Exemption No. 8812

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

In the matter of the petition of **Airbus** for an exemption from § 25.901(c) of Title 14, Code of Federal Regulations	**Regulatory Docket No. FAA-2006-26552**

GRANT OF EXEMPTION

By letter dated November 30, 2006, Mr. Wolfgang Engler, Vice-President Product Integrity, Airbus, 1, Rond-Point Maurice Bellonte, 31700 Blagnac 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 Airbus Model A318 airplanes equipped with Pratt & Whitney 6000 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:

> "The Airbus Model 318PW aircraft complies with 25.901(c) for any foreseeable uncontrollable high thrust failure conditions:
>
> - During all phases for the combination of failures,
>
> - Except for the 'single failure' criterion during final approach phase from 50 feet–0 feet (4.5 seconds) and for a short duration during the takeoff phase (4.5 seconds).

”The frequency of occurrence of the uncontrollable high thrust failure condition, not complying with § 25.901(c) ‘single failure’ criterion is less than once per ten million operating hours.

”Airbus has taken all practicable action to minimize the adverse effect on safety associated with granting this petition, in implementing Thrust Control Malfunction (TCM) logic on the Airbus Model 318PW. This logic ensures that compliance with § 25.901(c) ‘single failure’ criterion is met for most of the ground cases.

”However, this logic is not activated in-flight in order to preclude failure cases, which could lead to a double engine shutdown in-flight and increase the in-flight shutdown rate. For flight phases other than the final approach and a short duration during takeoff, the design of the system is such that compliance with § 25.901(c) ‘single failure’ criterion is met.

”Simulator results obtained during the Airbus Model 318PW EASA/FAA certification sessions and performance calculations have shown that for a duration of about 4.5 seconds during final approach/landing conditions and about 4.5 seconds during the takeoff phase the ‘no single failure criteria which jeopardize the safe operation of the airplane,’ as required by § 25.901(c) is not met.

”As a result of the TCM logic implemented on the A318 model powered by Pratt & Whitney 6000 engines, the risk associated with exempting the § 25.901(c) are much lower than those generally known to exist for similar aircraft within the current transport fleet.

”This request for exemption is conditional, as the Model 318PW will be re-assessed in accordance with the ‘Thrust Control Malfunction Airworthiness Program’. This program is to be instituted by the FAA for the purpose of managing the overall transport aircraft fleet risks associated with this and/or similar potentially unsafe conditions.”

Public Interest

“Airbus considers that the current proposed thrust management control on the Model A318PW is in the public interest, and the risks associated with exempting § 25.901(c) are much lower than those generally known to exist for similar aircraft within the current transport fleet. Based on the above rationale, Airbus requests this exemption.”

Airbus’ 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-2006-26552. 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 Airbus 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.

Airbus Model A318PW airplanes

The engine thrust control system for the Pratt & Whitney 6000 engine family proposed to be installed on the A318 includes Thrust Control Malfunction (TMC) protection logic to mitigate uncontrollable high thrust conditions on the ground only. However, the petitioner has indicated that there are single failures in flight and on the ground that can cause a Pratt & Whitney 6000 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 Airbus A318PW 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).

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

[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").

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 certificate the installation of the Pratt & Whitney 6000 series engines on the Airbus A318PW 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 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 A318PW airplanes. Airbus has indicated it intends to implement the Thrust Control Malfunction (TCM) logic on the A318PW airplane to ensure that compliance with § 25.901(c) "single failure" criterion is met for all uncontrollable high thrust failure conditions except for some specific final approach/landing phase and takeoff conditions. If the FAA is to certify the Airbus A318PW 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

[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.

this exemption, in combination with the condition to minimize that risk, means that 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 Airbus Model A318PW 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 A318PW 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 greater hazard 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, Airbus is granted a exemption from § 25.901(c) to the extent necessary to allow type certification of the Airbus Model A318 airplane equipped with Pratt & Whitney 6000 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. Airbus 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. Airbus 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 A318PW 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 50 feet, and for a short duration on the ground during 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 Airbus 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," Airbus must develop and obtain FAA approval of "Airbus 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 December 21, 2006.

Signed by Ali Bahrami

Ali Bahrami
Manager
Transport Airplane Directorate
Aircraft Certification Service