DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

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

[Docket No. FAA–2002–6717; Amendment Nos. 1–55, 21–89, 25–120, 33–21, 121–329, 135–108]

RIN 2120–AI03

Extended Operations (ETOPS) of Multi-Engine Airplanes

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final rule.

SUMMARY: This final rule applies to air carrier (part 121), commuter, and on-demand (part 135) turbine powered multi-engine airplanes used in extended-range operations. However, all-cargo operations in airplanes with more than two engines of both part 121 and part 135 are exempted from the majority of this rule. Today's rule establishes regulations governing the design, operation and maintenance of certain airplanes operated on flights that fly long distances from an adequate airport. This final rule codifies current FAA policy, industry best practices and recommendations, as well as international standards designed to ensure long-range flights will continue to operate safely. To ease the transition for current operators, this rule includes delayed compliance dates for certain ETOPS requirements.

DATES: *Effective date:* These amendments become effective February 15, 2007. *Compliance date:* Some sections of the final rule have a delayed compliance date as discussed in section VI of this document and provided in Table 2 of the appendix.

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SUPPLEMENTARY INFORMATION:

Availability of Rulemaking Documents

You can get an electronic copy using the Internet by:

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

(2) Visiting the Office of Rulemaking's web page at *http://www.faa.gov/regulations_policies/rulemaking/recently_published.*

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You can search comments in the docket by the name of the individual submitting or signing the comment. 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.*

Small Business Regulatory Enforcement Fairness Act

The Small Business Regulatory Enforcement Fairness Act (SBREFA) of 1996 requires FAA to comply with small entity requests for information or advice about compliance with statutes and regulations within its jurisdiction. If you are a small entity and you have a question about this document, you may contact your local FAA official, or the person listed under **FOR FURTHER INFORMATION CONTACT.** You can find out more about SBREFA on the Internet at *http://www.faa.gov/regulations_policies/rulemaking/sbre_act.*

Glossary of Terms Used in This Final Rule

Technical terms used in this final rule are located in 14 CFR 1.2. Definitions used in the rule are found in sections 1.1 and 121.7, and appendix G to part 135 of the final rule language.

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I. Executive Summary

This rule is a result of the FAA's desire to review the current body of rules and guidance for extended-range flight operations and to codify a uniform set of regulations for airplane and engine design in parts 21, 25, and 33, and airplane operations in parts 121 and 135.

Extended operations, or ETOPS, for long-range international travel provide many benefits related to savings in time, fuel, and operational efficiencies. However, there are unique safety concerns associated with these operations. When one travels great distances from airports, the safety of these operations depends on the risk of critical loss of engine thrust, additional system failures during a diversion for any cause, the distance from an adequate airport used in a diversion, and the conditions encountered upon arrival at the diversion airport.

Part 121 domestic, U.S. flag, and supplemental rules have limited the amount of time two-engine airplanes could fly from an airport (14 CFR 121.161). In the past, the risks associated with longer flights were accepted as a function of the number of engines on an airplane and were based on the reliability of engines existing at the time the part 121 rules were initially issued. Airplanes with more than two engines had minimal part 121 regulatory guidance since engine and system redundancies reduce the safety risk associated with engine failures during diversions.[1] Current part 121 regulations for airplanes with more than two engines require adequate oxygen supplies to address emergencies (14 CFR 121.329), but do not explicitly require the operator to consider other risk mitigation measures, such as providing the extra fuel necessary to reach a diversion airport. Likewise, the FAA has regulated turbine-powered on-demand operations under separate part 135 guidance, which specifies performance criteria when an engine is inoperative but not any restrictions based on the potential distance from an airport. (See 14 CFR 135.381 and 135.383.) A lack of regulatory oversight in areas of equipment requirements and fuel planning for a maximum diversion creates a very real safety risk apart from engine reliability.

As engine reliabilities increased during the previous three decades, there had been increasing pressure from the airline industry for the FAA to recognize technological advances and allow part 121 two-engine airplanes to fly farther from airports than § 121.161 allowed. The FAA developed advisory circulars (AC 120–42, June 6, 1985; AC 120–42A, December 30, 1988) that provided guidance for the operation of part 121 two-engine airplanes beyond the regulatory limits.[2] These advisory circulars introduced the term ''ETOPS'' for these extended operations and addressed airplane and engine design aspects, maintenance programs, and operations. Under this guidance, ETOPS operations for part 121 two-engine airplanes are permitted to fly up to 180 minutes from an airport sufficient to accommodate a landing, provided certain criteria are met. The FAA Administrator thus authorizes qualified operators to engage in long-range operations in remote areas. As a result of the FAA's ETOPS programs, two-engine airplane operators can fly over most of the world other than the South Polar Region, a small section in the South Pacific, and the North Polar area under certain winter weather conditions.

Operations under these programs have been highly successful. Although part 121 two-engine ETOPS have increased worldwide from less than 1,000 per *month* in 1985 to over 1,000 per *day* in 2004, engine reliability, as measured by the in-flight shutdown rate (IFSD rate), has improved to a point that is better than one-half the rates experienced in the 1980s.

With the growing success of the current ETOPS guidelines established for part 121 two-engine operators, the FAA recognized in the 1990s that we could no longer continue to administer this program as a special authorization under an operating rule. The FAA also recognized that there were certain aspects of the ETOPS guidelines not solely relevant to two-engine airplanes. Also during this period, the International Civil Aviation Organization (ICAO) established international standards requiring member states to define diversion time thresholds for all two-engine airplane operations. For the United States, this requirement includes airplanes operated under part 135. In addition, the airline industry requested the FAA develop standards extending the existing limit beyond which two-engine airplanes may operate.

The FAA tasked the Aviation Rulemaking Advisory Committee (ARAC) in June 2000 to codify the existing policies and practices to be applicable to all airplanes, regardless of the number of engines, by developing comprehensive ETOPS standards for 14 CFR parts 25, 33, 121, and 135, as appropriate. The FAA also tasked ARAC to develop ETOPS operational requirements for diversion times greater than 180 minutes up to whatever extent may be justified.

During this same period, the FAA developed guidance for polar operations. These operations became more commonplace with the opening up of Siberian airspace following the fall of the former Soviet Union. Although not defined as ETOPS, this guidance has been expanded in today's rule to include both the North and South Polar Areas and has been incorporated into the overall ETOPS rule package. Significantly, this aspect of the rule applies to all turbine-powered multi-engine operations including all-cargo operations.

Today's rule codifies and expands existing FAA policy and route authorizations for all part 121 two-engine airplanes conducting ETOPS beyond certain distances from an adequate airport. This final rule also extends most requirements previously applicable only to part 121 two-engine airplanes to a limited number of part 121 passenger-carrying three- and four-engine airplane operations and applies the same limitations to comparable part 135 operations. Significantly, this rule excludes the ETOPS maintenance requirements from the operation of airplanes with more than two engines in both part 121 and 135. The FAA has accepted the safety case that current

[1] Airplanes with more than two engines are excluded from the section 121.161 requirement to remain within 60 minutes from an adequate airport. Section 121.193 is a requirement limiting all airplanes to 90 minutes from an airport unless they have the performance, after the failure of two engines, to land at an adequate airport. Section 121.329 requires all turbine powered airplanes to have enough supplemental oxygen after a decompression to ''allow successful termination of the flight.'' Section 121.565 requires only two engine airplanes to ''land at the nearest suitable'' airport after engine failure. For airplanes that have three or more engines the rule allows the pilot to proceed to an airport that he selects if, after consideration, he decides that proceeding to that airport is as safe as landing at the nearest suitable airport. Section 121.645 requires similar ''normal'' fuel carriage for all turbine-powered airplanes.

[2] Section 121.645 allows an operator to fly farther from an airport in a two-engine airplane if authorized by the FAA. The FAA granted such authorizations for Caribbean operations in the 1970's. Since the mid-1980's, the FAA has provided formal ETOPS guidance for part 121 operators on how to receive two-engine ETOPS authorization.

engine reliabilities and the level of engine redundancy on such airplanes is sufficient to protect such operations. The appendix has several charts and tables that demonstrate the interrelationship between the affected parts of Title 14, as well as their applicability and compliance schedules.

Under past ETOPS guidance, a part 121 operator of a two-engine airplane was required to use an airplane-engine combination approved for ETOPS. The manufacturer of the airplane obtained the ETOPS type design approval on behalf of the operator. Under today's rule (§ 121.162, G135.2.3), two-engine airplane-engine combinations already approved for ETOPS under previous FAA guidance can continue to be used in ETOPS operations under parts 121 and 135. No re-certification under the new § 25.1535 is required. Likewise, this rule allows airplanes with more than two engines manufactured within 8 years of when this rule becomes effective to be used in ETOPS operations without type design approval under the new § 25.1535. Airplanes with more than two engines manufactured more than 8 years after the effective date of this final rule must meet the certification requirements for airplane-engine combinations adopted today. Today's rule allows two-engine airplanes with existing type certificates to be approved for up to 180-minutes ETOPS without meeting requirements for fuel system pressure and flow, low fuel alerting, and engine oil tank design. These three provisions are new to this rule, and are not in the guidance previously used to approve two-engine airplanes for ETOPS.

The FAA is adopting a compliance schedule to allow an orderly transition to future safety requirements as the industry adjusts to the new, broader ETOPS operating criteria. We recognize that, in some cases, it is appropriate to permit existing airplanes to continue to operate under existing authorization. It is also appropriate in some cases to delay implementation of certain portions of the rule to minimize its economic impact. We are setting a 1-year compliance date for most requirements involving a set-up or installation program. In all cases when a delayed compliance date is established, we have determined that there is a minimal increase in safety benefit for implementing the rule immediately. In addition, the FAA has provided grandfather provisions for part 121 ETOPS operations using airplanes with more than two engines and for all ETOPS operations conducted under part 135.

The total anticipated costs of today's rule are estimated at $20.9 million over a 16-year period or $12.4 million, present value. The costs of the rule to part 121 operators and U.S. manufacturers of airplanes with more than two engines are estimated to be $7.7 million ($3.8 million, present value). Benefits to the rule are attributed to increased safety resulting from design, dispatch, and operational requirements. In addition, operators of two-engine airplanes may realize cost savings from decreased fuel requirements.

II. Summary of the FAA's Existing ETOPS Program

The requirements adopted today are based almost exclusively on the FAA's existing ETOPS program, with some additions. Accordingly, the FAA believes it helpful to discuss in some detail the existing guidance. As noted earlier, all airplanes operated under 14 CFR part 121 are required to comply with § 121.161. Unless otherwise authorized by the Administrator, this regulation limits the operation of two-engine airplanes to routes that contain a point no farther than 60 minutes flying time at an approved one-engine inoperative cruise speed in still air from an adequate airport. This restriction applies to all airplanes operating under this rule regardless of the terrain or area to be over flown.

The first deviations to § 121.161 were issued for 75-minutes ETOPS in the Caribbean Sea in 1977. In June of 1985, responding to an increasing desire by industry to obtain further deviations that would allow flights from the United States to Europe, the FAA issued Advisory Circular (AC) 120–42, which defined a process for obtaining authorization for ETOPS diversions up to 120 minutes. This AC was amended in 1988 with the publication of AC 120–42A, which expanded the maximum diversion period to no more than 180 minutes. This AC defined a process for obtaining three categories of ETOPS operational approval, *i.e.*, guidance for 75-minute ETOPS (based on the earlier Caribbean approvals), 120-minute ETOPS, and 180-minute ETOPS. The AC 120–42A guidance contains a two-fold approval process: a type design approval of the airplane-engine combination and an operational approval consisting of ETOPS maintenance, flight dispatch, and crew training elements. The ETOPS maintenance program also incorporates supplemental processes to the non-ETOPS continuous airworthiness maintenance program (CAMP).

The original guidance for extended range operations with two-engine airplanes in AC 120–42 allowed for an increase of up to 15 percent above the 120-minute limit (138-minute ETOPS). This provision was eliminated with the release of the guidance in AC 120–42A providing for operations up to 180 minutes.

However, recognizing a need for ETOPS diversion authority between 120 and 180 minutes, the FAA reinstated the 138-minute provision by issuing policy letter EPL 95–1 in 1994. In March of 2000, at the request of the industry, the FAA issued ETOPS Policy Letter EPL–20–1, ''207-minute ETOPS Operation Approval Criteria''. This document provided a similar 15 percent increase in the 180-minute maximum diversion time, *i.e.*, 207 minutes. However, this approval was limited to ETOPS operators flying in the North Pacific and only when weather or airport conditions did not permit normal 180-minute ETOPS flights.

The basic principles expressed throughout this body of guidance are that (1) the design of the airplane and its systems must be acceptable for the safe conduct of the intended operation, and (2) the operator must have the requisite experience and ability to maintain and operate the airplane at the required level of reliability and competence. The design standards and operational processes for ETOPS were designed to prevent circumstances that could cause an engine in-flight shutdown or otherwise cause a diversion and to protect the safety of a diversion if one does occur.

A. Airplane-Engine Type Design Approval

Since the introduction of AC 120–42, airplane-engine combinations have had to be approved by the FAA before ETOPS flights could be conducted. The type design approval of airplanes for ETOPS under AC 120–42 and –;42A involves a two-part process. First, the FAA determines that airplane systems meet certain design standards for safe operations during an airplane diversion. One criterion for approval is that a candidate airplane have at least three independent electrical generators. Another criterion is that a required auxiliary power unit (APU) can start after the airplane has been at high altitude for several hours (cold-soaked) and can run reliably for the remainder of the flight. There are other criteria governing airplane systems such as cargo compartment fire suppression, communication, navigation, flight control, wing and engine ice protection, cabin pressurization, and cockpit and cabin environment. System safety analyses have to show that expected system failures will not prevent safe landing at a diversion airport. Systems with time limited capabilities, such as the cargo compartment fire suppression system, need to have the capacity to support a maximum length diversion, including a 15-minute allowance for a hold or go-around at the diversion airport.[3]

The second part of the approval process is an evaluation of engine in-flight shutdowns and other significant airplane system failures that have occurred while the airplane-engine combination has been in service. The candidate airplane-engine combination should accumulate at least 250,000 engine-hours of service experience for a meaningful evaluation, although the AC allows a lower number of hours with adequate compensating factors. An assessment of the causes of these in-flight shutdowns and other significant failures leads to a list of corrective actions that will prevent future occurrences of these events for similar causes. This list of corrective actions is contained in a configuration, maintenance, and procedures (CMP) document. The CMP document also contains minimum equipment requirements that come out of the airplane systems assessment from the first part of the process.[4]

AC 120–42A utilizes a relative risk model to support the expansion of maximum ETOPS diversion time for up to 180 minutes. This relative risk model is based on an airplane-engine combination maintaining a target IFSD rate at or below 0.02 per 1,000 engine-hours, which the model shows would allow a safe ETOPS flight for a 180-minute diversion. An applicant for ETOPS approval under this method has to show that the candidate airplane-engine combination has achieved this in-flight shutdown (IFSD) rate before the FAA will grant a 180-minute ETOPS approval. However, an applicant may also get an ETOPS approval for 120-minute ETOPS if the candidate airplane-engine combination IFSD rate is approximately 0.05 per 1,000 engine hours. For an IFSD rate that meets this standard, but is above the 0.02 for 180-minute ETOPS approval, the FAA conducts an assessment of the causes of in-flight shutdowns in the same manner as under AC 120–42, including the incorporation of corrective actions into a CMP document. The applicant must show that the incorporation of these corrective actions will bring the IFSD rate down to the target 0.02 level. After a year in service operating in 120-minute ETOPS, an airplane-engine combination is eligible for an expansion of its approval up to 180 minutes.

Once an ETOPS approval is granted, the FAA monitors the propulsion system IFSD rate of the world fleet to make sure that it remains at or below the target rate. If the IFSD rate for a particular airplane-engine combination in the world fleet goes above the target rate, the FAA asks the airplane and engine manufacturers what corrective actions they are taking to bring the rate below the target level. If, in our review of the manufacturer's corrective actions we determine that an unsafe condition exists, we may issue an airworthiness directive (AD) to correct the unsafe condition. We may also issue an AD to withdraw an ETOPS approval, or to require several corrective actions for causes that individually do not constitute an unsafe condition, but in the aggregate create an IFSD rate that is unacceptably high. In such cases, an operator's ETOPS approval may be predicated on compliance with the AD.

With the introduction of the Boeing Model 777, the FAA introduced a new method for an applicant to obtain an ETOPS type design approval without the service experience required for an approval under AC 120–42A. This method is known as the ''early ETOPS'' approval process.

The early ETOPS process takes a systems approach to the development of an airplane and engine. Without service experience to identify design flaws that could lead to in-flight shutdowns or diversions, an applicant must demonstrate that the design flaws on previously designed airplanes are not present in the new airplane. The applicant must also consider how the maximum length flight and diversion affect the design and function of airplane systems to ensure that they have the capability and reliability for safe ETOPS flight.

Rigorous ground and flight tests are required to demonstrate that the airplane-engine combination can successfully support an ETOPS program, including validation of maintenance procedures for systems whose failures could lead to an engine in-flight shutdown or a diversion. An enhanced problem reporting and resolution system identifies and corrects significant problems before the airplane is certified. After approval, this same system remains in place during the early service period to identify and correct such problems before they can lead to additional in-flight shutdowns and diversions.

B. Operational Requirements

AC 120–42A requires that each operator demonstrate its ability to maintain and operate the airplane so as to achieve the necessary reliability and to train its personnel to achieve competence in ETOPS. The operational approval to conduct ETOPS is made via amendment to the operator's operations specifications. Operator approval is based on the following levels of operator in-service experience:

1. 75-minute ETOPS—no minimum level required.
2. 120-minute ETOPS—12 consecutive months of operational experience with the airplane-engine combination listed in its application.
3. 180-minute ETOPS—12 consecutive months of operational experience at 120-minute ETOPS with the airplane-engine combination listed in its application.
4. 207-minute ETOPS—hold current approval for 180-minute ETOPS.

