



[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 23

[Docket No. FAA-2015-3881; Special Conditions No. 23-267-SC]

Special Conditions: Cirrus Design Corporation, SF50; Full Authority Digital Engine Control (FADEC) System

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final special conditions; request for comments.

SUMMARY: These special conditions are issued for the Cirrus Design Corporation SF50 airplane. This airplane will have a novel or unusual design feature(s) associated with the use of an electronic engine control system instead of a traditional mechanical control system. 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 **[INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER]**.

We must receive your comments by **[INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**

ADDRESSES: Send comments identified by docket number FAA-2015-3881 using any of the following methods:

- Federal eRegulations Portal: Go to <http://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, D.C., 20590-0001.
- Hand Delivery of Courier: Take comments to Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, S.E., Washington, D.C., between 9 a.m., and 5 p.m., Monday through Friday, except Federal holidays.
- Fax: Fax comments to Docket Operations at 202-493-2251.

Privacy: The FAA will post all comments it receives, without change, to <http://regulations.gov>, including any personal information the commenter provides. Using the search function of the docket web site, anyone can find and read the electronic form of all comments received into any FAA docket, including the name of the individual sending the comment (or signing the comment for an association, business, labor union, etc.). DOT's complete Privacy Act Statement can be found in the Federal Register published on April 11, 2000 ([65 FR 19477-19478](#)), as well as at <http://DocketsInfo.dot.gov>.

Docket: Background documents or comments received may be read at <http://www.regulations.gov> at any time. Follow the online instructions for accessing the docket or go to the Docket Operations in Room W12-140 of the West Building Ground Floor at 1200

New Jersey Avenue, SE., Washington, D.C., between 9 a.m., and 5 p.m., Monday through Friday, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: Jeff Pretz, Federal Aviation Administration, Small Airplane Directorate, ACE-111, 901 Locust, Room 301, Kansas City, MO 64106; telephone (816) 329-3239; facsimile (816) 329-4090.

SUPPLEMENTARY INFORMATION:

The FAA has determined, in accordance with 5 U.S.C. 553(b)(3)(B) and 553(d)(3), that notice and opportunity for prior public comment hereon are unnecessary because the substance of these special conditions has been subject to the public comment process in several prior instances with no substantive comments received. The FAA therefore finds that good cause exists for making these special conditions effective upon issuance.

Special condition number	Company/airplane model
23-237-SC	Spectrum Aeronautical Model S-40
23-246-SC	Cirrus Design Corporation Model SF50
23-253-SC	Diamond Aircraft Industries Model DA-40NG

Comments Invited

We invite 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 special conditions, explain the reason for any recommended change, and include supporting data. We ask that you send us two copies of written comments.

We will consider all comments we receive on or before the closing date for comments. We will consider comments filed late if it is possible to do so without incurring expense or delay. We may change these special conditions based on the comments we receive.

Background

On September 9, 2008, Cirrus Design Corporation applied for a type certificate for their new Model SF50. On December 11, 2012, Cirrus Design Corporation requested to revise the SF50 part 23 certification basis to include amendment 23-62. The Cirrus Design Corporation SF50 is a low-wing, seven-seat, single-engine turboprop-powered airplane. It incorporates an Electronic Flight Information System (EFIS), pressurized cabin, retractable gear, and a V-tail. The turboprop engine is mounted on the upper fuselage/tail cone along the aircraft centerline. It is constructed largely of carbon and fiberglass composite materials. Like other Cirrus products, the SF50 includes an airframe ballistic parachute system.

The model SF50 has a maximum operating altitude of 28,000 feet, where it cruises at speeds up to 300 knots true airspeed. Its maximum operating limit speed (V_{MO}) will not exceed 0.62 Mach. The maximum takeoff weight will be at or below 6,000 pounds with a range at economy cruise of roughly 1,000 nautical miles. Cirrus intends for the SF50 to be certified for single-pilot operations under 14 CFR parts 91 and 135 operating rules. The following operating conditions will be included:

- Day and Night VFR
- IFR
- Flight Into Known Icing

The Cirrus Design Corporation SF50 airplane is equipped with a Williams International FJ33-5A turbofan engine, which uses an Electronic Engine Control System (EEC, also commonly referred to as a FADEC) instead of a traditional mechanical control system. Even though the engine control system will be certificated as part of the engine, the installation of an engine with an electronic control system requires evaluation due to critical environmental effects and possible effects on or by other airplane systems. For example, indirect effects of lightning, radio interference with other airplane electronic systems, shared engine and airplane data and power sources.

