Exemption No. 8695

UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
RENTON, WASHINGTON 98055-4056

In the matter of the petition of Airbus SAS Section 25.841(a)(2)(i) and (ii), and (3), Amendment 25-87 of Title 14, Code of Federal Regulations	**Regulatory Docket No. FAA-2005-20139**

PARTIAL GRANT OF EXEMPTION

By letter dated December 7, 2004 (L21DO4027150), Mr. Wolfgang Engler, Vice President, Airbus SAS, 1 Rond Point Maurice Bellonte 3 1707 Blagnac Cedex, France, petitioned to exempt the Model A380-800 series airplanes from the requirements of 14 CFR 25.841(a)(2)(i), (a)(2)(ii), 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 failures of the fuselage structure, the engines, or other systems—airplane cabin pressure altitude not exceed 25,000 feet for more than 2 minutes or exceed 40,000 feet for any duration.

Sections of the Federal Aviation Regulations (FAR) affected:

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

(ii) Forty thousand (40,000) feet for any duration."

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's supporting information:

The Petition for Exemption submitted by Airbus contains information required by 14 CFR 11.81, technical information which supports the petition, a public interest statement, and a list of references. A copy of the petition is available at **http://dms.dot.gov** (Select Simple Search, then enter Docket Number 20139).

The Airbus A380 is designed to cruise at a maximum altitude of 43,000 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. Airbus 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]

Airbus states that Amendment 25-87 implements restrictions on the maximum allowable cabin altitude that could result from certain failures, including system, structural, and engine failures, unless those failures could be shown to be extremely improbable. It is not possible for the current state-of-the-art to ensure that certain engine failures (especially engine rotorbursts) are extremely improbable. Amendment 25-87 effectively prevents airplanes with wing-mounted engines from operating above 40,000 feet, because an engine rotorburst could potentially strike the pressurized fuselage at that altitude. Airbus observes that neither the Joint Airworthiness Authorities nor the European Aviation Safety Administration has implemented similar restrictions.

Airbus notes that very few, if any, decompression incidents have exposed an airplane cabin to pressure altitude profiles which pose a risk of injury to passengers. 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. The petitioner observes that the FAA has cited few cases of rotor burst 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.

Airbus supplied data for the A380, using estimated values of airplane rate of descent for several failure scenarios, as required in published FAA policy on this subject. In addition, Airbus provided information on the likelihood of various failure events. In its decompression analysis, Airbus included a measure of the severity of exposure for occupants, based on a Depressurization Exposure Integral (DEI) from the MSHWG report. The petitioner used the relationship between cabin pressure and the Depressurization Severity Indicator (DSI), which is a measure of the partial pressure of oxygen, as was proposed by the MSHWG. The petitioner showed that for all the failures modes reviewed for this exemption, the resultant DSI levels were much less than the critical value specified by the MSHWG. The analysis considers certain

[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.

design and operational features of the A380-800 which would mitigate the effects of an increase in cabin pressure altitude. One of these design features is the cabin pressurization control system (CPCS) which was designed to minimize system failures that would lead to loss of cabin pressurization events.

The petitioner's Statement of Public Interest:

> "The A380 aircraft fully complies with the requirements of 14 CFR 25.841, (a)(2)(i) and (ii) and (3) for all system and structural failure events. An exemption is requested for cabin depressurization that can occur from uncontained engine rotor failures that result in large holes in the fuselage (i.e., those holes with a geometric area exceeding 0.225 m^2). Airbus believes, based on fleet service experience, that these are rare events …The new aircraft complies with the latest FAA requirements and, therefore, offers a significantly higher basic level of safety than previously certified transport category aircraft.
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> "Approval for operation at FL 430 would enable the air traffic system to provide more capacity, and hence more aircraft separation and safety, without adversely affecting the safety of the passengers.
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> "Approval for flight at FL 430 would enable the A380 to compete fairly with other existing aircraft that are not subject to the same requirements, without causing any adverse effects to the passengers.
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> "Approval for operation at FL 430 would also serve the public interest via the use of the newest generation of engines available today, and permit them to operate where they offer lower emissions, and higher fuel efficiency.
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> "Approval for flight at FL 430 provides for more economical operation of the A380, reducing the cost to the traveling public."

