

airplane enters service. The proposed paragraph II(b)(8) addresses the first part of the special conditions requirement. The second part is captured in the proposed new § 21.4(a).

The original ARAC recommendation would have required the problem tracking and resolution system to address "relevant" problems encountered. The term "relevant" is subjective and may result in inconsistent application of the proposed rule. Furthermore, we have identified the types of problems that must be reported in the post type certification period in proposed new § 21.4(a)(5). In order to assure consistency with the companion post type certification problem reporting requirement contained in proposed § 21.4(a), we have replaced the term "relevant" with the phrase "as identified in § 21.4(a)(5)".

In evaluating the importance of this proposed rule, the FAA has reviewed the experience on the first early ETOPS airplane. The FAA approved the Model 777-200 powered by Pratt & Whitney PW4077 engines for ETOPS on May 30, 1995 and the airplane entered airline service in June 1995. By all accounts, it was a very successful new model introduction. This was followed by the FAA ETOPS approval of the Model 777-200 powered by General Electric GE90-77B and Rolls-Royce RB211-Trent 877-17 engines in October 1996. Based on data supplied by Boeing, the in-flight shutdown (IFSD) rate for all three-engine types was zero for at least the first year in service. The Pratt & Whitney PW4000 reached a peak 12-month rolling average IFSD rate of 0.018/1,000 hours in October 1996. The General Electric GE90 reached a peak of 0.021 for one month in July 1998 and the Rolls-Royce Trent reached a peak of 0.016 in December 1997.

Although the in-flight shutdown rates stayed within the allowable 0.02/1,000 hour standard for 180 minute ETOPS, Boeing and the engine manufacturers reported to the FAA new design problems that they discovered on each engine type after ETOPS approval. The FAA was concerned that the design problems being discovered may have been an indication of a failure of the early ETOPS process to identify these failure modes before they occurred in service. Some failure modes had the potential of resulting in in-flight shutdowns had they occurred under different circumstances or they had not been detected during maintenance for unassociated reasons. Had every one of these events resulted in an engine in-flight shutdown, the resulting IFSD rates for each engine type would have been

significantly higher. However, Boeing, the engine manufacturers, the FAA, the airlines, and other regulatory authorities worked together to prevent in-flight occurrences of these failure types.

The FAA did not expect that the early ETOPS process would eliminate ALL failures. That is why the FAA required a problem tracking system in the Model 777 ETOPS special conditions. The actual in-flight shutdown rates prove that Boeing and the engine manufacturers successfully managed these early in-service problems to maintain the safety of B777 ETOPS operations worldwide. A robust problem tracking, reporting, and resolution process was key to the continued safe operation of the Boeing Model 777 and will be an essential component of future early ETOPS programs. The proposed problem reporting and resolution requirements in paragraph II(b)(8) and new § 21.4(a) are important to the continued success of airplanes approved for ETOPS using the early ETOPS process proposed in this notice.

#### II(b)(9) Reliability Demonstration Acceptance Criteria

The applicant would have to show that the type and frequency of failures that occur during the airplane flight test program and the airplane demonstration test proposed by paragraph II(b)(7), are consistent with the type and frequency of failures or malfunctions that would be expected to occur on currently certified ETOPS airplanes.

#### Explanation

This paragraph would codify paragraph (h)(1) of the Boeing Model 777 ETOPS special conditions. This proposed paragraph is the so-called "type and frequency" requirement that is the final indicator of ETOPS suitability in the Boeing Model 777 ETOPS special conditions.

The FAA's intent for the type and frequency requirement is that it would provide an objective standard that we could use to assess an airplane's suitability for ETOPS. Significant propulsion system failures occurring during type certification testing, including the additional ETOPS testing that would be required in section II of proposed Appendix L, are an indicator that an airplane may not yet be ready to enter ETOPS service. Our intent is that the proposed type and frequency requirement would identify when an airplane is not suitable based on available test data.

We did not intend that the proposed type and frequency requirement would provide a meaningful measurement of

reliability. It is not possible to measure system reliability with any degree of statistical confidence with the limited amount of test experience obtained during a reasonable type certification program.

A lack of significant failures during type certification testing does not assure an ETOPS-suitable design at entry into service. It is for this reason that the proposed problem tracking system requirement exists. As we said in the explanation for proposed paragraph II(b)(8), the FAA concludes from the Boeing Model 777 experience that a manufacturer can successfully manage early in-service problems to maintain the safety of worldwide ETOPS operations during the initial introductory service period with the data provided by the enhanced problem tracking system that would be required by proposed in paragraph II(b)(8).

The combination of these two proposed requirements form the key supports of the early ETOPS safety standard for two-engine airplanes proposed in this notice. The proposed type and frequency requirement gives the basis for denying ETOPS approval for airplanes with known significant design problems. The proposed problem tracking and resolution system gives the FAA confidence that we have the means to safely manage a fleet of airplanes and engines that do not experience significant problems until after ETOPS approval.

The original ARAC proposed wording for paragraph II(b)(9) referred to failures that occur during the "airplane and engine validation programs." This wording is inconsistent with the Boeing Model 777 ETOPS special conditions, which refers to failures that occur during "the airplane flight test program and the airplane demonstration test." Nowhere does the proposed rule use the term "validation program." We think that the special conditions wording more accurately describes what testing is covered by this proposed requirement and have changed the proposal accordingly.

The ARAC draft had an additional qualifying phrase on the airplane models that the candidate airplane's failures and malfunctions would be compared to. In addition to "presently certified ETOPS airplanes," the ARAC draft added the phrase "or any non-ETOPS derivative models of those aircraft or engines." This added phrase is not in the existing Boeing Model 777 ETOPS special conditions. We are proposing that the proposed type and frequency requirement for two engine airplanes include a comparison with an existing fleet of ETOPS approved