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Part IV

Department of Transportation

Federal Aviation Administration

14 CFR Parts 1, 21, 25, 33, 121, 135
Extended Operations (ETOPS) of Multi-engine Airplanes; Proposed Rule

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Parts 1, 21, 25, 33, 121, 135

[Docket No. FAA–2002–6717; Notice No. 03–11]

RIN 2120–AI03

Extended Operations (ETOPS) of Multi-engine Airplanes

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of proposed rulemaking (NPRM).

SUMMARY: The FAA proposes to issue regulations governing the design, maintenance, and operation of airplanes and engines for flights that go beyond certain distances from an adequate airport. This proposal would extend some requirements that previously applied only to two-engine airplanes to airplanes with more than two-engines. The proposed rule implements existing policy, industry best practices and recommendations, and international standards to ensure that long-range flights will operate safely.

DATES: Send your comments on or before January 13, 2004.

ADDRESSES: You may submit comments to DOT DMS Docket Number FAA–2002–6717 by any of the following methods:

- *Web Site: http://dms.dot.gov*. Follow the instructions for submitting comments on the DOT electronic docket site.
- *Fax:* 1–202–493–2251.
- *Mail:* Docket Management Facility; U.S. Department of Transportation, 400 Seventh Street, SW., Nassif Building, Room PL–401, Washington, DC 20590–0001.
- *Hand Delivery:* Room PL–401 on the plaza level of the Nassif Building, 400 Seventh Street, SW., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.
- *Federal eRulemaking Portal:* Go to *http://www.regulations.gov*. Follow the online instructions for submitting comments.

Instructions: All submissions must include the agency name and docket number or Regulatory Identification Number (RIN) for this rulemaking. For detailed instructions on submitting comments and additional information on the rulemaking process, see the Public Participation heading of the Supplementary Information section of this document. Note that all comments received will be posted without change to *http://dms.dot.gov.* including any personal information provided. Please see the Privacy Act heading under Regulatory Notices.

Docket: For access to the docket to read background documents or comments received, go to *http://dms.dot.gov* at any time or to Room PL–401 on the plaza level of the Nassif Building, 400 Seventh Street, SW., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: Eric vanOpstal, Flight Standards Service, Air Transportation Division, AFS–200, Federal Aviation Administration, 800 Independence Avenue SW., Washington, DC 20591; telephone (202) 267–3774; facsimile (202) 267–5229.

SUPPLEMENTARY INFORMATION: *Comments Invited.* The FAA invites interested persons to participate in this proposed rulemaking by submitting written comments, data, or views. We also invite comments relating to the economic, environmental, energy, or federalism impact that might result from adopting the proposals in this document. The most helpful comments reference a specific portion of the proposal, explain the reason for any recommended change, and include supporting data. We ask that you send us two copies of written comments.

We will file in the docket all comments we receive, as well as a report summarizing each substantive public contact with FAA personnel concerning this proposed rulemaking. The docket is available for public inspection before and after the comment closing date. If you wish to review the docket in person, go to the address in the **ADDRESSES** section of this preamble between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays. You may also review the docket using the Internet at the web address in the **ADDRESSES** section.

Before acting on this proposal, 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 this proposal in light of the comments we receive.

If you want the FAA to acknowledge receipt of your comments on this proposal, include with your comments a pre-addressed, stamped postcard on which the docket number appears. We will stamp the date on the postcard and mail it to you.

Regulatory Notices

Privacy Act: Anyone is able to search the electronic form of all comments received into any of our dockets by the name of the individual submitting the comment (or signing the comment, if submitted on behalf of an association, business, labor union, etc.). You may review DOT's complete Privacy Act Statement in the **Federal Register** published on April 11, 2000 (Volume 65, Number 70; Pages 19477–78) or you may visit *http://dms.dot.gov*.

Availability of Rulemaking Documents

You can get an electronic copy using the Internet by taking the following steps:

(1) Go to the search function of the Department of Transportation's electronic Docket Management System (DMS) Web page (*http://dms.dot.gov/search*).

(2) On the search page type in the last five digits of the Docket number shown at the beginning of this notice. Click on ''search.''

(3) On the next page, which contains the Docket summary information for the Docket you selected, click on the document number of the item you wish to view.

You can also get an electronic copy using the Internet through FAA's web page at *http://www.faa.gov/avr/arm/nprm/nprm.htm* or the **Federal Register**'s Web page at *http://www.access.gpo.gov/su_docs/aces/aces140.html*.

You can also get a copy by submitting a request to the Federal Aviation Administration, Office of Rulemaking, ARM–1, 800 Independence Avenue SW., Washington, DC 20591, or by calling (202) 267–9680. Make sure to identify the docket number, notice number, or amendment number of this rulemaking.

Background

The Federal Aviation Administration (FAA) has long-standing regulations that restrict the operations of two-engine air carrier airplanes operated under part 121, Title 14 of the Code of Federal Regulations (14 CFR). Under current regulations these airplanes may not be operated on routes that lie more than sixty minutes from an airport unless authorized by the Administrator. The premise for these restrictions was that two-engine airplanes were less safe than three and four engine airplanes particularly over very long distances.

History of ETOPS

In the 1980s, a new generation of very reliable, two engine airplanes came into service and changed the underlying premise that restricted the operations of these airplanes. The airline industry sought to take advantage of the

improvements in reliability, range, and payload capabilities that these new airplanes offered. Beginning in 1985, the FAA allowed air carriers to operate certain twin-engine airplanes on routes that included points more than sixty-minutes from an adequate airport under a formal program known as Extended Range Operation with Two Engine Airplanes (''ETOPS''). The regulatory basis of ETOPS was the deviation authority contained in 14 CFR section 121.161. With the cooperation of the airlines, manufacturers, and other interested groups, the FAA carefully controlled and monitored this new type of flight operation.

Historical Documents

Advisory Circulars 120–42 and 120–42A

In support of ETOPS, the FAA issued two Advisory Circulars (AC) 120–42 and 120–42A in 1985 and 1988 respectively. These two AC documents have been the basis for type design and operational practices for ETOPS to date. Initially, the FAA set a maximum approval of 120 minutes from an airport for ETOPS. During the nascent stage of ETOPS, air carriers gained significant service experience; the safety and efficiency of ETOPS became apparent. In 1988, the FAA increased that approval to 180 minutes based on demonstrated safety record of these operations.

Deviation Authority From § 121.161 Prior to ETOPS

Since the 1970s, the FAA has authorized two-engine operations on routes up to 75 minutes away from an airport exclusively in the Caribbean. These were not considered ETOPS flights. These flights were approved by the FAA as deviations under section 121.161, but were authorized before a formal ETOPS program was developed. These deviations were approved after a safety evaluation of the areas of operation, the airplanes, and the operators conducting them.

207 Minute ETOPS

In March 1999, the Air Transport Association (ATA) asked the FAA to extend the 180-minute ETOPS authorization an additional fifteen percent to 207-minutes. The FAA published the ATA letter and asked for comments (64 FR 22667, April 27, 1999). Several commenters suggested that the FAA should formalize ETOPS in the regulations rather than continuing to rely on the deviation authority in section 121.161 and advisory materials. In January 2000, the FAA approved 207 minute ETOPS and stated its intent to task an Aviation Rulemaking Advisory Committee (ARAC) Working Group to study the issues and to recommend regulations for ETOPS (65 FR 3522, January 21, 2000). In this same notice, the FAA solicited comments from the public on its decision to approve 207 minute ETOPS.

Polar Operations Letter

The increasing use of Polar flights, while creating economic benefits, has brought new challenges to extended operations such as climactic extremes. Due to these new challenges and to the increasing similarity among all long-range operations, experience began to show that ETOPS requirements and processes are generally applicable to all long-range operations including those by three and four engine airplanes and would improve their safety.

Harmonization With International Standards

Related International Activity

Two related activities should be noted. First, the Joint Aviation Authorities (JAA) of European nations has chartered a working group that is also developing standards and guidance material for extended operations. In ongoing efforts of both the FAA and JAA to coordinate regulatory requirements, one of the ARAC ETOPS Working Group tasks was to ''harmonize * * * standardized requirements across national boundaries and regulatory bodies.'' Toward that end, there are representatives who are members of both the ARAC ETOPS Working Group and the JAA Working Group. Also, the two groups met together twice in Europe to facilitate joint action and harmonization. Second, the International Civil Aviation Organization (ICAO) Air Navigation Commission (ANC) Operations Panel has decided to develop standards and recommended practices (SARPS) for extended range operations. In May of 2001, the ARAC ETOPS Working Group held one of its meetings in Montreal, Quebec, Canada (ICAO's headquarters city) for the purpose of briefing members of the ANC and ICAO Air Navigation Bureau staff.

ARAC ETOPS Working Group Task Statement

The FAA established the ARAC ETOPS Working Group through a notice in the **Federal Register** at 65 FR 37447, dated June 14, 2000. It was given the following tasks:

1. Review the existing policy and requirements found in Advisory Circular (AC) 120–42A, applicable ETOPS special conditions, and policy memorandums and notices, for certification and operational regulations and guidance material for ETOPS approvals up to 180 minutes.

2. Develop comprehensive ETOPS airworthiness standards for 14 CFR parts 25, 33, 121, and 135, as appropriate, to codify the existing policies and practices.

3. Develop ETOPS requirements for operations in excess of 180 minutes up to whatever extent that may be justified. Develop those requirements such that incremental approvals up to a maximum may be approved.

4. Develop standardized requirements for extended range operations for all airplanes, regardless of the number of engines, including all turbojet and turbopropeller commercial twin-engine airplanes (business jets), excluding reciprocating engine powered commercial airplanes. This effort should establish criteria for diversion times up to 180 minutes that is consistent with existing ETOPS policy and procedures. It should also develop criteria for diversion times beyond 180 minutes that is consistent with the ETOPS criteria developed by the Working Group.

5. Develop additional guidance and/or advisory material as the ARAC finds appropriate.

6. Harmonize such standardized requirements across national boundaries and regulatory bodies.

7. Any proposal to increase the safety requirements for existing ETOPS approvals up to 207 minutes must contain data defining the unsafe conditions that would warrant the safety requirements.

8. The Working Group will provide briefings to the Transport Airplane and Engine Issues group.

9. The recommendations should consider the comments received as a result of the April 27, 1999 and January 21, 2000 **Federal Register** notices.

10. Within one year of publication of the ARAC task in the **Federal Register**, submit recommendations to the FAA in the form of a proposed rule.

Formation and Membership of the ETOPS Working Group

Formation

Following the formal tasking notice in the **Federal Register**, the ARAC organized an ETOPS Working Group.

Membership

The ETOPS Working Group consisted of over 50 representatives of U.S. and foreign airlines, aircraft and engine manufacturers, pilots' unions, industry groups, air disaster support groups, and

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.

Currently, we manage dual engine shut down risk on two engine airplanes by limiting the maximum allowable diversion distance and requiring a low engine in-flight shutdown rate. This is a one-dimensional risk model in that with a constant in-flight shutdown rate, the existing ETOPS requirements and policy consider only the maximum distance that an operator may plan a route from an enroute diversion airport. It assumes that there is a constant risk during the course of a flight with no consideration of how the actual diversion times vary along the track as different alternate airports come into and out of range of the airplane. This approach also does not consider the increase in overall risk that is created by increasing an airplane's range, and thus time aloft, by adding fuel. Further, this model provides no means to assess the effect on overall risk with changes with engine failure rates. Actual ETOPS involve continuously changing distances to alternates. Current ETOPS limits on maximum diversion time don't represent real world risk because diversions can occur anywhere along the track, not just at the maximum point. The new ETOPS risk model adopted for the development of this new proposed rule is based on the introduction of a ''two dimensional'' model to replace the ''one dimensional'' maximum diversion time/distance model currently in use.

The new ETOPS Exposure Index is a simplified form of several risk equations that have been developed over the past forty years. All share similar characteristics. The ARAC ETOPS Working Group compared several different mathematical representations for allowable risk versus engine failure rate. Each showed that an engine failure rate on the order of 0.01 per 1,000 engine flight hours was adequate to allow diversion times for two engine airplanes that for all practical purposes could be considered as unrestricted.

The new risk model consists of a comparative risk index based on a combination of range, average diversion distance, and engine failure rate. Independent cause dual engine shut down risk is driven by the footprint area of the route multiplied by the engine failure rate (E) squared. The footprint area is defined as the route length (L) multiplied by the average diversion distance (D). Note that the engine shut down rate is squared to account for loss of first engine and then loss of second engine. Therefore, we define ''ETOPS Exposure Index'' (EEI) as a function of:

- Footprint Area (Route Length × Average Diversion Distance) ($L \times D$) and
- E^2 (Engine Failure Rate Squared)

$EEI = L \times D \times E^2$

The ETOPS Exposure Index can be used as an evaluation tool to assess risk of ETOPS operations due to independent engine failure causes. Assuming the following values for each of the terms of the equation:

- Route Length = 5500 nautical miles,
- Average Distance for 180 minute ETOPS = 800 nautical miles, and
- Engine failure rate at the current required level = 0.02 shutdowns/1,000 engine-hours or 50,000 hours time between shutdowns.

The EEI would then be:

$EEI = 5500 \times 800 \times 0.02^2 = 1760$

With the ETOPS Exposure Index fixed at this level, longer flights and greater maximum diversion distances can be offset by decreased engine failure rate. In other words, as E becomes smaller, L and/or D can increase appropriately. An engine failure rate of one-half the current requirement (E = 0.01/1,000 engine-hours) would allow a four times increase in ''footprint'' area.

$EEI = L \times D \times E^2$

$EEI = 5500 \times 800 \times 0.02^2 = 1760$ equals

$EEI = 5500 \times 3200 \times 0.01^2 = 1760$ equals

$EEI = 11{,}000 \times 1600 \times 0.01^2 = 1760$

In other words, with an engine failure rate that is one-half the current requirement for 180 minute ETOPS we could allow four times the average diversion distance or a combination of increased route length and average diversion distance with no change in the current ETOPS risk.

For a two engine airplane, engine failure rate has the biggest impact on ETOPS risk because the factor is squared. A reduction in the engine failure rate has a large impact on the size of an allowable footprint area for the same risk. Using the ETOPS Exposure Index concept with a reduction in the engine failure rate standard allows the development of ETOPS rules for two engine airplanes that minimize restrictions on airline operations while maintaining the current excellent ETOPS safety record.

Current in-service engines are capable of achieving better than 100,000 hours time between shutdowns (.01/1,000 engine-hours), or double the current ETOPS reliability standard. This represents two in-flight shutdowns in the entire life of a typical transport airplane. It is not reasonable to expect that two in-flight shutdowns due to independent causes in the entire life of a typical transport airplane would occur on the same flight.

With an IFSD rate of 0.01/1,000 hours, the probability of complete loss of thrust due to independent failures will be sufficiently low so that the main focus of long-range operational safety can be on reducing the possibility of other risk factors.

We emphasize that this risk model represents a good tool for evaluating the risk of critical thrust loss due to ''independent'' failure causes. The biggest threat to long-range operational safety continues to be the loss of thrust from multiple engines resulting from:

Common Cause Multiple Failures
Cascading Multiple Failures
Fuel Exhaustion

These threats are common to all long-range operations, regardless of the number of engines on the airplane.

Examples of common cause multiple failure events:

Eastern Airlines L1011 nearly lost all engines after improper installation of engine magnetic chip detectors.

B–747 volcanic ash cloud encounter during volcanic eruption in Alaska—All engines severely damaged by ash.

Example of potential cascading failure:

Worn-out second engine fails after application of higher power following failure of first engine

Examples of Fuel Exhaustion events:

Air Canada 767—No power landing into Gimli, Canada

Air Transat A330—No power landing in the Azores

Sources of Common Cause and Cascading Failures:

Common Design Faults
  Hardware
  Software
Environmental Exposures
  Weather
  Volcanic Ash Clouds
  Bird Strikes
  High Intensity Radiated Fields (HIRF)
  Lightning
  Simultaneous Maintenance on More than One Engine
  Contaminated Fuel

Sources of Fuel Exhaustion:

Operational Errors
  Fuel System Mismanagement
  Fuel Loading Errors
Misleading Fuel Quantity Indications
Misleading Fuel Loading Procedures particularly during a non-normal (MEL) dispatch

Constant awareness of potential sources of common cause failures, cascading failures, and fuel exhaustion is the key to continued long-range operational safety. This awareness, growing from operating experience, is the basis for continued ETOPS safety. ETOPS safety enhancements focus on defining methods to prevent potential threats caused by known sources.

Examples of Common Cause/ Cascading Failure Prevention Strategies:

1. No single person performing simultaneous engine maintenance or servicing
2. Conservative fuel loading requirements
3. Intense rain/hail ingestion engine design requirements
4. Constant adherence to established ETOPS procedures without exception
5. Robust engine condition monitoring program

The FAA incorporated prevention strategies for these types of failures into airworthiness requirements and ETOPS policy as we learned of them. This proposal would codify those prevention strategies for known sources of common cause, cascading and fuel exhaustion failures that have not been incorporated into the regulations.

The ARAC ETOPS Working Group also looked at how the new risk model could be applied to airplanes with more than two engines. For these types of airplanes, the working group had to decide what a critical loss of thrust was in order to determine the impact that engine failure rate would have on overall risk. For a two-engine airplane, the risk model assumes that a loss of both engines is a critical thrust loss. This is because there is a general expectation that the result of such an occurrence would be a catastrophic loss of the airplane; though there are examples of safe landings following the loss of both engines. The working group applied a similar approach to define a critical thrust loss for airplanes with more than two engines.

The operating rules contained in 14 CFR part 121 have minimum performance requirements with two engines inoperative for airplanes that have more than two engines. Using this as a guide, the working group assumed that critical thrust loss for both three and four engine airplanes would be three engines. If three engines fail on either kind of airplane, there is a general expectation that the result would be a catastrophic loss of the airplane. In other words, the risk model assumes the fourth engine on a four-engine airplane provides no additional safety benefit compared to the loss of all engines on a three-engine airplane. As is the case for two-engine airplanes, there are examples where a flight crew was able to safely land a four-engine airplane following the loss of three of the engines. However, the ETOPS risk model makes the conservative assumption that this would result in loss of the airplane.

This assumption for three and four engine airplanes changes the risk model equations so that for these types of airplanes, the probability of the loss of three engines would be much more remote than the loss of both engines on a two engine airplane. Under this assumption there is a higher probability of losing three engines on a four-engine airplane than on a three-engine airplane. The following example illustrates the concept. A three-engine and a four-engine airplane are in-flight. Both airplanes suffer the loss of two-engines due to independent causes but can reach a diversion airport. However the loss of an additional engine for either airplane at this point would be catastrophic for the airplane. The three-engine airplane has a single engine that could possibly fail while the four-engine airplane has two engines that could possibly fail. In this unlikely situation, the four-engine airplane is at greater risk because the probability of experiencing an engine failure event increases with the number of engines. Assuming that the engine failure rate is the same for each type of airplane, a four-engine airplane would have twice the probability of losing one of the two remaining engines than the three-engine airplane would have of losing the one remaining engine.

Using the available risk model equations with these considerations, the ARAC ETOPS Working Group determined that the in-flight shutdown rate for a three engine airplane would be approximately 0.2 shutdowns per 1,000 engine-hours to have an equivalent risk of critical thrust loss compared to a two engine airplane with an in-flight shutdown rate of 0.01 per 1,000 engine-hours. On a four-engine airplane, the equivalent in-flight shutdown rate would be 0.1 per 1,000 engine-hours.

Because these rates are so high compared to the failure rates currently achieved by today's turbine engines, the FAA does not consider it necessary to specify in-flight shutdown rates for three and four engine airplanes other than as part of an operator's propulsion system monitoring program. Under these programs, the operator must notify the FAA and take corrective action if these rates are exceeded.

In-flight Shutdown (IFSD) Rate

Propulsion system monitoring is vital to ensure safe ETOPS flights. A propulsion system monitoring program is intended to detect adverse trends, to identify potential problems, and to establish criteria for when corrective action may be necessary. The certificate holder would have to ensure that its ETOPS airplanes have In-Flight Shutdown (IFSD) rates commensurate with the world fleet's operation for that airplane type. Propulsion system monitoring at the operator level has been accomplished via the guidance of AC 120–42A which defined specific IFSD rates for ETOPS.

Propulsion system problems and IFSD may be caused by type design deficiencies, ineffective maintenance or operational procedures. It is very important to identify the root cause of events so that appropriate corrective action may be determined. The diverse causes of propulsion system problems require different solutions. For example, type design problems may affect the world fleet of aircraft. If an individual certificate holder experiences a problem caused by a type design issue, it may not be appropriate for the FAA to reduce or withdraw the particular operator's ETOPS authority. However, maintenance or operational problems may be wholly, or partially, the responsibility of the certificate holder. If a certificate holder has an unacceptable IFSD rate risk attributed to maintenance or operational practices, then action carefully tailored to that certificate holder may be required.

The FAA does not use IFSD rate as the sole means to determine a certificate holder's ETOPS authority. The FAA considers the 12-month rolling average standard that occurs for a mature fleet after the commencement of ETOPS. A high IFSD rate could be due to the limited number of engine operating hours used as the denominator for the rate calculation or a small fleet. The effect may be an IFSD rate jump well above the standard rate due to a single IFSD event. The underlying causes for such a jump in the rate will have to be considered by the Administrator. Conversely, there may be occasions when a single ETOPS event may warrant corrective action even though the overall IFSD rate is not exceeded. In such a case, the cause would be certificate holder specific and may require changes to their operational, dispatch or maintenance procedures.

Configuration, Maintenance, and Procedures (CMP) Document

The use of a CMP document has been in the ETOPS criteria from AC 120–42, and later 120–42A, from the very first ETOPS airplane approvals. The CMP document defines airplane and propulsion system design configurations, maintenance procedures, and operational procedures required to comply with the ETOPS requirements that are not already a part of the original type design approved by the original issuance of the airplane and engine type certificates.

The CMP document is comprised of service bulletins, service letters,

maintenance manual references, and other pertinent documents which define the alterations, maintenance or operational requirements and limitations that the FAA requires to make an airplane type design suitable for ETOPS. The CMP is an amendment to the airplane type design defined in 14 CFR 21.31. The initial CMP approval, as a change to the type design, is analogous to other type design approvals for specific operations such as Category III autoland approval for autopilot systems that could involve design changes to a previously certified system.

After ETOPS approval, the CMP may be modified by any airworthiness directives (ADs) issued in accordance with part 39 that supersede existing CMP requirements. CMP document requirements will not increase except by AD.

Misconceptions about the criteria for revising CMP documents generated some of the biggest discussions in the ARAC ETOPS Working Group meetings. The FAA approved airplanes for ETOPS under the original AC 120–42 between 1985 and 1989 without a defined propulsion system reliability standard. The approach used in AC 120–42 to assess the suitability of an airplane-engine combination for ETOPS was to use a ''fix all problems'' approach. This process involved identifying the causes of propulsion system problems in service on the candidate airplane and including identified corrective actions into an approved CMP document as a condition for ETOPS approval. This was an ongoing process and the FAA conducted regular reviews to determine additional corrective actions as new problems occurred in service. As a result, the FAA routinely required the airplane manufacturer to revise the CMP documents during this period.

The ''fix all problems'' approach to airplane propulsion system assessment was carried over into the revised AC 120–42A at the end of 1988, and continues on in this notice in proposed part 25 Appendix L paragraph II(a)(ii). However, revision A of the AC added a propulsion system reliability standard as a provision for ETOPS type design approval that did not exist in the original AC. With an established propulsion system reliability standard, the FAA now had a gauge to monitor the safety of the approved ETOPS fleet without a need to continually update the CMP as new problems occurred. Also, several ETOPS operators began objecting to the FAA requiring them to continually upgrade existing ETOPS approved airplanes without any input to the changes being required.

The FAA recognized that our previous practice of requiring upgrades to already approved airplanes without prior public review created an undue burden on operators. As a result, the FAA changed its approval process for revisions to CMP documents. The FAA documented this change in an internal memorandum signed by the managers of the Transport Airplane Directorate, and the Engine and Propeller Directorate on April 3, 1990. In that memo, the directorate managers noted that the AC gave them the responsibility for the continuing airworthiness of the type design CMP standard and that the CMP should not be changed unless the reliability of the airplane-engine combination is not achieving or maintaining the reliability objective, or some other unsafe condition arises. As with any type design, the FAA permits manufacturers and operators to incorporate minor changes and routine enhancements by service bulletins or production design changes. However, the FAA will not mandate such enhancements in a revision to the CMP standard. The memo concludes by stating that the Transport Airplane and the Engine and Propeller Directorates plan to use the AD process to control the continuing airworthiness type design requirements of the ETOPS CMP standard.

As a result of the joint memo, the FAA established strict guidelines for CMP revisions to ensure that the requirements of the basic CMP standard originally approved for an airplane-engine combination are not increased without going through the AD process.

The FAA approves revisions to an airplane's CMP document for the following reasons:

1. When incorporating the CMP standard for a newly approved airplane-engine combination into an existing CMP document.

2. When correcting errors in previous revisions.

3. When ADs are issued that supersede existing CMP requirements.

4. When approving optional alternatives to existing requirements.

5. When mandating changes to the CMP by an AD.

The FAA aircraft certification offices have used these guidelines since issuance of the joint memo to approve CMP revisions. Because operators had already complied with several revisions to previously approved CMP documents in force at the time the FAA issued the new CMP guidelines, the FAA worked with the airlines and the manufacturers to establish ''baseline'' CMP requirements for each ETOPS approved airplane-engine combination. The affected operators agreed to ensure that all of the requirements of these baseline CMPs are incorporated into their ETOPS fleets. Thereafter, the new CMP revision guidelines would be the standard way of making subsequent revisions.

Summary of the Proposed Changes

The following chart summarizes which operations would be affected by the proposed rule changes:

Current requirements			Proposed rule		
	Up to 60 minutes	Beyond 60 minutes	Up to 60 minutes	Beyond 60 min up to 180 minutes	Beyond 180 minutes
Part 121 two engine	Section 121.161 applies.	Advisory material and policy letters.	No change	Would apply (Would codify previous practice).	Would apply.
Part 121 more than two engine.	No current regulation	No current regulation	No change	No change	Would apply.
Part 135	No current regulation	No current regulation	No change	No change	Would apply.

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The chart below summarizes ETOPS regulations before and after the proposed changes.

Proposed ETOPS requirement	Under current advisory circulars and policy			Under the proposed regulation		
	Twins	More than two engines	Part 135 operations	Twins	More than two engines	Part 135 operations
Applicability	More than 60 minutes from an adequate airport	Does not apply to turbine engine airplanes.	Does not apply	More than 60 minutes from an adequate airport	More than 180 minutes from an adequate airport	More than 180 minutes from an adequate airport
Terminology	ETOPS (Extended Operations for Two Engine Airplanes)	ETOPS does not currently apply to turbine engine airplanes with more than two engines	ETOPS does not currently apply to part 135 operations	ETOPS (Extended Operations)	ETOPS (Extended Operations)	ETOPS (Extended Operations)
Maximum permissible distance from an adequate airport	207 minutes	Not regulated	180 minutes	240 minutes with certificate holder approval, beyond 240 minutes with route specific approval	To maximum system limitation	240 minutes
Cargo fire suppression	Diversion limit plus 15 minutes	Not required	Not required	Diversion limit plus 15 minutes.	Diversion limit plus 15 minutes (6 year compliance period)	Not required
Rescue and fire fighting service capability	ICAO category 4	Not required	Not required	ICAO category 4 up to 180 min, ICAO category 7 beyond 180 min	ICAO category 7	Not required
Passenger recovery plan	Required for polar operations	Required for polar operations	Required for polar operations	Required	Required	Required
Engine reliability standards	IFSD rates: 0.02/1000 hrs for 180 min, 0.19/1000 hrs for 207 min	None	None	IFSD rates: 0.05/1000 hrs for 120 min, 0.02/1000 hrs for 180 min, 0.01/1000 hrs for > 180 min	IFSD rates: 0.2/1000 hrs for 3 engine airplanes, 0.1/1000 hrs for 4 engine airplanes	Not specified
Areas of designated ETOPS applicability	Polar	Polar	Polar	Applies	Applies	Applies
Time-limited systems	Per type design approval limit for the airplane (up to 207 min).	No requirement	No requirement	Specified in part 25, Appendix L	Specified in part 25, Appendix L	Specified in part 25, Appendix L
Dispatch weather requirements for alternate	Applies	No requirement	No requirement	Applies	Applies	Applies
ETOPS maintenance program	Required	No requirement	No requirement	Required	Required	Required
Communication capabilities	SATCOM required for 207 min ETOPS	No requirement	No requirement	Additional com required. SATCOM beyond 180 min..	Additional com required. SATCOM beyond 180 min..	Additional com required. SATCOM beyond 180 min..

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Section-by-Section Discussion of the Proposal

We begin the discussion by clarifying the term ''ETOPS''. Since its inception eighteen years ago, the term ''ETOPS'' has described extended-range operations of two-engine air carrier airplanes under a deviation from 14 CFR 121.161. The term has gained broad acceptance among operators and regulators throughout much of the world.

This proposal would create regulatory requirements for extended operations for all air carrier airplanes. As described previously, the thresholds for applicability would vary by the number of engines and type of operation. In its deliberations, the Working Group stated that it struggled with the question of whether to use a new term to describe the operations of airplanes beyond 180 minutes from an adequate airport. Early on, the Working Group considered and agreed to the term ''LROPS'' which stands for Long Range Operations to describe flights beyond the 180-minute threshold. However, as their efforts progressed the Working Group found that the use of two terms (ETOPS and LROPS) for two-engine airplanes flying beyond 60 minutes and 180 minutes from an airport quickly became awkward and cumbersome. Further, the Working Group members representing the maintenance community expressed great concern that the introduction of the LROPS term would needlessly create confusion among the maintenance community and would also require painstaking and potentially expensive revisions to numerous maintenance manuals and programs. In order to avoid any potential confusion, the Working Group recommended the use of the term ETOPS for all air carrier extended range operations irrespective of the number of engines.

The FAA strongly agrees with this recommendation. The FAA also believes that the addition of a new term could needlessly create confusion. Further it would potentially dilute the intent of this proposal, which is to codify existing ETOPS standards and procedures and to extend those concepts to airplanes with more than two engines. The FAA believes that the introduction of a new term could be misinterpreted as creating a new operational concept as opposed to the extension of an existing one.

The proposed amendments to the Type Design Rules 14 CFR parts 25 and 33 and supporting advisory material are a consolidation of requirements taken from AC 120–42A, the 777 Special Conditions, and JAA Information Leaflet (IL) 20. The materials contained in the proposed Airplane Type Design Rule (part 25) and AC are a compilation of the existing AC120–42A, 777 Special Condition, and JAA IL20.

The following discussion takes each of the Rule sections and attempts to capture all of the comments and discussion from the ARAC activities.

Part 1

Section by Section Discussion of the Proposed Changes to Part 1

Section 1.1—General Definitions

The proposed definitions were adopted directly from the ARAC recommendation. This proposal would establish three different definitions of ETOPS in three significant ways. In each case, the acronym would stand for ''extended operations'' for all airplanes regardless of the number of engines. The definition would vary in part 121, however, depending on whether the airplane involved has two engines or more than two engines. This proposal also would introduce ETOPS into part 135 for the first time, where ETOPS would have a third definition. The FAA believes the remainder of the proposed definitions for section 1.1 are self-explanatory.

Part 21

The amendments to part 21 would create reporting requirements for the holders of type certificate for two-engine ETOPS airplanes and ETOPS eligible engines. This would require type certificate holders to closely monitor the performance of their products to ensure their continuing reliability. These amendments would also ensure that the FAA is kept apprised of any existing or potential problems in a timely manner.

Section by Section Discussion of the Proposed Changes to Part 21

Proposed New Section 21.4—ETOPS Reporting Requirements

This proposal would add a new regulation consisting of two parts, Early ETOPS Problem Reporting & Tracking for all ETOPS airplanes, and ETOPS Operational Service Reliability Reporting for two-engine airplanes.

Explanation

1. Reporting for all ETOPS airplanes. The proposed rule is a codification of what the FAA considers to be one of the essential and objective elements of the early ETOPS Special Conditions (SC) for the B777 aircraft; specifically as they pertain to problem tracking and reporting. The FAA accepts the ARAC recommendation and proposes it as a new section 21.4. Section 21.4 would require the type certificate holder to establish an early ETOPS problem reporting system. The proposed system would contain a means for the prompt identification of those problems that could impact the safety of ETOPS operations in order that they may be resolved in a timely manner. The system would also contain the process for the timely notification to the responsible FAA office of all relevant problems encountered, and identification of corrective actions deemed necessary and provide for appropriate FAA review of all planned corrective actions. The system would be in place for the first 250,000 engine-hours of fleet operating experience after the airplane enters service.

For two-engine ETOPS airplanes the system would remain in effect beyond 250,000 engine-hours of fleet operating experience until the fleet has demonstrated a specified and stable IFSD rate consistent with the approved diversion time of the aircraft. For the service period, this system would define the sources and content of in-service data that will be made available to the type certificate holder in support of the problem tracking system. The content of the data provided would include the data necessary to evaluate the specific cause of all service events reportable under section 21.3(c) of part 21, in addition to any other failure or malfunction that could affect the safety of ETOPS operation. Ten event occurrences, specifically defined with respect to reliable, safe ETOPS operation that would require reporting are defined in the proposal.

2. Reporting for two engine ETOPS airplanes. Paragraph (b)(1) of the proposed section 21.4 would require engine and airplane manufacturers to report periodically on the reliability of their two-engine airplane fleets. Reporting would include: IFSD events, IFSD rates, and ETOPS fleet statistics. This reporting may be combined with the reporting required by section 21.3. The proposed rule also would require the identification of cause and appropriate corrective action to assure reliable, safe ETOPS operations.

The periodic reporting of the reliability required of the manufacturers of engines and airplanes approved for ETOPS service would begin at the introduction of the product into service and continue throughout its product life. The interval of the reporting would be more frequent early in its product cycle and generally longer later in its product service life, especially after the product has achieved maturity with regard to engine reliability. Reliability would be indicated by a stable engine

shutdown event rate at or below the target values.

Generally, early product service life reporting on a quarterly basis is adequate, especially considering the fact that the manufacturers report engine failure events as they occur under the requirements of section 21.3. Event rates may fluctuate considerably early in the product's service life cycle because, although the fleet is growing in numbers of engine-airplane combinations in service, the accumulation of engine flight hours is generally slow. Typically, event rates are not very stable when the fleet cumulative time is less than 1 or 2 million engine flight hours. Therefore the focus should be on event occurrences, not failure rates, with a small fleet typical of early service time.

After maturity (a stable engine shutdown event rate at or below the target values) with a large fleet, reporting intervals continue on a quarterly basis. Regardless of fleet size, fleet age, and state of maturity, engine failures are reported under the requirements of section 21.3.

3. Paragraph (b)(2) of the proposed section 21.4 identifies world fleet IFSD rate/reliability requirements. The standards in section 21.4(b)(2)(i) are the IFSD rates compatible with the current FAA ETOPS AC and Policy for operation up to 180 minutes (including North Pacific operation). The standard in section 21.4(b)(2)(ii) is an IFSD rate compatible with operation beyond 180 minutes to 240 minutes and beyond, as contained in the proposed Operational rule and guidance material.

As discussed in this proposed NPRM, an IFSD rate of 0.01/1,000 Engine Flight Hours (EFH) is consistent with an extremely improbable risk of a dual in-flight power loss from independent causes for a two-engine airplane, even assuming a decision of practically unlimited duration. The rates given are not operator specific, but rather apply across the fleet of a given airplane-engine combination.

The FAA expects implementation of corrective action will maintain an acceptable in-flight shutdown rate below the required levels. This is borne out by the current ETOPS fleet in-flight shutdown rates, which have achieved and consistently maintained rates at or below 0.01 per 1,000 engine-hours. If the normal airworthiness monitoring process is not sufficient by itself to maintain an acceptable propulsion system reliability for a particular airplane-engine combination, then the FAA may require additional corrective actions, or reduce or withdraw the ETOPS diversion authority as described in section 21.4(c), if the risk of dual power loss is unacceptably high. Before such action is taken, however, the certificate holder and the FAA will assess the fleet-wide risk based upon the risk model developed for ETOPS presented in this preamble.

Part 25

Section by Section Discussion of the Proposed Changes to Part 25

Proposed Change to Paragraph 25.857(c)(2)—Cargo Fire Suppression

The proposed change to section 25.857(c)(2) would require that the applicant furnish the certified time capability of a Class C cargo fire suppression system in the Airplane Flight Manual (AFM) in accordance with section 25.1581(a)(2). The time capability of a system is the maximum length of time a system can suppress a fire.

Explanation

The proposed new section 121.633 and part 135, Appendix H, paragraph E would specify that the time that an operator needs to fly to a planned ETOPS alternate may not exceed the maximum time capability specified in the Airplane Flight Manual for the airplane's most time limited system. This change to section 25.857(c)(2) and a similar requirement in the new Appendix L, section I, paragraph (e)(4) will ensure that the Airplane Flight Manual provides the information that the operators will need regarding the fire suppression system to comply with the operating requirements. The justification for these changes is further discussed in the explanations for those proposed operating rules.

Proposed New Section 25.1535—ETOPS Approval

A proposed new section 25.1535 would prescribe the requirements for obtaining ETOPS type design approval.

Explanation

This new rule in the body of part 25 is effectively a pointer to a new Appendix L, which sets out additional design, analysis and test requirements for ETOPS type design approval. This rule also requires that in showing compliance with part 25 rules the applicant must consider the maximum length ETOPS mission. The applicant must also consider the effects of airplane system failure on crew workload and passenger physiological needs during a diversion of the maximum time considered. The system safety assessment required by section 25.1309 is an example of a rule where the ETOPS mission profile would be considered in an analysis to determine compliance. The ETOPS mission profile (including the maximum diversion time) could also affect the compliance analysis for section 25.1011(b) concerning oil endurance, and section 25.571 governing structural fatigue and damage tolerance.

This proposed rule is crucial to ensure that throughout the airplane design, the ETOPS mission profile is properly considered, and the standard of compliance is high because of it. The ''ETOPS Scenario'' diagram and the ETOPS significant systems definition that would be provided in the associated advisory circular for this rule are good tools that system designers can use to assess all conditions although they are not regulatory. There are also additional requirements in Appendix L to provide focus on those airplane systems that have, historically, been important to ETOPS operations such as electrical power, APU, and fuel systems. The emphasis on these specific airplane systems does not mean that these are the only airplane systems that are important to ETOPS. The section 25.1535 and Appendix L requirements along with the advisory circular guidance for ETOPS significant systems and the ETOPS mission profile provide the basis for assessing other airplane systems for ETOPS approval.

Proposed New Part 25 Appendix L—Extended Operations

A proposed new appendix L to part 25 defines additional airworthiness requirements for ETOPS approval.

Explanation

Appendix L would codify the airworthiness standards unique to ETOPS from Advisory Circular 120–42A, the Boeing 777 ETOPS special conditions, and the 207-minute ETOPS Policy Letter EPL 20–01. The requirements of Appendix L would go beyond simply considering the ETOPS mission in applying the basic part 25 requirements.

Since we would not require an applicant to comply with these ETOPS requirements in order to receive a basic part 25 type certificate, we decided that a separate appendix to part 25 would be the best location for these additional requirements for ETOPS.

Appendix L Format

Appendix L is organized into three sections. Section I sets out design requirements that all airplanes must comply with for ETOPS approval. Section II prescribes specific requirements for two engine airplanes. Section III prescribes specific

requirements for airplanes with more than two engines.

The proposed numbering system and organization of Appendix L is a significant departure from the ARAC recommendation. As an aid to readers familiar with the original ARAC proposal, Tables 1 and 2 cross-reference the original Appendix L paragraph numbers recommended by ARAC to the reorganized appendix proposed in this notice.

TABLE 1.—CROSS-REFERENCE OF ARAC PROPOSED AND NEW APPENDIX L PARAGRAPH NUMBERS

Original ARAC Proposal		New	
L25.1		Appendix L	Applicability
L25.2	(a)	Section I	(a)
	(a)(i)	Section I	(a)(1)
	(a)(i)(1)	Section I	(a)(1)(i)
	(a)(i)(2)	Section I	(a)(1)(ii)
	(a)(ii)	Section I	(a)(2)
	(a)(ii)(1)	Section I	(a)(2)(i)
	(a)(ii)(2)	Section I	(a)(2)(ii)
	(a)(ii)(3)	Section I	(a)(2)(iii)
	(a)(iii)	Section I	(a)(3)
	(b)	Section I	(b)
	(b)(i)	Section I	(b)(1)
	(b)(i)(1)	Section I	(b)(1)(i)
	(b)(ii)	Section I	(b)(1)
	(b)(iii)	Section I	(b)(1)(ii)
	(b)(iv)	Section I	(b)(2)
	(b)(iv)(1)	Section I	(b)(2)(i)
	(b)(iv)(2)	Section I	(b)(2)(ii)
L25.3	(i)	Section II	(b)(1)
	(ii)	Section II	(b)(2)(ii)
	(iii)	Section I	(c)
L25.4		Section II, Section III	
	(a)	Section II, Section III	(a)
	(a)(i)	Section II, Section III	(a)(1)
	(a)(ii)	Section II, Section III	(a)(1)
	(a)(iii)	Section II	(a)(2), (a)(3)
		Section III	(a)(2)
	(a)(iv)	Section II	(a)(4)
	(a)(iv)(a)	Section II	(a)(4)(i)
	(a)(iv)(b)	Section II	(a)(4)(ii)
	(a)(iv)(c)	Section II	(a)(4)(iii)
	(a)(v)	Section II	(a)(3)
		Section III	(a)(2)
	(a)(vi)	Section II	(a)(5)
		Section III	(a)(3)
	(a)(vii)	Section I	(d)
	(b)	Omit	
	(b)(i)	Section II	(b)(9)
		Section III	(b)(6)
	(b)(i)(1)	Section II	(b)(4)
	(b)(i)(1)(a)	Section II	(b)(4)(i)
	(b)(i)(1)(b)	Section II	(b)(4)(ii)
	(b)(i)(2)	Section II	(b)(6)
	(b)(i)(2)	Section III	(b)(3)
	(b)(i)(3)	Section II	(b)(7)
	(b)(i)(3)	Section III	(b)(4)
	(b)(i)(3)(a)	Section II	(b)(7)(i)
		Section III	(b)(4)(i)
	(b)(i)(3)(a)(i)	Section II	(b)(7)(i)(1)
		Section III	(b)(4)(i)(1)
	(b)(i)(3)(a)(ii)	Section II	(b)(7)(i)(2)
		Section III	(b)(4)(i)(2)
	(b)(i)(3)(a)(iii)	Section II	(b)(7)(i)(3)
		Section III	(b)(4)(i)(3)
	(b)(i)(3)(a)(iv)	Section II	(b)(7)(i)(4)
		Section III	(b)(4)(i)(4)
	(b)(i)(3)(a)(v)	Section II	(b)(7)(i)(5)
		Section III	(b)(4)(i)(5)
	(b)(i)(3)(a)(vi)	Section II	(b)(7)(i)(6)
		Section III	(b)(4)(i)(6)
	(b)(i)(3)(b)	Section II	(b)(7)(ii)
		Section III	(b)(4)(ii)
	(b)(i)(3)(c)	Section II	(b)(7)(iii)
		Section III	(b)(4)(iii)
	(b)(i)(3)(d)	Section II	(b)(7)(iv)
		Section III	(b)(4)(iv)

TABLE 1.—CROSS-REFERENCE OF ARAC PROPOSED AND NEW APPENDIX L PARAGRAPH NUMBERS—Continued

Original ARAC Proposal		New	
	(b)(i)(3)(e)	Section II	(b)(7)(v)
		Section III	(b)(4)(v)
	(b)(ii)	Section II	(b)(8)
		Section III	(b)(5)
	(b)(ii)(a)	Section II	(b)(8)(i)
		Section III	(b)(5)(i)
	(b)(ii)(b)	Section II	(b)(8)(ii)
		Section III	(b)(5)(ii)
	(b)(ii)(c)	Section II	(b)(8)(iii)
		Section III	(b)(5)(iii)
	(b)(ii)(d)	Section II	(b)(8)(iv)
		Section III	(b)(5)(iv)
	(b)(iii)	Section II	(b)(3)
		Section III	(b)(1)
	(c)	Section II, Section III	(c)
	(c)(i)	Section II, Section III	(c)(1)
	(c)(ii)	Section II, Section III	(c)(2)
L25.5		Section I	(e)(4)

TABLE 2.—CROSS-REFERENCE OF NEW AND ARAC PROPOSED APPENDIX L PARAGRAPH NUMBERS

New		Original ARAC Proposal	
Appendix L	Applicability	L25.1.	
Section I		L25.2.	
	(a)	L25.2	(a)
	(a)(1)	L25.2	(a)(i)
	(a)(1)(i)	L25.2	(a)(i)(1)
	(a)(1)(ii)	L25.2	(a)(i)(2)
	(a)(1)(iii)	New.	
	(a)(2)	L25.2	(a)(ii)
	(a)(2)(i)	L25.2	(a)(ii)1
	(a)(2)(ii)	L25.2	(a)(ii)(2)
	(a)(2)(iii)	L25.2	(a)(ii)(3)
	(a)(3)	L25.2	(a)(iii)
	(b)	L25.2	(b)
	(b)(1)	L25.2	(b)(i), (b)(ii)
	(b)(1)(i)	L25.2	(b)(i)(1)
	(b)(1)(ii)	L25.2	(b)(iii)
	(b)(2)	L25.2	(b)(iv)
	(b)(2)(i)	L25.2	(b)(iv)(1)
	(b)(2)(ii)	L25.2	(b)(iv)(2)
	(b)(3)	New.	
	(c)	L25.3	(iii)
	(d)	L25.4	(a)(vii)
	(e)	New.	
	(e)(1)	New.	
	(e)(2)	New.	
	(e)(3)	New.	
	(e)(4)	L25.5.	
	(e)(5)	New.	
Section II		L25.4.	
	(a)	L25.4	(a)
	(a)(1)	L25.4	(a)(i), (a)(ii)
	(a)(2)	L25.4	(a)(iii)
	(a)(3)	L25.4	(a)(iii), (a)(v)
	(a)(4)	L25.4	(a)(iv)
	(a)(4)(i)	L25.4	(a)(iv)(a)
	(a)(4)(ii)	L25.4	(a)(iv)(b)
	(a)(4)(iii)	L25.4	(a)(iv)(c)
	(a)(5)	L25.4	(a)(vi)
	(b)(1)	L25.3	(i)
	(b)(2)(i)	New.	
	(b)(2)(ii)	L25.3	(ii)
	(b)(3)	L25.4	(b)(iii)
	(b)(4)	L25.4	(b)(i)(1)
	(b)(4)(i)	L25.4	(b)(i)(1)(a)
	(b)(4)(ii)	L25.4	(b)(i)(1)(b)
	(b)(5)	New.	