Notice and Opportunity for Public Comment

A Notice of Petition for Exemption was published in the Federal Register on January 13, 2005. Four comments were received.[1] Two of the commenters—the Boeing Company and a pilot for the Airbus Model A300-600F—support a grant of exemption. The pilot suggests a restriction to "require provisions of the relief within the Master Minimum Equipment List (MMEL). Operations could be limited to a maximum of FL390 if any component of the CPCS (Cabin Pressure Control System) is inoperable or deferred for a flight."

The FAA does not agree with this suggestion because the A380's CPCS is designed so that—in the event of the loss of one air generation unit (AGU)—cabin pressure altitude will remain at or below the maximum permitted by the regulations. The design capability of the A380 is such that

[1] Copies of all comments may be found in the Department of Transportation's Docket Management System at http://dms.dot.gov/ in Docket FAA-2005-20139.

the loss of one means of providing pressurized air to the cabin does not affect compliance with the normal cabin pressure limit specified in 14 CFR part 25.

Two other commenters—the Association of Flight Attendants (AFA) and the Airline Pilots Association (ALPA)—oppose a grant of exemption. Their comments address the following topics:

1. Physiological effects of decompression

One commenter, AFA, states that the Airbus petition seems to be built upon the framework of the FAA's Interim Policy on Amendment 25-87 Requirements and the MSHWG's Final Report on § 25.841(a)(2) and (a)(3). AFA participated in the MSHWG but voted against submitting its Final Report to the FAA. The commenter says that its opposition was based upon

> "the lack of consensus within the MSHWG over the question of whether to allow cabin altitude to exceed 40,000 feet following a rapid depressurization. We also objected to the use of, for design purposes, an untested, unverified pressure-integral methodology, which is apparently lacking even the most minimal validation, independent peer review of the analysis method itself."

The AFA attached a letter, dated July 3, 2003, expressing opposition to the FAA's Draft Interim Policy on Amendment 25-87 Requirements. The commenter states that the letter "fully supports key elements of our critique on the Airbus petition for exemption." The letter recommends that the Draft Interim Policy not be adopted for the following reasons:

> "the 40,000 foot cabin altitude represents a useful regulatory limit for high altitude flight in the absence of sufficient, comprehensive data on human tolerance at high altitudes; that the proposed pressure-time integral method lacks sufficient data and a rigorous peer review to validate its use as a means of compliance; and that the FAA proposal represents bad public policy since it represents means to circumvent existing regulations and may reduce or even eliminate any motivation to validate the means of compliance."

Another commenter, ALPA, also participated in the MSHWG and voted against submitting its Final Report to the FAA. ALPA says that the "FAA's aero medical experts had concerns associated with several of the findings of the working group, some of the proposed language discussed, and the amount of appropriate research available at the time."

In terms of the MSHWG Final Report which examined available research studies on the physiological effects of exposure to high cabin altitude, ALPA states that

- There was insufficient data available about the physiological effects;
- The data that was available did not represent a proper cross-section of the flying public, and thus additional research was necessary to confirm the conclusions of the MSHWG;

- The Depressurization Exposure Integral (DEI) method, proposed in the report, was "based on assumptions and extrapolations" that were not supported by research, and not all members of the MSHWG agreed with the methodology.

ALPA further points out that additional research into the physiological effects of exposure to high cabin altitude has not been conducted to date. Specifically, the commenter says that "Much, and possibly all, of the research to date using humans has been limited to young, healthy, and fit test subjects….Further testing is necessary to ascertain the resultant effects on a population more representative of the traveling public." ALPA adds that the DEI methodology has not yet been validated.

2. Holes from uncontained engine rotor failures

The AFA takes issue with the way Airbus—using data from historical instances of uncontained engine rotor failures—determined the size of the holes which such events would cause in the fuselage and/or the wings of the A380. The commenter states that "…it seems counter-intuitive to assume that equivalent hole-area scales by the fan diameter ratio rather than some other, more conservative factor, such as the square of the diameter ratio….So while there will be larger holes, one would also expect there will be more of them."

3: Use of supplemental oxygen

One commenter, AFA, states that

> "The sweeping conclusion inferred in [Section 2-2, final paragraph, p. 9 of the Airbus petition] that the combination of existing FAA regulations on oxygen equipment and A380 emergency descent rates will 'adequately' protect all passengers (not to mention crew) is clearly unsupportable. No rapid, 'worst-case' cabin depressurization can possibly result in no adverse consequences to the airplanes's occupants."