The regulatory requirements in part 23 for evaluating the installation of complex systems, including electronic systems and critical environmental effects, are contained in §§ 23.1306, Electrical and electronic system lightning protection; 23.1308, High-intensity Radiated Fields (HIRF) Protection; and 23.1309, Equipment, systems, and installations. However, when § 23.1309 was developed, the use of electronic control systems for engines was not envisioned. The integral nature of these systems makes it necessary to ensure the airplane functions included in the EEC are properly evaluated and that the installation does not degrade the EEC reliability, both of which are approved under part 33. Sections 23.1306(a) and 23.1308(a) are applied to the EEC to ensure it remains equivalent to a mechanical system, which is not generally susceptible to the HIRF and lightning environments.

In some cases, the airplane, which the engine is being installed in, will determine a higher classification than the engine controls are certificated for, requiring the EEC systems be analyzed at a higher classification. As of November 2005, EEC special conditions mandated the § 23.1309 classification for loss of EEC control as catastrophic for any airplane. This is not to imply an

engine failure is classified as catastrophic, but that the EEC must provide an equivalent reliability to mechanical engine controls. In addition, §§ 23.1141, Powerplant controls: General, paragraph (e) and 25.901, Powerplant—General—Installation, paragraph (b)(2), are applied to provide the fault tolerant design requirements of turbine engine mechanical controls to the EEC and ensure adequate inspection and maintenance interval of the EEC.

Type Certification Basis

Under the provisions of 14 CFR 21.17, Cirrus Design Corporation must show that the SF50 meets the applicable provisions of part 23, as amended by amendments 23-1 through 23-62 thereto.

If the Administrator finds that the applicable airworthiness regulations (i.e., 14 CFR part 23) do not contain adequate or appropriate safety standards for the SF50 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 SF50 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 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 § 11.19, under § 11.38 and they become part of the type certification basis under § 21.17(a)(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, the special conditions would also apply to the other model.

Novel or Unusual Design Features

The SF50 will incorporate the following novel or unusual design features:

Electronic engine control system

Discussion

As discussed in the summary section, the SF50 makes use of an electronic engine control system instead of a traditional mechanical control system, which is considered a novel design for this type of airplane. The applicable airworthiness regulations do not contain adequate or appropriate safety standards for this design feature. Mandating a structured assessment to determine potential installation issues mitigates the concerns that the addition of an electronic engine control may produce failure conditions not previously considered.

Applicability

As discussed above, these special conditions are applicable to the SF50. Should Cirrus Design Corporation 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 the model SF50 airplanes. 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.

The substance of these special conditions has previously been subjected to the notice and comment period as identified above, and has been derived without substantive change from those previously issued. It is unlikely that prior public comment would result in a significant change from the substance contained herein. Therefore, notice and opportunity for prior public comment

hereon are unnecessary and the FAA finds good cause, in accordance with 5 U.S.C. 553(b)(3)(B) and 553(d)(3), making these special conditions effective upon issuance. The FAA is requesting comments to allow interested persons to submit views that may not have been submitted in response to the prior opportunities for comment described above.

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 and 44701; 14 CFR 21.16 and 21.17; and 14 CFR 11.38 and 11.19.

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 Cirrus Design Corporation SF50 airplane.

1. Full Authority Digital Engine Control (FADEC) System.

a. For electronic engine control system installations, it must be established that no single failure or malfunction or probable combinations of failures of Electronic Engine Control System (EEC) system components will have an effect on the system, as installed in the airplane, that causes the LOTC probability of the system to exceed those allowed in part 33 certification.

b. Electronic engine control system installations must be evaluated for environmental and atmospheric conditions, including lightning. The EEC system lightning and HIRF effects that could result in LOTC must be evaluated in accordance with §§ 23.1306(a) and 23.1308(a).

c. The components of the installation must be constructed, arranged, and installed to ensure their continued safe operation between normal inspections or overhauls.

d. Functions incorporated into any electronic engine control that make it part of any equipment, systems, or installation whose functions are beyond that of basic engine control, and which may also introduce system failures and malfunctions, are not exempt from § 23.1309 and must be shown to meet part 23 levels of safety as derived from § 23.1309. Part 33 certification data, if applicable, may be used to show compliance with any part 23 requirements. If part 33 data is used to substantiate compliance with part 23 requirements, then the applicant must be able to provide this data for showing or compliance.

Issued in Kansas City, Missouri on September 14, 2015.

Mel Johnson
Acting Manager, Small Airplane Directorate
Aircraft Certification Service

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