These in-service requirements can be reduced, or equivalent in-service experience can be substituted, based on a review by the FAA. The reduction of operator in-service requirements is called ''accelerated ETOPS'' and the substitution of equivalent experience is called ''simulated ETOPS.'' As a minimum, an ETOPS validation flight or flights must be completed prior to FAA approval. Guidance for both of these approval mechanisms are contained in draft appendices to the AC 120–42A.[5]

Certain operational requirements are also placed on the operator. The most prominent requirement is for the operator to plan airplane routings and to dispatch airplanes so as to remain within the approved diversion distance from adequate airports.[6] Further, these adequate airports must have certain required weather minimums both at dispatch and during the flight and must have minimum levels of rescue and fire fighting services (RFFS). The operator must have programs in place to monitor the conditions at these airports during ETOPS and have a methodology to provide the flight crew with this data.

[3] For a 180-minute ETPOS approval, these time-limited systems would have a 195-minute capacity to meet this requirement.

[4] The CMP document is an extension of the airplane type for an ETOPS approval. An operator wishing to fly an airplane in ETOPS has to comply with the CMP document as a condition for obtaining its operational approval.

[5] Although the AC was never officially revised to include these appendices, the FAA has approved operators for ETOPS using the draft policy.

[6] ''Adequate airport'' is a new definition that codifies various references in current regulatory language and practice. It defines the minimum requirements for sufficiency based on the landing limitations contained in 121.197 and the airport requirements of part 139.

The operator must also have a methodology to calculate the fuel and oil supply for the ''critical fuel scenario.'' [7] Further, the operator must provide in its operations manual airplane performance data to support both this critical fuel requirement and any other area of operations calculations in their operations manual.

AC 120–42A also provides guidance on airplane system redundancy levels appropriate for ETOPS. An operator's Minimum Equipment List (MEL) based on this guidance may be more restrictive than the Master Minimum Equipment List (MMEL) when considering the kind of operation proposed and equipment and service problems unique to the operator. The FAA has established criteria for MMEL based on this guidance and the ETOPS approval level. Operational dispatch of an ETOPS flight is based on these criteria.[8]

Since the quality of maintenance and reliability programs can have an appreciable effect on the reliability of the propulsion system and the airframe systems required for ETOPS, AC 120–42A requires a two-engine airplane operator to have a maintenance and reliability program sufficient to maintain a satisfactory level of airplane systems reliability for the particular airplane-engine combination. The elements of such a program are contained in an ETOPS-approved CAMP. This CAMP begins with a basic CAMP that is approved for use in non-ETOPS operation, which is then supplemented for ETOPS with:

1. An ETOPS maintenance document,
2. An ETOPS pre-departure service check,
3. Dual maintenance procedures,
4. Verification procedures for corrective action to ETOPS significant systems,
5. ETOPS task identification,
6. Centralized maintenance control procedures,
7. ETOPS parts control program,
8. An airplane reliability program,
9. Propulsion system monitoring,
10. Engine condition monitoring program,
11. Oil consumption monitoring program,
12. An APU in-flight start program, if APU in-flight start capability is required for ETOPS,
13. Maintenance training for ETOPS, and
14.A system to ensure compliance with the minimum requirements set forth in the CMP document or the type design document for each airframe and engine combination.

C. Polar Policy

In February 2001, in response to several U.S. carriers' plans to conduct polar operations with two-engine airplanes, the FAA developed a ''Polar Policy Letter.'' This policy letter documented the requirement for airlines to develop necessary plans in preparation for polar flights and identified the necessary equipment and airplane configuration requirements for all airplanes regardless of the number of engines. The FAA's intent in issuing the policy letter was to establish a process that can be applied uniformly to all applicants for polar route authority.

This policy letter placed the following requirements on the operator:

1. Defined area of application,
2. Enhanced facilities requirements for ETOPS alternate airports,
3. Passenger recovery plan for diversion airports used to support operations,
4. A fuel freeze strategy,
5. Enhanced MEL requirements to include emergency medical kits and crew foul weather gear,
6. Consideration of solar flare,
7. Polar specific crew and dispatcher training,
8. MEL requirements similar to those for operations beyond 180-minute ETOPS, and
9. A validation flight prior to approval.

III. Notice of Proposed Rulemaking To Codify and Expand Existing ETOPS Program

A. Development of the NPRM

In response to FAA's tasking, the ARAC formed an ETOPS working group consisting of more than 50 representatives of U.S. and foreign airlines, aircraft and engine manufacturers, pilot unions, industry groups and airline accident family support groups, as well as representatives from the Joint Aviation Authority (JAA), ICAO, and the FAA.

After 2 years, the ETOPS working group produced a draft notice of proposed rulemaking (NPRM), advisory material, and a proposed preamble discussion to explain how the working group arrived at its recommendations. The ARAC presented the ETOPS working group final product to the FAA as a consensus document, which the FAA published, largely unchanged, as an NPRM on November 14, 2003 (68 FR 64730).

Among the recommendations were:

- Given the current reliability of part 121 two-engine airplanes, successful ETOPS processes should be expanded to allow two-engine ETOPS throughout the world.
- A comprehensive ETOPS rule should include all part 121 and part 135 airplanes used in specific long-range operations regardless of the number of engines.
- The term ETOPS should be retained, but its definition should be changed to ''extended operations'' to highlight its application to all extended airplane operations.

The ARAC ETOPS working group recognized that although engine reliability has improved significantly, diversions are sometimes necessary for reasons unrelated to engine performance, such as onboard fire, medical emergency or cabin decompression. Ensuring availability of en-route alternate airports, adequate fire fighting capabilities at these airports, and fuel planning to account for decompression are sound operational practices for all airplanes. Likewise, limits on an airplane's maximum allowable diversion time for certain time-limited systems (*e.g.*, cargo fire suppression) that were applied to two-engine airplanes under the existing AC guidance should also apply to airplanes with more than two engines. Accordingly, ARAC recommended adding certain safety requirements to long-range operations for parts 121 and 135 independent of the number of engines on an airplane.

B. Summary of the NPRM

The NPRM proposed an expansion of ETOPS for part 121 two-engine airplanes and implementation of consistent ETOPS requirements for airplanes flying beyond 180 minutes from an adequate airport. The NPRM addressed three specific areas: airplane and engine design and reporting requirements (parts 21, 25, and 33), air carrier operations and maintenance (part 121), and commuter and on-demand operations and maintenance (part 135). The NPRM also proposed definitions in part 1 for terms used in these three areas.

The two main objectives of the proposed airplane and engine design requirements were to prevent failures that result in airplane diversions and to protect the safety of diversions when

[7] AC 120–42A describes this scenario as any combination of engine failure and decompression at the most critical (furthest) distance from the airports used to plan the flight.

[8] Some examples of the increasing requirements of the MMEL for ETOPS approvals are (1) ETOPS beyond 120 minutes requires three generators; (2) ETOPS beyond 180 minutes requires SATCOM equipment, an engine-out auto land system, an auto throttle system, a fuel quantity indicating system, and minimum requirements for fuel cross feed and fuel boost pump electrical power.

they do occur. The proposed airplane and engine design requirements fell into five categories:

1. Designing to reliably provide functions necessary for safe ETOPS flights.
2. Eliminating sources of airplane diversions that occurred in current or past designs.
3. Ground and flight testing.
4. Reporting and correcting design problems.
5. Demonstrating reliability.

The airplane design requirements in part 25 were further divided into three parts: those applicable to all airplanes; those applicable to two-engine airplanes only; and those applicable to airplanes with more than two engines. Within each of the two latter parts, an applicant could choose to certify its airplane using existing service experience with the candidate airplane-engine combination, by conducting more thorough analysis and testing to certify a new airplane-engine combination without service experience (early ETOPS method) or through a combination of the two. Table 5 in the appendix summarizes how today's rule meets these design objectives from the NPRM.

Requirements specifically applicable to engines to make them eligible for installation on an ETOPS airplane were proposed for part 33. Only engines intended for installation on two-engine airplanes being certified for ETOPS, using the early ETOPS method in part 25 were contemplated under the proposed engine test requirements.

The NPRM proposed part 121 amendments to codify current two-engine ETOPS guidance, including the designation of areas where the ETOPS rule would apply. It also proposed additional communications requirements; fire-fighting capabilities necessary at an ETOPS alternate airport; a recovery plan for caring for stranded passengers; utilization of an expanded ETOPS CAMP; airplane system performance requirements; and additional training and reporting requirements for crewmembers and dispatchers.

Additionally, the FAA proposed other requirements for part 135 operations conducted beyond 180 minutes from an airport. The proposed part 135 amendments were similar to part 121 but recognized the differing regulatory history and nature of part 135 operations. For example, the fire and rescue equipment required at diversion airports for part 121 operations would not be required for part 135 operations since these operations are irregular and few in number.

Although most current air carrier operations can be conducted within 180 minutes flying time from an adequate airport, there are certain remote and demanding routes where diversion times greater than 180 minutes are required to reach an adequate en-route alternate airport. Knowing that all operators flying routes with greater than 180-minute diversion times would experience the same operating demands, the FAA proposed an ETOPS program to regulate flights in remote areas, which would benefit part 121 three- and four-engine airplanes and all part 135 airplane operations, regardless of the number of engines. The NPRM provided a public comment period to end on January 13, 2004. In response to requests, the FAA extended the comment period to March 15, 2004 (69 FR 551; January 6, 2004).

C. Summary of Comments

More than 50 commenters representing foreign regulatory bodies, associations, manufacturers, and foreign and U.S. operators responded to the NPRM. In general, the comments supported the work of the ARAC and agreed with the framework of the NPRM.

However, commenters took issue with the economic summary of the NPRM and its stated cost benefits. They believed, and we now agree, that these benefits were based on the incorrect premise that the operations proposed to be regulated as ETOPS for part 121 three- and four-engine and all part 135 airplanes were previously restricted and consequently would provide new opportunities to the industry. In addition, many of the commenters disputed specific provisions of the proposal. In most cases, those who disagreed are operators or manufacturers of three- and four-engine airplanes, or part 135 operators. Currently, these operators and manufacturers are not subject to any ETOPS safety provisions such as en-route alternate planning, time-critical systems analysis (e.g., cargo fire suppression), and the more rigorous ETOPS maintenance program. They expressed a strong opinion that 35 years of experience shows such rules are unnecessary, cost-prohibitive, and add nothing to aviation safety. The FAA also received detailed comments on satellite communications, certification standards, engine monitoring, fuel requirements, maintenance requirements and passenger recovery plans—all related ultimately to additional costs for operators. The FAA has mitigated many of these costs with extended compliance dates as shown in Table 2 of the appendix to this document. In addition, we have decided against adopting the ETOPS maintenance program for airplanes with more than two engines and have excluded all-cargo operations aboard airplanes with more than two engines from all aspects of the rule other than the minimal requirements for safe operation in the North and South polar areas for part 121 operations and the North polar area for part 135 operations. We justify the safety need for applying this rule to airplanes with more than two engines in section IV of this preamble. A more detailed discussion of the commenters' recommended changes, a number of which the FAA adopt today, is provided in the substantive discussion of this final rule.

In addition, some commenters provided extensive comments and suggestions on the risk of smoke and fire in ETOPS operations and asked the FAA to establish smoke detection standards. However, smoke in the cockpit issues are beyond the scope of this proposal. Since the issues raised by these commenters introduce new safety requirements, the FAA may consider them for future rulemaking, but will not discuss them further here.

Several commenters, including the JAA, National Air Carrier Association (NACA) and the Civil Aviation Authority of the United Kingdom (UK CAA), recommended use of the acronym ''LROPS''—meaning ''Long Range Operations''—for three- and four-engine ETOPS, to avoid confusion, particularly for those operations beyond 180-minutes diversion time. The FAA has decided to use the single term, ''extended operations,'' or ETOPS, for all affected operations regardless of the number of engines on the airplane. As discussed in the NPRM, the ARAC had determined that the use of a single term would be less confusing than two separate terms that govern the same types of operations. We agree with this assessment and believe any confusion created by expanding the term to three- and four-engine airplanes will be short-lived.

IV. Safety Need for the Final Rule

A. Safety Risks Associated With ETOPS

The FAA believes that operations of all long-range passenger-carrying airplanes, regardless of the number of engines, need a viable diversion airport in the case of an onboard fire, medical emergency, or loss of cabin pressure. Ensuring availability of diversion airports, adequate fire fighting coverage at these airports, passenger recovery plans, and fuel plans for the diversion are sound operational practices for all airplanes. Likewise, all airplane time-critical systems should account for the maximum allowable diversion and worst-case scenarios. Many commenters to the NPRM disagreed with this fundamental premise and questioned why new regulations should be imposed on operations that have been safely flown without any regulatory restrictions.

In response to these comments, the FAA has reviewed the historic data for past long range operations and has come to several conclusions.

First, the operating environment for certain long-range operations has changed significantly in the past 35 years. In the past, most operations conducted under part 121 and part 135 have flown over routes that remain within a reasonable distance from adequate airports. As technology has increased the range and endurance of all airplanes, operators are increasingly flying over regions of the world that both are less likely to be served by sizable airports and present extreme weather conditions. Some of the airports that would support a diversion are over 180 minutes away from the airplane during some portion of the flight, the previous limit for two-engine ETOPS. While the frequency of long-range operations is increasing, the aviation infrastructure to support these operations in remote areas of the world is decreasing. The U.S. military has abandoned long-standing diversion airports in the Aleutians and Pacific such as Adak and Wake Islands. In addition, Canada no longer provides financial support for its airports. At the same time, opening up of North Polar routes has resulted in an increase in operations over a particularly harsh and remote environment. The aviation industry expects that with increased route authority for two-engine airplanes and increasing use of polar routes, by 2010 there will be 39,000 flights a year over the four current Polar routes alone. In 2004, U.S. operators conducted 1,600 flights over these routes. Conservative industry estimates are that the number of these flights by U.S. operators will double by 2010. In the Southern Pacific and Atlantic Oceans and the Antarctic area, only a few routes are being flown today, mostly by non-U.S. carriers. The industry estimates that by 2010 there will be 3,200 flights per year in these areas. Transport Canada stated that operations over the Canadian Arctic rose from 85,000 in 1999 to 142,000 in 2004 and predicts a 7% yearly increase in these operations.

Second, in-service data shows that all airplanes, regardless of the number of engines, occasionally divert for reasons unrelated to engine failure. Since most operations are conducted over areas of robust infrastructure where the crew usually has numerous choices in airports, most diversions are not problematic. The same cannot be said for diversions over remote areas of the world, particularly in light of operational infrastructure changes that have eroded the basic safety net upon which long-range operations of all types of airplanes have come to rely.

In its development of proposed new regulations for expanded part 121 two-engine operations, ARAC recommended extending the authority of these two-engine airplanes to operate on routes that are greater than 180 minutes from an airport. The additional operational challenges of these more remote routes are equally demanding of all airplanes, regardless of the number of engines, and include such issues as extremes in terrain and climate, as well as limited navigation and communications infrastructure. Support of a necessary diversion and subsequent recovery in such areas demand added training, expertise, and dedication from all operators. Therefore ARAC concluded that there is a need to address these issues for all airplanes flying in these areas. ARAC recommended that some of the same ETOPS guidance developed for part 121 two-engine airplanes be applied to common elements of all airplane operations, both part 121 and part 135. The FAA agrees that such issues are relevant to all operations but is unable to justify the cost of this rule for all-cargo operations in airplanes with more than two engines and has accepted this recommendation only for passenger carrying operations.

As a result, the same limited geographic areas that would cover greater than 180-minute two-engine ETOPS would also be applicable to part 121 and part 135 passenger-carrying operations in three- and four-engine airplanes and all part 135 two-engine airplanes under this rule. Operations in these very limited areas are the only ones the FAA intends to regulate for these airplanes. All long-range operations could benefit from an ETOPS program. However, we believe, as do some commenters, the increased systems redundancy of the three- and four-engine airplane operating less than 180 minutes is sufficient to maintain acceptable levels of risk associated with engine failure at a distance far from an adequate airport. We also believe imposing new regulatory guidance on part 135 two-engine airplanes below this threshold would impose costs on these operations that cannot be justified. However, for the limited case of operations beyond 180 minutes from an adequate airport, we are convinced these operations must meet the minimum requirements of this rule.

The whole premise of ETOPS has been to prevent a diversion and, if one were to occur, to have programs in place that protect the diversion. ETOPS demands that propulsion systems are designed and tested to ensure an acceptable level of in-flight shutdown risk, and it demands that other airplane systems are designed and tested to ensure their reliability. Maintenance practices must be adopted to monitor the condition of the engines and take aggressive steps to resolve problems with airplane systems and engines, thus minimizing the potential for procedural and human errors that could lead to a diversion.

However, despite the best design, testing, and maintenance practices, situations may occur which require an airplane to divert. Regardless of whether the diversion is for technical (airplane systems or engines related) or non-technical reasons, there must be a flight operations plan in place to protect both crew and passengers during that diversion. Such a plan may include ensuring pilots are knowledgeable about diversion airport alternatives and weather conditions at those airports; pilots have the ability to communicate with the airline's dispatch office and air traffic control; and airplanes have sufficient fuel to divert to the alternate airport. Under the ETOPS ''preclude and protect'' concept, various failure scenarios also need to be considered by the operator. The best available options are then provided to the pilot before and during the flight.

Unlike the ETOPS guidance provided for two-engine airplanes, there has been no regulatory framework governing the long-range operations airplanes with more than two engines. For example, in emergencies such as loss of cabin pressure, current regulations require adequate oxygen supplies but do not require the operator to consider the amount of extra fuel necessary to reach a diversion airport. An analysis by Boeing shows that between 1980 and 2000, 33 of the 73 cruise depressurization events occurred on airplanes with more than two engines. A study conducted by this manufacturer using a modern four-engine aircraft carrying normal route planning fuel reserves raises issues about the adequacy of the current fuel planning requirements in the event of a diversion. Accordingly, the FAA finds there is a need for all passenger-carrying operations beyond 180 minutes from an adequate airport to adopt the same ''preclude and protect'' concept contained in the two-engine ETOPS rules for all types of operations.