TABLE 2.—CROSS-REFERENCE OF NEW AND ARAC PROPOSED APPENDIX L PARAGRAPH NUMBERS—Continued

New		Original ARAC Proposal	
	(b)(6)	L25.4	(b)(i)(2)
	(b)(7)	L25.4	(b)(i)(3)
	(b)(7)(i)	L25.4	(b)(i)(3)(a)
	(b)(7)(i)(1)	L25.4	(b)(i)(3)(a)(i)
	(b)(7)(i)(2)	L25.4	(b)(i)(3)(a)(ii)
	(b)(7)(i)(3)	L25.4	(b)(i)(3)(a)(iii)
	(b)(7)(i)(4)	L25.4	(b)(i)(3)(a)(iv)
	(b)(7)(i)(5)	L25.4	(b)(i)(3)(a)(v)
	(b)(7)(i)(6)	L25.4	(b)(i)(3)(a)(vi)
	(b)(7)(ii)	L25.4	(b)(i)(3)(b)
	(b)(7)(iii)	L25.4	(b)(i)(3)(c)
	(b)(7)(iv)	L25.4	(b)(i)(3)(d)
	(b)(7)(v)	L25.4	(b)(i)(3)(e)
	(b)(8)	L25.4	(b)(ii)
	(b)(8)(i)	L25.4	(b)(ii)(a)
	(b)(8)(ii)	L25.4	(b)(ii)(b)
	(b)(8)(iii)	L25.4	(b)(ii)(c)
	(b)(8)(iv)	L25.4	(b)(ii)(d)
	(b)(9)	L25.4	(b)(i)
	(c)	L25.4	(c)
	(c)(1)	L25.4	(c)(i)
	(c)(2)	L25.4	(c)(ii)
Section III		L25.4.	
	(a)	L25.4	(a)
	(a)(1)	L25.4	(a)(i), (a)(ii)
	(a)(2)	L25.4	(a)(iii), (a)(v)
	(a)(3)	L25.4	(a)(vi)
	(b)(1)	L25.4	(b)(iii)
	(b)(2)	New.	
	(b)(3)	L25.4	(b)(i)(2)
	(b)(4)	L25.4	(b)(i)(3)
	(b)(4)(i)	L25.4	(b)(i)(3)(a)
	(b)(4)(i)(1)	L25.4	(b)(i)(3)(a)(i)
	(b)(4)(i)(2)	L25.4	(b)(i)(3)(a)(ii)
	(b)(4)(i)(3)	L25.4	(b)(i)(3)(a)(iii)
	(b)(4)(i)(4)	L25.4	(b)(i)(3)(a)(iv)
	(b)(4)(i)(5)	L25.4	(b)(i)(3)(a)(v)
	(b)(4)(i)(6)	L25.4	(b)(i)(3)(a)(vi)
	(b)(4)(ii)	L25.4	(b)(i)(3)(b)
	(b)(4)(iii)	L25.4	(b)(i)(3)(c)
	(b)(4)(iv)	L25.4	(b)(i)(3)(d)
	(b)(4)(v)	L25.4	(b)(i)(3)(e)
	(b)(5)	L25.4	(b)(ii)
	(b)(5)(i)	L25.4	(b)(ii)(a)
	(b)(5)(ii)	L25.4	(b)(ii)(b)
	(b)(5)(iii)	L25.4	(b)(ii)(c)
	(b)(5)(iv)	L25.4	(b)(ii)(d)
	(b)(6)	L25.4	(b)(i)
	(c)	L25.4	(c)
	(c)(1)	L25.4	(c)(i)
	(c)(2)	L25.4	(c)(ii)

We discuss each paragraph of the proposed new Appendix L below.

Section I—Design Requirements

I(a) Airplane Systems

I(a)(1) Operation in Icing Conditions

I(a)(1)(i)

ETOPS airplanes would have to comply with the requirements of section 25.1419 for operation in icing conditions.

Explanation

Section 25.1419 sets out the requirements for certifying a transport category airplane for flight into icing conditions. This requirement is optional in that an applicant may choose to not apply for approval in icing conditions. However, from a practical standpoint no one would request certification of an airplane that did not meet this requirement. This proposed new regulation makes this approval mandatory for ETOPS approval.

I(a)(1)(ii)

The airframe and propulsion system ice protection would have to be capable of continued safe flight and landing at engine-inoperative and decompression altitudes in icing conditions. Following the loss of an engine at cruising altitude, an airplane will drift down to a lower (engine-inoperative) altitude. A decompression altitude is an altitude to which an airplane must descend following the loss of cabin pressure. Decompression altitudes are 10,000 feet MSL and below.

Explanation

This paragraph would codify AC 120–42A, paragraph 8(b)(11) for airframe ice protection. The applicant would have to demonstrate that the airplane is capable of continued safe flight and landing at

the decompression altitudes. This rule would require the applicant to demonstrate to the FAA that the anti-icing systems on the airplane will assure the airplane's capability to continue to operate during a worst-case diversion. The ARAC Working Group recommended a standard that would require the capability to safely divert if anti-icing cannot be shown available for all scenarios. This recommended standard tacitly assumes that airplane ice protection is not necessarily required during an ETOPS diversion. We disagree with this recommendation. Paragraph 8(b)(11) of AC 120–42A says that the airframe and propulsion ice protection should be shown to provide adequate capability for the intended operation. The AC says that this should account for prolonged exposure to lower altitudes associated with the engine-out diversion, cruise, holding, approach and landing. We do not interpret this paragraph as allowing circumstances where anti-icing would not normally be available during an ETOPS diversion. An applicant would have to address any failure conditions where the ice-protection systems would not be available during an ETOPS diversion as part of the safety analysis required by section 25.1309.

The preamble justification provided in the ARAC proposal stated that this rule ''will also require the applicant to demonstrate that the non-heated (or ''non-deiced'') areas of the airplane will not pick up a load of ice that would make the airplane uncontrollable or create too much drag to complete the diversion.'' This statement is consistent with how the FAA has applied the criteria of AC 120–42A paragraph 8.(b)(11) for all airplanes certified using that policy. However, the ARAC recommendation did not include this specific provision. We have added this requirement into the proposed rule as a new paragraph I(a)(1)(iii). It is consistent with ARAC's recommendation and consistent with what has been standard ETOPS type certification practice to consider the accumulation of ice on the non-heated or non-deiced areas of the airplane.

The associated advisory material for this proposed requirement will describe the conditions and assumptions that an applicant may use in simulating a diversion icing environment for showing compliance with the proposed rule. The advisory material will also provide guidance for developing analyses or testing that would justify not having to assume that the entire diversion would be in icing conditions.

I(a)(2) Electrical Power Supply

I(a)(2)(i) and (ii)

These paragraphs would establish reliability requirements for the electrical power supply system on an ETOPS flight.

Explanation

Paragraphs I(a)(2)(i) and (ii) are basically a restatement of section 25.1309 for the electrical power supply system in consideration of the ETOPS mission. We agree with the ARAC's apparent intent that these paragraphs, in conjunction with the new sections 25.1535(a) and (b), codify paragraphs 8(b)(1), 8(b)(6), 8(b)(7) and 8(c)(4) of AC 120–42A for the electrically powered ETOPS significant systems. These paragraphs establish the overall system safety objectives for these systems in extended operations.

The proposed rule is not as explicit as AC 120–42A in stating the types of functions that an applicant would need to consider in applying the safety objectives of section 25.1309 for an ETOPS mission. The general philosophy of the proposed rule is to let the existing policy associated with section 25.1309 compliance determine the design analysis for ETOPS. This philosophy is consistent with paragraph (c)(1) of the Boeing Model 777 ETOPS special conditions, which requires the applicant to comply with part 25 with regards to the ETOPS mission. Although we discuss this regulatory philosophy here in reference to the specific electrical power supply system requirements, it also applies to other ETOPS significant systems that are not specifically addressed in the proposed rule.

The FAA's intent for paragraphs I(a)(2)(i) and (ii) is to assure that the applicant properly focuses on electrical power redundancy and reliability when considering ETOPS mission scenarios in showing compliance with section 25.1309. On a two-engine airplane, the potential lack of redundancy available for electrical power generation makes this requirement especially important. However, the new emphasis is in paragraph (ii). It will be up to the applicant to demonstrate which functions would reduce the capability of the airplane or the ability of the crew to cope with adverse operating conditions. It is not realistic, for instance, for an applicant to state that operating for an extended period of time on suction feed would not reduce the capability of the airplane to cope with adverse operating conditions (for example, negative g or turbulence). Additionally, the applicant would have to determine what navigation and communication systems must be powered by emergency generation sources during a worst case ETOPS diversion.

I(a)(2)(iii)

This paragraph would require at least three independent electrical generation sources for airplanes being certified for greater than 180 minutes.

Explanation

Paragraph I(a)(2)(iii) would codify the three generator requirement of paragraph 8.(b)(8) in AC 120–42A. However, the ARAC recommendation only applies this requirement to airplanes being certified for greater than 180-minute ETOPS. The AC specifies three generators for any ETOPS approval. This specific requirement created much discussion within the ARAC ETOPS Working Group. Paragraph I(a)(2)(iii) as proposed in this notice represents the compromise position that allowed working group consensus. The following paragraphs are the ARAC's recommended justification for this requirement. The FAA is publishing them without comment.

This topic is inextricably linked to the discussion about MMELs. The MMEL or Master Minimum Equipment List allows an airplane operator to fly without equipment not on this fully functioning. There is concern that without a specific number of generators required in the rule, the MMEL could strip away some of the redundancy required for long-range flight. The arguments against a prescriptive number are generally as follows:

(1) Defining a number of generators would not assure proper system reliability (for example, is it better to have three generators with a Mean Time Between Failures (MTBF) of 20,000 hours each, or four generators with an MTBF of 3,000 each?)

(2) Defining a number of generators would either artificially constrain or give a ''pass'' to future airplane designs. For instance, if a new airplane had a system architectural need for 8 generating systems, requiring three in the ETOPS rule would not assure an adequately safe design.

(3) Trying to address the formation of the MMEL in part 25 is impractical and inconsistent with agreed-to policies for MMEL development.

''Nonetheless, it was agreed that there should be a tie-in between the analysis performed for Part 25 ETOPS approval and the analysis the Flight Operations Evaluation Review Board (FOEB), who develop the MMEL, used in determining dispatch criteria. This is almost always the case in today's process, but

formalizing the process would be a positive step.

''Therefore, an additional paragraph has been added to the ETOPS regulation to require a minimum number of electrical generators. This requirement codifies the existing AC 120–42A electrical generator redundancy criteria. The intent of this requirement is to ensure future airplanes to be certified for ETOPS have an electrical generation system architecture equivalent to the 737, 757, 767, 777 and A310, 320, A330 era airplanes. Future airplane electrical system architectures may be significantly different from today's airplanes, but the architecture must be equivalent from the perspective of robustness to independent failure scenarios.''

I(a)(3) Time Limited Systems

This paragraph would require that the applicant state the capability of most time limiting ETOPS significant system in the airplane flight manual.

Explanation

As stated previously for the revised paragraph 25.857(c)(2), this requirement would provide the information that the operators would need to comply with the applicable operating requirements. Advisory Circular 120–42A has two main categories of ETOPS approval (120 minutes and 180 minutes) based on demonstrated propulsion system reliability. The ETOPS approval, as stated in the airplane flight manual in currently approved ETOPS airplanes, identifies the maximum approved diversion time based as one of these two times. In order to qualify for the ETOPS type design approval, the applicant must design the airplane time-limited systems to support this maximum approved diversion time with an additional 15 minutes capability to allow for airplane holding, approach and landing.

In the context of proposed paragraph I(a)(3), we do not consider the propulsion system as a time-limited ETOPS significant system. Proposed Appendix L, section II(a), codifies the service experience method for ETOPS approval from AC 120–42A. Paragraph II(a)(4) of this section defines the required world fleet in-flight shutdown rate with each level of ETOPS operational approval. In this particular case, the level of ETOPS approval refers to the operational approval authority defined in the operating rules, not the time-limited system capability required in paragraph I(a)(3).

I(b) Propulsion System

I(b)(1) Fuel System Design

This paragraph would require design features to ensure that fuel necessary to complete an ETOPS mission will be available at the flow and pressure required for the engine, during a diversion for the longest time being approved for the airplane. The proposed rule includes a requirement for alerts to the crew when the fuel available to the engines falls below the level required to complete the mission which can occur because of fuel mismanagement, abnormal transfer between tanks, and fuel loss.

Explanation

Fuel system design and the ability of the crew to properly deal with fuel system malfunctions are arguably the most important issues facing the designer of ETOPS airplanes. The proposed rule (with corresponding AC guidance) addresses the need for:

(1) Positive fuel pressure at the engine fuel pump (no suction feed);

(2) Fuel availability following system failures (no hidden/trapped fuel, functional crossfeed valves, etc.); and

(3) Flight deck alerts when fuel available to the engines falls below the level required to complete the mission.

The proposed requirements would codify the intent of paragraph 8.(b)(2)(iii) of AC 120–42A, paragraph (c)(3)(i)(C) of the Boeing 777 ETOPS special conditions, and items 7 and 8 of the type design provisions of the 207 minute ETOPS Policy Letter EPL 20–1.

There has been some discussion regarding newer generation airplanes (B777) and their system architecture being the standard by which operations beyond 180 minutes will be judged. Currently, all transport category aircraft are required to perform suction feed testing as part of basic part 25 certification, which requires the applicant to simulate an all Alternating Current (AC) power loss at the highest altitude the airplane is used in service (''service ceiling''). The testing is performed to demonstrate that in the event of an all AC power loss, there is still ability (at some safe altitude) to re-start the engines after flameout on suction feed and generate thrust to a safe landing. This demonstration does not, however, provide any assurance that the engines can operate on suction feed for the long duration diversion times envisioned for ETOPS. The engines are certified with a minimum engine fuel pump inlet pressure limit of typically one-half pound per square inch (0.5 psi) above the ambient air pressure, or the fuel vapor pressure, whichever is higher. Section 25.955 requires that the airplane fuel system deliver fuel to the engine at this minimum pressure for the maximum fuel flow required by the engine. Without the fuel boost pressure, airplanes cannot comply with § 25.955. The fuel system design requirements proposed in this notice are intended to ensure that continued operation on suction feed is not a practical possibility on ETOPS airplanes. Paragraph I(b)(1) would be applicable to all ETOPS airplanes irrespective of the number of engines.

Loss of normal electrical power to the boost pumps is the primary cause of the loss of fuel system boost pressure. A specific fuel feed capability requirement has been added for twin-engine ETOPS operations beyond 180 minutes that is intended to address the concerns about loss of fuel boost pressure raised in the development of the 207 minute ETOPS policy. The 207-minute policy included a provision to also address fuel cross-feed capability following the failure of normal electrical power. Proposed paragraph I(b)(1)(i) would require that the applicant design the airplane fuel system with a fuel boost pump in each main tank and the capability to operate at least one crossfeed valve by a back-up electrical generation source other than the primary engine driven or APU driven generators. There is an exception in the proposed rule for fuel system designs for situations when electrical power does not provide required fuel boost pressure or crossfeed valve actuation. Although this is a specific design requirement applicable to two engine airplanes for ETOPS beyond 180 minutes, the overall design objective underlying paragraph I(b)(1) is applicable to all ETOPS airplanes. The applicant may use the same design features required by paragraph I(b)(1)(i) as part of their compliance with paragraph I(b)(1) for airplanes not specifically covered by this subparagraph.

The other possible source of the loss of fuel boost pressure is mechanical failure of fuel system components. These include pump failures or performance degradation, valve failures, and plumbing failures causing internal or external fuel leaks that result in significant fuel pressure loss. Possible design alternatives to address mechanical failures as a source of loss of fuel system boost pressure are:

1. Redundancy (additional boost pumps, cross-feed valves, etc.)

2. Improved component reliability (including any instructions for continued airworthiness necessary to maintain that level of reliability)

3. Enlarged main fuel tank capacity (to minimize the effect of loss of boost pressure in other fuel tanks)

4. A time-limited engine fuel inlet pressure limit at which the engine can demonstrate acceptable operation and integrity for the longest diversion time for which the airplane manufacturer is requesting approval.

Each of these design alternatives has advantages and disadvantages that the manufacturer would need to consider in designing an airplane to comply with the proposed rule.

We intend that the proposed paragraph I(b)(1) would preclude all causes of loss of system boost pressure in extended operations. This is consistent with the overall safety objectives established by the part 25 airworthiness standards for potentially catastrophic failure conditions.

Proposed paragraph I(b)(1)(ii) would require flight deck alerts when the fuel available to the engines falls below that required to complete the mission. The FAA's intent is that the required flight deck alerts would give flight crews clear warning of impending fuel exhaustion with enough time to safely land the airplane before the condition becomes critical. As a minimum, the manufacturer would have to design the flight deck alerts to address the types of failures or human errors that have resulted in airline fuel exhaustion events in service.

Examples of fuel exhaustion events include an Air Canada Boeing 767 that landed on an abandoned runway after both engines flamed out from fuel exhaustion. In this case, the normal low fuel alerts did not function because of a fuel quantity indication system failure. The fuel exhaustion was caused by the crew not receiving a low fuel alert, in combination with an unapproved airplane dispatch and a fueling error. An Air Tran Airbus A330 landed in the Azores following flameout of both engines caused by fuel exhaustion due to an unrecognized engine fuel leak. The AC provides guidance on critical fuel system alerts derived from these types of fuel loss events that have occurred in the current generation of aircraft.

I(b)(2) APU design

If operation of an auxiliary power unit (APU) were needed to comply with the ETOPS requirements, the applicant would have to demonstrate that the APU has adequate reliability for that operation. Also, if in-flight start and run capability is necessary, the APU in-flight operating envelope would have to extend to the maximum operating altitude of the airplane or 45,000 feet, whichever is lower.

Explanation

The electrical system reliability standard contained in AC 120–42A envisions three independent alternating current (AC) electrical generators. Besides the two engine driven generators, an auxiliary power unit (APU) could drive a third generator to meet this standard. Auxiliary power units are separately controlled small engines that are installed on an aircraft to power services when the main aircraft engines are not running. Airlines normally use an airplane APU at the gate to provide electrical power for onboard lighting and an air source for the air conditioning system between flights. Besides this normal function, the FAA may allow an airline to use an APU powered electrical generator during a revenue flight when a main engine generator is not working.

The electrical system reliability requirements proposed in this notice do not specifically require three independent generators except for airplanes being certified for ETOPS diversion times greater than 180 minutes. Current two engine aircraft that the FAA has approved for ETOPS would only be able to comply with the proposed requirement for electrical system reliability by having three independent generators. Other required aircraft system functions also may be powered by an APU. Proposed paragraph I(b)(2) of the rule would require that if the applicant is going to rely on the APU for compliance with the ETOPS requirements:

(1) The APU has to have adequate reliability; and

(2) If it must be started and run in-flight, the APU must demonstrate that it has the capability to start and perform its intended function up to the maximum operating altitude of the airplane, or 45,000 feet, whichever is lower.

The major reason for wanting high altitude APU in-flight start capability is to avoid having flight level changes that would cause the flight to have to cross through established flight track systems just to start the APU. Also, once the flight leaves the established track system it can be very difficult, or impossible to re-enter the track system, reducing the pilot's flexibility to fly the optimum flight plan. Having an in-flight start capability up to 45,000 feet mitigates these concerns.

''Adequate'' reliability consumed much of the Working Group's discussion time during development of the rule. This term can only be placed in context by understanding the overall electrical and pneumatic system architecture of the airplane. For instance, if an applicant has installed generators with inadequate reliability, their mean time between failure (MTBF) may require an extremely reliable APU generator in order to comply with the electrical system reliability objectives of § 25.1309. This would drive the applicant into a significant APU reliability demonstration program. The reverse could also be true. An electrical system may have generators with an excellent MTBF of 100,000 hours with additional non-APU back-up sources. In this case, the ''required'' reliability of the APU would be less than for current airplane electrical systems with APU driven generators. However, the applicant would have to present a convincing system level reliability analysis backed by validated component reliability data before the FAA would accept an assumption of lower APU reliability from that required for today's airplanes.

An APU has traditionally been used only to ''back-up'' the electrical system, and the proposed new regulatory and advisory material focuses on this function. No current aircraft utilizes an APU to provide ''back-up'' pneumatic system capability to meet ETOPS significant system reliability standards. However, the associated advisory circular addresses the possible operational need for APU pneumatics on the ground to power the cabin air conditioning system following an airplane diversion. If the APU is necessary as a bleed source to comply with section 25.1309 or the new section 25.1535, the applicant would have to define the operating envelope of where it can perform this intended function. The FAA requires this for any APU required function under the existing airworthiness standards of part 25. Currently most APUs can only provide both bleed air and electrical power at lower cruise altitudes, and cannot provide enough bleed air to power an air conditioning pack at the airplane service ceiling. The applicant would have to fully account for the use of a ''limited'' ETOPS APU operating envelope in substantiating compliance with section 25.1309 or section 25.1535. In accounting for a limited APU operating envelope, the applicant would have to address the operational implications, including air traffic control, of having to descend to a lower altitude in order to use the required APU function.

ARAC recommended the following language for paragraph I(b)(2): ''If operation of the APU installation is required to comply with this appendix, the applicant must * * *''. Except for

the electrical system, which has specific requirements in proposed Appendix L, all other potential airplane system functions that could be powered by an APU are addressed by the overall ETOPS requirement contained in section 25.1535(a). Examples include the cabin pressurization and hydraulic systems, which may be powered by an APU. The ARAC recommended proposed rule and preamble states the intent that this requirement should not be limited to just electrical system reliability. We have corrected this oversight by replacing ''this appendix'' with section 25.1535 in proposed paragraph I(b)(2).

I(b)(3) Engine Oil Tank Design

The engine oil filler cap design would have to comply with a proposed change to section 33.71(c)(4), which will require oil tank cap designs that prevent hazardous oil loss in the event of an oil tank cap installation error.

Explanation

See the proposed change to section 33.71(c)(4) for an explanation of the reasons for this change. We added paragraph I(b)(3) to Appendix L to ensure that engines installed on ETOPS airplanes comply with the part 33 requirement.

I(c) Engine Condition Monitoring

The applicant would have to define and validate, as required, an engine condition monitoring process in accordance with part 33, Appendix A, paragraph A33.4.

Explanation

This requirement would codify paragraph a(5) of Appendix A of AC 120–42A and paragraph (b)(2) of the Boeing Model 777 ETOPS special conditions.

With the propulsion system reliabilities existing on today's long range airplanes, the FAA is very concerned that the biggest threat to ETOPS safety is the risk associated with common cause, cascading failures and fuel exhaustion. Several of the proposed requirements in this notice would address these threats. The engine condition monitoring process requirement specifically addresses the potential of additional engine failure or failures resulting from the increased thrust or service demands on the remaining engine or engines.

Operators would be required, in the proposed changes to parts 121 and 135, to have an engine condition monitoring program as part of their ETOPS maintenance program. Paragraph I(c) of Appendix L and paragraph A33.4 in part 33 would require the airplane and engine manufacturer to provide the instructions necessary for an operator to develop this program.

Since the potential for a catastrophic loss of thrust is greater on a two engine airplane than on airplanes with more than two engines, this proposed rule would require that the applicant validate the engine condition monitoring process for use on two engine airplanes before ETOPS approval. For airplanes with more than two engines, the applicant would need only to define the process.

I(d) Configuration, Maintenance and Procedures

The applicant would have to identify configuration, maintenance, or operational standards necessary to maintain appropriate reliability or to obtain required capability for ETOPS in a Configuration, Maintenance, and Procedures (CMP) document.

Explanation

Paragraph I(d) of the proposed rule would codify material AC 120–42A. All existing policy on revising CMP documents would remain in force under the new rule. This is discussed more fully previously under general issues in the general discussion of the proposal.

I(e) Airplane Flight Manual

This paragraph would specify certain information that the airplane flight manual (AFM) must contain for ETOPS approval.

Explanation

This proposed requirement would codify paragraph 8(f)(1) of AC 120–42A. ARAC did not include this paragraph in their proposed rule draft. However, there are provisions within the AC paragraph that the FAA has required in all ETOPS type design approvals issued since 1985. The ETOPS approval statement contained in AC subparagraph 8(f)(1)(vi) is particularly important as applicants have based their airplane flight manual ETOPS approval statements on this wording. We are proposing to add the relevant provisions from AC paragraph 8(f)(1) into this notice in order to maintain continuity with the historical AFM ETOPS requirements.

The two provisions from AC 120–42A that we are not proposing to incorporate directly into proposed paragraph I(e) are subparagraphs 8(f)(1)(iii) and (v). Subparagraph 8(f)(1)(iii) addresses inclusion of the performance data used to comply with the engine-inoperative diversion criteria of the flight dispatch considerations in the operational approval section of the advisory circular. Contrary to this advisory circular provision, the FAA has not required that the performance data be included in the approved parts of the AFM and have not included this provision in the proposed rule. Subparagraph 8(f)(1)(v) asks for a description or reference to a document containing the approved airplane configuration CMP standard. The CMP document identification has traditionally been included in the ETOPS approval statement defined in subparagraph 8(f)(1)(vi) for ETOPS airplanes approved under the existing policy. Therefore, we have combined subparagraphs 8(f)(1)(v) and 8(f)(1)(vi) from the AC into the new proposed paragraph I(e)(5).

We are also proposing to add the original AFM requirement from the ARAC proposal into paragraph I(e)(4). This proposed requirement is not in AC 120–42A. This proposed paragraph would require the applicant to define the maximum ETOPS diversion time capability required by paragraph I(a)(3) into the airplane flight manual in accordance with § 25.1581(a)(2), ''Furnishing Information.'' This proposed requirement provides a cross-reference to proposed paragraph I(a)(3), which would require that the ETOPS capability defined by most limiting ETOPS significant system capability be stated in the airplane flight manual.

Section II—Two Engine Airplanes

In addition to the requirements of section I, an applicant for a two engine airplane would have to also show compliance with one of three proposed requirements of section II.

II(a) Service Experience Method

The applicant would have to demonstrate that the airplane and engine combination for which approval is sought has the required airplane and propulsion system capability to safely conduct an ETOPS mission with the maximum diversion for which approval is sought, and has achieved required airframe and propulsion system reliability based upon fleet in-service experience.

Explanation

Proposed sub-section II(a) would codify part of the existing approval process based on service experience, as contained in AC 120–42A for two engine airplanes. This includes the most significant aspect of this process, the propulsion system assessment contained in Appendix 1 of the advisory circular. The AC process is predicated on having a sufficient amount of service

experience to give the FAA enough data to assess the overall suitability of a two-engine airplane for ETOPS approval.

The AC type design assessment criteria are divided into two parts. The first part defines specific system design capability and safety objectives in order to provide a minimum design standard for airplanes operating in ETOPS. This part of the AC criteria is addressed in proposed section 25.1535(a) and (b), and section I of proposed part 25 appendix L.

The second part of the AC process is a review of in-service problems and identification of appropriate corrective actions to prevent problems that could have an adverse effect on ETOPS safety. Part of this review is to establish that the airplane and propulsion systems have an appropriate level of reliability to meet the safety objectives defined in the AC. Appendix 1 of the AC defines an amount of service experience that would normally be required in order to give a sufficient database to evaluate propulsion system reliability. We are proposing to address this second part of the AC type design assessment process in sub-section II(b) of this notice.

II(a)(1) Required Service Experience

This paragraph would require that an applicant who desires to obtain ETOPS type design approval using service experience conduct a reliability review after accumulating 250,000 worldwide fleet engine hours on the airplane and engine combination for which approval is being sought. The number of hours could be reduced if adequate compensating factors are identified which give a reasonable equivalent database. A significant portion of the 250,000 engine hours would have to be obtained on the candidate airplane.

Explanation

Proposed paragraph II(a)(1) would codify the service experience eligibility criteria from paragraph a(1) of Appendix 1 of AC 120–42A.

II(a)(2) Propulsion System Assessment

Paragraph II(a)(2)(i) would require an applicant to conduct a propulsion system assessment based on data collected from the entire fleet of the specific airplane and engine combination for which approval is sought. Paragraph II(a)(2)(ii) would require an applicant to identify corrective actions to prevent future occurrences of engine in-flight shutdowns or loss of thrust control.

Explanation

Paragraph II(a)(2)(i) would codify the reliability data base criteria from paragraph b. of Appendix 1 of AC 120–42A. ARAC did not include the reliability data base criteria in their proposed rule draft, but did have it in their associated draft advisory material. In paragraph 10(a)(iii) of the draft part 25 advisory circular, ARAC stated ''A propulsion system assessment must be based on the following data, collected from the entire fleet of the specific airplane/engine combination type for which approval is sought* * *''. Since ARAC clearly stated its intent that an applicant ''must'' conduct a propulsion system assessment on the specific list that follows, and based on the clear reference to the existing policy from Appendix 1 of AC 120–42A, we have incorporated this section from the ARAC draft advisory circular into proposed paragraph II(a)(2)(i) of this notice.

Paragraph II(a)(2)(ii) would codify the intent of the propulsion system assessment criteria from paragraph 3 of Appendix 1 of AC 120–42A. This is the so-called ''fix-all-problems'' requirement that has been the practice for all ETOPS type design approvals that the FAA has given using the service experience approval process defined in AC 120–42A.

The corrective actions that the applicant identifies in compliance with proposed paragraph II(a)(2) would be included in the approved configuration, maintenance, and procedures (CMP) document as a condition of the ETOPS approval.

II(a)(3) Airplane systems assessment

The applicant would have to show compliance with section 25.1535(a) using available in-service reliability data for ETOPS significant systems. The applicant would have to identify corrective actions to prevent future occurrences of ETOPS significant system failures occurring in service.

Explanation

The first part of this paragraph would codify the intent of paragraph 8(c)(1) of AC 120–42A for those ETOPS significant airplane systems addressed in proposed § 25.1535(a). This AC paragraph states that the analysis and demonstration of airframe and propulsion system failure effects and reliability provided by the applicant should be based on in-service experience and the longest diversion time for the airplane.

The second part of proposed paragraph II(a)(3) is an extension of the ''fix-all-problems'' approach used in the propulsion system assessment that we are proposing in paragraph II(a)(2). For all airplanes approved using the policy contained in AC 120–42A, the FAA has required an applicant to define effective corrective actions for all in-service problems known to result in, or potentially result in, airplane diversions. The FAA has required this in order to enter ETOPS service with the highest quality airplane. An applicant rarely considers known system failure conditions to be acceptable occurrences in service that they account for in their system failure analyses submitted for compliance with section 25.1309. Therefore, this fix all problems approach is appropriate in reassessing compliance with the applicable airworthiness requirements of proposed section 25.1535(a).

The corrective actions that the applicant identifies in compliance with proposed paragraph II(a)(3) would be included in the approved configuration, maintenance, and procedures (CMP) document as a condition of the ETOPS approval.

II(a)(4) In-Flight Shutdown (IFSD) Rates

This proposed paragraph defines propulsion system reliability standards for three levels of ETOPS type design approval.

(i) *For operations up to 120 minutes:* a rate of approximately 0.05 or less per 1,000 fleet engine hours with a CMP intended to bring the rate down to 0.02.

(ii) *For operations up to 180 minutes:* a rate of approximately 0.02 or less per 1,000 engine hours with an existing 120 minute CMP standard, or new or additional CMP requirements that have been demonstrated to achieve this in-flight shutdown rate.

(iii) *For operations greater than 180 minutes:* a rate of approximately 0.01 or less per 1,000 engine hours with an existing 120 minute or 180 minute CMP standard, or new or additional CMP requirements that have been demonstrated to achieve this in-flight shutdown rate.

Explanation

This proposed paragraph would codify the propulsion system reliability standards from Appendix 1 of AC 120–42A. In addition, we are proposing to add the reliability standard of 0.01 per 1,000 engine hours for ETOPS greater than 180 minutes that ARAC proposed in their recommended draft ETOPS rule.

The original ARAC recommendation refers to ''target threshold'' or ''target'' rate. These terms do not adequately define what would constitute an acceptable or unacceptable in-flight shutdown rate for showing compliance with this proposed requirement. The FAA has similar concerns about the term ''approximately'' as used in this

proposal, but this term is in the existing AC 120–42A policy and has been applied successfully since issuance of the AC. Therefore, the FAA has tentatively chosen to retain the term ''approximately'' as used in the existing AC policy in this proposed rule.

We have added the qualifier ''or less'' to the proposed in-flight shutdown rate requirement. Without this term, the rule could be interpreted to mean that the in-flight shutdown rate ''must'' be the approximate value specified. We clearly do not intend that an applicant with an in-flight shutdown rate well below the requirement would not be in compliance with the rule. We have added this additional qualifier in order to clarify this intent.

The original ARAC recommendation for operations up to 120 minutes was written in the following manner: ''with a required list of corrective actions that would result in continuing improvement toward an IFSD rate of 0.02 per 1000 fleet engine-hours.'' We have added ''in the CMP document'' in order to clarify where the list of corrective actions must be contained.

For the proposed requirements for both operations up to 180 minutes and operations greater than 180 minutes we have added a provision that considers the effect that existing or new CMP standards have on compliance with the required in-flight shutdown rate. In the past, we granted ETOPS approvals using a 180-minute CMP standard developed from the 120 minute ETOPS CMP documents. This has occurred when the applicant has substantiated, through service experience, additional requirements that would achieve the desired in-flight shutdown rate for those airplanes incorporating the additional requirements. The added provision proposed in this notice is a statement of existing practice for granting 180-minute ETOPS approval where the 120-minute standard had to be modified. This notice proposes to codify this existing practice into the rule as noted above.

II(a)(5) Airplane Flight Test Requirements

This paragraph would require a flight test to validate the adequacy of the airplane's flying qualities, performance, and the flight crew's ability to deal with engine inoperative and non-normal worst case system failure conditions expected to occur in service.

Explanation

This paragraph would codify the intent of paragraph 8(d)(3) of AC 120–42A. The original ARAC proposed paragraph stated that the proposed flight test would validate ''non-normal worst case probable system failure conditions.'' This proposed wording would not adequately reflect how the FAA has applied the AC paragraph being codified.

The term ''probable'' as used in the original ARAC proposal would have a specific meaning within the type certification community. As defined by Advisory Circular 25.1309–1A, probable failures are those anticipated to occur one or more times during the entire operational life of each airplane. Probable failures would most likely only include significant single failures, or more frequent double failures. However, we have required applicants for ETOPS type design approval under AC paragraph 8(d)(3) to demonstrate multiple failure conditions that are much less frequent in service, such as

(i) the loss of all normal electrical power;

(ii) flight controls powered by an emergency backup hydraulic source; and

(iii) loss of normal flight instruments.

These types of failure conditions would be expected to occur during the life of a fleet of airplanes, but not necessarily on each airplane. We believe that ARAC may have intended to include these failure conditions by using the qualifying term ''worst case'' in their proposal, however, we are not confident that it would be interpreted correctly with the wording as ARAC proposed. We have deleted the word ''probable'' and replaced it with system failure conditions ''expected to occur in service'' in the proposed rule. This clarification more accurately reflects how the FAA has applied the paragraph 8(d)(3) of AC 120–42A.

II(b) Early ETOPS Method

This part of section II defines requirements that an applicant would have to comply with to certify an airplane for ETOPS without first accumulating the service experience that would be required in section II(a).

Explanation

This section would codify the early ETOPS process defined in the Boeing Model 777 ETOPS special conditions 25–ANM–84 for two engine airplanes. These special conditions defined requirements that allowed the FAA to approve the Boeing Model 777 airplane for ETOPS without the service experience normally expected under the policy in AC 120–42A. The intent of this proposed sub-section of Appendix L is to define requirements that would allow the FAA to grant ETOPS approval concurrent with the original type certification of an airplane.

II(b)(1) Relevant Experience Assessment

The applicant would have to identify specific corrective actions taken on the airplane design to address relevant design, manufacturing, operational and maintenance problems experienced on previously certified part 25 airplanes manufactured by the applicant. Specific corrective actions would not be required if the nature of the problem is such that it would not have a significant impact on the safety or reliability of the system. The proposed rule would require that this assessment include the relevant experience of supplier provided ETOPS Group 1 significant systems and similar or identical equipment utilized on aircraft built by other manufacturers.

Explanation

This proposed rule would codify paragraph (c)(2) of the Boeing Model 777 ETOPS special conditions 25–ANM–84. The term ''relevant experience'' as used in the proposed rule means the design, manufacturing, operational or maintenance problems that have, or could have, resulted in the types of occurrences that would be included in propulsion system and airplane system assessments conducted in accordance with a service experience based ETOPS approval process proposed in section II(a).

The intent of this proposed requirement is to take advantage of service experience on other airplane types built by the applicant as much as is practical. This relevant experience assessment is in lieu of service experience on the actual airplane to be approved and is a major compensating factor for that direct service experience.

One of the five key elements of the early ETOPS process on the Boeing Model 777 was the ''relevant experience assessment,'' or ''lessons learned.'' Simply stated, the intent is for the applicant to review the failures on previous airplane/engine combinations, and assure that the causes of those failures are mitigated. While simple in concept, the execution of this assessment is significant in scope. One of the most significant aspects of this proposed rule is that an applicant with no previous transport category manufacturing experience would not be eligible to receive early ETOPS approval. The FAA considers the relevant experience assessment as elemental to the early ETOPS process. Without the ability to perform this assessment including lessons learned on manufacturing and engineering processes, the FAA could not

confidently grant an early ETOPS approval.

Beyond a certain level of commonality, past experience may not be relevant to a new design. This is particularly true where a specific design feature that contributed to problems in previous airplanes is not a part of the new airplane design. However, the demonstration of the applicability of past experience to the new design is inherent in the relevant experience assessment.

This proposed rule would require that the applicant identify corrective actions taken to preclude similar problems from occurring on the new airplane. Removal from the design of a system, sub-system, or component that has had problems in the past may be an acceptable corrective action, as long as it precludes similar problems from occurring.

Where new technology is introduced, the lessons learned assessment becomes impractical, as there is no previous experience with this technology. While this is true, there may still be applicable relevant experience. For example, an applicant's previous experience with new technology introductions may lead to changes in manufacturing and quality control processes. Further, lessons learned of general applicability can be introduced into the new technology design, such as a general design practice to prevent cross-connector installation.

II(b)(2) Propulsion System Design

II(b)(2)(i) Engine ETOPS Eligibility

This paragraph would require that the engines to be installed on the airplane be approved for ETOPS eligibility in accordance with proposed new section 33.200.

Explanation

Proposed new section 33.200 would require that an engine intended for a two engine ETOPS airplane that does not have the service experience required by part 25, section II(a), would have to comply with certain requirements. The ARAC proposed rule draft did not specifically state that the engines installed in an early ETOPS airplane must be certified in accordance with section 33.200. We have corrected that oversight in this notice.

We intend that section II(b) of this notice apply to all new airplanes and engines. We have considered the possibility that an applicant may install an already certified engine with existing service experience onto a new airplane. In this case, the combined service experience and early ETOPS approval method of proposed section II(c) would provide a way of certifying this type of mixed configuration.

II(b)(2)(ii) Design To Preclude In-Flight Shutdowns

The applicant would have to design the propulsion system to preclude failures and malfunctions that could result in an engine in-flight shutdown. In addition, the applicant would have to substantiate compliance with this requirement by analysis, test, in-service experience on other airplanes, or other means that the propulsion system will minimize failures and malfunctions with the objective of achieving the following in-flight shutdown rates:

(i) 0.02 or less per 1,000 engine fleet hours for 180 minute ETOPS or less;

(ii) 0.01 or less per 1,000 engine fleet hours for ETOPS beyond 180 minutes.

Explanation

ARAC provided the following justification for this proposed rule. ''This rule section requires that the propulsion system be designed to preclude failures and malfunctions that could result in an engine in-flight shutdown. Propulsion systems on previous airplanes were designed and certified to be ''fail-safe,'' in compliance with section 25.901 of part 25; in other words, any single failure, or probable combination of failures, would not jeopardize continued safe flight and landing of the airplane. Because safe flight following an engine shutdown is required by part 25, preventing engine in-flight shutdowns has not been a major design objective on some previous airplane designs. The additional design requirement in this section to preclude failures and malfunctions that could result in an engine in-flight shutdown has an enormous effect on propulsion system reliability in that normal design decisions must now consider whether a failure or malfunction might result in an engine in-flight shutdown. The method of compliance to this section may vary from applicant to applicant, but the intent remains—all design features of the propulsion system must preclude shutdowns or power losses. This intent is also captured in the proposed part 33 rule.''

We agree with the justification that ARAC provided. The ''design to preclude failures and malfunctions that could result in an engine in-flight shutdown'' is one of the most important features of the early ETOPS special conditions that we required for the Boeing Model 777 airplane. The FAA had a similar justification for this requirement in the preamble to those special conditions. However, the proposed rule that ARAC recommended did not clearly state this intent. We have modified the original ARAC proposal to clarify this stated ARAC intent and bring the proposed rule in line with the existing Boeing Model 777 ETOPS special conditions.

