



[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 23

Docket No.FAA-2013-0650; Notice No. 23-13-01-SC

Special Conditions: Eclipse, EA500, Certification of Autothrottle Functions

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final special conditions.

SUMMARY: These special conditions are issued for the Eclipse EA500 airplane. This airplane as modified by Innovative Solutions and Support (IS&S) will have a novel or unusual design feature(s) associated with the autothrottle system (ATS). 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: The effective date of these special conditions is September 11, 2013.

FOR FURTHER INFORMATION CONTACT: Mark S. Orr, FAA, Programs and Procedures Branch, ACE-114, Small Airplane Directorate, Aircraft Certification Service, 901 Locust; Kansas City, Missouri 64106; telephone (816) 329-4151; facsimile (816) 329-4090.

SUPPLEMENTARY INFORMATION:

Background

On April 15, 2011, Innovative Solutions and Support (IS&S) applied for a supplemental type certificate for an update to the aircraft software to activate the previously installed autothrottle provisions in the EA500. The EA500 is a pressurized monoplane with provisions for up to six persons (standard seating five people) and may be operated as a single or two pilot aircraft (reference Minimum Flight Crew Limitation, AFM 06-122204 Rev 4 section 2-4). The airplane is operated under 14 CFR part 91 with standard systems installed and under 14 CFR part 135 with additional equipment installed. The Eclipse Model EA500 was certificated under part 23 by the FAA on September 30, 2006 (Type Certificate A00002AC) with autothrottle provisions (i.e., motors and controls) installed yet rendered inactive through “collaring” of the ATS motor Electronic Circuit Breaker (ECB). Under the original Type Certification program, no certification credit was received nor the regulatory basis established for the autothrottle functions of the Eclipse Model EA500 aircraft.

Current part 23 airworthiness regulations do not contain appropriate safety standards for autothrottle system (ATS) installations, so special conditions are required to establish an acceptable level of safety. Part 25 regulations contain appropriate safety standards for these systems, so the intent for this project is to apply the language in § 25.1329 for the autothrottle, substituting § 23.1309 and § 23.143 in place of the similar part 25 regulations referenced in § 25.1329.

Type Certification Basis

Under the provisions of § 21.101, IS&S must show that the EA500, as changed,
continues

to meet the applicable provisions of the regulations incorporated by reference in A00002AC 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 A00002AC are as follows:

14 CFR Part 23 through Amendment 55 (except 14 CFR 23.1303 Amendment 23-62), Part 34 through Amendment 34-3, and Part 36 through Amendment 36-26.

Special Conditions:

23-128-SC for Engine Fire Extinguishing System

23-121-SC for Electronic Engine Control System

23-112A-SC for High Intensity Radiated Fields (HIRF) Protection

Equivalent Levels of Safety Findings:

ACE-02-19: 14 CFR 23.777(d) and 23.781 Fuel Cutoff Control

ACE-05-32: 14 CFR 23.1545(a) and 23.1581(d) for Indicated Airspeeds

ACE-05-34: 14 CFR 23.181(b), Dynamic Stability

ACE-05-35: 14 CFR 23.1353(h), Storage Battery Design and Installation

ACE-05-36: 14 CFR 23.1323(c), Airspeed Indicating System

ACE-06-01: 14 CFR 23.1545(b)(4), Airspeed Indicator

ACE-06-05: 14 CFR part 23, Appendix H, § H23.5, Installation of an Automatic Power Reserve System

ACE-07-04: 14 CFR 23.1545(b)(4), Airspeed Indicator

ACE-08-12, 14 CFR 23.201(b)(2) Wings Level Stall, and 23.203(a), Turning Flight and Accelerated Turning Stalls for flight into known icing (FIKI)

If the Administrator finds that the applicable airworthiness regulations (i.e., part 23) do not contain adequate or appropriate safety standards for the EA500 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 applicant apply for a supplemental type certificate to modify any other model included on the same type certificate to incorporate 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 EA500 must comply with the fuel vent and exhaust emission requirements of part 34 and the noise certification requirements of part 36.

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 § 21.101.

