DEP

Federal Aviation Administration

14 CFR Part 25

[Docket No. FAA-2021-1032; Notice No. 25-23-03-SC]

Special Conditions: Airbus Model A321neo XLR Airplanes; Flight Envelope Protection, Icing and Non-icing Conditions; High Incidence Protection.

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of proposed special conditions.

SUMMARY: This action proposes special conditions for the Airbus Model A321neo XLR airplane. The airplane will have a novel or unusual design feature when compared to the state of technology envisioned in the airworthiness standards for transport-category airplanes. This design feature is associated with flight-envelope protections, in icing and non-icing conditions, that use high-incidence protection and an alpha-floor system to automatically advance throttles when the airplane angle of attack reaches a predetermined value. 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: Send comments on or before **[INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**.

ADDRESSES: Send comments identified by Docket No. FAA-2021-1032 using any of the following methods:

Federal eRegulations Portal: Go to https://www.regulations.gov/ and follow the online instructions for sending your comments electronically.

Mail: Send comments to Docket Operations, M-30, U.S. Department of Transportation (DOT), 1200 New Jersey Avenue, SE, Room W12-140, West Building Ground Floor, Washington, DC, 20590-0001.

Hand Delivery or Courier: Take comments to Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE, Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

Fax: Fax comments to Docket Operations at 202-493-2251.

Docket: Background documents or comments received may be read at https://www.regulations.gov/ at any time. Follow the online instructions for accessing the docket or go to Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE, Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: Troy Brown, Performance and Environment Unit, AIR-621A, Technical Policy Branch, Policy and Standards Division, Aircraft Certification Service, Federal Aviation Administration, 1801 S. Airport Rd., Wichita, KS 67209-2190; telephone and fax 405-666-1050; e-mail troy.a.brown@faa.gov.

SUPPLEMENTARY INFORMATION:

Comments Invited

The FAA invites interested people to take part in this rulemaking by sending written comments, data, or views. The most helpful comments reference a specific portion of the proposed special conditions, explain the reason for any recommended change, and include supporting data.

Certification of the Airbus Model A321neo XLR airplane is currently scheduled for December 2023. The substance of these special conditions, in all material respects, has been subject to the notice and public-comment procedure in several prior instances. Therefore, because a delay would significantly affect the applicant's installation of the

novel or unusual design feature, and delay certification of the airplane, the FAA is reducing the public-comment period to 30 days.

The FAA will consider all comments received by the closing date for comments, and will consider comments filed late if it is possible to do so without incurring delay. The FAA may change these special conditions based on the comments received.

Privacy

Except for Confidential Business Information (CBI) as described in the following paragraph, and other information as described in title 14, Code of Federal Regulations (14 CFR) 11.35, the FAA will post all comments received without change to https://www.regulations.gov/, including any personal information you provide. The FAA will also post a report summarizing each substantive verbal contact received about these special conditions.

Confidential Business Information

Confidential Business Information (CBI) is commercial or financial information that is both customarily and actually treated as private by its owner. Under the Freedom of Information Act (FOIA) (5 U.S.C. 552), CBI is exempt from public disclosure. If your comments responsive to these special conditions contain commercial or financial information that is customarily treated as private, that you actually treat as private, and that is relevant or responsive to these special conditions, it is important that you clearly designate the submitted comments as CBI. Please mark each page of your submission containing CBI as "PROPIN." The FAA will treat such marked submissions as confidential under the FOIA, and the indicated comments will not be placed in the public docket of these special conditions. Send submissions containing CBI to the individual listed in the For Further Information Contact section below. Comments the FAA receives, which are not specifically designated as CBI, will be placed in the public docket for these special conditions.

Background

On September 16, 2019, Airbus applied for an amendment to Type Certificate No. A28NM to include the new Model A321neo XLR airplane. These airplanes are twin-engine, transport-category airplanes with seating for 244 passengers and a maximum take-off weight of 222,000 pounds.

Type Certification Basis

Under the provisions of 14 CFR 21.101, Airbus must show that the Model A321neo XLR airplane meets the applicable provisions of the regulations listed in Type Certificate No. A28NM, or the applicable regulations in effect on the date of application for the change, except for earlier amendments as agreed upon by the FAA.

If the Administrator finds that the applicable airworthiness regulations (e.g., 14 CFR part 25) do not contain adequate or appropriate safety standards for the Airbus Model A321neo XLR airplanes 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 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, these special conditions would also apply to the other model under § 21.101.

