

Exemption No. 9117

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

In the matter of the petition of

Dassault Aviation

for an exemption from § 25.901(c) of
Title 14, Code of Federal Regulations

Regulatory Docket No. FAA-2006-26450

GRANT OF EXEMPTION

By letter dated November 21, 2006, Mr. Nicolas Cognie, Airworthiness Office, Dassault Aviation, 54, avenue Marcel DASSAULT AVIATION, BP 24, 33701 MERIGNAC Cedex, France, petitioned for an exemption from the “no single failure criteria” of § 25.901(c) of Title 14, Code of Federal Regulations (14 CFR) as it relates to “uncontrollable high thrust failure conditions.” If granted, the exemption would permit type certification of Dassault Model Falcon 7X airplanes equipped with Pratt & Whitney Canada PW307A series engines.

The petitioner requires relief from the following regulation(s):

Section 25.901(c) requires in part that no single failure will jeopardize the safe operation of the airplane.

The petitioner supports its request with the following information:

Dassault Aviation requests an exemption from compliance with 14 CFR 25.901(c) for certain extremely remote powerplant failures that could affect only a very limited portion of the flight envelope of the Model Falcon 7X. (This model is currently pending type certification by the FAA).

Dassault will demonstrate that the overall level of safety of the thrust control system of the Model Falcon 7X will not be less than that of the current transport category aircraft fleet. Dassault will analyze the uncontrollable high engine thrust event failures for the PW300 family and perform simulated flights per scenarios specified in FAA Issue Paper P-08, dated November 23, 2004.

The nature of this petition for partial exemption is similar to previously granted exemptions for the Airbus models A340-500, A340-600, the Embraer models EMB-135BJ, EMB-145XR, the Boeing model 757-300 and 777's and the Gulfstream models G-1159, G-IV, GV, GV-SP and G150.

The Model Falcon 7X aircraft is of the same general design for thrust control management as other Falcon family models that have maintained a high level of safety and reliability.

The Falcon 7X is fitted with three PW307A engines, manufactured by Pratt & Whitney Canada Corp. a subsidiary of United Technology Corp., a US company. This PW307A engine is a member of the PW300 family which has accumulated more than 5 million flight hours.

The engine control system for the Falcon 7X is a full authority digital electronic control (FADEC) based system, and as such, future design changes to this control system should provide opportunities to significantly reduce or even eliminate the subject non-compliance. The conditions established by the FAA for granting this partial exemption, when applied to each proposed design change, are intended to take full advantage of each practicable opportunity for improvement, while affording the petitioner all warranted flexibility to certificate noncompliant derivative designs.

Public Interest

It is in the public interest to allow type certification for the Model Falcon 7X aircraft as this aircraft sets a new level of safety among business aircraft with the introduction of new design features that enhance aircraft reliability and safety, such as fly-by-wire. Furthermore, these new design features have no direct bearing on the failure modes leading to un-commanded high thrust.

A control system that might eliminate all failure modes of concern for the Falcon 7X would require significant modifications to the current engine control system, and introduce additional complexity, (and the possibility of additional failure modes). In addition, a redesign of previously approved engine control system architecture would add significant cost, schedule impacts, and put the Falcon 7X at an unfair disadvantage with its competitors.

In support of this exemption and prior to customer delivery of any Falcon 7X aircraft, Dassault will develop and obtain FAA approval of a document listing those failures that can contribute to or cause an uncontrollable high thrust failure condition covered by this partial exemption. This document will be made available as part of the instructions for continued airworthiness. Further the failures listed within this document will be added to the list of reportable incidents under 14 CFR part 21.3 for any airplane certificated under this partial exemption.

Dassault's complete petition for exemption is available on the Department of Transportation's docket website. Go to <http://dms.dot.gov>. The docket number is FAA-2006-26450. The petitioner's complete supportive information is contained in its petition.