Part 135 operations are subject to the same types of causal factors resulting in accidents as large transport operations are under part 121. Therefore, the FAA is applying the same safety provisions required for part 121 operators to part 135 operators in these limited operations.

The FAA also recognizes the need to respond to the ICAO Annex 6 requirement for states to establish ETOPS thresholds for all two-engine turbine powered airplanes, including on-demand operations. Unlike other ICAO member states, the U.S. recognizes several categories of air carrier operations and has never imposed ETOPS rules on operators that conduct non-scheduled flights with ''business jets.'' The FAA is adopting these amendments for part 135 two-engine operations and passenger operations using airplanes with more than two engines in recognition that these operations are very similar to part 121 operations in terms of both the types of airplane used and the particular long-range routings. The FAA believes the rule is a legitimate and necessary step to harmonize with international aviation standards.

B. Impact of ETOPS Requirements on Engine Reliability

ETOPS design and maintenance requirements have contributed greatly to the reliability of the engines used in two-engine airplanes and appear to have had some impact on engines used in three- and four-engine airplanes. Applying these requirements to all airplanes that fly long distances from airports would improve the reliability of all engines. However we agree with many commenters that the current level of engine reliability coupled with the engine and system redundancy on airplanes with more than two engines is sufficient to protect the operation from critical loss of thrust. Consequently there is no requirement for an ETOPS maintenance program for ETOPS on airplanes with more than two engines.

Operators and manufacturers of airplanes with more than two engines have benefited from improvements in engine safety resulting from ETOPS requirements for airplanes with two engines.[9] Prior to ETOPS, we considered a 0.02 IFSD rate the best rate the industry could achieve. Since ETOPS began in 1985, the IFSD rates have improved to 0.01 or lower, half of what we previously thought possible. This overall improvement in the IFSD rate for all airplanes was a result of design improvements and aggressive maintenance programs introduced by the engine and airplane manufacturers to correct in-service events to maintain the world fleet IFSD rate below the ETOPS maximum.

C. Fuel Exhaustion

In 1983, a U.S.-manufactured two-engine airplane (foreign operator) made a no power landing at an airport in North America that was caused by an inadequate amount of fuel being loaded on the airplane for the flight.

In August 2001, a foreign manufactured two-engine airplane (foreign operator) made a no-power landing at an airport in the Eastern Atlantic, due to the fact that the flight crew was unaware of a fuel leak that resulted in a critical amount of fuel being leaked overboard.

Both of these airplane types are used in long-range passenger service in U.S. operations. Due to the similarity of the operating environment, it is the FAA's view that these particular incidents could have occurred in U.S. operations and, therefore, we view them as viable data points. We were extremely lucky that both airplanes in these instances made safe landings. The low fuel alerting requirement in the ETOPS rule will prevent low fuel quantity problems from becoming accidents on ETOPS flights. The low fuel alert will tell the flight crew when the quantity of fuel available to the engines falls below the level required to fly to the destination airport. The alert must be given while there is still enough fuel remaining to safely complete a diversion.

D. Cargo or Baggage Compartment Fire Suppression Requirements

The historical rate of occurrence of in-flight cargo and baggage compartment fires is approximately 1×10^{-7} per flight hour.[10] This rate translates to about one cargo fire per 10 million flight hours. The FAA Seattle Aircraft Certification Office received five reports of cargo or baggage compartment fires for the period 1999 to 2004. In-flight fires can be particularly hazardous. The cargo and baggage compartment fire suppression system requirement will ensure all ETOPS airplanes whose cargo or baggage compartments require fire suppression systems will have systems capable of putting out fires and suppressing re-ignition for the longest duration diversion for which the airplane is approved.

E. Decompression Scenarios

Most estimates for the probability of decompression on a commercial airplane are on the order of 1×10^{-6} or 1×10^{-7} per flight hour. Airbus, in a recent exemption request for the A380 stated in comments to the docket that there have been nearly 3,000 depressurization events since 1959.[11] It notes the probability of decompression due to the pressurization system alone to be in the order of 3.5×10^{-6} per flight hour (3.5 decompression events per million flights). Boeing has provided a sample of depressurization events on Boeing airplanes from 1980 to 2000. Their sample shows 33 of 73 events occurred on three- and four-engine aircraft. Two-engine ETOPS requirements have always required those operations to flight plan their fuel requirements for a ''critical fuel scenario.'' This requirement has been codified into the new approval process in this rule.

Unlike ETOPS guidance for two-engine airplanes, there is no existing regulatory framework governing the long-range operations of airplanes with more than two engines other than the requirements of 14 CFR 121.193, which only governs the operation up to 90 minutes from an airport. The only rule governing decompression on a these airplanes addresses oxygen supplies and not fuel necessary for a successful diversion (14 CFR 121.329). The regulation does not require the operator of an airplane with more than two engines to check the conditions at possible diversion airports where the flight might terminate or check for fuel sufficiency.

Boeing conducted a study using a modern four-engine airplane carrying normal route planning fuel reserves. On any route that is 16 hours long, if a four-engine airplane has a major decompression anywhere in the cruise phase between approximately 7.25 hours to 12.5 hours, the airplane will not have sufficient fuel to descend and cruise at 10,000 ft and reach its point of origin or destination. A similar calculation for a 10-hour flight shows that between the 4.5 to 7.5 hours into the flight that same airplane would not have enough fuel to be able to continue

[9] Operators of three- and four-engine airplanes have benefited from the engine reliability improvements introduced into the same engine models that are also used on two-engine airplanes in ETOPS. Because of industry lease pool arrangements, there is a very strong industry incentive to maintain all engines to the ETOPS standard so that they can be swapped easily from non-ETOPS to ETOPS fleets.

[10] Boeing analysis drawing from Boeing and other industry sources. Boeing presented this analysis to the ARAC ETOPS Working Group.

[11] Docket No. 20139, January 21, 2005.

to its destination or turn back to its origination airport. Without a suitable airport at which to land, the results would be catastrophic. Under today's final rule, 14 CFR 121.646 now covers this omission and requires three- and four-engine operators flying more than 90 minutes to have enough fuel to fly to an adequate airport. The rule also extends ETOPS requirements on their operations that are greater than 180 minutes from an airport.

F. Satellite-Based Voice Communications

The use of SATCOM is a new requirement that applies only to ETOPS conducted beyond 180-minutes. Other available communication systems in use (VHF, HF voice, and datalink) all have significant limitations. The range of very high frequency (VHF) radio is limited to line-of-sight distances, typically less than 200 miles at high altitude. High frequency (HF) radio works at the longer distances from transmitting and receiving stations associated with ETOPS flights, but is subject to unreliable voice quality and loss of signal. This is particularly true during periods of intense solar flare activity.

Datalink capability (both HF and SATCOM) is limited by message length and ability to clearly state the issue or message. A bigger limitation on datalink is the full attention required by the flight crew to interact with a small and compactly designed keypad. The device is difficult to use without error during turbulence and airplane maneuvering. Its use also requires crew coordination and verification of message content. This is extremely distracting during a time that requires the pilot's focused attention on a problem at hand. In comparison, the use of SATCOM voice allows clear and immediate conversation that can quickly convey the situation and needs for the flight.

In March 2004 during a period of intense solar flare activity, a certification test flight was aborted because the crew could not communicate with air traffic using the HF radio. The purpose of this flight test was to simulate an airplane failure condition that made SATCOM unavailable and was conducted in a part of the world beyond the range of normal VHF radio signals. The test pilot decided the safety risk was too high to continue the flight test without his ability to communicate the airplane's position with air traffic control. This situation is similar to one an airline crew would face under similar solar conditions during a flight in areas outside the range of normal line-of-sight VHF radio in an airplane not equipped with SATCOM. The requirement for satellite-based voice communications adopted today will ensure that ETOPS flight crews will be able to communicate emergency situations with air traffic control or their airline during an ETOPS flight.

V. Applicability of the Final Rule

This final rule is applicable to all ''extended operations (ETOPS)'' as now defined. These are long-range operations beyond certain distances from adequate airports. Specifically they are: (1) Two-engine airplanes operated under part 121 when more than 60 minutes from an adequate airport; (2) passenger-carrying airplanes with more than two engines operated under part 121 when more than 180 minutes from an adequate airport; and (3) flight operations of all two-engine transport category turbine powered airplanes and all passenger-carrying transport category turbine powered airplanes with more than two engines under part 135 when more than 180 minutes from an adequate airport. Because of the harsh and remote environments of the Polar areas, portions of this rule are also applicable to all airplane operations in those areas, although these operations are not classified as ETOPS.

Today's rule imposes a requirement for a passenger recovery plan for certain operations of all U.S. flag and supplemental passenger operators. The rule also affects manufacturers of both airplanes and engines used in ETOPS by mandating certain certification standards for their manufacture. Should the manufacturers choose not to meet the new requirements of parts 25 and 33, their products could not be used for ETOPS operations.[12]

Current ETOPS guidance only covers part 121 two-engine operations between 60 and 180 minutes from adequate airports. This rule codifies current guidance up to 180 minutes and is expanded to include unlimited two-engine operations in certain parts of the world. We have responded to certain comments to the NPRM by enlarging the geographic area defined for the current 207-minute approval and the geographic area defined for the new 240-minute ETOPS approval.

In keeping with the ARAC recommendation, the rule applies certain elements of current part 121 two-engine ETOPS guidance to operations in remote and demanding areas of the world, defined by flights more than 180 minutes from an adequate airport, of part 121 passenger-carrying airplanes with more than two engines and to comparable part 135 operations using turbine-powered airplanes. Many commenters to the original NPRM expressed concern over the cost of the rule and the difficulty in its application. Where the FAA determined that no reduction in safety would occur, we made changes from the NPRM. For example, the passenger recovery plan requirements are applicable only to part 121 ETOPS operations beyond 180 minutes from an airport or in the Polar areas and are no longer applicable to cargo operations. Similarly, such plans are only applicable to part 135 passenger operations in the North Polar Region. Likewise, we have eliminated ETOPS requirements for part 121 operations using airplanes with more than two engines operating at less than 180 minutes from an adequate airport in the Polar Regions. We have also excluded all-cargo operations of airplanes with more than two engines in both part 121 and part 135 from the ETOPS requirements of the rule.

Many commenters were concerned that airplanes they were currently using in operations that would be covered under the ETOPS rule would have to be re-certified when the new rule becomes effective. That is not our intent. A new § 25.3 has been created specifying the applicability of the new airworthiness standards to airplanes with existing type certificates on the effective date of the rule, or to airplanes for which an application for an original type certificate was submitted before the effective date. A new § 121.162 has been created delineating the airworthiness standards required for airplanes to be used in part 121 ETOPS. Appendix G, paragraph G135.2.3, has been revised to make the requirements applicable to all airplanes operated under that part similar to the requirements in § 121.162 for airplanes with more than two engines. Table 4 in the appendix compares the applicability of both the NPRM and the final rule to current guidelines.

VI. Delayed Compliance Dates and Grandfather Provisions

In this final rule the FAA has adopted a compliance schedule that will ease the

[12] Because of the potential benefits associated with the superior design of airplane-engine combinations demonstrated under the existing ETOPS certification programs, the FAA has decided to extend those requirements to the airplanes with more than two engines should the manufacturer wish to market these airplanes as suitable for ETOPS operation. The FAA anticipates the cost associated with this requirement ultimately will result in greater engine reliability at a very low cost. This is because these requirements are optional and will not take effect for such airplanes within the next 8 years.

burden of compliance and make the rule less costly. Airplane-engine combinations that have been previously approved for ETOPS can continue to be used in those operations without re-certification. Manufacturers of two-engine airplanes who seek type design approval for ETOPS after the effective date of the rule must meet certain requirements based on whether they request approval for ETOPS up to and including 180 minutes, or beyond 180 minutes. For type design approvals of 180 minutes or less, two-engine airplanes with existing type certificates are exempted from the fuel system pressure and flow requirements, low fuel alerting, and oil engine tank design requirements. These three requirements are beyond what has been required under AC 120–42A.

For airplanes with more than two engines, the new airplane certification requirements found in part 25 applies only to airplane-engine combinations that are manufactured more than 8 years after the effective date of this rule.

Likewise, the operational requirements under part 121 have delayed compliance dates. Some requirements, such as dispatch, weather minimums and fuel supply, are already required by either regulation or ETOPS approvals and may require minimum adjustment to an operator's ETOPS program within 30 days of publication of today's rule. For requirements that take additional planning and implementation time—such as SATCOM, training and passenger recovery plans—the FAA established a 1-year extended compliance period. Cargo fire suppression may present a retrofit requirement for airplanes with more than two engines, and so the FAA is allowing 6 years to meet this requirement. Some requirements proposed in the NPRM have been eliminated. Passenger recovery plans are not required for part 121 ETOPS of 180 minutes or less or for all-cargo operations. For part 135 operations, passenger recovery plans are only required in the North Polar Region. An ETOPS maintenance program is not required for passenger airplanes with more than two engines operated in ETOPS, and the ETOPS requirements are not applicable to all-cargo operations in airplanes with more than two engines in either part 121 or part 135.

Because part 135 operators will have limited ETOPS operations, the FAA has decided to grandfather from today's rule all part 135 airplanes manufactured up to 8 years from the effective date of the rule. For purposes of airworthiness requirements, part 135 operators may use these airplanes in ETOPS without certification under § 25.1535. This is a change from the NPRM, which proposed grandfathering only those airplanes that were on an operator's operations specifications up to 8 years after the rule. Under the NPRM, they would then have had to remain on the operator's operations specifications to continue to operate ETOPS.

To meet the operational requirements, the FAA has allowed a delayed compliance date of 1 year for part 135 operators to meet the North Polar, passenger recovery, and training requirements of the final rule. For cargo fire suppression, the final rule allows 8 years for currently approved part 135 ETOPS operators to comply.

Tables 2 and 3 of the appendix present these delayed compliance dates.

VII. In-Flight Shutdown Rates

A 12-month rolling average IFSD rate is the primary measuring tool the FAA uses to determine if an airplane-engine combination has acceptable propulsion system reliability before approving it for ETOPS. It is also used to monitor the health of a fleet of existing ETOPS approved airplanes in service. A 12-month rolling average IFSD rate is calculated by dividing the number of in-flight shutdowns that occur in an airplane fleet by the total number of engine-hours [13] that accumulate in that fleet during the same 12-month period. Each month, the number of in-flight shutdowns and engine-hours from the same month 12 months earlier are dropped from the calculation and replaced by the number of IFSD's and engine-hours in the current month. In this way, the resulting IFSD rate ''rolls'' from one month to the next.

The manufacturer of an airplane approved for ETOPS and the manufacturer of the engines installed on that airplane monitor the IFSD rate of all airplanes and engines of that type, whether or not those airplanes and engines are operated on ETOPS routes. Today's rule refers to these airplanes as the ''world fleet.'' Operators of that airplane-engine combination monitor the IFSD rate of only the airplanes and engines in their fleet. In-flight shutdown rates are discussed in several parts of the rule. Section 1.1 defines ''in-flight shutdown,'' which an operator or manufacturer uses, for ETOPS purposes only, to determine which in-service occurrences count in the calculation of an IFSD rate.

Part 25, appendix K identifies the IFSD rate limits that a two-engine airplane must remain at or below in order to receive an ETOPS type design approval.

Paragraph 21.4(b)(2) identifies IFSD rate limits for airplanes approved for ETOPS in service. The manufacturer of an airplane approved for ETOPS and the manufacturer of the engines installed on that airplane must issue service information to the operators of that airplane-engine combination, as appropriate, to maintain the world-fleet IFSD rate at or below the regulatory limit. Operators may incorporate this service information as part of their reliability program to maintain the IFSD rate of their fleet at or below the world-fleet limits.

Paragraph 121.374(i)(1) identifies the IFSD rate limits that prompt an investigation into whether there are any common cause or systemic problems in an operator's ETOPS program that are contributing to the high IFSD rate. The operator must report the results of its investigation and any necessary corrective action it is taking to the FAA. The IFSD rates specified in this paragraph are higher than the world-fleet rates in recognition that this action is taken only after the operator's normal reliability program fails to maintain the operator's rate at or below the world-fleet IFSD rate objective.

Several factors may cause in-flight shutdowns that contribute to an operator's IFSD rate exceeding the world-fleet rate. First, there may be causes of in-flight shutdowns for which the manufacturer has not issued service information. There may be existing service information available to prevent causes of in-flight shutdowns that the operator has not yet incorporated into its fleet. An operator may have unique maintenance or operational procedures that unknowingly cause in-flight shutdowns. Finally, an operator may experience a higher IFSD rate for no known reason other than statistical chance.

Another factor affecting an operator's IFSD rate is the numerical effect that a single in-flight shutdown has on the rate of a small fleet of airplanes. An IFSD rate of 0.01 per 1,000 engine-hours results in an in-flight shutdown approximately once every 100,000 engine-hours. A fleet of 100 two-engine airplanes operating an average of 10 hours a day would accumulate 2,000 engine-hours per day or 730,000 engine-hours in 12 months. This fleet of airplanes could experience seven in-

[13] An engine-hour is an operating hour accumulated on each engine installed on an airplane. Similarly, an airplane-hour is an operating-hour accumulated on an airplane independent of the number of engines installed. For example, one airplane-hour on a four-engine airplane would correspond to four engine-hours (one engine-hour for each engine.)

flight shutdowns during that 12-month period and still have an IFSD rate below the 0.01 limit. A 10-airplane fleet of the same type operated in the same manner would accumulate only 73,000 engine-hours in a 12-month period. One in-flight shutdown on the 10-airplane fleet would result in an IFSD rate of 0.014, which is above the 0.01 limit. Thus, one in-flight shutdown on an operator of a small fleet of airplanes can place their fleet above the limit. To further compound the impact of fleet size, an in-flight shutdown that occurs in June of one year continues to count in the IFSD rate until the next June. A single in-flight shutdown would place the operator of the 10-airplane fleet above the 0.01 limit for an entire year.