AFA goes on to say that, "…were the FAA to allow this exemption, we strongly urge the FAA to do so only after ensuring that each and every one of the following MSHWG recommendations (Reference 2, pp. 41-42) are first incorporated into the A380 design and operational plan…."

Another commenter, ALPA, indicates that

> "Before the FAA considers granting this exemption, …there must be close examination of the descent profiles and passenger systems being proposed by the petitioner to determine the extent of cabin exposure times and how the oxygen system design will aid/affect the aircraft occupants in the event of a high altitude explosive decompression."

ALPA adds, "Passenger cabin masks are not designed to provide protection against hypoxia above FL 400 (40,000 feet). These masks provide no protection against DCS [decompression sickness]. Before considering granting this exemption, [we] recommend study of the level of protection provided by current masks above FL400."

4. Various statements in Petition for Exemption

The commenters opposing a grant of the petition, i.e., AFA and ALPA, also took issue with various statements in the petition. Although the FAA reviewed and considered all of these comments, we responded explicitly only to those that were directly pertinent to our analysis. For example, AFA says that a certain conclusion stated by Airbus is based on a certain assumption. The FAA agrees that making a different assumption would lead to a different conclusion, but we do not find that the statement in the petition directly affects our analysis.

The FAA has carefully considered all the comments received and has taken them into account in our analysis of the Petition for Exemption submitted by Airbus. We acknowledge the need for additional research on the effects of exposure to high altitude cabin pressure—particularly research about its effects on people of various ages and those with circulatory, respiratory, or other diseases. We also acknowledge the need for validation of the DEI methodology recommended in the MSHWG's Final Report and in our Interim Policy on Amendment 25-87 Requirements. Even though the FAA plans to conduct additional research on this subject, we find that sufficient data, including service history, is available to support this proposed exemption for the Model A380-800. In the following section, we consider comments on the Airbus petition in greater detail.

The FAA's Analysis of the Petition

1. Need for exemption

Airbus requests relief from § 25.841(a)(2)(i) which specifies that cabin pressure altitude may not exceed 25,000 feet for more than 2 minutes after decompression from any failure condition not shown to be extremely improbable. A grant of exemption from this regulation would allow the Model A380-800 to take longer than 2 minutes to descend from 43,000 feet to 25,000 feet after such decompression.

Airbus 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 A380-800 cabin pressure altitude to exceed 40,000 feet after such decompression.

Based upon data received from Airbus, the FAA's analysis confirms that the design of the A380-800 meets 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 A380-800 does not meet the requirements of § 25.841(a)(2)(i) and (ii). A grant of exemption from this regulation would allow the Model A380-800 to operate up to 43,000 feet, which could briefly expose cabin occupants to this altitude in the event of a worst-case decompression.

Finally, Airbus 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…."

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

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) 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 that there is 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—he 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 that there is 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.

The FAA supports a research program to gather additional information on the effects of exposure to high altitude cabin pressure. We envision that such research would be conducted in conjunction with rulemaking to develop a new standard for cabin pressure altitude following decompression.

Our review of the Airbus petition indicates that Airbus used the methodology recommended in the FAA's Interim Policy. 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 43,000 feet.

Airbus provided descent profiles for the A380, based on conservative estimates of descent performance for several failure scenarios, as described in the FAA's Interim Policy. The descent profiles indicate that the A380 can descend rapidly from 43,000 feet altitude to below 25,000 feet.

Airbus also performed a depressurization analysis, based upon maximum cruise flight conditions, defined the envelope of vulnerability of passengers following failures that result in a decompression, and identified design and operational features of the A380 which would mitigate the effects of an increase in cabin pressure altitude.

The decompression analysis used several measures recommended in the Final Report of the MSHWG. Specifically, Airbus estimated the severity of exposure to high altitude cabin pressure for occupants, based on calculation of a Depressurization Exposure Integral (DEI). The analysis also considers the relationship between cabin pressure and the Depressurization Severity Indicator (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 Airbus analysis also shows that—for all of the failures modes reviewed for this exemption—resultant DSI levels were much less than the critical value recommended by the MSHWG.

