

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

In the matter of the petition of

Bombardier Aerospace

for an exemption from § 25.981(a)(3) of
Title 14, Code of Federal Regulations

Regulatory Docket No. FAA-2016-4198

GRANT OF TIME-LIMITED EXEMPTION

By letters dated February 18, 2016, and April 4, 2016, Mr. Glenn Baxter, C Series Airworthiness Manager, Bombardier Aerospace (Bombardier), 400 Cote-Vertu Road West, Dorval, Quebec, H4S 1Y9, Canada, petitioned the Federal Aviation Administration (FAA) for a time-limited exemption from the requirements of § 25.981(a)(3) of Title 14, Code of Federal Regulations (14 CFR). This exemption, if granted, would allow Bombardier 3 years after type validation to incorporate necessary design changes to the fuel boost pump on Model BD-500-1A10 and Model BD-500-1A11 airplanes in order to fully comply with 14 CFR 25.981(a)(3).

The petitioner requests relief from the following regulations:

Section 25.981(a)(3) – No ignition source may be present at each point in the fuel tank or fuel tank system where catastrophic failure could occur due to ignition of fuel or vapors. This must be shown by demonstrating that an ignition source could not result from each single failure, from each single failure in combination with each latent failure condition not shown to be extremely remote, and from all combinations of failures not shown to be extremely improbable. The effects of manufacturing variability, aging, wear, corrosion, and likely damage must be considered.

Section 25.901(c)* – For each powerplant and auxiliary power unit installation, it must be established that no single failure or malfunction or probable combination of failures will jeopardize the safe operation of the airplane except that the failure of structural elements need not be considered if the probability of such failure is extremely remote.

Related section of 14 CFR:

Section 25.1309 states, in pertinent part, that required equipment, systems, and installations must be designed to ensure that they perform their intended functions under any foreseeable operating condition and that the occurrence of any failure condition that would prevent the continued safe flight and landing of the airplane is extremely improbable.

The petitioner supports its request with the following information:

This section quotes the relevant information from the petitioner’s request, with minor edits for clarity. 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-2016-4198.

Description of Relief Sought

Bombardier respectfully requests a time-limited exemption to 14 CFR 25.981(a)(3) as it relates to the fuel alternating current (AC) boost pump design on the BD-500-1A10 and BD-500-1A11 (C Series CS100 and C Series CS300, respectively); in particular, where the regulation states to consider “aging, wear, corrosion, and likely damage.”

The exemption is requested for a 3-year period after FAA type validation. Due to the impracticality of quick redesign to include a ground fault interrupter (GFI) or a fast-acting arc fault protection, Bombardier believes temporary relief from § 25.981(a)(3) relative to the fuel boost pump is appropriate. The design change will be introduced into production. Furthermore, Bombardier understands precedent exists with the FAA for this relief, most recently with FAA Exemption No. 11321.

Justification

Bombardier has described the details in FAA Issue Paper P-32 where the AC boost pump design is claimed to meet dual fault tolerant methodology. Full compliance with § 25.981(a)(3) will require introduction of a GFI or a fast-acting arc fault circuit protection device. Bombardier strongly believes that the AC boost pump design as outlined in Issue Paper P-32 at Stage 3, fully demonstrates that the design is robust with

* The petitioner did not request relief from § 25.901(c) which is a general powerplant installation requirement. Compliance with § 25.981(a)(3) requires an analysis of the fuel tank system using the same analytical methods and documentation required by § 25.901(c). Prior to the promulgation of § 25.981, industry had not been consistently evaluating single failures in combination with latent failures. In order to eliminate ambiguity, § 25.981(a)(3) explicitly requires that latent failures be assumed unless they are extremely remote. For that reason, this exemption provides time-limited relief from § 25.901(c) in addition to time-limited relief from § 25.981(a)(3).

many redundant ignition protection features to prohibit any single failure, from each single failure in combination with each latent failure condition, and from all combinations of failures to not be a threat to fuel tank ignition. At this time, Bombardier is assessing and evaluating potential design solutions to incorporate a GFI or a fast-acting arc fault circuit protection device into the AC boost pump external electrical wiring of the BD-500-1A10 and BD-500-1A11 in order to fully comply to § 25.981(a)(3).

Issue of Public Interest

Since the incorporation of this additional feature is in development, this prevents Bombardier from certifying the Model BD-500-1A10 and BD-500-1A11 designs within a timely and competitive schedule, putting the product at an unfair disadvantage. This will, in due course, directly impact potential customers in the United States (US) as well as Bombardier US suppliers which are heavily involved in the development of these airplanes.

Bombardier's current design has been certified by Transport Canada during the baseline certification program for the C Series CS100 aircraft. The identified FAA concerns require significant aircraft utilization and/or aging to potentially develop into a non-compliant condition. The AC boost pump is not used continuously and therefore, the timeframe proposed for this exemption is not sufficient for the affected airplanes to accumulate the flight hours or cycles required for the components to exhibit these aging effects.