This one factor showing the magnified effect an in-flight shutdown has on the IFSD rate of a small fleet has generated the most concern from both the manufacturers and operators since AC 120–42A introduced IFSD rates into the ETOPS standard. They are concerned the FAA, or other airworthiness authorities, will adopt an FAA ETOPS standard that improperly uses IFSD rates in the rule to revoke the ETOPS authority of an operator who experiences in-flight shutdowns due to causes beyond its control, simply because its rate exceeds the allowable limit. Many comments to the NPRM were in some way connected to reducing the number of occurrences that count toward the IFSD rate, or in lessening the regulatory effect of a rate that exceeds the limit.

The FAA will not revoke an existing ETOPS operational approval solely because of a high IFSD rate. The operating rules require the operator to investigate the cause of each in-flight shutdown and report to the FAA any corrective actions it is taking to prevent future occurrences. Only after additional in-flight shutdowns in the operator's fleet cause the FAA to believe the operator's corrective actions are insufficient to reduce the IFSD rate below the limit, will the FAA investigate taking further action. During this subsequent investigation, we will consider how a small fleet, even with successful corrective actions, may need up to a year to reduce the IFSD rate to below the required limit. However, if we determine that a series of in-flight shutdowns is caused by a common cause or systemic problem in the operator's ETOPS program, we may reduce the maximum allowable diversion time or revoke the ETOPS approval until we are satisfied that the operator has corrected the problem.

The FAA received several comments on the proposed IFSD rate requirements. Continental Airlines (Continental) and United Airlines (United) were concerned that the definition of in-flight shutdown, as proposed, would cause certain events to count against their IFSD rate even if the engine was not actually shut down by the flightcrew. Continental also stated that the proposed definition does not address modern engine auto-relight capability in which an engine flameout is detected by the engine control and an engine re-start is initiated automatically without any flightcrew action.

The FAA finds these concerns have merit. We have revised the NPRM definition of in-flight shutdown to clarify our intent and address these commenters' concerns. First, we have replaced ''in-flight'' with ''when an airplane is airborne'' which more clearly indicates that a condition for an in-flight shutdown is that the airplane is in the air (wheels not touching the ground). There has been some disagreement in the past about whether an engine failure that occurs during the takeoff roll should be considered an in-flight shutdown. This change clarifies our intent that the airplane must be in the air.

We have clarified that an in-flight shutdown includes a situation when a flight crew member cycles the engine start control, however briefly, even if the engine operates normally for the remainder of the flight. This clarification addresses confusion over events that have occurred in service where a pilot has cycled the engine start control switch to re-establish normal engine operation following a compressor stall that causes the engine to not respond to throttle changes. Some have argued that such events, even though the engine was temporarily shut down, should not be counted in the IFSD rate because normal engine operation was reestablished and the engine operated normally for the remainder of the flight.

We agree that an engine control system that performs this cycling as part of its normal design without any flight crew action should not be counted as an in-flight shutdown. The engine control system is performing a function that the engine was certified to perform. Accordingly, we have specifically excluded this type of ''auto-relight'' function from the revised definition.

We have also excluded from the revised definition the situation where an engine does not achieve desired thrust, but is not shutdown. There have been such events in service where some have argued that they should be counted as an in-flight shutdown because the engine does not produce usable thrust for the remainder of the flight. Historically, we have not counted these ''loss of thrust control'' events as in-flight shutdowns because the engines were not physically shutdown by the flight crew. All of these changes to the definition of in-flight shutdown are consistent with our past interpretations under AC 120–42A.

United, American Airlines (American), and Continental all said that the IFSD rates contained in various parts of the rule were inconsistent. United suspects that some of the rates are based on the individual operator's rates and others are based on the world fleet rates. American and Continental requested further clarification as to why the rates in § 121.374 were different from those in part 25, appendix K. American also said there is no guidance or timeline to establish when or if the 120-minute initial rate of 0.05 will be reduced down to 0.02.

The Air Line Pilots Association (ALPA) commented that since the IFSD rates are a benchmark by which a regulator must manage an operator's performance and measure its success, the critical issue is what number above this rate will the FAA use to manage in-flight shutdowns. ALPA asked what the consequence of such a process would be?

The FAA agrees that the NPRM created confusion with how IFSD rates are used for propulsion system reliability monitoring. We have revised the rule to clarify the differences in the various sections of the type design and operating rules that address IFSD rates.

Part 25, appendix K, K25.2, defines the world-fleet IFSD rates that a two-engine airplane would have to achieve before it could receive an ETOPS type design approval based on service experience. As noted by Boeing, calculation of this rate is not based solely on ETOPS operations. There are no comparable IFSD rate requirements for airplanes with more than two engines in K25.3 of appendix K. Because of the greater number of engines per airplane, the corresponding rates for these airplanes would be so high that we were concerned we may inadvertently encourage a lower standard than is already normally achieved without a specific IFSD rate requirement.

The NPRM proposed that IFSD rates for the purpose of obtaining type design approval for ETOPS would be approximate rates. This terminology came from AC 120–42A, which had been successfully applied to those airplanes currently used in ETOPS. However, for the purposes of a final rule, such terminology does not convey that a candidate airplane-engine combination must be at or below these IFSD rates before the FAA would grant an ETOPS type design approval. We recognize that there are circumstances where a candidate airplane-engine combination may be slightly above the regulatory limit, but because of factors such as the small fleet size effect discussed earlier, we may determine that the rate meets the intent of the rule. Therefore, we have revised K25.2.1(b) of this final rule to say that the world-fleet must be at or below the limit unless otherwise approved by the FAA.[14]

K25.2.2(b)(2) of appendix K, requires an applicant for Early ETOPS approval to design an airplane's propulsion system to minimize failures and malfunctions so as to achieve the same IFSD rate objectives as apply to airplanes with service experience.

Paragraph 21.4(b)(2) defines IFSD rates for airplanes that have received ETOPS type design approval. These rates are requirements that apply to airplane and engine manufacturers, and they are used to monitor the reliability of the world fleet in service.

Additionally, the world-fleet IFSD rate applies to operators who must show the FAA that they have the ability to achieve and maintain these rates before the FAA will grant approval to conduct ETOPS. This requirement comes from AC 120–42A, paragraph 10(b) and is now codified in the final rule in part 121, Appendix P, section I, paragraph (a). (Note that the FAA proposed this appendix as Appendix O in the NPRM. Because an Appendix O was adopted in a separate final rule after the ETOPS NPRM was issued, the FAA is adopting proposed Appendix O as Appendix P in this final rule.)

The IFSD rates in § 121.374 are for an individual operator's propulsion system monitoring program. They were derived from AC 120–42A, Appendix 4, and were recommended by the ARAC. These rates are slightly higher than those for the world fleet required elsewhere in the rule. Although operators are required to investigate the cause of each in-flight shutdown in order to maintain their fleet IFSD rate at or below the level required for the world fleet, these higher rates provide a trigger for when the operator must do a comprehensive review of its operations to determine if there are any common cause or systemic errors contributing to the high rate.

The IFSD rate required to obtain type design approval for 120-minute ETOPS in part 25 is 0.05 per 1,000 engine-hours or less. However, unless the IFSD rate is 0.02 or less, the manufacturer must provide a list of corrective actions in the CMP document specified in K25.1.6 of Appendix K that, when taken, would result in a rate of 0.02 per 1,000 engine-hours or less.[15]

The Air Transport Association (ATA) concurs with the IFSD rate requirements for two-engine airplanes under the propulsion system monitoring requirements in § 121.374(i) as they simply codify the existing ETOPS policy and guidance. However, it objects to including IFSD rate standards for three- and four-engine airplanes. The ATA stated that the proposed rate threshold for these airplanes is significantly higher than the current IFSD rates of the industry. It also says that the existing reliability programs and reporting requirements of § 121.703 has provided a safe and reliable system for these airplanes.

The FAA agrees that the IFSD rates identified in § 121.374(i) are significantly higher for three- and four-engine airplanes than for airplanes with two-engines. These rates were the result of applying established risk models and an analysis of the probability of losing a critical number of engines on airplanes with three and four engines.

We also agree that the industry is achieving IFSD rates that are significantly lower than the threshold rates in § 121.374(i). However, if an operator of a three- or four-engine airplane were to actually have a rate higher than the threshold, this provision will aid the FAA and the operator in determining if there are any common cause or systemic errors contributing to the high IFSD rate.

JAA and the UK CAA believe that the 0.01 IFSD rate standard for greater than 180-minute ETOPS should apply to 207-minute approval in the North Pacific as well. Airbus makes a similar comment, but they also suggest that for the 207-minute exception-based operation, the 0.01 rate should be applied in a similar manner to 120-minute ETOPS: That is, start out with an initial rate of 0.02 with a CMP standard that results in a rate of 0.01.

The FAA disagrees that the 0.01 per 1,000 engine-hours IFSD rate requirement should be applied to the specific exception based 207-minute ETOPS approval. This operation is fundamentally a 180-minute operation. The 207-minute allowance is only permitted when the alternate airports normally available within 180 minutes diversion time are not available for a particular flight in the North Pacific area of operations. The baseline airplane requirement for 207-minute ETOPS is a 180-minute type design approval.

The JAA and UK CAA comment that the IFSD rate targets should not be specified in part 21 as it creates an immediate non-compliance in case of an excessive rate, particularly early in the life of an airplane. As discussed earlier, this rule only requires a type certificate holder to issue service information, as appropriate, to maintain the world-fleet IFSD rate at or below the limit. Paragraph 21.4(b)(2) does not apply to an Early ETOPS airplane until the world fleet has accumulated a minimum of 250,000 engine-hours. Accordingly, these commenters' concern about an immediate non-compliance in the early life of an airplane is unwarranted.

The JAA and UK CAA also comment the FAA proposal for diversion times greater than 180 minutes has a fixed IFSD rate requirement unrelated to the maximum approved diversion time, whereas the JAA criteria provide a curve of IFSD rate target from 0.014 to 0.01 per 1000 flight hours for diversion times ranging from 3 to 10 hours.

The FAA requirements are intended to eliminate propulsion system reliability as a consideration from the maximum diversion time capability of the airplane. Only the most time-limiting airplane system capability will determine the maximum diversion time capability for a two-engine airplane under the new requirements for airplanes certified for ETOPS greater than 180 minutes in part 25. The FAA's risk model, discussed in detail in the NPRM, established that the probability of complete loss of thrust due to independent failures with an IFSD rate for two-engine airplanes of 0.01 per 1000 engine-hours would be sufficiently low that the main focus of long-range operational safety should be on reducing the possibility of other risk factors. This approach eliminates the need to re-evaluate an airplane-engine combination's propulsion system reliability each time the applicant seeks to increase the airplane's approved maximum diversion time.

Dassault comments that there are no IFSD rate requirements for airplanes that will be operated under part 135. Thus, they posited that appendix K should be revised to say that the minimum IFSD rates only apply to

[14] Boeing had suggested the FAA merely specify the IFSD rate as approximate. Such a qualifier results in an ambiguous regulation. The FAA believes that it can retain the desired flexibility by approving, on a case-by-case basis, those IFSD rates that exceed the regulatory cap because of unique circumstances.

[15] The NPRM did not clearly state in proposed paragraph 21.4(b)(2) that a reduction in the IFSD rate from 0.05 to 0.02 for 120-minute ETOPS was linked to compliance with a CMP document that was required as a condition for an airplane's ETOPS approval. We have revised the language of this paragraph to clarify this intent.

airplanes that will be used in part 121 operations. Dassault's comment was made with respect to the Early ETOPS method of approval of Appendix K. However, this comment has equal applicability for airplanes certified for ETOPS using the service experience or combined service experience and Early ETOPS methods.

We disagree with Dassault's position. At the time an airplane receives a type certificate, the FAA cannot determine what rules an airplane will be operated under throughout its service life. Part 25 airworthiness standards apply equally to all airplanes receiving part 25 type certificates regardless of the operating part they will be flown under.

Boeing commented that the term ''IFSD'' in the rate implies that only ''flight'' hours should be used as the denominator for the statistic. Boeing recommends changing how the rate is based from ''engine-hours'' to ''engine *flight* hours.'' To do as Boeing suggests would constitute a change in the way IFSD rates have been calculated since ETOPS began in 1985. The FAA discussed whether to calculate the IFSD rate calculations using engine flight-hours when the IFSD rate definition was established in 1985. At that time, the industry had already established methods for tracking engine-hours, and the FAA did not want to create an additional burden on the industry by requiring it to track engine-flight hours for the purpose of calculating an IFSD rate for ETOPS. Given the historical method of calculation is well understood, we have decided against adopting Boeing's suggestion.

Boeing also recommended replacing the word ''operations'' with ''type design approval'' for each IFSD rate listed in K25.2.1(b) of Appendix K. Boeing stated that part 25 pertains to type design approval and using the word ''operations'' could create unnecessary confusion with the operational approvals granted under parts 121 and 135. We agree and have made this change as Boeing recommended.

The NPRM proposed a new paragraph 21.4(c), which defined what actions the FAA would take if the world-fleet IFSD rate were exceeded. General Electric (GE) stated that section 21.4(c) is inconsistent with AC 39–8, which stated that any IFSD rate less than 2×10^{-4} per cycle is not an unsafe condition. We disagree with GE. AC 39–8 provides general policy the FAA Engine and Propeller Directorate uses as a guideline for determining whether an unsafe condition exists for engines used in all types of airplane operations. Since it is advisory in nature, this policy is subject to change.

Proposed paragraph 21.4(c) stated the FAA will review the IFSD rate to determine if an unsafe condition exists. The FAA will review all in-service problems to determine if an unsafe condition exists and may issue ADs as necessary to correct each unsafe condition found. If each individual cause for an in-flight shutdown does not constitute an unsafe condition, the FAA has the discretion to determine that a high IFSD rate by itself constitutes an unsafe condition and may issue an AD mandating a revised CMP document containing several corrective actions that collectively will bring the IFSD rate back down to a safe level. Because the FAA already has this discretionary authority, proposed paragraph 21.4(c) is unnecessary and has been withdrawn from this final rule.

VIII. Definition of ETOPS Significant System

Boeing, Airbus, and ALPA had comments on the proposed definitions of ETOPS significant systems, ETOPS Group 1 systems, and ETOPS Group 2 systems.

Boeing stated that the definition of ETOPS significant systems should be revised to add ''extended'' before ''diversion'' at the end of the first sentence to clarify that ETOPS significant systems relate to extended diversions of ETOPS flights, not any length diversion. ALPA recommended deleting the last part of the definition of ETOPS significant systems ''based on the relationship to the number of engines, or to continued safe engine operation'' since the definition of ETOPS significant systems make this redundant. Boeing recommended deleting the parenthetical examples from the definition of ETOPS Group 1 systems. They felt that the examples could be confusing or misinterpreted for designs where these systems may not be associated with the number of engines. Airbus commented that the NPRM introduced definitions for ETOPS Group 1 and ETOPS Group 2 systems, but did not use them anywhere in the proposed rule. It recommended the FAA withdraw these two definitions.

The FAA agrees that the definition of ETOPS significant systems needs clarification. We agree with the recommended changes from Boeing and ALPA for the reasons they cited. We have made these changes in the final rule.

Airbus is correct that nowhere in the NPRM was ETOPS Group 2 significant systems used. However, the term ''ETOPS group 1 significant systems'' was used in several places in the NPRM, including the problem reporting requirements for Early ETOPS airplanes in paragraph 21.4(a) and the relevant experience assessment required for Early ETOPS two-engine airplanes in K25.2.2(a) of Appendix K. The generic term ''ETOPS significant systems'' is also used in several places, including paragraph 21.4(a) and the time limited systems requirement of K25.1.3(c).

We looked at whether we could eliminate the group 2 definition and combine the group 1 definition with the basic ETOPS significant system definition. However, there is a sufficient difference between the group 1 systems, whose design depends on the number of engines on the airplane, and the other ETOPS significant systems, such as a cargo fire suppression system, whose design does not depend on the number of engines, but whose failure or malfunctioning could adversely affect the safety of extended operations. We could not eliminate this broader class of ETOPS significant systems from the rule, nor could we include these systems in those requirements that only apply to the group 1 systems without increasing the burden of those requirements. Even though ''ETOPS group 2 significant systems'' is not used in the rule, we have decided to keep this term for completeness. We have revised the definition to clarify that an ETOPS group 2 system is any ETOPS significant system that is not a group 1 system.

IX. Airplane and Engine Certification Requirements

A. Transport Category Airplanes Airworthiness Standards (Part 25)

As proposed in the NPRM, we are adding a new § 25.1535 to part 25 as a general requirement for manufacturers seeking ETOPS type design approval. The FAA decided against adopting a new subpart into part 25 because ETOPS approval is an optional certification for manufacturers. The NPRM contained three provisions under this section. These included showing compliance with part 25 requirements considering the maximum mission time and longest diversion time, considering crew workload and operational implications and the flight crew's and passengers' physiological needs following system failures, and complying with the requirements of a new part 25 appendix. The specific airworthiness requirements applicable to ETOPS type design approval are contained in that appendix.[16]

[16] The first two provisions, contained in subparagraphs (a) and (b) of § 25.1535 in the NPRM, are also specific airworthiness requirements that are

1. General

Today's rule adopts a regulatory scheme that airplane manufacturers must follow to receive ETOPS type design approval. Airplanes with existing type certificates at the time this rule becomes effective are exempted from some or all of the new part 25 requirements (see § 25.3).[17] The inclusion of type design requirements and reliability validation methods in the rule has been objected to by the JAA and the UK CAA. They state a regulatory approach is too prescriptive and does not allow any flexibility for alternative reliability methods. These commenters add that the design materials are already included as objective requirements in Title 14 of the Code of Federal Regulations. Further, they state that the reliability validation process should be included as interpretive material to be agreed upon at the time of application.