In addition to the applicable airworthiness regulations and special conditions, the Airbus Model A321neo XLR airplane 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.

The FAA issues special conditions, as defined in § 11.19, in accordance with § 11.38, and they become part of the type certification basis under 14 CFR 21.101.

Novel or Unusual Design Features

The Airbus Model A321neo XLR airplane will incorporate the following novel or unusual design feature:

Flight-envelope protections, in icing and non-icing conditions, that use high-incidence protection and an alpha-floor function to automatically advance throttles when the airplane angle of attack (AoA) reaches a predetermined value.

Discussion

The current airworthiness standards do not contain adequate safety standards for the high-incidence protection system and the alpha-floor system for the Airbus Model A321neo XLR series airplanes. This is because the current standards were designed for more traditional electronic flight control systems (EFCS), which involve less advanced envelope protections, such as stick shakers and pushers. These special conditions address the more advanced flight envelope protections, including icing and non-icing conditions, that are part of the EFCS design of the A321neo XLR airplane.

The high-incidence protection system prevents the airplane from stalling and, therefore, the stall warning system is not needed during normal flight conditions. However, during failure conditions, which are not shown to be extremely improbable, the requirements of 14 CFR 25.203 and 25.207 apply, although slightly modified. If there are failures not shown to be extremely improbable, the flight characteristics at the angle-of-attack for C_{LMAX} must be suitable in the traditional sense, and stall warning must be provided in a conventional manner-. These special conditions address the need for modification during icing conditions and non-icing conditions

The alpha-floor function automatically advances the throttles on the operating engines under flight circumstances of low speed if the airplane reaches a predetermined high AoA. This function is intended to provide increased climb capability.

These special conditions address these novel or unusual design features on the Airbus Model A321neo XLR and 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.

Applicability

As discussed above, these special conditions apply to Airbus Model A321neo XLR airplane. Should Airbus apply later 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 series of airplanes. It is not a rule of general applicability.

List of Subjects in 14 CFR Part 25

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

Authority Citation

The authority citation for these special conditions is as follows:

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

The Proposed Special Conditions

Accordingly, the Federal Aviation Administration (FAA) proposes the following special conditions as part of the type certification basis for Airbus Model A321neo XLR airplane. These special conditions are issued in lieu of the paragraphs of 14 CFR part 25 referenced below.

Foreword

In the following paragraphs, “In icing conditions” means with the ice accretions, relevant for the flight phase, as defined in part 25, amendment 121, appendix C.

(a) Definitions

These special conditions address novel or unusual design features of the Airbus A321neo XLR and use terminology that does not appear in part 25. For the purpose of these special conditions, the following terms describe certain aspects of these novel or unusual design features:

High-Incidecnce Protection System Angle-of-Attack Limiting Function

A system that operates directly and automatically on the airplane's flying controls to limit the maximum angle of attack (AoA) that can be attained to a value below that at which an aerodynamic stall would occur.

Alpha-floor system

A system that automatically increases thrust on the operating engines when AoA increases through a particular value.

Alpha limit

The maximum angle of attack at which the airplane stabilizes with the high-incidence protection system operating and the longitudinal control held on its aft stop.

V_{CLmax}

An airspeed calculated from a variety of factors, including load factor normal to the flight path at V_{CLmax}, airplane gross weight, aerodynamic reference wing area, and dynamic pressure.

V_{min}

The minimum steady flight speed in the airplane configuration under consideration with the high-incidence protection system operating.

V_{min1g}

V_{min} corrected to 1g conditions. This is the minimum calibrated airspeed at which the airplane can develop a lift force normal to the flight path and equal to its weight when at an angle of attack not greater than that determined for V_{min}.

(b) Capability and Reliability of the High-Incidence Protection System.

Acceptable capability and reliability of the high-incidence protection system can be established by flight test, simulation, and analysis, as appropriate. The capability and reliability required are as follows:

(1) It must not be possible, during pilot-induced maneuvers, to encounter a stall; and handling characteristics must be acceptable, as required by condition (e) of these Special Conditions.

(2) The airplane must be protected against stalling due to the effects of wind-shears and gusts at low speeds as required by condition (f) of these Special Conditions.

(3) The ability of the high-incidence protection system to accommodate any reduction in stalling incidence must be verified in icing conditions.

(4) The high-incidence protection system must be provided in each abnormal configuration of the high-lift devices that are likely to be used in-flight following system failures.

