DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 29

[Docket No. FAA–2016–6939; Notice No. 29–038–SC]

Special Conditions: Bell Helicopter Textron, Inc. (BHTI), Model 525 Helicopters; Interaction of Systems and Structures.

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final special conditions.

SUMMARY: These special conditions are issued for the BHTI Model 525 helicopter. This helicopter will have a novel or unusual design feature associated with fly-by-wire flight control system (FBW FCS) functions that affect the structural integrity of the rotorcraft. The applicable airworthiness regulations do not contain adequate or appropriate safety standards for this design feature. 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.

DATES: These special conditions are effective January 9, 2017.

FOR FURTHER INFORMATION CONTACT: Martin R. Crane, Aviation Safety Engineer, Safety Management Group, Rotorcraft Directorate, FAA, 10101 Hillwood Pkwy, Fort Worth, TX 76177; telephone (817) 222–5110; email *martin.r.crane@faa.gov.*

SUPPLEMENTARY INFORMATION:

Background

On December 15, 2011, BHTI applied for a type certificate for a new transport category helicopter designated as the Model 525. The aircraft is a medium twin engine rotorcraft. The design maximum takeoff weight is 20,000 pounds, with a maximum capacity of 16 passengers and a crew of 2.

The BHTI Model 525 helicopter will be equipped with a FBW FCS. The control functions of the FBW FCS and its related systems affect the structural integrity of the rotorcraft. Current regulations do not take into account loads for the rotorcraft due to the effects of systems on structural performance including normal operation and failure conditions with strength levels related to probability of occurrence. Special conditions are needed to account for these features.

Type Certification Basis

Under the provisions of 14 CFR 21.17, BHTI must show that the Model 525 helicopter meets the applicable provisions of part 29, as amended by Amendment 29–1 through 29–55 thereto. The BHTI Model 525 certification basis date is December 15, 2011, the date of application to the FAA.

If the Administrator finds that the applicable airworthiness regulations (*i.e.,* 14 CFR part 29) do not contain adequate or appropriate safety standards for the BHTI Model 525 because of a novel or unusual design feature, special conditions are prescribed under the provisions of § 21.16.

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 or similar novel or unusual design feature, the special conditions would also apply to the other model under § 21.101.

In addition to the applicable airworthiness regulations and special conditions, the BHTI Model 525 helicopter must comply with the noise certification requirements of 14 CFR part 36, and the FAA must issue a finding of regulatory adequacy under § 611 of Public Law 92–574, the ‘‘Noise Control Act of 1972.’’

The FAA issues special conditions, as defined in 14 CFR 11.19, in accordance with § 11.38, and they become part of the type-certification basis under § 21.17(a)(2).

Novel or Unusual Design Features

The BHTI Model 525 helicopter will incorporate the following novel or unusual design features: FBW FCS, and its related systems (stability augmentation system, load alleviation system, flutter control system, and fuel management system), with control functions that affect the structural integrity of the rotorcraft. Current regulations are inadequate for considering the effects of these systems and their failures on structural performance. The general approach of accounting for the effect of system failures on structural performance would be extended to include any system where partial or complete failure, alone or in combination with any other system's partial or complete failure, would affect structural performance.

Discussion

Active flight control systems are capable of providing automatic responses to inputs from sources other than the pilots. Active flight control systems have been expanded in function, effectiveness, and reliability to the point that FBW FCS systems are being installed on new rotorcraft. As a result of these advancements in flight control technology, 14 CFR part 29 does not provide a basis to achieve an acceptable level of safety for rotorcraft so equipped. Certification of these systems requires issuing special conditions under the provisions of § 21.16.

In the past, traditional rotorcraft flight control system designs have incorporated power-operated systems, stability or control augmentation with limited control authority, and autopilots that were certificated partly under § 29.672 with guidance from Advisory Circular 29–2C, Section AC 29.672. These systems are integrated into the primary flight controls and are given sufficient control authority to maneuver the rotorcraft up to its structural design limits in 14 CFR part 29 subparts C and D. The FBW FCS advanced technology with its full authority necessitates additional requirements to account for the interaction of control systems and structures.