The FAA understands that the European Aviation Safety Agency (EASA) may be taking a different approach in overseeing ETOPS design criteria. We believe JAA's and UK CAA's comments reflect this philosophy. The type design requirements and reliability validation methods adopted today are the result of nearly 20 years of successful experience in certifying airplanes for ETOPS. However, most of this experience comes from the two major transport airplane manufacturers in the world today. As ETOPS has grown, and now with the new operating requirements expanding ETOPS to part 135 airplanes, we expect many more manufacturers to apply for ETOPS type design approval.

The type design requirements contained in this rule provide a consistent standard of proven ETOPS type design approval methods for the new applicants. This will ensure that all manufacturers use the same methods as used successfully in previous ETOPS approvals the FAA granted under AC 120–42A and the Boeing Model 777 ETOPS special conditions.

We also disagree that the airworthiness standard contained in appendix K does not allow any flexibility for alternative reliability methods. If an applicant chooses to pursue validation methods different from those in appendix K, the applicant may do so under § 21.21(b)(1).

more appropriately located in new appendix K. In this final rule, we have re-identified these subparagraphs as paragraphs K25.1 and K25.1.2.

[17] The FAA believes the accommodation to existing type certificate designs should relieve the concerns raised by NACA regarding the economic impracticability of the new requirements for existing airplane designs, a concern shared by the FAA.

Dassault stated that parts of the proposal, such as the requirement for an independent electrical power source for fuel boost pumps and cross-feed valve actuation, would impose a system architecture. Dassault notes that the goal of a requirement should be to set safety objectives rather than drive airplane systems design.

We agree with Dassault's basic premise that the goal of a requirement should be objective rather than prescriptive. We have made every effort to define objective requirements whenever possible except where existing experience dictates that a specific design requirement is necessary to provide an acceptable level of safety.[18]

Dassault also stated that the NPRM lacked information that normally would be part of an advisory circular. It recommended the FAA publish the advisory circular and then reopen the comment period. We have decided against delaying this rule until after publication of an advisory circular on the proposed rule. Since the advisory circular defines an acceptable method of compliance, but not the only method, it is not a necessary element of the rule. Dassault will have an opportunity to comment on the associated advisory circular under a separate notice of availability.

2. Additional Airworthiness Requirements for Approval of an Airplane-Engine Combination for ETOPS (Part 25, Appendix K)

The NPRM proposed adding a new appendix K, which defines specific airworthiness requirements for type certification of an airplane for ETOPS. The appendix is divided into three parts. Section K25.1 is applicable to all airplanes, K25.2 is applicable to airplanes with two engines, and K25.3 is applicable to airplanes with more than two engines.

The NPRM divided the appendix into three sections I, II, and III. Paragraphs of each section were labeled sequentially as (a), (b), (c), and so on. This numbering system led to confusion on how to refer to paragraphs from different sections with the same number. In this final rule, we have reorganized the paragraph numbering to include the applicable section in the paragraph number. This renumbering more clearly identifies which section of the appendix a particular paragraph is in.

[18] The particular section mentioned in Dassault's comment codifies a provision of the 207-minute ETOPS policy letter EPL 20–1. As stated in the preamble to the NPRM, loss of normal electrical power to the boost pumps is the primary cause of the loss of fuel system boost pressure. The FAA finds it necessary to include this requirement in order to address this specific cause of loss of fuel boost pressure on airplanes being certified for greater than 180 minute ETOPS. Paragraph K25.1.4(a) defines the basic objective for the fuel system design. Changes to this rule in response to Boeing comments on that provision provide a less restrictive requirement while maintaining the basic objective.

Appendix K—Design Requirements (K25.1)

We moved paragraphs (a) and (b) from proposed § 25.1535 in the NPRM to K25.1 as these are design requirements that an applicant must comply with for all airplane-engine combinations proposed for ETOPS type design approval. The following discussion of comments refers to the designation of these paragraphs in the final rule.

Boeing stated that the ARAC proposal did not discuss how system safety assessments are conducted for ETOPS. Boeing points out that the JAA's draft Notice of Proposed Amendment (NPA) addresses how to conduct system safety assessments for group 1 versus group 2 systems and recommends the FAA include similar information in its guidance material. Boeing recommends the FAA acknowledge in the preamble that the system safety assessments are different for group 1 and group 2 systems and reference the JAA's draft NPA.

Boeing is correct that ARAC did not discuss how airplane system safety assessments are to be conducted for ETOPS. However, we disagree with Boeing that there should be a difference between Group 1 and Group 2 systems. Section K25.1 simply requires an applicant to comply with the requirements of part 25 considering the maximum flight time and the longest diversion time for which the applicant seeks approval. Airplane safety assessments would be covered under the specific objectives of §§ 25.901(c) and 25.1309 considering these additional factors.

The FAA has already established a body of policy for showing compliance with these sections. These policies do not differentiate between systems whose design depends on the number of engines from those that do not. Boeing did not provide any justification for treating relevant system failure conditions for ETOPS assessment differently just because they are associated with Group 2 systems. The main impact that ETOPS will have on airplane safety assessments is a potential increased hazard when considering the long range and diversion distances associated with an ETOPS flight. The purpose of conducting the airplane safety assessments required by §§ 25.901(c) and 25.1309 are to evaluate the airplane for potentially hazardous safety conditions that are not specifically addressed elsewhere in the rule.

Boeing also provides suggested language for system safety assessments to be included in the ETOPS advisory circular. That language is not relevant to the specific safety objective of paragraph K25.1.1. However, Boeing will have an opportunity to comment on the part 25 ETOPS AC under a separate notice of availability.

Although paragraph K25.1.1 would require an applicant to consider the flight crew's and passengers' physiological needs following failures during a maximum length diversion, Transport Canada is concerned about the introduction of new technologies such as onboard oxygen generating systems. These systems would allow flight with a depressurized cabin at altitudes in excess of 15,000 feet, which would require less fuel for diversions on ETOPS flights because airplanes do not use as much fuel at higher altitudes.

Transport Canada stated that the NPRM does not adequately address the potential physiological problems for crewmembers or passengers associated with continued exposure to higher altitudes even if breathing 100 percent oxygen. Therefore, Transport Canada recommends the FAA revise the appendix to include a maximum decompression profile altitude, such as 18,000 feet.

We agree that Transport Canada's comment has merit, but is beyond the scope of this rulemaking project, which was to codify existing ETOPS standards and certain ARAC recommendations. The FAA is investigating specific policy or future regulations for the certification of onboard oxygen generating systems. When we receive an application for approval of such a system, we will apply this policy as interpretation of existing regulations or introduce special conditions if appropriate.

Appendix K—Operation in icing conditions (K25.1.3(a))

The NPRM proposed that an ETOPS airplane must be certified for flight in icing conditions in accordance with § 25.1419, which is otherwise optional. In addition, the NPRM proposed that the ice protection systems must be capable of continued safe flight and landing at engine inoperative and decompression altitudes in icing conditions, and the applicant show the unprotected areas of the airplane would 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.

Only ALPA supported the proposed requirements for operation in icing conditions without change. New World Jet stated the manufacturer already demonstrates that its airplanes can operate in icing conditions and questions why the proposal would be different from normal requirements.

Although airplanes are regularly certified for flight into known icing conditions under § 25.1419, part 25 does not require that certification in order to be granted a type certificate. Paragraph K25.1.3(a)(1) of today's rule makes certified flight into known icing conditions a prerequisite for ETOPS approval. The other part of paragraph K25.1.3(a)(2) addresses the unique aspects of operation in icing conditions during an ETOPS flight not now covered in a basic part 25 evaluation of flight into icing conditions.

Boeing agrees the FAA needs to codify the icing criteria in AC 120–42A, paragraph 8(b)(11). However, Boeing is concerned the proposed requirement could create confusion with respect to compliance with § 25.1419 and the operational fuel planning requirements in parts 121 and 135. Boeing recommends the rule be rewritten to a single requirement stating, ''The airplane must be able to safely conduct an ETOPS diversion in icing conditions.''

The FAA does not believe paragraph K25.1.3(a) will create confusion with respect to compliance with the basic § 25.1419 icing regulation and the operational fuel planning requirements in parts 121 and 135. In addition to applying to airplane manufacturers under part 25, rather than operators under parts 121 or 135, the objectives of paragraph K25.1.3.(a), including § 25.1419, are different from the fuel planning requirements of parts 121 and 135. The part 25 requirements establish that an airplane can operate safely in icing conditions that could be encountered during an ETOPS flight. The operational requirements ensure enough fuel is onboard to safely complete a flight along a route with known icing conditions. In order to establish safe operation, the manufacturer must define the most critical ice accumulation that may occur on the airplane. This accumulation usually also results in the highest fuel usage. Thus, it is likely the airplane manufacturer will use the testing and analysis performed for compliance with paragraph K25.1.3(a) to develop the performance data an operator will need for compliance with the fuel planning requirements of parts 121 and 135.

The JAA and UK CAA state the terms ''load of ice'' and ''too much drag'' in the proposed appendix are not appropriate language for regulatory material because they lack precision. Airbus recommends the FAA withdraw the proposed requirement because this issue is not unique to ETOPS and would be more appropriately addressed under a general rulemaking action.

We agree the proposed paragraphs lacked normal regulatory precision. We also agree with Boeing that the intent of AC 120–42A was to ensure the airplane would continue to be airworthy, considering the exposure to potential icing conditions during an ETOPS diversion at engine-inoperative or decompression altitudes.

The NPRM proposed requirements to meet this objective, but did not clearly state that continued safe flight and landing at engine inoperative and decompression altitudes in icing conditions applies to all of the flight phases during an ETOPS diversion, including a 15-minute hold. The NPRM also did not define the icing conditions to consider during each of these flight phases.

In § 25.1419, safe operations with ice accretions on the protected and unprotected areas are considered, but not specifically mentioned. The FAA has revised this final rule to more clearly state which flight phases and associated icing conditions must be considered during an ETOPS diversion. Paragraph K25.1.3(a)(2), requires that the airplane must be able to safely conduct an ETOPS diversion with the most critical ice accretion resulting from:

(A) Icing conditions encountered at an altitude that the airplane would have to fly following an engine failure or cabin decompression; and

(B) A 15-minute hold in the continuous maximum icing conditions of Appendix C with a liquid water content factor of 1.0.

(C) Ice accumulated during approach and landing in Appendix C icing conditions.

This new paragraph makes the rule language similar to § 25.1419 while adding the icing conditions encountered during an altitude-limited diversion to those factors currently evaluated under § 25.1419.

Boeing, Dassault, and Airbus all state additional guidance for this rule is needed in an associated advisory circular. Dassault and Airbus stated the NPRM would require analytical and flight testing to assess the impact of ice accumulation. The commenters add that without guidance material describing the assessment, they cannot comment properly on this section. Airbus also adds that it is inappropriate for the FAA to define a critical test parameter in an advisory circular.

As discussed above, the FAA has revised this final rule to clarify the flight phases and associated icing conditions to consider during an ETOPS diversion. The FAA disagrees that the associated guidance material is necessary to properly comment on the proposal. Airbus rightfully notes that it is inappropriate for the FAA to define a critical test parameter in an advisory circular, and the FAA is not doing that. Rather, the advisory circular merely will describe an acceptable method for showing compliance with the new rule.

The rule as revised stands on its own merit. The second and third provisions of the revised paragraph K25.1.3(a)(2) are based on Appendix C icing conditions that are currently evaluated for compliance with § 25.1419. There is currently no accepted industry standard for icing conditions that may be encountered during an altitude-limited diversion due to an engine failure or cabin decompression. Until such an industry standard is developed and accepted by the FAA, each applicant will have to propose an acceptable method for showing compliance with this requirement.

Airbus stated that the preamble does not indicate why the FAA increased the severity of the certification standards and does not relate the increase to a clearly documented service event or safety problem that has occurred. Nor does the economic impact assessment compare the cost of the proposed type design assessment to the expanded safety benefit. Airbus stated the FAA proposed to reduce the contribution of icing in the ETOPS fuel reserve calculations compared with the reserves required by current ETOPS criteria as a result of the CASP II [19] icing research program that ARAC extensively used to show that prolonged substantial icing was virtually impossible during a diversion. On the other hand, Airbus pointed out that the type design rule seems to assume that extremely severe icing beyond the level covered by normal certification criteria may be encountered during engine inoperative diversions at decompression altitudes. Thus, Airbus posited that the proposed type design rule appears to contradict the operating rule, which excludes significant prolonged icing.

We have not increased the severity of part 25 certification standards as indicated by Airbus' comments. ETOPS approvals accomplished in accordance with AC 120–42A have included conditions that were not previously considered during a part 25 certification program. This rule codifies the existing ETOPS policies and practices. Consequently, the part 25 regulations address the ETOPS-related issues that were addressed in previous ETOPS approvals. The FAA has determined that the current policies applied to approve airplanes for ETOPS have provided an acceptable level of safety. This rule simply codifies these policies.

The FAA does not agree that the type certification and operating rules are contradictory. Previous ETOPS type design approvals have included an evaluation of the drag effects of conservative ice accumulations on airplane surfaces. The FAA determined that this conservatism, combined with the operational fuel reserves resulting from the original ETOPS icing fuel planning requirements, has been excessive. The NPRM proposed to reduce the fuel reserves required for ETOPS operational dispatch on the assumption that the fuel consumption used for fuel planning would be based upon the conservative ice shapes used during the type certification of the airplane.

The Final Regulatory Evaluation includes the overall cost to comply with the proposed rulemaking and the overall benefit of the rule. The ETOPS icing requirements define additional conditions that an applicant must consider when showing compliance with § 25.1419 to certify an airplane for flight in icing. The maximum ice accretion on an airplane during an ETOPS diversion will be compared to the maximum accretion from other icing conditions used for icing certification to determine the most critical ice shapes to demonstrate during certification flight testing. The applicant will also likely use these ice shapes to define fuel consumption in icing conditions that the operators will use for ETOPS fuel planning.

Airbus indicates that the rule seems to assume the airplane will encounter ''extreme severe icing'' during a diversion. This interpretation of the proposed amendment is incorrect. The rule requires an applicant consider icing conditions expected to occur at the altitudes an airplane would fly during a maximum length diversion with an inoperative engine or depressurized cabin. The rule merely requires the consideration that the airplane may be at altitudes conducive to icing for extended distances. The FAA does not consider this to be extremely severe icing, although the resulting ice accumulations may be greater than that resulting from traditional compliance with § 25.1419.

We acknowledge the CASP II icing research that Airbus cites showing that prolonged substantial icing is virtually impossible during a diversion. However, the CASP II data only covers a limited part of the globe in the North Atlantic region. Since a significant future growth is forecast for ETOPS in the Arctic, Antarctic and Southern oceanic areas, we are concerned about the ice accumulation that may occur during altitude-limited diversions in those areas.

As we indicated above, each applicant will have to propose an acceptable method for showing compliance with the icing requirements. The applicant may use whatever data at its disposal to justify the icing conditions used to determine the most critical ice accretion during an altitude limited diversion.

Dassault recommends the FAA not go beyond already established certification standards, in particular the maximum three inches of ice in the JAA's proposed Advisory Circular Joint (ACJ) 25.1419. Dassault's proposal would impose a specific design requirement in this rule. In keeping with our overall objective of basing regulations on the safety objectives, instead of driving airplane design, we are not adopting Dassault's recommendation. Each applicant will have to propose an acceptable method for determining the ice thickness to be evaluated in order to meet the overall objectives of the requirement.

The British Air Line Pilots Association (BALPA) notes that an auxiliary power unit could be susceptible to icing during prolonged exposure to icing conditions while on the ground. BALPA is concerned that running the APU in flight during prolonged icing conditions may result in surging or failure and loss while the APU is being used as a critical power source. As a result, BALPA recommends the FAA amend the rule to require an APU to continue to function in icing conditions.

The FAA agrees with BALPA that an APU could be susceptible to icing during prolonged exposure to icing conditions. The FAA evaluates APU

[19] The Atmospheric Environment Service (AES) of Canada with support from the National Research Council (NRC) of Canada conducted the Second Canadian Atlantic Storms Program (CASP II) out of St. John's, Newfoundland during the period of January 16 through March 16, 1992. The objective of this program was to study the icing climatology off the east coast of Canada to provide better short term, severe weather forecasting for the area around the Hibernia Oil Fields and the cod fishing ground in the Grand Banks. ARAC used the data from this research to evaluate the severity and extent of icing conditions that may be encountered during an ETOPS diversion.

exposure to icing conditions during basic certification of the airplane for compliance with § 25.1093(b). This evaluation includes the ground operating condition, which historically has been the most severe operating environment for an APU in icing conditions. This finding correlates with the commenter's own experience. However, the FAA does not believe that a change to the rule is necessary. New section K25.1 will require an applicant to consider the ETOPS mission in showing compliance with the requirements of part 25. For an APU, this would include operation in icing conditions for compliance with the applicable part 25 APU icing requirements.

Airbus stated that three- and four-engine airplane service experience indicates that depressurization events almost never occur in cruise or during the ETOPS portion of the flight. It goes on to state that engine failures do not put three- and four-engine airplanes at icing altitudes. Airbus contends that there is no support for applying the type design rule to three- and four-engine airplanes.

Though uncommon, decompression events have occurred at cruise altitudes. Furthermore, most decompression events are independent of the number of engines on the airplane. Following decompression, it is common practice to descend to and maintain an altitude where supplemental oxygen is not required. This would result in operation of the airplane at altitudes where icing can occur.

The FAA agrees that the engine inoperative altitudes for three- and four-engine airplanes may place them above altitudes conducive to icing. This would mean that the engine inoperative diversion would not contribute to the most critical ice accretion that the applicant must consider for compliance with the rule. However, the applicant would still have to consider the ice accretion during a 15-minute hold, approach and landing as those phases of flight are relevant to all airplanes regardless of the number of engines.

