DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 25

[Docket No. NM162; Special Conditions No. 25–154–SC]

Special Conditions: Bombardier Model DHC–8–400 Airplane; Automatic Takeoff Thrust Control System

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final special conditions.

SUMMARY: These special conditions are issued for the Bombardier Model DHC–8–400 series airplanes. This new airplane will have a novel or unusual design feature associated with an Automatic Takeoff Thrust Control System (ATTCS). The applicable airworthiness regulations do not contain appropriate safety standards for approach climb performance using an ATTCS. These special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

EFFECTIVE DATE: November 22, 1999.

FOR FURTHER INFORMATION CONTACT: Greg Dunn, FAA, Transport Airplane Directorate, Aircraft Certification Office, Standardization Branch, ANM–113, 1601 Lind Avenue SW., Renton, Washington, telephone (425) 227–2799; facsimile (425) 227–1149.

SUPPLEMENTARY INFORMATION:

Background

On January 31, 1995, Bombardier Regional Aircraft, 123 Garratt Blvd., Downsview, Ontario, Canada, M3K 1Y5, applied for an amended type certificate to include the new Bombardier Model DHC–8–400 airplane. The Bombardier Model DHC–8–400, which is a derivative of the Bombardier (formerly de Havilland, Inc.) Model DHC 8–300 series airplanes currently under Type Certificate No. A13NM is a medium-sized airplane powered by two Pratt & Whitney Canada PW150A turbopropeller engines mounted on the wings. Each engine is equipped with a Dowty Aerospace Model R408 propeller and is capable of delivering 5071 horsepower at takeoff. The airplane is configured for five flight crewmembers and 78 passengers.

The Bombardier Model DHC–8–400 incorporates an unusual design feature, the Automatic Takeoff Thrust Control System (ATTCS), referred to by Bombardier as uptrim, to show compliance with the approach climb requirements of § 25.121(d). Appendix I to part 25 limits the application of performance credit for ATTCS to takeoff only. Since the airworthiness regulations do not contain appropriate safety standards for approach climb performance using ATTCS, special conditions are required to ensure a level of safety equivalent to that established in the regulations.

Type Certification Basis

Under the provisions of Title 14, Code of Federal Regulations (14 CFR) § 21.101, Bombardier must show that the Model DHC–8–400 meets the applicable provisions of the regulations incorporated by reference in Type Certificate No. A13NM or the applicable regulations in effect on the date of application for the change to the Model DHC–8–400. The regulations incorporated by reference in the type certificate are commonly referred to as the ''original type certification basis.'' The regulations incorporated by reference in Type Certificate No. A13NM are as follows: part 25, effective February 1, 1965, including Amendments 25–1 through 25–86, and § 25.109 as amended by Amendment 92. The certification basis may also include later amendments to part 25 that are not relevant to these special conditions. In addition, the certification basis for the Model DHC–8–400 includes part 34, effective September 10, 1990, including Amendment 34–3 effective February 3, 1999, plus any amendments in effect at the time of certification; and part 36, effective December 1, 1969, including Amendments 36–1 through 36–21 and any subsequent amendments which will be applicable on the date the type certificate is issued. These special conditions form an additional part of the type certification basis. In addition, the certification basis may include other special conditions that are not relevant to these special conditions.

If the Administrator finds that the applicable airworthiness regulations (i.e., part 25, as amended) do not contain adequate or appropriate safety standards for the Bombardier Model DHC–8–400 because of a novel or unusual design feature, special conditions are prescribed under the provisions of § 21.16.

In addition to the applicable airworthiness regulations and special conditions, the Model DHC–8–400 must comply with the fuel vent and exhaust emission requirements of 14 CFR part 34 and the noise certification requirements of 14 CFR part 36.

Special conditions, as appropriate, are issued in accordance with § 11.49 after public notice, as required by §§ 11.28 and 11.29(b), and become part of the type certification basis in accordance with § 21.101(b)(2).

