DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 33

[Docket No. FAA–2017–0171; Special Conditions No. 33–018–SC

Special Conditions: General Electric Company, GE9X Engine Models; Incorporation of Composite Fan Blades

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final special conditions; request for comments.

SUMMARY: These special conditions are issued for the General Electric (GE) GE9X turbofan engine models. These engine models will have novel or unusual design features associated with composite fan blades. The applicable airworthiness regulations do not contain adequate or appropriate safety standards for these design features. 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 April 14, 2017. We must receive your comments by May 1, 2017.

ADDRESSES: Send comments identified by docket number FAA–2017–0171 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, 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.

Privacy: In accordance with 5 U.S.C. 553(c), DOT solicits comments from the public to better inform its rulemaking process. DOT posts these comments, without edit, including any personal information the commenter provides, to *www.regulations.gov,* as described in the system of records notice (DOT/ALL–14 FDMS), which can be reviewed at *www.dot.gov/privacy.*

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, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: For technical questions concerning these special conditions, contact Jay Turnberg, Engine and Propeller Directorate, Aircraft Certification Service, 1200 District Avenue, Burlington, Massachusetts, 01803–5213; telephone (781) 238–7755; facsimile (781) 238–7199; email *Jay.Turnberg@faa.gov.*

SUPPLEMENTARY INFORMATION: The FAA has determined that notice of, and opportunity for prior public comment on, these special conditions is impracticable because these procedures would significantly delay issuance of the Type Certificate approval and thus, delivery of the affected engines.

In addition, the substance of these special conditions has been subjected to the notice and comment period in several prior instances, 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, because a delay would significantly affect the certification of the engine, which is imminent, the FAA has determined that prior public notice and comment are unnecessary and impracticable, and good cause exists for adopting these special conditions.

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 will consider all comments we receive by the closing date for comments. We may change these special conditions based on the comments we receive.

Background

On January 29, 2016, GE applied for a type certificate for their new GE9X turbofan engine models. The High-Bypass-Ratio GE9X engine models incorporate composite fan blades, a novel or unusual design feature. These fan blades have significant material property characteristics differences from conventional, single load path, metallic fan blades. Additionally, they have multiple load path features and/or crack arresting feature capabilities that, during the blade life, may prevent delamination, crack propagation, and/or blade failure.

Because of their novel or unusual design, these fan blades require additional airworthiness standards for GE9X engine type certification, to account for material property and failure mode differences with conventional fan blades. The applicable airworthiness regulations that exist do not contain appropriate safety standards for these new blades. The FAA may allow for application of different fan blade containment requirements, if GE demonstrates improved load path features and/or crack arresting feature capabilities of the new blade design, below the inner annulus flow path line.

Type Certification Basis

Under the provisions of Title 14, Code of Federal Regulations (14 CFR) 21.17, GE must show that the GE9X engine models meet the applicable provisions of part 33, ''Airworthiness Standards, Aircraft Engines,'' dated February 1, 1965, as amended by Amendments 33–1 through 33–34, dated January 5, 2015. The FAA has determined that the applicable airworthiness regulations in part 33 do not contain adequate or appropriate safety standards for the GE9X engine models because of their novel and unusual fan blade design features. Therefore, these special conditions are prescribed under the provisions of 14 CFR 11.19 and 21.16, and will become part of the type certification basis for GE9X engine models in accordance with § 21.17(a)(2).

Special conditions are initially applicable to the engine models for which they are issued. Should the type certificate for that engine model be amended later to include any other engine models that incorporate the same novel or unusual design features, the special conditions would also apply to the other engine models under § 21.101.

In addition to complying with the applicable product airworthiness regulations and special conditions, the GE9X engine models must comply with the fuel venting and exhaust emission requirements of 14 CFR part 34.

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 GE9X engine models will incorporate the following novel or

unusual design features: Composite fan blades. These fan blades will have significant differences in material property characteristics as compared to conventionally designed fan blades using non-composite metallic materials. Composite material designs can incorporate multiple load paths and/or crack arresting features that prevent delamination or crack propagation that could result in blade failure during the blade service life. These blades require additional airworthiness standards for type certification of the GE9X engine models.

Discussion

As discussed in the summary section, the GE9X engine models incorporate composite fan blades instead of conventional, single load path, metallic fan blades, which is a novel or unusual design feature for aircraft engines. The applicable airworthiness regulations do not contain adequate or appropriate safety standards for this design feature.

Applicability

As discussed above, these special conditions are applicable to the GE9X engine models. Should GE apply at a later date for a change to the type certificate to include another model on the same type certificate incorporating the same novel or unusual design features, the special conditions would apply to that model as well.

Conclusion

This action affects only certain novel or unusual design features on GE9X engine models. It is not a rule of general applicability and applies only to GE, who requested FAA approval of this engine feature.

List of Subjects in 14 CFR Part 33

Aircraft, Engines, 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 GE9X engine models.

1. *Special Conditions:* General Electric Company, GE9X Engine Models; Incorporation of Composite Fan Blades. In lieu of the fan blade containment test with the fan blade failing at the outermost retention groove as specified in § 33.94(a)(1), complete the following requirements:

(a) Conduct an engine fan blade containment test with the fan blade failing at the inner annulus flow path line instead of at the outermost retention groove.

(b) Substantiate by test and analysis, or other methods acceptable to the FAA, that a fan disk and fan blade retention system with minimum material properties can withstand, without failure, a centrifugal load equal to two times the maximum load the retention system could experience within approved engine operating limitations. The fan blade retention system includes the portion of the fan blade from the inner annulus flow path line inward to the blade dovetail, the blade retention components, and the fan disk and fan blade attachment features.

(c) Using a procedure approved by the FAA, establish an operating limitation that specifies the maximum allowable number of start-stop stress cycles for the fan blade retention system. The life evaluation must include the combined effects of high-cycle and low-cycle fatigue. If the operating limitation is less than 100,000 cycles, that limitation must be specified in Chapter 5 of the Engine Manual Airworthiness Limitation Section. The procedure used to establish the maximum allowable number of start-stop stress cycles for the fan blade retention system will incorporate the integrity requirements specified in paragraphs (c)(1), (c)(2), and (c)(3) of these special conditions for the fan blade retention system.

(1) An engineering plan which establishes and maintains that the combinations of loads, material properties, environmental influences, and operating conditions, including the effects of parts influencing these parameters, are well known or predictable through validated analysis, test, or service experience.

(2) A manufacturing plan that identifies the specific manufacturing constraints necessary to consistently produce the fan blade retention system with the attributes required by the engineering plan.

(3) A service management plan that defines in-service processes for maintenance and repair of the fan blade retention system, which will maintain attributes consistent with those required by the engineering plan.

(d) Substantiate by test and analysis, or other methods acceptable to the FAA, that the blade design below the inner annulus flow path line provides multiple load paths and/or crack arresting features that prevent delamination or crack propagation to blade failure during the life of the blade.

(e) Substantiate that, during the service life of the engine, the total probability of the occurrence of a hazardous engine effect defined in § 33.75 due to an individual blade retention system failure resulting from all possible causes will be extremely improbable, with (a cumulative calculated probability of failure of less than 10^{-9}) per engine flight hour.

(f) Substantiate by test or analysis that not only will the engine continue to meet the requirements of § 33.75 following a lightning strike on the composite fan blade structure, but that the lightning strike will not cause damage to the fan blades that would prevent continued safe operation of the affected engine.

(g) Account for the effects of in-service deterioration, manufacturing variations, minimum material properties, and environmental effects during the tests and analyses required by paragraphs (b), (c), (d), (e), and (f) of these special conditions.

(h) Propose fleet leader monitoring and field sampling programs that will monitor the effects of engine fan blade usage on fan blade retention system integrity. The programs must be approved by the FAA prior to certification of the GE9X engine models.

(i) Mark each fan blade legibly and permanently with a part number and a serial number.

Issued in Burlington, Massachusetts, on March 23, 2017.

Robert J. Ganley,

Acting Manager, Engine and Propeller Directorate, Aircraft Certification Service.

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DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 95

[Docket No. 31129; Amdt. No. 532]

IFR Altitudes; Miscellaneous Amendments

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final rule

SUMMARY: This amendment adopts miscellaneous amendments to the required IFR (instrument flight rules) altitudes and changeover points for certain Federal airways, jet routes, or direct routes for which a minimum or maximum en route authorized IFR altitude is prescribed. This regulatory