Effect of the Exemption on Safety

While issuing an exemption implies a lower standard of safety, Bombardier believes that the pump as designed is more robust and better suited to preventing ignition sources than those currently installed on thousands of aircraft that were not required to meet the requirements of § 25.981(a)(3) at Amendment 25-125. Therefore, Bombardier believes there will not be a negative impact on the current level of safety. Furthermore, the robust design of the BD-500-1A10 and BD-500-1A11 fuel boost pumps, in comparison to that of in-service aircraft not meeting the standards of § 25.981(a)(3) at Amendment 25-125, will result in an increase in safety. In addition, the time-limited nature of this exemption will ensure that the number of airplanes delivered is negligible to the overall fleet risk.

Conclusion & Request to Extend Privilege of Exemption Outside the United States

Bombardier believes that the above arguments favor a time-limited exemption from § 25.981(3)(3) regarding fuel tank ignition for the BD-500-1A10 and BD-500-1A11 airplanes. Additionally, Bombardier believes that any risk due to a fuel tank ignition is mitigated by the multiple safety features that Bombardier has incorporated (as defined in Issue Paper P-32). The AC boost pump failure condition on the subject airplanes will not exceed that of comparable existing transport category airplanes and an exemption is in the public interest. Bombardier requests that the privileges of this exemption apply outside the United States due to the transoceanic capability of the BD-500-1A10 and

BD-500-1A11 airplanes and the character of mission for many of our operators.

Federal Register publication

Although the petitioner requested that action on its petition not be delayed for publication in the *Federal Register*, the FAA found that the petition, if granted, would set a precedent. Therefore, to allow an opportunity for the public to comment on the petition, a summary of it was published in the Federal Register on April 27, 2016 (81 FR 24932). No comments were received.

The FAA's Analysis

Introduction

Bombardier has requested relief from the requirements of § 25.981(a)(3) as it pertains to the AC fuel boost pump installation of the Model BD-500-1A10 and Model BD-500-1A11 airplanes for a period of 3 years. Bombardier states that they need 3 years to design and certify a fuel boost pump installation that includes GFI in order to fully comply with the requirements of § 25.981(a)(3). Bombardier also states that they will provide service information to accommodate a retrofit of the US fleet of airplanes within the 3-year timeframe. Bombardier contends that the fuel boost pump design is robust and complies with § 25.981(a)(3) because of many redundant ignition protection features to prohibit single failures, single failures in combination with each latent failure condition, and all combinations of failures from becoming a threat to fuel tank ignition. They state that the robust design of the fuel boost pump in comparison to those in service that were not required to comply with § 25.981(a)(3) will result in an increase in safety and that the time-limited exemption will ensure that the number of airplanes delivered with the non-compliant design is negligible to the overall fleet risk.

Bombardier mentions that a precedent exists in Exemption 11321, issued to Airbus, for granting temporary relief from § 25.981(a)(3). The FAA does not agree that Exemption 11321 sets a precedent for the Bombardier fuel boost pump redesign because Exemption 11321 grants relief to a fuel boost pump design that already includes a GFI and only an estimated 5 airplanes would be delivered in a non-compliant configuration. That number of airplanes is considerably less than the number of airplanes Bombardier estimates they will deliver during the 3-year exemption period.

However, the FAA has granted time-limited exemptions specifically for certain AC fuel boost pump installations to allow applicants time to design and install GFI. Time-limited Exemption 8761C, issued to Hawker Beechcraft Corporation on September 30, 2009, grants an extension to an existing exemption to allow the applicant to design and certify a GFI and develop service information for retrofit of the existing fleet of affected airplanes.

Public Interest & Effect on Safety

The petitioner must show that the granting of this request for exemption is in the public interest per § 11.81(d). The FAA agrees with Bombardier that there would be adverse impacts on US

interests, including airplane operators and component manufacturers, as a result of delaying approval of a type certificate for the BD-500-1A10 and BD-500-1A11 airplanes for 3 years while Bombardier redesigns the fuel boost pump.

In their petition dated February 18, 2016, Bombardier proposed to design a GFI or fast-acting arc fault circuit protection. However, Bombardier later provided additional information on April 4, 2016, indicating that they will design and install a GFI to disconnect power to the fuel boost pump in the event of a ground fault present in the fuel boost pump or the pump power wire. Bombardier stated that the GFI will not contain any software or complex hardware and that inadvertent operation of the GFI would be an active failure, preventing fuel boost pump operation.

Bombardier also proposes to include an inspection of the GFI at an agreed upon interval to reduce the exposure to a latently failed GFI. Bombardier explains that inadvertent activation of the GFI would be an active failure because the pump operates every flight. However, inadvertent activation of the GFI that prevents fuel boost pump operation does not directly affect compliance with § 25.981(a)(3). The FAA is concerned that a latent failure of the GFI may result in a failure to remove power from the fuel boost pump in the event of a ground fault which may result in fuel tank ignition.