Special conditions are initially applicable to the model for which they are issued. Should the type certificate for that model be amended later to include any other model that incorporates the same novel or unusual design feature, or should any other model already included on the same type certificate be modified to incorporate the same novel or unusual design feature, the special conditions would also apply to the other model under the provisions of § 21.101(a)(1).

Novel or Unusual Design Features

The Model DHC–8–400 will incorporate the following novel or unusual design feature: the Automatic Takeoff Thrust Control System (ATTCS), referred to by Bombardier as uptrim, to show compliance with the approach climb requirements of § 25.121(d). The Bombardier Model DHC–8–400 is a medium-sized airplane powered by two Pratt & Whitney Canada PW150A turbopropeller engines equipped with Full Authority Digital Engine Controls (FADEC) that, in part, protect against exceeding engine limits. The Model DHC–8–400 is also equipped with Dowty Aerospace Model R408 propellers as part of the propulsion package. The propellers incorporate a Propeller Electronic Control (PEC) that functions with the FADEC to control the engine/propeller system.

The Model DHC–8–400 incorporates a non-moving throttle system that functions by placing the throttle levers in detents for the takeoff and climb phases of flight, allowing the FADEC to schedule power settings based on flight phase. With the uptrim and associated systems functioning normally as designed, all applicable requirements of 14 CFR, part 25 and paragraph 25 of the Joint Aviation Requirements (JAR), will be met without requiring any action by the crew to increase power.

Automatic takeoff power control on the Model DHC–8–400 involves uptrimming the remaining engine to Maximum Takeoff Power (MTOP) and autofeathering the propeller on the failed engine. These actions will be controlled by the PEC. At takeoff when AUTOFEATHER (A/F) is selected and the power levers are set to Normal Takeoff Power (NTOP), the engine display will show an ''A/F ARM'' message. This engine display will confirm to the pilot that the system is armed and autofeather and uptrim will occur without any further action by the crew if an engine fails. During go-around the uptrim will be automatically armed as soon as the control (power) levers are set to the takeoff (go-around) configuration.

Engine power is set to NTOP, which is 90 percent of MTOP, to initiate the takeoff roll. The value of NTOP for the current ambient conditions will be calculated and set by the FADEC. Following an engine failure during takeoff or go-around, the ATTCS will change the power reference on the operating engine to achieve the MTOP rating if the engine power was originally set to NTOP. If the reduced power takeoff option is being used the ATTCS will increase the power of the operating engine from 90 percent to 100 percent of the corresponding set power.

The engine operating limits (turbine temperature and RPM) for NTOP are set and displayed to the pilot when that rating is selected. These limits are set such that the engine red line limits are not exceeded when an uptrim is applied. When MTOP rating is selected or triggered, the engine limits are reset automatically to reflect the engine red line limits.

When both Power Lever Angles (PLA) are high and both the Condition Lever Angles (CLA) are at maximum position (MAX), the system is armed. If the torque on one engine drops below 25 percent, the PEC on the failed engine sends an uptrim signal to the remaining engine. Other conditions that will trigger the uptrim are the reduction of prop speed (Np) below 80 percent or the automatic feathering of the prop. The power levers will continue to function normally should the ATTCS fail. The MTOP can also be selected by pressing the ''MTOP'' switch on the engine control panel. The full MTOP is available if the pilot elects to push the PLA past the takeoff power detent into the over travel range.

To deactivate the uptrim, the PLA's should be moved out of the rating detent to a position less than 60 degrees (PLA not high) or the CLA of the active engine should be moved out of the MAX/1020 takeoff detent.

The part 25 standards for ATTCS, contained in § 25.904 and appendix I, specifically restrict performance credit for ATTCS to takeoff. Expanding the scope of the standards to include other phases of flight, including go-around, was considered at the time the standards were issued, but flightcrew workload issues precluded further consideration. As stated in the preamble to Amendment 25–62: ''In regard to ATTCS credit for approach climb and go-around maneuvers, current regulations preclude a higher thrust for the approach climb (§ 25.121(d)) than for the landing climb (§ 25.119). The workload required for the flightcrew to monitor and select from multiple in-flight thrust settings in the event of an engine failure during a critical point in the approach, landing, or go-around operations is excessive. Therefore, the FAA does not agree that the scope of the amendment should be changed to include the use of ATTCS for anything except the takeoff phase'' (52 FR 43153, November 9, 1987).