ARAC did not provide a specific justification for the proposed in-flight shutdown rate analysis requirement. Boeing has submitted such an analysis under compliance with paragraph (c)(5) of the ETOPS special conditions for the Model 777 airplane. Paragraph (c)(5) of those special conditions requires the applicant to define specific new analyses that will be used to assure engine and airplane system design integrity. The addition of a predicted in-flight shutdown rate analysis into this proposed rule would codify this method of compliance with the Boeing ETOPS special conditions.

Since in-service experience does not exist on a new airplane, we have also changed the ARAC proposed rule language for the in-flight shutdown rate analysis to clarify that the in-service experience to be considered in this analysis would be from other airplanes. Applicable service experience would include the same basic engine design or other propulsion system components on other airplanes manufactured by the applicant, or by other manufacturers if the applicant has access to that data and can substantiate its applicability to the new airplane design.

II(b)(3) Maintenance and Operational Procedures

The applicant would have to validate all ETOPS significant systems maintenance and operational procedures. Any problems found would have to be tracked and resolved through the problem tracking system and resolution system proposed in paragraph (II)(b)(8).

Explanation

This proposed rule would codify the intent of paragraph (d)(2) of the Boeing Model 777 ETOPS special conditions. The special conditions paragraph requires the applicant to have a program to systematically detect and correct problems occurring as a result of improper execution of maintenance and flight operations. Boeing has complied with this requirement by validating maintenance and operational procedures important to the safety of ETOPS operations. This proposed rule would codify this method of compliance.

Human error continues to be a major cause of engine in-flight shutdowns and forced airplane diversions. The proposed maintenance validation requirement, combined with the proposed requirement to operate and

maintain the test airplane during the airplane demonstrate test in paragraph II(b)(7) using the recommended operations and maintenance manual procedures, are part of the FAA's overall regulatory objective to minimize human errors in the ETOPS rule. The FAA intends that the proposed ETOPS type design requirements would result in an airplane entering service with validated maintenance and operational procedures that minimize the possibility of human error in ETOPS operations.

II(b)(4) Propulsion System Validation Test

This paragraph would require the applicant for an early ETOPS airplane to comply with the 3,000-cycle engine test in the proposed new § 33.200(c) with the installed engine configuration. The test engine would have to be configured with a complete airplane nacelle package, including engine-mounted equipment except for any configuration differences necessary to accommodate test stand interfaces with the engine nacelle package. At the conclusion of the test, the test hardware would have to be:

(i) visually inspected in according to the applicant's on-wing inspection recommendations and limits; and

(ii) completely disassembled and inspected in accordance with the service limits submitted in compliance with § 25.1529.

Explanation

Proposed paragraph II(b)(4) would codify paragraphs (e)(3) and (e)(6) of the Boeing Model 777 ETOPS special conditions for the airplane propulsion system installation. These special conditions paragraphs require vibration testing and a 3,000-cycle engine demonstration test on the installed engine configuration. The proposed § 33.200(c) would combine these two special conditions test requirements into one test based on how Boeing complied with these paragraphs for the Model 777 airplane.

The original ARAC recommended rule draft proposed the following wording for the first sentence of this paragraph: ''The *propulsion system* for which approval is being sought * * *'' The FAA defines the airplane propulsion system based on the definition of the powerplant installation contained in § 25.901(a), which states:

''For the purpose of this part, the airplane powerplant installation includes each component that—

(1) Is necessary for propulsion;

(2) Affects the control of the major propulsive units; or

(3) Affects the safety of the major propulsive units between normal inspections or overhauls.''

The components and systems covered by the overall definition of ''propulsion system'' include the fuel system and the engine and fuel system flight deck controls. We do not intend that the proposed propulsion system validation test in paragraph II(b)(4) would include any propulsion system components outside of the airplane nacelle package. We have made two changes to the original ARAC wording in order to clarify the intended test configuration. We have replaced ''propulsion system'' with ''installed engine configuration'' in the first sentence. We have changed the second sentence to clarify that the test engine must be configured with a complete airplane nacelle package, including engine-mounted equipment except for any configuration differences necessary to accommodate test stand interfaces with the engine nacelle package. These proposed changes are consistent with a recent revision of the Boeing Model 777 ETOPS special conditions.

The Boeing Model 777 ETOPS special conditions did not originally require a post-test teardown inspection. However, all three-engine companies, in cooperation with Boeing, conducted post-test teardown inspections on the original baseline engines installed on the Model 777 series airplanes based on their own experience of what would constitute an adequate evaluation.

The FAA reviewed the data from the 3,000-cycle tests for the three original engine types installed on the Model 777 and found that most of the early in-service 777 engine failure modes could have been discovered with additional inspection and analysis of the 3,000-cycle test engine and propulsion system hardware. Part conditions noted in the teardown inspection reports for the three baseline 777 engine types did later occur in service, and they resulted in engine in-flight shutdowns or airplane diversions.

In order to provide a consistent standard for a post-test evaluation of the 3,000-cycle test hardware, the FAA is proposing an enhanced 3,000-cycle test requirement in proposed paragraph II(b)(4) of Appendix L and § 33.200(c). The standard would require a complete teardown inspection of the engine and airplane nacelle test hardware after completion of the test. The FAA intends that the enhanced teardown inspection requirement for the 3,000-cycle test hardware would catch potential sources of engine in-flight shutdowns or diversions.

An enhanced post-test teardown inspection requirement is part of a revision to the Boeing Model 777 ETOPS special conditions that the FAA developed for the Model 777–300ER program. The ARAC ETOPS Working Group had knowledge of our intent to revise the Model 777 ETOPS special conditions in this manner as they developed their recommendations.

Even though paragraphs II(b)(4) and § 33.200(c) address the same proposed post-test teardown inspection requirement, the wording for the requirement in paragraph II(b)(4) is different from that in § 33.200(c). The FAA considers that the intent of the proposed post-test teardown and inspection requirement in parts 25 and 33 to be identical. However, the specific language used in each part is tailored to the unique aspects of the engine and airplane type certification processes used to show compliance with this requirement.

See the discussion for the proposed new § 33.200(c) for a complete explanation of the proposed 3,000-cycle engine test requirement.

Proposed paragraph II(b)(4) is largely a ''pointer'' to the proposed requirements to perform an engine cyclic endurance test in part 33. The purpose of this paragraph in the rule is to assure that the entire installed engine configuration (engine accessories, nacelle, thrust reverser, etc.) is installed on the test vehicle during the part 33 testing. Since the proposed part 33 requirement only covers the engine type design, this proposed rule is necessary.

II(b)(5) New Technology Demonstration Testing

The applicant would have to conduct testing to demonstrate the suitability of any technology new to the applicant.

Explanation

This paragraph would codify paragraph (e)(4) of the Boeing Model 777 ETOPS special conditions. The ARAC left this requirement from the special conditions out of its recommended rule proposal, even though the associated part 25 draft advisory circular provided with their recommendation refers to this as a requirement. We propose to add the new technology demonstration testing requirement to the notice for completeness.

II(b)(6) APU Validation Test

This paragraph would require an applicant to complete a test consisting of 3,000 equivalent airplane operational cycles on an auxiliary power unit that the applicant uses to comply with the

electrical power supply system requirements of paragraph I(a)(2) of this proposed appendix.

Explanation

This paragraph would codify paragraph (e)(5) of the Boeing Model 777 ETOPS special conditions.

As we stated in the section on APU design for proposed paragraph I(b)(2), current twin engine airplanes approved for ETOPS only comply with the proposed requirement for electrical system reliability contained in this notice by having three independent electrical generators. On these airplanes, the third independent electrical generator is normally powered by an auxiliary power unit. To assure that an APU would have the proper reliability at entry into service, the proposed rule would require the applicant to conduct an APU endurance test in a similar manner to that proposed in paragraph II(b)(4) for the main engines. The phrase ''equivalent airplane operational cycles'' requires the applicant to test the APU in an environment that the APU would be operating in an airline ETOPS operation. In most cases this would include starting and operating the APU in extremely cold temperatures representative of high altitude operation or ground operations in extremely cold climates. This would also include operation in high temperature environments, and with simulated pneumatic and electrical loads. Further amplification of the interpretation of ''equivalent airplane operational cycles'' is found in the draft part 25 advisory circular.

II(b)(7) Airplane Demonstration Test

This paragraph would require the applicant to conduct an airplane flight test to demonstrate that the airplane, its components and equipment are capable of and function properly during ETOPS and ETOPS diversions. This flight test may be coordinated with, but would not be in place of the function and reliability flight testing required for compliance with § 21.35(b)(2).

The proposed requirement includes several conditions that the applicant would have to comply with in conducting this test. Among these are:

(1) The flight test program would have to include:
  (i) Flights simulating actual ETOPS operation;
  (ii) demonstration of maximum normal flight duration with maximum diversions;
  (iii) maximum time engine inoperative diversions;
  (iv) non-normal conditions to demonstrate the airplanes capability to safely; conduct an ETOPS diversion,
  (v) diversions into representative operational diversionary airports; and
  (vi) repeated exposure to humid and inclement weather on the ground followed by long-range operations at normal cruise altitude.
(2) The flight testing would have to validate the adequacy of the airplane's flying qualities, performance and the flight crew's ability to deal with adverse operating conditions.
(3) The engine-inoperative diversions would have to be evenly distributed among the number of engines in the applicant's flight test program.
(4) The test airplane would have to be operated and maintained using the recommended operations and maintenance manual procedures during the test.
(5) At the completion of the test, the ETOPS Group 1 significant systems would have to undergo an airplane visual inspection and the engines would have to also undergo an internal gas path inspection.

Explanation

This paragraph would codify the airplane demonstration test requirement of paragraph (e)(7) of the Boeing Model 777 ETOPS special conditions. The original version of the special conditions effective July 1, 1994 required the applicant to fly one complete airplane for at least 1,000 flight-cycles simulating an actual airline operation.

The FAA developed the 1,000-cycle airplane demonstration test requirement with the intent of exposing the candidate airplane to the conditions where the greatest numbers of in-flight shutdowns occur. Most in-flight shutdowns occur during takeoff and climb. Failures that tend to occur only during certain portions of a flight are known as ''cyclic'' failures. An example of a cyclic failure would be a tire failure where exposure to the high tire speeds that could lead to a tire failure would only occur during takeoff or landing. These are in contrast to failures that are more likely to occur as components age, which are known as ''hourly'' failures. An example of an hourly failure is an electric cooling fan failure where the fan runs continuously to cool electronic components.

The failure modes associated with takeoff- and climb-related in-flight shutdowns tend to be cyclic in nature for a couple of reasons. In cases where the loads and stresses on engine or airplane hardware increase as engine power or thrust increases, the takeoff portion of the flight is most critical. Failure modes that occur due to improper maintenance or engine servicing, for instance loss of engine oil due to improper assembly of an oil tube connection, also tend to occur early in the flight. A larger number of airplane flights increases the exposure to these types of failures. Therefore, the FAA considered a cyclic type of test to be the most appropriate airplane validation test for the original 777 ETOPS special conditions.

Although the fewest in-flight shutdowns occur during cruise, this is the phase of flight that is most important to an ETOPS operation. Traditionally, the FAA and industry have avoided trying to differentiate between those in-flight shutdowns that may occur during cruise from those that would only occur in a non-ETOPS environment. The main reason for this approach in existing ETOPS policy is that by correcting all causes of in-flight shutdowns, we gain confidence in the overall integrity of the propulsion system design. Since an enhanced 3,000-cycle engine demonstration test proposed for paragraph II(b)(4) of Appendix L and § 33.200(c) would provide adequate cyclic exposure, the FAA has concluded that the airplane validation program should emphasize exposure to the cruise phase of flight.

During the three 1,000-cycle tests conducted for the original 777 engine installation certification programs, only 91 of the total 1,000 cycles were of durations of two hours or more. Since we intend for the airplane demonstration test to simulate an actual airline operation, this would better be accomplished through longer duration flight cycles. Long duration flight exposure provides additional confidence that the design accounts for cruise-related failure modes that cannot be evaluated in a cyclic test environment. Such failure modes could include freezing of entrapped water condensation or binding of propulsion system components, neither of which would likely occur in a sea level test facility.

Based on these considerations, the FAA has determined that the airplane demonstration test requirement should be refocused on those conditions that are most prevalent in an ETOPS operating environment. Those conditions include long flights to a variety of airports with broad variations of airport elevation, temperature, and humidity. It is also important that these flights expose the airplane to several enroute climbs, such as may occur with a fully loaded 777–300ER on a long-

range flight, and a number of engine-inoperative diversions. As such, the FAA proposes that the specific test conditions described in the sub-paragraphs to proposed paragraph II(b)(7) more clearly state the objectives of the test program. Those objectives include demonstrations that the aircraft, its components, and equipment are capable of and function properly during long-range operations and airplane diversions, including engine-inoperative diversions.

This change in focus constitutes a significant departure from the original purpose of the 1,000-cycle airplane demonstration test requirement discussed in the preamble to the Boeing Model 777 ETOPS special conditions. However, the proposed changes to the 3,000 cycle test requirement and the airplane demonstration test that we propose for this rule would provide an overall better evaluation of a new airplane design for ETOPS approval.

The original ARAC proposal recommended the following wording for paragraph II(b)(7)(i)(4): ''Non-normal conditions to demonstrate the airplane's capability to safely conduct an ETOPS diversion under worst case probable system failure conditions.'' This is similar language for a flight test demonstration of non-normal operating conditions to Section III—Airplanes with more than two engines that proposed for paragraph II(a)(5). For similar reasons to those in the explanation for paragraph II(a)(5), we have deleted the word ''probable'' in proposed paragraph II(b)(7)(i)(4) and replaced it with system failure conditions ''expected to occur in service'' in the proposed rule.

Human error continues to be a major cause of engine in-flight shutdowns and forced airplane diversions. The proposed requirement in paragraph II(b)(7)(iv) to operate and maintain the test airplane using the recommended operations and maintenance manual procedures, combined with the proposed maintenance validation requirement in paragraph II(b)(3), are part of the FAA's overall regulatory objective to minimize human errors in the ETOPS rule. The FAA intends that the proposed ETOPS type design requirements would result in an airplane entering service with validated maintenance and operational procedures that minimize the possibility of human error in ETOPS operations.

During the certification of the B777 for early ETOPS, the special conditions required that the airplane demonstration test be conducted using the airline maintenance and operations manuals. The purpose of this requirement was three-fold: (1) To assure that the airplane test was as close to an airline simulation as possible, (2) to assure that the maintenance and operations products were mature at entry into service, and (3) to assure that no maintenance or operations procedures would erroneously contribute to system failures.

In developing their draft rule, the ARAC ETOPS Working Group fully concurred with the proposed requirement to assure maintenance and operational product maturity at entry into service. However, the working group also recognized that validation of these products could be accomplished in different fashions. Nonetheless, ARAC noted that the proposed associated advisory circular (AC) recommends that the maintenance manual should be used for all testing necessary for ETOPS validation (component, engine and airplane). Tasks such as LRU replacement, testing following removal/replacement of parts, etc., must be validated per the requirements of the rule. The proposed AC does provide amplification, however, on what maintenance manual sections should be validated, namely only those sections pertinent to Groups 1 and 2 ETOPS significant systems. For instance, while validation of a landing gear maintenance task may be prudent for product readiness, the landing gear is not considered ETOPS critical, and therefore validation of related maintenance procedures would not be required.

As we said in the discussion for the proposed 3,000 cycle test requirement in paragraph II(b)(4), the FAA has concluded from a review of in-service experience of the Model 777 series airplanes that the 3,000-cycle engine and propulsion system test in proposed paragraph II(b)(4) of Appendix L and § 33.200(c) provides an adequate opportunity to discover cyclic-related failure modes associated with the design, provided that the engine and airplane manufacturers conduct an adequate post-test evaluation. For similar reasons, proposed subparagraph II(b)(7)(v) would require a post-test external and internal visual inspection of the airplane demonstration test engines and propulsion system hardware. The applicant would have to identify, track and resolve any abnormal conditions found during these inspections in accordance with the provisions of the proposed problem tracking and resolution system requirement of paragraph II(b)(8).

The proposed paragraph II(b)(7)(v) would require the manufacturer to visually inspect the airplane ETOPS significant systems per the Instructions for Continued Airworthiness of section 25.1529 following the airplane demonstration test. The stated objective for this inspection in the proposed rule is to identify any abnormal conditions that could result in an in-flight shutdown or diversion. We have proposed this paragraph as ARAC recommended. However, many of the airplane ETOPS significant systems have components that are not amenable to visual inspection. An example is an electronic controller for airplane electrical load management. We request comments on this specific aspect of the proposed rule. If a visual inspection alone is not a sufficient post-test inspection requirement, what additional post-test inspections or tests should be incorporated into the final rule? If certain ETOPS significant systems should not be covered by this post-test inspection requirement, then what should be the criteria in the final rule for their exclusion? We invite commenters to respond to other commenters' suggestions because the FAA may select one or more commenter recommended approaches for the final rule.

The FAA proposed a change to the airplane demonstration flight test requirement in a revision to the Boeing Model 777 ETOPS special conditions for the Model 777–300ER type certification program. The ARAC ETOPS Working Group had knowledge of our intent to revise the Model 777 ETOPS special conditions in this manner as they developed their recommendations. We have provided a more detailed justification of the airplane demonstration test requirement changes proposed in this notice in the preamble for that special conditions revision.

II(b)(8) Problem Tracking and Resolution System

This paragraph would require the applicant to establish a problem tracking and resolution system to address problems, as identified in proposed 21.4(a)(5), encountered on ETOPS significant systems during airplane and engine testing that could affect the safety of ETOPS operations.

Explanation. This paragraph would codify the problem tracking system requirements of paragraph (f) from the Boeing Model 777 ETOPS special conditions.

The special conditions problem tracking system requirement is divided into two parts: the problem tracking/reporting required during type certification testing, and that required during the ''early ETOPS'' period of the first 250,000 hours of operation after the

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

airplanes that are currently operating at a stable level of reliability in ETOPS service. It would not be appropriate to make this comparison with a non-ETOPS approved fleet. The FAA does not require the operators of non-ETOPS fleets to maintain a level of reliability consistent with the ETOPS standard for two-engine airplanes.

We speculate that the ARAC may have intended that the added phrase ''or any non-ETOPS derivative models of those aircraft or engines'' would address a manufacturer that initially would have no previously approved ETOPS airplanes in service from which to base a type and frequency comparison. The proposed rule would not specifically require that the comparison be with currently certified ETOPS airplanes by that manufacturer. If an applicant does not currently have an existing ETOPS approved airplane in service from which to base a type and frequency comparison, the proposed rule would allow the manufacturer to use available data for ETOPS approved airplanes of other manufacturers. It is not necessary that the applicant use a single existing airplane model in the comparison that would be required by proposed paragraph II(b)(9). We have not included this phrase in proposed paragraph II(b)(9).

In finding compliance with the proposed type and frequency requirement, we would be looking at the significance of the problems that occur during the type certification testing and whether or not they would require a design change prior to type certification of the airplane. Manufacturers continually make improvements to enhance their designs based on in-service experience. These design improvements may eliminate nuisance problems that are not, in themselves, safety related. In addition, certain failures that occur in service are expected during the life of the product at a known low rate of occurrence and are not indicative of a significant design shortcoming. We could find compliance with the proposed reliability demonstration acceptance criteria even though we might expect that these types of failures or problems occurring during airplane flight testing could also occur on a mature ETOPS fleet.

In contrast, the types of failures or problems that would give the FAA concern about compliance with the proposed reliability demonstration acceptance criteria would fall into two categories:

(1) A major failure that would require a significant redesign before the airplane could receive a basic part 25 type certificate. In other words, a problem that makes the airplane unsafe without a significant redesign and testing.

(2) Random ETOPS significant failures occurring during the test program at a frequency greater than would be expected on a mature ETOPS fleet. ETOPS significant failures would be those that result in the events listed in proposed § 21.4(a)(5).

II(c) Combined Service Experience and Early ETOPS Method

This proposed paragraph would allow an applicant to combine certain elements of the early ETOPS process proposed in section II(b) with a reduced amount of service experience from what would be required by paragraph II(a)(1) to obtain ETOPS approval.

Explanation

The early ETOPS process proposed in section II(b) of Appendix L would define requirements for obtaining ETOPS type design approval without the service experience that would be required by section II(a). Proposed sub-section II(c) would define requirements for obtaining ETOPS approval with a combination of service experience and elements of the early ETOPS process.

The FAA has accepted, in principle, the concept of trading a limited amount of service experience for the airplane demonstration test requirements contained in the 777 early ETOPS special conditions. The FAA did this based on a concept already contained in Advisory Circular 120–42A, which allows a reduction in the normal amount of service experience if ''adequate compensating factors exist which give a reasonable equivalent database.'' The FAA considers that elements of the early ETOPS process may be used to provide ''adequate compensating factors.'' Since the 777 early ETOPS process provides a method for obtaining ETOPS approval without any service experience, a minimum amount of actual service experience would provide an adequate evaluation if the applicant complies with the other elements of the early ETOPS process.

Proposed section II(c) would codify this concept into the ETOPS rule. The proposed rule would allow two methods of reduced service experience in place of the complete early ETOPS process contained in section II(b). Paragraph II(c)(1) would specifically require only 15,000 engine hours of service experience if the applicant complies with the following elements of sections II(a) and (b):

(a)(5) Airplane flight test requirements,
(b)(1) Relevant experience assessment,
(b)(2) Propulsion system design,
(b)(3) Maintenance and operational procedures,
(b)(4) Propulsion system validation test,
(b)(5) New technology demonstration testing,
(b)(6) APU validation test,
(b)(8) Problem tracking and resolution system, and
(b)(9) Reliability demonstration acceptance criteria.

In addition to the airplane flight test requirement from the service experience method, paragraph II(a)(5), these are all of the elements of the early ETOPS process except for the airplane demonstration test in proposed paragraph II(b)(7). We have added three paragraphs to the original ARAC proposal. The first is the airplane flight test requirement from the service experience method, paragraph II(a)(5). Without some required airplane flight-testing, the ARAC proposal would not result in an equivalent demonstration of a capability to safely operate in an ETOPS environment. Paragraph II(a)(5) would require an applicant for ETOPS approval based on service experience to conduct a flight test to validate the adequacy of the airplane's flying qualities, performance and the flight crew's ability to deal with engine inoperative and non-normal worst case system failure conditions expected to occur in service. The FAA considers that an applicant who does not complete the airplane demonstration flight test requirement in accordance with proposed paragraph II(b)(7) as part of a combined ETOPS approval method must as a minimum complete the flight testing that would be required if the applicant were using service experience only.

The second is proposed paragraph (b)(5), new technology testing. We have added the new technology testing requirement here and in section III because we could find no valid reason to exclude it when every other requirement of proposed early ETOPS section is included except for the airplane demonstration test requirement. Since ARAC overlooked the new technology testing requirement in their original proposal as discussed above for proposed paragraph II(b)(5), we assume that it would have been included in proposed paragraph II(c)(a) had they not overlooked it.

The third paragraph we have added is the reliability demonstration acceptance criteria in proposed paragraph II(b)(9). In section II(a) for a service experience based approval, in-flight shutdown rate provides the FAA with a reliability objective to assess a design's suitability.

In the early ETOPS method proposed in section II(b), the reliability demonstration acceptance criteria provides a way to compare the airplane flight test history to existing ETOPS approved airplanes as a way to assess design suitability. Without some defined criteria for assessing the suitability of a design for ETOPS approval, we would have no way of determining if a candidate airplane were acceptable when an applicant chooses to use the combined approach. Therefore, we have added the reliability demonstration acceptance criteria requirement to proposed paragraph II(c)(1). Since we consider this to be a significant departure from ARAC's original recommendation and ARAC did not clearly state their intent for this section, we request specific comments on this particular proposal.

The second method for reduced service experience proposed in paragraph II(c)(2) would allow some level of service experience other than 15,000 engine hours, provided the applicant defines compensating factors that provide an equivalent level of safety to that provided using any of the other methods. This method would allow an applicant some latitude to create an ETOPS approval program tailored to the unique aspects of the airplane model.

Section III—Airplanes With More Than Two Engines

In addition to the requirements of section I, an applicant for an airplane with more than two engines would have to show compliance with the proposed requirements of section III.

Explanation

This section of Appendix L would define those specific requirements that would be applicable to airplanes with more than two engines. In order to achieve an equivalent risk of a critical loss of thrust during an ETOPS flight due to independent failure causes, the in-flight shutdown rate for twins needs to be ten times lower than four engine airplanes and 20 times lower than three engine airplanes to achieve an equivalent level of safety for ETOPS. For maximum diversion times greater than 180 minutes, the proposed standard for two engine airplanes is 0.01 shutdowns per 1,000 engine-hours. The associated in-flight shutdown rate to achieve the same level of safety would be 0.2 for three engine airplanes and 0.1 for four engine airplanes. These levels of reliability are inherent in current generation turbine engines without the need for specific propulsion system requirements beyond those now in parts 33 and 25. The FAA is concerned that we may inadvertently encourage a lower standard than is already normally achieved by specifying these high in-flight shutdown rates in the proposed rule for three and four engine airplanes. Therefore, we have not included any of the proposed propulsion system requirements that would be applicable to two engine airplanes into proposed Appendix L, section III.

What remains for section III are the proposed airplane level system requirements from section II including a flight test demonstration of airplane and propulsion system capability during a maximum ETOPS diversion. Since we are equally concerned about human error caused critical multiple failures for airplanes with more than two engines as we are for twins, we are also proposing a maintenance and operational procedure validation requirement in section III. Except as noted, the explanation for each of the proposed paragraphs in section III is the same as for section II.

III(a) Service Experience Method

The applicant would have to demonstrate that the airplane and engine combination for which approval is sought has the required airplane and propulsion system capability to safely conduct an ETOPS mission and maximum diversion and has achieved required airplane system reliability based upon fleet in-service experience.

Explanation

This proposed requirement is the same as in section II with the exception that ''propulsion system'' has been removed from the last phrase of the proposed requirement. Otherwise, the explanation is the same as for paragraph II(a).

III(a)(1) Required Service Experience

This paragraph would require that an applicant who desires to obtain ETOPS type design approval using service experience conduct a reliability review after accumulating 250,000 worldwide fleet engine hours on the airplane and engine combination for which approval is being sought. The number of hours would be allowed to be reduced if adequate compensating factors are identified which give a reasonable equivalent database. A significant portion of the 250,000 engine hours would have to be obtained on the candidate airplane.

Explanation

The explanation for this proposed paragraph is the same as for proposed paragraph II(a)(1).

III(a)(2) Airplane Systems Assessment

The applicant would have to show compliance with section 25.1535(a) using available in-service reliability data for ETOPS significant systems. The applicant would have to identify corrective actions for all causes or potential causes of ETOPS significant system failures occurring in service that are shown to be effective in preventing future occurrences.

Explanation

The explanation for this proposed paragraph is the same as for proposed paragraph II(a)(3).

III(a)(3) Airplane Flight Test Requirements

This paragraph would require a flight test to validate the adequacy of the airplane's flying qualities, performance and the flight crew's ability to deal with engine inoperative and non-normal worst case system failure conditions expected to occur in service.

Explanation

The explanation for this proposed paragraph is the same as for proposed paragraph II(a)(5).

III(b) Early ETOPS Method

This part of section II defines requirements that an applicant would have to comply with to certify an airplane for ETOPS without first accumulating the service experience that would be required in section III(a).

Explanation

Proposed section III(b) is the same as proposed section II(b) except that the relevant experience assessment and propulsion system design requirements have been removed from the proposed section III requirements. Otherwise, the explanation is the same as for paragraph II(b).

III(b)(1) Maintenance and Operational Procedures

Under this proposed requirement, the applicant would have to validate maintenance and operational procedures for ETOPS Significant Systems. The applicant would have to track and resolve any problems discovered during the validation process using the proposed Problem Tracking and Resolution System as described by paragraph (b)(5).

Explanation

The explanation for this proposed paragraph is the same as for proposed paragraph II(b)(3).

III(b)(2) New Technology Demonstration Testing

The applicant would have to validate all ETOPS significant systems maintenance and operational procedures. Any problems found would have to be tracked and resolved through the problem tracking system and resolution system proposed in paragraph III(b)(5).

Explanation

The explanation for this proposed paragraph is the same as for proposed paragraph II(b)(5).

III(b)(3) APU Validation Test

This paragraph would require an applicant to complete a test consisting of 3,000 equivalent airplane operational cycles on an auxiliary power unit that the applicant uses to comply with the electrical power supply system requirements of paragraph I(a)(2) of this proposed appendix.

Explanation

The explanation for this proposed paragraph is the same as for proposed paragraph II(b)(6).

III(b)(4) Airplane Demonstration Test

This paragraph would require the applicant to conduct an airplane flight test to demonstrate that the airplane, its components and equipment are capable of and function properly during ETOPS and ETOPS diversions. This flight test may be coordinated with, but would not be in place of the function and reliability flight testing required for compliance with § 21.35(b)(2).

The proposed requirement includes several conditions that the applicant would have to comply with in conducting this test. Among these are:

(1) The flight test program would have to include:
  (i) flights simulating actual ETOPS operation;
  (ii) demonstration of maximum normal flight duration with maximum diversions;
  (iii) maximum time engine inoperative diversions;
  (iv) non-normal conditions to demonstrate the airplanes capability to safely conduct and ETOPS diversion;
  (v) diversions into representative operational diversionary airports; and
  (vi) repeated exposure to humid and inclement weather on the ground followed by long-range operations at normal cruise altitude.
(2) The flight testing would have to validate the adequacy of the airplane's flying qualities, performance and the flight crew's ability to deal with adverse operating conditions.
(3) The engine-inoperative diversions would have to be evenly distributed among the number of engines in the applicant's flight test program.
(4) The test airplane would have to be operated and maintained using the recommended operations and maintenance manual procedures during the test.
(5) At the completion of the test, the ETOPS Group 1 significant systems would have to undergo an airplane visual inspection and the engines would have to also undergo an internal gas path inspection.

Explanation

The explanation for this proposed paragraph is the same as for proposed paragraph II(b)(7).

III(b)(5) Problem Tracking and Resolution System

This paragraph would require the applicant to establish a problem tracking and resolution system to address problems, as identified in proposed section 21.4(a)(5), encountered on ETOPS significant systems during airplane and engine testing that could affect the safety of ETOPS operations.

Explanation

The explanation for this proposed paragraph is the same as for proposed paragraph II(b)(8).

III(b)(6) 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 III(b)(4), are consistent with the type and frequency of failures or malfunctions that would be expected to occur on presently certified ETOPS airplanes, or any non-ETOPS derivative models of those aircraft or engines.

Explanation

As discussed above for proposed paragraph II(b)(9), the original ARAC draft did not differentiate between two engine airplanes from airplanes with more than two engines in the applicability of the type and frequency requirement. The ARAC proposal for this paragraph included the added phrase ''or any non-ETOPS derivative models of those airplanes or engines'' for those airplanes and engines that could be included in this comparison of reliability. As we discussed above for proposed paragraph II(b)(9), we have deleted this phrase from the proposed rule for two engine airplanes because an applicant would not necessarily have to do the comparison to previously approved airplanes manufactured by that applicant. We are now proposing to separately state the requirements for airplanes with more than two engines in proposed section III of Appendix L. We have retained this provision in the proposed requirement for airplanes with more than two engines in paragraph III(b)(6) since previous ETOPS experience may not exist on airplanes with more than two engines at the time this proposed rule becomes effective.

III(c) Combined Service Experience and Early ETOPS Method

Explanation

With the exception of any specific propulsion system requirements that are being applied to airplanes with more than two engines as discussed above, the explanation for proposed section III(c) is the same as for proposed section II(c).

Part 33

Global Issues for Part 33

The overall philosophy behind ETOPS type design approval is to build upon the improved reliability observed in today's engines, resulting in an even higher level of reliability for future engine products. However, the FAA recognizes that even with the advances in design and manufacturing technology, loss of thrust control (LOTC), in-flight shutdown (IFSD), or other power loss events will continue to occur. Therefore the overall intent of these ETOPS type design requirements are to minimize the likelihood of an engine power loss during ETOPS operations.

Specifically, the part 33 ETOPS related amendments require the engine manufacturers to use their best design and manufacturing practices, skills and lessons learned in designing and manufacturing the new product. The intent is to eliminate from the design all known ETOPS relevant failures, malfunctions, or design related maintenance errors experienced in their other relevant FAA certified engine models. These failures include but are not limited to loss of thrust control, in-flight shutdown, or other power loss events.

It is important to note that complying with the part 33 ETOPS requirements for certification makes the product ''eligible'' for ETOPS operation only, and in no way implies an approval

separate from the aircraft or operator. Therefore, compliance with these requirements does not constitute an operational or aircraft level approval for ETOPS operations.

Discussion of General Issues in Part 33

ETOPS Engine Testing

A 3,000-cycle test would be required for ETOPS engine eligibility. This test simulates 3,000 flights from engine startup to engine shutdown. A 3,000-cycle test was first required for the early ETOPS approval of two-engine aircraft under an FAA Early ETOPS Special Condition. However, prior to and subsequent to that Special Condition, other aircraft types with new engines, and others with derivative engine types, have successfully demonstrated the requisite level of reliability in service for ETOPS using normal certification procedures. However, the FAA considers that new two-engine airplane-engine combinations intended for immediate ETOPS operations should be required to undergo a cyclic endurance ground test to give confidence that the requisite level of reliability for such operations will be achieved at entry into service.

The technical basis for applying this test to two-engine airplanes rather than all airplanes, is that the allowable IFSD rate needed to maintain safe flight throughout the diversion and landing is an order of magnitude greater for a three or four engine aircraft as compared to a two-engine aircraft (assuming equivalent risk and flight duration). This also assumes that the aircraft can maintain safe flight throughout the diversion and land with one engine inoperative.

The FAA has concluded from a review of in-service experience that the 3,000-cycle engine and propulsion system test provides an adequate opportunity to discover cyclic-related failure modes associated with the design. However this is predicated upon an adequate post-test evaluation to identify conditions that could result in an in-flight shutdown, power loss, or inability to control engine thrust. An FAA review of the data from the 3,000-cycle tests for three new engine types has shown that most of the early in-service engine failure modes could have been discovered using a more thorough teardown inspection and analysis of a 3,000-cycle test engine and propulsion system hardware. This would include evaluating hardware condition against the required lessons learned analysis, and also to evaluate abnormal or other wear or distress conditions not currently addressed in the Instructions for Continued Airworthiness (ICA).

In light of the FAA experience certifying and monitoring the Boeing 777, and in order to provide a consistent standard for post-test evaluation, the FAA proposes to require a complete teardown inspection of the engine hardware after completion of the test. The inspection would include an analysis of any abnormal conditions found. The analysis would consider the possible consequences of similar occurrences in service to determine if they might become sources of engine in-flight shutdowns, power loss, or inability to control engine thrust. The intent of this requirement is to identify potential sources of engine in-flight shutdowns or diversions and prevent these from occurring in the future.

The basic premise behind the engine demonstration tests required by this proposal is that the tests will provide a useful validation of the inherent level of reliability that was the product of an enhanced design and test process. The FAA's expectation for these tests is that significant failures will not occur. The probability of significant failures occurring on a single engine test program is so low that if any do occur, it would be indicative of a design that is not suitable for ETOPS approval. This expectation is addressed in the ''type and frequency'' requirement of the rule.

FAA General Changes to the ARAC Proposal for Part 33

The ARAC ETOPS recommendations for part 33 engine rulemaking addresses the Tasking Statement objectives for part 33 and incorporates the fundamental elements to achieve the Tasking Statement's stated objective. The FAA has concluded that the fundamental elements of the ARAC Recommendations, along with the identified changes, supports achieving the target level of safety and reliability necessary for safe ETOPS operations for engines installed in two-engine aircraft at entry-into-service.

However the FAA has identified a number of areas where the level of detail in the ARAC rule recommendation is not adequate to fully address a fundamental element, or has details that the FAA believes are inappropriate or lacking in adequate detail. Also, for the purpose of clarity, completeness, and terminology usage, and to follow required rule format, the ARAC rule recommendation has been reorganized within part 33.

FAA Changes From the ARAC Part 33 Rule Recommendations

1. Format and Organization

The Rule has been reformatted and reorganized to include all early ETOPS design, lessons learned, and test requirements under one specific rule. The rule number is 33.200, which resides in new part 33 subpart G, Special Requirements. The ARAC recommendations divided the ETOPS requirements between existing § 33.90 Initial Maintenance Inspection (IMI) and a specific ETOPS rule. Section 33.90 retains the provision to utilize the ETOPS testing for compliance purposes. The reorganization is generally as follows:

ARAC recommendation paragraph number	New paragraph number
33.90(a)	Same
33.90(b)	Same
33.90(b)(1)	33.200(c)(1)
33.90(b)(2)	33.200(c)(2)
33.90(b)(3)	33.200(f)
33.100(a)(1)	33.200(a)
33.100(a)(2)	33.200(b)
33.100(b)	33.200(c)/(d)/(e)

2. Revision of the 10-Year Limit on Service Data To Be Reviewed for the Lessons Learned Analysis From Section 33.200(b)

The ARAC proposal for section 33.200(b) limited the assessment of past design problems that have resulted in loss of thrust control, in-flight shutdown, or other power loss to ''the applicant's other relevant type design approvals provided within the past ten years.''

''Ten years'' as used in the rule, is considered to be the time frame relevant to design/manufacture evolving technology for which the applicant must show that problems especially relevant to ETOPS have been addressed in the design for which early ETOPS eligibility is sought. For example, an early 1980's certified engine with a relatively lower level of reliability, would not be appropriate to use the applicant's experience base of lessons learned for compliance with section 33.200(b) for an engine certified in year 2000; a much better experience base would be engines certified from 1990, which as an industry group have very good reliability. The intent is to continuously build upon the improved reliability seen in today's engines into even higher levels of reliability.''

The corresponding part 25 requirement proposed by ARAC does not contain such a time limit on the relevant experience assessment, nor

does the Boeing 777 ETOPS Special Condition, which is the basis for this proposed requirement. The relevant experience assessment that Boeing submitted for compliance with the Special Condition's requirement consisted of data from a ten year time period immediately prior to the B777 design development. The FAA approved this ten-year period at the time because it included three previous major airplane certification programs (Models 757, 767, and 737–300). For the current Model 777–300ER type certification program, the assessment was updated to include the additional relevant experience that has occurred since the original database was developed. Coincidentally, this covers a ten-year time period. However, the FAA cannot draw a conclusion from this experience that a ten-year period will always provide adequate data for all manufacturers that may apply for an early ETOPS approval. Therefore, the FAA has included a provision that the 10-year limit applies if adequate data exists to do the assessment. If the FAA determines that the applicant's other relevant type design approvals provided within the past ten years do not constitute an adequate database, the FAA will determine the extent of additional data required to be included in the relevant experience assessment based on the following factors:

a. The manufacturer's level of experience in certifying engines installed on Transport Category airplanes,

b. Recent experience certifying new engines,

c. Completeness of the manufacturer's design practices/manuals used in the development of new engines, and

d. Any other factors that the manufacturer may want to present to the FAA for consideration.

3. Insertion of the Word ''Independently'' in the Test Section of Section 33.200(c)(2)

The ARAC Recommendation 3,000 cycle test requires all rotors to be unbalanced to 90% of a limit value, however the actual rule text is not specific as to whether each rotor is to be unbalanced independently. The FAA has verified that it was the ARAC's intent that each rotor must be unbalanced independently relative to its individual rotor limit. So the word ''independently'' is inserted to clarify that each individual rotor must be unbalanced to the specified 90% limit value.

4. Addition of Inspection Criteria for Post 3,000 Test [See 33.200(e)(3)(i)(C)]

The ARAC Recommendations specify hardware layout inspections in accordance with the Instructions for Continued Airworthiness (ICA) and the Lessons Learned analysis. The FAA proposes to add a third inspection criteria as follows: ''Inspect in a manner to identify wear or distress conditions which could result in IFSD, LOTC or other power loss, and which are not specifically identified by 33.200(b) or addressed within the current ICA.'' It should be noted that the ARAC Recommendation's AC material discusses such an inspection method and that the recent FAA B777 Special Condition for ETOPS also included a similar inspection requirement.

5. Clarification of an Incomplete Statement Relating to Post-Test Hardware Condition [See § 33.200(e)(3)(ii)]

The ARAC Recommendation contains a requirement that post-test hardware condition be such that no distress is observed that could result in a power loss. However many engine parts if distressed and operated long enough will fail and potentially cause a power loss. As written, distress in many parts could be predicted to result in power loss over an inappropriately long period of operation. Therefore the FAA proposes to define the period of operation to make this judgment as follows; ''* * * within a period of operation before the component, assembly or system would likely have been inspected or functionally tested for integrity while in service''.

6. Revision of Interim Inspection To Be Used for § 33.90 Compliance

The ARAC Recommendations propose to use the 3,000-cycle test for § 33.90 compliance by means of an interim on-wing inspection method. The FAA concurs with the basic on-wing inspection approach. However, the ARAC Recommendations only specify a visual inspection for § 33.90 compliance purposes. This Recommendation does not meet the most basic existing Method of Compliance (MoC) for a § 33.90 inspection. The FAA proposes to revise the ''visual only'' inspection to be an inspection acceptable to the Administrator, and specify an acceptable MoC within the AC. Currently for an on-wing type inspection for § 33.90 compliance, the FAA would accept an inspection that does all of the following:

(1) Full borescope inspection of accessible gas path stages or areas of the fan, compressor, combustor, and turbine modules, to the serviceable limits of the ICA.

(2) For Full Authority Digital Electronic Control (FADEC) equipped engines, observe and interrogate the FADEC system for fault messages and status messages, both current or previously recorded, to the serviceable limits of the ICA.

(3) Inspect all oil system chip detectors and filters for contamination.

(4) Inspect all fuel system filters for contamination.

(5) Test a sample of main engine oil for contaminants that might indicate impending internal failure.

(6) Conduct a complete visual inspection of the inlet, exhaust, and externals, to the serviceable limits of the ICA.

(7) Conduct a power calibration to show that the engine can produce power or thrust within established limits, and is free of surge or stall when operated in accordance with the Operating Instructions.

General pass/fail criteria for the above items is serviceable in accordance with the ICA, unless otherwise approved by the Administrator.

The above method of compliance has been established for conventionally designed engines, and is discussed further in the companion AC. Other inspections or checks, or deletion of non-applicable items may be necessary for new or unconventional designs.

7. Addition of Oil Tank Design Requirement

The FAA is proposing to revise the current requirements of § 33.71(c)(4), which addresses oil tank caps. The proposed revision would incorporate a new ETOPS eligibility design requirement for oil tanks intended to prevent hazardous oil loss in the event of an oil tank cap installation error. The FAA is aware of a number of single and dual engine oil loss events due to oil tank cap installation errors, and is concerned that these types of problems will continue to occur, potentially resulting in an unsafe condition during extended operations. The FAA believes it prudent to address this situation by requiring oil tanks to be designed to accommodate cap installation errors without hazardous oil loss. The proposed rule would not allow compliance by maintenance procedures; the necessary physical features or characteristics must be part of the oil tank design. The rule is intended to protect against hazardous oil loss when oil tank cap installation errors occur.

8. Engine Endurance Test With Vibration

The ARAC Recommendations include a 3,000-cycle endurance test with main rotor unbalance. The Recommendations specify the minimum unbalance as being an ''average value'' of the peak vibration level observed during required vibration surveys. In section 33.200(c)(2)(iv), the term ''average value'' is being replaced by the term ''equivalent value'' to better address the concept of cumulative damage. For example, utilizing an average value could result in less cumulative damage due to vibration then if the 90% requirement was precisely maintained over the test duration. By computing and working to an equivalent value of rotor unbalance, cumulative damage will always be equal to or greater then a test conducted with a steady value of 90% unbalance. The equivalent value is a Miner's rule summation calculation, and is further described in the companion AC.

Section-by-Section Discussion of the Proposal

Proposed New Appendix A, Paragraph A33.3(c), Extended Operations (ETOPS) Requirements

A proposed new Appendix A Paragraph A33.3(c) would define new engine condition monitoring requirements necessary for obtaining ETOPS type design eligibility approval.