Notice and Public Procedure

A summary of this petition was not published in the Federal Register, as the nature of this exemption is effectively identical to those of previous petitions for which there were no public comments received.

The Federal Aviation Administration's (FAA) analysis is as follows:

Uncontrollable High Thrust Failure Conditions

Numerous single and anticipated combinations of failures within traditional turbojet engine control systems result in losing the normal means to control thrust (i.e., control via the throttle lever, autothrottle, etc.). A subset of the resulting failure conditions may include actual thrust either increasing to higher than commanded and/or remaining high when low thrust is commanded. These "Uncontrollable High Thrust Failure Conditions," and the hazards they pose, have long been inherent in transport airplane designs. In fact, the "fail-safe" states for engine controls have traditionally been chosen to protect high thrust capability and allow the flightcrew to decide when an engine shutdown is appropriate.

An initial estimate indicates that over the last 20 years the average rate of occurrence for the uncontrollable high thrust failure condition on turbofan-powered large transport category airplanes has remained relatively constant at around one every 2.5 million flight hours. This would indicate that to date an "Uncontrollable High Thrust Failure Condition" has occurred hundreds of times without resulting in a single reported serious injury.

When these failure conditions were identified during past certifications, compliance was typically based on accepting an assertion that the flightcrew will recognize and safely accommodate the loss of the normal means to control engine thrust, including shutting down the affected engine via an independent fuel shutoff as required. However, recent engineering studies and service experience, including a 1997 Saudi Arabian Airlines Boeing 737-200 accident, indicate this traditionally accepted assertion is not always valid. For those airplanes re-evaluated to date, the available failure recognition and accommodation time under certain anticipated operating conditions is so short and the required corrective actions sufficiently unnatural that the flightcrew cannot be relied upon to reliably and completely perform those actions before the safe operation of the airplane is jeopardized.

While the focus of this petition was on the impacts of this determination on compliance with the general objective requirement of §25.901(c) relating to single failures, the FAA recognizes that this determination may have a similar impact on compliance with other regulations such as: §§ 21.21, 25.107, 25.109, 25.125, 25.143, 25.145, 25.147, 25.149, 25.161, 25.251, 25.571, 25.901(b), 25.903, and 25.1309. The FAA has concluded that, by addressing all the potential impacts of this determination on compliance with the general requirements of § 25.901(c), we will inherently cover the scope of potential impacts on all other applicable regulations.

The FAA is responding to the full scope of this determination by developing a “Thrust Control Malfunction Airworthiness Program” to consistently and objectively assess and manage the existing and future transport airplane fleet risks associated with this endemic potential for non-compliance and unsafe conditions. The ultimate goals of this program will be to bring the transport airplane fleet back into compliance as quickly as practicable. The interim goal of this program will be to manage the risks associated with each instance of non-compliance so that it does not represent an unsafe condition.

In the interim, for type certification the FAA has begun requesting more effective validation of any assertion that the flightcrew will recognize and safely accommodate the loss of the normal means to control engine thrust. A series of such requests is what led Dassault Aviation to submit the subject petition. Until practicable design solutions can be identified, validated, and safely integrated into turbine engine control system type designs, it is clearly in the public interest to continue to certificate type design improvements, even if they don’t strictly comply with the reference standard.

Dassault Model Falcon 7X airplanes

The engine thrust control system for the Pratt & Whitney Canada PW307A engine proposed to be installed on the Falcon 7X is the same as or very similar to the engine thrust control system types installed on the PW300 engine family. However, the petitioner has indicated that there are single failures in flight and on the ground that can cause a PW307A series engine to produce high thrust, up to the fuel metering unit mechanical stop, while not responding to the throttle lever. Further, the petitioner has indicated that this may jeopardize the safe operation of the Dassault Falcon 7X airplane if it occurs during some specific final approach/landing phase and takeoff conditions.