The regulations defining the loads envelope in 14 CFR part 29 do not fully account for the effects of systems on structural performance. Automatic systems may be inoperative or they may operate in a degraded mode with less than full system authority and associated built-in protection features. Therefore, it is necessary to determine the structural factors of safety and operating margins such that the probability of structural failures due to application of loads during FBW FCS malfunctions is not greater than that found in rotorcraft equipped with traditional flight control systems. To achieve this objective and to ensure an acceptable level of safety, it is necessary to define the failure conditions and their associated frequency of occurrence.

Traditional flight control systems provide two states, either fully functioning or completely inoperative. These conditions are readily apparent to the flight crew. Newer active flight control systems have failure modes that allow the system to function in a degraded mode without full authority and associated built-in protection features. As these degraded modes are not readily apparent to the flight crew, monitoring systems are required to provide an annunciation of degraded system capability.

Comments

A notice of proposed special conditions for the BHTI Model 525 helicopter FBW FCS and its related systems was published in the **Federal Register** on May 27, 2016 (81 FR 33606). We did not receive any comments.

Applicability

As discussed above, these special conditions are applicable to the BHTI Model 525 helicopter. Should BHTI apply at a later date for a change to the type certificate to include another model incorporating the same novel or unusual design feature, the special conditions would apply to that model as well.

Conclusion

This action affects only certain novel or unusual design features on one model of rotorcraft. It is not a rule of general applicability.

List of Subjects in 14 CFR Part 29

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

The authority citation for these 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 Bell Helicopter Textron, Inc., Model 525 helicopters when a fly-by-wire flight control system is installed:

Interaction of Systems and Structures

For rotorcraft equipped with systems that affect structural performance, either directly or as a result of a failure or malfunction, the influence of these systems and their failure conditions must be taken into account when showing compliance with the requirements of Title 14, Code of Federal Regulations (14 CFR) part 29 subparts C and D.

The following criteria must be used for showing compliance with these special conditions for rotorcraft equipped with flight control systems, autopilots, stability augmentation systems, load alleviation systems, flutter control systems, fuel management systems, and other systems that either directly or as a result of failure or malfunction affect structural performance. If these special conditions are used for other systems, it may be necessary to adapt the criteria to the specific system.

(a) The criteria defined herein only address the direct structural consequences of the system responses and performance. They cannot be considered in isolation but should be included in the overall safety evaluation of the rotorcraft. These criteria may in some instances duplicate standards already established for this evaluation. These criteria are only applicable to structure whose failure could prevent continued safe flight and landing. Specific criteria that define acceptable limits on handling characteristics or stability requirements when operating in the system degraded or inoperative mode are not provided in these special conditions.

(b) Depending upon the specific characteristics of the rotorcraft, additional studies may be required that go beyond the criteria provided in this special condition in order to demonstrate the capability of the rotorcraft to meet other realistic conditions such as alternative gust or maneuver descriptions for a rotorcraft equipped with a load alleviation system.

(c) The following definitions are applicable to these special conditions:

(1) Structural performance: Capability of the rotorcraft to meet the structural requirements of 14 CFR part 29.

(2) Flight limitations: Limitations that can be applied to the rotorcraft flight conditions following an in-flight occurrence and that are included in the flight manual (*e.g.,* speed limitations and avoidance of severe weather conditions).

(3) Operational limitations: Limitations, including flight limitations, which can be applied to the rotorcraft operating conditions before dispatch (*e.g.,* fuel, payload, and Master Minimum Equipment List limitations).

(4) Probabilistic terms: The terms ''improbable'' and ''extremely improbable'' are the same as those used in § 29.1309.

(5) Failure condition: The term ''failure condition'' is the same as that used in § 29.1309; however, these special conditions apply only to system failure conditions that affect the structural performance of the rotorcraft (*e.g.,* system failure conditions that induce loads, change the response of the rotorcraft to inputs such as gusts or pilot actions, or lower flutter margins).