The ATTCS incorporated on the Model DHC–8–400 allows the pilot to use the same power setting procedure during a go-around, regardless of whether or not an engine fails. In either case, the pilot obtains go-around power by moving the throttles into the forward (takeoff/go-around) throttle detent. Since the ATTCS is permanently armed, it will function automatically following an engine failure, and advance the remaining engine to the ATTCS thrust level. Therefore, this design adequately addresses the pilot workload concerns identified in the preamble to Amendment 25–62. Accordingly, these proposed special conditions would require a showing of compliance with those provisions of § 25.904 and appendix I that are applicable to the approach climb and go-around maneuvers.

The definition of a critical time interval for the approach climb case, during which time it must be extremely improbable to violate a flight path based on the § 25.121(d) gradient requirement, is of primary importance. The § 25.121(d) gradient requirement implies a minimum one-engine-inoperative flight path capability with the airplane in the approach configuration. The engine may have been inoperative before initiating the go-around, or it may become inoperative during the go-around. The definition of the critical time interval must consider both possibilities.

Discussion of Comments

Notice of Proposed Special Conditions No. 25–99–08–SC for the Bombardier Model DHC–8–400 series airplanes was published in the **Federal Register** on August 12, 1999 (64 FR 43943). Two commenters responded to the Notice.

Comment: One commenter agrees that the applicable airworthiness regulations do not contain appropriate safety standards for approach climb performance using an Automatic Takeoff Thrust Control System (ATTCS), and concurs with the proposed special conditions.

Disposition: The comment is accepted with no action required.

Comment: One commenter states that the proposed special condition uses a complicated construction to determine a ''critical time interval,'' broadly following the idea of Appendix I to JAR–25 for ATTCS takeoffs, but having defined the time interval, the special condition itself assigns it no regulatory function.

Disposition: The critical time interval concept used in the special condition originated with Appendix I to part 25. Appendix I to part 25 remains in effect for the Model DHC–8–400. Therefore, § I25.3, which specifies the requirements associated with the critical time interval, continues to apply. The combined failure of an engine and the ATTCS must be extremely improbable during the critical time interval. Also, an ATTCS failure or combination of failures during the critical time interval shall not prevent the insertion of the maximum approved takeoff thrust or power, or must be shown to be an improbable event. An ATTCS failure or combination of failures during the critical time interval shall not result in a significant loss or reduction in thrust or power, or must be shown to be an extremely improbable event. No changes were made to the proposed special condition as a result of this comment.

Comment: One commenter states the proposed special condition defines time periods for two different failure cases in an ATTCS go-around (not the same as critical time intervals) whose permitted duration is related to a period in the takeoff case (again, not the critical time interval). However, the correlation with the takeoff case seems weak; in the takeoff case, the effect of an engine failure plus ATTCS failure in the critical time interval is clearly hazardous (flight below the normal takeoff flight path) and an appropriate probability target must be met in this interval. In the go-around case, it just means the reduced gradient starts slightly earlier.

Disposition: The time periods referring to the takeoff case in the definition of the critical time interval for go-around are associated with the minimum acceptable time period for the flightcrew to recognize the combined ATTCS and engine failure and to take corrective action by manually inserting go-around thrust. Using the time interval from the takeoff case for the time it takes the flightcrew to recognize and respond makes use of an accepted benchmark and ensures consistent treatment in the design and evaluation of the ATTCS for both takeoff and go-around. The intent of the special condition is to ensure that the flight path implied by the part 25 approach climb gradient requirement is maintained when an automatic system is used to increase thrust on the operating engine when an engine fails. For both the takeoff and the go-around cases, the intent is for compliance with the applicable part 25 performance requirements to continue to be met, considering the potential for a concurrent ATTCS and engine failure. No changes were made to the proposed special condition as a result of this comment.