(5) The reliability of the system and the effects of failures must be acceptable in accordance with § 25.1309.

(c) Minimum Steady Flight Speed and Reference Stall Speed.

In lieu of § 25.103, minimum steady flight speed and reference stall speed, the following requirements apply:

(1) The minimum steady flight speed, V_{min}, is the final stabilized calibrated airspeed obtained when the airplane is decelerated until the longitudinal control is on its stop in such a way that the entry rate does not exceed 1 knot per second.

(2) The minimum steady flight speed, V_{min}, must be determined in icing and non-icing conditions with:

(i) The high-incidence protection system operating normally;

(ii) Idle thrust and alpha-floor system inhibited;

(iii) All combinations of flaps setting and landing gear position for which V_{min} is required to be determined;

(iv) The weight used when the reference stall speed, V_{SR}, is being used as a factor to determine compliance with a required performance standard;

(v) The most unfavorable center of gravity allowable; and

(vi) The airplane trimmed for straight flight at a speed achievable by the automatic trim system.

(3) The 1g minimum steady flight speed, V_{min1g}, is the minimum calibrated airspeed at which the airplane can develop a lift force (normal to the flight path) equal to its weight, while at an angle of attack not greater than that at which the minimum steady flight speed of condition (c)(1), above, was determined. It must be determined in icing and non-icing conditions.

(4) The reference stall speed, V_{SR}, is a calibrated airspeed the applicant defines. V_{SR} may not be less than a 1g stall speed. V_{SR} must be determined in non-icing conditions and expressed as:

$$V_{SR} \geq \frac{V_{CL_{MAX}}}{\sqrt{n_{zw}}}$$

Where:

V_{CLmax} = Calibrated airspeed obtained when the load factor corrected lift coefficient (n_{zw} W/qS) is first a maximum during the maneuver prescribed in condition (c)(5)(viii) of these Special Conditions;

n_{zw} = Load factor normal to the flight path at V_{CLmax};

W = Airplane gross weight;

S = Aerodynamic reference wing area; and

q = Dynamic pressure.

(5) V_{CLmax} is determined in non-icing conditions with:

(i) Engines idling, or, if that resultant thrust causes an appreciable decrease in stall speed, not more than zero thrust at the stall speed;

(ii) The airplane in other respects (such as flaps and landing gear) in the condition existing in the test or performance standard in which V_{SR} is being used;

(iii) The weight used when V_{SR} is being used as a factor to determine compliance with a required performance standard;

(iv) The center of gravity position that results in the highest value of reference stall speed;

(v) The airplane trimmed for straight flight at a speed achievable by the automatic trim system, but not less than 1.13 V_{SR} and not greater than 1.3 V_{SR};

(vi) Alpha-floor system inhibited; and

(vii) The high-incidence protection system adjusted, at the option of the applicant, to allow higher incidence than is possible with the normal production system.

(viii) Starting from the stabilized trim condition, apply the longitudinal control to decelerate the airplane so that the speed reduction does not exceed 1 knot per second.

(d) Stall Warning.

In lieu of § 25.207, the following requirements apply:

(1) Normal Operation.

If the capabilities of the high-incidence protection system are met, then condition (b) of these Special Conditions are satisfied. These conditions provide an equivalent level of safety to § 25.207, Stall Warning, so the provision of an additional, unique warning device is not required.

(2) High-Incidence Protection System Failure.

(i) In non-icing conditions, following failures of the high-incidence protection system, not shown to be extremely improbable, such that the capability of the system no

longer satisfies conditions (b)(1), (2), and (3) of these Special Conditions, stall warning must be provided in accordance with § 25.207(a), (b), and (f).

(ii) In icing conditions, after a failure leading to the loss of the high-incidence protection system, a safety margin not less than 3 percent or 3 knots between stall warning and stall must be maintained.

(e) Handling Characteristics at High Incidence.

(1) High Incidence Handling Demonstrations.

In lieu of § 25.201: High-incidence handling demonstration in icing and non-icing conditions:

(i) Maneuvers to the limit of the longitudinal control, in the nose up sense, must be demonstrated in straight flight and in 30-degree banked turns with:

(A) The high-incidence protection system operating normally.

(B) Initial power conditions of:

(1) Power off.

(2) The power necessary to maintain level flight at 1.5 V_{SR1}, where V_{SR1} is the reference stall speed with flaps in approach position, the landing gear retracted, and maximum landing weight.