Effects of Systems on Structures

(a) *General.* The following criteria will be used in determining the influence of a system and its failure conditions on the rotorcraft structure.

(b) *System fully operative.* With the system fully operative, the following apply:

(1) Limit loads must be derived in all normal operating configurations of the system from all the limit conditions specified in subpart C (or defined by special condition or equivalent level of safety in lieu of those specified in subpart C), taking into account any special behavior of such a system or associated functions or any effect on the structural performance of the rotorcraft that may occur up to the limit loads. In particular, any significant nonlinearity (rate of displacement of control surface, thresholds or any other system nonlinearities) must be accounted for in a realistic or conservative way when deriving limit loads from limit conditions.

(2) The rotorcraft must meet the strength requirements of part 29 (static strength, residual strength), using the specified factors to derive ultimate loads from the limit loads defined above. The effect of nonlinearities must be investigated beyond limit conditions to ensure the behavior of the system presents no anomaly compared to the behavior below limit conditions. However, conditions beyond limit conditions need not be considered when it can be shown that the rotorcraft has design features that will not allow it to exceed those limit conditions.

(3) The rotorcraft must meet the flutter and divergence requirements of § 29.629.

(c) *System in the failure condition.* For all system failure conditions shown to be not extremely improbable, the following apply:

(1) At the time of occurrence. Starting from 1–g level flight conditions, a realistic scenario, including pilot corrective actions, must be established to determine the loads occurring at the time of failure and immediately after the failure.

(i) For static strength substantiation, these loads multiplied by an appropriate factor of safety that is related to the probability of occurrence of the failure are the ultimate loads that must be considered for design. The factor of safety is defined in Figure 1.

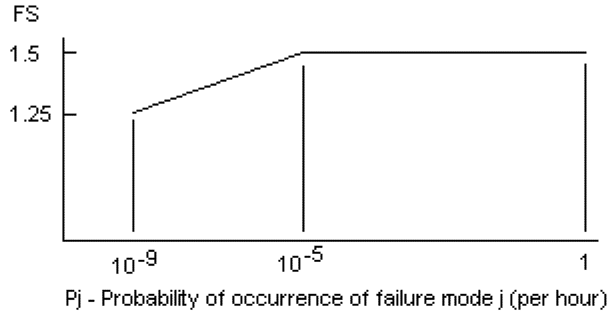

Figure 1: Factor of safety at the time of occurrence

(ii) For residual strength substantiation, the rotorcraft must be able to withstand two-thirds of the ultimate loads defined in paragraph (c)(1)(i) of these special conditions.

(iii) Freedom from flutter and divergence must be shown under all conditions of operation including:

(A) Airspeeds up to 1.11 V_{NE} (power on and power off).

(B) Main rotor speeds from 0.95 multiplied by the minimum permitted speed up to 1.05 multiplied by the maximum permitted speed (power on and power off).

(C) The critical combinations of weight, center of gravity position, load factor, and altitude.

(iv) For failure conditions that result in excursions beyond operating limitations, freedom from flutter and divergence must be shown to increased speeds, so that the margins intended by paragraph (c)(1)(iii) of these special conditions are maintained.

(v) Failures of the system that result in forced structural vibrations (oscillatory failures) must not produce loads that could result in detrimental deformation of primary structure.

(2) For the continuation of the flight. For the rotorcraft in the system failed state, and considering all appropriate reconfiguration and flight limitations, the following apply:

(i) The loads derived from the following conditions (or defined by special conditions or equivalent level of safety in lieu of the following conditions) at speeds up to V_{NE} (power on and power off) (or the speed limitation prescribed for the remainder of the flight) and at the minimum and maximum main rotor speeds, if applicable, must be determined:

(A) The limit maneuvering conditions specified in §§ 29.337 and 29.339.

(B) The limit gust conditions specified in § 29.341.

(C) The limit yaw maneuvering conditions specified in § 29.351.