Novel or Unusual Design Features

The EA500 will incorporate the following novel or unusual design features: Innovative Solutions and Support (IS&S) has applied for a Supplemental Type Certificate (STC) to update the aircraft software for implementation of an autothrottle function on the EA500 aircraft. Included with the software upgrade is the activation of previously installed autothrottle provisions. Since the current part 23 airworthiness regulations do not contain appropriate safety standards for ATS installations, special conditions are required to establish an acceptable level of safety. Part 25 regulations contain appropriate safety standards for these systems, so the intent for this project is to apply the language in § 25.1329 for the autothrottle, substituting § 23.1309 and § 23.143 in place of the similar part 25 regulations referenced in § 25.1329. In addition, proper function of the ATS must be demonstrated according to § 23.1301 in a manner acceptable to the administrator, as prior evaluations of the system components included in the existing type design did not include demonstration of proper installed function on the ground or in the air.

Discussion

Part 23 at this time does not sufficiently address autothrottle technology and safety concerns. Therefore, special conditions must be developed and applied to this project to ensure an acceptable level of safety has been obtained. For approval to use the ATS during flight, the

Eclipse EA500 airplane must demonstrate compliance to the intent of the requirements of § 25.1329, applying the appropriate part 23 references to § 23.1309 (to include performing FHA/SSA to determine the appropriate/applicable Software and Airborne Electronic Hardware assurance levels) and § 23.143 and the following special conditions:

The following special conditions, derived from § 25.1329, are issued for the Eclipse EA500 airplane:

- (a) Quick disengagement controls for the autothrust functions must be provided for each pilot. The autothrust quick disengagement controls must be located on the thrust control levers. Quick disengagement controls must be readily accessible to each pilot while operating the thrust control levers.
- (b) The effects of a failure of the system to disengage the autothrust functions when manually commanded by the pilot must be assessed in accordance with the requirements of Sec. 23.1309
- (c) Engagement or switching of the flight guidance system, a mode, or a sensor may not cause the autothrust system to effect a transient response that alters the airplane's flight path any greater than a minor transient, as defined in paragraph (l)(1) of this section.
- (d) Under normal conditions, the disengagement of any automatic control function of a flight guidance system may not cause a transient response of the airplane's flight path any greater than a minor transient.
- (e) Under rare normal and non-normal conditions, disengagement of any automatic control function of a flight guidance system may not result in a transient any greater than a significant transient, as defined in paragraph (l)(2) of this section.
- (f) The function and direction of motion of each command reference control, such as heading select or vertical speed, must be plainly indicated on, or adjacent to, each control if necessary to prevent inappropriate use or confusion.
- (g) Under any condition of flight appropriate to its use, the flight guidance system may not produce hazardous loads on the airplane, nor create hazardous deviations in the flight path. This applies to both fault-free operation and in the event of a malfunction, and assumes that the pilot begins corrective action within a reasonable period of time.
- (h) When the flight guidance system is in use, a means must be provided to avoid excursions beyond an acceptable margin from the speed range of the normal flight envelope. If the airplane experiences an excursion outside this range, a means must be provided to prevent the flight guidance system from providing guidance or control to an unsafe speed.

(i) The flight guidance system functions, controls, indications, and alerts must be designed to minimize flightcrew errors and confusion concerning the behavior and operation of the flight guidance system. Means must be provided to indicate the current mode of operation, including any armed modes, transitions, and reversions. Selector switch position is not an acceptable means of indication. The controls and indications must be grouped and presented in a logical and consistent manner. The indications must be visible to each pilot under all expected lighting conditions.

(j) Following disengagement of the autothrust function, a caution (visual and auditory) must be provided to each pilot.

(k) During autothrust operation, it must be possible for the flightcrew to move the thrust levers without requiring excessive force. The autothrust may not create a potential hazard when the flightcrew applies an override force to the thrust levers.

(l) For purposes of this section, a transient is a disturbance in the control or flight path of the airplane that is not consistent with response to flightcrew inputs or environmental conditions.

(1) A minor transient would not significantly reduce safety margins and would involve flightcrew actions that are well within their capabilities. A minor transient may involve a slight increase in flightcrew workload or some physical discomfort to passengers or cabin crew.

(2) A significant transient may lead to a significant reduction in safety margins, an increase in flightcrew workload, discomfort to the flightcrew, or physical distress to the passengers or cabin crew, possibly including non-fatal injuries. Significant transients do not require, in order to remain within or recover to the normal flight envelope, any of the following:

(i) Exceptional piloting skill, alertness, or strength.

(ii) Forces applied by the pilot which are greater than those specified in Sec. 23.143(c).

(iii) Accelerations or attitudes in the airplane that might result in further hazard to secured or non-secured occupants.

