition, BA identified design and operational features of the Model CS100 and CS300 airplanes that would mitigate the effects of an increase in cabin pressure altitude.

The decompression analysis used several measures recommended in the MSHWG Final Report. However, BA did not provide an estimated severity of exposure to high-altitude cabin pressure for occupants, based on calculation of a Depressurization Exposure Integral (DEI) as recommended in the report. We did not consider this to be a significant deviation, as the maximum cabin altitude for which relief is requested is 41,000 feet.

The FAA reviewed BA design features and operational procedures that would mitigate the threat of a high-altitude rapid decompression while maintaining the descent capability of the Model CS100 and CS300 airplanes, and/or ensure occupant survival. We conclude that the design features and operational procedures associated with rapid decompression, followed by an emergency descent, support grant of an exemption.

3. Review of historical data and research

The FAA reviewed databases from its National Aviation Safety Data Analysis Center, covering 1959 to the present. Approximately 3,000 instances, since 1959, of loss-of-cabin-pressure have shown that system failures (e.g., cabin-pressurization controller failures and valve failures) and structural failures, (e.g., door-seal failures) have caused the vast majority of these, 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). Indeed, 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 a UEF at cruise of approximately 1x10-7 per engine hour. New engine designs appear to reduce this probability by an order of magnitude. The FAA 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, BA 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, BA performed decompression analyses for several scenarios. BA analyzed the probability of uncontained engine-rotor failure, and of penetration of the fuselage of the Model CS100 and CS300 airplanes from fragments of various sizes 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 BA's exclusion of some data in their analysis that concerned large holes in the fuselage causing decompression. These larger hole sizes were greater than 203 inches^2 effective area and occurred from two historical events. However, BA'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 CS100 and CS300 airplanes would be able to meet the FAA's interim-policy criteria.

4. Holes from uncontained engine rotor failure

The FAA evaluated the BA methodology for determining hole size, in the fuselage and/or wings, caused by uncontained engine-rotor failure. We concluded that the method makes some assumptions that one could question. However, this issue is not of great significance because the FAA required BA to assume a failure that produced a very large hole in the fuselage, in turn causing a sudden decompression.

5. Use of supplemental oxygen

As discussed below, the FAA has analyzed the BA petition in the context of those 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 diluter-demand pressure-breathing regulators (TSO-89) and demand oxygen masks (TSO-78) up to 45,000 feet. In addition, the Society of Automotive Engineers (SAE) Standard AS 8027 provides specifications for diluter-demand pressure-breathing regulators up to 45,000 feet. It is the FAA's understanding that no diluter-demand pressure-breathing regulators available for commercial airplanes meet all the requirements of TSO-89 or AS 8027.

As part of the certification for the Model CS100 and CS300 airplanes, BA must substantiate the adequacy of the supplemental oxygen systems installed for the flightcrew exposed to cabin altitudes above 40,000 feet.

Flightcrew pressure-breathing equipment 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. Training of passengers to use pressure-breathing equipment safely is considered 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 CS100 and CS300 airplanes can descend at acceptable rates.

6. Conclusion of FAA analysis

Permitting airplanes to fly above 40,000 feet does offer 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 BA provided, the FAA finds 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 § 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 belief that the petitioner will successfully demonstrate that compliance for the Model CS100 and CS300 airplanes. 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 § 25.729(f)(1) and historic data, tire bursts do occur in-flight. It is very difficult to demonstrate that tires cannot burst in case of overheating. It cannot be demonstrated that tires do not burst in high-altitude flight. Therefore, the tire-burst event must be considered in the cabin-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 will 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 Model CS100 and CS300 airplanes successfully demonstrate 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 that:

- one pilot wear and use their oxygen mask when operating at and above certain altitudes, and
- an adequate quantity of oxygen is provided for crew operations.

The FAA recognizes that BA accounts for non-standard conditions, such as rapid decompression, in defining appropriate supplemental-oxygen-system maintenance and checks at appropriate intervals that they include in the Instructions for Continued Airworthiness (ICA). To facilitate each operator's incorporation of this information into their maintenance procedures, BA also helps operators understand the details of the ICAs.

BA typically accounts for non-standard conditions, such as rapid decompression and emergency descent, in developing appropriate dispatch criteria with a malfunctioning system in the Master Minimum Equipment List (MMEL). For example, if BA determines that dispatch is possible with a malfunctioning system that contributes to the airplane's ability to perform an emergency descent, BA could propose that the MMEL limit dispatch to a lower maximum flight altitude. Rather than identify 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.

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.

The applicable rapid-decompression procedures for the flightcrew must be included in the Emergency Procedures section of the AFM. This information must also be included in the BA Flightcrew 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.

The partial grant of exemption from § 25.841(a)(2)(ii) will permit cabin pressure altitude to exceed 40,000 feet for one minute (but not to exceed 41,000 feet for any duration) after decompression from any UEF condition not shown to be extremely improbable. The partial grant of exemption from § 25.841(a)(2)(i) will permit cabin pressure altitude to exceed 25,000 feet for more than 2 minutes (but not more than three minutes) after decompression from any UEF condition not shown to be extremely improbable, allowing time for the airplane to descend from an altitude of 41,000 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 §§ 25.841(a)(2)(i) and (ii) at Amendment 25-87. Therefore, pursuant to the authority contained in 49 U.S.C. 40113 and 44701, delegated to me by the Administrator, partial exemption from the requirements of §§ 25.841(a)(2)(i) and (ii), at Amendment 25-87, is granted for The Bombardier Aerospace Company CSeries Model BD-500-1A10 (CS100) and BD-500-1A11 (CS300) airplanes.

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

1. The AFM for the Model CS100 and CS300 airplanes must indicate that the maximum indicated operating pressure altitude is 41,000 feet.

2. The AFM must contain applicable flightdeck crew procedures for a rapid-decompression event. The section of the AFM, for the Model CS100 and CS300 airplanes, that 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 typically is 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 CSeries Model CS100 and CS300 airplanes simulating the loss of one engine (i.e., from an uncontained engine-rotor burst), and subsequent loss of systems associated with the loss of one engine, that corroborate the descent profiles used in the analysis to show that, after decompression at an airplane indicated operating pressure altitude of 41,000 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 2, 2015.

/s/ Jeffrey E. Duven

Jeffrey E. Duven
Manager, Transport Airplane Directorate
Aircraft Certification Service