(D) The limit unsymmetrical conditions specified in § 29.427.

(E) The limit ground loading conditions specified in § 29.473.

(ii) For static strength substantiation, each part of the structure must be able to withstand the loads in paragraph (c)(2)(i) of these special conditions multiplied by a factor of safety depending on the probability of being in this failure state. The factor of safety is defined in Figure 2.

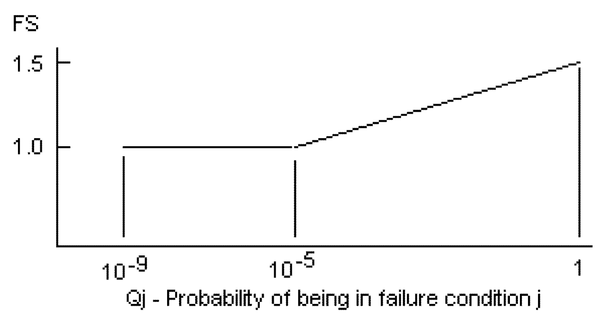

Figure 2: Factor of safety for continuation of flight:

$Q_j = (T_j)(P_j)$

Where:

T_j = Average time spent in failure condition j (in hours)

P_j = Probability of occurrence of failure mode j (per hour)

Note: If P_j is greater than 10^{-3} per flight hour, then a 1.5 factor of safety must be applied to all limit load conditions specified in Subpart C.

(iii) For residual strength substantiation, the rotorcraft must be able to withstand two-thirds of the ultimate loads defined in paragraph (c)(2)(ii) of these special conditions.

(iv) If the loads induced by the failure condition have a significant effect on fatigue or damage tolerance, then their effects must be taken into account.

(v) Freedom from flutter and divergence must be shown up to 1.11 V_{NE} (power on and power off).

(vi) Freedom from flutter and divergence must also be shown up to 1.11 V_{NE} (power on and power off) for all probable system failure conditions combined with any damage required or considered under § 29.571(g) or § 29.573(d)(3).

(3) Consideration of certain failure conditions may be required by other sections of 14 CFR part 29 regardless of calculated system reliability. Where the failure analysis shows the probability of

these failure conditions to be less than 10^{-9}, criteria other than those specified in this paragraph may be used for structural substantiation to show continued safe flight and landing.

(d) *Failure indications.* For system failure detection and indication, the following apply:

(1) The system must be checked for failure conditions, not extremely improbable, that degrade the structural capability below the level required by 14 CFR part 29 or that significantly reduce the reliability of the remaining operational portion of the system. As far as reasonably practicable, the flight crew must be made aware of these failures before flight. Certain elements of the control system, such as mechanical and hydraulic components, may use special periodic inspections, and electronic components may use daily checks, in lieu of detection and indication systems to achieve the objective of this requirement. These other means of detecting failures before flight will become part of the certification maintenance requirements (CMRs) and must be limited to components that are not readily detectable by normal detection and indication systems, and where service history shows that inspections will provide an adequate level of safety.

(2) The existence of any failure condition, shown to be not extremely improbable, during flight that could significantly affect the structural capability of the rotorcraft and for which the associated reduction in airworthiness can be minimized by suitable flight limitations, must be signaled to the flight crew. For example, failure conditions that result in a factor of safety between the rotorcraft strength and the loads of Subpart C below 1.25, or flutter and divergence margins below 1.11 V_{NE} (power on and power off), must be signaled to the crew during flight.

(e) *Dispatch with known failure conditions.* If the rotorcraft is to be dispatched in a known system failure condition that affects structural performance, or that affects the reliability of the remaining operational portion of the system to maintain structural performance, then the provisions of these special conditions must be met, including the provisions of paragraph (b) for the dispatched condition and paragraph (c) for subsequent failures. Expected operational limitations may be taken into account in establishing P_j as the probability of failure occurrence for determining the safety margin in Figure 1 of these special conditions. Flight limitations and expected operational limitations may be taken into account in establishing Q_j as the combined probability of being in the dispatched failure condition and the subsequent failure condition for the safety margins in Figure 2 of these special conditions. These limitations must be such that the probability of being in this combined failure state and then subsequently encountering limit load conditions is extremely improbable. No reduction in these safety margins is allowed if the subsequent system failure rate is greater than 10^{-3} per hour.