Explanation

This section requires inclusion of a power assurance check methodology into the ICA for all engine models requiring ETOPS eligibility. A special requirement exists for engines to be installed in twin-engine aircraft applications, that being the power assurance method must be validated by test or experience.

Proposed Revision to Section 33.71(c)(4)—Oil Tanks

A proposed revision to section 33.71(c)(4) would define new oil tank design requirements necessary for obtaining ETOPS type design eligibility approval.

Explanation

See the explanation in paragraph 7 of this section, above.

Proposed Revision to Section 33.90—Initial Maintenance Inspection (IMI)

A proposed revision of section 33.90 would define requirements for utilizing ETOPS type design eligibility test data obtained during section 33.200 testing for section 33.90 compliance purposes.

Explanation

The fundamental requirements of section 33.90 are unchanged; except for the inclusion of a provision to allow utilization of data obtained under section 33.200 testing to show compliance to section 33.90 IMI.

Proposed New Section 33.200—Early Extended Operations (ETOPS) Eligibility and Test Requirements

A proposed new section 33.200 would define overall requirements for obtaining ETOPS type design eligibility approval.

Explanation

Compliance with this section results in an engine model that is eligible for two-engine ETOPS operation before the service experience required under 14 CFR part 25, Appendix L, Section II, paragraph (a) is achieved. The individual subparagraphs are discussed below:

Sections 33.200(a) and 33.200(b)

These sections require an applicant to establish a design quality process acceptable to the Administrator that will ensure that the type design minimizes the possibility of power loss failure events.

These rule sections require the applicant to use its best design practices, including all its corporate knowledge, skills and lessons learned in the design and manufacture of the engine. The intent is to eliminate from the design all known failures, malfunctions or design related maintenance errors experienced in other relevant FAA certified engines, and that are especially relevant to ETOPS. Such events include loss of thrust control, in-flight shutdown, or other power loss events.

Compliance may be shown by evidence acceptable to the Administrator that the applicant's design quality assurance process has demonstrated the capability to eliminate causes of engine failures, malfunctions, and design related maintenance problems known to have occurred within the applicant's commercial engine experience base. The applicant should also show that the design quality process would preclude the recurrence of that cause in the new design. Also, the design quality process and design features must address all applicable failures, malfunctions, and maintenance problems that could affect ETOPS even if they occurred on taxi, if such an event could have occurred in-flight.

The FAA will determine the extent of data required to be included in the relevant experience assessment based on the following factors:

(1) The manufacturer's level of experience in certifying engines installed on Transport Category airplanes;

(2) Recent experience certifying new engines;

(3) Completeness of the manufacturer's design practices and manuals used in the development of new engines; and

(4) Any other factors that the manufacturer may want to present to the FAA for consideration.

If adequate data exists the time period of consideration will be the prior 10 years of applicant experience.

Section 33.200(c)

The intent of this testing is to simulate in-service operation; and to simulate the extent of time that the engine will operate at maximum continuous power for the longest diversion time in an ETOPS scenario, and at a level of engine vibration that exceeds expected service operation. The test is not intended to duplicate or repeat or replace the endurance test required by section 33.87.

Explanation

This 3,000-cycle test requirement simulates the typical field service operation expected to be encountered in the first 250,000 fleet hours (typically two years of service) and the extent of time that an engine will operate in the event of a diversion at maximum continuous power for the longest diversion time expected. In addition, the test is required to be conducted at a level of vibration for the complete test that exceeds expected service exposure. The new test is an important part of the early ETOPS eligibility determination for both the engine and propulsion system of the airplane. No other type of engine vibration testing can simulate the vibration induced by imbalance of its rotors running through the speed and power ranges experienced in service. The test is required to simulate 3,000 cycles of service operation (typically two years) in a short time span. This test is similar to that conducted for the original certification of the three engine types used on the B777 under the Special Conditions. Those tests were also a combination of engine cyclic endurance with high cycle fatigue (HCF) vibration induced by way of imbalancing the main rotors of the engine.

Section 33.200(d)

The purpose of this test is to establish thrust characteristics, and ensure that

the engine can deliver rated takeoff power or thrust within approved limits prior to the start of the test.

Section 33.200(e)

This section establishes what the required inspections are and what the pass/fail criteria is for section 33.200 compliance. Further detail on a MoC for this section can be found in the companion advisory circular.

Section 33.200(f)

This section establishes the requirements for utilizing paragraph 33.200(c) 3,000-cycle test data to show compliance to section 33.90 Initial Maintenance Inspection. The companion AC provides details of an acceptable MoC.

Part 121

Global Issues for Part 121

FAA General Changes to the ARAC Proposal for Part 121

(1) Section 121.368 Has Become 121.374

The ARAC proposed rule number had to be changed due to other FAA rule writing projects. The content and concepts from the proposal were retained wherever possible within the new rule. Specific format changes and the differences between this proposed rule and the ARAC proposal are discussed in each section below.

Section-by-Section Discussion of the Proposed Changes to Part 121

Proposed New Section 121.7 Definitions and Designations

The FAA proposes to add a new section in part 121 for definitions applicable to ETOPS.

Explanation

Many of the terms used in the proposed regulatory and guidance material for ETOPS under this part are unique to these operations. Requirements and concepts for ETOPS require precise definition to assure common understanding and compliance. Definitions are added for:

Adequate Airport
ETOPS Alternate
ETOPS Area of Operation
ETOPS Dual Maintenance
ETOPS Entry Point
ETOPS Maintenance Significant System
ETOPS Qualified Personnel
Maximum Diversion Time
One Engine Inoperative Cruise Speed (Approved)

The following areas are designated as ETOPS areas by the Administrator in which the planning, operational, and equipage requirements for ETOPS apply. The areas are defined as:

NOPAC
North Pacific
Polar Areas
North Pole
South Pole

Proposed New Section 121.97 (b)(1)(ii) Airports: Required Data

The FAA proposes to clarify the ''public protection'' requirement of section 121.97 to include consideration of facilities available for public safety, protection, and welfare during regular and irregular operations (including diversions to the airport).

Explanation

Airlines must consider passenger facilities when selecting an ETOPS Alternate and in diversion planning. The facilities at an airport or in the immediate area must be sufficient to protect the passengers and crew from the elements and to see to their welfare during the time required to transport them onward.

By definition, ETOPS operations are those with long segments over water or remote areas. Some of these remote areas are affected by severe weather conditions such as, but not limited to, extreme cold or high winds and cold temperatures. Some of the airports that are well positioned for use as enroute alternates are in remote areas. These airports may have only limited or seasonal facilities that could be used to shelter passengers and crew after an unscheduled landing. As ETOPS operations have expanded in scope and extended in length, operations over more remote areas with more extreme weather possibilities have become routine. Northern Canada and the Russian Far East are typical examples. Facilities at some of the airports in those areas have not been maintained because of political, economic and military changes. It cannot be assumed that the passengers and crew of an aircraft will be safe simply because a safe landing can be made at an airport. Therefore, certificate holders are obligated to be aware of the available facilities and satisfy them that there will be adequate facilities to protect the passengers and crew should it be necessary to make an unscheduled landing for any reason.

These are new requirements. The FAA is proposing to add these additional requirements to this regulation because it has learned that not all certificate holders have planned for these contingencies in the past, apparently because the current wording of the regulation did not require them to do so. The FAA believes regulations are needed to prudently insure carriers recognize ''the duty of an air carrier to provide service with the highest possible degree of safety in the public interest * * *'' 49 U.S.C. sec. 44701 (d)(1)(A). The ARAC recommendation included arguments that since ETOPS flights are generally international flights, treaties limit damages for negligence that passengers on international flights may recover from airlines. The ARAC further stated that absent the compelling motivation of unlimited liability for proven damages available to domestic passengers, carrier motivation to avoid findings of negligence may also be lessened somewhat.

Others have pointed out that in the Polar Policy letter the FAA has already included instructions and requirements detailing the treatment of passengers in case of diversions or accidents and the facilities to be made available for them. Further, the addition of passenger related contingencies are based on rules, regulations and International Treaties, which have been and are in the process of being enacted for the protection of passengers well being such as: ''Aviation Disaster Family Assistance Act of 1996'', the DOT/NTSB Task Force Report on Assistance to Families of Aviation Disasters of 1997, Public Law 105–148 of 1997 (105th Congress), ICAO Circular 285–AN166 (33rd Assembly, 2001), European Union Regulation (EG) 2027/97, the ''Convention for the Unification of Certain Rules for International Carriage by Air'' of 1999 and others. Providing for the safety, security, comfort and well being of all of the occupants of an airplane has become especially important on long range flights because of increasing medical consequences. It was also pointed out that ignoring those requirements expose the carriers to increasing liability claims and to loss of business because of passengers' discomfort.

Proposed New Sections 121.99(c) and (d) Communications Facilities

The FAA proposes to add sections 121.99(c) and 121.99(d). Section 121.99(c) would create a baseline ETOPS equipage requirement for flag operations. Section 121.99(d) would create an additional equipage requirement for operations beyond 180-minutes.

Explanation

Under this proposal a certificate holder would have to provide for voice communication between the crew and air traffic services and the crew and the certificate holder wherever and whenever it is available. In areas where voice communication is not possible,

the certificate holder would have to provide a non-voice communication system, such as High Frequency (HF) data link, to ensure communication capability.

Paragraph 121.99(d) would apply on to ETOPS flights planned on greater than 180-minutes and would require the installation of an additional communication system. This communication system would have to be capable of providing immediate satellite based voice communication of land-line telephone-fidelity between the flight crew and air traffic services and between the flight crew and the company. The term ''immediate'' in the context of this section would mean the time period required to connect an ordinary land-line telephone call. The modifiers ''land-line telephone-fidelity'' are included as performance standards to describe the faithful reproduction of sound. The FAA is essentially describing Satellite Communication (SATCOM). At this time, only SATCOM provides this capability and compliance with this proposed rule. The FAA acknowledges that technological innovation may create alternatives to SATCOM or render the system obsolete. Certificate holders would be required to equip airplanes used in ETOPS beyond 180 minutes with SATCOM or other system that offers equivalent or enhanced capability. The FAA notes that the ARAC consolidated these requirements in a single paragraph (c) in their recommendation. The FAA elected to reformat for clarity.

Both paragraphs (c) and (d) would require the certificate holder to consider ''potential routes and altitudes necessary for diversion to ETOPS alternates'' when assessing the availability of voice communication facilities. The ARAC recommended that the FAA amend paragraph 121.99(a) to include the above-quoted language. The FAA has elected not to amend paragraph 121.99(a). Paragraph 121.99(a) is the baseline requirement for all domestic and flag certificate holders operating under part 121. The FAA believes the equipage and communication performance requirements for ETOPS should be separate and distinct from the baseline communication requirement for part 121. Further, the FAA has proposed amending paragraph 121.99(a) in the Area Navigation (RNAV) proposed rulemaking. *See* 67 FR 77326 (December 17, 2002).

The origin of paragraph 121.99(d) is the 207-minute policy letter, which conditioned extension of section 121.161 deviation authority upon the installation SATCOM for operation on those routes. See 65 FR 3520 (January 21, 2000). The purpose of this proposal is to ensure that flight crews have the best communication capability in the event of an extended diversion. During a diversion, crew workload increases considerably. The use of an unwieldy communication system during a diversion would needlessly distract the crew from more important cockpit duties. SATCOM is not available in all regions of the world. In those regions, flight crews must have another means to communicate with the certificate holder and air traffic services.

Proposed New Section 121.106 Required Rescue Fire Fighting Capability at ETOPS Alternate Airports

The FAA proposes to add new section 121.106, requiring a rescue fire fighting capability at an airport designated as an ETOPS alternate.

Explanation

Currently, part 139 does not require any aircraft rescue fire fighting (RFF) capability at airports designated as Takeoff and Destination alternates. Alternate airports are referred to in part 139 but not defined. The common perception of an alternate airport is that it is an airport that is used infrequently, when diversions occur. The original use of the definition was limited to the destination or takeoff airports. There was no specific mention of the en route alternate until Advisory Circular 120–42, Extended Range Operation With Two Engine Airplanes (ETOPS), was issued in 1985. The airport regulations specified in part 139 were first published in 1972 prior to the inception of ETOPS. For these reasons, and as outlined further, we propose new section 121.106 to include the requirement for RFF at an en route alternate airport.

Normally a flight diverts to its destination alternate airport because of poor weather at the destination airport or the aircraft having a low fuel state. In contrast, a diversion to an ETOPS en route alternate is likely attributable to an engine or system failure or medical emergency. Throughout the ETOPS flight the designation of the en route alternate may be revised, with consideration of the designated en route alternate airport maintaining an adequate level of weather and runway conditions to safely land the airplane. At the most critical point of an ETOPS en route diversion there is no other choice as to the diversion airport. It remains necessary to ensure that all the facilities and services are adequate to ensure that a safe landing can be made at the diversion airport in the event that it is necessary to divert. Thus, some have argued that there is an increased importance of a rescue fire fighting service at airports designated as an ETOPS en route alternate. Further, they have argued that establishing such a requirement in the Federal Aviation Regulations is consistent with ICAO Annex 6, Part I, Attachment E, wherein an ''adequate alternate aerodrome'' is defined. The definition includes a list of various facilities and services, including ''rescue and fire fighting'', as being necessary. (An attachment to ICAO Annex is intended as a guide or supplementary material to ICAO Standards and Recommended Practices and as such, is not a requirement.)

The fact that en route diversions have occurred in the past and will continue to occur necessitates evaluation of the facts surrounding those events and the needs they identify. ETOPS operators in the United States (as well as Europe) operating across the North Atlantic have encountered difficulties in being able to designate certain Canadian airports as ETOPS en route alternates due to the reduction of RFF service capability (Canadian airport privatization) and numerous military base closures.

History has shown that in-flight diversions occur for a variety of reasons, other than In-Flight Shutdown (IFSD) of two engine aircraft. Any aircraft conducting extended range operations could experience a critical emergency requiring diversion to an en route alternate airport. Thus, it is proposed by some that a regulation be established to require an en route alternate for all extended range flight operations (aircraft with 2, 3, and 4 engines) because, in such an event requiring a diversion, a simple emergency evacuation in a hostile environment (for example, due to cold temperatures) could be deadly, or in a similar way, a mechanical event requiring a need to land could result in an unanticipated accident, such as a runway overrun and thus become catastrophic. It is further argued by some that these considerations have led to the conclusion that some level of accident mitigation systems should be required for airports designated as en route alternate airports. This accident mitigation protection is provided for at airports designated as origin and destination airports in the regulations of part 121, and the appropriate levels of protection are specified in the airport certification regulations designated as part 139.

Part 139 specifies the level of aircraft Rescue and Fire Fighting (RFF) as a function of aircraft size. This level of protection is deemed the ''Index'' and

specifies the amount of agent for fire extinguishment and the number of vehicles to deliver the agent proportionate to the size of the largest airplane using the airport. In the international Standards of ICAO, the length and width of the aircraft fuselage determines the ''RFF Category''. An allowance for reducing the index/category is provided in the event that the aircraft only uses the airport infrequently *i.e.*, less than 700 movements in the busiest consecutive three months with the airplane in the highest category. This is termed a remission factor. Even though frequency of operations may allow a reduction of service levels by 1 Category, this reduction will no longer be allowed after January 2005 under the ICAO Standards. ICAO RFF category range from 1 to 10. As an example, the ICAO category of RFF 4, which is nearly equivalent to Index A in part 139, provides at least 1 firefighter and 1 vehicle with the ability for immediate fire suppression or ground assistance to occupants.

Contradicting the arguments of those who support RFF at enroute alternates, some have stated that based on the last sixteen years of ETOPS operations with well over 2.5 million ETOPS flights around the world, there is no record of a single incident where a twin on an ETOPS phase of flight with a mechanical event diverted to an ETOPS alternate and the landing resulted in an unanticipated accident, such as a runway overrun and thus became catastrophic, and required the RFF services. It was further argued that the probability of an ETOPS flight diverting on the ETOPS portion of the flight, landing at an ETOPS alternate, resulting in an accident or a catastrophic situation is very remote, and need not be considered. However, some have pointed out that the fact that an event has not happened does not mean it will never happen, and industry needs to be proactive and provide a level of safety as a margin, should the situation arise.

Some have pointed out that requiring high levels of RFF protection for the enroute alternate airports would either severely limit the selection of diversion airports necessitating longer divert times, or demand the communities supporting these enroute alternate airports increase their level of emergency service beyond that currently available. However, it can be argued that for airplanes on long diversions a pad may need to be built in so that a minimum level of RFF capability is assured at the time of landing.

Even though currently not required by part 139, the FAA considers it very desirable to have some minimum level of RFF protection at the ETOPS alternates. Taking into account the various opinions expressed in the ARAC recommendations, the FAA proposes to establish a minimum RFF of 4 for ETOPS operations below 180 minutes, and a minimum RFF of 7 for diversion times greater than 180 minutes. This reflects the RFF requirements stated in FAA Order 8400.10, Flight Standards Handbook Bulletins for Air Transportation, HBAT 99–15 titled Level of Rescue and Fire Fighting Services (RFFS) for ETOPS En Route Alternates, and the 207-Minute ETOPS Policy.

Similar to the allowance contained in HBAT 99–15, the proposed regulation allows for an off airport response time of thirty minutes, however, the required equipment must be available on-scene for the arrival of the diverting airplane and should remain for as long as their services are needed. In contrast to a destination or departure airport, the diversion airport has time to muster community emergency service assets to provide the necessary emergency response following notification of the aircraft diversion. This provision for the use of off-airport emergency services necessitates that a robust communications link must be established in order to provide sufficient time to muster the necessary RFF personnel and equipment. Further, local community emergency services support of required RFF response in providing equipment and personnel is considered prudent.

In all cases the certificate holder must ensure that the flight crews are provided current information (in plain language) concerning the RFF capability for those airports designated as alternate airports

Proposed New Section 121.122 Communication Facilities

The FAA proposes to add a communication facilities requirement for supplemental operators. This section would mirror section 121.99, which applies to flag and domestic operators.

Explanation

The FAA believes it is necessary to create comparable communication requirement for supplemental operators to ensure consistency among part 121 operations. To this end, the FAA proposes communication requirements similar to those in section 121.99. For example, paragraph 121.122(a) is based on the existing paragraph 121.99(a), which is the basic communication requirement for domestic and flag operators. Similarly paragraphs 121.122(b) and (c) are based on the proposed sections 121.99(c) and (d) respectively which would establish communication requirements for ETOPS. See discussion above for 121.99(c) and (d) for the rationale of ETOPS communication requirements.

Proposed New Paragraph 121.135(b)(10) Contents

Add a new 14 CFR 121.135(b)(10) to require performance data to support ETOPS.

Explanation

The FAA proposes to insert a new requirement for performance data in the manual required by this section to support ETOPS as paragraph (b)(10), and to renumber existing paragraphs 121.135(b)(10) through (24) to new paragraphs 121.135(b)(11) through (25). Since ETOPS are conducted under a special authorization, there is an additional performance data requirement to support these operations. The flight crew and dispatchers should have available the engine inoperative and cabin depressurization cruise data used by the certificate holder to plan flights and operate under ETOPS.

Proposed New Paragraph 121.135(b)(26) Contents (New)

Add paragraph 121.135(b)(26) to require a passenger recovery plan for flag and supplemental operations in the certificate holder's manual.

Explanation

The FAA proposes to add paragraph 121.135(b)(24) to require a passenger recovery plan for flag and supplemental operations in the certificate holder's manual. The FAA introduced the requirement for an airline to develop and maintain a passenger recovery plan for flights authorized in the North Pole area of operation by policy letter in March 2001.

It is incumbent that a carrier account for contingencies when diversions occur to airports not normally served by the carrier. When a diversion occurs in an area where the carrier has a substantial operational infrastructure, (that is, a carrier serves many destinations in Europe but is forced by operational circumstances to divert to an airport not served by the carrier but within the region) that diversion plan becomes a simple matter of describing how the carrier's assets within the region can supply immediate logistical support to the diversion aircraft. This can be called a regional passenger recovery plan applicable to a stated geographical area.

However, a carrier with an extensive route system extending over remote areas has a responsibility to devise a

plan of substance to recover the passengers, crew, and aircraft in the event of a diversion within a remote area. The plan should be of sufficient detail to demonstrate that the recovery operation can be readily affected, and the basic needs of the diverted customers and crew can be provided for in the interim.

The certificate holder must demonstrate that a regional plan is robust enough to handle diversion scenarios within that region by showing the effectiveness and adequacy of communications; coordination; facilities; accuracy of NOTAM and weather information; and operability of support ground equipment. The recovery plan should also address the care and safety of passengers and crew at the diversion airport, and include the plan of operation to extract the passengers and crew from that airport. The certificate holder must maintain the accuracy and completeness of its recovery plan as part of its annual audit.

Proposed Change to Section 121.161 Airplane Limitations: Type of Route

The FAA proposes to revise section 121.161(a) to create ETOPS route authority within the regulations and to move away from ETOPS conducted under the Administrator's deviation authority.

Explanation

As discussed earlier in this proposal, deviation from section 121.161(a) has been the regulatory basis of ETOPS since its inception. The FAA issued AC 120–42 and AC 120–42A to provide guidance for carriers seeking to conduct ETOPS. However as ETOPS evolved from an exceptional kind of operation to a prevalent kind of operation, the need for amending paragraph 121.161(a) has become became apparent. The proposed paragraph 121.161(a) would describe when and where the requirements of ETOPS would apply and furthermore would contain a pointer to the new Appendix O. Appendix O would contain the approval requirements for the different ETOPS time thresholds and ETOPS areas of applicability. ETOPS would no longer be conducted under the Administrator's deviation authority under this proposal but would have a distinct regulatory basis.

The FAA proposes to add a new paragraph 121.161(d) that would limit operations of reciprocating engine powered airplanes to routes no more than 60 minutes away from an adequate airport at single-engine inoperative speed in still air and standard conditions. This new section would have language allowing the Administrator to grant deviations. The FAA believes that, although not possible at present, reciprocating engines may someday achieve the reliability necessary for operations beyond 60 minutes.

Proposed New Section 121.374 ETOPS Maintenance Requirements

(1) Format changes

ARAC proposal	NPRM draft
121.368 ETOPS Maintenance	121.374 ETOPS Maintenance Elements.
(a) CMP	(a) CMP.
(b) Initial maintenance and training procedures	(b) CAMP. (g) Maintenance training.
(c)(1) CMP requirements	Deleted.
(c)(2) Pre-departure service check	(b)(1) Pre-departure service check.
(c)(3) Verification procedures	(b)(3) Verification program.
(c)(4) Preclude dual maintenance	(b)(2)(i) Preclude dual maintenance.
(c)(5) Procedures if dual maintenance cannot be avoided	(b)(2)(ii) Procedures if dual maintenance cannot be avoided.
(c)(6) APU in-flight start program	(f) APU in-flight start program.
(d) Centralized maintenance control	(b)(5) Centralized maintenance control.
(e) Changes to maintenance and training procedures	(h) Procedural changes.
(f) ETOPS task identification	(b)(4) ETOPS task identification.
(g) ETOPS document	(b)(6) ETOPS document.
(h) ETOPS parts control	(b)(7) ETOPS parts control.
(i) ETOPS reliability program	(b)(8) ETOPS reliability program.
None	(b)(8)(i) Reporting requirements.
(j) Investigate each IFSD	(b)(8)(ii) Investigation requirements.
(j) Also contained IFSD rates	(c) Propulsion system monitoring.
(k) Engine condition monitoring	(d) Engine condition monitoring.
(l) Oil consumption program	(e) Oil consumption monitoring.
(m) APU in-flight start program	(f) APU in-flight start program.

Explanation

A crucial element of ETOPS is a robust maintenance program that complements the standard airplane-engine maintenance program. ETOPS maintenance practices are designed to preclude and protect diversions through closely controlled procedures such as engine condition monitoring, oil consumption monitoring, the aggressive resolution of reliability issues, and procedures to reduce the risks of human error during maintenance of airplane systems and engines. For the past 18 years, AC 120–42 and AC 120–42A have provided guidance describing the specialized maintenance requirements necessary for ETOPS. The FAA proposes to codify the guidance from the AC. These requirements would apply to all airplanes used in ETOPS regardless of the number of the engines installed.

This proposal would require operators to develop an ETOPS maintenance program that addresses or incorporates the following elements:

(a) Configuration, Maintenance, and Procedures (CMP) Compliance

Each certificate holder would have to establish a system to ensure compliance with the CMP. The importance of the CMP is discussed more fully above in the General Discussion of the Proposal.

(b) Continuous Airworthiness Maintenance Program (CAMP)

A CAMP is a comprehensive oversight program to ensure the continuing airworthiness of an airplane. A CAMP includes but is not limited to maintenance tasks, inspection tasks, auditing requirements, and data analysis. CAMP is required by part 121 Subpart L. The proposed regulation would expand the scope of the CAMP for ETOPS operators to encompass issues unique to ETOPS. The following are considered basic additional

elements of a CAMP for an ETOPS operator:

(1) ETOPS Pre-Departure Service Check

The pre-departure service check is designed to ensure that ETOPS significant systems will perform their intended function throughout the flight. An ETOPS pre-departure service check would have to verify the status of ETOPS significant systems. Some certificate holders conducting ETOPS flights have elected to add other items to their check as a result of operational experience and knowledge gained from their reliability programs. Regardless of any additional items an operator may add to a check, the focal point of this check must be inspection, servicing, and maintenance of ETOPS significant systems.

(2) Dual Maintenance

Dual maintenance is a concept relating to repetition of maintenance errors on redundant systems. There have been instances of a single mechanic repeating a maintenance error on multiple systems. An example of dual maintenance error is failing to install o-rings on engine oil or fuel components on multiple engines. Establishing procedures to avoid dual maintenance can minimize the probability of such errors. The use of two or more mechanics reduces the risk of this type of error. Routine tasks on multiple similar elements, such as oil and fuel filter changes, should never be scheduled and assigned on the same maintenance visit.

However, the FAA is aware that under some limited circumstances, dual maintenance may be unavoidable. For instance, a pilot's report of a discrepancy on an ETOPS significant system may require maintenance on one engine at the same time as a scheduled maintenance event for the other engine. In such cases, the certificate holder must establish and follow procedures to mitigate the risk of a common cause human error.

(3) Verification Program

The verification program ensures the effectiveness of ETOPS maintenance actions. Verification programs are designed to identify any potential problems and may consist of ground tests, flight tests, use of built in test equipment (BITE), and other tests as appropriate. Verification action must be accomplished following corrective action to an ETOPS significant system, primary system failure, IFSD or in response to significant adverse trends. The certificate holder must establish procedures to clearly indicate who is going to initiate the action and what verification action is necessary. A verification flight may be performed in combination with an ETOPS revenue flight, provided the verification phase is documented as satisfactorily completed upon reaching the ETOPS entry point.

(4) Task Identification

ETOPS maintenance programs include numerous tasks that are critical to ETOPS. Under this proposal, the certificate holder would have to identify specific tasks that must be accomplished by ETOPS qualified personnel. These ETOPS-specific tasks are performed during all phases of maintenance. On the other hand, some tasks in an ETOPS maintenance program are identical to tasks on a non-ETOPS airplane. The FAA realizes that tasks, such as checking seat belts prior to a flight, do not involve ETOPS significant systems and may be performed by non-ETOPS qualified personnel. ETOPS specific tasks would either be identified on the certificate holder's routine work forms and related instructions or parceled together and identified as an ''ETOPS package.''

(5) Centralized Maintenance Control Procedures

The certificate holder would have to develop and clearly define in their program ETOPS related procedures, duties, and responsibilities, such as the involvement of centralized maintenance control. The function of centralized maintenance control is to be a focal point for operational aspects of ETOPS maintenance and to ensure that ETOPS aircraft are airworthy. Procedures and centralized control processes would be established which would preclude an airplane being dispatched for ETOPS flights after a propulsion system shut-down, significant primary airframe system failure, or significant adverse trends in system performance without appropriate corrective action having been taken. Confirmation of corrective maintenance would require appropriate verification action prior to an ETOPS flight. Depending on the size and scope of the ETOPS operation, the maintenance control entity could be an entire department or one ETOPS-qualified individual for a small operation. ''Centralized maintenance control'' is also referred to as ''technical services center'', ''maintenance operations control (MOC)'', and ''maintenance coordination center'' among other terms within industry.

(6) ETOPS Program Document

The certificate holder would have to develop a document that identifies all ETOPS requirements, including supportive programs, procedures, duties, and responsibilities. The ETOPS program document would be for use by personnel involved in ETOPS and would be readily accessible to those personnel. This document need not be inclusive but should at least reference the maintenance program and other requirements, and clearly indicate where they are located in the certificate holder's document system. The ETOPS program document would have to be submitted to the CHDO for approval at least 60 days before beginning ETOPS flights and be subject to revision control.

(7) ETOPS Parts Control

Under this proposal, the certificate holder would have to develop a parts control program that ensures the proper parts and configurations are maintained for ETOPS airplanes. The program would have to include procedures to verify that the parts installed on ETOPS airplanes during parts borrowing or pooling arrangements, as well as those parts used after repair or overhaul, maintains the necessary ETOPS configuration. In many cases, certificate holders utilize the Illustrated Parts Catalog (IPC) as the ETOPS parts controlling document. However, other methods may be used provided that the configuration standard of the airplane and engine is maintained.

(8) Reliability Program

The certificate holder would have to develop an ETOPS Reliability Program or the certificate holder's existing Reliability Program would have to be supplemented. This program should be designed to identify and prevent ETOPS related problems. The program would be event-oriented and incorporate reporting procedures for critical events detrimental to ETOPS flights. For those certificate holders that do not have a FAA approved reliability program, their Continuing Analysis and Surveillance (CAS) would have to be enhanced to achieve ETOPS reliability goals. Reliability data would have to be readily available for use by the certificate holder and the FAA to ensure that an acceptable level of reliability is achieved and maintained.

The reporting requirements differ from the ARAC recommendation. The ARAC proposal indicated that the reporting requirements for ETOPS would be satisfied through reporting required by sections 121.363, 121.703, 121.704 and 121.705. Due to other FAA rulemaking activity to amend sections 121.703 and 121.704, the reporting requirements of 121.703 and 121.704

would not apply in the manner as understood by the Working Group. In order to adjust for these changes, the FAA proposes to codify the existing list of reportable events from Advisory Circular 120–42A.

(1) The following are in addition to the reporting requirements in section 121.703 and would include:

(a) In-flight shutdowns.

(b) Diversions or turnback.

(c) Uncommanded power changes or surges.

(d) Inability to control the engine or obtain desired power.

(e) Problems with systems critical to ETOPS.

(f) Any other event detrimental to ETOPS.

(2) Certificate holders would also be required to furnish the following information:

(a) Airplane identification (type and N-number).

(b) Engine identification (make and serial number).

(c) Total time, cycles and time since last shop visit.

(d) For systems, time since overhaul or last inspection of the discrepant unit.

(e) Phase of flight.

(f) Corrective action.

This proposed regulation would require certificate holders to conduct an investigation into the cause of the occurrence of any event listed above in addition to any event described in section 121.703. The certificate holder would have to submit findings and description of corrective action taken to the CHDO. The FAA expects certificate holders to investigate events above in conjunction with manufacturers. The report must be submitted in the manner prescribed by section 121.703(e).

(c) Propulsion System Monitoring

Propulsion system monitoring is vital to ensure safe ETOPS flights. A propulsion system-monitoring program is intended to detect adverse trends, to identify potential problems, and to establish criteria for when corrective action may be necessary. Propulsion system problems and IFSD may be caused by type design deficiencies, ineffective maintenance, or operational procedures. It is very important to identify the root cause of events so that corrective action may be determined. The diverse causes of propulsion system problems require different solutions. For example, type design problems may affect an entire fleet of aircraft. If an individual certificate holder experiences a problem caused by a type design issue, it may not be appropriate for the FAA to withdraw ETOPS authority. Fundamental design problems that require an effective hardware (or software) final fix will normally be corrected by an FAA Airworthiness Directive. Inspections may be satisfactory as an interim solution but long-term design solutions are required for terminating action. However, maintenance or operational problems may be wholly, or partially, the responsibility of the certificate holder. In these cases, the cause would be specific to that certificate holder and may require changes to their operational, dispatch or maintenance procedures. Propulsion system monitoring should be used to ensure that airplane and engine reliability stay within approximate IFSD rates as described in the proposed regulation.

(d) Engine Condition Monitoring

The certificate holder would have to monitor the condition of engines on ETOPS airplanes. The monitoring program would describe the engine performance parameters to be tracked, method of data collection, analysis, and corrective action processes. It would detect deterioration in engine performance by tracking parameters such as rotor speeds, exhaust gas temperatures, and fuel flow and to allow for corrective action before safe operation is affected. The program should reflect the manufacturer's instructions and industry practices. Engine limit margins must be maintained so that prolonged engine inoperative diversions may be conducted without exceeding approved engine limits at all approved power levels and expected environmental conditions. Engine margins are maintained through this program to account for the effects of additional engine loading demands such as electrical and pneumatic systems that may be required during a diversion. If oil analysis such as Spectrographic Oil Analysis Program (SOAP) would be relevant, it should be included.

(e) Oil Consumption Monitoring

The certificate holder would have to establish an engine oil consumption monitoring program to ensure that there is enough oil to complete any ETOPS flight. The certificate holder's consumption limit would not be allowed to exceed the manufacturer's recommendations, and would have to be sensitive to oil consumption trends. The program would have to track the amount of oil added at the departing ETOPS station with reference to the running average consumption. The monitoring must be continuous up to and including the oil added at the ETOPS departure station. For example, after servicing, the oil consumption may be calculated by maintenance personnel as part of the pre-departure check or may be automatically calculated by the certificate holder's computer software program. The amount of oil added could also be reported to centralized maintenance control for calculation prior to the ETOPS flight. If an Auxiliary Power Unit (APU) is required for ETOPS, then its oil consumption for the APU must be included in the program.

(f) APU In-Flight Start Program

If APU in-flight start capability is required for ETOPS, the certificate holder would be required to establish an in flight start and run monitoring program. The primary function of an APU is to provide backup electrical power in the event of a main system failure such as engine in-flight shut down or generator loss. This program would have to ensure that the APU in-flight start capability would continue at a level of performance and reliability established by the manufacturer or the FAA. The program would have to be acceptable to the Administrator and include periodic sampling of each ETOPS airplane's APU in-flight starting capabilities. Certificate holders with existing approved programs may continue under that authority under this proposal. Sampling intervals may be adjusted according to system performance and fleet maturity. The Advisory Circular accompanying this proposal contains guidance for APU reliability and performance assessment.

(g) Maintenance Training

The certificate holder would have to develop additional ETOPS specific training that focuses on the special nature of ETOPS and is required for all personnel involved in ETOPS. This training would be in addition to the certificate holder's accepted maintenance training program to qualify individuals for specific airplane and engines. This program may be incorporated into the accepted maintenance training curricula. The certificate holder would have to review the entire maintenance-training program with the CHDO to ensure that it adequately supports ETOPS training requirements. The goal of this program is to ensure that all personnel involved in ETOPS are provided the necessary training so that the ETOPS maintenance requirements are properly accomplished.

The program must establish a system to qualify ETOPS maintenance personnel. ETOPS qualified maintenance personnel are those who

have successfully completed the certificate holder's ETOPS training program and who have satisfactorily performed extended range tasks under the direct supervision of an FAA certificated maintenance person who has had previous experience with maintaining the particular make and model aircraft being utilized under the certificate holder's maintenance program. For new aircraft introduction, the previous experience for training can be obtained from the manufacturers training program.

(h) Procedural Changes

Following approval of the maintenance and training procedures established to qualify for ETOPS; substantial changes to those procedures must be submitted to the Certificate Holding District Office (CHDO) and approved before they may be adopted. The determination of what constitutes substantial changes should be negotiated between the certificate holder and the CHDO. This is to allow some flexibility depending on the certificate holder's ETOPS experience and performance history. The CHDO may require submission of all changes for a new ETOPS operator or for an operator experiencing difficulties. However, as experience is gained the CHDO may reevaluate what changes it needs to approve.

Continuing Surveillance

As with all other operations, the CHDO may also monitor all aspects of the ETOPS operations it has authorized, to ensure that the levels of reliability achieved in ETOPS operations remain at acceptable levels, and that the operation continues to be conducted safely. In the event that an acceptable level of reliability is not maintained, if significant adverse trends exists, or if critical deficiencies are detected in the type design or in the conduct of ETOPS operations, the CHDO may initiate a special evaluation, impose operational restrictions, and ensure the operator adopts corrective actions in order to resolve the problems in a timely manner. The CHDO should alert the appropriate FAA Aircraft Certification Office and Aircraft Evaluation Group when problems associated with airplane design or operations are identified.

Proposed New Paragraph 121.415(a)(4) Crewmember and Dispatcher Training Requirements

The FAA proposes to add a new requirement to train crewmembers and dispatchers in their roles and responsibilities in the certificate holder's passenger recovery plan to the certificate holder's approved training program.

Explanation

Crewmember and dispatcher involvement in seeing to the welfare of passengers following a diversion often is an important factor in the success of post diversion passenger handling. With ETOPS and the possibility of diversion to a remote foreign airport with reduced services and facilities available for passenger welfare, it is increasingly important that the certificate holder have a passenger recovery plan and that crew members and dispatchers understand their role in that plan. Current regulations do not require training for crewmembers or dispatchers in their role in a certificate holder's passenger recovery plan. The role of the crewmembers and dispatchers must be defined and the training program tailored around those defined roles.

Proposed Change to Paragraph 121.565(a) Engine Inoperative: Landing; Reporting Below

Explanation

The FAA proposes a minor revision to paragraph 121.565(a) to delete the reference to stopping the rotation of an engine, which applies only to propeller driven airplanes. This is to be replaced with terminology * * * ''whenever an engine is shut down * * *'' that applies to all reciprocating engines and turbine powered engines.

Proposed New Section 121.624 Dispatch Requirements for an ETOPS Alternate Airport

The FAA proposes to add a regulation, which specifies the dispatch requirements for an ETOPS alternate, and the requirements for a valid ETOPS alternate after takeoff.

Explanation

Most airplanes operate in an environment where there is usually a choice of diversion airports available within a close proximity to the route of flight. The available airports usually have significant infrastructure and facilities for routine handling of aircraft, crews, and passengers. An airplane conducting ETOPS may have only one alternate within a range dictated by the endurance of a particular airframe system (for example, cargo fire suppressant) and therefore the approved maximum diversion time for that route. Additionally, the alternates may be isolated and less completely equipped to deal with passenger aircraft. Therefore, it is important that any airport designated as an ETOPS alternate has the capabilities, services and facilities to safely support the airplane and its passengers and crew during the diversion.

A regulatory requirement for an ETOPS alternate meets a prudent planning requirement for an en route diversion alternative for all long-range aircraft in the event of an engine failure, an airplane system failure or a serious passenger problem. A new regulation is required to specify the dispatch and en route requirements for ETOPS alternates. In addition, past experience in ETOPS operations of twin-engine aircraft with en route diversions for reasons other than engine failure justify the imposition of a requirement to designate en route alternate for all long-range operations with airplanes with two or more engines. The additional operational challenges of these routes are equally demanding of all airplanes, regardless of the number of engines, and include such issues as extremes in terrain and meteorology, as well as limited navigation and communications infrastructure.

At dispatch, an enroute alternate must meet the alternate weather requirements specified in the certificate holder's operations specifications. Due to the natural variability of weather conditions with time, as well as the need to determine the suitability of a particular enroute alternate prior to departure, such requirements are higher than the weather minimums required to initiate an instrument approach. This is necessary to assure that the instrument approach can be conducted safely if the flight must divert to an alternate airport. The visual reference necessary to safely complete an approach and landing is determined, among other things, by the accuracy with which the airplane can be controlled along the approach path by reference to instruments and the accuracy of the ground-based instrument aids, as well as the tasks the pilot is required to accomplish to maneuver the airplane so as to complete the landing. For these reasons the weather minima for non-precision approaches are generally higher than for precision approaches.

The weather conditions at the time of arrival should provide a high assurance that adequate visual references are available upon arrival at decision height (DH) or minimum descent altitude (MDA), and the surface wind conditions and corresponding runway surface conditions must be within acceptable limits to permit the approach and landing to be safely completed with an engine and/or systems inoperative.

The proposed section (d) would require operators to designate only those airports as ETOPS alternates that

adequately protect the passengers and crew from the elements and see to their welfare.

Proposed Change to Section 121.625 Alternate Airport Weather Minimums Explanation

The purpose of the proposed amendment to section 121.625 is to clarify the intent of this regulation as being applicable to destination and takeoff alternates only and not to ETOPS alternates requirements. ETOPS alternate requirements are the subject of proposed new regulation, section 121.624 ETOPS Alternates.

Proposed Change to Section 121.631 Original Dispatch or Flight Release, Redispatch or Amendment of Dispatch or Flight Release

The FAA proposes to modify section 121.631 to specify weather requirements for ETOPS alternates while a flight is en route and the availability of the option to amend the dispatch or flight release to add another ETOPS alternate if a required ETOPS alternate becomes unavailable.

Explanation

The FAA proposes to modify section 121.631 to address weather conditions required at designated ETOPS alternates while a flight is en route. This regulation is consistent with the standards and practices of AC 120–42A, the advisory circular that provided guidance for ETOPS since 1985.

The proposed regulation also specifies the action required of the pilot in command and, in the case of flag operations, the dispatcher, in the event a required, designated alternate becomes unavailable and no other qualifying airport is available. In that event, the flight may not continue as an ETOPS flight unless another track that qualifies is available. The FAA recognizes that this may sometimes cause disruptions in scheduled operations and anticipates that carriers will adjust the enroute alternate weather minimums upward on routes on which this becomes more than a very infrequent problem.

Proposed New Section 121.633 Planned ETOPS Diversion Time Limitations

The FAA proposes to add new regulation section 121.633 to require that planned ETOPS diversion times not exceed the time limit specified in the Airplane Flight Manual (AFM) for the airplanes most time-limited system minus 15 minutes. For airplanes with more than two engines and type certificated before the effective date of this regulation, the effective date for compliance with paragraph 121.633(b) is proposed to be not later than six years following the date on which this rule becomes effective.

Explanation

Section 121.633 has been developed to codify the two-engine airplane operating practices with regard to diversion time and time critical systems and to expand those regulations to include airplanes with more than two engines in long-range operations.

The premise of ETOPS has been to preclude a diversion and, if it were to occur, to have programs in place that protect the diversion. Under this concept, propulsion systems are designed and tested to assure an acceptable level of in-flight shutdown; other airplane systems are designed and tested to ensure their reliability. However, despite the best design/testing, and maintenance practices, situations have occurred which required an airplane to divert. In-service data has also shown that all airplanes, regardless of the number of engines, divert from time to time for various causes. Airplanes with more than two engines currently are operated in areas where there are a limited number of enroute airports, where the support infrastructure is marginal or with challenging weather conditions. All such operations should adopt the same 'preclude and protect' concept.

Under the 'preclude and protect' concept, various failure scenarios need to be considered. For example, during the design of the airplane, time limited systems such as cargo compartment fire suppression/containment capability are considered. The fuel planning process accounts for the possibility of decompression and/or the failure of an engine with considerations for icing.

If airplanes with more than two engines plan to operate in areas where en route airports are farther than 180 minutes or in north polar areas where weather conditions can be challenging at certain times of the year, these operations should be required to meet the standards to ensure that all efforts are made to preclude a diversion and, if a diversion were to occur, procedures are in place to protect that diversion. This would include systems capability to protect the aircraft and its occupants during the entire length of the diversion. As such, for ETOPS operations less than 180 minutes the one engine inoperative cruise speed maximum diversion time to any ETOPS alternate may not exceed the time specified in the Airplane Flight Manual (AFM) for the airplane's most time-limited system, minus 15 minutes. The 15 minutes allows time for approach and landing. The cruise speed is calculated as if in still air under standard temperature conditions.