(C) Alpha-floor system operating normally unless more severe conditions are achieved with inhibited alpha floor.

(D) Flaps, landing gear, and deceleration devices in any likely combination of positions.

(E) Representative weights within the range for which certification is requested; and

(F) The airplane trimmed for straight flight at a speed achievable by the automatic trim system.

(ii) The following procedures must be used to show compliance in non-icing and icing conditions:

(A) Starting at a speed sufficiently above the minimum steady flight speed to ensure that a steady rate of speed reduction can be established, apply the longitudinal control so that the speed reduction does not exceed 1 knot per second until the control reaches the stop.

(B) The longitudinal control must be maintained at the stop until the airplane has reached a stabilized flight condition, and must then be recovered through normal recovery techniques.

(C) Maneuvers with increased deceleration rates:

(1) In non-icing conditions, the requirements must also be met with increased rates of entry to the incidence limit, up to the maximum rate achievable.

(2) In icing conditions, with the anti-ice system working normally, the requirements must also be met with increased rates of entry to the incidence limit up to 2 knots per second.

(D) Maneuvers with ice accretion prior to operation of the normal anti-ice system: With the ice accretion prior to operation of the normal anti-ice system, the requirement must also be met in deceleration at 1 knot per second up to full back stick maintained for at least 3 seconds before normal recovery is performed (requirement to be met with and without alpha floor operating).

(2) Characteristics in High-Incidence Maneuvers.

In lieu of § 25.203: Characteristics in High Incidence.

In icing and non-icing conditions:

(i) Throughout maneuvers with a rate of deceleration of not more than 1 knot per second, both in straight flight and in 30-degree banked turns, the airplane's characteristics must be as follows:

(A) The airplane must not exhibit abnormal nose-up pitching.

(B) The airplane must not exhibit uncommanded nose-down pitching, which would be indicative of stall. However, reasonable attitude changes associated with stabilizing the incidence at alpha limit, as the longitudinal control reaches the stop, would be acceptable.

(C) The airplane must not exhibit uncommanded lateral or directional motion, and the pilot must retain good lateral and directional control through conventional use of the controls, throughout the maneuver.

(D) Buffeting:

(1) In non-icing conditions, the airplane must not exhibit buffeting of a magnitude and severity that would act as a deterrent from completing the maneuver specified in condition (e)(1)(i) of these Special Conditions.

(2) In icing conditions, the airplane may exhibit buffeting of a stronger magnitude and severity than in non-icing conditions, provided that the airplane is demonstrated to be free from excessive vibration and buffeting over the range of speeds adequate for normal operation.

(ii) In maneuvers with increased rates of deceleration, some degradation of characteristics are acceptable, associated with a transient excursion beyond the stabilized alpha limit. However, the airplane must not exhibit dangerous characteristics, nor characteristics that would deter the pilot from holding the longitudinal control on the stop for a period of time appropriate to the maneuver.

(iii) The pilot must always be able to reduce incidence through conventional use of the controls.

(iv) The rate at which the airplane can be maneuvered from trim speeds associated with scheduled operating speeds such as V_2 and V_{ref}, up to alpha limit, must not be unduly damped or be significantly slower than can be achieved on conventionally controlled transport airplanes.

(3) Characteristics up to V_{CLmax}.

Maneuvers with a rate of deceleration of not more than 1 knot per second, up to the angle of attack at which V_{CLmax} was obtained as defined in condition (c)(4) of these Special Conditions, must be demonstrated in straight flight and in 30-degree banked turns with:

(i) The high-incidence protection system deactivated or adjusted, at the option of the applicant, to allow higher incidence than is possible with the normal production system,

(ii) Alpha-floor system inhibited,

(iii) Engines idling,

(iv) Flaps and landing gear in any likely combination of positions, and

(v) The airplane trimmed for straight flight at a speed achievable by the automatic trim system.

During such maneuvers, the airplane must not exhibit dangerous characteristics; the pilot must always be able to reduce angle of attack by conventional use of the controls. The pilot must retain good lateral and directional control, by conventional use of the controls, throughout the maneuver.

(f) Atmospheric Disturbances.

Operation of the high-incidence protection system must not adversely affect airplane control during expected levels of atmospheric disturbances, nor impede the application of recovery procedures in case of wind shear. This must be demonstrated in non-icing conditions only, and must allow for drawing conclusion for icing conditions without further demonstration.

(g) Speed associated with other requirements.

