

representatives from the Joint Aviation Authority (JAA), International Civil Aviation Organization (ICAO) and the FAA.

In accordance with the task statement and the Working Group's work plan approved by the ARAC Air Carrier Operations Issues Group on August 15, 2000, the Working Group reviewed existing ETOPS documents and developed a risk assessment method for ETOPS and other long-range flights. The risk assessment method is comprised of three parts: a loss of thrust model; a system safety analysis using the FAR/JAR 25.1309 process; and an operational assessment assuring that pertinent operational considerations are taken into account.

On the basis of the risk model and their review of long-range operations, the Working Group used the following general concepts as the basis for proposed regulations and advisory material.

- Special considerations must be given for extended range flights to prevent the need for a diversion and to protect the airplane and passengers during the diversion when it cannot be prevented;
- Airplanes must be designed and built for the intended mission.
- Airplanes must be designed, manufactured, and maintained at a level that ensures the original reliability throughout the life of the airplane.
- When engine reliability reaches a certain level, as measured by the In Flight Shut Down (IFSD) rate (IFSD=0.01/1,000 hours), the risk of independent failures leading to loss of all thrust is not significant enough to require limiting the allowed time from an airport and other limiting factors come into play.
- For part 121 air carrier operations, ETOPS should be defined as flights more than 60 minutes from an adequate airport for two-engine airplanes and more than 180 minutes from an adequate airport for air carrier airplanes with more than two engines. For part 135 operations ETOPS should be defined as flights more than 180 minutes from an adequate airport.
- Because of extreme climactic conditions certain ETOPS requirements should be applied to Polar operations even if those operations would not otherwise be considered ETOPS
- Part 135 operations have unique considerations

Improvements in airplane engine and system reliability have reached a point that they may no longer be the constraining factor on the long-range flight operations. The Working Group found, however, and the FAA agrees,

that it would be prudent for two-engine airplanes to remain within 180 minutes of an adequate airport whenever possible. There is a positive correlation between risk and diversion length. Thus the FAA believes that diversion lengths should be kept to a minimum.

ARAC ETOPS Working Group Concept General Observations

As already noted, the working group acknowledged that the reliability of aircraft engines and systems has improved to the point that it may not be limiting to the operation. The Working Group recommended that two-engine airplanes should be approved in many cases for 180 minutes ETOPS and ETOPS beyond 180 minutes may be appropriate in some situations. The Working Group recommended that airplanes with more than two engines should be approved for ETOPS beyond 180 minutes in many cases. Even though engine reliability has significantly improved, diversions are sometimes necessary for reasons that are unrelated to the number of engines on an aircraft and their reliability, such as passenger illness or other occurrences.

Regarding extended range operations by jet-powered airplanes under part 135, FAA policy for many years has permitted such flights up to 180 minutes from an airport, without additional ETOPS-like requirements. Operational experience has validated that policy, and the Working Group proposal continues existing policy and provides for flights with longer diversion times with appropriate additional requirements.

Regarding extended range operations by air carrier airplanes with more than two engines, those flights have been conducted without any ETOPS-like requirements since the air carrier jet era began. The Working Group's proposals would ensure the continued safety of those flights by adding requirements in areas that are not dependent upon the number of engines on the airplane, such as cargo fire protection duration.

The ETOPS Working Group has proposed regulations and guidance material in three specific areas: Type Design (parts 25 and 33); part 121 Operations; and part 135 Operations.

General Discussion of the Proposal

FAA Approach to the ARAC Recommendations

In developing this proposal the FAA has accepted ARAC recommendations without change where possible. The FAA made changes for clarity, to correct for incomplete ARAC recommendations, to ensure that requirements are legally

sufficient, and to make improvements in style of presentation. The FAA provides explanation in this notice for any substantial differences with the ARAC recommendation.

General Issues

Terminology—Extended Operations (ETOPS)

This proposal has two primary objectives: (1) To create new regulations and amend existing regulations for the design, maintenance, and operation of aircraft used in ETOPS; thus far ETOPS has been allowed by the FAA's discretionary authority and supported by an Advisory Circular and; (2) To apply the lessons learned from ETOPS to all airplanes that are operated in Extended Operations (ETOPS) regardless of the number of engines. The acronym ETOPS would apply to all airplanes in Extended Operations and not just twin-engine airplanes. These rules would apply equally to airplanes operating over oceanic areas or routes entirely over land.

Risk Model

Item 3 of the ARAC tasking was to "develop ETOPS requirements for operations in excess of 180 minutes up to whatever extent that may be justified." At the early ARAC ETOPS Working Group meetings, the FAA presented a new risk model for assessing risk on an ETOPS flight. The new approach for assessing the overall risk of critical thrust loss on an ETOPS flight considers such factors as the length of the flight and engine reliability in addition to the more traditional maximum diversion time.

The ARAC ETOPS Working Group adopted the FAA's proposed risk model and further developed it to apply it to three and four engine airplanes. It did this by including the corresponding engine failure rate that would be required to achieve an equivalent risk of critical thrust loss due to independent failures on three and four engine airplanes. We will now summarize the risk model used in the development of this proposed rule.

The basic premise that the FAA used in developing its risk model is that ETOPS service experience is excellent and that any changes to allow further expansion of ETOPS need to preserve this record. With this premise in mind, the basic objective is to define a risk model that would allow an expansion of two engine airplane operations to use the same routes as three and four engine airplanes with no substantial change in the overall risk.