The FAA reviewed information provided by Airbus about design features and operational procedures that would increase the descent capability of the A380 and/or occupant survival. We concluded 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

FAA reviewed databases from our own National Aviation Safety Data Analysis Center, covering 1959 to the present. Since 1959 there have been approximately 3,000 instances of loss-of-cabin-pressure. The vast majority of these have been caused by system failures, (e.g., cabin pressurization controller failures and valve failures) and structural failures, (e.g., door seal failures) which have typically 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 an uncontained engine failure at cruise of approximately $1x10^{-7}$ 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, Airbus 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 data, the petitioner performed decompression analysis for several scenarios. Airbus analyzed the probability of uncontained engine rotor failure and of penetration of the fuselage of the A380 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 concurs with the petitioner that uncontained engine rotor failures are rare events, and this consideration had a bearing on the granting of the exemption. Our analysis in this case is in contrast to our analysis of an earlier petition for exemption from a different applicant for an airplane with a lower cruise altitude. The petition submitted by the 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. Holes from uncontained engine rotor failure

The FAA evaluated both the Airbus approach and the method suggested by one of the commenters for determining the size of holes in the fuselage and/or wings caused by uncontained engine rotor failure. We concluded that each method makes some assumptions which one could question. However, this issue is not of great significance since the FAA required Airbus to assume a failure which produced a very large hole in the fuselage, causing a sudden decompression. Airbus evaluated this scenario and provided the results in its petition.

5. Use of supplemental oxygen

In terms of the comment that "…were the FAA to allow this exemption, we strongly urge the FAA to do so only after ensuring that each and every one of the following MSHWG recommendations (Reference 2, pp. 41-42) are first incorporated into the A380 design and operational plan…." As discussed below, the FAA has analyzed the Airbus 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 flight crew 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 validation work on the A380-800, the FAA requested that Airbus propose performance standards for fixed and portable oxygen systems for the flight crew, flight attendants, and passengers to use between 40,000 and 43,000 feet cabin altitude. We also requested that Airbus substantiate the adequacy of the proposed performance standards. Airbus provided test results and analysis which substantiate that the proposed standards for oxygen pressure breathing equipment would adequately protect the flight crew in the event of decompression to 43,000 feet.

Flight crew 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 A380-800 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 airplanes 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 benefits of their more advanced technology.

Based upon its evaluation of the data and analysis provided by Airbus, the FAA has determined that there is sufficient justification for a partial grant of exemption from § 25.841(a)(2)(i) and (ii).

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 his 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 condition that—in the Airplane Maintenance Manual—the airplane manufacturer and the airline operator include any required maintenance and checks of supplemental oxygen systems prior to each flight. In addition, this partial grant of

exemption is premised on the condition that—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)—then 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 AFM.

The applicable rapid decompression procedures for the flightcrew must be included in the emergency procedures section of the Airplane Flight Manual. This information should also be included in the Airbus 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.

The Partial Grant of Exemption

In consideration of the foregoing, I find that a partial grant of exemption is in the pubic 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 Airbus for an exemption from the requirement of 14 CFR 25.841(a)(2)(i), and 25.841(a)(2)(ii), as amended by Amendment 25-87, is granted.

Regarding the provisions of § 25.841(a)(3), the petitioner complies with the regulation, since its analysis did consider fuselage structure, engine failures, and system failures. Therefore, relief from this requirement is not necessary.

The partial grant of exemption from § 25.841(a)(2)(ii) will permit cabin pressure altitude to exceed 40,000 feet for 1 minute (but not to exceed 43,000 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) will permit cabin pressure altitude to exceed 25,000 feet for more than 2 minutes (but not more than 3 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 43,000 feet to 25,000 feet.

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

1. The Airplane Flight Manual for the A380-800 must indicate that the maximum indicated operating pressure altitude is 43,000 feet.

2. The Airplane Flight Manual must contain applicable flightdeck crew procedures for rapid decompression event. The section of the Airplane Flight Manual for the A380-800 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 Model A380-800 that corroborate the descent profiles used in the analysis to show that after decompression at an airplane indicated operating pressure altitude of 43,000 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.

4. If dispatch is deemed appropriate with a malfunctioning system that is required to ensure the airplane is capable of performing an emergency descent, then 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.

Issued in Renton, Washington, on March 24, 2006.

/s/
Ali Bahrami
Manager
Transport Airplane Directorate
Aircraft Certification Service