The petitioner intends to demonstrate that those combinations of failures that could jeopardize safe operation comply with § 25.901(c) in that they are not “probable combinations.”¹ Conversely, the petitioner does not always intend to demonstrate that those single failures which could jeopardize safe operation comply with § 25.901(c).

¹ The term “probable,” as used in § 25.901(c) has a very different meaning from the same term as subsequently used in association with § 25.1309(b) compliance. As used in § 25.901(c), “probable” means “foreseeable.” In § 25.1309(b) terms, this means the subject failure conditions are “anticipated to occur” (i.e., are not “extremely improbable”).

Compliance with § 25.901(c) requires each identified single failure be assumed to occur under all anticipated combinations of airplane operating and environmental conditions. While the single failures themselves must be assumed to occur regardless of their probability,² probability can be considered when determining what combinations of operating and environmental conditions are anticipated to occur in the fleet life of the airplane type. Single failures do not need to be assumed to occur under conditions that are in and of themselves not expected to occur. Nonetheless, the proposed design is known to have single failures that will cause uncontrollable high thrust.

Uncontrollable high thrust under certain anticipated takeoff and landing conditions is expected to jeopardize the safe operation of the proposed airplane. Consequently, in order to certify the installation of the Canada PW07A series engines on the Model Falcon 7X airplane, the petitioner must either obtain this exemption or substantially modify the associated engine control system design to mitigate the noted failure conditions in flight as well. As delineated in the petitioners supporting information, the petitioner has concluded that the exemption is the option which best serves the public interest.

FAA Analysis - Public Interest

The FAA agrees with the petitioner's statement of public interest. Also, the petitioner will be required by the conditions for granting this exemption to demonstrate that all practicable actions have been taken to minimize the adverse effect on safety associated with granting of the exemption from § 25.901(c) for the Model Falcon 7X airplanes. If the FAA is to certify the Falcon 7X airplanes, making this commitment a condition of the exemption assures that granting the exemption will be in the public interest. That is, any risks associated with a known non-compliance must be eliminated or further reduced wherever the FAA finds that to do so is technologically feasible and cost beneficial for the public. This has traditionally been accepted as the level of safety which is "in the public interest." Furthermore, if bringing the airplane into compliance is found to be a "practicable action," then this exemption would in effect be self eliminating. In consideration of the above, the FAA concludes that granting this petition is in the public interest.

FAA Analysis - Effect on Safety

The petitioner will be required by the conditions for granting this exemption to demonstrate that the risks due to uncontrollable high thrust failure conditions on any airplane certificated under this exemption will not exceed those currently known and accepted for comparable existing transport category airplanes. Making this a condition of this exemption, in combination with the condition to minimize that risk, means that

² While probability has been an acceptable means of supporting a finding that a particular "combination" of failures are not "probable," any single failure where the physics of the failure can be identified is typically "anticipated to occur," unless that occurrence within the relevant exposure can be clearly and acceptably ruled out, as is the case for those structural failures specifically excepted by the rule itself.

granting this exemption should not adversely affect and, in fact, should improve the average per flight hour risk within the current transport airplane fleet.

For those existing transport airplanes re-evaluated to date, the conditions under which an uncontrollable high thrust failure may jeopardize the safe operation of the airplane are limited to specific aborted takeoff or approach and landing scenarios. Given that these scenarios occur, there is still a low probability that any serious injury will result. This limited exposure, in conjunction with the historically low occurrence rates, makes this a relatively low per flight hour risk. This assessment is supported by the fact that the 1997 Saudi Arabian Airlines Boeing 737-200 accident is the only one attributed to these types of failures and there were no serious injuries in that accident.

