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DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 29

[Docket No. FAA-2017-1127; Notice No. 29-044-SC]

Special Conditions: Bell Helicopter Textron, Inc. (BHTI), Model 525 Helicopters; Flight Envelope Protection

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) flight envelope protection. 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 November 13, 2018.

FOR FURTHER INFORMATION CONTACT: George Harrum, Aerospace Engineer, FAA, Rotorcraft Standards Branch, Policy and Innovation Division, 10101 Hillwood Pkwy., Fort Worth, TX 76177; telephone (817) 222-4087; email George.Harrum@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 Model 525 is a medium twin-engine rotorcraft. The design maximum takeoff weight is 20,500 pounds, with a maximum capacity of 19 passengers and a crew of 2.

The BHTI Model 525 helicopter will be equipped with a four axis full authority digital FBW FCS that provides for aircraft control through pilot input and coupled flight director modes. The FBW FCS will contain an advanced flight control system that will alter the nominal flight control laws to ensure that the aircraft remains in a predetermined flight envelope. These Flight Envelope Protection (FEP) features prevent the pilot or autopilot functions from making control commands that would force the aircraft to exceed its structural, aerodynamic, or operating limits. The design and construction standards, specifically 14 CFR Section 29.779(a), require that movement of the flight controls results in a corresponding sense of aircraft motion in the same axis. The airworthiness standards for an automatic pilot system in Section 29.1329 covers design requirements for basic operation of the system but does not address dynamic flight envelope limitations imposed by the automatic pilot system. Currently there are no specific airworthiness requirements that address FBW FCS FEP in rotorcraft. The special conditions will require the minimum safety standard for the FEP 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 31, 2013, the effective 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 incorporating FEP features. FEP is used to prevent the pilot or an autopilot from making control commands that would force the rotorcraft to exceed its structural, aerodynamic, or operating limits. To accomplish this envelope limiting, the FCS control laws change as the limit is approached or exceeded.

Discussion

These special conditions require the minimum safety standard for the flight envelope protection features. The FEP features must meet requirements for handling qualities, compatibility of flight parameter limit values, response to dynamic maneuvering, and failure modes.

Discussion of Comments

Notice of proposed special conditions No. 29-044-SC for the BHTI Model 525 helicopter was published in the **Federal Register** on June 6, 2018 (83 FR 26226). No comments were received, and the special conditions are adopted as proposed.

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:

Flight Envelope Protection

The Flight Envelope Protection (FEP) features of the flight control system (FCS) must meet the following requirements:

a. Onset characteristics of each envelope protection feature must be smooth, appropriate to the phase of flight and type of maneuver, and not in conflict with the ability of the pilot to satisfactorily change rotorcraft flight path, speed, or attitude within the approved flight envelope.

b. Limit values of protected flight parameters (and if applicable, associated warning thresholds) must be compatible with:

1. Rotorcraft structural limits;
2. Safe and controllable maneuvering of the rotorcraft;

3. Margins to critical conditions. Dynamic maneuvering, airframe and system tolerances (both manufacturing and in-service), and non-steady atmospheric conditions—in any appropriate combination and phase of flight—must not result in a limited flight parameter beyond the nominal design limit value that would cause unsafe flight characteristics;

4. Rotor rotational speed limits;
5. Blade stall limits; and
6. Engine and transmission torque limits.

c. The aircraft must be responsive to pilot-commanded dynamic maneuvering within a suitable range of the parameter limits that define the approved flight envelope.

d. The FEP system must not create unusual or adverse flight characteristics when atmospheric conditions or unintentional pilot action causes the approved flight envelope to be exceeded.

e. When simultaneous envelope limiting is active, adverse coupling or adverse priority must not result.

f. Following a single FEP failure shown to not be extremely improbable, the rotorcraft must:

1. Be capable of continued safe flight and landing;

2. Be capable of initial counteraction of malfunctions without requiring exceptional pilot skill or strength;

3. Be controllable and maneuverable when operated with a degraded FCS, within a practical flight envelope identified in the Rotorcraft Flight Manual;

4. Be capable of prolonged instrument flight without requiring exceptional pilot skill;

5. Meet the controllability and maneuverability requirements of 14 CFR part 29 Subpart B throughout a practical flight envelope; and

6. Be safely controllable following any additional failure or malfunction shown to not be extremely improbable occurring within the approved flight envelope.

Issued in Fort Worth, Texas, on October 3, 2018.

Jorge Castillo,

Acting Manager, Rotorcraft Standards Branch, Policy and Innovation Division, Aircraft Certification Services.

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DEPARTMENT OF TRANSPORTATION**Federal Aviation Administration****14 CFR Part 29**

[Docket No.FAA–2017–1128; Notice No. 29–045–SC]

Special Conditions: Bell Helicopter Textron, Inc. (BHTI), Model 525 Helicopters; Control Margin Awareness

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 the fly-by-wire flight control system (FBW FCS) in the area of pilot awareness of the control margins remaining while maneuvering the helicopter. 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 November 13, 2018.

FOR FURTHER INFORMATION CONTACT: George Harrum, Aerospace Engineer,

FAA, Rotorcraft Standards Branch, Policy and Innovation Division, 10101 Hillwood Pkwy., Fort Worth, TX 76177; telephone (817) 222–4087; email George.Harrum@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 Model 525 is a medium twin-engine rotorcraft. The design maximum takeoff weight is 20,500 pounds, with a maximum capacity of 19 passengers and a crew of 2.

The BHTI Model 525 helicopter will be equipped with a four-axis full authority digital FBW FCS that provides for aircraft control through pilot input and coupled flight director modes. The current 14 CFR part 29 regulations do not contain adequate standards for FBW FCS with respect to control margin awareness. The airworthiness standards for controllability and maneuverability of the rotorcraft are contained in § 29.143. These controllability requirements are compatible with most FBW systems, while most of the maneuverability requirements are not affected by FBW systems, except for the control margins. One of the purposes of the rule is to ensure that control margins (at the rotor and the anti-torque system level) are sufficient in the defined flight envelope to avoid loss of control (that is, the rotorcraft has adequate control power for the pilot to exit potentially hazardous flight conditions). Implicit in this purpose is that the pilot is provided with sufficient awareness of proximity to control limits. Because § 29.143 was written to address hydro-mechanical flight control systems, through which pilot awareness of control margins is provided by cyclic and pedal position relative to cockpit control stops, the rule is inadequate for certification of a FBW FCS, where there is no mechanical link between the inceptor and the receptor. Without a constant correlation between cockpit control and main or tail rotor actuator positions, the FCS may not provide tactile control margin feedback to the pilot through cockpit control position relative to the control position physical stop or limit, for all flight conditions. The special conditions will require the minimum safety standard to ensure awareness of proximity to control limits at the main rotor and tail rotor is provided to pilots of the Bell Model 525 helicopter.

Type Certification Basis

Under the provisions of 14 CFR 21.17, BHTI must show that the Model 525 helicopter meets the applicable