Appendix K—Electrical power supply (paragraph K25.1.3(b))

The NPRM proposed requirements for airplane electrical system reliability, including a requirement that airplanes certified for ETOPS greater than 180 minutes must be equipped with at least three independent electrical generation sources.

The JAA and the UK CAA state that the second and third electrical system requirements proposed in the NPRM are objective requirements already covered in part 25 and JAR 25. The FAA agrees. These proposed paragraphs are essentially restatements of § 25.1309(b)(1) and (2), which are already required for ETOPS airplanes by new paragraph K25.1.1. These paragraphs are deleted from the final rule.

ALPA expressed concern that the proposal did not conform to the current standard of requiring three independent electrical power sources for all two-engine airplanes approved for ETOPS, including for diversion times less than 180 minutes. ALPA stated that ARAC was tasked with codifying current design and MMEL relief provisions for two-engine airplanes. ALPA expressed discomfort with the lack of justification in the NPRM for ignoring current requirements. ALPA also suggested that future three- and four-engine airplanes could be developed with fewer than three electrical power sources. ALPA proposed changes to the rule to ensure that all ETOPS airplanes covered by part 121 and two-engine airplanes covered by part 135 would comply with the three-generator requirement.

The FAA acknowledged in the NPRM that the three-generator requirement would apply only to airplanes being certified for greater than 180-minute ETOPS. AC 120–42A specifies three generators for any airplane approved for ETOPS under this guidance. However, the FAA also stated in the NPRM that the proposed requirement represented a compromise position that allowed ARAC consensus on the proposal. ALPA is the only organization to comment that the rule should apply to ETOPS approval of any two-engine airplane intended for part 121 operations, indicating general support for this compromise.

However, after further consideration, and in order to establish a consistent industry minimum standard for ETOPS, the FAA has revised paragraph K25.1.3(b) to require a minimum of three independent sources of electrical power for all airplanes being approved for ETOPS without regard to maximum diversion time. Manufacturers already have to comply with § 25.1309. The FAA has determined from service experience that a minimum of three electrical power sources is necessary to comply with the objectives of § 25.1309 when considering long ETOPS diversions. Paragraph K25.1.3(b) codifies the "three-generator" criteria of paragraph 8.(b)(8) of AC 120–42A.[20]

New World Jet commented that levels of risk are defined based upon systems design and failure rate and then compared to a determined level of acceptable risk for the operation to be conducted. If the risk is within an acceptable level, the aircraft should be allowed to operate at the specified number of minutes from an airport. The probability of an event associated with aircraft system failures, rather than the number of generators, should determine if an aircraft is qualified for a route.

The FAA agrees that the level of risk of a system failure should be commensurate with its effect on the safety of the airplane. The airplane system assessments required by § 25.1309 do exactly as New World Jet suggested. New section K25.1 would require an applicant to show compliance with this section considering the effects of a system failure during an ETOPS flight. The three generator requirement of paragraph K25.1.3(b) is an acknowledgement that electrical generator technology has not yet achieved a level of reliability that would allow an electrical system design with fewer than three generator sources and still meet the system safety objectives of § 25.1309 for ETOPS approval.

The JAA and the UK CAA stated that the JAA specifies what loads each electrical power source should be capable of powering in an Advisory Circular Joint. Since each new airplane may have unique electrically powered functions that are critical to continued safe flight and landing, the FAA is reluctant to specify a list of functions. The safety assessments required under § 25.1309 will determine what system functions must be powered by the three required electrical power sources. These assessments should consider the cumulative effect on airplane safety from the loss of seemingly unrelated airplane system functions resulting from the same loss of power.

The JAA and UK CAA add that for beyond 180-minute ETOPS, a fourth stand-by power source is needed, because it is unlikely that three power sources would meet the safety objectives associated with the total loss of electrical power. The FAA does not have any data to confirm a fourth stand-by electrical power source would be required to meet the safety objectives associated with the total loss of electrical power for diversion times

[20] Four commenters remarked that the three-generator requirement was too prescriptive. These commenters believe that the rule should allow the safety analyses to dictate the number of electrical power sources rather than specifying a number in the rule. We disagree that the rule is too prescriptive. This paragraph establishes a consistent industry minimum standard for ETOPS in keeping with the original objective of paragraph 8(b)(8) of AC 120–42A.

greater than 180 minutes. Accordingly, the FAA is comfortable in letting the safety analyses of § 25.1309 determine if additional power sources are required.

American Airlines asks whether a ram air turbine generator would be considered an alternative source of electrical generation for compliance with the rule or whether the APU is the only acceptable third independent source of power for a ''legacy'' aircraft like the Boeing Model 777. It further queries whether the determination of the three independent electrical generation sources is left to the discretion of the individual operators or the aircraft manufacturer.

The airplane manufacturer will decide what power sources constitute the three independent electrical power sources for compliance with paragraph K25.1.3(b). Any electrical power source that provides those airplane functions for continued safe flight and landing during an ETOPS diversion would qualify as one of the three independent sources of electrical power. Electrical power sources the FAA has accepted for meeting this requirement include generators powered by a ram air turbine (RAT), APU generators, or dedicated back-up generators driven by the main engines. Future airplanes may have other arrangements to meet this requirement.

Appendix K—Time-limited systems (K25.1.3(c)) and Airplane flight manual (K25.1.7(d))

The NPRM proposed to add a new requirement to existing § 25.857(c)(2) that would require an applicant to provide the certified time capability of a Class C cargo compartment fire suppression system in the airplane flight manual for ETOPS approval. One paragraph in the proposed appendix would have required an applicant to define each ETOPS significant system that is time-limited while a separate paragraph in that appendix would have required the airplane flight manual to contain the maximum diversion time capability of the airplane.

The JAA and the UK CAA commented that it is not clear whether the certified time capability of the cargo fire extinguishing system under the proposed § 25.857(c)(2) would be considered as a particular case or if it would be treated separately as additional time limited information under the proposed appendix. They also commented that the rule should indicate how to translate the maximum system capability into maximum diversion time.

The FAA agrees that the NPRM was unclear how proposed § 25.857(c)(2) and the two paragraphs of the proposed appendix are related to each other. We also agree that it was not clear how cargo and baggage compartment fire suppression system information and other limiting airplane systems' time-capability should be defined in the airplane flight manual. We have revised this final rule to state that the applicant must define the system time-capability of each ETOPS Significant System that is time-limited under appendix K (K25.1.3(c)). A time-limited cargo fire suppression system for any cargo or baggage compartments would be included under this requirement.

We have also revised the airplane flight manual requirement in paragraph K25.1.7(d) to require the operator to identify in the airplane flight manual the system time-capability for both the most limiting fire suppression system for any cargo or baggage compartment and the most limiting ETOPS Significant System other than fire suppression for cargo and baggage compartments. It is necessary to specify both times in the airplane flight manual because of how they are used in the operating rules to determine the maximum diversion time that an airplane may fly. We are withdrawing the proposed change to § 25.857(c)(2), because we have determined it is no longer needed and is potentially confusing.

The FAA likewise recognizes that the proposed paragraph on maximum diversion time capability for the flight manual was confusing. We did not intend to require the maximum diversion time capability be stated in the airplane flight manual. The maximum diversion time that an airplane may operate is controlled by the operating rules in parts 121 and 135. Our changes to this requirement in paragraph K25.1.7(d) described above clarify our original intent.

Boeing stated the FAA needs to issue advisory material to clarify the compliance methods for obtaining ETOPS approval of cargo compartments. Boeing recommended the FAA allow certification of any required changes using the policies and certification methodology in place at the time of original type certification of the airplane. Boeing also stated that compliance with the flight test requirements in § 25.855(h)(3) should be allowed based on data from the original certification flight tests of the airplane model being modified. Boeing added that additional flight testing should be required only if novel systems designs are used.

In its comment, Boeing seemed to be concerned about the certification of increased capacity cargo or baggage compartment fire suppression systems on currently certified airplanes. The requirements of the Changed Product Rule, § 21.101, will apply to the modification of currently certificated airplanes. The certification of time-limited cargo or baggage compartment fire suppression systems will be done in accordance with the applicable certification requirements, methods, and policy as determined through compliance with § 21.101.

Appendix K—Fuel system design (K25.1.4(a))

The NPRM proposed three requirements for an airplane fuel system design. The first would require that the system supply fuel to the engines at a pressure required by the engine type certificate for any failure condition not shown to be extremely improbable. The second would require one fuel boost pump in each tank and at least one crossfeed valve to be powered by a back-up electrical generation source other than the primary engine or APU driven generators. The third fuel system provision would require alerts to be displayed to the flight crew when the quantity of fuel falls below the level required to complete a flight.

Boeing stated the FAA has unintentionally proposed an increase to the safety requirements for existing ETOPS approvals. This section presented objective requirements but does not take into consideration the practical impact on fuel system design. Boeing noted the FAA's explanation in the NPRM suggests that there must always be a method for boosting the fuel pressure delivered to the engine beyond what is available from head pressure or fuel tank ram air rise. Boeing pointed out that with today's fuel boost pumps and their associated reliability, the standard design configuration of two fuel boost pumps per tank would not meet the intent of this section.

Boeing agreed it is important that fuel be available to the operating engine or engines at the pressure and flow required for safe operation. Boeing pointed out that the ARAC and the JAA working groups extensively discussed this issue and the intent of this requirement was to ensure the fuel boost pumps would function following all power supply failures not shown to be extremely improbable. Boeing stated ARAC found the two fuel boost pumps per tank configuration was satisfactory for any length ETOPS operation and determined adding boost pumps to a fuel tank would be detrimental and introduce additional complexity to the fuel system without any benefit. Boeing stated the JAA's draft Notice of Proposed Amendment allows engine operation at negative fuel pressures (suction feed) provided appropriate criteria are met. Boeing disagreed with the NPRM and stated that not allowing suction feed is overly restrictive. Boeing also suggested rule language changes consistent with their comments including provisions for demonstrating suction feed operation.

We disagree with Boeing's proposal to limit consideration of loss of fuel boost pressure to only fuel pump power supply failures. The proposed rule stated a clear objective that the airplane fuel system must deliver fuel to the engines at the pressure and flow they require for any intended operation following airplane failure conditions that are not extremely improbable. These may include failures to more than just the fuel pump power supply.

This rule intentionally increases the safety standard from that applied to airplanes approved under the previous guidance. The FAA went to great lengths in the NPRM to explain the safety justification for this requirement. Section 25.1351(d) requires an applicant to show that an airplane can operate safely in visual flight rule weather conditions for at least 5 minutes with normal electrical power inoperative using the type fuel most likely to cause an engine flameout with the airplane initially at its maximum altitude. Airplane manufacturers show compliance with this requirement by demonstrating that an engine will start on suction feed following an expected engine flameout at this altitude. The reason this demonstration is required for a minimum of five-minutes is to give time for the flight crew to restore normal electrical power to the fuel boost pumps after engine restart.

Current regulations do not require applicants to demonstrate the engines will operate at negative pump inlet pressures (suction feed) for extended periods of time. The types of engine failure conditions that could result from suction feed operation fall into two categories, engine operating problems and mechanical failures. Engine operating problems could mean engine instability, permanent loss of thrust, or flameout. Mechanical failures to the engine pump would result in flameout and permanent loss of the engine for the remainder of the flight.

The FAA is aware of at least one engine pump failure that occurred on a test stand during a non-required demonstration of suction feed operation. A loss of fuel boost pressure to more than one engine during an ETOPS diversion on an airplane with engines with this kind of vulnerability could potentially result in the failure of multiple engines from the same cause. However, contrary to Boeing's comments, certifying an engine for extended suction feed operation is an acceptable option for complying with paragraph K25.1.4(a). In this case, the airplane manufacturer must design a fuel feed system to deliver fuel to the engine above a certified suction feed pump inlet pressure limit established for the engine under § 33.7. The engine manufacturer must demonstrate acceptable engine operation and integrity under part 33 in order to establish this suction feed limit.

The effect of today's rule is to ensure that the engines will always have fuel delivered at normal pump inlet pressure, or that the engines are certified to operate for the longest diversion time for which the airplane manufacturer is requesting approval at the lowest engine pump inlet pressure expected to occur during operation with the normal airplane fuel boost pumps inoperative. If an applicant chooses to use suction feed as a means to comply with this rule, it must demonstrate safe operation of the airplane in that configuration.[21]

When using suction feed to comply with this requirement, the Instructions for Continued Airworthiness developed in accordance with § 25.1529 must include procedures for maintaining the integrity of the fuel system plumbing. The purpose of these procedures is to prevent the introduction of air into the fuel feed lines during suction feed operation. Any air in the fuel feed lines can lead to flameout of a turbine engine.

Boeing recommends revising the proposed requirement for an alternative fuel boost pump power source to not limit it to a back-up electrical generator. Boeing stated that an acceptable design could be a four-generator system, all with equal capability. We agree with the intent of Boeing's comment that the back-up generator source required in proposed requirement could include a fourth main electrical generator instead of a back-up generator system. We have broadened the requirement of K25.1.4(a)(2) to state that for two-engine airplanes to be certified for ETOPS beyond 180 minutes, one fuel boost pump in each main tank and the actuation capability of at least one crossfeed valve must be capable of being powered by an independent electrical generation source other than the three required to comply with K25.1.3(b). This requirement does not apply if the required fuel boost pressure or crossfeed valve actuation is not provided by electrical power.

Dassault commented that it understands the FAA's intent for an automatic warning to clearly indicate to the flight crew what's wrong with the fuel system, but believes this is not the only way to achieve this goal. Dassault stated that pilot training and fully developed flightcrew procedures are another efficient way to achieve the same goal. Dassault pointed out that automatic fuel alerts would require flightcrew initialization before the flight. Dassault noted that the human error during this procedure is of the same order of magnitude as the application of procedures. Therefore, Dassault stated that adequate pilot training and procedures provide an equivalent means of compliance.

UPS stated that an automatic warning is not necessary for three- and four-engine ETOPS airplanes because of their demonstrated safety and reliability. UPS pointed out that the rule seems to assume a two-crew airplane and does not take airplanes with three crewmembers into account. UPS added that compliance with this section would require extensive modifications to three- and four-engine airplanes to add flight management computers to provide the required alerts. It argued this burden is unjustified because there is no need for the automatic warning.

The FAA does not believe crew training and fuel management procedures are a long-term solution for the types of fuel exhaustion events the FAA is addressing with this requirement. Dassault's proposal in effect would not require anything not already done operationally. The low fuel alerting system will provide a safety net for major fuel loss events or fuel loading errors perhaps too difficult to detect by operational procedures alone, such as occurred in 2001 when an Air Transat A330 was forced to land in the Azores following an all engine flameout from fuel exhaustion.

However, we recognize some existing airplanes may have difficulty in complying with this requirement without substantial airplane system modifications. Also, older three-crew airplanes have a flight engineer who monitors fuel quantity throughout a long flight. The FAA considers this additional crewmember to be an

[21] Boeing recommended rule changes that add certain conditions that an applicant must consider if suction feed is to be a means to comply with the rule. We agree that these conditions further clarify the meaning of the rule and have added them to the final rule as paragraph (1), (1)(i) and (1)(ii) with editorial changes to state the requirement in proper regulatory language. The following paragraphs proposed in the NPRM have been re-numbered sequentially.

acceptable alternative to the automatic low fuel alerting for those airplanes.

In recognition of these concerns and the compensation that a flight engineer provides, the FAA has modified the rule to exempt existing airplanes from this requirement. However, all new two-crew airplanes, and two-crew airplanes with existing type certificates manufactured 8 years after the effective date of the rule must comply with this requirement.

Appendix K—APU design (K25.1.4(b))

When APUs are necessary for an airplane to comply with the ETOPS requirements, the NPRM proposed that these APUs have adequate reliability and be capable of starting and providing their required functions up to the maximum operating altitude of the airplane, but no higher than 45,000 feet.

Dassault, Air New Zealand, New World Jet, the JAA, and UK CAA questioned the proposed requirement to substantiate that the APU in-flight start envelope extends up to the maximum altitude of the airplane, but need not exceed 45,000 feet. Dassault, Air New Zealand, and New World Jet indicated that 45,000 feet was too high. The JAA and UK CAA commented the demonstration of APU starting should cover all altitudes for which the airplane is approved.

The ARAC ETOPS Working Group discussed whether required APUs on ETOPS airplanes should be capable of starting throughout the entire flight envelope. The FAA was concerned that an electrical generator failure should not force an ETOPS flight to a lower altitude in order to successfully start an APU. Doing so could create problems with other traffic on the same track in areas with limited communications capability. Also, the additional fuel consumed during a descent to start an APU and climb back to the assigned altitude could itself lead to a diversion later on in the flight if the remaining fuel reserves become too low. However, certain members of the working group stated that some part 25 airplanes were certified for altitudes above 50,000 feet and that it may not be possible to design an APU to start at those altitudes. The 45,000 foot minimum altitude start capability requirement is an acknowledgement of this possibility while still mandating a minimum start envelope that would keep any necessary altitude changes above the more densely traveled altitudes along these routes.

New World Jet commented that a need to start an APU at the maximum operating altitude is unlikely. Dassault stated that the need to start an APU in flight is likely to occur following an engine failure, which would result in an altitude substantially less than maximum certificated altitude. Dassault recommended changing the requirement to the one-engine inoperative maximum altitude. New World Jet commented that the 45,000-foot start requirement assumes that an airplane experiences a dual generator failure, is then unable to receive a clearance to descend and has to declare an emergency. They say that this scenario seems unlikely.

We disagree with these commenters. Dassault implies an APU would only be started in flight following an engine failure. More commonly, the APU is started following a main engine-driven generator failure. Generator failures may occur at any altitude that the airplane is certified to fly. Typical mean time between failures of main engine-driven generators is approximately 10,000 hours while the mean time between failures for engines on ETOPS airplanes operating under the existing 180-minute standard is 50,000 hours. For ETOPS approval on a two-engine airplane for greater than 180 minutes, the required engine reliability will be 100,000 hours between engine shutdowns. Therefore, an electrical generator will fail 5 to 10 times more frequently than an engine on the same ETOPS airplane. Additionally, the loss of two electrical generators in flight is not uncommon. Dassault's proposal would lower the existing level of safety compared to airplanes approved under the criteria of AC 120–42A, which have had APU start and run capability up to the maximum certificated altitude of the airplane.