Comment: One commenter states there are no criteria directly associated with failures in the go-around critical time interval, noting that the ''effect'' is variable depending on go-around height, but surprisingly, the special condition deals only in terms of gradients. This is presumably by analogy with the basic go-around performance requirements, which are not tightly tied to obstacle clearance, but it does make it difficult to understand the objective of the special condition. Is it obstacle clearance or ground contact in the go-around?

Disposition: The Appendix I to part 25 requirements related to the critical time interval continue to apply for use of ATTCS in the go-around phase of flight. The part 25 approach climb gradient, which is the only applicable part 25 requirement for the use of ATTCS for go-around, is independent of the go-around initiation height. The objective of the special condition is to retain the performance capability associated with the part 25 approach climb requirement, which is not directly tied to either obstacle clearance or ground contact in the go-around. No changes were made to the proposed special condition as a result of this comment.

Comment: One commenter asks why the approach is assumed to be made on a 2.5 degree glidepath.

Disposition: Two and one-half degrees were selected to conservatively represent a normal approach glidepath, which is typically 2.5 to 3 degrees. No changes were made to the proposed special condition as a result of this comment.

Comment: One commenter notes that in the absence of any height constraints, the construction of the flight paths for setting the critical time interval could in theory involve flight below ground level, but still give a valid interval. Would this be acceptable?

Disposition: The special condition ensures that the existing part 25 requirements are met for an airplane incorporating an ATTCS. Under this special condition, the go-around flight path will not deviate below that required by part 25. The operating requirements address the relationship between this go-around flight path capability and the surrounding terrain. No changes were made to the proposed special condition as a result of this comment.

Comment: One commenter asks the purpose of the proposed special condition.

Disposition: The special condition ensures that the existing part 25 requirements are met for an airplane incorporating an ATTCS.

Comment: One commenter asks what regulatory effect the proposed special condition might have on design or performance scheduling.

Disposition: The special condition will affect the design of the ATTCS to the extent that the system meets the reliability requirements associated with the critical time interval for the go-around phase of flight. The special condition will provide the flightcrew with a means to verify, before beginning an approach for landing, that the ATTCS is in a condition to operate. There will be no effect on performance scheduling.

Comment: One commenter states that the absence of a defined point of origin for the go-around makes the possible effects and safety benefits of the proposed special condition hard to predict.

Disposition: The proposed special condition will ensure that the relevant part 25 requirement associated with go-around, § 25.121(d), will continue to be met when a system is installed that automatically increases power on the operating engine after an engine fails. Therefore, the level of safety provided by the special condition for an airplane with such a system installed is equivalent to that assured by part 25 for airplanes that do not have such a system. No changes were made to the proposed special condition as a result of this comment.

Applicability

As discussed above, these proposed special conditions would be applicable to the Bombardier Model DHC–8–400. Should Bombardier apply at a later date for a change to the type certificate to include another model incorporating the same novel or unusual design feature, these special conditions would apply to that model as well under the provisions of § 21.101(a)(1).

Under standard practice, the effective date of final special conditions would be 30 days after the date of publication in the **Federal Register**; however, as the certification date for the CASA Model C–295 is imminent, the FAA finds that good cause exists to make these special conditions effective upon issuance.

Conclusion

This action affects only certain novel or unusual design features on the Bombardier Model DHC–8–400 airplane. It is not a rule of general applicability and affects only the applicant who applied to the FAA for approval of these features on the airplane.

List of Subjects in 14 CFR part 25

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

The authority citation for these proposed special conditions is as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701, 44702, 44704.

The Special Conditions

Accordingly, pursuant to the authority delegated to me by the Administrator, the following special conditions are issued as part of the type certification basis for the Bombardier Regional Aircraft Model DHC–8–400 airplane.