The design must meet the following modified requirements:

a. Section 25.145(a): V_{min} in lieu of "stall identification."

b. Section 25.145(b): V_{min} in lieu of V_{sw}.

c. Section 25.1323(d): "From 1.23 V_{SR} to V_{min}" in lieu of "1.23 V_{SR} to stall warning speed" and "speeds below V_{min}" in lieu of "speeds below stall warning."

(h) Alpha floor

In icing and non-icing conditions, the alpha-floor setting must be such that the airplane can be flown at the speeds and bank angles specified in § 25.143(h). The applicant also must show that the alpha-floor setting does not interfere with normal maneuvering of the airplane. In addition, the airplane must exhibit no alpha-floor triggering unless appropriate when the airplane is flown in usual operational maneuvers and in turbulence.

(i) Proof of compliance

In addition to the requirements in § 25.21(b), the following requirement applies:

The flying qualities will be evaluated at the most unfavorable center-of-gravity (CG) position.

(j) Performance in Icing Conditions

(1) Take-off

In lieu of compliance with § 25.105(a)(2)(i), the following special conditions apply:

(a) In icing conditions, if in the configuration used in showing compliance with § 25.121(b), and with the most critical of the "Take-off Ice" accretion(s) defined in 14 CFR part 25, amendment 121, appendix C:

(i) The V_2 speed scheduled in non-icing conditions does not provide the maneuvering capability specified in § 25.143(h) for the take-off configuration.

NOTE: This requirement does not apply if the $V_{min}1g$ is increased in icing conditions, with the "Take-off Ice" accretion defined in part 25, amendment 121, appendix C, by less than 2.5 knots or 2.5 percent, whichever is greater.

(2) Climb: one-engine inoperative.

In lieu of compliance with § 25.121(b)(2)(ii)(A), the following special conditions apply:

(a) In icing conditions, with the most critical of the take-off ice accretion(s) defined in appendix C, if in the configuration used to show compliance with § 25.121(b) with this take-off ice accretion:

(i) The V_2 speed scheduled in non-icing conditions does not provide the maneuvering capability specified in § 25.143(h), for the take-off configuration.

NOTE: This requirement does not apply if the $V_{min}1g$ is increased in icing conditions, with the “Take-off Ice” accretion defined in 14 CFR part 25, amendment 121, appendix C, by less than 2.5 knots or 2.5 percent, whichever is greater.

In lieu of compliance with § 25.121(c)(2)(ii)(A) and (B), the following special conditions apply:

(a) In icing conditions, with the most critical of the final take-off ice accretion(s) defined in appendix C , if in the configuration used to show compliance with § 25.121(b) with the take-off ice accretion used to show compliance with § 25.111(c)(5)(i):

(i) The V_{FTO} (final take-off speed) scheduled in non-icing conditions does not provide the maneuvering capability, specified in § 25.143(h), for the en-route configuration.

NOTE: This requirement does not apply if the $V_{min}1g$ is increased in icing conditions, with the “Final Take-off Ice” accretion defined in 14 CFR part 25, amendment 121, appendix C, by less than 2.5 knots or 2.5 percent, whichever is greater.

(ii) The degradation of the gradient of climb, determined in accordance with § 25.121(b), with the take-off ice accretion used in showing compliance with § 25.111(c)(5)(i), is greater than one-half of the applicable actual-to-net take-off flight path gradient reduction defined in § 25.115(b);

In lieu of compliance with 25.121(d)(2)(ii), the following special conditions apply:

(a) In icing conditions, with the most critical of the approach ice accretion(s) defined in 14 CFR part 25, amendment 121, appendix C, as applicable, in a configuration corresponding to the normal all-engines-operating procedure, the $V_{min}1g$ for this configuration does not exceed 110 percent of the $V_{min}1g$ for the related all-engines-operating landing configuration in icing conditions, with a climb speed established with

normal landing procedures, but not more than 1.4 V_{SR} (V_{SR} determined in non-icing conditions).

(3) En-route flight paths.

In lieu of compliance with 25.123(b)(2)(i), the following special conditions apply:

(a) In icing conditions with the most critical of the en-route ice accretion(s) defined in 14 CFR part 25, amendment 121, appendix C, if:

(i) The V_{FTO} speed scheduled in non-icing conditions does not provide the maneuvering capability, specified in § 25.143(h), for the en-route configuration.

Issued in in Kansas City, Missouri, on October 27, 2023.

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