Air New Zealand stated the APU on the Boeing 767, which is currently approved for ETOPS, is certified to start up to 35,000 feet, while the airplane maximum altitude is 43,100 feet. Air New Zealand's statement is in error. We required design changes to the 767 APU so that it would start up to 43,100 feet when we approved that airplane for 180-minute ETOPS. These design changes are required by the Boeing 767 ETOPS CMP document before that airplane may be flown on 180-minute ETOPS routes.

United expressed concern that an APU should only be required on airplanes with more than two engines to meet the design requirements if the APU is one of the three sources for back-up in-flight electrical power. The final rule does address United's concern. We have revised paragraph K25.1.4(b) to clarify that the APU reliability and starting requirements apply only if an APU is needed to comply with that appendix K.

Appendix K—Engine condition monitoring (K25.1.5)

The NPRM proposed that an applicant must develop procedures for engine condition monitoring in accordance with part 33, appendix A.

Transport Canada recommended the FAA eliminate the term ''condition monitoring'' because its use was discontinued in reliability centered maintenance and Maintenance Steering Group MSG–3, and contends there is an inherent safety risk associated with mixing terminologies and maintenance program development processes. Transport Canada recommended a harmonized and standardized approach for setting terminology and maintenance program requirements.

Transport Canada recommended substantial changes to the proposal to permit manufacturers, operators, and regulatory authorities to participate in a structured maintenance review board process for the development of an airplane ETOPS maintenance program and engine health assessment program.

Transport Canada made some interesting points, but they involve concepts that are beyond the scope of the proposed ETOPS rule, which was to codify the existing ETOPS standard contained in AC 120–42A. This advisory circular used the term ''engine condition monitoring'' which has been successfully applied since its inception. Transport Canada's other suggested changes would involve a level of integration that has never been used before. Although such an integrated approach is in the FAA's long term goals of improving safety, we do not want to compromise those future long-term goals by introducing such concepts into this rule without a much larger review in the context of that effort.

Appendix K—Configuration, maintenance, and procedures (CMP) (K25.1.6)

The NPRM proposed that any configuration, maintenance, and operational standards necessary to maintain appropriate reliability for ETOPS must be contained in a CMP document.

Transport Canada proposed eliminating the CMP document requirement and placing the information that would be contained in the CMP document into the illustrated parts catalog, the Instructions for Continued Airworthiness required by § 25.1529, or the airplane flight manual. It states a separate CMP document is duplicative for a new airplane being evaluated for ETOPS as part of a basic type certificate program.

The CMP document is an extension of the airplane type design definition described in § 21.31 as a prerequisite for the airplane being eligible for extended operations. FAA airworthiness inspectors use compliance with the CMP requirements to determine if an airplane may be added to a carrier's operations specifications.

Since the CMP requirements are a condition for the ETOPS approval, they have to be in an FAA approved document. The Instructions for Continued Airworthiness required by § 25.1529 must be accepted by the FAA, but are not approved. The illustrated parts catalog is a manufacturer document and is not even reviewed by the FAA. The airplane flight manual may contain ETOPS procedures since it is approved for issuance of the type certificate. However, the airplane flight manual would not contain the other information that would be included in a CMP document. Therefore, we are adopting paragraph K25.1.6 as proposed with editorial changes to make the rule easier to understand.

Appendix K—Two-engine airplanes (K25.2)

Section K25.2 defines the ETOPS design requirements applicable to two-engine airplanes. Three methods are provided for ETOPS certification. An applicant may assess a candidate airplane-engine combination already in service by a review of service experience gained on that airplane. If an airplane-engine combination has not yet been certified, an applicant may use the Early ETOPS method, which takes a systems approach to the design, testing, and monitoring of a new airplane-engine combination as a substitute for service experience. This method establishes more rigorous analysis and test requirements than for an airplane with existing service experience. If the candidate airplane-engine combination has some service experience, but not enough to use the service experience method, the applicant may substitute 15,000 engine-hours of world-fleet service experience in place of the rigorous airplane demonstration test required by the Early ETOPS method. All of the other Early ETOPS requirements would apply in this case.

Appendix K—Service experience method (K25.2.1)

After obtaining a minimum of 250,000 engine-hours of service experience, an applicant using the service experience method would conduct airplane and propulsion system assessments to evaluate the safety and reliability of those systems for ETOPS. A two-engine airplane must also meet minimum IFSD rate requirements and demonstrate by a flight test that it has the capability to safely conduct ETOPS flights for the maximum diversion time being assessed.

Boeing and GE commented that the proposed requirement to have corrective actions for all causes or potential causes of engine in-flight shutdowns or loss of thrust control occurring in service does not recognize that even engines with IFSD rates well below the rate required for ETOPS approval occasionally fail in service. While they agreed with the philosophy of the rule to correct causes of engine in-flight shutdowns or loss of thrust control, there are situations in service where no cause is identified or no technology is currently available to prevent future failures. They posited the FAA has accepted situations where industry did not have corrective actions for some causes if the IFSD rate was at an acceptable level without these corrective actions. They go on to state the intent of the ARAC proposal was to ensure an acceptable IFSD rate for the ETOPS approval being sought.

These commenters propose similar changes to address these concerns. Boeing proposes the causes of in-flight shutdowns and loss of thrust control be assessed and appropriate corrective actions be taken to ensure an appropriate IFSD rate will be maintained. GE proposes all causes or potential causes of engine IFSD or loss of thrust control must have corrective actions, unless it can be shown the rate of the causes or potential causes will not result in IFSD rates exceeding the requirement.

The FAA agrees the proposed rule needs clarification. Sometimes a corrective action is either not technologically feasible or cannot be determined because the root cause of the failure is unknown. We also agree we have accepted situations where industry did not have corrective actions for some causes or potential causes of in-flight shutdowns if the rate was at an acceptable level without these corrective actions. However, we disagree with commenters' proposed changes.

The commenters' proposed changes suggest that for an airplane with an existing IFSD rate above the maximum allowable for approval, the identification or development of corrective actions could stop at a point when the applicant predicts the IFSD rate would just meet the maximum allowable with incorporation of those corrective actions already identified or developed. The FAA found from airplanes approved using the guidance of AC 120–42A, Appendix 1, the basis for the proposed rule, that it is necessary to correct as many causes of in-flight shutdowns or loss of thrust control as possible at the time the applicant conducts the propulsion system assessment in order to offset unforeseen problems that would cause a higher IFSD rate in the future.

However, we want to be consistent with how we have required corrective actions for causes of engine in-flight shutdowns and loss of thrust control in past airplane ETOPS approvals. Therefore, we have revised paragraph K25.2.1(c)(2) to say that corrective actions are not required for events where the manufacturer is unable to determine a cause or potential cause, for events where it is technologically unfeasible to develop corrective actions, or where the world fleet IFSD rate already complies with the final IFSD rate required by paragraph K25.2.1(b) for the level of ETOPS approval being sought. However, the FAA emphasizes that we will respond to any cause of an engine in-flight shutdown or loss of thrust control that we determine to be an unsafe condition even if the IFSD rate meets the required rate. In such a case, we will issue an airworthiness directive (AD) requiring corrective action on all airplanes that may fail from the same cause. If the FAA determines an unsafe condition would exist only during the ETOPS portion of a flight, we would require the corrective action be specified in the CMP document as a condition for ETOPS approval of the airplane under the provisions of § 21.21(b)(2). That paragraph requires an airplane to have no feature or characteristic that makes it unsafe for the issuance of a type certificate. In addition, the FAA reiterates that an operator must comply with the provisions of the CMP document as a condition for ETOPS operational approval under part 121.

Boeing stated that the NPRM unintentionally requires a more comprehensive airplane systems assessment under the proposed service experience approval method than it does for the proposed Early ETOPS method. Boeing stated that assessing, providing corrective action for, and showing effectiveness of the corrective action as proposed in the NPRM creates an extraordinary amount of work if it includes all ETOPS significant systems, including Group 1 and Group 2 systems. Boeing recommends changing the requirement to apply the airplane systems assessment only to ETOPS group 1 significant systems.

The FAA acknowledges that the NPRM would have required a more comprehensive airplane systems assessment under the service experience method than the comparable relevant experience assessment under the Early ETOPS method. The proposed service experience method would have required corrective actions for ''all'' causes or potential causes of ETOPS significant system failures while the Early ETOPS method would have required the applicant to identify specific corrective actions for ''relevant'' design, manufacturing, operational and maintenance problems. Also, the proposed Early ETOPS method relevant experience assessment would not require corrective actions if the nature of the problem is such that it would not significantly impact the safety or reliability of the system. This proposed requirement also defines what types of problems are ''relevant'' for this assessment.

Boeing is correct the FAA did not intend to create this inconsistency. The requirements for conducting assessments of the airplane systems for ETOPS should be similar when using either the service experience or the Early ETOPS method. The only difference between the two methods is that the data used under the service experience method would come from the candidate airplane-engine combination; whereas for the Early ETOPS method, the data would come from previously certified part 25 airplanes manufactured by the applicant. The FAA has changed the requirements for these two assessments to be similar in paragraphs K25.2.1(d) and K25.2.2(a) in this final rule.

Boeing comments that it may not be clear from the proposal that the flight test requirements are related specifically to ETOPS operations. Boeing stated that it is not necessary for every conceivable failure condition to be demonstrated. It says that the intent of the rule is to codify AC 120–42A, paragraph 8.d.(3), which was meant to focus on failures of ETOPS significant systems, primarily group 1 systems, or group 2 systems whose failure would be more hazardous during an ETOPS diversion. To clarify this intent, Boeing proposes changing the rule to state a flight test must be conducted to validate the adequacy of the airplane's flying qualities, performance, and the flight crew's ability to safely conduct an ETOPS diversion with engine inoperative and non-normal worst case ETOPS significant system failure conditions that are expected to occur in service.

The FAA agrees that the required flight test evaluation is related to safely conducting an ETOPS diversion. We also agree the intent of the flight test is to evaluate ETOPS significant systems. Any airplane system whose failure would be worse the farther an airplane is from a place to land would make the associated system an ETOPS significant system by definition. We have changed K25.2.1(e) as Boeing recommends. We have also revised the similar requirement for airplanes with more than two engines in paragraph K25.3.1(c) for consistency.

Appendix K—Early ETOPS method (K25.2.2)

The NPRM proposed an Early ETOPS approval method that takes a systems approach to the design, testing, and monitoring of a new airplane-engine combination. This method contains several elements designed to minimize the number of design, maintenance or operational problems that could result in engine in-flight shutdowns or diversions. This method also includes elements to demonstrate that the airplane systems have the capability to meet the operational requirements for ETOPS. An applicant using this method must evaluate problems that occurred on previous airplanes it has manufactured and describe how it will prevent these same problems from occurring on the new airplane. The applicant must design the propulsion system to preclude failures or malfunctions that could result in an in-flight shutdown. The applicant must validate all maintenance and operational procedures for ETOPS significant systems. There are ground and flight test requirements and a problem-tracking and resolution system requirement the FAA will use to evaluate the airplane prior to ETOPS approval. This problem-tracking and resolution system continues in accordance with new § 21.4(a) after an airplane receiving ETOPS approval under this method enters service. Finally, the rule defines reliability demonstration acceptance criteria used to compare the type and frequency of failures that occur on a candidate airplane-engine combination with those that we expect could occur on airplanes with existing ETOPS approvals.

ALPA commented that the objective for the propulsion system design in the proposed appendix did not match the explanation in the preamble of the NPRM. The rates should have been specified as 0.02 or less for 180-minute ETOPS and 0.01 or less for ETOPS beyond 180 minutes. We agree with ALPA's comment. We had intended the rule specify that the IFSD rate objective for the propulsion system design would be the target rate or less. This was an inadvertent omission from the rule text in the NPRM that we have corrected in the final rule.

Dassault stated that the proposed rule requires that new technology be demonstrated through testing. Dassault points out that it is not able to identify the exact criteria the FAA will use to determine if such technology is defined as a new technology. Dassault recommends the FAA better define the scope of this requirement to require testing only for systems defined as ''time limited systems,'' and those for which the occurrence of any failure condition is probable, that is, greater than 1×10^{-5} per flight hour.

The FAA believes the proposed rule was clear in stating that the requirement is applicable to technology new to the ''applicant,'' and has adopted the requirement as proposed. The applicant will determine which technology is new to it when the airplane is designed. The purpose for requiring testing of new technology is to provide a process to evaluate airplane components designed or manufactured using technology with which the applicant has had no previous experience. In an Early ETOPS program, this testing substitutes for the service experience that we would otherwise require before approving an airplane for ETOPS.

Boeing recommends limiting the demonstration of non-normal failures during the airplane demonstration flight testing under the Early ETOPS method to ETOPS significant systems, the same as they recommend for the flight test required under paragraph K25.2.1(e) of this service experience method. We agree with Boeing's recommendation for the same reasons as we gave for the flight testing required under the service experience method. However, for an Early ETOPS airplane, we want to make sure that an applicant considers all relevant failures early in an airplane development program to determine what systems are ''ETOPS significant.'' It may not be obvious during the airplane design phase what failure conditions may potentially affect the safety of an ETOPS diversion. We also want to leave open the possibility that unforeseen failure effects may be identified during other flight testing that changes the list of ETOPS significant systems and the failure conditions that must be demonstrated during the ETOPS airplane demonstration. We have revised the similar requirement for airplanes with more than two engines in K25.3.2(d)(1)(iv) for consistency.

Dassault comments that the non-normal failure conditions demonstrated during the airplane demonstration test should come from the system failure analyses, taking into account the specific airplane design. We agree the system failure analyses would be a good method for identifying failure conditions that could occur in service. However, in using this method, Dassault is proposing a particular method of compliance that may not fit all situations. Each applicant will have to propose a list of failure conditions the FAA accepts for the airplane demonstration. In coming up with this list, an applicant must consider the effects that failures in one system may have on other airplane systems. An example is the loss of multiple systems following the loss of all normal electrical power. Individual system failure analyses alone may not be sufficient to determine the worst case failure conditions. In this instance, an airplane-level failure analysis that considers the combined effect of multiple system failures would be the best guide for determining what failure conditions to demonstrate.

Dassault comments that the requirement to demonstrate airplane diversions into representative operational diversionary airports is typically an operational requirement. Dassault recommends moving this requirement from the proposed appendix to parts 121 and 135. We disagree with Dassault's recommendation. The overall objective of the airplane demonstration flight testing during type certification is to simulate the operational environment that an operator of the airplane may expect in service. We require such a demonstration to verify the candidate airplane has the capability to operate in extended operations. With this objective in mind, it is appropriate that the applicant conduct diversions into airports that represent airports normally used for ETOPS diversions.

Boeing acknowledges that the wording of the proposed airplane demonstration test requirement for repeated exposure to humid and inclement weather on the ground followed by long-range operations at normal cruise altitude, is identical to what ARAC proposed and what appears in the 777–300ER ETOPS Special Conditions. However, Boeing contends that the intent of this rule is to expose the airplane and engines to moisture that could potentially become trapped and freeze at altitude. This freezing could cause a system to malfunction causing an in-flight shutdown or loss of thrust control.

Boeing stated the use of the word ''inclement'' may be misinterpreted to imply that an airplane must be exposed to all types of inclement weather, including snow, hail, sleet, hurricanes, and typhoons. Boeing stated that as demonstrated during the 777–300ER ETOPS flight test program, cycling the airplane in and out of high humidity airports sufficiently demonstrates the intent of the rule. Boeing recommends the FAA replace ''humid and inclement weather'' with ''high humidity.''

The FAA never intended the test requirement in the 777 ETOPS special conditions to be limited to high humidity, and we do not intend such a limitation in today's rule. Rather, the inclement weather requirement should be interpreted exactly as Boeing has indicated in their comment. Inclement weather is not solely limited to high humidity conditions, but may include such meteorological conditions as heavy rain, high winds, snow, and extreme cold. We want to expose an airplane to the types of conditions on the ground that may be encountered in service to demonstrate that there are no unexpected design problems associated with such exposures.

We agree that a major source of engine problems on long duration flights typical of ETOPS has been moisture becoming trapped in engine control pressure sense lines and freezing at altitude, causing engine operating problems. Heavy precipitation on the ground and high humidity intensify the amount of moisture available to create this type of failure mode.

This rule does not require specific types of inclement weather for the airplane demonstration, except for high humidity, in recognition of the chance nature of encountering such conditions. We expect, however, an applicant would take advantage of any available inclement weather conditions during the required airplane demonstration test.

Dassault comments that the inclement weather requirements are not specifically relevant to ETOPS operations. Dassault recommends the FAA remove these two paragraphs from the final rule. While none of the environmental conditions we are requiring for the airplane demonstration would be unique to ETOPS, the potential consequences of system failures resulting from these conditions could be worse the farther an airplane is from a suitable place to land. Accordingly, we have decided against dropping the requirement.

Boeing, ALPA, and BALPA commented on the post-airplane demonstration inspection requirement. The NPRM proposed that an applicant conduct on-wing inspections or tests of ETOPS significant systems installed on the test airplane or airplanes used for the airplane demonstration in accordance with the tasks defined in the proposed Instruction for Continued Airworthiness to establish their condition for continued safe operation. These inspections or tests must be conducted in a manner to identify abnormal conditions that could result in an in-flight shutdown or diversion.

Boeing stated it considers an external inspection of the engine and an internal inspection of the airflow path of the fan, compressor, combustor and turbine sections of the engine to provide the most valuable information for ETOPS. Boeing noted the ETOPS flight test demonstrates an airplane's capability. It is not an endurance test. Boeing recommended changing the rule to require only a complete external on-wing inspection of the engines and engine-mounted equipment.