The applicant must also functionally demonstrate independence between the left and right ATS installation to prove they cannot have a single point failure that is not extremely improbable that inadvertently leads to a loss of thrust, or to substantial uncommanded thrust changes and transients, in both engines simultaneously.

Discussion of Comments

Notice of proposed special conditions No. 23-13-01-SC for the Eclipse EA500 airplane

was published in the Federal Register on July 31, 2013, (78 FR 46295). No comments were received, and the special conditions are adopted as proposed.

Applicability

As discussed above, these special conditions are applicable to the EA500. Should IS&S apply at a later date for a supplemental type certificate to modify any other model included on A00002AC to incorporate 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 EA500 of airplanes. It is not a rule of general applicability and it affects only the applicant who applied to the FAA for approval of these features on the airplane.

List of Subjects in 14 CFR Part 23

Aircraft, Aviation safety, Signs and symbols.

Citation

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 Eclipse EA500 airplanes modified by IS&S.

1. Certification of Autothrottle Functions under Part 23.

The following special conditions, derived from § 25.1329, are issued for the Eclipse

EA500 airplane:

- (a) Quick disengagement controls for the autothrust functions must be provided for each pilot. The autothrust quick disengagement controls must be located on the thrust control levers. Quick disengagement controls must be readily accessible to each pilot while operating the thrust control levers.
- (b) The effects of a failure of the system to disengage the autothrust functions when manually commanded by the pilot must be assessed in accordance with the requirements of Sec. 23.1309
- (c) Engagement or switching of the flight guidance system, a mode, or a sensor may not cause the autothrust system to effect a transient response that alters the airplane's flight path any greater than a minor transient, as defined in paragraph (l)(1) of this section.
- (d) Under normal conditions, the disengagement of any automatic control function of a flight guidance system may not cause a transient response of the airplane's flight path any greater than a minor transient.
- (e) Under rare normal and non-normal conditions, disengagement of any automatic control function of a flight guidance system may not result in a transient any greater than a significant transient, as defined in paragraph (l)(2) of this section.
- (f) The function and direction of motion of each command reference control, such as heading select or vertical speed, must be plainly indicated on, or adjacent to, each control if necessary to prevent inappropriate use or confusion.
- (g) Under any condition of flight appropriate to its use, the flight guidance system may not produce hazardous loads on the airplane, nor create hazardous deviations in the flight path. This applies to both fault-free operation and in the event of a malfunction, and assumes that the pilot begins corrective action within a reasonable period of time.
- (h) When the flight guidance system is in use, a means must be provided to avoid excursions beyond an acceptable margin from the speed range of the normal flight envelope. If the airplane experiences an excursion outside this range, a means must be provided to prevent the flight guidance system from providing guidance or control to an unsafe speed.
- (i) The flight guidance system functions, controls, indications, and alerts must be designed to minimize flightcrew errors and confusion concerning the behavior and operation of the flight guidance system. Means must be provided to indicate the current mode of operation, including any armed modes, transitions, and reversions. Selector switch position is not an acceptable means of indication. The controls and indications must be grouped and presented in a logical and consistent manner. The indications must be visible to each pilot under all expected lighting conditions.
- (j) Following disengagement of the autothrust function, a caution (visual and auditory) must be provided to each pilot.

(k) During autothrust operation, it must be possible for the flightcrew to move the thrust levers without requiring excessive force. The autothrust may not create a potential hazard when the flightcrew applies an override force to the thrust levers.

(l) For purposes of this section, a transient is a disturbance in the control or flight path of the airplane that is not consistent with response to flightcrew inputs or environmental conditions.

(1) A minor transient would not significantly reduce safety margins and would involve flightcrew actions that are well within their capabilities. A minor transient may involve a slight increase in flightcrew workload or some physical discomfort to passengers or cabin crew.

(2) A significant transient may lead to a significant reduction in safety margins, an increase in flightcrew workload, discomfort to the flightcrew, or physical distress to the passengers or cabin crew, possibly including non-fatal injuries. Significant transients do not require, in order to remain within or recover to the normal flight envelope, any of the following:

(i) Exceptional piloting skill, alertness, or strength.

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The applicant must also functionally demonstrate independence between the left and right ATS installation to prove they cannot have a single point failure that is not extremely improbable that inadvertently leads to a loss of thrust, or to substantial uncommanded thrust changes and transients, in both engines simultaneously.

Issued in Kansas City, Missouri, on September 11, 2013.

s/

Earl Lawrence
Manager, Small Airplane Directorate
Aircraft Certification Service

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