1. *General.* An Automatic Takeoff Thrust Control System (ATTCS) is defined as the entire automatic system, including all devices, both mechanical and electrical that sense engine failure, transmit signals, actuate fuel controls or power levers, or increase engine power by other means on operating engines to achieve scheduled thrust or power increases and furnish cockpit information on system operation.

2. *ATTCS.* The engine power control system that automatically resets the power or thrust on the operating engine (following engine failure during the approach for landing) must comply with the following requirements:

a. *Performance and System Reliability Requirements.* The probability analysis must include consideration of ATTCS failure occurring after the time at which the flightcrew last verifies that the ATTCS is in a condition to operate until the beginning of the critical time interval.

b. *Thrust Setting.* The initial takeoff thrust set on each engine at the beginning of the takeoff roll or go-around may not be less than:

(1) Ninety (90) percent of the thrust level set by the ATTCS (the maximum takeoff thrust or power approved for the airplane under existing ambient conditions);

(2) That required to permit normal operation of all safety-related systems and equipment dependent upon engine thrust or power lever position; or

(3) That shown to be free of hazardous engine response characteristics when thrust is advanced from the initial takeoff thrust or power to the maximum approved takeoff thrust or power.

c. *Powerplant Controls.* In addition to the requirements of § 25.1141, no single failure or malfunction, or probable combination thereof, of the ATTCS, including associated systems, may cause the failure of any powerplant function necessary for safety. The ATTCS must be designed to:

(1) Apply thrust or power on the operating engine(s), following any one engine failure during takeoff or go-around, to achieve the maximum approved takeoff thrust or power without exceeding engine operating limits; and

(2) Provide a means to verify to the flightcrew before takeoff and before beginning an approach for landing that the ATTCS is in a condition to operate.

3. *Critical Time Interval.* The definition of the Critical Time Interval in appendix I, § I25.2(b) shall be expanded to include the following:

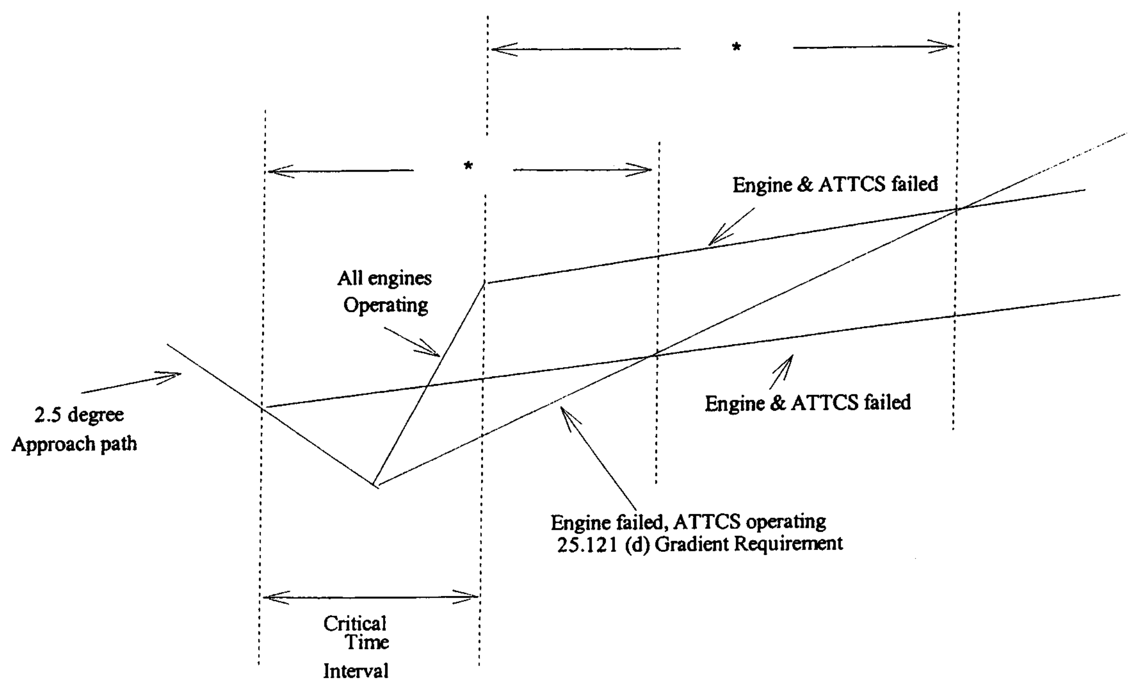
a. When conducting an approach for landing using ATTCS, the critical time interval is defined as follows:

(1) The critical time interval begins at a point on a 2.5 degree approach glide path from which, assuming a simultaneous engine and ATTCS failure, the resulting approach climb flight path intersects a flight path originating at a later point on the same approach path corresponding to the part 25 one-engine-inoperative approach climb gradient. The period of time from the point of simultaneous engine and ATTCS failure to the intersection of these flight paths must be no shorter than the time interval used in evaluating the critical time interval for takeoff beginning from the point of simultaneous engine and ATTCS failure and ending upon reaching a height of 400 feet.

(2) The critical time interval ends at the point on a minimum performance, all-engines-operating go-around flight path from which, assuming a simultaneous engine and ATTCS failure, the resulting minimum approach climb flight path intersects a flight path corresponding to the part 25 minimum one-engine-inoperative approach climb gradient. The all-engines-operating go-around flight path and the part 25 one-engine-inoperative approach climb gradient flight path originate from a common point on a 2.5 degree approach path. The period of time from the point of simultaneous engine and ATTCS failure to the intersection of these flight paths must be no shorter than the time interval used in evaluating the critical time interval for the takeoff beginning from the point of simultaneous engine and ATTCS failure and ending upon reaching a height of 400 feet.

b. The critical time interval must be determined at the altitude resulting in the longest critical time interval for which one-engine-inoperative approach climb performance data are presented in the Airplane Flight Manual.

c. The critical time interval is illustrated in the following figure:



*The engine and ATTCS failed time interval must be no shorter than the time interval from the point of simultaneous engine and ATTCS failure to a height of 400 feet used to comply with I25.2(b) for ATTCS use during takeoff.

Issued in Renton, Washington, on November 22, 1999.

Donald L. Riggin,

Acting Manager, Transport Airplane Directorate, Aircraft Certification Service, ANM–100.

[FR Doc. 99–31396 Filed 12–2–99; 8:45 am]

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DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 25

[Docket No. NM160, Special Conditions No. 25–153–SC]

Special Conditions: Dassault Aviation Falcon Model 20–C5/-D5/-E5/-F5 Airplanes; High Intensity Radiated Fields (HIRF)

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final special conditions.

SUMMARY: These special conditions are issued for the Dassault Aviation Falcon Model 20–C5/-D5/-E5/-F5 airplanes, as modified by Garrett Aviation Services. The Model 20–C5/-D5/-E5/-F5 airplanes are equipped with a high-technology digital avionics system that performs critical functions. The applicable regulations do not contain adequate or appropriate safety standards for the protection of this system from the effects of high-intensity radiated fields (HIRF). These special conditions provide the additional safety standards that the Administrator considers necessary to ensure that the critical functions that this system performs are maintained when the airplane is exposed to HIRF.

EFFECTIVE DATE: January 3, 2000.

FOR FURTHER INFORMATION CONTACT: Connie Beane, FAA, Transport Airplane Directorate, Aircraft Certification Service, Standardization Branch, ANM–113, 1601 Lind Avenue SW., Renton, Washington, 98055–4056; telephone (425) 227–2796; facsimile (425) 227–1149.

SUPPLEMENTARY INFORMATION:

Background

On November 8, 1998, Garrett Aviation Services applied for a supplemental type certificate (STC) to modify Dassault Aviation Falcon Model 20–C5/-D5/-E5/-F5 airplanes listed on Type Certificate A7EU.