In ETOPS operations wind becomes an increasingly significant factor with increasing diversion times and should be considered in ETOPS operations beyond 180 minutes to assure that AFM system time limits are not exceeded. For example, while diverting with an engine inoperative, it is essential to ensure that there is sufficient amount of oil in the tank for continuous operation of the remaining engines at Maximum Continuous Thrust for the actual duration of divert. As a result, for ETOPS operations with approved diversion times greater than 180 minutes the one engine inoperative cruise speed (approved) maximum diversion time is calculated by taking into account forecast wind and temperature. The maximum diversion time may not exceed the time specified in the airplane flight manual for the airplane's most time-limited system, minus 15 minutes for approach and landing.

However, there are some other time limited systems, like cargo fire suppression, which may not have as much relevance to the one engine inoperative diversion time. The FAA believes that the likelihood of an engine failure at the critical point followed by cargo fire to be extremely remote. Thus ETOPS beyond 180 minutes, cargo fire suppression requirement would be based on covering the diversion distance authorized (maximum diversion time authorized at the approved one engine inoperative speed) at the all engine operating speed. It has already been stated that for ETOPS operations beyond 180 minutes wind becomes an increasingly significant factor with increasing diversion times and should be considered. Therefore this proposed rule requires that for ETOPS beyond 180 minutes, cargo fire suppression time required be based on the airplane operating at all engine operating speed with actual wind. For ETOPS at or below 180 min, there is precedent in AC 120–42, for cargo fire suppression for the maximum diversion time based on one engine inoperative speed. This proposal would codify that practice. The cargo fire suppression time in all cases shall also include 15 minutes allowance for holding, approach and landing.

During development of their recommendation the ARAC ETOPS Working Group had much discussion regarding aircraft utilized in long haul operations. Some three and four-engine airplanes routinely operate on routes with diversion times that exceed aircraft

system capabilities such as cargo fire suppression. The FAA believes equivalent cargo fire suppression capabilities should exist among the entire fleet of airplanes conducting ETOPS. The proposed regulation would require the modification of those airplanes. The FAA recognizes that a transition period to gain full compliance with the proposed rule is necessary for the industry. The FAA finds that these modifications can be accomplished within the scheduled maintenance D check cycle (6 years) based on ARAC recommendations. This proposal would grant the operator sufficient time to adequately plan for and incorporate necessary modifications in the 6-year time frame proposed.

The FAA recognizes this proposal would allow three and four engine airplanes to continue to operate on routes with diversion times up to and including 180 minutes without having to update time-limited system capabilities. The FAA seeks comment on how it should address this discrepancy in the future.

Proposed New Section 121.646 Fuel Supply Required Following Depressurization

We propose to add a new rule, section 121.646, to specify the fuel supply required following depressurization. Current regulations contain no requirement for a fuel supply sufficient to reach an en route diversion airport.

Explanation

ICAO Annex 6, Part I, section 4.3.6.4(d) requires consideration of additional fuel in the event of loss of pressurization. Fuel consumption increases considerably at the lower altitudes flown following a loss of pressurization. Although section 121.329 requires descent following cabin depressurization ''to an altitude that will allow successful termination of the flight,'' there is no explicit requirement in part 121 for a fuel supply in the event of cabin depressurization to assure a safe landing. It should be noted that an interpretation can be made that fuel to provide for cabin pressurization is required because of the requirement of section 121.329.

Both AC 120–42 and 120–42A considered the fuel supply required at the most critical point in the ETOPS area of operation in the event of the cabin depressurization, and also considered the possibility of a simultaneous failure of an engine. As the probability of depressurization is comparable between two, three, and four-engine airplanes, the proposed section 121.646 would retain the AC conditions for fuel supply to an ETOPS alternate in the event of cabin depressurization for all ETOPS operations.

For airplanes with more than two engines the section 121.329 implied fuel supply requirement becomes a proposed regulatory requirement. Paragraph 121.646(a) applies to operations more than 90 minutes (with all engines operating at cruising power) and less than 180 minutes (at the approved one engine inoperative cruise speed) from an adequate airport, while the requirements in paragraph 121.646(b) apply for operations greater than 180 minutes (at the approved one engine inoperative cruise speed) from an adequate airport.

Further, the AC required consideration of fuel for icing at the cabin depressurization cruise altitude and consideration of errors in wind forecasting. Studies done by the Atmospheric Environment Service of Canada with the assistance of airplane manufacturers under the second Canadian Atlantic Storms Program (CASP II) confirm that the probability of a continuous or repetitive significant icing encounter is very small on a long flight segment. The airspeeds associated with cruise at cabin depressurization altitude are not conducive to ice build-up. Moreover, pilots can avoid icing with minor changes in altitude or by changing the cruise speed, either of which can have a large effect on ice accretion. Based on the CASP II study, considering the probability of encountering depressurization at the critical point and icing on the same flight, an argument was made that fuel for icing in addition to fuel for depressurization is not deemed necessary. However, as a conservative measure, paragraph 121.646(b)(C)(iv) requires fuel to compensate for the greater of the effect of airframe icing (including the fuel used by engine and wing anti-ice during this period) during 10 percent of the time for which icing is forecast, or a combination of fuel for engine anti-ice, and for some models of airplanes based on their characteristics and the manufacturer's recommended procedures fuel for wing anti-ice for the time during which icing is forecast.

Based on the weather forecasting techniques of the early 1980s, the AC required a five percent fuel pad to account for wind forecast errors. However, winds aloft forecasting has improved dramatically in the last twenty years as a result of the following:

- The sophistication of wind forecast models have experienced a quantum improvement. These models provide forecasts based on a wider range of inputs and more accurate extrapolation throughout the altitude profile.
- Wind forecasting responsibilities have been assigned to computers with vastly increased capacity, capability, and speed.
- The flow of input data has significantly increased; largely as a result of systems that automatically downlink weather information at much more frequent intervals. Additionally, weather is measured on a worldwide grid of collection points. This grid has nearly four times the collection points compared to the grid used previously.
- Information gleaned from satellite downlinks and satellite depictions of air mass movement are added to the data stream, not only to fine tune forecasting at frequently flown altitudes, but also to provide more accurate forecasts at lower altitudes (10,000 to 15,000 feet) where the decompression profiles are flown.

This information is collected, analyzed, and distributed worldwide by the World Area Forecast System (WAFS). This centralized distribution of weather information provides for a consistent level of accuracy that can eliminate the assignment of arbitrary penalties, provided that individual airlines subscribe to the service and make use of this level of information.

Therefore, given the documented improvements in forecasting accuracy when using WAFS, a more accurate means of determining the fuel used during a decompression profile involves adding a pad to the actual forecast winds in making the fuel calculation rather than adding an arbitrary fuel penalty. The addition of a five-percent wind error pad provides an accurate case-by-case adjustment as compared with a five-percent fuel penalty, while preserving the necessary level of safety. However, if a certificate holder elects not to use such accurate winds in the computation of decompression fuel, then the proposed rule will require the operator to continue applying the five percent fuel pad to account for wind forecast errors.

Section 121.646 requires accounting for any airplane performance degradation on the fuel requirement. In addition, if APU is a required power source, then its fuel consumption also must be accounted for.

Proposed New Paragraph 121.687(a)(6) Dispatch Release: Flag and Domestic Operations

We propose to add new paragraph 121.687(a)(6), which would add the ETOPS approval basis to the content of the dispatch release under which the flight is being dispatched.

Explanation

The proposal assures that the pilot in command of an ETOPS flight is notified as to the time basis, (for example, 120-minute or 180-minute ETOPS) including the Minimum Equipment List (MEL) limitations, under which the flight is dispatched.

Proposed New Paragraph 121.689(a)(8) Flight Release Form: Supplemental Operations

The FAA proposes to add a new paragraph 121.689(a)(8) to add the ETOPS time basis to the content of the flight release of each ETOPS flight.

Explanation

The proposal assures that the pilot in command of an ETOPS flight is aware of the limitations (for example, 120-minute or 180-minute ETOPS) including the minimum Equipment List (MEL) limitations, under which the flight is released.

Proposed New 14 CFR 121 Appendix O Requirements for ETOPS Approvals

Appendix O to Part 121 would establish the operational requirements and limitations for the various ETOPS diversion time thresholds and areas of ETOPS applicability. In very general terms, Appendix O would codify existing approvals and operational practices that have been developed since 1985 and it would also establish requirements for ETOPS flights that certificate holders may elect to operate in the future. These latter ETOPS flights would have diversion time bases exceeding 180 minutes and are not authorized at this time. The FAA points out again that 207-minute ETOPS flights are an extension of the 180-minute authority and not an independent diversion time authority.

A. ETOPS Authorizations: Airplanes With 2 engines

(a) 75 Minutes ETOPS

The proposed 75-minute ETOPS diversion authority is a codification of the criteria that was specified in AC 120–42A. This deviation authority has traditionally been used for operations in the Caribbean, Western Atlantic, and less frequently, in the North Atlantic areas of operation.

(b) 90-Minute ETOPS (Micronesia)

This ARAC recommendation for a new diversion authorization is to establish a 90-minute ETOPS authority for exclusive use on Micronesia routes. This geographical area has been served with ETOPS approved airplanes with operational authority to dispatch at 120 minutes. The only difference between the proposed 90-minute level in comparison to 120-minute ETOPS is to require the ETOPS pre-departure check on the outbound segment only. The nature of flights to serve this area involves destinations to islands at frequencies such that it becomes unreasonable for the operator to have an ETOPS certified mechanic stationed at the arrival location. An alternative means is for the operator to carry on board each flight a certified ETOPS mechanic that would conduct the ETOPS pre-departure check prior to the return to the return flight. This option is an inefficient use of a certified mechanic. The Micronesia route structure is such that it lies beyond a 75-minute authority (which would allow for the operation to be conducted without requiring the ETOPS pre-departure check for the return flight), but short of requiring the full 120-minute diversion. The Micronesia area in terms of weather and airport availability is similar to the area associated with ETOPS conducted in the Caribbean area.

The FAA proposes to allow for a 90-minute ETOPS diversion authority for use in Micronesia routes provided that the airplane is type design approved, and configured to the CMP standards for 120-minutes. The operations are to be conducted to 120-minute ETOPS standards and requirements and MEL requirements, with the exception that the ETOPS pre-departure check will not be required for the return leg of the round trip flight.

(c) 120 Minutes

The FAA proposed 120-minute ETOPS diversion authority is a codification of the criteria that was specified in AC 120–42A. The airplane and engine combination would have to be ETOPS type design approved for a minimum of 120-minutes and configured to the standards specified in the CMP document. All flight operations dispatched or released to 120-minute ETOPS standards would have to comply with MEL requirements specified for the operation.

(d) 138 Minutes

The FAA proposed 138-minute ETOPS diversion authority is a codification of the criteria that is specified in the 138-minute ETOPS policy letter. No changes to the present existing requirements are proposed. Operators may request 138-minute ETOPS operational approval on an airplane engine combination that has an ETOPS type design approval of 120-minutes provided that the airplane engine combination has been assessed by the FAA for the extended diversion length. In such cases the dispatch authority may only be exercised on a flight-by-flight exception basis. The operator will be required to amend and use a MEL that has been amended to include those items that are specified for operations beyond 120-minutes. Operators approved to conduct 138-minute ETOPS with an airplane and engine combination that has 180-minute ETOPS type design approval may do so without any restriction to frequency of use. The operator must dispatch or release such flights in accordance with the MEL provisions for ETOPS beyond 120 minutes.

(e) 180 Minutes

The FAA proposed 180-minute ETOPS diversion authority is a codification of the criteria that was specified in AC 120–42A. The airplane and engine combination would have to be ETOPS type design approved for a minimum of 180-minutes and configured to the standards specified in the CMP document for 180-minutes. All flight operations dispatched or released to 180-minute ETOPS standards would have to comply with MEL requirements specified for the operation.

(f) Greater Than 180 Minutes

The FAA accepts the ARAC recommendations to include the increased ETOPS diversion authorizations beyond 180-minutes. ETOPS beyond 180 minutes has been in use on a limited, flight by flight exception basis, since March 2000 with the issuance of the 207-minute ETOPS policy. The industry has demonstrated its capability to maintain the necessary engine and systems reliability for such operations using the B–777 airplane. Certain geographical areas of the world have few adequate airports along flight routing, and are separated by a distance that is farther than what could be flown within 180-minutes. Other geographical areas have severe weather patterns and weather systems that at times would not allow for the designation and use of area airports as ETOPS alternates. In these cases the air carrier would benefit with better dispatch reliability and added safety of the flight with the ability to flight plan with diversion times that exceed 180-minutes to avoid exposure to such conditions.

The authority for this increased diversion distance flight planning is dependent on the demonstrated capability of the operator's ETOPS program, and the use of an airplane and engine combination that is approved for such operations. The FAA therefore

proposes that eligibility of an air carrier to conduct ETOPS beyond 180 minutes will be dependant on the air carrier already having ETOPS approval to conduct 180-minute ETOPS with the requested airplane and engine combination. It will therefore not be possible for the air carrier to bypass the 180-minute ETOPS approval process before making application for ETOPS approvals beyond 180-minutes.

Air carriers that are authorized to conduct ETOPS beyond 180-minutes will be required to consider all available airports that are within 180-minutes of the routing being planned for use as ETOPS alternates. This is to minimize the dispatch diversion time to 180-minutes when possible, and thereby minimizes the risk of the extended exposure when possible. The proposed rule in Appendix O requires that:

''In conducting all such operations, operators shall make every attempt to minimize diversion time along the preferred track and plan ETOPS at maximum diversion distances of 180 minutes or less. If conditions prevent the use of adequate airports within 180 minutes as ETOPS alternates, the route may be flown beyond 180 minutes subject to the requirements provided for the specific area of operations.''

In March 2000 the FAA implemented the 207-minute ETOPS policy that required certain airplane system capabilities and that specific equipment be operable at time of dispatch or flight release for a 207-minute planned route. This included enhanced communication capability with the use of SATCOM, or with the use of SATCOM data link. It also required that the flight crew before entering the extended range entry point receive company communication to update the flight plan information based on a review of the airplane status and systems capability, as well as an update on all available alternates along the flight route. For airplane capabilities, single engine autoland is required to be operative at dispatch for a 207-minute ETOPS flight. The policy letter also specified additional system and equipment operability that cannot be deferred for such operations through the use of a minimum equipment list (MEL). This includes the fuel quantity indicating system (FQIS), the auxiliary power unit (APU) to its full electrical and pneumatic designed capability, and the autothrottle system.

The ETOPS ARAC recommended that the additional requirements that were introduced by the FAA for 207-minute ETOPS continue as requirements for all ETOPS diversion authorizations greater than 180-minutes. The FAA accepts the recommendation.

(1) North Pacific

ETOPS authority for the North Pacific area of operation is a codification of the FAA 207-minute ETOPS policy letter. This authority allows on a flight by flight exception basis flight planning to an ETOPS alternate up to 207-minutes, when an ETOPS alternate within 180-minutes is not available. As with the previous 207-minute ETOPS policy, this exception is limited to circumstances such as political or military concern, volcanic activity, airport weather below dispatch requirements, temporary airport conditions and other weather related events. The airplane and engine combination must as a minimum be ETOPS type design approved for 180-minutes and configured to the standards specified in the CMP document for 180-minutes. All flight operations dispatched or released to 207-minute ETOPS standards have to comply with an approved MEL required for 180-minutes that includes the additional items specified in this part for operations beyond 180-minutes. In all cases, the time required to fly the distance to the planned ETOPS alternate or alternates, at the approved one engine inoperative cruise speed, in still air and standard day temperature, may not exceed the time specified in the Airplane Flight Manual for the airplane's most time limited system time minus 15 minutes. This means that the most time limiting system on the airplane used for a 207-minute ETOPS flight cannot be less than 222-minutes.

(2) Polar Area (North Pole) and North of NOPAC

This authorization for use in the North Pole allows for a diversion authority of 240-minutes on a flight-by-flight exception basis. This dispatch authority may be used when the area experiences temporary extreme weather conditions that cause airport closures, extreme cold temperatures, or weather below dispatch minimums. Consideration for other weather related conditions and events such as volcanic activity that are particular to this area of the world may be given.

The operator will be required to establish criteria to be used when flight planning in order to determine if the use of a 240-minute authority is appropriate in order to designate an ETOPS alternate. These criteria and procedures developed must be accepted by the FAA and published in the certificate holder's manual for the use of dispatchers and pilots.

For such operations, the airframe and engine combination must be type design approved for a minimum of 240 minute ETOPS and configured to the standards as specified in the Configuration Maintenance and Procedures (CMP) Standard for such operations. For such operations, the requirements in paragraph C, Polar Area (North & South Pole) and ETOPS beyond 180 minutes North of the NOPAC area, of this appendix apply.

(3) 240 Minutes Area of Operations

There are several geographical areas that have few airports available for use as an ETOPS alternate, and those airports are situated at a distance beyond what could be flown in 180-minutes. These areas include the Pacific oceanic areas between the U.S. west coast and Australia, New Zealand and Polynesia; the south Atlantic oceanic areas; the Indian Oceanic areas; and the oceanic areas between Australia and South America. The FAA proposes that a diversion authority of up to 240-minutes be established for use in these geographical areas. Operators that apply for this authority must have as a prerequisite 180-minute ETOPS authority and experience with the requested airframe and engine combination.

When planning flight routes in these areas, the operator will be required to designate the nearest available ETOPS alternate along the planned flight route, and always within a maximum of 240-minutes. Whenever possible along the planned route, designated ETOPS alternates should be within 180-minutes. In all cases for ETOPS beyond 180 minutes, the time required to fly the distance to the planned ETOPS alternate(s), at the approved one engine inoperative cruise speed, correcting for wind and temperature, may not exceed the time specified in the Airplane Flight Manual for the airplanes most time limited system time (except for cargo fire suppression), minus 15 minutes. The flight routing must also be within the time required to fly the distance to the planned ETOPS alternate or alternates, at the all engines operating cruise speed, correcting for wind and temperature, that is specified in the Airplane Flight Manual for the airplane's cargo fire suppression system time minus, 15 minutes.

For such operations, the airframe/engine combination must be type design approved for a minimum of 240 minute ETOPS and configured to the standards as specified in the Configuration Maintenance and Procedures (CMP) Standard for such operations.

(4) Beyond 240 Minutes Area of Operations

The FAA proposes a new ETOPS diversion limit that is beyond 240-minutes. This authority would be available only to those operators that have considerable experience with ETOPS, including operations with routes requiring 240-minutes ETOPS. At a minimum, the operator would have to have 24 consecutive months of ETOPS experience with operations 180 minutes and greater, of which at least 12 consecutive months were at 240-minute ETOPS on the airframe and engine combination for which the authority is requested.

There are only a few routes that would require a diversion time greater than 240-minutes from an ETOPS alternate. The geographical areas with routes that would be best flown with such an authority are the Pacific oceanic areas between the U.S. west coast and Australia, New Zealand and Polynesia; the south Atlantic oceanic areas; the Indian Oceanic areas; the oceanic areas between Australia and South America, and South Pole area. The FAA proposes that for such routes, the authority to dispatch or release a flight that would be more than 240-minutes from an ETOPS alternate would be granted only for specific city pairs served. In planning the route, the operator would be required to always designate the nearest available ETOPS alternate(s). In all cases for ETOPS flight segments that are beyond 180 minutes, the time required to fly the distance to the planned ETOPS alternate(s), at the approved one engine inoperative cruise speed, correcting for wind and temperature, may not exceed the time specified in the Airplane Flight Manual for the airplanes most time limited system time (except for cargo fire suppression), minus 15 minutes. The flight routing must also be within the time required to fly the distance to the planned ETOPS alternate or alternates, at the all engines operating cruise speed, correcting for wind and temperature, that is specified in the Airplane Flight Manual for the airplane's cargo fire suppression system time minus, 15 minutes.

For such operations, the airframe and engine combination would have to be type design approved for the maximum authorized ETOPS diversion time. All requirements specified in the Configuration Maintenance and Procedures (CMP) Standard for beyond 240 minute ETOPS would be applicable to such operations.

B. ETOPS Authorizations: Airplanes With More Than 2 Engines

The flight planning for long-range flights traversing remote areas with few airports available for a non-scheduled landing should not be different because of the number of engines installed. Flights in all engine configurations have experienced conditions requiring landings short of the planned destination. The conditions included onboard technical failures, adverse atmospheric flight conditions, and increasingly, passengers that develop life threatening medical conditions that require prompt medical care. The preclude and protect philosophy that has been a foundation for two-engine airplane ETOPS has similar application and benefit to flight operations that are conducted with 3 and 4-engine airplanes.

The FAA proposes that ETOPS practices apply to flights conducted with 3 and 4-engine airplanes on routes where the flight will be more than 180-minutes from an adequate airport. Operations in any area up to a maximum diversion time up to 240-minutes (based on the one-engine inoperative speed flown in still air) may be conducted on a routine basis. For all such operations, the nearest available ETOPS alternate within 240 minutes diversion time must be specified. If an ETOPS alternate is not available within 240 minutes, the operator may conduct the flight by designating the nearest ETOPS alternate on the planned route that is within the airplanes most time limited system capability as specified by § 121.633 of this chapter.

On all such operations, MEL limitations for ETOPS apply and in addition, the Fuel Quantity Indicating System (FQIS) and the communication requirements specified in § 121.99 and § 121.122 as appropriate must be operational. The airframe/engine combination must be type design approved for the maximum authorized ETOPS diversion time.

C. Polar Area (North & South Pole) and ETOPS Beyond 180 Minutes North of the NOPAC Area

The ARAC ETOPS recommendation includes the adoption of the FAA Polar Policy that was issued March 2001. Because of extreme cold weather during the winter months and the limited availability of supporting services and facilities, it is proposed that the Polar, the area north of N 78°00″, be designated as an area of ETOPS applicability. Except for intrastate operations within the State of Alaska, ETOPS requirements would apply regardless of the number of engines or an airplane's proximity to an airport. Support of a necessary diversion and subsequent recovery in such areas would require the following items to be addressed by the operator:

(1) Designation and requirements for airports that may be used for enroute diversions
(2) Recovery plan for passengers at diversion alternates
(3) Fuel freeze strategy and monitoring requirements for Polar operations
(4) Communication capability for Polar operations
(5) MEL considerations for Polar operations
(6) Training issues for Polar operations
(7) Crew considerations during solar flare activity
(8) Special equipment for Polar operations such as cold weather anti-exposure suits.

In order to receive authorization to conduct polar operations, the operator would be required to conduct an FAA observed validation of its polar program. As part of the validation, the operator would be required to exercise its reaction and recovery plan that would be implemented in the event of a diversion to a designated polar area alternate airport.

Part 135

Global Issues for Part 135

Discussion of General Issues in Part 135

(1) Defining a safe operation for ETOPS

The intent of the proposed amendments to part 135 is to establish ETOPS safety standards for commuter and on-demand operators that are adapted for the unique nature of those operations. Regardless of whether a commercial flight is operated under part 121 or part 135, the same safety considerations of ETOPS apply. The FAA believes that these proposals would preclude and protect any diversions.

The applicability of ETOPS requirements would differ from part 121 to part 135. Part 135 casts a wider net than part 121. Part 135 operators range from one or two person companies operating a single Cessna 172 to larger companies that operate fleets of turbojets. As a practical matter, these amendments would not affect the vast majority of part 135 operators. Unlike a typical part 121 operator, a part 135 on-demand operators may fly on a given route only once or twice in a year. This proposal takes into account these differences.

Under this proposal, ETOPS requirement under part 135 would

apply to: (1) Flights that operate on routes containing a point greater than 180 minutes from an adequate airport based on a single-engine inoperative speed in still air and standard conditions; (2) and flights that operate in designated geographical areas. In contrast to part 121, there would be no distinction between airplanes with two engines and those with more than two engines.

Recent Changes to Part 135

In 1998, the FAA added part 119 to 14 CFR. This amendment modified the types of operations permitted in accordance with part 135. Among the changes was an allowance for infrequent scheduled operations with airplanes with 9 or fewer seats and a maximum payload capacity of 7,500 pounds. These airplanes often do not have the range capability to operate on routes to which ETOPS requirements would apply to this proposal. This proposal would not allow the use of many of these aircraft in ETOPS even if they are modified with additional fuel tanks that would give them additional range. The reason is that range capability is necessary but not sufficient for ETOPS. There are other airplane system capabilities and redundancies that are required for safe ETOPS flights. These issues are discussed in further detail in the following section.

ICAO Standards

This proposal would make part 135 regulations more consistent with paragraph 4.7.1 of Annex 6 of ICAO Standards and Recommended Practices (SARPs). That paragraph states: ''Unless the operation has been specifically approved by the State of the Operators, an aeroplane with two turbine power-units shall not, except as provided in 4.7.4, be operated on a route where the flight time at single engine cruise speed to an adequate en-route alternate aerodrome exceeds a threshold time established for such operations by that State.'' This SARP does not specify a time threshold for two-engine ETOPS but clearly assumes the existence of one. The SARP was written to give signatory States the flexibility to determine appropriate time thresholds.

Safety Study

In 2000, Robert Breiling of the National Business Aviation Association (NBAA) conducted a study of airplane accidents between 1964 and 1999. This study may be purchased directly from NBAA, 1200 18th Street, NW.; Washington, DC 20036–2506. This study revealed that there was not a single accident with a two-engine airplane in long-range operations. Historically the vast majority of airplanes operated in accordance with part 135 have not had the range capability for routes that would require ETOPS beyond 180 minutes, thus the FAA never found sufficient safety justification for proposing rules.

In 1996, manufacturers began delivering airplanes to part 135 operators that had vastly improved range capability. These new-generation two-engine airplanes have ranges up to 6,500 nautical miles and are capable of operating on routes that would require diversion times in excess of 180 minutes. Thus the FAA believes that regulations are necessary to assure the safe operation of such flights if an operator elects to conduct them.

Existing FAA Policy

In 1996, the European Joint Aviation Authorities (JAA) proposed a regulation that would have limited commercial operations of small airplanes to less than 120 minutes from an aerodrome, unless specifically approved by the State authority. In our response, we expressed our view that 180-minutes would be the U.S. threshold for these type of operations. The FAA disagreed with the JAA 120-minute threshold because it would have shut down a number of part 135 operators that have been conducting these operations safely for many years. By policy the FAA has not authorized operations beyond 180 minutes for part 135 operators.

(2) Specific Differences Between Part 121 ETOPS

As noted earlier the ETOPS requirements for part 135 would differ from those of part 121 due to the differing nature of those operations. For instance, the presence of adequate crash, fire and rescue equipment is an important consideration for part 121 operations, which may operate many times per year to a single location with a relatively large number of passengers. Although adequate RFF service is desirable for any long-range operations, it is not feasible to require the presence of crash, fire and rescue equipment at an airport before authorizing an on-demand operation that may operate only once a year with very few passengers. Therefore, no such requirement exists in part 135.

Another difference is that part 135 would not identify specific IFSD rates for authorization. IFSD rates have less predictive value in small fleets of airplanes with lower annual cycles that are prevalent among part 135 operators.

(3) Nomenclature

The issue of nomenclature was controversial among ARAC participants from the part 135 community. The consensus decision was the use of the term ETOPS in lieu of alternatives including Commercial On-Demand Operations (CODEOPS). The FAA accepts the ARAC recommendation and proposes to use the acronym ETOPS defined as Extended Operations for part 135 operations.

(4) Airplane and Engine ETOPS Type Design and Transition Period

Type-Design

No specific type design approval has ever been required by part 25 or part 33 before an airplane can be flown over long-ranges in accordance with part 135. The proposed ETOPS rule was drafted to allow currently-certified airplanes to operate in accordance with ETOPS procedures without requiring a new type design approval. However, when an operator first applies to the FAA for approval to use a certain airplane in ETOPS (beyond 180 minutes from an airport), the operator must demonstrate that the airplane meets certain system and equipment requirements specified the proposed Appendix H and the guidance contained in the ETOPS Advisory Circular.

The proposed changes to airplane and engine certification rules in this NPRM will apply to any new airplane certified under part 25, regardless of whether the airplane is to be operated in accordance with part 135 or part 121. As newly designed airplanes are granted type-design approvals incorporating the requirements for ETOPS contained in part 25 or part 33, the flight manual will specify each time-limited system, and the maximum time that system can safely operate.

Transition

The proposed rule allows a transition period of eight years from the date the revised part 25 and part 33 are published during which certificate holders may continue to add airplanes of current designs to their part 135 fleets. After that date, the proposed rule requires that airplanes added to a certificate holder's fleet be type-certificated in accordance with the new ETOPS design requirements. This method of transition recognizes the excellent safety record of current airplane designs, and avoids penalizing certificate holders who may have made significant capital investments in airplanes. The length of this transition period was set at eight years because it is typical of the time required for a new,

long-range turbine-powered airplane to go from initial design to the time it is commonly available to the majority of certificate holders. However, this transition period applies only to type design. The transition period will allow manufacturers to produce newly compliant aircraft and for those aircraft to become readily available in the aircraft marketplace. The operational practices required in part 135 Subpart H would become effective immediately. These standards for operation, maintenance and dispatching of ETOPS would contribute to the continued safe operation of part 135 long-range aircraft operations.

(5) Approved One-Engine Inoperative Speed

When scheduled air carriers apply for route authority over a route requiring ETOPS, FAA approves a one-engine inoperative speed for a specific route flown by that operator in a specific airplane model. This speed is then used to determine fuel reserves and maximum diversion distances for all subsequent flights. Unlike scheduled air carriers, an on-demand operator may only operate once over any given route-of-flight, and they must be able to do so with relatively short notice. Flexibility is required for ETOPS conducted in accordance with part 135. It is therefore not feasible to require pre-approval of a single one-engine inoperative speed for certificate holders operating ETOPS on each route in accordance with part 135. Instead, when a certificate holder applies for ETOPS approval, the operator will suggest a range of speeds within the certified limits for a specific model of airplane. The FAA will approve this range of speeds for that operator. When planning for a specific flight, the certificate holder will select a single speed within this range and ensure that this selected speed is used to determine both fuel reserves and maximum diversion distances.

(6) Polar Operations

The increasing use of Polar flights, while creating economic benefits, has brought new challenges to the extended operations. Due to these pressures and to the increasing commonality of all long-range operations, the data began to show that ETOPS requirements and processes are generally applicable to all long-range operations including those by three and four engine airplanes and would improve the safety and viability of all long range operations. The FAA polar policy issued March 2001 provides the requirements for approval to conduct these operations. Given the nature of part 135 on-demand operations, it is conceivable that flights in the designated polar area may occur. Polar operations require the designation of airports that may be used in the event a diversion is necessary, and it requires that the operator have a passenger recovery plan. The recovery plan should address the care and safety of passengers and crew at the diversion airport, and include the plan of operation to extract the passengers and crew from that airport. The certificate holder would have to maintain the accuracy and completeness of its recovery plan. As the rule would apply to those part 135 on-demand operations that can be conducted less than 180 minutes from an airport as well as those operations conducted as ETOPS, the FAA proposes section 135.98 to be a separate requirement from ETOPS requirements. The proposed section 135.98 for polar operations excludes intrastate operations within the State of Alaska.

FAA General Changes to the ARAC Proposal for Part 135

The following table cross-references the ARAC proposed rules with what the FAA has proposed in this NPRM. The ARAC proposal included several requirements that were in their Advisory Circular, but were not included in their proposed rules. The FAA has therefore included these ARAC Advisory Circular requirements into this NPRM in order to codify the ARAC proposal.

ARAC proposal	NPRM
135 Appendix H ETOPS	135 Appendix H ETOPS.
Paragraph H Maintenance Program Requirements	Paragraph Maintenance. Program Requirements.
None	H(a) Configuration, Maintenance & Procedures (CMP).
H(a) CAMP	H(b) CAMP.
None	H(b)(1) ETOPS Pre-departure service check.
H(2)(a) procedures to preclude dual maintenance	H(b)(2) procedures to preclude dual maintenance.
H(2)(b) verification procedures	H(b)(3) verification program.
None	H(b)(4) task identification.
None	H(b)(5) centralized maintenance control procedures.
None	H(b)(6) ETOPS program document.
None	H(b)(7) ETOPS parts control.
None	H(b)(8) Enhanced CAS.
H(3) reporting requirements	H(b)(8)(a) reporting requirements.
H(4) periodic report of engine hours & cycles	None.
H(5) corrective action	H(b)(8)(b) corrective action.
None	H(c) propulsion system monitoring.
None	H(d) engine condition monitoring.
None	H(e) oil consumption monitoring.
H(2)(c) APU in-flight start program	H(f) APU in-flight start program.
None	H(g) maintenance training.
None	H(h) procedural changes.

Section-by-Section Discussion of the Proposed Changes to Part 135

Proposed New Section 135.98 Polar Operations

The FAA proposes a new rule for the conduct of flights in the North Pole area as defined as the region north of N 78°00′.

Explanation

Operations in this defined area, with the exception of intrastate operations within the State of Alaska, would require specific approval. Operators applying for polar authority would be required to address specific areas identified in proposed paragraphs 135.98 (1) through (8). All certificate holders conducting polar operations would have to develop a plan for recovering passengers at designated diversion airports. The recovery plan

should address the care and safety of passengers and crew at the diversion airport.

Proposed Change to Section 135.345 Pilots: Initial, Transition, and Upgrade Ground Training

The FAA proposes to amend section 135.345 by adding subject material to be included in the pilot training requirement.

Explanation

The additional training includes ETOPS for those operators that will have ETOPS authority. It would also add the requirement for training on the operator's passenger recovery plan that would apply for those operators conducting ETOPS, and those operators conducting non-ETOPS polar flights. The recovery plan should address the care and safety of passengers and crew at the diversion airport, and include the plan of operation to extract the passengers and crew from that airport. It is therefore important that crew members are adequately trained so that they understand their role in the certificate holder's passenger recovery plan.

Proposed New Section 135.364 Multi-Engine Airplane Limitations:

Maximum Distance From an Airport

The FAA proposes to add a new rule, section 135.364, which establishes the maximum distance that a multi-engine airplane may be operated from an airport that meets the requirements of part 135.

Explanation

The rule would allow flight operations beyond 180-minutes when approved by the FAA, and conducted to the ETOPS requirements specified in part 135, Appendix H.

Proposed Change to Section 135.411 Applicability

The proposal would add paragraph (d) to require ETOPS operators to maintain the aircraft under a maintenance program in accordance with paragraph (a)(2) and the additional requirements of Appendix H of this part.

Explanation

The ARAC proposed that part 135 operators could maintain their airplanes under paragraph 135.411(a)(1) for 9 or less passenger seats with an approved aircraft inspection program under section 135.419 or under paragraph 135.411(a)(2) for ten or more passenger seats. This proposal differs from ARAC's proposal in that it would require all part 135 operators to maintain their aircraft in accordance with paragraph 135.411(a)(2). The FAA does not feel that an inspection program approved under section 135.419 will support the ETOPS requirement. A CAMP approved under paragraph 135.411(a)(2) sets the same foundation to support ETOPS operations as part 121.

The ARAC recommended periodic reporting of airplane and engine operating hours and cycles. The FAA did not include this recommendation because the information is currently available and reported to the FAA by the engine manufacturers.

Proposed New Part 135 Appendix H

Appendix H to part 135 would establish the certification, airplane, operation and maintenance requirements for ETOPS operations.

A. Definitions

The FAA proposes to use the following definitions applicable to ETOPS. Many of the terms used in the proposed regulatory and guidance material for ETOPS under this part are unique to these operations. Requirements and concepts for ETOPS require precise definition to assure common understanding and compliance.

1. ETOPS: Extended Operations.
2. ETOPS Dual Maintenance.

B. Certificate Holder Experience Prior To Conducting ETOPS

Safety is enhanced when, prior to conducting ETOPS, a certificate holder gains operational experience in the type of airplane capable of ETOPS, and with the operational environment typically encountered on longer range flights (up to 180 minutes) in areas where airports available for an enroute diversion are limited. Typically, this involves prior operational experience on overwater flights to international areas of operation in accordance with part 135.

Operators requesting authority to operate ETOPS would have to show operating experience on international routes with a transport category turbine powered airplane. For this particular case, experience with international operations does not include operations from the 48 contiguous States to Canada and Mexico. This experience can only be obtained on extended flight operations that involve oceanic crossings.

A minimum 12 months operating experience is required. The proposal allows for up to 6 months credit toward the 12-month requirement for those operators that were certificated under part 135 or part 121 prior to the effective date of this rule. Additionally, for operators with previous ETOPS experience with other airplane types may have that experience credited in whole, or in part to the 12 month experience requirement.

C. Airplane Requirements

The proposed regulation would require that airplanes operated in ETOPS be certificated to the new section 25.1535 standards. In order to allow for a smooth industry transition to this requirement for a period of 8 years following the effective date of the new part 25 regulation with airplanes certificated to the present part 25 standards could be used in ETOPS if they have specific electrical and fuel system capabilities. Such an airplane would have to be found acceptable to the FAA after consultation with the type certificate holder. The determination that an airplane is acceptable for ETOPS is a simply a verification that the airplane electrical and fuel systems are capable of supporting the intended operation. This provision would apply to airplanes added to the operator operations specifications on or before the date that is 8 years after the new part 25 is in effect. Airplanes added to the operating certificate after the 8-year period would have to be certificated to the new part 25 standards.

D. Certificate Holder Requirements

The ARAC recommended that part 135 flights conducted under ETOPS authority be limited to a maximum diversion time of 240 minutes from an enroute alternate airport, at a speed selected by the certificate holder from a range of speeds approved by the FAA that is within the certificated operating limits of the airplane, with one engine inoperative (under standard conditions in still air). This was deemed to be sufficient for the routes that could be expected for an on-demand type operation. Having an upper limit would enable an operator to maintain an operational readiness and the required reliability especially when these types of operations may occur infrequently. The FAA accepts the recommendation and reflects it in the proposed rule.

The proposed rule would require the certificate holder to have the means and the procedure to allow flight crews to have in-flight access to current weather and operational information on all enroute alternate, destination and destination alternate airports proposed for each ETOPS flight. By validated ETOPS practices, flights can be launched on the basis of weather forecasts that are revised and updated while the flight is enroute. It is essential

that the flight crew be informed and aware of changing weather as well as airport status.

E. Operational Requirements

The proposed rule would require that the flight crew only plan and conduct ETOPS on instrument flight rules. The FAA believes that ETOPS cannot be conducted safely under visual flight rules. The flight crew may not proceed beyond the ETOPS entry point unless the weather and operating conditions at the required enroute alternate airports are reviewed and expected to be at or above the operating minimums specified in the operations specifications during the period in which that airport may be expected to be used based on expected estimated times of arrival at that airport. The planned route of flight may be amended while en route to allow use of additional enroute alternate airports provided weather is forecast to be at or above operating minima and the airport is within the maximum ETOPS diversion time.

In ETOPS operations wind becomes an increasingly significant factor with increasing diversion times and should be considered in ETOPS operations beyond 180 minutes to assure that Airplane Flight Manual (AFM) system time limits are not exceeded. For example, while diverting with an engine inoperative, it is essential to ensure that there is sufficient amount of oil in the tank for continuous operation of the remaining engines at Maximum Continuous Thrust for the actual duration of divert. As a result, for ETOPS operations with approved diversion times greater than 180 minutes the one engine inoperative cruise speed (approved) maximum diversion time, taking forecast wind and temperature into account, to each ETOPS alternate may not exceed the time specified in the airplane flight manual for the airplane's most time-limited system minus 15 minutes (for approach and landing). However, there are some other time limited systems like cargo fire suppression, where the use of cargo fire suppression may not have as much relevance to the one engine inoperative diversion time. Data was presented that showed the likelihood of an engine failure at the critical point followed by cargo fire is extremely remote. Hence for ETOPS beyond 180 minutes, cargo fire suppression requirement would be based on covering the diversion distance authorized (maximum diversion time authorized at the approved one engine inoperative speed) at the all engine operating speed. Therefore this proposed rule requires that for ETOPS beyond 180 minutes with airplanes equipped with a Class C cargo fire suppression system, the cargo fire suppression time required be based on the airplane operating at all engine operating speed with actual wind.

The certificate holder may continue ETOPS with airplanes that lack the airplane flight manual information regarding time-limited systems (*e.g.* cargo fire suppression) for a period not to exceed 8 years from the effective date of this rule. See the discussion in the airplane requirements above.

F. Communications Requirements

The proposal would establish the minimum standard for communication for ETOPS. Two independent transmitters and two independent receivers, appropriate to the planned route, would be required for ETOPS flights. At least one of each would have to be capable of voice communication. If operating in areas where voice communication is not possible or of poor quality, alternate systems (data link, SATCOM, etc.) may be used.

G. Fuel Planning Requirements

An airplane should not be released for an ETOPS flight unless it carries sufficient fuel and oil to meet the requirements of section 135.223, and any additional fuel that may be determined in accordance with the critical fuel reserves of this section. In establishing the critical fuel reserves, the operator would determine the fuel necessary to fly to the most critical point and execute a diversion to an ETOPS alternate under the conditions outlined in paragraph 1(b) of this section for the critical fuel scenario. The computed critical fuel reserve would be compared to the normal section 135.223 fuel requirements for the flight. If it is determined by this comparison that the fuel to complete the critical fuel scenario exceeds the fuel that would be on board at the most critical point, as determined by section 135.223 requirements, additional fuel should be included to the extent necessary to safely complete the critical fuel scenario.

To determine the critical fuel reserves necessary, the operator would plan on that which is operationally the most critical considering both time and the airplane configuration, such as one engine inoperative or all engines running. For those airplanes that are not certificated to operate above Flight Level (FL) 450, the flight would also be planned for failure of the pressurization system to an altitude of 10,000 feet or at an altitude in compliance with the oxygen supply requirements of section 135.157. (ICAO Annex 6, Part I, section 4.3.6.4(d) for fuel planning requires consideration of additional fuel in the event of loss of pressurization).

The critical fuel scenario would require an immediate descent to the determined altitude and continued cruise at the planned one-engine inoperative speed to the enroute alternate and upon reaching the alternate airport, a descent to 1,500 feet, hold for 15 minutes, and then conduct an instrument approach and land.

A pad for wind speed error would be required. Based on the weather forecasting techniques of the early 1980s, ETOPS critical fuel planning required a five percent fuel pad to account for wind forecast errors. However, winds aloft forecasting has improved dramatically in the last twenty years as a result of sophisticated wind modeling with super computers, and weather information that is automatically down linked at much more frequent intervals. There are many more collection points, as well as satellite depictions of air mass movement. This information is collected, analyzed, and distributed worldwide by the World Area Forecast System (WAFS). This centralized distribution of weather information provides for a consistent level of accuracy that can eliminate the assignment of arbitrary penalties, provided that individual airlines subscribe to the service and make use of this level of information. Therefore, given the documented improvements in forecasting accuracy when using WAFS, a more accurate means of determining the fuel used during a decompression profile involves adding a pad to the actual forecast winds in making the fuel calculation rather than adding an arbitrary fuel penalty. The addition of a five-percent wind error pad provides an accurate case-by-case adjustment as compared with a five-percent fuel penalty, while preserving the necessary level of safety. However, if a certificate holder elects not to use such accurate winds in the computation of decompression fuel, then the proposed rule will require the operator to continue applying the five percent fuel pad to account for wind forecast errors.

Consideration of fuel for icing at the cabin depressurization cruise altitude is also required. Studies done by the Atmospheric Environment Service of Canada with the assistance of airplane manufacturers under the second Canadian Atlantic Storms Program (CASP II) confirm that the probability of a continuous or repetitive significant icing encounter is very small on a long

flight segment. The airspeeds associated with cruise at cabin depressurization altitude are not conducive to ice build-up. Moreover, pilots can avoid icing with minor changes in altitude or by changing the cruise speed, either of which can have a large effect on ice accretion. Based on the CASP II study, considering the probability of encountering depressurization at the critical point and icing on the same flight, an argument was made that fuel for icing in addition to fuel for depressurization is not necessary. However, as a conservative measure, this section requires fuel to compensate for the greater of the effect of airframe icing (including the fuel used by engine and wing anti-ice during this period) during 10 percent of the time for which icing is forecast, or a combination of fuel for engine anti-ice, and for some models of airplanes based on their characteristics and the manufacturer's recommended procedures fuel for wing anti-ice for the time during which icing is forecast.