Compliance with § 25.981(a)(3) requires applicants to perform a safety analysis and account for the effects of manufacturing variability, aging, wear, corrosion, and likely damage of each component of the fuel tank or fuel tank system. That analysis often results in the need for reliable fast-acting circuit protection to prevent an undetected ground fault and resultant fuel tank ignition. Service history of fuel pumps has shown that safety features (e.g., explosion-proof cavities, robust connectors, insulated wires) are particularly susceptible to the effects of aging, wear, corrosion, and damage which has typically resulted in requiring applicants to show that the failure of the GFI is extremely remote or by limiting the latency period of a failed GFI by performing a daily check.

Bombardier states that they will deliver a limited number of airplanes within the 3-year time period of the exemption and have estimated that number to be approximately 145 to 155 airplanes; 30 of those airplanes will be operating in the US. A provision of this exemption requires Bombardier to provide service information, including all associated instructions for continued airworthiness required by § 25.981(d) to ensure operators incorporate the new fuel boost pump design into their existing fleet. The retrofit requirement affects an estimated 30 airplanes that will be delivered to US operators prior to the incorporation of the compliant fuel boost pump with GFI design into production.

The airplanes delivered in the non-compliant condition will be operated for a limited time and are not anticipated to develop the failure conditions that may result in fuel tank ignition during that limited time period. These airplanes are expected to provide a level of safety equal to or better than much of the existing transport category fleet.

Based on the service history of existing fleets and the limited time in which the new airplanes will be allowed to operate under this exemption, the risk to safety within the US fleet is very low. Therefore, we have concluded that this time-limited exemption will not adversely affect safety.

The FAA has reviewed the information provided by Bombardier and acknowledges that incorporating a GFI into the AC fuel boost pumps installed on the BD-500-1A10 and BD-500-1A11 airplanes should support compliance by preventing single failures, single failures plus latent failure conditions not shown to be extremely remote, and all failures not shown to be extremely improbable that may result in fuel tank ignition.

The FAA's decision

In consideration of the foregoing, I find that a grant of time-limited exemption is in the public interest. Therefore, pursuant to the authority contained in 49 U.S.C. 40113 and 44701 delegated to me by the Administrator, I grant Bombardier Aerospace an exemption from 14 CFR 25.901(c) and 25.981(a)(3) as it pertains to fuel tank ignition prevention associated with the fuel boost pump on the Model BD-500-1A10 and BD-500-1A11 airplanes until July 31, 2019. I grant the exemption to the extent necessary to allow Bombardier Aerospace time to incorporate into production a GFI in the fuel system design so that it is fully and directly compliant with §§ 25.901(c) and 25.981(a)(3).

This exemption is subject to the following conditions:

1. Bombardier Aerospace will develop a comprehensive plan and schedule for compliance and present them to the FAA within 90 days after issuance of the BD-500-1A10 and BD-500-1A11 US type certificate.
2. Bombardier Aerospace will complete the fuel boost pump safety analysis, including a structured failure modes and effects analysis, and provide documentation to show compliance with § 25.901(c) at Amendment 25-126 and § 25.981(a)(3) at Amendment 25-125, and submit to the FAA for approval on or before July 31, 2017.
3. Airplanes for which the original airworthiness certificate is issued after July 31, 2019, must incorporate a GFI in the AC fuel boost pump power supply. The GFI must include a daily test to insure the GFI is functioning properly; or alternatively, Bombardier may show that failure of the GFI to remove power from the fuel boost pump in the event of a ground fault is extremely remote.
4. On or before July 31, 2019, Bombardier must develop and submit for FAA approval, service information for incorporating all design changes and airworthiness limitations to meet the provisions of § 25.901(c) at Amendment 25-126 and § 25.981(a)(3) at Amendment 25-125, as required by § 25.981(d).

5. The airworthiness limitations section of the instructions for continued airworthiness must state that airplanes that received their original airworthiness certificate on or before July 31, 2019, cannot be operated after July 31, 2021, unless all design changes and limitations developed in accordance with condition 4 above are incorporated by the owner or operator.
6. The FAA will not issue original airworthiness certificates for Bombardier Model BD-500-1A10 and BD-500-1A11 airplanes after July 31, 2019, unless the newly produced airplanes conform to the modified type design, incorporating GFI, which directly complies with §§ 25.901(c) and 25.981(a)(3).

Issued in Renton, Washington, on June 9, 2016.

A handwritten signature in black ink, appearing to read "Michael Kaszycki". The signature is fluid and cursive, with a prominent initial "M" and a long, sweeping underline.

Michael Kaszycki
Assistant Manager, Transport Airplane Directorate
Aircraft Certification Service