The Model 20–C5/-D5/-E5/-F5 series of low wing airplanes are pressurized airplanes with twin, Garrett TRE731–5AR turbofans that are configured for 8–10 passengers and a crew of 2. The airplane has a maximum takeoff weight of 29,000 pounds, a maximum landing weight of 27,734 pounds, and a range of 1600 nautical miles. The overall length of the Falcon Model 20–C5/-D5/-E5/-F5 airplanes is 56 feet 3 inches, and the wing span is 53 feet, 6 inches.

The modification incorporates the installation of flat panel displays for display of critical flight parameters (altitude, airspeed, and attitude) to the crew. These displays can be susceptible to disruption to both command/response signals as a result of electrical and magnetic interference. This disruption of signals could result in loss of all critical flight displays and annunciations or present misleading information to the pilot.

Type Certification Basis

Under the provisions of 14 CFR 21.101, Garrett Aviation Services must show that the Dassault Aviation Falcon Model 20–C5/-D5/-E5/-F5 airplanes, as changed, continue to meet the applicable provisions of the regulations incorporated by reference in Type Certificate No. A7EU, or the applicable regulations in effect on the date of application for the change. The regulations incorporated by reference in the type certificate are commonly referred to as the ‘‘original type certification basis.’’ The regulations incorporated by reference in Type Certificate No. A7EU are as follows:

The certification basis for the modified Dassault Aviation Falcon Model 20–C5/-D5/-E5/-F5 airplanes includes Civil Air Regulations (CAR) 4b, effective December 31, 1953, Amendments 4b-1 through 4b-12, Special Regulation SR422B, and provisions of FAR amendment 25–4 in lieu of CAR 4b.350(e) and (f).

If the Administrator finds that the applicable airworthiness regulations (i.e., CAR 4b, as amended) do not contain adequate or appropriate safety standards for the Dassault Aviation Falcon Model 20–C5/-D5/-E5/-F5 airplanes because of a novel or unusual design feature, special conditions are prescribed under the provisions of § 21.16.

In addition to the applicable airworthiness regulations and special conditions, the Model 20–C5/-D5/-E5/-F5 must comply with the fuel vent and exhaust emission requirements of 14 CFR part 34 and the noise certification requirements of 14 CFR part 36.

Special conditions, as appropriate, are issued in accordance with 14 CFR 11.49, as required by §§ 11.28 and 11.29(b), and become part of the type certification basis in accordance with § 21.101(b)(2).

Special conditions are initially applicable to the model for which they are issued. Should Garrett Aviation Services apply for a supplemental type certificate to modify any other model included on the same type certificate to incorporate the same novel or unusual design feature, the special conditions would also apply to the other model under the provisions of § 21.101(a)(1).

Novel or Unusual Design Features

The modified Dassault Aviation Falcon Model 20–C5/-D5/-E5/-F5 airplanes will incorporate the following new design feature: a new electronic flat panel display system, which was not available at the time of certification of these airplanes, that performs critical functions. This system may be vulnerable to HIRF external to the airplane.

Discussion

There is no specific regulation that addresses protection requirements for electrical and electronic systems from HIRF. Increased power levels from ground-based radio transmitters and the growing use of sensitive electrical and electronic systems to command and control airplanes have made it necessary to provide adequate protection.

To ensure that a level of safety is achieved equivalent to that intended by the regulations incorporated by reference, special conditions are needed for the Dassault Aviation Falcon Model 20–C5/–D5/–E5/–F5 airplanes, which require that new electrical and electronic systems that perform critical functions, such as the flat panel displays for display of critical flight parameters (altitude, airspeed, and attitude) to the crew, be designed and installed to preclude component damage and interruption of function due to both the direct and indirect effects of HIRF.

High-Intensity Radiated Fields (HIRF)

With the trend toward increased power levels from ground-based transmitters, plus the advent of space and satellite communications coupled with electronic command and control of the airplane, the immunity of critical digital avionics systems to HIRF must be established.

It is not possible to precisely define the HIRF to which the airplane will be exposed in service. There is also uncertainty concerning the effectiveness of airframe shielding for HIRF.