The proposal also requires that the fuel supply be increased by 5 percent to account for deterioration in cruise fuel burn performance unless the certificate holder has a program established to monitor airplane in-service deterioration of cruise fuel burn performance and includes in fuel supply calculations fuel sufficient to compensate for any such deterioration.

Finally, if the APU is a power source required by this appendix, then its fuel consumption must be accounted for.

H. Maintenance Program Requirements

(a) Configuration, Maintenance, and Procedures (CMP)

This type design document establishes the baseline configuration standard for each specific airplane and engine combination used in ETOPS. The importance of the CMP is discussed more fully above in the discussion of part 25 amendments of this proposal.

(b) Continuous airworthiness maintenance program (CAMP)

A CAMP is a comprehensive oversight program to ensure the continuing airworthiness of an airplane. A CAMP includes but is not limited to maintenance tasks, inspection tasks, auditing requirements, and data analysis. CAMP is required by section 135.411(a)(2). The proposed regulation would expand the scope of CAMP for ETOPS operators to encompass issues unique to ETOPS. The following are considered basic additional elements of a CAMP for an ETOPS operator.

(1) ETOPS pre-departure service check

The pre-departure service check is designed to ensure that ETOPS significant systems will perform their intended function throughout the flight. An ETOPS pre-departure service check would have to verify the status of ETOPS significant systems. Some certificate holders conducting ETOPS flights have elected to add other items to their check as a result of operational experience and knowledge gained through reliability data. Regardless of any additional items an operator may add to a check, the focal point of this check must be inspection, servicing, and maintenance of ETOPS significant systems.

(2) Dual Maintenance

There have been instances of a single mechanic repeating a maintenance error on multiple systems. An example of dual maintenance is failing to install o-rings on engine oil or fuel components on multiple engines. Establishing procedures to avoid dual maintenance can minimize the probability of such errors. The use of two or more mechanics reduces the risk of this type of error. Routine tasks on multiple similar elements, such as oil and fuel filter changes, should never be assigned on the same maintenance visit.

However, the FAA is aware that under some limited circumstances, dual maintenance may be unavoidable. For instance, a pilot's report of a discrepancy on an ETOPS significant system may require maintenance on one engine at the same time as a scheduled maintenance event for the other engine. In such cases, the certificate holder must establish and follow procedures to mitigate the risk of a common cause human error jeopardizing the ETOPS flight.

(3) Verification Program

The verification program ensures the effectiveness of ETOPS maintenance actions. Verification programs are designed to identify any potential problems and may consist of ground tests, flight tests, use of built in test equipment (BITE), and other tests as appropriate. Verification action must be accomplished following corrective action to an ETOPS significant system, primary system failure, IFSD or in response to significant adverse trends. The certificate holder must establish procedures to clearly indicate who is going to initiate the action, what verification action is necessary. A verification flight may be performed in combination with an ETOPS revenue flight, provided the verification phase is documented as satisfactorily completed upon reaching the ETOPS entry point.

(4) Task Identification

ETOPS maintenance programs include numerous tasks. Under this proposal, the certificate holder would have to identify specific tasks that must be accomplished by ETOPS qualified personnel. These ETOPS-specific tasks are performed during all phases of maintenance. On the other hand, some tasks in an ETOPS maintenance program are identical to tasks on a non-ETOPS airplane. The FAA realizes that tasks, such as checking seat belts prior to a flight, do not involve ETOPS significant systems and may be performed by non-ETOPS qualified personnel. ETOPS specific tasks would either be identified on the certificate holder's routine work forms and related instructions or parceled together and identified as an ''ETOPS package.''

(5) Centralized Maintenance Control Procedures

The certificate holder would have to develop and clearly define in their program ETOPS related procedures, duties, and responsibilities, such as involvement of centralized maintenance control. The function of centralized maintenance control is to be a focal point for operational aspects of ETOPS maintenance and to ensure that ETOPS aircraft are airworthy. Procedures and centralized control processes would be established which would preclude an airplane being dispatched for ETOPS flights after a propulsion system shut-down, significant primary airframe system failure, or significant adverse trends in system performance without appropriate corrective action having been taken. Confirmation of corrective maintenance would require appropriate verification action prior to dispatch on an ETOPS flight. Depending on the size and scope of the ETOPS operation, the maintenance control entity could be an entire department or one ETOPS-qualified individual for a small operation. ''Centralized maintenance control'' is also referred to as ''technical services center'', ''maintenance operations control (MOC)'', and ''maintenance coordination center'' among other terms within industry.

(6) ETOPS Program Document

The certificate holder would have to develop a document that identifies all ETOPS requirements, including supportive programs, procedures, duties, and responsibilities for use. The ETOPS program document would be for use by personnel involved in ETOPS and would be readily accessible to those

personnel. This document need not be inclusive but should at least reference the maintenance program and other requirements, and clearly indicate where they are located in the certificate holder's document system. The ETOPS program document would have to be submitted to the CHDO for approval at least 60 days before beginning ETOPS flights and be subject to revision control.

(7) ETOPS Parts Control

Under this proposal, the certificate holder would have to develop a parts control program that ensures the proper parts and configurations are maintained for ETOPS airplanes. The program should include procedures to verify that the parts installed on ETOPS airplanes during parts borrowing or pooling arrangements, as well as those parts used after repair or overhaul, maintains the necessary ETOPS configuration. In many cases, certificate holders utilize the Illustrated Parts Catalog (IPC) as the ETOPS parts controlling document. However, other methods may be used provided that the configuration standard of the airplane and engine is maintained.

(8) Enhanced Continuing Analysis and Surveillance (CAS)

The certificate holder would have to enhance their existing CAS in order to achieve ETOPS reliability goals. This program should be designed to identify and prevent ETOPS related problems. The program would be event-oriented and incorporate reporting procedures for critical events detrimental to ETOPS flights. Reliability data would have to be readily available for use by the certificate holder and the FAA to ensure that an acceptable level of reliability is achieved and maintained.

In addition to the reporting requirements in section 135.415, the following items would have to be reported within 72 hours to the CHDO.

(a) In-flight shutdowns.

(b) Diversions or turnback.

(c) Uncommanded power changes or surges.

(d) Inability to control the engine or obtain desired power.

(e) Problems with systems critical to ETOPS.

(f) Any other event detrimental to ETOPS.

(2) Certificate holders would also be required to furnish the following information:

(a) Airplane identification (type and N-number)

(b) Engine identification (make and serial number)

(c) Total time, cycles and time since last shop visit.

(d) For systems, time since overhaul or last inspection of the discrepant unit.

(e) Phase of flight.

(f) Corrective action

This proposed regulation would require certificate holders to conduct an investigation into the cause of the occurrence of any event listed above in addition to any event described in section 135.415. The certificate holder would have to submit findings and description of corrective action taken to the CHDO. The FAA expects certificate holders to investigate events above in conjunction with manufacturers. The report must be submitted in the manner prescribed by section 135.415(e).

(c) Propulsion System Monitoring

Propulsion system monitoring is vital to ensure safe ETOPS flights. A propulsion system-monitoring program is intended to detect adverse trends, to identify potential problems, and to establish criteria for when corrective action may be necessary.

Propulsion system problems and IFSD may be caused by type design deficiencies, ineffective maintenance, or operational procedures. It is very important to identify the root cause of events so that corrective action may be determined.

The diverse causes of propulsion system problems require different solutions. For example, type design problems may affect an entire fleet of aircraft. If an individual certificate holder experiences a problem caused by a type design issue, it may not be appropriate for the FAA to withdraw ETOPS authority. The FAA will normally address by an Airworthiness Directive fundamental design problems that require an effective hardware (or software) final fix. Inspections may be satisfactory as an interim solution but long-term design solutions are required for terminating action. However, maintenance or operational problems may be wholly, or partially, the responsibility of the certificate holder. In these cases, the cause would be specific to that certificate holder and may require changes to their operational, dispatch or maintenance procedures.

(d) Engine Condition Monitoring

The certificate holder would have to monitor the condition of engines on ETOPS airplanes. The monitoring program would describe the engine performance parameters to be tracked, method of data collection, and corrective action processes. It would detect deterioration in engine performance by tracking parameters such as rotor speeds, exhaust gas temperatures, and fuel flow and allow for corrective action before safe operation is affected. The program should reflect the manufacturer's instructions and industry practices. Engine limit margins must be maintained so that prolonged engine inoperative diversions may be conducted without exceeding approved engine limits at all approved power levels and expected environmental conditions. Engine margins are maintained through this program to account for the effects of additional engine loading demands such as electrical and pneumatic systems that may be required during a diversion. If oil analysis such as Spectrographic Oil Analysis Program (SOAP) is meaningful, it should be included.

(e) Oil Consumption Monitoring

The certificate holder would have to establish an engine oil consumption-monitoring program to ensure that there is enough oil to complete any ETOPS flight. The certificate holder's consumption limit would not be allowed to exceed the manufacturer's recommendations, and would have to be sensitive to oil consumption trends. The program would have to track the amount of oil added at the departing ETOPS station with reference to the running average consumption. The monitoring must be continuous up to and including the oil added at the ETOPS departure station. For example, after servicing, the oil consumption may be calculated by maintenance personnel as part of the pre-departure check or may be automatically calculated by a computer program. The amount of oil added could also be reported to centralized maintenance control for calculation prior to the ETOPS flight. If an Auxiliary Power Unit (APU) is required for ETOPS, then its oil consumption must be included in the program.

(f) APU In-Flight Start Program

If APU in-flight start capability is required for ETOPS, the certificate holder would be required to establish an in flight start and run monitoring program. The primary function of an APU is to provide backup electrical power in the event of a main system failure such as engine in-flight shut down or generator loss. This program would have to ensure that the APU in-flight start capability will continue at a level of performance and reliability established by the manufacturer or the FAA. The program would have to be acceptable to the Administrator and include periodic sampling of each ETOPS airplane's APU in-flight starting

capabilities. Certificate holders with existing approved programs may continue under that authority under this proposal. Sampling intervals may be adjusted according to system performance and fleet maturity. The Advisory Circular accompanying this proposal contains guidance for APU reliability and performance assessment.

(g) Maintenance Training

The certificate holder would have to develop additional ETOPS specific training that focuses on the special nature of ETOPS and is required for all personnel involved in ETOPS. This training would be in addition to the certificate holder's accepted maintenance training program to qualify individuals for specific airplanes and engines. This program may be incorporated into the accepted maintenance training curricula. The certificate holder would have to review the entire maintenance-training program with the CHDO to ensure that it adequately supports ETOPS training requirements. The goal of this program is to ensure that all personnel involved in ETOPS are provided the necessary training so that the ETOPS maintenance requirements are properly accomplished.

The program must establish a system to qualify ETOPS maintenance personnel. ETOPS qualified maintenance personnel are those who have successfully completed the certificate holder's ETOPS training program and who have satisfactorily performed extended range tasks under the direct supervision of an FAA certificated maintenance person who has had previous experience with maintaining the particular make and model aircraft being utilized under the certificate holder's maintenance program. For new aircraft introduction, the previous experience for training can be obtained from the manufacturers training program.

(h) Procedural Changes

Following approval of the maintenance and training procedures established to qualify for ETOPS; substantial changes to those procedures must be submitted to the CHDO and approved before they may be adopted. The determination of what constitutes substantial changes should be negotiated between the certificate holder and the CHDO. This is to allow some flexibility depending on the certificate holder's ETOPS experience and performance history. The CHDO may require submission of all changes for a new ETOPS operator or for an operator experiencing difficulties. However, as experience is gained the CHDO may reevaluate what substantial changes it needs to approve.

(i) Reporting

The FAA proposes to require certificate holders to report the operating hours and cycles for each airplane and engine authorized for use in ETOPS on a quarterly basis to the CHDO and the respective manufacturers. These reports would allow the FAA and manufacturers to ensure safe operations and to anticipate potential problems.

Continuing Surveillance

As with all other operations, the CHDO may also monitor all aspects of the ETOPS operations it has authorized, to ensure that the levels of reliability achieved in ETOPS operations remain at acceptable levels, and that the operation continues to be conducted safely. In the event that an acceptable level of reliability is not maintained, if significant adverse trends exists, or if critical deficiencies are detected in the type design or in the conduct of ETOPS operations, the CHDO may initiate a special evaluation, impose operational restrictions, and ensure the operator adopts corrective actions in order to resolve the problems in a timely manner. The CHDO should alert the appropriate FAA Aircraft Certification Office and Aircraft Evaluation Group when problems associated with airplane design or operations are identified.

International Compatibility

In keeping with U.S. obligations under the Convention on International Civil Aviation, it is FAA policy to comply with International Civil Aviation Organization (ICAO) Standards and Recommended Practices to the maximum extent practicable. The FAA has determined that there are no ICAO Standards and Recommended Practices (SARPS) that correspond to these proposed regulations. ICAO SARPS are currently being developed for ETOPS and we expect that this proposed rule and rules currently being developed in Europe would affect the ICAO SARPS. We expect that there will be some differences between the rule developed in the United States and the rules developed in Europe.

Economic Summary

Proposed changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 directs each Federal agency must propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs. Second, the Regulatory Flexibility Act of 1980 requires agencies to analyze the economic impact of regulatory changes on small entities. Third, the Trade Agreements Act (19 U.S.C. sections 2531–2533) prohibits agencies from setting standards that create unnecessary obstacles to the foreign commerce of the United States. In developing U.S. standards, this Trade Act requires agencies to consider international standards and, where appropriate, that they be the basis for U.S. standards. Fourth, the Unfunded Mandates Reform Act of 1995 (Public Law 104–4) requires agencies to prepare a written assessment of the costs, benefits, and other effects of proposed or final rules that include a Federal mandate likely to result in the expenditure by State, local, or tribal governments, in the aggregate, or by the private sector, of $100 million or more annually (adjusted for inflation.).

In conducting these analyses, FAA has determined this proposed rule: (1) Would have benefits that justify its costs, would be a ''significant regulatory action'' as defined in section 3(f) of Executive Order 12866, and would be ''significant'' as defined in DOT's Regulatory Policies and Procedures; (2) would not have a significant economic impact on a substantial number of small entities; (3) would not constitute a barrier to international trade; and (4) would not impose an unfunded mandate on state, local, or tribal governments, or on the private sector. The FAA has placed these analyses in the docket and summarized them as follows.

Cost Savings

The ability to fly the most direct route between two points results in time and fuel savings and thus reduces operating costs. The mileage savings for a two-engine ETOPS flight can be very significant. For example, a two-engine operator approved for 180 minutes flying the Great Circle Route, the shortest distance between two points on the earth, between Milan, Italy and Barbados would save over 1,300 nautical miles compared to a routing staying within 60 minutes of an adequate airport.

Part 121 operators of two-engine airplanes will elect to incur the costs associated with the higher ETOPS requirements based on their judgment of whether cost savings would exceed the cost of compliance. A new 2-engine ETOPS operator operating a single daily roundtrip is estimated to save 38 minutes per round trip. This timesaving is based on the reported timesaving of a current twin-engine Part 121 ETOPS

operator operating a route beyond 180-minutes. The operator reported that operating beyond 180-minutes saved 27 minutes on a westbound trans-Pacific flight and 11 minutes on the return leg. The annual hours saved would total approximately 231 hours based on a single daily roundtrip. The total annual savings based on hourly operating costs of $4,500 would be $1,040,000; the ten-year savings would be $10.4 million or $7.3 million, discounted. The costs of the proposed rule to this operator are estimated in the Cost section at $106,500 or $75,900, discounted. This operator would have net cost savings of $10.3 million or $7.2 million, discounted over a 10-year period.

Part 121 operators of three- or four-engine airplanes would be required to make a similar judgment if they elect to fly beyond 180-minutes ETOPS. However, the net cost savings would take longer to achieve than if the rule had not been proposed since there are proposed costs that are not currently required for three- or four-engine airplanes to fly beyond 180-minutes. A part 121 operator of a three- or four-engine fleet serving a single route beyond 180-minutes assuming the same time savings of 38 minutes per round trip and a single daily roundtrip would have total annual savings of $1,965,000 based on an hourly operating costs of $8,500. The ten-year savings would be $19.7 million or $13.8 million, discounted. The costs of the proposed rule to this operator are estimated in the Cost section at $3.7 million or $2.8 million, discounted. This operator would have net cost savings of $16 million or $11 million, discounted over a 10-year period.

Part 135 operators currently are not permitted to operate beyond 180-minutes from an airport meeting minimum requirements but the proposed rule would allow these operators to do so. Those that elect to incur the costs associated with the proposed rule would experience cost savings attributable to the proposed rule. The timesaving varies by route, airplane speed, and prevailing winds. A part 135 operator with less fuel capacity would be able to avoid a fuel stop in each direction, which would result in significant timesaving. The FAA estimates that a part 135 operator would save 2 hours of flying time per round trip by operating beyond 180-minutes. A part 135 operator with a fleet of four airplanes, with each airplane operating 12 roundtrips beyond 180-minutes ETOPS per year would save 96 hours annually or 960 hours over a 10-year period. The cost savings associated with the timesaving would total $9.6 million or $6.7 million, discounted. The costs of the proposed rule to this operator are estimated in the Cost section at $1.1 million or $777,000, discounted. This operator would experience net cost savings of $8.5 million or $6.0 million, discounted over a 10-year period based on an airplane operating cost of $10,000 per hour.

The net cost savings to individual operators are summarized in Table 1.

TABLE 1.—NET TEN-YEAR COST SAVINGS TO INDIVIDUAL NEW ETOPS OPERATORS

	New 2-engine operator	3 or 4-engine operator	Part 135 operator
Total Cost savings	$10,395,000	$19,650,000	$9,600,000
Total Cost	106,500	3,676,100	1,030,400
Net Cost Savings	10,288,500	15,973,900	8,569,600
Present Cost savings	7,300,400	13,800,200	6,742,100
Present Cost	75,900	2,789,200	741,100
Net Present Cost Savings	7,224,500	11,011,000	6,001,000

An applicant seeking certification of a new type engine (as opposed to an applicant seeking a type certificate through an amendment of an existing type certificate or through supplemental type certificate procedures) for ETOPS eligibility would realize cost savings under proposed 33.200(f). Proposed 33.200(f) would allow the applicant to interrupt the 3000 cycle engine test required by 33.200(c) to show compliance with the existing initial maintenance inspection (IMI) test and inspection required by sections 33.90(a–b). The applicant would then resume the ETOPS test to complete the requirements of section 33.200. Thus the applicant for a new type design engine would only have to provide one engine to complete the existing IMI test and inspection and the 3,000-cycle test of the proposed section 33.200(f) rather than 2 engines. The 3,000-cycle test is estimated in the Cost section to cost $6.5 million or $6.1 million, discounted. The FAA requests comments and data addressing this issue.

Manufacturers of business airplanes do not have direct offsetting cost savings. These manufacturers would only voluntarily incur these costs after making a business decision that they could recoup their costs by the sale of airplanes capable of operating beyond 180-minutes ETOPS. The substantial net cost savings that could be achieved by a part 135 operator operating beyond 180-minutes ETOPS would aid the market demand for such airplanes by business airplane operators.

The total cost savings to operators are estimated at $1.09 billion over a ten-year period or $762.3 million, discounted as shown in Table 2. These savings are based on the following assumptions:

- There are currently 3 2-engine operators flying beyond 180 minutes on an exception basis. It is assumed they will routinely fly 231 hours each beyond 180 minutes.
- There are currently 7 ''low cost'' passenger carriers (AirTran, America West, ATA, Frontier, JetBlue, Southwest, and Spirit as defined by the *Aviation Daily*). It is assumed each would operate 4 ETOPS airplanes on a single route.
- There are currently 13 U.S. operators of 3- or 4-engine aircraft and it is assumed each would operate 1 route beyond 180 minutes.
- There are 81 Part 135 operators that both meet the proposed aircraft and maintenance requirements and each would save 96 hours annually.

TABLE 2.—TEN-YEAR COST SAVINGS TO OPERATORS

Cost-savings to—	Cost savings	Present value
3 Existing 2-engine Operators	$31,185,000	$21,901,225
7 New 2-engine Operators	72,054,500	50,596,140

TABLE 2.—TEN-YEAR COST SAVINGS TO OPERATORS—Continued

Cost-savings to—	Cost savings	Present value
13 3- or 4-engine Operators	207,660,700	143,142,935
81 Part 135 Operators	777,600,000	546,108,480
Total Cost Savings	1,089,210,700	762,255,500

The net cost-savings to the industry are reduced by the costs incurred by the operators and manufacturers. These costs are addressed in the Cost section. These costs are estimated to be less than the estimated savings and the net cost-savings to the industry are estimated at $823.9 million or $530.2 million, discounted as shown in Table 3.

TABLE 3.—TEN-YEAR NET COST-SAVINGS OR COSTS TO INDUSTRY

Category	Cost savings or cost	Present value
Existing 2-engine Operators	$20,449,500	14,341,826
7 New 2-engine Operators	72,019,500	50,571,560
13 3- or 4-engine Operators	159,866,200	106,879,435
81 Part 135 Operators	694,137,600	486,079,380
Reporting and Certification Costs for:		
3 models of 3- or 4- engine airplanes	(11,875,500)	(9,797,100)
5 Business Aircraft Manufacturers Part 25 costs	(36,065,000)	(33,720,900)
5 Business Aircraft Manufacturers Part 33 Costs	(50,625,000)	(47,337,500)
Current Part 135 Operators:		
Aircraft Replacement Costs	(24,000,000)	(22,440,000)
Total Net Cost Savings	823,907,300	530,234,875

In addition to cost savings to operators there are other benefits of the proposed rule.

Benefits

Accidents due to diversions are non-existent for twin-engine aircraft operating under parts 121 or 135 and for more than two engine aircraft operating under part 121. The FAA believes the proposed weather provisions of the rule would reduce the probability of an accident occurring and the provision requiring rescue fire fighting services at ETOPS alternate airports would minimize the impact if an accident were to occur. In addition, the FAA believes the proposed requirements to require certificate holders to develop and implement passenger recovery plans for ETOPS alternate airports would better protect passengers and crew if a diversion is made for any reason.

Benefits cannot be assigned to specific provisions of the proposed rule; rather, it is assumed that the proposed revisions would work together to prevent diversions and to reduce the impact of any diversions that do occur. Aviation routes not supported within 180-minute diversion authority tend to be routes over remote areas of the world that are uniquely challenging. The additional operational challenges of these routes are equally demanding of all airplanes, regardless of the number of engines, and require all operators to equip their aircraft and train their personnel to prevent diversions and to minimize the impact of diversions that do occur. All operators must support any diversion that occurs and the subsequent recovery by providing the added planning, training and expertise demanded by the event. The FAA believes the requirements of the proposed rule provide the support and procedures necessary to minimize the stress on the airplane, crew, and passengers inherent in a diversion experience.

The FAA believes that the proposed ETOPS requirements would increase the system reliability of an operator that decides to conduct ETOPS operations and thus costly diversions could be reduced. One study that only addressed the cost of an ''irregular'' operation, unrelated to an ETOPS-type diversion, estimated the cost of a single diversion of a wide-body international flight with passengers having an overnight stay at another airport at between $89,400 and $181,800 [1]. The estimate is based on 200 passengers and 400 passengers and includes allowance for hotel, meals and telephone, aircraft operating costs, lost opportunity cost, and revenue lost from the diverted flight to passengers switching to another carrier. Omitting the opportunity cost would reduce these estimates by $10,000 resulting in a minimum cost of approximately $79,000. The cost of a diversion to a remote site would incur significant costs since recovery times as long as 48 hours are anticipated and per passenger costs may exceed the estimate included in the study. A worst-case scenario presented by Airbus in a CD labeled LROPS involves an engine loss and diversion to an airport in Siberia. Airbus estimated the recovery costs could be as high as $1 million including passenger accommodations, chartering an airplane to ferry the passengers to their destination, chartering an airplane to ferry a replacement engine, ferrying the repaired airplane to its station, and loss of airplane use. The FAA requests comments on the number of diversions that might be avoided on flights beyond 180-minutes as a result of the proposed rule and seeks diversion cost data.

Costs

Compliance with the proposed rule is voluntary for all operators, airframe-engine manufacturers. Since the decision is voluntary, the FAA has estimated the cost to current ETOPS operators for the cost of provisions not incurred by current practices and has estimated the cost savings and costs to individual operators, and airframe and engine manufacturers. The FAA has also

[1] ''Improving Airline Profitability Through Better Estimated Times of Arrival and Terminal Area Flight Information: a Benefit Analysis of PASSUR'' Darryl Jenkins and Bill Cotton. Available at *http://www.passur.com/report.*

estimated the total cost to industry based on a set of assumptions as to the number of operators and airplane manufacturers that would voluntarily participate.

The FAA estimates that the cost of the rule to a new entrant part 121 operator of a twin-engine airplane would be approximately $106,500 over 10 years more than the operator would incur under the existing deviation policy and procedures. This reflects the cost of preparing and maintaining passenger recovery plans and maintenance investigation and resolution costs for a four-airplane ETOPS operation.

A part 121 operator of a three- or four-engine fleet serving a single route beyond 180-minutes would incur costs of approximately $3.7 million over 10 years. It is assumed that the route would require a four-airplane fleet with 60 crewmembers, supported by 2 dispatchers and 20 mechanics.

A part 135 operator seeking authorization to conduct ETOPS operations beyond 180-minutes would incur costs of approximately $1.0 million over 10 years. This estimate is based on a fleet of 4 airplanes flown by a crew of 16 pilots and maintained by 2 certified mechanics, and each aircraft conducts a monthly ETOPS operation. The fleet excludes aircraft with a Class C cargo compartment. Aircraft with Class C cargo compartments would add $1.5 million to the cost. All aircraft are capable of operating between the West Coast-Hawaii. Currently 6 operators that are authorized to fly between the West Coast and Hawaii only operate airplanes that would not be acceptable to the FAA under the proposed rule. These operators would have to upgrade to an acceptable aircraft at an estimated cost of $4 million per aircraft to continue these flights.

A business aircraft manufacturer would incur reporting and investigation costs that would be required by the proposed provisions of part 21 estimated at $3.2 million over 10 years. This expenditure would by incurred to fund 2 full-time staff for reporting purposes and a full-time staff member to conduct investigations of incidents. The manufacturer would also incur airplane ETOPS certification costs of $7.2 million. This would consist of design costs of $6 million, and assessment and validation costs of $1.2 million. Engine certification costs that would be required to make an engine ETOPS eligible would cost $10.1 million. This would consist of design costs $3.2 million, testing costs of $6.5 million and establishing engine-monitoring procedures at a cost of $400,000. The total cost to a business aircraft manufacturer for reporting and investigation, and airframe and engine certification would be $20.6 million.

The manufacturer of an existing three- or four-engine airplane would incur additional reporting costs under part 21 of $1.9 million to include operators that choose to fly beyond 180-minutes, supplemental certification costs of $1.9 million to allow operators of existing three- or four-engine airplanes to increase the capacity of the cargo fire suppression system required for beyond 180-minute ETOPS and other required costs of $200,000 for a total cost of $4 million.

The quantified costs to all the individual entities affected by the proposed rule are summarized in Table 4. The FAA requests comments and data addressing these estimates.

TABLE 4.—ESTIMATED TEN YEAR QUANTIFIED COSTS OF PROPOSED RULE TO INDIVIDUAL ENTITIES

Cost area	Total cost	Present value
Cost to a New Part 121 Twin-Engine ETOPS Operator	$106,500	$75,900
Cost to a 3- or 4-Engine Operator	3,676,500	2,789,500
Cost to a Part 135 Operator	1,030,400	741,100
Costs to a Business Aircraft Manufacturer for Reporting and Investigation, and Certification of Airframe and ETOPS-Eligible Engine	20,560,000	18,474,500
Reporting and Certification Costs to Manufacturer of 3- or 4-engine airplane	3,958,500	3,265,700

In addition, the total cost of the provisions of the proposed rule for existing two-engine ETOPS operators over a ten-year period beyond those incurred to comply with the existing policy and guidance is estimated at $10.7 million or $7.6 million, discounted.

The total costs to the industry are estimated at $265.3 million over a ten-year period or $217.7 million, discounted as shown in Table 5. These costs are based on the following assumptions:

- Costs to existing 2-engine operators as shown in the Regulatory Evaluation.
- Costs for a single operator, as shown in the Regulatory Evaluation, are multiplied by the number in the first column for each row to obtain the Total Cost and Present Value columns.
- There are currently 7 ''low cost'' passenger carriers (AirTran, America West, ATA, Frontier, JetBlue, Southwest, and Spirit as defined by the *Aviation Daily*). It is assumed each would operate 4 ETOPS airplanes on a single route.
- There are currently 13 U.S. operators of 3- or 4-engine aircraft and it is assumed each would operate 1 route beyond 180 minutes.
- There are 81 Part 135 operators that both meet the proposed aircraft and maintenance requirements.
- There are 3 ''makes'' of 3- or 4-engine airplanes (B–747, DC–10, MD–11).
- There are 5 ''major'' business airplane manufacturers serving this market segment. (Boeing, Cessna, Gulfstream, Raytheon, and Sabreliner)

There are 6 current Part 135 operators using airplanes that could not be upgraded to meet the specifications of the proposed rule. It would cost each operator approximately $4 million to replace a single airplane to meet the specifications.

TABLE 5.—ESTIMATED TEN-YEAR COSTS TO INDUSTRY

Costs incurred by—	Total cost	Present value
Existing 2-engine Operators	$10,735,500	$7,559,400
7 New 2-engine Operators	745,500	531,300
13 3- or 4-engine Operators	47,794,500	36,263,500
81 Part 135 Operators	83,462,400	60,029,100
Reporting and Certification Costs for:		

TABLE 5.—ESTIMATED TEN-YEAR COSTS TO INDUSTRY—Continued

Costs incurred by—	Total cost	Present value
3 makes of 3- or 4-engine airplanes	11,875,500	9,797,100
5 Business Aircraft Manufacturers Part 25 Costs	36,065,000	33,720,900
5 Business Aircraft Manufacturers Part 33 Costs	50,625,000	47,337,500
Current Part 135 Operators:		
Aircraft Replacement Costs	24,000,000	22,440,000
Total Costs	265,303,400	217,678,800

Initial Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 (RFA) establishes ''as a principle of regulatory issuance that agencies shall endeavor, consistent with the objective of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of the business, organizations, and governmental jurisdictions subject to regulation.'' To achieve that principle, the RFA requires agencies to solicit and consider flexible regulatory proposals and to explain the rationale for their actions. The RFA covers a wide-range of small entities, including small businesses, not-for-profit organizations and small governmental jurisdictions.

Agencies must perform a review to determine whether a proposed or final rule will have a significant economic impact on a substantial number of small entities. If the agency determines that it will, the agency must prepare a regulatory flexibility analysis as described in the RFA.

However, if an agency determines that a proposed or final rule is not expected to have a significant economic impact on a substantial number of small entities, section 605(b) of the RFA provides that the head of the agency may so certify and a regulatory flexibility analysis is not required. The certification must include a statement providing the factual basis for this determination, and the reasoning should be clear.

This proposed rule would affect airframe and engine manufacturers and part 121 and part 135 operators engaged in ETOPS operations. All United States manufacturers of transport category airplanes exceed the Small Business Administration small entity criteria of 1,500 employees for aircraft manufacturers. Those U.S. manufacturers include: Boeing, Cessna, Gulfstream, Lockheed Martin, McDonnell Douglas, Raytheon, and Sabreliner. All United States manufacturers of ETOPS-capable engines exceed the Small Business Administration small entity criteria of 1,000 employees for aircraft engine manufacturers. Those U.S. manufacturers include: General Electric, Pratt & Whitney, and Rolls Royce. All United States operators of transport category airplanes that are currently authorized to conduct 180-minute ETOPS operations exceed the Small Business Administration small entity criteria of 1,500 employees for scheduled and non-scheduled air transportation firms. Those U.S. operators include: American, American Trans Air, Continental, Delta, United, U.S. Airways, and UPS. There are a number of small non-scheduled part 121 operators that operate 3- or 4-engine aircraft that have the capability to operate ETOPS flights beyond 180 minutes. Those operators include: Atlas, Evergreen, Gemini, Kalitta, Southern Air, Polar, and World. There are a number of small non-scheduled part 135 operators that operate 2-engine aircraft that have the capability to operate ETOPS flights beyond 180 minutes. These non-scheduled part 121 and part 135 operators are not required to conduct beyond 180-minute ETOPS operations. Those who voluntarily decide to equip their aircraft and conduct the required training and planning under this proposed rule will have made their own business decisions that the costs associated with this NPRM are less than the cost savings of operating beyond 180-minute ETOPS flights. The FAA therefore certifies that the proposed rule would not have a significant economic impact on a substantial number of small operators. The FAA seeks public comments regarding this finding and requests that all comments be accompanied with detailed supporting data.

International Trade Impact Assessment

The Trade Agreement Act of 1979 prohibits Federal agencies from establishing any standards or engaging in related activities that create unnecessary obstacles to the foreign commerce of the United States. Legitimate domestic objectives, such as safety, are not considered unnecessary obstacles. The statute also requires consideration of international standards and, where appropriate, that they be the basis for U.S. standards.

In accordance with the above statute, the FAA has assessed the potential effect of this proposed rule and determined that it would impose requirements on airframe and engine manufacturers that both domestic and foreign firms would have to comply with. U.S. operators of 3- and 4-engine aircraft that seek authority to operate beyond 180-minutes ETOPS flight would have to comply with the same proposed equipment and training provisions regardless of the country of origin of the aircraft or engine manufacturer. Also the FAA does not believe that U.S. operators of 3- and 4-engine airplanes would be placed at a competitive disadvantage to foreign operators of 3- and 4-engine airplanes as a result of this proposed rule. The FAA seeks public comments regarding this finding and requests that all comments be accompanied with detailed supporting data.

The FAA concludes that these proposed requirements would have a neutral impact on foreign trade and, therefore, create no obstacles to the foreign commerce of the United States.

Unfunded Mandates Reform Act Assessment

The Unfunded Mandates Reform Act of 1995 (the Act) is intended, among other things, to curb the practice of imposing unfunded Federal mandates on State, local, and tribal governments. Title II of the Act requires each Federal agency to prepare a written statement assessing the effects of any Federal mandate in a proposed or final agency rule that may result in an expenditure of $100 million or more (adjusted annually for inflation) in any one year by State, local, and tribal governments, in the aggregate, or by the private sector; such a mandate is deemed to be a ''significant regulatory action.''

This proposed rule does not contain such a mandate. The requirements of Title II do not apply.

Paperwork Reduction Act

This proposal contains new information collection requirements. As required by the Paperwork Reduction Act of 1995 (44 U.S.C. 3507(d)), the FAA will submit the information requirements associated with this proposal to the Office of Management and Budget for its review. A summary of those requirements follows.

Title: Extended Operations (ETOPS) of Multi-engine Airplanes

Summary: The regulations currently prohibit operators of two engine airplanes from flying more than one hour from an adequate airport. The NPRM would codify current practices that permit certificated air carriers to obtain approval under the Administrator's deviation authority to operate two-engine airplanes further than one hour from an adequate airport. It would also add regulations for ETOPS for all carriers regardless of the number of engines. ETOPS is voluntary for operators and manufacturers.

Use of the information: This rule is necessary to support the following elements of the FAA's strategic plan:

• *Global leadership*—The worldwide aviation industry is interested in extended operations. Civil aviation authorities of other countries and international aviation organizations are carefully watching the FAA's efforts to develop rules to govern extended operations. This proposed rule will enhance worldwide air travel safety and efficiency.

• *System efficiency*—Allowing extended operations allows operators to take more direct routes to long-range destinations and improves overall system efficiency.

Safety—The proposed rule addresses the safety aspects of extended operations.

Respondents: The likely respondents to this proposed information requirement are airplane manufacturers and air carriers who wish to operate on routes that go more than one hour from an adequate airport.

Frequency: Initial authorization and additional annual requirements.

Annual Burden Estimate:

This collection of information includes four areas:

1. Operators who elect to use the ETOPS alternative would have to prepare a *passenger recovery plan* applicable to each ETOPS alternate airport listed in the carrier's operations specifications. The FAA estimates that the initial preparation of such plans would require 100 staff hours, and to keep the plans up-to-date and viable would expend an additional 50 hours annually.

2. Operators are required under 121.703 to file mechanical reliability reports concerning the failure, malfunction, or defect for 17 areas. This proposal, however, would require that operators investigate *certain failures and submit findings and corrective actions* acceptable to the FAA. The FAA believes that there is a 5% probability of such a failure that would require additional reporting, and that such action could be resolved in two staff days.

3. Section 121.374 would require each certificate holder operating beyond the 180-minutes to have an *ETOPS maintenance program* in addition to the program currently required by 121.367. The program consists of 18 areas, including manual preparation, establishing procedures, and conducting training. The FAA estimates that it would take 3 months to develop.

4. Section 121.374 would require the certificate holder to *develop and write procedures for a pre-departure check.* The FAA estimates that it would take 6 weeks to develop this check. In addition, the carrier must *develop and write procedures* for identifying ETOPS specific procedures, which is estimated to take 8 hours. Carriers must also *supplement their existing reliability program;* estimated time to complete is 100 hours.

Each of these four areas is covered under three types of operators: 2-engine, 3–4 engine, and business jets. In addition, there are reporting requirements for parts 21, and 25 certification requirements. The burden is estimated based on the assumption that there will be 7 new 2-engine ETOPS Part 121 operators, 13 Part 121 3- or 4-engine operators and 81 business jet operators. Since many aspects of the proposed rule are voluntary the actual burden may vary significantly. The hours and costs per hour break down as follows:

Two-engine operators:

Passenger recovery plans—For current operators using ETOPS, estimate 19 plans × 100 hours × $75 = $142,500 for the initial plan. Thereafter, operators would spend 40 hours annually reviewing and validating the plan for a total 10-year cost of $655,000.

Initial development = 100 hrs × 19 plans = 1900 hours
Initial cost = $142,500
Recurring hours = 40 hrs × 19 plans × 9 years = 6840 hours
Recurring cost = $513,000
Total Hours = 8,740
Total Cost = $655,500

For estimated 7 new ETOPS operators:

Initial development = 100 hrs × 7 plans = 700 hours
Initial cost = $52,500
Recurring hours = 40 hrs × 7 plans × 9 years = 2520 hours
Recurring cost = $189,000
Total Hours = 3220
Total Cost = $241,500

Reporting failures and findings

For existing operators:

Initial = 16 hrs × 1,400 incidents = 22,400 hours × $45 = $1,008,000
Total over 10 years = 224,000 hours × $45 = $10,080,000
For estimated 7 new operators:
Initial = 16 hours × 7 operators × 10 incidents per = 1,120 hours × $45 = $50,400
Total over 10 years = 11,200 hours = $504,000

3- or 4-engine airplanes

Passenger recovery plans

For estimated 13 new ETOPS operators

Initial development = 100 hrs × 13 plans = 1,300 hours
Initial cost = 1,300 hours × $75 = $97,500
Recurring hours = 40 hrs × 13 plans × 9 years = 4680 hours
Recurring cost = $351,000
Total Hours = 5,980
Total Cost = $448,500

ETOPS Maintenance Program

For estimated 13 new ETOPS operators

Program document:

One time cost of 520 hours × 13 = 6760 hours × $85 = $574,600

Pre-departure check program:

240 hours × 13 = 3,120 hours × $85 = $265,200

ETOPS specific procedures:

8 hours × 13 = 104 hours × $85 = $8,840

Reliability program:

200 hours × 13 = 2600 hours × $85 = $221,000

Pre-departure service check:

2 hours × 3 planes × 360 days × 13 = 28080 hours × $45 = $1,263,600
Total Hours = 280,800
Total Cost = $12,636,000

Reporting Failures and Findings

16 hours × 10 incidents × 13 = 2080 hours × $45 = $93,600
Total Hours = 20,800
Total Cost = $936,000

Training

Initial Training

• 44 hours × 20 mechanics × 13 = 11440 hours × $45 = $514,800

• 16 hours × 20 pilots × 13 = 4160 hours × $173 = $719,680
• 4 hours × 40 flight attendants × 13 = 2080 hours × $52 = $108,160
• 12 hours × 8 dispatchers × 13 = 1248 hours × $38 = $47,424
Total Hours = 18,928
Total Cost = $1,390,064

Recurrent Training

• 1 hour × 20 mechanics × 13 × 9 = 2340 hours × $45 = $105,300
• 1 hour × 20 pilots × 13 × 9 = 2340 hours × $173 = $404,820
• 1 hour × 40 flight attendants × 13 × 9 = 4680 hours × $52 = $243,360
• 1 hour × 8 dispatchers × 13 × 9 = 936 hours × $38 = $35,568
Total Hours = 10,296
Total Cost = $789,048

Ten Year Training

Total Hours = 29,224
Total Cost = $2,179,112

Business Jets

For estimated 81 new ETOPS operators

Maintenance program:
50 hours × 81 = 4050 hours × $100 = $405,000

Pre-departure service check:
1 hour × 24 inspections × 81 = 1944 hours × $45 = $87,480
Total Hours = 19,440
Total Cost =$874,800

Continuing Analysis Surveillance Program (CASS)
100 hours × 81 = 8100 hours × $45 = $364,500

Monitoring programs.
1 mechanic × 81 × 2080 hours = 168480 × $45 = $7,581,600
Total Hours = 1,684,800
Total Cost = $75,816,000

Training

Initial Training

• 4 hours × 2 mechanics × 81 = 648 hours × $45 = $29,160

Recurrent Training

• 1 hour × 2 mechanics × 81 × 9 = 1458 hours × $45 = $65,610
Total Hours = 2,106
Total Cost = $94,770
Quarterly reporting:
8 hours × 81 = 648 hours × $45 = $29,160
8 hours × 81 × 10 = 6480 hours × $45 = $291,600
For operations north of latitude N78:
Recovery plan:
Initial development t = 40 hrs × 81 plans = 3240 hours
Initial cost = 3240 hours × $75 = $243,000
Recurring hours = 10 hrs × 81 plans × 9 years = 7290 hours
Recurring cost = 7290 × $75 = $546,750
Total Hours = 10,530
Total Cost = $789,750

Training

Initial Training

• 16 hours × 16 pilots × 81 = 20736 hours × $173 = $3,587,328

Recurring Training

• 1 hour × 16 pilots × 81 × 9 = 11664 hours × $173 = $2,017,872
Total Hours = 32,400
Total Cost = $5,605,200

Part 21

Expanded ETOPS reporting:
Two engineer aides × 2080 = 4,160 hours × $45 = $187,200
Total Hours = 41,600
Total Cost = $1,872,000
New ETOPS reporting:
For estimated 5 new ETOPS manufacturers
Two engineer aides × 2080 = 4,160 hours × 5 = 20,800 hours × $45 = $936,000
Total Hours = 208,000
Total Cost = $9,360,000

Investigation of shutdown causes:
2,000 hours × 5 = 10,000 hours × $67.50 = $675,000
Total Hours = 100,000
Total Cost = $6,750,000

Part 25

One time certification for fire suppression:
25,000 hours (for 3 type certificates) × $75 = $1,875,000 million

In summary, the FAA estimates that the one-time and first year burden of the paperwork requirements for ETOPS operators and manufacturers would be approximately 357,000 hours and cost $21.2 million, undiscounted. The ten-year burden is estimated at 2.7 million hours and the undiscounted cost is estimated $132.8 million as shown in the attached table.

In addition, there are other certification costs that are difficult to sort by information requirements. Some of these other costs are manufacturing costs with additional reporting requirements.

The FAA is soliciting comments to—

(1) evaluate whether the proposed information requirement is necessary for the proper performance of the functions of the agency, including whether the information will have practical utility;

(2) evaluate the accuracy of the agency's estimate of the burden;

(3) enhance the quality, utility, and clarity of the information to be collected; and

(4) minimize the burden of the collection of information on those who are to respond, including through the use of appropriate automated, electronic, mechanical, or other technological collection techniques or other forms of information technology.