Issued in Fort Worth, Texas, on November 30, 2012.

Lance Gant,

Manager, Rotorcraft Directorate, Aircraft Certification Service.

[FR Doc. 2016–29431 Filed 12–7–16; 8:45 am]

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DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 39

[Docket No. FAA–2016–7267; Directorate Identifier 2016–NM–015–AD; Amendment 39–18723; AD 2016–24–06]

RIN 2120–AA64

Airworthiness Directives; Bombardier, Inc. Airplanes

AGENCY: Federal Aviation Administration (FAA), Department of Transportation (DOT).

ACTION: Final rule.

SUMMARY: We are adopting a new airworthiness directive (AD) for certain Bombardier, Inc. Model DHC–8–102, –103, and –106 airplanes, Model DHC–8–200 series airplanes, and Model DHC–8–300 series airplanes. This AD was prompted by several occurrences of loss of airspeed data on both pilot and co-pilot air speed indicators due to the accumulation of ice on the pitot probes caused by inoperative pitot probe heaters. This AD requires replacing the existing circuit breakers in the pitot heater system. We are issuing this AD to address the unsafe condition on these products.

DATES: This AD is effective January 12, 2017.

The Director of the Federal Register approved the incorporation by reference of certain publications listed in this AD as of January 12, 2017.

ADDRESSES: For service information identified in this final rule, contact Bombardier, Inc., Q-Series Technical Help Desk, 123 Garratt Boulevard, Toronto, Ontario M3K 1Y5, Canada; telephone: 416–375–4000; fax: 416–375–4539; email: *thd.qseries@aero.bombardier.com;* Internet: *http://www.bombardier.com.* You may view this referenced service information at the FAA, Transport Airplane Directorate, 1601 Lind Avenue SW., Renton, WA. For information on the availability of this material at the FAA, call 425–227–1221. It is also available on the Internet at *http://www.regulations.gov* by searching for and locating Docket No. FAA–2016–7267.

Examining the AD Docket

You may examine the AD docket on the Internet at *http://www.regulations.gov* by searching for and locating Docket No. FAA–2016–7267; or in person at the Docket Management Facility between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays. The AD docket contains this AD, the regulatory evaluation, any comments received, and other information. The street address for the Docket Office (telephone 800–647–5527) is Docket Management Facility, U.S. Department of Transportation, Docket Operations, M–30, West Building Ground Floor, Room W12–140, 1200 New Jersey Avenue SE., Washington, DC 20590.

FOR FURTHER INFORMATION CONTACT: Assata Dessaline, Aerospace Engineer, Avionics and Services Branch, ANE–172, FAA, New York Aircraft Certification Office (ACO), 1600 Stewart Avenue, Suite 410, Westbury, NY 11590; telephone: 516–228–7301; fax: 516–794–5531.

SUPPLEMENTARY INFORMATION:

Discussion

We issued a notice of proposed rulemaking (NPRM) to amend 14 CFR part 39 by adding an AD that would apply to certain Bombardier, Inc. Model DHC–8–102, –103, and –106 airplanes, Model DHC–8–200 series airplanes, and Model DHC–8–300 series airplanes. The NPRM published in the **Federal Register** on June 28, 2016 (81 FR 41897) (''the NPRM'').

Transport Canada Civil Aviation (TCCA), which is the aviation authority for Canada, has issued Canadian AD CF–2016–04, dated February 1, 2016 (referred to after this as the Mandatory Continuing Airworthiness Information, or ''the MCAI''), to correct an unsafe condition for certain Bombardier, Inc. Model DHC–8–102, –103, and –106 airplanes, Model DHC–8–200 series airplanes, and Model DHC–8–300 series airplanes. The MCAI states: