

further ETOPS flight or withdrawn ETOPS approval.

Since we cannot be certain that an airplane approved for ETOPS under the special conditions will have the same maturity at original type certification as an airplane that we have approved based on service experience, our experience with the 777 and 737NG confirms that the five elements of the special conditions, in conjunction with the FAA's normal safety oversight processes, adequately compensate for that uncertainty.

The changes we propose for the engine demonstration test and the airplane demonstration test, including enhanced post-test inspection requirements, are intended to address our experience with the existing ETOPS special conditions, which identified several shortcomings in the original test requirements. We are proposing these changes to more clearly focus the testing on the objective of exposing the engines and airplane to those operating conditions that give us the best chance of identifying underlying major design flaws that could jeopardize ETOPS safety in service. These proposed changes would provide a better evaluation of the design than the existing requirements, including the 1000-cycle airplane flight test as previously conducted.

The FAA therefore proposes to change the purpose of the airplane demonstration test requirement of paragraph (e)(7) from being a demonstration of reliability to a demonstration of airplane capability under the types of ETOPS operational and diversion scenarios being proposed in this notice. The requirements of that airplane demonstration test have been changed accordingly.

Aged Engine Requirement

In response to Boeing's request, the FAA is proposing to delete paragraph (e)(7)(ii), which currently requires the installation of the engine and propulsion system from the 3000-cycle engine demonstration test required by paragraph (e)(6), or another suitable aged engine, on the 1000-cycle demonstration test airplane for a minimum of 500 cycles. Boeing provided the following information in support of its request for deleting the aged engine requirement:

Review of the aged engine data from the baseline 777 program showed that the nature of the findings, which occurred on the aged engines, was not related to the aging of the engines. The findings were related to the variation that occurs during manufacturing, assembly, etc. This lesson learned on

the aged engines is consistent for each engine manufacturers' baseline 777 ETOPS test program.

The lack of findings related to the aging of an engine in the ETOPS flight test program has been demonstrated three times. Based on this consistent demonstration, there is no further need to maintain the requirement for an aged engine in the flight test program. Additionally, flying more airplane/engine combinations will provide increased opportunities for evaluating potential problem areas.

Boeing reported nine events (EE-1 Reports) which occurred during the "aged" engine portions of the 1000-cycle tests for the three baseline engine types, with an explanation of why the aged engine requirement was not necessary in order to identify each failure. Boeing stated that the lack of any EE-1 reports from the post-test inspections is an indication that there were no significant findings from the aged engine testing.

FAA Analysis of Boeing's Proposal: The original intent of the aged engine requirement was to expose the 3000-cycle test engine, or equivalent, to inflight conditions that cannot be simulated in a ground test environment. This would further validate the propulsion system design out to an age beyond 3000 cycles. Boeing data available at the time the ETOPS special conditions were developed indicated that 95% of all new significant failure modes occur on airplane propulsion systems with 3000 cycles or less. That concept is still valid. The lack of specific findings on the aged engine during the 1000-cycle airplane validation test only confirms the validity of the Reliability Assessment Board's conclusion that those baseline 777 engine installations were suitable for 180-minute ETOPS. A number of significant events during the 1000-cycle test program would have jeopardized that conclusion.

The question that the FAA considers to be more relevant is whether or not a greater benefit would come from a more thorough teardown inspection and analysis of the 3000-cycle test engine and propulsion system hardware than from this additional level of validation. In this regard, the FAA agrees with Boeing that other test articles may provide sufficient experience to uncover the majority of age-related problems independent of the additional exposure provided by the 1000-cycle test inflight exposure.

In consideration of the need to perform a detailed analysis of the 3000-cycle test engine and the extra expense of using a parallel 3000-cycle test engine

as "another suitable aged engine," the FAA agrees that the requirement for installation of an aged engine on the ETOPS test airplane can be eliminated provided significantly improved processes are used to analyze the condition of the 3000-cycle test and airplane demonstration test engines at the conclusion of these tests, as being proposed for paragraph (e)(6).

Miscellaneous Amendments

We are also proposing the following revisions.

Re-identification of paragraph (e)(7)(iii) as (e)(7)(iv) and revision of the requirement that the 1000-cycle test airplane be operated and maintained using the recommended operations and maintenance procedures to recognize that more than one test airplane may be used.

Replacement of the reference to the "1000-cycle ETOPS test" with "Airplane Demonstration Test" in paragraph (g)(2) in order to be consistent with the changes being proposed for paragraph (e)(7).

Replacement of the reference to the "1000-flight-cycle ETOPS test" with "Airplane Demonstration Test" in paragraph (h)(1) in order to be consistent with the changes being proposed for paragraph (e)(7).

Applicability

As discussed above, these special conditions are applicable to Boeing Model 777 series airplanes. Should The Boeing Company apply at a later date for a change to the type certificate to modify any model included on Type Certificate No. T00001SE to incorporate the same novel or unusual design feature, the special conditions would apply to that model as well under the provisions of § 21.101(a)(1), Amendment 21-69, effective September 16, 1991.

Conclusion

This action affects only certain novel or unusual design features on Boeing Model 777 series 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 CFR Part 25

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.