Individuals and organizations may submit comments on the information collection requirement by January 13, 2004, and should direct them to the address listed in the **ADDRESSES** section of this document. According to the 1995 amendments to the Paperwork Reduction Act (5 CFR 1320.8(b)(2)(vi)), an agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. The OMB control number for this information collection will be published in the **Federal Register**, after the Office of Management and Budget approves it.

SUMMARY OF INITIAL AND TOTAL PAPERWORK HOURS AND COSTS

Category	Initial hours	Initial cost	Ten year hours	Ten year costs
2-engine:				
Recovery Plans:				
Existing	1,900	$142,500	8,740	$655,500
New	700	52,500	3,320	241,500
Reporting:				
Existing	22,400	1,008,000	224,000	10,080,000
New	1,120	50,400	11,200	504,000
More than 2-engine:				
Recovery Plans	1,300	97,500	5,980	448,500

SUMMARY OF INITIAL AND TOTAL PAPERWORK HOURS AND COSTS—Continued

Category	Initial hours	Initial cost	Ten year hours	Ten year costs
ETOPS Program document	6,760	574,600	6,760	574,600
Pre-departure Program	3,120	265,200	3,120	265,200
ETOPS SpecificProcedures	104	8,840	104	8,840
Reliability Program	2,600	221,000	2,600	221,000
Pre-departure Service Check	28,080	1,263,600	280,800	12,636,000
Reporting Failures	2080	93,600	20,800	936,000
Training	18928	1,390,064	29,224	2,179,112
Business Jets:				
ETOPS Maintenance Program	4050	405,000	4,050	405,000
Pre-departure Service Check	1944	87,480	19,440	874,800
CASS	8100	364,500	8,100	364,500
Monitoring Programs	168,480	7,581,600	1,684,800	75,816,000
Training	648	29,160	2,106	94,770
Quarterly Reporting	648	29,160	6,480	291,600
Polar Recovery Plan	3,240	243,000	10,530	789,750
Polar Training	20,736	3,587,328	32,400	5,605,200
Part 21:				
ETOPS Reporting:				
Expanded	4,160	187,200	41,600	1,872,000
New	20,800	936,000	208,000	9,360,000
Shutdown Investigations	10,000	675,000	100,000	6,750,000
Part 25: Certification	25,000	1,875,000	25,000	1,875,000
Total	356,898	21,168,232	2,739,154	132,848,872

Executive Order 13132, Federalism

The FAA has analyzed this proposed rule under the principles and criteria of Executive Order 13132, Federalism. We determined that this action would not have a substantial direct effect on the States, on the relationship between the national Government and the States, or on the distribution of power and responsibilities among the various levels of government, and therefore would not have federalism implications.

Plain Language

Executive Order 12866 (58 FR 51735, Oct. 4, 1993) requires each agency to write regulations that are simple and easy to understand. We invite your comments on how to make these proposed regulations easier to understand, including answers to questions such as the following:

- Are the requirements in the proposed regulations clearly stated?
- Do the proposed regulations contain unnecessary technical language or jargon that interferes with their clarity?
- Would the regulations be easier to understand if they were divided into more (but shorter) sections?
- Is the description in the preamble helpful in understanding the proposed regulations?

Please send your comments to the address specified in the **ADDRESSES** section.

Environmental Analysis

FAA Order 1050.1D defines FAA actions that may be categorically excluded from preparation of a National Environmental Policy Act (NEPA) environmental impact statement. In accordance with FAA Order 1050.1D, appendix 4, paragraph 4(j), this proposed rulemaking action qualifies for a categorical exclusion.

Energy Impact

The energy impact of the notice has been assessed in accordance with the Energy Policy and Conservation Act (EPCA) Public Law 94–163, as amended (42 U.S.C. 6362) and FAA Order 1053.1. We have determined that the notice is not a major regulatory action under the provisions of the EPCA.

Executive Order 13211—Energy Supply, Distribution, or Use

Executive Order 13211 requires agencies to submit a Statement of Energy Effects to the Administrator of the Office of Information and Regulatory Affairs (OIRA), Office of Management and Budget, for matters identified as significant energy actions. A significant energy action is an action that (1) is significant under Executive Order 12866 and is likely to have a significant adverse effect on the supply, distribution, or use of energy or (2) is designated by the administrator of the Administrator of OIRA as a significant energy action. This proposed rule would save fuel for operators who obtain authorization for ETOPS routes and would therefore have a significant positive effect on energy use. We are not required to submit a Statement of Energy Effects for this proposed rule because we do not expect this rule to have a significant adverse effect on the supply, distribution, or use of energy and the Administrator of OIRA has not identified it as a significant energy action.

List of Subjects

14 CFR Part 1

Air transportation.

14 CFR Part 25

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

14 CFR Part 33

Aircraft, Aviation safety.

14 CFR Part 121

Air carriers, Aircraft, Airmen, Alcohol abuse, Aviation safety, Charter flights, Drug abuse, Drug testing, Reporting and recordkeeping requirements, Safety, Transportation.

14 CFR Part 135

Air taxis, Aircraft, Airmen, Alcohol abuse, Aviation safety, Drug abuse, Drug testing, Reporting and recordkeeping requirements.

The Proposed Amendment

For the reasons discussed in the preamble, the Federal Aviation Administration proposes to amend part 14 CFR parts 1, 25, 33, 121, and 135 as follows:

PART 1—DEFINITIONS

1. The authority citation for part 1 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701.

2. Amend § 1.1 by adding the definitions of ''Early ETOPS'', ''ETOPS Configuration, Maintenance and Procedures Standard (CMP)''. ''ETOPS Significant Systems'', ''Extended Operations (ETOPS)'', ''Group 1 Systems'', ''Group 2 Systems'', and ''In-flight shutdown (IFSD)'', to read as follows:

§ 1.1 General Definitions.

* * * * *

Early ETOPS means obtaining ETOPS type design certification without first gaining service experience on the airplane/engine combination to be certified.

* * * * *

ETOPS Configuration, Maintenance and Procedures Standard (CMP) means specific airframe and engine configuration minimum requirements, including any special inspection, hardware life limits, Master Minimum Equipment List (MMEL) constraints and maintenance practices found necessary by the FAA to establish the suitability of that airframe and engine combination for ETOPS.

* * * * *

ETOPS Significant Systems means the airplane propulsion system and any other airplane systems whose failure could adversely affect the safety of an ETOPS flight, or whose functioning is important to continued safe flight and landing during an airplane diversion. Each ETOPS significant system is either a Group 1 or Group 2 system based on the relationship to the number of engines, or to continued safe engine operation.

Extended Operations (ETOPS) means an airplane flight operation in which a portion of the flight is operated beyond a predetermined time threshold, as identified in parts 121 and 135 of this title, from an adequate airport based on an approved one engine inoperative cruise speed under standard conditions in still air.

* * * * *

ETOPS Group 1 Systems: Group 1 Systems include any systems that relate to the number of engines on the airplane and are important to the safe operation of the airplane on an ETOPS flight. The following provides additional discriminating definitions of an ETOPS Group 1 Significant System:

(1) A system for which the fail-safe redundancy characteristics are directly linked to the number of engines (for example, hydraulic system, pneumatic system, electrical system).

(2) A system that may affect the proper functioning of the engines to the extent that it could result in an in-flight shutdown or uncommanded loss of thrust (for example, fuel system, thrust reverser or engine control or indicating system, and engine fire detection systems).

(3) A system which contributes significantly to the safety of an engine inoperative ETOPS diversion and is intended to provide additional redundancy to accommodate the system(s) lost by the inoperative engine. These include back-up systems such as an emergency generator or APU.

(4) Any system essential to prolonged operation at engine inoperative altitudes including anti-icing systems for a twin-engine airplane if single engine performance results in the airplane operating in the icing envelope.

ETOPS Group 2 Systems: Group 2 Systems are systems that do not relate to the number of engines on the airplane, but are important to the safe operation of the airplane on an ETOPS flight. The following provides additional discriminating definitions of an ETOPS Group 2 Significant System:

(1) A system the failure of which would reduce the capability of the airplane or the ability of the crew to cope with an ETOPS diversion, (for example, long-range navigation or communication, equipment cooling, or systems important to safe operation on a ETOPS diversion after a decompression.)

(2) Time-limited systems including cargo fire suppression and oxygen if the duration of ETOPS dependent on the availability of such systems.

(3) Systems whose failure would result in excessive crew workload or have operational implications or significant detrimental impact on flight crew or passengers physiological well being for an ETOPS diversion (for example flight control forces that would be exhausting for a maximum ETOPS diversion, system failures that would require continuous fuel balancing to ensure proper Center of Gravity (CG), or a cabin environmental control failure that could cause extreme heat or cold that it could incapacitate the crew or cause physical harm to the passengers).

(4) Any other system specifically installed to enhance the safety of long-range operations including an ETOPS diversion regardless of the applicability of paragraphs (1), (2) and (3) of this definition (for example SATCOM, GPS).

* * * * *

In-flight shutdown (IFSD) means when an engine ceases to function in flight and is shutdown, whether self-induced, crew initiated or caused by some other external influence. (The FAA considers IFSD for all causes, for example. flameout, internal failure, crew initiated shutoff, foreign object ingestion, icing, inability to obtain and/or control desired thrust.)

PART 21—CERTIFICATION PROCEDURES FOR PRODUCTS AND PARTS

3. The authority citation for part 21 continues to read as follows:

Authority: 42 U.S.C. 7572; 49 U.S.C. 106(g), 40105, 40113, 44701–44701, 44707, 44709, 44711, 44713, 44715, 45303.

4. Add § 21.4 to read as follows:

§ 21.4 ETOPS reporting requirements.

(a) *Early ETOPS problem reporting, tracking, and resolution.* (1) The holder of a type certificate of an airplane that has been approved for ETOPS without service experience in accordance with section II, paragraph (a), or section III, paragraph (a), of Appendix L of 14 CFR part 25 must establish a system for reporting, tracking, and promptly resolving problems encountered with ETOPS Significant Systems.

(2) The system must contain a means for the prompt identification of problems with ETOPS Significant Systems, for the reporting of such problems to the responsible FAA certification office, and for proffering solutions to and obtaining FAA approval for the resolution of the problems. The implementation of the problem resolution can be accomplished by way of an FAA approved change(s) in the type design, the manufacturing process, or an operating or maintenance procedures.

(3) The reporting system must be in place for the first 250,000 fleet engine hours. For a two-engine ETOPS airplane, the reporting requirement remains in place until the fleet has demonstrated a stable in-flight shutdown rate in accordance with paragraph (b)(2) of this section for the maximum diversion time for which the airplane has been certified.

(4) If the airplane or engine type certificated is a derivative of a previously certificated airplane or engine, the type certificate holder may, with prior authorization from the Administrator, report only on systems that have changed from the original type certificate.

(5) For the early ETOPS service period, an applicant must define the sources and content of in-service data that will be made available to them in support of their problem reporting and

tracking system. The content of this data must be adequate to evaluate the specific cause of all service incidents reportable under § 21.3(c) of part 21, in addition to any occurrences that could affect the safety of ETOPS operations and must be reported, including:

(i) In-flight shutdown events, and for twin-engine ETOPS airplanes, in-flight shutdown rates;

(ii) Inability to control the engine or obtain desired power;

(iii) Precautionary thrust reductions (except for normal troubleshooting as allowed in the aircraft manual);

(iv) Degraded propulsion in-flight start capability;

(v) Inadvertent fuel loss or fuel unavailability, or uncorrectable fuel imbalance in flight;

(vi) Technical air turn backs or diversions associated with an ETOPS Group 1 Significant System;

(vii) Inability of an ETOPS Group 1 Significant System, designed to provide backup capability after failure of a primary system, to provide the required backup capability in-flight;

(viii) A complete loss of any electrical power generating system or hydraulic power system during an operation of the aircraft;

(ix) Any event that would jeopardize the safe flight and landing of the airplane on an ETOPS flight;

(x) Unscheduled engine removals for conditions that could result in one of the reportable items listed above.

(b) ETOPS operational service reliability reporting for two-engine airplanes.

(1) *Two engine reliability reporting.* Type Certificate Holder of engines and airplanes used in ETOPS service must report monthly on the reliability of their two-engine airplane fleets in service. The Administrator may approve reporting on a quarterly basis if the airplane and engine demonstrate sustained IFSD rates below those identified in paragraph (b)(2) of this section. This reporting may be combined with the reporting requirements of § 21.3. Causes of propulsion system in-flight shutdown must be investigated by the manufacturer(s), and where appropriate for the safety and airworthiness of ETOPS operations, FAA approved corrective action must be implemented. Reporting must include:

(i) Propulsion system in-flight shutdown events (excluding normal training events)

(ii) In-flight shutdown rates for all causes (excluding normal training events).

(iii) ETOPS fleet utilization, including a list of operators, their ETOPS diversion time authority, flight hours, and cycles.

(2) *ETOPS World Fleet In-Flight Shutdown Rate Requirements.* Type Certificate Holders of engines and airplanes approved for ETOPS service must monitor and report the worldwide fleet in-flight shutdown rates by airplane-engine type combinations to ensure appropriate rates are maintained. ETOPS 12 month rolling average in-flight shutdown rates must be maintained at the following levels:

(i) A threshold rate of 0.05 per 1,000 fleet engine hours for two-engine airplanes in ETOPS for initial approval up to 120 minutes, with continuing improvement toward a rate of 0.02 per 1,000 fleet engine hours;

(ii) A rate of 0.02 per 1,000 fleet engine hours for two-engine airplanes in ETOPS up to 180 minutes, and as provided for flight by flight exception based operations up to 207 minutes maximum diversion time in the North Pacific area of operation as defined in 14 CFR Part 121;

(iii) A rate of 0.01 per 1,000 fleet engine hours for twin-engine airplanes in ETOPS beyond 180 minutes, except as provided for flight by flight exception based operations up to 207 minutes maximum diversion time in the North Pacific area of operation as defined in 14 CFR Part 121.

PART 25—AIRPLANE TYPE DESIGN

5. The authority citation for part 25 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701, 44702 and 44704.

6. Amend § 25.857 by revising paragraph (c)(2) to read as follows:

§ 25.857 Cargo compartment classification.

* * * * *

(c) * * *

(2) There is an approved built-in fire extinguishing or suppression system controllable from the cockpit. For ETOPS approval, the certified time capability of the system must be provided as required by § 25.1581(a)(2).

* * * * *

7. Add § 25.1535 to read as follows:

§ 25.1535 ETOPS approval.

Each applicant seeking type design certification for ETOPS must:

(a) Comply with the requirements of this part considering the maximum mission time and the longest diversion time for which approval is being sought.

(b) Consider crew workload and operational implications and the flight crew's and passengers' physiological needs of continued operation with failure effects for the longest diversion time for which approval is being sought, and

(c) Comply with the requirements of Appendix L of this part.

8. Add Appendix L to read as follows:

Appendix L to Part 25—Extended Operations (ETOPS)

This appendix defines additional airworthiness requirements for the approval of an airplane-engine combination for Extended Operations (ETOPS) in accordance with § 25.1535. Two engine airplanes must comply with Sections I and II of this appendix. Airplanes with more than two engines must comply with Sections I and III of this appendix.

Section I—Design Requirements

(a) Airplane Systems. (1) Operation in icing conditions. (i) The airplane must be certificated for operation in icing conditions in accordance with § 25.1419.

(ii) The airframe and propulsion system ice protection must be capable of continued safe flight and landing at engine inoperative and decompression altitudes in icing conditions.

(iii) The applicant must show that the unprotected areas of the airplane will not collect a load of ice that would make the airplane uncontrollable or create too much drag to safely complete a diversion in icing conditions.

(2) *Electrical power supply.* The electrical power supply system must be designed so that—

(i) The occurrence of any failure condition which would prevent the continued safe flight and landing of the airplane on an ETOPS flight is extremely improbable, and

(ii) The occurrence of any other failure conditions which would reduce the capability of the airplane or the ability of the crew to cope with adverse operating conditions on an ETOPS flight is improbable.

(iii) For airplanes to be certificated for usage on routes further than 180 minutes from a suitable airport, the airplane must be equipped with at least three independent electrical generation sources.

(3) *Time limited systems.* For each ETOPS Significant System that is time limited, the system capability must be defined. The most limiting ETOPS Significant System capability must be stated in the Airplane Flight Manual per the requirements of paragraph (e)(4) of Section I of this appendix.

(b) *Propulsion systems.* (1) Fuel system design. Fuel necessary to complete an ETOPS mission, including a diversion for the longest time for which approval is being sought, must be available to the operating engine or engines at the pressure and flow required by § 25.955 under any airplane failure condition not shown to be extremely improbable. Examples of the types of failures to be considered include crossfeed valve failures, automatic fuel management system failures, and normal electrical power generation failures.

(i) For two engine airplanes to be certificated for usage on routes further than 180 minutes from a suitable airport, one fuel boost pump in each main tank and actuation

capability of at least one crossfeed valve must be able to be powered by a back-up electrical generation source other than the primary engine driven or APU driven generators, unless the required fuel boost pressure or crossfeed valve actuation is not provided by electrical power.

(ii) Alerts must be displayed to the flight crew when the quantity of fuel available to the engines falls below that level required to complete the mission. These alerts must include provisions for abnormal fuel management or transfer between tanks, and possible loss of fuel.

(2) *APU design.* If operation of the APU installation is required to comply with this appendix, the applicant must substantiate that:

(i) The APU has adequate reliability for that operation, and;

(ii) If in-flight start and run capability is necessary, the APU in-flight operating envelope shall extend to the maximum operating altitude of the airplane, but need not exceed 45,000 feet.

(3) *Engine oil tank design.* The engine oil tank filler cap must comply with section 33.71(c)(4).

(c) *Engine condition monitoring.* Procedures for an engine condition monitoring process must be defined and validated in accordance with Part 33 Appendix A, paragraph 33.3(c).

(d) *Configuration, maintenance and procedures.* If the airplane, propulsion, and ETOPS Significant System assessments identify configuration, maintenance or operational standards necessary to maintain appropriate reliability for ETOPS, the applicant must identify the appropriate standards in a Configuration, Maintenance and Procedures (CMP) document.

(e) *Airplane flight manual.* The airplane flight manual must contain the following information.

(1) Special limitations, including any limitations associated with operation of the airplane up to the maximum diversion time being approved.

(2) Required markings or placards.

(3) The airborne equipment, installation, and flight crew procedures required for extended operations.

(4) The maximum diversion time capability of the airplane for ETOPS required by paragraph (a)(3) of this appendix in accordance with § 25.1581(a)(2), ''Furnishing information.''

(5) The following statement: ''The type design reliability and performance of this airframe-engine combination has been evaluated in accordance with § 25.1535 and found suitable for (*state maximum diversion time*) extended operations (ETOPS) with the incorporation of the approved airplane configuration CMP standard contained in (*state description or reference to a document containing the approved CMP standard*). This finding does not constitute approval to conduct ETOPS.''

Section II—Two Engine Airplanes

An applicant for a two engine airplane must use one of the methods described in paragraphs (a), (b), or (c) of Section II of this appendix to certify the airplane for Extended Operations.

(a) *Service experience method.* The applicant must demonstrate that the airplane and engine combination for which approval is sought has the required airplane and propulsion system capability to safely conduct an ETOPS mission and maximum diversion and has achieved required airframe and propulsion system reliability based upon fleet in-service experience.

(1) *Required service experience.* After accumulating 250,000 worldwide fleet engine hours on the airplane and engine combination for which approval is sought, a reliability review must be performed. The number of hours may be reduced if adequate compensating factors are identified which give a reasonable equivalent database. Where experience on another airplane is applicable, a significant portion of the 250,000 hours must be obtained on the candidate airplane.

(2) *Propulsion system assessment.* (i) The applicant must conduct a propulsion system assessment based on the following data, collected from the entire fleet of the specific airplane and engine combination for which approval is sought:

(A) A list of all engine shutdown events both ground and in-flight for all causes (excluding normal training events) including flameouts. The list should provide identification (engine and airplane model and serial number), engine configuration and modification history, engine position, circumstances leading up to the event, phase of flight or ground operation, weather/environmental conditions, and reason for shutdown. In addition, similar information should be provided for all occurrences where control of desired thrust level was not attained.

(B) Unscheduled engine removal rate (accumulated 6- and 12-month rolling averages), removal summary, time history of removal rate and primary causes for unscheduled removal.

(C) Dispatch delays, cancellations, aborted takeoffs (includes those induced by maintenance or crew error) and en-route diversions chargeable to the propulsion system.

(D) Total engine hours and cycles and engine hour population (age distribution).

(E) Mean time between failure of propulsion system components that affect reliability.

(F) IFSD rate based upon a 6- and 12-month rolling average.

(ii) All causes or potential causes of engine in-flight shutdowns or loss of thrust control occurring in service must have corrective actions that are shown to be effective in preventing future occurrences.

(3) *Airplane systems assessment.* Airplane systems must comply with the requirements of § 25.1535(a) using available in-service reliability data for ETOPS significant systems. All causes or potential causes of ETOPS significant system failures occurring in service must have corrective actions that are shown to be effective in preventing future occurrences.

(4) *In-flight shutdown (IFSD) rates.* The demonstrated airplane and engine combination world fleet propulsion system 12 month rolling average IFSD rate must be commensurate with the level of ETOPS approval being sought.

(i) For operations up to 120 minutes: A rate of approximately 0.05 or less per 1,000 fleet engine hours with a required list of corrective actions in the CMP document that would result in continuing improvement toward an IFSD rate of 0.02 per 1,000 fleet engine hours.

(ii) For operations up to 180 minutes: A rate of approximately 0.02 or less per 1,000 fleet engine hours with an existing 120 minute CMP standard, or new or additional CMP requirements that have been demonstrated to achieve this in-flight shutdown rate.

(iii) For operations beyond 180 minutes: A rate of approximately 0.01 or less per 1,000 fleet engine hours with an existing 120 minute or 180 minute CMP standard, or new or additional CMP requirements that have been demonstrated to achieve this in-flight shutdown rate.

(5) *Airplane flight test requirements.* A flight test must be conducted to validate the adequacy of the airplane's flying qualities, performance and the flight crew's ability to deal with engine inoperative and non-normal worst case system failure conditions expected to occur in service.

(b) *Early ETOPS method.*

(1) *Relevant experience assessment.* The applicant must identify specific corrective actions taken on the airplane design to address relevant design, manufacturing, operational and maintenance problems experienced on previously certified Part 25 airplanes manufactured by the applicant. Specific corrective actions are not required if the nature of the problem is such that the problem would not significantly impact the safety or reliability of the system. Relevant problems are those problems on ETOPS Group 1 Significant Systems that have or could have resulted in in-flight shutdowns or diversions. To experience of supplier-provided ETOPS Group 1 Significant Systems and similar or identical equipment utilized on aircraft built by other manufacturers must be included.

(2) *Propulsion system design. (i) Engine ETOPS eligibility.* The engine must be approved for ETOPS eligibility in accordance with § 33.200.

(ii) *Design to preclude in-flight shutdowns.* The applicant must design the propulsion system to preclude failures or malfunctions that could result in an engine in-flight shutdown. The applicant must substantiate compliance with this requirement by analysis, test, in-service experience on other airplanes, or other means. The analysis must show that the propulsion system design will minimize failures and malfunctions with the objective of achieving the following in-flight shutdown rates: 0.02 per 1,000 engine fleet hours for ETOPS (180 minutes or less) 0.01 per 1,000 engine fleet hours for ETOPS (beyond 180 minutes).

(3) *Maintenance and operational procedures.* The applicant must validate all ETOPS significant systems maintenance and operational procedures. Any problems found as a result of the validation must be tracked and resolved through the Problem Tracking and Resolution System required by Section II, paragraph (b)(8) of this appendix.

(4) *Propulsion system validation test.* The installed engine configuration for which

approval is being sought must comply with § 33.200(c). The test engine must be configured with a complete airplane nacelle package, including engine-mounted equipment except for any configuration differences necessary to accommodate test stand interfaces with the engine nacelle package. At the conclusion of the test, the propulsion system must be:

(i) Visually inspected according to the applicant's on-wing inspection recommendations and limits.

(ii) Completely disassembled and the propulsion system hardware must be inspected in accordance with the service limits submitted in compliance with § 25.1529. Any potential sources of in-flight shutdown, loss of thrust control, or other power loss encountered during this inspection must be tracked and resolved in accordance with Section II, paragraph (b)(8) of this appendix.

(5) *New technology demonstration testing.* Testing must be conducted to substantiate the suitability of any technology new to the applicant, including substantially new manufacturing techniques.

(6) *APU validation test.* If utilizing an APU in order to meet the requirements of paragraph (a)(2) of section I of this appendix, one APU of the type to be certificated with the airplane must complete a test consisting of 3,000 equivalent airplane operational cycles. Following completion of the demonstration test, the APU must be disassembled and inspected. Any potential sources of in-flight start problems or run problems or both must be identified, tracked and resolved in accordance with Section II, paragraph (b)(8) of this appendix.

(7) *Airplane demonstration test.* For each airplane and engine combination to be certificated one or more airplanes must conduct flight-testing that demonstrates that the aircraft, its components and equipment are capable of and function properly during ETOPS and ETOPS diversions. This flight-testing may be coordinated with, but is not in place of flight-testing required for compliance to § 21.35(b)(2).

(i) The flight test program must include:

(A) Flights simulating actual ETOPS operation including normal cruise altitude, step climbs, and APU operations if paragraph (b)(2) of section I of this appendix applies.

(B) Demonstration of maximum normal flight duration with maximum diversion time for which eligibility is sought.

(C) Engine inoperative maximum time diversions to demonstrate the airplane and propulsion system capability to safely conduct an ETOPS diversion, including a repeat of a maximum continuous thrust (MCT) diversion on the same engine.

(D) Non-normal conditions to demonstrate the airplane's capability to safely conduct an ETOPS diversion under worst-case system failure conditions expected to occur in service.

(E) Diversions into representative operational diversionary airports.

(F) Repeated exposure to humid and inclement weather on the ground followed by long-range operations at normal cruise altitude.

(ii) The flight testing must validate the adequacy of the airplane's flying qualities, performance and flight crew's ability to deal with the conditions of paragraphs (b)(7)(i)(C), (b)(7)(i)(D), and (b)(7)(i)(E) of Section II of this appendix.

(iii) The engine-inoperative diversions must be evenly distributed among the number of engines in the applicant's flight test program except as required by paragraph (b)(7)(i)(C) of Section II of this appendix.

(iv) The test airplane or airplanes must be operated and maintained using the recommended operations and maintenance manual procedures during the airplane demonstration test.

(v) At the completion of the airplane or airplanes demonstration testing, the ETOPS significant systems must undergo an airplane visual inspection per the Instructions for Continued Airworthiness of § 25.1529. The engines must also undergo a gas path inspection. These inspections are intended to identify any abnormal conditions that could result in an in-flight shutdown or diversion. Any abnormal conditions must be identified, tracked and resolved in accordance with paragraph (b)(8) of Section II of this appendix.

(8) *Problem tracking and resolution system.* A problem tracking and resolution system must be established to address problems, as identified in § 21.4(a)(5), encountered on the ETOPS significant systems during airplane and engine testing that could affect the safety of ETOPS operations. If the airplane or engine type certificated is a derivative of a previously certificated airplane or engine, the criteria of § 21.4(a)(4) may apply.

(i) The system must contain a means for prompt identification of problems that could impact the safety of ETOPS operations.

(ii) The system must contain the process for the timely notification to the responsible FAA office of all relevant problems encountered, and corrective actions deemed necessary, in a manner that allows for appropriate FAA review of all planned corrective actions.

(iii) The system must be in effect during the phases of airplane and engine development that will be used to assess early ETOPS eligibility.

(iv) Upon Type Certification, the certificate holder must comply with problem tracking and resolution system requirements of § 21.4.

(9) *Reliability demonstration acceptance criteria.* For airplane, propulsion and ETOPS significant systems, the type and frequency of failures that occur during the airplane flight test program and the airplane demonstration test required by paragraph (b)(7) of Section II of this appendix must be consistent with the type and frequency of failures or malfunctions that would be expected to occur on presently certified ETOPS airplanes.

(c) *Combined service experience and early ETOPS method.*

(1) The in-service experience requirements of paragraph (a)(1) may be reduced to 15,000 engine hours provided compliance to paragraphs (a)(5), (b)(1), (b)(2), (b)(3), (b)(4), (b)(5), (b)(6), (b)(8), and (b)(9) of Section II of this appendix have been met.

(2) Additionally, as allowed by § 21.21(b)(1), the in-service experience requirements of paragraph (a)(1) of Section II of this appendix may be reduced to some level other than 15,000 engine hours provided compensating factors that provide an equivalent level of safety are provided.

Section III—Airplanes With More Than Two Engines

An applicant for an airplane with more than two engines must use one of the methods described in the following paragraphs (a), (b) or (c) of Section III of this appendix to certify the airplane for Extended Operations.

(a) *Service experience method.* The applicant must demonstrate that the airplane and engine combination for which approval is sought has the required airplane and propulsion system capability to safely conduct an ETOPS mission and maximum diversion and has achieved required airplane system reliability based upon fleet in-service experience.

(1) *Required service experience.* After accumulating 250,000 worldwide fleet engine hours on the airplane and engine combination for which approval is sought, the applicant must perform a reliability review. The number of hours may be reduced if adequate compensating factors are identified which give a reasonable equivalent database. Where experience on another airplane is applicable, a significant portion of the 250,000 hours must be obtained on the candidate airplane.

(2) *Airplane systems assessment.* Airplane systems must comply with the requirements of § 25.1535(a) using available in-service reliability data for ETOPS significant systems. All causes or potential causes of ETOPS significant system failures occurring in service must have corrective actions that are shown to be effective in preventing future occurrences.

(3) *Airplane flight test requirements.* The applicant must conduct a flight test to validate the adequacy of the airplane's flying qualities, performance and the flight crew's ability to deal with engine inoperative and non-normal worst case system failure conditions expected to occur in service.

(b) *Early ETOPS method.*

(1) *Maintenance and operational procedures.* The applicant must validate all ETOPS Significant Systems maintenance and operational procedures. The applicant must track and resolve any problems found as a result of the validation through the Problem Tracking and Resolution System required by paragraph (b)(5) of Section III of this appendix.

(2) *New technology demonstration testing.* The applicant must conduct testing to substantiate the suitability of any technology new to the applicant, including substantially new manufacturing techniques.

(3) *APU validation test.* If utilizing an APU in order to meet the requirements of paragraph (a)(2) of section I of this appendix, one APU of the type to certificated with the airplane must complete a test consisting of 3,000 equivalent airplane operational cycles. Following completion of the demonstration test, the APU must be disassembled and inspected. Any potential sources of in-flight start problems or run problems or both must be identified, tracked and resolved in accordance with paragraph (b)(5) of Section III of this appendix.

(4) *Airplane demonstration test.* For each airplane and engine combination to be certificated, the applicant must conduct flight-testing with one or more airplanes to demonstrate that the aircraft, its components and equipment are capable of and function properly during ETOPS and ETOPS diversions. This flight-testing may be coordinated with, but is not in place of flight-testing required for compliance to § 21.35(b)(2).

(i) The flight test program must include:

(A) Flights simulating actual ETOPS operation including normal cruise altitude, step climbs, and APU operations if compliance to paragraph I (b)(2) of this appendix is necessary.

(B) Demonstration of maximum normal flight duration with maximum diversion time for which eligibility is sought.

(C) Engine inoperative maximum time diversions to demonstrate the airplane and propulsion system's capability to safely conduct an ETOPS diversion, including a repeat of a maximum continuous thrust (MCT) diversion on the same engine.

(D) Non-normal conditions to demonstrate the airplane's capability to safely conduct an ETOPS diversion under worst case system failure conditions expected to occur in service.

(E) Diversions into representative operational diversionary airports.

(F) Repeated exposure to humid and inclement weather on the ground followed by long-range operations at normal cruise altitude.

(ii) The flight testing must validate the adequacy of the airplane's flying qualities, performance and flight crew's ability to deal with the conditions of paragraphs (b)(4)(i)(C), (b)(4)(i)(D), and (b)(4)(i)(E) of Section III of this appendix.

(iii) The engine-inoperative diversions must be evenly distributed among the number of engines in the applicant's flight test program except as required by paragraph (b)(4)(i)(C) of Section III of this appendix.

(iv) The test airplane or airplanes must be operated and maintained using the recommended operations and maintenance manual procedures during the airplane demonstration test.

(v) At the completion of the airplane or airplanes demonstration testing, the ETOPS Significant Systems must undergo an airplane visual inspection per the Instructions for Continued Airworthiness of § 25.1529. The engines must also undergo a gas path inspection. These inspections are intended to identify any abnormal conditions that could result in an in-flight shutdown or diversion. The applicant must identify, track and resolve any abnormal conditions in accordance with paragraph (b)(5) of Section III of this appendix.

(5) *Problem tracking and resolution system.* The applicant must establish a problem tracking and resolution system to address problems, as identified in § 21.4(a)(5), encountered on the ETOPS Significant Systems during airplane and engine testing that could affect the safety of ETOPS operations. If the airplane or engine type certificated is a derivative of a previously certificated airplane or engine the criteria of § 21.4(a)(4) may apply.

(i) The system must contain a means for prompt identification of problems that could impact the safety of ETOPS operations.

(ii) The system must contain the process for the timely notification to the responsible FAA office of all relevant problems encountered, and corrective actions deemed necessary, in a manner that allows for appropriate FAA review of all planned corrective actions.

(iii) The system must be in effect during the phases of airplane and engine development that will be used to assess early ETOPS eligibility.

(iv) Upon type certification, the problem tracking and resolution system will revert to the requirements of § 21.4.

(6) *Reliability demonstration acceptance criteria.* For ETOPS significant systems, the type and frequency of failures that occur during the airplane flight test program and the airplane demonstration test required by paragraph (b)(4) of this section must be consistent with the type and frequency of failures or malfunctions that would be expected to occur on presently certified ETOPS airplanes, or any non-ETOPS derivative models of those aircraft or engines.

(c) *Combined service experience and early ETOPS method.*

(1) The in-service experience requirements of paragraph (a)(1) of Section III of this appendix may be reduced to 15,000 engine hours provided compliance to paragraphs (a)(3), (b)(1), (b)(2), (b)(3), (b)(5), and (b)(6) of Section III of this appendix have been met.

(2) Additionally, as allowed by § 21.21(b)(1), the in-service experience requirements of paragraph (a)(1) of Section III of this appendix may be reduced to some level other than 15,000 engine hours provided compensating factors that provide an equivalent level of safety are provided.

PART 33—ENGINE CERTIFICATION

9. The authority citation for part 33 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701–44702–44704.

10. Amend § 33.71 by revising paragraph (c)(4) to read as follows:

§ 33.71 Lubrication system.

* * * * *

(c) * * *

(4) Each oil tank cap must provide an oil-tight seal. For applicants seeking type design eligibility for engines to be installed in an Extended Operations (ETOPS) airplane in accordance with § 25.1535, the oil tank must be designed to prevent a hazardous quantity of oil loss due to oil tank cap installation errors.

* * * * *

11. Revise § 33.90 to read as follows:

§ 33.90 Initial maintenance inspection test.

Each engine, except engines being type certificated through amendment of an existing type certificate or through supplemental type certification procedures, must complete one of the following tests on an engine that substantially conforms to the final type design to establish when the initial maintenance inspection is required:

(a) An approved engine test that simulates the conditions in which the engine is expected to operate in service, including typical start-stop cycles.

(b) An approved engine test in accordance with §§ 33.200(c) and 33.200(f) of this part.

12. Add subpart G of part 33 to read as follows:

Subpart G—Special Requirements: Turbine Aircraft Engines

§ 33.200 Early extended operations (ETOPS) eligibility and test requirements.

Each applicant seeking engine type design eligibility for an engine to be installed in a twin-engine ETOPS airplane that does not have the service experience required by 14 CFR part 25, Appendix L, section II, paragraph (a) must comply with the following:

(a) The engine must be designed using a design quality process acceptable to the Administrator, which assures that design features of the engine minimize the occurrence of failures, malfunctions, or maintenance errors that could result in loss of thrust control, in-flight shutdown, or other power loss.

(b) The design features of the engine must address problems that have been shown to result in loss of thrust control, in-flight shutdown, or other power loss, when compared to the applicant's other relevant type design approvals received within the past ten years, providing that adequate service data is available within that ten year period. Applicants without applicable engine service experience may show equivalent experience and equivalent knowledge of problem mitigating design practices to that gained from actual service experience in a manner acceptable to the Administrator.

(c) The following test must be conducted on an engine that substantially conforms to the type design and in accordance with an approved test plan that consists of:

(1) *Simulated ETOPS Mission Cyclic Endurance.* The test must include a minimum of 3,000 representative service start-stop mission cycles (take-off, climb, cruise, descent, approach, landing and thrust reverse), plus three simulated diversion cycles at maximum continuous thrust for the maximum diversion time for which ETOPS eligibility is sought. The diversions are to be approximately evenly distributed over the cyclic duration of the test, with the last diversion to be conducted

within 100 cycles of the completion of the test.

(2) *Unbalance and Vibration Endurance.* (i) The simulated ETOPS mission cyclic endurance test required by § 33.200(c)(1) must be performed with the high speed and low speed main engine rotors independently unbalanced to obtain a minimum of 90 percent of the recommended field service maintenance vibration levels. In addition to the specified unbalance for the low and high-speed rotors, for engines with three main engine rotors, the intermediate speed rotor must also be independently unbalanced to obtain a minimum of 90 percent of the recommended production acceptance vibration level. The vibration level must be defined as the peak level seen during a slow acceleration and deceleration of the engine across the operating speed range.

(ii) Each 60 rpm incremental step of the typical high-speed rotor start-stop mission cycle speed range (take-off, climb, cruise, descent, approach, landing and thrust reverse) must be subjected to a minimum of three million vibration cycles during the cyclic endurance test. The test may be conducted using any rotor speed step increment up to 200 rpm provided that the typical service start-stop cycle speed range is covered. For a 200 rpm step the corresponding vibration cycle count is to be ten million cycles.

(iii) Each 60 rpm incremental step of the high-speed rotor approved operational speed range between minimum flight idle and cruise power, and not covered by § 33.200(c)(2)(ii), must be subjected to a minimum of 300,000 vibration cycles during the cyclic endurance test. The test may be conducted using any rotor speed step increment up to 200 rpm provided that the applicable speed range is covered. For a 200 rpm step the corresponding vibration cycle count is to be 1 million cycles.

(iv) Vibration surveys will be conducted at periodic intervals throughout the cyclic endurance test. The equivalent value of the peak vibration level observed during the surveys must meet the minimum vibration requirement of § 33.200(c)(2)(i).

(v) An alternate vibration test that provides an equivalent demonstration of the unbalance and vibration endurance test specified in paragraphs §§ 33.200(c)(2)(i) through 33.200(c)(2)(iv) may be approved by the Administrator.

(d) Prior to the testing required by § 33.200(c), the test engine must be subjected to a calibration run to document power and thrust characteristics.

(e) At the conclusion of the testing required by § 33.200(c), the test engine must:

(1) Be subjected to a calibration test at sea-level conditions; and any change in thrust characteristics must be within certified limits.

(2) Be visually inspected in accordance with the on-wing inspection recommendations and limits contained in the Instructions for Continued Airworthiness submitted in support of § 33.4.

(3) Be completely disassembled and:

(i) The engine hardware must be inspected:

(A) In accordance with the applicable inspection recommendations and limits contained in the Instructions for Continued Airworthiness submitted in support of § 33.4;

(B) With consideration of the causes of loss of thrust control, in-flight shutdown or other power losses identified by § 33.200(b); and

(C) In a manner to identify wear or distress conditions which could result in loss of thrust control, in-flight shutdown, or other power loss, and which are not specifically identified by § 33.200(b) or addressed within the current Instructions for Continued Airworthiness.

(ii) The engine hardware must not show distress to the extent that could result in loss of thrust control, in-flight shutdown, or other power loss within a period of operation before the component, assembly or system would likely have been inspected or functionally tested for integrity while in service. Such hardware distress must have corrective action implemented by way of design changes, maintenance instructions or operational procedures before ETOPS eligibility is granted.

(iii) The type and frequency of hardware distress that occurs during the engine test must be consistent with the type and frequency of hardware distress that would be expected to occur on ETOPS eligible engines, or any non-ETOPS derivative engines of this type. Additional analysis and/or tests may be required to satisfy this requirement.

(f) The 3,000 cycle simulated ETOPS mission cyclic endurance test required by § 33.200(c) may be used to show compliance with §§ 33.90 and 33.90(b). After completing the full number of test cycles required for an initial maintenance inspection test conducted in accordance with § 33.90(a), the 3,000 cycle simulated ETOPS mission cyclic endurance test may be interrupted so that the engine may be inspected by an on-wing or other method and criteria acceptable to the Administrator. Following the § 33.90(b) inspection, the ETOPS test must be resumed to complete the requirements of § 33.200.

13. Add paragraph A33.3(c) to Appendix A to read as follows:

Appendix A to Part 33—Instructions for Continued Airworthiness

* * * * *

A33.3 Content

* * * * *

(c) *Extended Operations (ETOPS) Requirements.* For engines to be installed in ETOPS airplanes, procedures for engine condition monitoring must be included within the Instructions for Continued Airworthiness. The engine condition monitoring procedures must be able to determine prior to flight, whether an engine is capable of providing, within certified engine operating limits, the maximum power or thrust, bleed air and power extraction required for the desired engine inoperative diversion. For engines to be installed on twin-engine ETOPS airplanes, the engine condition monitoring procedures must be validated before ETOPS eligibility is granted.

PART 121—AIR CARRIER OPERATIONS

14. The authority citation for part 121 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 40119, 41706, 44101, 44701–44702, 44705, 44709–44711, 44713, 44716–44717, 44722, 46105.

15. Add § 121.7 to read as follows:

§ 121.7 Definitions and designations.

The following definitions apply to those sections of part 121 that apply to ETOPS:

Adequate airport means an airport that:

(1) The Administrator determines satisfies safety requirements of part 139, subpart D, excluding aircraft rescue and fire fighting service, or

(2) Meets the landing performance requirements of § 121.197, or

(3) Is a military airport that is active and operational, and meets the landing performance requirements of § 121.197.

ETOPS alternate means an adequate airport listed in the certificate holder's operations specifications that meets the requirements of § 121.624 and the Rescue and Fire Fighting (RFF) requirements of § 121.106 designated in a dispatch/flight release. This definition applies to flight planning and does not in any way limit the discretion of the pilot in command during flight.

ETOPS area of operation. (1) ETOPS area of operation means for turbine engine powered airplanes with two engines, an area beyond 60 minutes from an adequate airport, or with more than two engines, an area beyond 180 minutes from an adequate airport, and

within the authorized ETOPS maximum diversion time approved for the operation being conducted or an area designated by the Administrator as an area of ETOPS applicability. An ETOPS area of operation is calculated at a one-engine inoperative cruise speed (approved) under standard conditions in still air.

(2) The Administrator designates the following areas as ETOPS areas in which the planning, operational, and equipage requirements for ETOPS apply:

(i) NOPAC: The North Pacific Air Traffic Service routes and adjacent airspace between Anchorage and Tokyo Flight Information Region.

(ii) North Pacific: Pacific Ocean areas north of 40° N latitudes including NOPAC ATS routes, and published PACOTS (Pacific organized track system) tracks between Japan and North America.

(iii) Polar areas—North Pole: The entire area north of 78° N latitude.

(iv) Polar areas—South Pole: The entire area south of 60° S latitude.

ETOPS dual maintenance means maintenance actions performed on the same element of identical, but separate ETOPS maintenance significant systems, during the same routine or non-routine visit. This is to recognize and preclude common cause human failure modes without proper verification process or operation test prior to ETOPS.

(1) For turbine engine powered airplanes with two engines—A maintenance action performed on the same element of identical but separate ETOPS significant systems during the same routine or non-routine visit.

(2) For turbine engine powered airplanes with more than two engines—A maintenance action performed on the same element of identical but separate ETOPS significant systems on 2 engines of a 3 engine aircraft, or more than 1 engine per side of a 4 engine aircraft during the same routine or non-routine visit.