It is the spectre of this low per flight hour risk accumulating indefinitely on many, if not most, existing and future transport airplanes that is the primary concern driving development of the FAA “Thrust Control Malfunction Airworthiness Program.” To date, corrective actions under 14 CFR part 39 have only been deemed warranted when the uncorrected risks for a particular type design were considered significantly greater than the known average risks within the transport fleet. Since the conditions and limitations of this exemption require that the Dassault Model Falcon 7X airplane be expected to have an uncontrollable high thrust failure rate over three times better than the current fleet average, the impact of adding the Falcon 7X airplane fleet hours to the overall transport fleet exposure should be insignificant. Furthermore, if as part of the “Thrust Control Malfunction Airworthiness Program,” the FAA determines that additional generally applicable precautions must be taken, including perhaps some future introduction of a compliant design, these will further minimize any cumulative risk impact of granting this exemption.

This exemption inherently implies a somewhat more hazardous than full compliance with § 25.901(c). This is why the FAA intends to bring the transport fleet back into full compliance as soon as practicable. Nevertheless, the fact that the per flight hour risks associated with this non-compliance are low allows us to develop a well considered recovery program to assure we don't introduce a worse problem than we are trying to solve and that this recovery program is clearly in the public interest.

In consideration of the above, the FAA concludes that granting this petition will not adversely affect safety.

The Grant of Exemption

In consideration of the foregoing, I find that a grant of exemption is in the public interest and will not adversely affect safety. Therefore, pursuant to the authority contained in 49 U.S.C. 40113 and 44701, delegated to me by the Administrator, Dassault Aviation is granted an

exemption from § 25.901(c) to the extent necessary to allow type certification of the Dassault Model Falcon 7X airplane equipped with Pratt & Whitney Canada PW307A series engines without an exact showing of compliance with the requirements of § 25.901(c) or other applicable regulations as they relate to single failures resulting in uncontrollable high thrust conditions. This exemption is subject to the following conditions and limitations:

1. Dassault must demonstrate, in accordance with an FAA-approved “Airworthiness Assessment and Risk Management Plan,” that all practicable actions have been taken to minimize the adverse effects on safety associated with granting this petition. These must include, but are not limited to, practical actions to eliminate or further reduce the risks by improving designs, procedures, training, and instructions for continued airworthiness.
2. Dassault must demonstrate, in accordance with an FAA-approved “Airworthiness Assessment and Risk Management Plan,” that the risks associated with exempting the “uncontrollable high thrust failure condition” from the single failure provisions of § 25.901(c) are no greater for the proposed Falcon 7X than those generally known to exist for comparable airplanes within the current transport fleet. Acceptable risk for this provision can be characterized as:
 - a. The airplane complies with § 25.901(c) for any foreseeable uncontrollable high thrust failure conditions in flight, except possibly during approach below 170 feet, and for a short duration on the ground during landing and takeoff; and
 - b. The expected frequency of occurrence of the uncontrollable high thrust failure condition is less than once per ten million airplane operating hours.
3. The following “Note” will be added to the airplane Type Certification Data Sheet for any airplane certificated under this exemption:

“The FAA has concluded that the occurrence of any uncontrollable high thrust failure condition, or any of the associated causal failures listed within Dassault Document [reference tbd], may endanger the safe operation of an airplane. Consequently, the FAA recommends that operators be encouraged to report such failures in accordance with §§ 121.703(c), 125.409(c), and 135.415(c).”

In support of this “Note,” Dassault must develop and obtain FAA approval of “Dassault Document (referenced tbd)” which lists those failures that can contribute to or cause an uncontrollable high thrust failure condition covered by this exemption. This document must be available as part of the instructions for continued airworthiness prior to delivery of the first airplane or issuance of a standard airworthiness certificate, whichever occurs

later. Further, the failures listed within this document must be added to the list of reportables under § 21.3 for any airplane certificated under this exemption.

4. The granting of this exemption does not relieve any regulatory obligation to identify and correct unsafe conditions related to uncontrollable high thrust failure conditions.

Note: Additional background and guidance regarding these provisions are provided in FAA Letter 02-112-02, dated October 19, 2001.

Issued in Renton Washington on April 16, 2007.

/s/

Ali Bahrami

Manager

Transport Airplane Directorate

Aircraft Certification Service