ETOPS entry point means, for turbine engine powered airplanes, the first point on the route of an authorized flight which is more than 60 minutes from an adequate airport for airplanes with two engines, or 180 minutes from an adequate airport for airplanes with more than two engines, or a point designated as an entry point in an area designated by the Administrator as an area of ETOPS applicability. The ETOPS entry point is calculated at a one-engine inoperative cruise speed (approved) under standard conditions in still air.

ETOPS maintenance significant system means:

(1) A system for which the redundancy characteristics are directly linked to the number of engines; or

(2) A system that may affect the proper functioning of the engines to the extent that it could result in an in-flight shutdown or uncommanded loss of thrust; or

(3) A system that contributes significantly to the safety of a diversion.

ETOPS qualified personnel means maintenance personnel that have completed the certificate holder's ETOPS training program.

Maximum diversion time means for the purposes of ETOPS in part 121 the diversion time, under standard conditions in still air at the One Engine Inoperative Cruise Speed (Approved).

One engine inoperative cruise speed means, for the purposes of those sections of part 121 applicable to ETOPS, a speed within the certified operating limits of the airplane, selected by the certificate holder and approved by the FAA, that is used for calculating fuel reserve requirements and the still air distance associated with the maximum approved one engine inoperative diversion distance for the flight.

16. Amend § 121.97 by revising paragraph (b)(1)(ii) to read as follows:

§ 121. 97 Airports: Required data.

* * * * *

(b) * * *

(1) * * *

(ii) Public protection including the availability of facilities at each airport or in the immediate area sufficient to protect the passengers and crew from the elements and to see to their welfare.

* * * * *

17. Amend § 121.99 by adding paragraphs (c) and (d) to read as follows:

§ 121.99 Communications facilities.

* * * * *

(c) For ETOPS where voice communication facilities are available, voice communications must be provided. The certificate holder must consider potential routes and altitudes necessary for diversion to ETOPS alternates in determining whether voice communication facilities are available. Where voice communication facilities are not available or is of poor quality, and voice communication is not possible, communications using alternative systems must be substituted.

(d) For ETOPS beyond 180 minutes the certificate holder must have an additional communication system that is capable of providing immediate satellite based voice communications of landline telephone-fidelity. The system must provide communication capability between the flight crew and air traffic services and the flight crew and the certificate holder. The certificate holder must consider potential routes and altitudes necessary for diversion to ETOPS alternates in determining whether immediate, satellite based voice communications are available. Where immediate, satellite based voice communications are not available, or are of poor quality, communications using alternative systems must be substituted.

18. Add § 121.106 to read as follows:

§ 121.106 ETOPS alternate: Rescue fire fighting service (RFFS).

(a) Except as provided in paragraph (b) of this section, the following rescue fire fighting service must be available at each airport designated as an ETOPS alternate listed in a dispatch or flight release.

(1) For ETOPS up to 180-minute diversion length, the designated ETOPS alternates must have rescue fire fighting capability equivalent to that specified by ICAO Category 4.

(2) For Two-Engine 207-Minute operations the designated ETOPS Alternates must have rescue fire fighting capability equivalent to that specified by ICAO Category 4. In addition, at least one adequate airport within the 207-minute diversion time must have rescue fire fighting capability equivalent to that specified by ICAO Category 7.

(3) For all other ETOPS operations beyond 180 minutes, the designated ETOPS alternates must have rescue fire fighting capability equivalent to that specified by ICAO Category 7.

(b) If the equipment and personnel required in paragraph (a) are not immediately available at the airport, the airport may still be listed on the dispatch or flight release if the required RFFS capability can be augmented from the local fire fighting assets. Such equipment and personnel must be available on arrival of the diverting airplane and must remain as long as the diverting airplane requires the services. A 30-minute response time for augmentation by the local fire department is adequate if the initial notification to respond can be initiated while the diverting airplane is enroute.

19. Add § 121.122 to read as follows:

§ 121.122 Communications facilities.

(a) Each certificate holder conducting supplemental operations must show that a two-way radio communication system or other means of communication approved by the Administrator is available at points that will ensure reliable and rapid communications, under normal operating conditions over the entire

route, (either direct or via approved point-to-point circuits) between each airplane and the certificate holder, and between each airplane and the appropriate air traffic services, except as specified in § 121.351(c).

(b) For ETOPS where voice communication facilities are available, voice communications must be provided. The certificate holder must consider potential routes and altitudes necessary for diversion to ETOPS alternates in determining whether voice communication facilities are available. Where voice communication facilities are not available or is of poor quality, and voice communication is not possible, communications using alternative systems must be substituted.

(c) For ETOPS beyond 180 minutes the certificate holder must have an additional communication system that is capable of providing immediate satellite based voice communications of landline telephone-fidelity. The system must provide communication capability between the flight crew and air traffic services and the flight crew and the certificate holder. The certificate holder must consider potential routes and altitudes necessary for diversion to ETOPS alternates in determining whether immediate, satellite based voice communications are available. Where immediate, satellite based voice communications are not available, or are of poor quality, communications using alternative systems must be substituted.

20. Amend § 121.135(b) by:

a. Redesignating paragraphs (b)(10) through (b)(22) as paragraphs (b)(11) through (b)(23);

b. Redesignating paragraphs (b)(23) and (b)(24) as paragraphs (b)(25) and (b)(26); and

c. Adding paragraphs (b)(10) and (b)(24) as follows:

§ 121.135 Contents.

* * * * *

(b) * * *

(10) For ETOPS, airplane performance data to support all phases of these operations.

* * * * *

(24) For flag and supplemental operations, a passenger recovery plan applicable to each approved en route alternate airport listed in the air carrier's operations specifications.

* * * * *

21. Amend § 121.161 by revising paragraph (a) and adding paragraph (d) to read as follows:

§ 121.161 Airplane limitations: Type of route.

(a) No certificate holder may operate a turbine engine powered airplane over a route that contains a point farther than 60 minutes flying time from an adequate airport for airplanes with two engines, or 180 minutes flying time from an adequate airport for airplanes with more than two engines, (in still air at normal cruising speed with one engine inoperative) or within an area designated by the Administrator as an Area of ETOPS Applicability unless approved by the Administrator in accordance with Appendix O of this part. The polar areas are designated as areas of ETOPS applicability. ETOPS must be authorized in the certificate holder's operations specifications.

* * * * *

(d) Unless authorized by the Administrator, based on the character of the terrain, the kind of operation or the performance of the airplane to be used, no certificate holder may operate a reciprocating engine powered airplane over a route that contains a point farther than 60 minutes flying time (in still air at normal cruising speed with one engine inoperative) from an adequate airport.

22. Add § 121.374 to read as follows:

§ 121.374 ETOPS maintenance elements.

Each certificate holder authorized to conduct ETOPS under Appendix O must have a maintenance program that includes the following:

(a) *Configuration, maintenance, and procedures (CMP) compliance.* A system to ensure compliance with the minimum requirements set forth in the Configuration, Maintenance and Procedures (CMP) for each airframe and engine combination, or the Type Design document for each airframe and engine combination. Any CMP changes necessary for continued safe ETOPS flights will be mandated through the Airworthiness Directive procedures pursuant to part 39 of this chapter.

(b) *Continuous airworthiness maintenance program (CAMP).* Develop and follow a continuous airworthiness maintenance program based on the manufacturers maintenance program or one currently approved for the operator and supplemented for ETOPS for each airframe and engine combination. The program must include the following:

(1) *ETOPS pre-departure service check.* A check that must be accomplished immediately prior to an ETOPS flight and certified complete by an ETOPS qualified maintenance person.

(2) *Dual maintenance.* (i) Procedures to preclude ETOPS dual maintenance.

(ii) Procedures to use if ETOPS dual maintenance cannot be avoided.

(3) *Verification program.* Procedures for corrective action to an ETOPS maintenance significant system.

(4) *Task identification.* Identify ETOPS specific procedures or tasks that must be accomplished or verified by ETOPS qualified personnel.

(5) *Centralized maintenance control procedures.* Establish and document procedures for centralized Maintenance Control related to ETOPS.

(6) *ETOPS program document.* Develop a document for use by personnel involved in ETOPS. All ETOPS requirements, including supportive programs, procedures, duties and responsibilities, must be identified in this document and submitted for approval to the CHDO. This document is not required to be inclusive but must at least reference the maintenance programs and clearly define where they are located in the certificate holder's document system. Changes to the ETOPS document must be submitted to the CHDO and approved before such changes may be adopted.

(7) *ETOPS parts control.* Develop an ETOPS parts control program to ensure the proper identification of parts to maintain the ETOPS configuration.

(8) *Reliability program.* Develop an ETOPS reliability program, or supplement the existing reliability program. The program must be event-oriented and incorporate reporting procedures for significant events detrimental to ETOPS flights.

(i) In addition to the reporting requirements in § 121.703, the following items must be reported within 72 hours to the CHDO:

(A) In-flight shutdowns.

(B) Diversions or turnback.

(C) Uncommanded power changes or surges.

(D) Inability to control the engine or obtain desired power.

(E) Problems with systems critical to ETOPS.

(F) Any other event detrimental to ETOPS.

(ii) The certificate holder must conduct an investigation into the cause of the occurrence of any event listed in § 121.703 and paragraph (b)(8)(i) of this section in conjunction with manufacturers and submit findings and description of corrective action to the CHDO. The report must be submitted in the manner prescribed by § 121.703(e). The corrective action must be acceptable to the CHDO.

(c) *Propulsion system monitoring.* (1) If the IFSD rate computed on a 12-month rolling average exceeds the following values, the certificate holder, in conjunction with the CHDO, must

investigate common cause effects or systemic errors.

(i) Two engine airplanes:

(A) 0.05/1,000 engine hours for ETOPS up to and including 120 minutes;

(B) 0.03/1,000 engine hours for ETOPS beyond 120 minutes up to and including 180 minutes, and 207 minutes in North Pacific; and

(C) 0.02/1,000 engine hours for ETOPS beyond 180 minutes, except for 207 minutes in North Pacific.

(ii) For airplanes with more than two engines:

(A) 0.2/1,000 engine hours for 3-engine ETOPS; and

(B) 0.1/1,000 engine hours for 4-engine ETOPS.

(2) The report of investigation and, if necessary, corrective action taken, must be submitted within 30 days through the CHDO to the Director of the Flight Standards Service for approval.

(d) *Engine condition monitoring.* The certificate holder must establish and conduct an Engine Condition Monitoring program to detect deterioration, at an early stage, and to allow for corrective action before safe operation is affected.

(1) This program must describe the parameters to be monitored, method of data collection, analysis, and corrective action process.

(2) The program must ensure that engine limit margins are maintained so that a prolonged engine inoperative diversion may be conducted without exceeding approved engine limits (for example, rotor speeds, exhaust gas temperatures) at all approved power levels and expected environmental conditions.

(e) *Oil consumption monitoring.* The certificate holder must establish and conduct an engine oil consumption monitoring program to ensure that there is enough oil to complete any ETOPS flight. The operator's consumption limit must not exceed the manufacturer's recommendations. The program must consider the amount of oil added at the departing ETOPS stations with reference to the running average consumption. The monitoring must be continuous up to and including oil added at the ETOPS departure station. The APU must be included if an APU is required for ETOPS.

(f) *APU in-flight start program.* If APU in-flight start capability is required for ETOPS, the certificate holder must have a cold soak in-flight APU start and run reliability program acceptable to the Administrator.

(g) *Maintenance training.* The certificate holder must review the airplane and engine combination maintenance training program with the CHDO to ensure that it adequately supports ETOPS training requirements. The certificate holder must develop additional ETOPS specific training that focuses on the special nature of ETOPS and is required for all personnel involved in ETOPS. This training is in addition to the operator's accepted maintenance training program to qualify individuals for specific airplanes and engines.

(h) *Procedural changes.* Any substantial changes to the maintenance or training procedures established to qualify for ETOPS must be submitted to the CHDO and approved before they may be adopted.

23. Amend § 121.415 by adding paragraph (a)(4) to read as follows:

§ 121.415 Crewmember and dispatcher training requirements.

(a) * * *

(4) Training for crewmembers and dispatchers in their roles and responsibilities in the certificate holder's passenger recovery plan.

* * * * *

24. Amend § 121.565 by revising paragraph (a) to read as follows:

§ 121.565 Engine inoperative: Landing; reporting.

(a) Except as provided in paragraph (b) of this section, whenever an engine of an airplane fails or whenever an engine is shutdown to prevent possible damage, the pilot in command shall land the airplane at the nearest suitable airport in point of time at which a safe landing can be made.

* * * * *

25. Add § 121.624 to read as follows:

§ 121.624 ETOPS alternates.

(a) No person may dispatch an airplane for ETOPS unless the ETOPS Alternates listed in the dispatch or flight release are located such that the airplane remains within the authorized ETOPS maximum diversion time under which the flight is to be dispatched. The certificate holder must consider all adequate airports within the diversion limits of the operation that meet the standards of this part. Each required ETOPS Alternate must be listed in the dispatch or flight release.

(b) No person may list an airport as an ETOPS Alternate in the dispatch or flight release unless the appropriate weather reports or forecasts or any combination thereof indicating that weather conditions are at or above ETOPS Alternate minima specified in the certificate holder's operations specifications and with field condition reports indicating that a safe landing can be accomplished at the time of the intended operation (from the earliest to the latest time of landing at that airport). Once a flight is enroute, the ETOPS Alternates must meet the requirements of § 121.631(c).

(c) No person may list an airport as an ETOPS Alternate in the dispatch or flight release unless that airport meets the requirements of this part.

(d) No person may list an airport as an ETOPS Alternate in the dispatch or flight release unless that airport meets the public protection requirements of § 121.97(b)(1)(ii).

26. Revise § 121.625 to read as follows:

§ 121.625 Alternate airport weather minimums.

Except as required by § 121.624, no person may list an airport as an alternate in the dispatch or flight release unless the appropriate weather reports or forecasts or any combination thereof indicate that the weather conditions will be at or above the alternate weather minimums specified in the certificate holder's operations specifications for that airport when the flight arrives.

27. Amend § 121.631 by redesignating paragraphs (c) and (d) as paragraphs (e) and (f), respectively, and adding new paragraphs (c) and (d) to read as follows:

§ 121.631 Original dispatch or flight release, redispatch or amendment of dispatch or flight release.

* * * * *

(c) For ETOPS, in addition to paragraph (b) of this section, no person may allow a flight to continue beyond the ETOPS Entry Point unless the weather conditions at required ETOPS Alternates specified in the dispatch or flight release are reviewed and forecast to be at or above the operating minimums specified in the operations specifications for that airport during the period in which that airport may be expected to be used (from the earliest to the latest time of landing at that airport). Such a review must include all ETOPS Alternates within the dispatch diversion time of the planned routing and advice to the flight crew of any changes that have occurred since dispatch. However, the dispatch or flight release may be amended en route to add any ETOPS Alternate with weather above operating minima and that is within the maximum ETOPS diversion time that could be authorized for that flight.

(d) The pilot in command for supplemental operators, or a dispatcher for flag operators must, prior to the ETOPS Entry Point, use company communications to update any revised flight plan if required as a result of

re-evaluation of aircraft system capabilities.

28. Add § 121.633 to read as follows:

§ 121.633 ETOPS: Time limited system planning.

(a) For ETOPS up to and including 180 minutes, the time required to fly the distance to the planned ETOPS Alternate or Alternates, at the approved one engine inoperative cruise speed, in still air and standard day temperature, may not exceed the time specified in the Airplane Flight Manual for the airplanes most time limited system time minus 15 minutes.

(b) Except as provided in paragraphs (c) and (d) of this section, for ETOPS beyond 180 minutes, the time required to fly the distance to the planned ETOPS Alternate or Alternates, at the all engines operating cruise speed, correcting for wind and temperature, may not exceed the time specified in the Airplane Flight Manual for the airplane's cargo fire suppression system time minus 15 minutes.

(c) Except as provided in paragraphs (b) and (d) of this section, for ETOPS beyond 180 minutes, the time required to fly the distance to the planned ETOPS Alternate or Alternates, at the approved one engine inoperative cruise speed, correcting for wind and temperature, may not exceed the time specified in the Airplane Flight Manual for the airplanes most time limited system time (except for cargo fire suppression) minus 15 minutes.

(d) Three and four-engine turbine powered airplanes not meeting the requirements of paragraph (b) of this section as of the effective date of this regulation may continue ETOPS operations for a period not to exceed 6 years from the effective date of this regulation.

29. Add § 121.646 to read as follows:

§ 121.646 En route fuel supply: flag and supplemental operations.

(a) No person may dispatch or release for flight or takeoff a turbine engine powered airplane with more than two engines more than 90 minutes (with all engines operating at cruising power) and less than 180 minutes (at the approved one engine inoperative cruise speed) from an adequate airport unless, considering wind and other weather conditions (including icing), it has enough fuel, assuming a rapid decompression at the most critical point followed by descent to a safe altitude in compliance with the oxygen supply requirements of § 121.333, to fly to an adequate airport and conduct a normal approach and landing with enough fuel remaining to hold for 15 minutes at 1500 feet above field elevation.

(b) No person may dispatch or release for flight or takeoff a turbine powered airplane in ETOPS unless, considering wind and other weather conditions expected, it has enough fuel to satisfy the following requirements (b)(1) through (b)(4) of this section:

(1) Greater of:

(i) Fuel sufficient to fly to an ETOPS Alternate assuming a rapid decompression at the most critical point followed by descent to a safe altitude in compliance with the oxygen supply requirements of § 121.333, or

(ii) Fuel sufficient to fly to an ETOPS Alternate at the approved one engine inoperative cruise speed assuming a rapid decompression and a simultaneous engine failure at the most critical point followed by descent to a safe altitude in compliance with the oxygen supply requirements of § 121.333, or

(iii) Fuel sufficient to fly to an ETOPS Alternate at the approved one engine inoperative cruise speed assuming an engine failure at the most critical point followed by descent to the one engine inoperative cruise altitude.

(2) Upon reaching the alternate hold at 1500 feet above field elevation for 15 minutes and then conduct an instrument approach and land.

(3) Add a 5% wind speed factor (*i.e.*, an increment to headwind or a decrement to tailwind) on the actual forecast wind used to calculate fuel in paragraph (b)(1)(i) above to account for any potential errors in wind forecasting. If a certificate holder is not using the actual forecast wind based on wind model acceptable to the FAA, allow 5% of the fuel required for paragraph (b)(1)(i) above, as reserve fuel to allow for errors in wind data.

(4) Compensate in paragraph (b)(1)(i) above for the greater of:

(A) The effect of airframe icing during 10 percent of the time during which icing is forecast (including the fuel used by engine and wing anti-ice during this period), or

(B) Fuel for engine anti-ice, and if appropriate wing anti-ice for the entire time during which icing is forecast.

(C) Unless the certificate holder has a program established to monitor airplane in-service deterioration in cruise fuel burn performance and includes in fuel supply calculations fuel sufficient to compensate for any such deterioration, increase the fuel supply by 5% to account for deterioration in cruise fuel burn performance.

(D) If an APU is a required power source, then its fuel consumption must be accounted for during the appropriate phases of flight.

30. Amend § 121.687 by adding paragraph (a)(6) to read as follows:

§ 121.687 Dispatch release: Flag and domestic operations.

(a) * * *

(6) For each flight dispatched as an ETOPS flight, the ETOPS time basis (if any) under which the flight is dispatched.

* * * * *

31. Amend § 121.689 by adding paragraph (a)(8) to read as follows:

§ 121.689 Flight release form: Supplemental operations.

(a) * * *

(8) For each flight released as an ETOPS flight, the ETOPS time basis (if any) under which the flight is released.

* * * * *

32. Add appendix O to read as follows:

Appendix O to Part 121—Requirements for ETOPS

The Administrator may approve ETOPS for various areas of operation in accordance with the requirements and limitations specified in this appendix.

A. ETOPS Authorizations: Airplanes with Two engines

(a) *75 Minutes ETOPS— (1) Caribbean/Western Atlantic Area.* Approvals may be granted to conduct ETOPS with maximum diversion times up to 75 minutes on Western Atlantic/Caribbean area routes. The airframe and engine combination shall be reviewed by the Administrator to ensure the absence of factors that could prevent safe operations. The airframe and engine combination need not be approved for ETOPS; however, it must have sufficient favorable experience to demonstrate a level of reliability appropriate for 75-minute ETOPS. These operations must comply with the requirements of section 121.633. The certificate holder must employ an FAA approved maintenance program that specifically addresses factors significant to 75-minute ETOPS operations except that a service check before departure of the return flight may not be required.

(2) *Other Areas.* Approvals may be granted to conduct ETOPS operations with maximum diversion times up to 75 minutes on other than Western Atlantic/Caribbean area routes. The airframe and engine combination shall be reviewed by the Administrator to ensure the absence of factors that could prevent safe operations. The airframe and engine combination need not be approved for ETOPS; however it must have sufficient favorable experience to demonstrate a level of reliability appropriate for 75-minute ETOPS. These operations must comply with the requirements of section 121.633. The certificate holder must employ an FAA approved operations and maintenance program that specifically addresses factors significant to 75-minute ETOPS operations.

(b) 90-minutes ETOPS (Micronesia). Approvals may be granted to conduct ETOPS

with maximum diversion times up to 90 minutes on Micronesian area routes. For such operations the airframe and engine combination must be type design approved for a minimum of 120 minute ETOPS. The certificate holder must employ an FAA approved operations and maintenance program that specifically addresses factors significant to 120 minute ETOPS, except that a service check before departure of the return flight may not be required. Minimum equipment list requirements for 120 minute extended range (''ER'') operations apply to such operations.

(c) *120 minutes.* Approvals may be granted to conduct ETOPS with maximum diversion times up to 120 minutes. For such operations the airframe/engine combination must be type design approved for a minimum of 120 minute ETOPS. The certificate holder must employ an FAA approved operations and maintenance program that specifically addresses factors significant to 120 minute ETOPS. Minimum equipment list requirements for 120 minute extended range (''ER'') operations apply to such operations.

(d) *138 Minutes.* 138-minute ETOPS must be operated under one of the following:

(1) *Extension of 120-minute ETOPS authority.* Approvals may be granted to conduct ETOPS with maximum diversion times up to 138 minutes. This authority is deemed to be an extension of already existing 120-minute ETOPS authority, and may only be exercised on a flight-by-flight exception basis. For such operations the airframe-engine combination must be type design approved for a minimum of 120 minute ETOPS. In addition, airplane time-limited system capability may not be less than the authorized 138-minute diversion time in still air conditions at the approved one engine inoperative cruise speed plus a 15-minute allowance for holding, approach and landing. The certificate holder must employ an FAA approved operations and maintenance program that specifically addresses factors significant to 138-minute ETOPS. Operators with 120-minute ETOPS authority but no 180-minute authority may apply to AFS–200 through their certificate holding district office (CHDO) for a modified MEL which satisfies the MMEL policy for system/component relief in ETOPS beyond 120 minutes. The certificate holder shall submit for FAA approval a summary of revisions to training curricula for maintenance, dispatch and flight crew personnel which identifies differences between 138-minute ETOPS diversion authority and its previously approved 120-minute ETOPS diversion authority.

(2) *Use of existing 180-minute ETOPS approval.* Approvals may be granted to conduct ETOPS with maximum diversion times up to 138 minutes to certificate holders with existing 180 minute ETOPS approval. This authority may be exercised on an unlimited basis. For such operations the airframe/engine combination must be type design approved for a minimum of 180-minute ETOPS. The certificate holder must employ an FAA approved operations and maintenance program that specifically addresses factors significant to 138-minute ETOPS. Approved minimum equipment list provisions for ''beyond 120 minutes ETOPS'' apply to these operations. The certificate holder shall submit for FAA approval a summary of revisions to training curricula for maintenance, dispatch and flight crew personnel which identifies differences between 138-minute ETOPS diversion authority and its previously approved 180-minute ETOPS diversion authority.

(e) *180 minutes.* Approvals may be granted to conduct ETOPS with maximum diversion times up to 180 minutes. For such operations the airframe and engine combination must be type design approved for a minimum of 180-minute ETOPS. The certificate holder must employ an FAA approved operations and maintenance program that specifically addresses factors significant to 180-minute ETOPS operations. Minimum equipment list provisions for ''beyond 120 minutes ETOPS'' apply to these operations.

(f) *Greater than 180 minutes.*

Approvals may be granted to certificate holders with previous ETOPS experience to conduct ETOPS with maximum diversion times exceeding 180 minutes as specified in paragraphs (g) through (j) of this appendix. Approvals may be granted only to certificate holders with existing 180 minutes ETOPS approval on the airframe/engine combination listed in their application. In conducting all such operations, operators must make every attempt to minimize diversion time along the preferred track and plan ETOPS at maximum diversion distances of 180 minutes or less. If conditions prevent the use of adequate airports within 180 minutes as ETOPS Alternates, the route may be flown beyond 180 minutes authority subject to the requirements provided for the specific area of operations. In addition to the MEL limitations for 180 minute ETOPS, the following systems must be operational for dispatch:

(1) Fuel Quantity Indicating System (FQIS),

(2) APU (including electrical and pneumatic supply to its designed capability),

(3) auto throttle system,

(4) the communication system required by section 121.99(d) or 121.122(c), as applicable, and

(5) one engine inoperative auto land capability, if flight planning is predicated on its use.

Operators must inform the flight crew any time an aircraft is proposed for dispatch under this authority and make available the dispatch considerations requiring such operations.

(g) *North Pacific.*

On flight by flight exception basis, tracked by the certificate holder, when an ETOPS Alternate is not available within 180 minutes in the North Pacific area of operation, the nearest available ETOPS Alternate must be specified within 207 minutes maximum diversion time. In conducting such operations the operator must give Air Traffic Services preferred track, if available, the first consideration. Application of this exception must be limited to circumstances such as political or military concern, volcanic activity, airport weather below dispatch requirements, temporary airport conditions and other weather related events. For such operations, the airframe and engine combination must be type design approved for a minimum of 180-minute ETOPS. The time required to fly the distance to the planned ETOPS Alternate or alternates, at the approved one engine inoperative cruise speed, in still air and standard day temperature, may not exceed the time specified in the Airplane Flight Manual for the airplane's most time limited system time minus 15 minutes.

(h) *Polar Area (North Pole) and North of NOPAC.*

On a flight by flight exception basis, tracked by the certificate holder, when an ETOPS alternate is not available within 180 minutes in the Polar Area (North Pole) or north of the North Pacific Area of Operations, the nearest available ETOPS Alternate must be specified within 240 minutes maximum diversion time. Application of this exception shall be limited to circumstances related to the weather extremes particular to this area of the world such as volcanic activity, extreme cold weather at en route airports, airport weather below dispatch requirements, temporary airport conditions and other weather related events. The criteria used by the certificate holder to make determinations that extreme weather precludes the use of an airport must be established by the certificate holder and accepted by the FAA and published in the certificate holder's manual for the use of dispatchers and pilots. For such operations, the airframe/engine combination must be type design approved for a minimum of 240-minute ETOPS as specified in the Configuration Maintenance and Procedures (CMP) Standard for such operations. For such operations, the requirements in paragraph C, Polar Area (North & South Pole) and ETOPS beyond 180 minutes North of the NOPAC area, of this appendix apply.

(i) *240 minutes Area of Operations.*

Approvals may be granted to certificate holders with previous ETOPS experience and existing 180-minute ETOPS approval for the airframe engine combination listed in their application to conduct ETOPS with maximum diversion times up to 240 minutes on routes in the Pacific oceanic areas between the U.S. west coast and Australia, New Zealand and Polynesia; south Atlantic oceanic areas; Indian Oceanic areas; oceanic areas between Australia and South America. The operator must designate the nearest available ETOPS Alternate or Alternates along the planned route of flight. For such operations, the airframe and engine combination must be type design approved for a minimum of 240 minute ETOPS. All requirements specified in the Configuration Maintenance and Procedures (CMP) Standard for 240 minute ETOPS are applicable to such operations.

(j) *Beyond 240 minutes Area of Operations.*

Approvals may be granted, to certificate holders who have been operating in accordance with 180 minute or greater ETOPS for 24 consecutive months, of which at least 12 consecutive months shall be at 240 minute ETOPS on the airframe/engine combination for which the authority is requested, to conduct ETOPS with maximum diversion times beyond 240 minutes between city pairs on routes in the Pacific oceanic areas between the U.S. west coast and

Australia, New Zealand and Polynesia; south Atlantic oceanic areas; Indian Oceanic areas; oceanic areas between Australia and South America, and South Pole area. The operator must designate the nearest available ETOPS alternate(s) along the planned route of flight. For such operations, the airframe and engine combination must be type design approved for at least the maximum authorized ETOPS diversion time necessary for that operation. All requirements specified in the Configuration Maintenance and Procedures (CMP) Standard for beyond 240 minute ETOPS are applicable to such operations.

B. ETOPS Authorizations: Airplanes with more than two engines

Approvals may be granted to conduct ETOPS on a routine basis with maximum diversion times up to 240 minutes in any area of operations. For all such operations, the nearest available ETOPS Alternate within 240 minutes diversion time (in still air at one engine inoperative speed) must be specified. If an ETOPS Alternate is not available within 240 minutes, the nearest alternate ETOPS alternate must be specified. In either case the operator must designate the nearest available ETOPS Alternate(s) along the planned route of flight. On all such operations, MEL limitations for ETOPS apply and in addition, the Fuel Quantity Indicating System (FQIS) and the communications requirements of § 121.99(d) or § 121.122(c) must be operational. For company communications on such operations, operators must use the system required by § 121.99(d). For such operations, the airframe and engine combination must be type design approved for the maximum authorized ETOPS diversion time.

C. Polar Area (North & South Pole) and ETOPS Beyond 180 Minutes North of the NOPAC Area

Approvals may be granted to conduct any operations within these areas. To obtain such approvals, in addition to the requirements in paragraphs (A) and (B) of this appendix, the operator must consider airport requirements for ETOPS Alternates, airline recovery plan for passengers at diversion alternates, fuel freeze strategy and monitoring, communication capability, Minimum Equipment List considerations, airline training issues specific to polar operations, long range crew requirements, dispatch and crew considerations during solar flare activity, special equipment requirements, and validation requirements for area approval in a manner acceptable to the Administrator.

PART 135—OPERATING REQUIREMENTS; COMMUTER AND ON DEMAND OPERATION AND RULES GOVERNING PERSONS ON BOARD SUCH AIRCRAFT

33. The authority citation for part 135 continues to read as follows:

Authority: 49 U.S.C. 106(g), 41706, 44113, 44701–44702, 44705, 44709, 44711–44713, 44715–44717, 44722.

34. Add § 135.98 to read as follows:

§ 135.98 Polar operations.

Except for intrastate operations within the State of Alaska, no person may operate an aircraft in the region north of N 78° 00′, designated as Polar, unless authorized by the Administrator and unless the certificate holder's operation specifications address the following items:

(a) Designation and requirements for airports that may be used for enroute diversions.

(b) Recovery plan for passengers at diversion alternates.

(c) Fuel freeze strategy and monitoring requirements for Polar operations.

(d) Communication capability for Polar operations.

(e) MEL considerations for Polar operations.

(f) Training issues for Polar operations.

(g) Crew considerations during solar flare activity.

(h) Special equipment for Polar operations

35. Amend § 135.345 by removing the word ''and'' from the end of (a)(7), redesignating paragraph (a)(8) as (a)(10), and by adding new paragraphs (a)(8) and (a)(9) to read as follows:

§ 135.345 Pilots: Initial, transition, and upgrade ground training.

* * * * *

(a) * * *

(8) ETOPS, if applicable;

(9) Passenger Recovery for ETOPS, if applicable; and

* * * * *

36. Add § 135.364 to read as follows:

§ 135.364 Multi-engine airplane limitations: Maximum distance from an airport.

Unless approved by the Administrator in accordance with Appendix H of this part (Extended Operations (ETOPS)), no certificate holder may operate an airplane outside the continental U.S. unless the planned route for that airplane remains within 180 minutes flying time (in still air at normal cruise speed with one engine inoperative) from an airport meeting the requirements of §§ 135.385, 135.387, 135.393 or 135.395, as applicable, and §§ 135.219 or 135.221 as applicable.

37. Amend § 135.411 by adding paragraph (d) to read as follows:

§ 135.411 Applicability.

* * * * *

(d) A certificate holder performing Extended Operations must comply with paragraph (a)(2) of this section and the additional requirements of Appendix H of this part.

38. Add appendix H to read as follows:

Appendix H to Part 135—Extended Operations (ETOPS)

The Administrator may approve ETOPS for various areas of operation in accordance with the requirements and limitations specified in this appendix

(A) Definitions

(1) *ETOPS: Extended operations.*

ETOPS is an operation authorized under part 135 for flights beyond 180 minutes flying time (in still air at normal cruise speed with one engine inoperative) from an airport meeting the requirements of §§ 135.385, 135.387, 135.393 or 135.395, as applicable, and §§ 135.219 or 135.221 as applicable. However, ETOPS flights must be planned so as to remain within 240 minutes flying time (in still air with one engine inoperative) from an airport meeting the requirements of §§ 135.385, 135.387, 135.393 or 135.395, as applicable, and §§ 135.219 or 135.221 as applicable.

(2) *ETOPS dual maintenance.*

Maintenance actions performed on the same element of identical, but separate ETOPS maintenance significant systems, during the same routine or non-routine visit. This is to recognize and preclude common cause human failure modes without proper verification process or operation test prior to ETOPS.

(B) Certificate Holder Experience Prior to Conducting ETOPS

(1) Prior to applying for authorization to conduct ETOPS, the certificate holder must have at least 12 months operating experience with a type of transport category turbine-engine powered airplane conducting international operations (excluding Canada and Mexico). For the purpose of this subparagraph, operations to or from the State of Hawaii may be considered as experience in international operations.

(2) Certificate holders granted authority to operate under part 135 or part 121 before [*insert date final rule is effective*] may credit up to 6 months of domestic operating experience (including Canada and Mexico) in a transport category turbojet airplane as part of the required 12 months of international experience.

(3) A certificate holder's previous ETOPS experience with other aircraft types may be considered by the Administrator as meeting the requirements of paragraph (B)(1) in whole or in part.

(C) Airplane Requirements

(1) No person may conduct ETOPS in a multi-engine airplane that was added to the certificate holder's U.S. operations specifications after [*insert date that is eight years after the effective date of this final rule*] unless the airplane is certificated to § 25.1535.

(2) No person may conduct ETOPS in a multi-engine airplane that was added to the certificate holder's U.S. operations specifications on or before [*insert date that is eight years after the effective date of this final rule*] unless the airplane has the following systems capability acceptable to the Administrator:

(a) *Electrical System.* Three or more independent electrical power sources must

be available, each of which must be capable of providing power for all of the equipment required by this part for the duration of any diversion.

(b) *Fuel System.* The fuel supply system must be able to provide sufficient fuel for the duration of any diversion following any single failure of fuel system components.

(D) Certificate Holder Requirements

(1) No certificate holder may operate an airplane in accordance with ETOPS unless the planned route for that airplane remains within 240 minutes flying time (in still air and one engine inoperative) from an airport meeting the requirements of § 135.385, § 135.387, § 135.393 or § 135.395, as applicable, and § 135.219 or § 135.221 as applicable.

(2) In addition to the requirements of § 135.83, § 135.225 and § 135.229 the certificate holder will ensure flight crews have in-flight access to current weather and operational information on all enroute alternate, destination and destination alternate airports proposed for each ETOPS flight.

(E) Operational Requirements

(1) No pilot in command may allow a flight to continue beyond the ETOPS entry point unless the weather and operating conditions at the required enroute alternate airports are reviewed and expected to be at or above the operating minimums specified in the operations specifications during the period in which that airport may be expected to be used based on expected estimated times of arrival at that airport. The planned route of flight may be amended while en route to allow use of additional enroute alternate airports provided weather is forecast to be at or above operating minima and the airport is within the maximum ETOPS diversion time.

(2) Pilots shall plan and conduct ETOPS under instrument flight rules.

(3) Time Limited Systems.

(a) For ETOPS, the time required to fly the distance to the planned ETOPS alternate or alternates, at the all engines operating cruise speed, correcting for wind and temperature, may not exceed the time specified in the Airplane Flight Manual for the airplane's cargo fire suppression system time (if installed), minus 15 minutes.

(b) Except as provided in paragraph (a) above, the time required to fly the distance to the planned ETOPS Alternate or Alternates, at the approved one engine inoperative cruise speed, correcting for wind and temperature, may not exceed the time specified in the Airplane Flight Manual for the airplanes most time limited system time (except for cargo fire suppression) minus 15 minutes.

(c) Certificate holders operating turbine-engine powered airplanes that, on the effective date of this regulation, lack the airplane flight manual information required by paragraphs a and b above, may continue ETOPS operations for a period not to exceed the date that occurs eight years following the effective date of this rule.

(F) Communications Requirements

(1) No person may conduct an ETOPS flight unless the following communications equipment, appropriate to the route to be flown, is installed and operational:

(a) Two independent communication transmitters (at least one must allow voice communication).

(b) Two independent communication receivers (at least one must allow voice communication).

(c) Two headsets, or one headset and one speaker.

(2) In areas where voice communication facilities are not available, or voice communication is not possible or is of poor quality, communications using alternative systems may be substituted.

(G) Fuel Planning Requirements

1. No person may take off a flight for operations in ETOPS unless the fuel carried on board is the greater of:

a. Fuel required under § 135.223, or

b. Considering forecast wind and other weather conditions, the airplane carries sufficient fuel to complete the flight under the following conditions:

(i) Greater of:

(a) Fuel sufficient to fly to a ETOPS enroute alternate airport assuming a rapid decompression at the most critical point followed by descent to a safe altitude in compliance with the oxygen supply requirements of § 135.157; or

(b) Fuel sufficient to fly to a ETOPS enroute alternate airport at the approved one engine inoperative cruise speed assuming a rapid decompression and a simultaneous engine failure at the most critical point followed by descent to a safe altitude in compliance with the oxygen supply requirements of § 135.157; or

(c) Fuel sufficient to fly to a ETOPS enroute alternate airport at the approved one engine inoperative cruise speed assuming an engine failure at the most critical point followed by descent to the one engine inoperative cruise altitude.

(ii) Upon reaching the enroute alternate airport, hold at 1500 ft. above field elevation for 15 minutes and then conduct an instrument approach and land.

(iii) Add a 5% wind speed factor (*i.e.*, an increment to headwind or a decrement to tailwind) on the actual forecast wind used to calculate fuel in paragragh b.(i) of this appendix to account for any potential errors in wind forecasting. If a certificate holder is not using the actual forecast wind based on wind model acceptable to the FAA, allow 5% of the fuel required for a above, as reserve fuel to allow for errors in wind data.

(iv) Compensate in paragraph b.(i) above for the greater of:

(A) The effect of airframe icing during 10 percent of the time during which icing is forecast, or

(B) Fuel for engine anti-ice, and if appropriate wing anti-ice for the time during which icing is forecast,

2. Unless the certificate holder has a program established to monitor airplane in-service deterioration of cruise fuel burn performance and includes in fuel supply calculations fuel sufficient to compensate for any such deterioration, increase the fuel supply by 5 percent to account for deterioration in cruise fuel burn performance.

3. If the APU is a power source required by this appendix, then its fuel consumption must be accounted for.

(H) Maintenance Program Requirements

Each certificate holder authorized to conduct ETOPS under section 135.364 must have a maintenance program that includes the following:

(a) *Configuration, Maintenance, and Procedures (CMP) compliance.*

A system to ensure compliance with the minimum requirements set forth in the Configuration, Maintenance and Procedures (CMP) for each airframe and engine combination, or the Type Design document for each airframe and engine combination.

(b) *Continuous airworthiness maintenance program (CAMP).*

Develop and follow a continuous airworthiness maintenance program based on the manufacturers maintenance program or one currently approved for the operator and supplemented for ETOPS for each airframe and engine combination. The program must include the following:

(1) *ETOPS pre-departure service check.* A check that must be accomplished immediately prior to an ETOPS flight and certified complete by an ETOPS qualified maintenance person

(2) *Dual maintenance.*

(a) Procedures to preclude ETOPS dual maintenance.

(b) Procedures to use if ETOPS dual maintenance cannot be avoided.

(3) *Verification program.* Procedures for corrective action to an ETOPS maintenance significant system.

(4) *Task identification.* Identify ETOPS specific procedures or tasks that must be accomplished or verified by ETOPS qualified personnel.

(5) *Centralized maintenance control procedures.* Establish and document procedures for centralized Maintenance Control related to ETOPS.

(6) *ETOPS program document.* Develop a document for use by personnel involved in ETOPS. All ETOPS requirements, including supportive programs, procedures, duties and responsibilities, must be identified in this document and submitted for approval to the CHDO. This document is not required to be inclusive but must at least reference the maintenance programs and clearly define where they are located in the certificate holder's document system. Changes to the ETOPS document must be submitted to the CHDO and approved before such changes may be adopted.

(7) *ETOPS parts control.* Develop an ETOPS parts control program to ensure the proper identification of parts to maintain the ETOPS configuration.

(8) *Enhanced Continuing Analysis and Surveillance System (CASS) program.* The certificate holder must include the ETOPS program elements in the certificate holder's CASS program. The program must incorporate reporting procedures for significant events detrimental to ETOPS flights.

(a) In addition to the reporting requirements in § 135.415 and § 135.417, the following items must be reported within 72 hours to the CHDO.

(1) In-flight shutdowns.

(2) Uncommanded power changes or surges.

(3) Inability to control the engine or obtain desired power.

(4) Problems with systems critical to ETOPS.

(5) Any other event detrimental to ETOPS.

(b) The certificate holder must conduct an investigation into the cause of the occurrence of any event listed in § 135.415, § 135.417, or paragraph (8)(a) above in conjunction with manufacturers and submit findings and corrective action to the CHDO. The report must be submitted in the manner prescribed by section 135.415(e). If the CHDO determines that additional corrective action is necessary, the certificate holder must implement the corrective action.

(c) *Propulsion system monitoring.*

The certificate holder, in conjunction with the CHDO, must

(1) establish criteria as to what action is to be taken when adverse trends in propulsion system conditions are detected and

(2) investigate common cause effects or systemic errors and submit the findings to the CHDO within 30 days.

(d) *Engine condition monitoring.*

The certificate holder must establish an Engine Condition Monitoring program to detect deterioration at an early stage to allow for corrective action before safe operation is affected.

(1) This program must describe the parameters to be monitored, method of data collection and corrective action process.

(2) The program must ensure that engine limit margins are maintained so that a prolonged engine inoperative diversion may be conducted without exceeding approved engine limits (for example, rotor speeds, exhaust gas temperatures) at all approved power levels and expected environmental conditions.

(e) *Oil consumption monitoring.*

The certificate holder must establish an engine oil consumption monitoring program to ensure that there is enough oil to complete any ETOPS flight. The operator's consumption limit must not exceed the manufacturer's recommendations. The program must consider the amount of oil added at the departing ETOPS stations with reference to the running average consumption. The monitoring must be continuous up to and including oil added at the ETOPS departure station. The APU must be included if an APU is required for ETOPS.

(f) *APU in-flight start program.*

If APU in-flight start capability is required for ETOPS, the certificate holder must have a cold soak in-flight APU start and run reliability program acceptable to the Administrator.

(g) *Maintenance training.*

The certificate holder must review the airplane and engine combination maintenance training program with the CHDO to ensure that it adequately supports ETOPS training requirements. The certificate holder must develop additional ETOPS specific training that focuses on the special nature of ETOPS and is required for all personnel involved in ETOPS. This training is in addition to the operator's accepted maintenance training program to qualify individuals for specific airplanes and engines.

(h) *Procedural changes.*

Any substantial changes to the maintenance or training procedures established to qualify for ETOPS must be submitted to the CHDO and approved before they may be adopted.

(i) *Reporting.*

For each airplane authorized to conduct ETOPS, the certificate holder shall report on a quarterly basis operating hours and cycles for each engine and airframe to the CHDO and to the airplane and engine manufacturer.

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James Ballough,

Director, Flight Standards Service.

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