The FAA agrees with Boeing that the ETOPS airplane demonstration is not an endurance test, such as the 3000-cycle propulsion system validation test. This flight test is a demonstration of an airplane's ability to safely operate in ETOPS. We did not intend that it be a test of durability. However, the FAA does not agree with Boeing that a complete on-wing external inspection of the engines and engine-mounted equipment alone would be adequate for a completely new airplane being evaluated under the Early ETOPS approval method. Many of the airplane ETOPS significant systems that need to be evaluated are located inside the engine compartment or airplane fuselage, and such wording could be confusing.

ALPA does not believe that a cursory ''visual inspection'' such as those performed on routine overnight or even weekly or monthly checks would meet the intent of this requirement. ALPA commented that the requirement should include the types of airplane inspections performed in conjunction with major, heavy, or ''D'' checks. ALPA proposed that a robust inspection process similar to that required at the conclusion of the 3000 cycle propulsion system validation test could uncover potential future failure modes.

The FAA does not believe that a robust post-test inspection requirement applied to the airplane demonstration test would uncover any significant information. Unlike the 3000-cycle test (which is designed to identify potential failures resulting from high stresses caused by repeatedly starting the engine, running it to high power then shutting it down), the airplane demonstration test would not accumulate a large enough number of these ''cycles'' to inflict noticeable damage. Similarly, the few hundred hours accumulated during the airplane demonstration would not be enough to create a significant amount of wear on moving parts.

BALPA said that a visual inspection is inadequate for some ETOPS significant systems. BALPA recommended a change in this section to state there must be an assessment of the ability of essential components or systems to function within their specified performance and tolerance limits by appropriate test methods.

We agree with BALPA that a visual inspection is not adequate for some ETOPS significant systems. The instructions for continued airworthiness required by § 25.1529 define appropriate inspections or tests to establish that a system or component is in a condition for safe operation. However, these are not necessarily ''visual'' inspections. As such, we have changed paragraph K25.2.2(g)(4), and the same requirement for airplanes with more than two engines under paragraph K25.3.2(d)(4), to require that each ETOPS significant system must undergo an on-wing inspection or test in accordance with the tasks defined in the proposed Instructions for Continued Airworthiness to establish their condition for continued safe operation. We have included the qualifier ''on-wing'' to clarify that we are not requiring any equipment be removed from the airplane for these inspections. These inspections are of the type that an airline would do to establish the airworthiness of the airplane in service, with the exception that the inspections must be conducted in a manner to identify abnormal conditions that could result in in-flight shutdowns or diversions.

ALPA and BALPA commented the FAA has proposed deleting wording recommended by ARAC for the use of non-ETOPS fleets in the reliability demonstration acceptance criteria for two-engine airplanes, but retained this provision in the corresponding requirement for airplanes with more than two engines. ALPA and BALPA want the ARAC wording in both locations. BALPA avers that the non-ETOPS fleet may provide a significant ''heads up'' on cyclic related failures. ALPA contends that the wording is meant to ensure consideration of similar airplanes and engine types, which may be certified and flown in both ETOPS and non-ETOPS environments.

We are not including non-ETOPS airplanes in the reliability acceptance criteria of paragraph K25.2.2(i). It appears these two commenters are confusing the reliability benchmark that we judge a new airplane against under this requirement with the relevant experience assessment of K25.2.2(a). For the relevant experience assessment, we expect that a manufacturer of a new airplane to consider any relevant failures from ETOPS and non-ETOPS airplanes that may be applicable to the new design. The objective of the reliability acceptance criteria requirement is to demonstrate a level of reliability similar to that of airplanes currently approved for ETOPS. Including non-ETOPS airplanes in the reliability comparison would result in a lower safety standard because the types and frequency of failures that would be expected to occur on non-ETOPS derivative models may be more severe than would be expected on a currently approved ETOPS fleet that has established a high level of reliability.

We explained in the NPRM our rationale for allowing non-ETOPS airplanes to be used in the reliability comparison of airplanes with more than two engines. We said previous ETOPS experience might not exist on airplanes with more than two engines at the time this proposed rule becomes effective. However, the rule as proposed would limit the use of non-ETOPS airplanes to derivative models of the same airplane and engine. Under this provision, an applicant for a new type certificate would have no derivative models of the airplane to use in place of existing ETOPS approved airplanes. For the same reason, we outlined above for two-engine airplanes, derivative models of a candidate airplane and engine may not have a service history that is consistent with our expectations for an airplane approved for ETOPS. After further consideration, we find a comparison with any non-ETOPS fleet of airplanes would not be consistent with the objectives of this rule. An applicant can predict the type and frequency of the failures and malfunctions expected to occur in service on airplanes with more than two engines based on whatever data the FAA accepts to meet this requirement.

Only airplanes with more than two engines manufactured 8 years after the effective date of this rule will have to be approved for ETOPS under the grandfathering provisions of new § 25.3. Airplanes manufactured before that date may be operated under the new operating requirements from the effective date of the rule. For the initial type design approvals of airplanes with more than two engines under § 25.1535, world-fleets of newer, more reliable airplanes with previous experience in extended operations would provide the best source for the comparison specified in paragraph K25.3.2(f). As a larger number of airplanes with more than two engines receive ETOPS type design approval and are operated under the new part 121 ETOPS operational requirements, the comparison database for compliance with this provision will grow.

We inadvertently included the use of non-ETOPS fleets from the original ARAC proposal in the corresponding engine certification requirement under proposed § 33.200(e)(iii). For the reasons noted here, the FAA is changing § 33.201(e)(4) to be consistent with appendix K.

Appendix K—Combined service experience and Early ETOPS method (K25.2.3)

The NPRM proposed an alternative to either the service experience or Early ETOPS methods for airplane approval. This combined method would use all of the design, analyses, and tests required by the Early ETOPS method except for the airplane demonstration test. In place of the airplane demonstration test, this method would allow the much less rigorous flight test of the service experience approval method, providing the candidate airplane-engine combination had obtained at least 15,000 engine-hours of service experience. The NPRM also contained a provision for a reduction of service experience below 15,000 engine-hours as long as the applicant had compensating factors that provide an equivalent level of safety.

ALPA commented it understands how the combined service experience and Early ETOPS method can be used to reduce the service experience required for type design approval of an airplane for ETOPS. However, it expressed concern that the equivalent level of safety provision as proposed might unintentionally allow an applicant to use a method resulting in a lower level of safety than provided of the other defined approval methods. Without listing specific additional requirements in a manner similar to that contained in the first paragraph of the combined method, ALPA stated that an applicant could attempt to completely bypass the requirements of any of these methods.

ALPA recommended the FAA amend this paragraph to say that the in-service experience requirements may be reduced to some other level, provided the applicant defines compensating factors that provide an equivalent level of safety as the provisions of paragraph K25.2.3 (a).

The FAA agrees with ALPA's concern that without further definition the proposed wording of the equivalent safety provision in the combined approval method might unintentionally lead to a level of validation substantially less than provided by the other provisions of section K25.2. After further review, we have determined that this proposal and the related paragraph for airplanes with more than two engines are just a restatement of existing authority under § 21.21(b)(1) and are not necessary. Therefore, we have deleted these sections in the final rule.

Appendix K—Airplanes with more than two engines (Section K25.3)

The requirements for airplanes with more than two engines are organized similarly to section K25.2 for two-engine airplanes. We created this separate section, K25.3, so that an applicant for airplanes of this configuration would not be confused about which requirements applied to it.

Many commenters made the same comments on paragraphs in section K25.3 for airplanes with more than two engines than they did for the corresponding paragraphs in section K25.2. Our responses for those comments in section K25.2 also apply to this section. We are only discussing those comments on section K25.3 here that are unique to airplanes with more than two engines.

ALPA expressed concern that under the NPRM an applicant could apply for ETOPS approval of an airplane with more than two engines that has a high IFSD rate (such as those experienced during introduction of the B–747, DC–10, and L–1011 airplanes almost 30 years ago). ALPA stated the original ARAC draft proposal required a ‘‘review * * * utilizing reliability data for all airplane, propulsion and ETOPS significant systems.’’ ALPA noted the ARAC proposal would apply equally to all airplane types regardless of the number of engines. ALPA commented this level of ‘‘benign’’ review would provide the FAA with satisfactory regulatory guidance to prevent the certification of a design otherwise unsatisfactory for the challenging ETOPS environment.

The FAA does not believe a propulsion system assessment is necessary for airplanes with more than two engines to get a type design approval for ETOPS. We do not envision any modern propulsion system experiencing the kinds of high IFSD rates experienced by the airplanes in their examples. The IFSD rates required for three- and four-engine airplanes to reach an unsafe level are so high that the normal FAA engine safety management program and the propulsion system monitoring requirements of § 121.374 would correct any major causes of engine in-flight shutdowns before that level could be reached.

The JAA and the UK CAA stated that the required 250,000 engine-hours of service experience seems excessive for three- and four-engine airplanes considering the lower in-flight shutdown objectives for these types of airplanes and the built-in systems redundancy.

The FAA disagrees with this comment. Since there are no IFSD rate requirements for three- and four-engine airplanes in the proposed rule, the service experience requirement is primarily focused on obtaining a significant experience base to properly evaluate the airplane systems.

The 250,000 engine-hours service experience requirement came from AC 120–42A. Taken in the context of the actual exposure of the airplane systems under this requirement, those airplane systems on a two-engine airplane would accumulate a total of 125,000 airplane hours during this period while the same systems on a four-engine airplane would only accumulate a total of 62,500 airplane hours. This is a significant reduction in the total amount of required service experience compared to the same systems on a two-engine airplane. This constitutes a natural compensation for the added redundancy of systems on airplanes with more than two engines.

Dassault commented that the flight test requirements of paragraph K25.3.1(c) should not require an applicant for an airplane with more than two engines to demonstrate the loss of all normal electrical power. This proposed requirement would require an applicant to conduct a flight test to evaluate non-normal worst case system failure conditions expected to occur in service. Dassault posited this requirement would be unfair to airplanes with more than two engines, which it claims should not be treated at the same level as two-engine airplanes. Dassault recommended the FAA withdraw the loss of all normal electrical power from the required flight testing for airplanes with more than two engines.

The FAA disagrees with Dassault. Although the electrical systems on airplanes with more than two engines may have additional redundancy that would make loss of normal electrical power less likely than on a two-engine airplane, we cannot assume that this would not occur. Most occurrences of the loss of normal electrical power in service are the result of multiple generator or electrical bus failures from a common source. Airplanes with more than two engines are not immune to these types of failures. An example from service experience of a common cause failure mode would be spilled fluids from galleys that leak through floor panels onto electrical equipment.

Also, we cannot assume that an airplane manufacturer would always design an electrical system to take full advantage of the inherent isolation and redundancy that the additional engines provide. For example, an electrical system architecture consisting of four engine-driven generators supplying two main electrical busses would not provide any more isolation from bus failures than for a two-engine airplane.

ALPA commented that the reliability acceptance criteria for airplanes with more than two engines should include airplane and propulsion systems, not just ETOPS significant systems. They said that the ARAC proposal did not limit the reliability acceptance criteria to ETOPS significant systems only.

We are not making the suggested change. The only systems that would be relevant in assessing an airplane’s readiness for ETOPS would be those whose failure could impact the safety of ETOPS. By definition, an ETOPS significant system means an airplane system, including the propulsion system, the failure or malfunctioning of which could adversely affect the safety of an ETOPS flight, or the continued safe flight and landing of an airplane during an ETOPS diversion. The propulsion system is covered already by the proposed reliability acceptance criteria because it is an ETOPS significant system. Airplane systems of interest are also ETOPS significant systems. Thus, ALPA’s concern is already addressed by the existing language of paragraph K25.3.2(f). For consistency, we have revised the corresponding paragraph K25.2.2(i) for two-engine airplanes to be the same as this requirement for airplanes with more than two engines.

B. Engine Certification (Part 33)

For certain ‘‘early ETOPS’’ applications, the part 33 amendments require engine manufacturers to address all ETOPS relevant malfunctions (e.g., lost of thrust control or in-flight shutdown) and design-related maintenance errors that have occurred in the manufacturer’s current FAA-certified engine models. The part 33 amendments also include a test requirement for these ‘‘early ETOPS’’ applications, and certain, specific type design requirements for all ETOPS applications.

1. Engine Design and Test Requirements for ETOPS Eligibility

The JAA and UK CAA stated the introduction of precise and detailed testing requirements in the rule (proposed § 33.200; hereafter § 33.201) is too prescriptive and prevents tailoring of the testing program to the different intermediate cases that may be encountered between the completely new design and the derivatives. The commenters recommend the FAA make reference to an approved testing program and transfer the detailed content into an advisory circular, such as the JAA has done.

The FAA does not concur with deleting the specific test requirements from § 33.201 and placing them in an advisory circular. This requirement is for Early ETOPS eligibility for two-engine applications without any service experience. These requirements have been carefully developed to address this specific case, and successful completion of this test should provide a suitably reliable engine for the purpose of Early ETOPS approval at the airplane level. To place these test requirements in an advisory circular as an option, would likely result in instances of non-standard testing that is not the equivalent to the contemplated safety standard, and potentially not suitable to support the Early ETOPS concept. Also, § 33.201 would not generally be required for an existing engine design that has the requisite service experience, and therefore this section's applicability to ''intermediate cases'' should be relatively uncommon. However in the event such a situation occurs, the test requirements of § 33.201 can be modified using a part 21 Equivalent Level of Safety approach to optimize a test for a specific ''intermediate case'' situation.

Pratt and Whitney stated that it is not clear when the rule must be completed with regard to the overall part 33 type certification and asks if part 33 certification will be held until all the requirements of § 33.201 are complete. The FAA clarifies that compliance with § 33.201 is only required when an applicant desires Early ETOPS eligibility for a two-engine-engine application under § 25.1535 authority. Compliance with § 33.201 is not required for basic engine type certification. The lead-in sentence of § 33.201 is clear on this.

ALPA fully supported the guidance presented for part 33. Because various part 33 regulatory design and testing requirements would establish a ''limit'' of ETOPS engine suitability, ALPA suggested that an engine type certificate data sheet note be required stating the specific diversion time limit. NACA recommended the FAA clarify that the text simply codifies current engine certification procedures for two-engine airplanes and apply any new requirements to new engine designs in the future (that is, ''grandfather'' current designs).

The FAA does not agree the engine Type Certificate Data Sheet should specifically note ETOPS diversion time limitations nor does it believe a ''grandfather'' provision is appropriate. Approved ETOPS diversion times are controlled through the operating standards (*i.e.*, parts 121 and 135) and airplane type design (§ 25.1535) certification. The part 33 requirements do not establish an independent maximum diversion time limitation for ETOPS. ETOPS diversion times are dependent upon many factors, most of which are beyond basic engine certification. However, for Early ETOPS eligibility for two-engine applications where compliance with § 33.201 is required, FAA will include a discussion in advisory material for the use of a Type Certificate Data Sheet Note to state that § 33.201 has been complied with (*i.e.*, ETOPS eligibility granted), along with the applicants demonstrated diversion time from that test.

The JAA and UK CAA agreed with the proposal that each oil cap provide an oil-tight seal. Along with Federal Express (FedEx), International Air Transport Association (IATA), and Royal Dutch Airlines (KLM), they commented that the design requirements for oil tank cap installation errors causing hazardous oil loss should apply to all types of operations, and the FAA should not limit them to ETOPS. The commenters added that an in-flight engine shutdown due to massive oil loss after an incorrect oil tank cap installation will most likely occur early in the flight and probably well outside any ETOPS segment. These commenters recommended the FAA word the rule as a generic requirement applicable to all new engine models. ALPA fully supported the requirement for engine oil tank filler cap design, as proposed.

The FAA has decided against expanding applicability of this new regulation to all new engine models at this time. While it is true that oil tank cap installation errors can, and have, occurred in all types of operations, this proposal was only evaluated for ETOPS operations where suitable alternate landing sites are limited, especially when considering the multi-engine nature of many of these types of events. Also, the FAA does not agree that hazardous oil loss due to such errors would only occur early in a flight, as it is impossible to predict the exact error (*e.g.*, cap loose vs. cap off) or how a given design may be affected by that particular error. A range of outcomes is possible, including hazardous oil loss near the maximum diversion time point in an ETOPS operation. The FAA will continue to monitor related service experience, and will consider expanding the applicability of this requirement by future rulemaking if service data so dictates.

2. Engine Instructions for Continued Airworthiness

Appendix A to part 33 proposed an engine condition monitoring program to ensure continuing engine reliability.

Transport Canada recommended the FAA delete the rule, or replace the term ''condition monitoring'' with ''engine health assessment programs'' which is a more descriptive term. It added that a power assurance check methodology should not be required in the Instructions for Continued Airworthiness and validated at the part 33 design certification stage when the engine would not as yet be installed on an ETOPS type certificated airplane; these requirements should more appropriately be required as part of the part 25 design certification process. Transport Canada stated the operational requirements determine a viable health assessment program for a particular airframe-engine installation. Thus, the most effective time for developing an engine health assessment program would be when the engine is installed in an identified airplane and when the operational role of that airplane has been defined. Transport Canada concluded the development of ETOPS maintenance and health assessment programs would be most effectively managed when the airplane's total maintenance program is being developed.

The FAA does not agree with eliminating the term ''condition monitoring'' from the rule to be replaced with the term ''engine health assessment''. The agency believes either term is adequate, but will retain the currently used and proposed term ''condition monitoring''. Compliance with this section is only required when an applicant desires ETOPS eligibility under § 25.1535. Compliance with this section is not required for basic engine type certification. The lead-in sentence of Appendix A to part 33, paragraph A33.3(c) makes this clear. However, conversely, an engine applicant could choose to obtain ETOPS eligibility without identifying a specific airplane installation identified. The engine manufacturer would define generic Instructions for Continued Airworthiness to comply with part 33 Appendix A, which in turn may be modified once the engine is installed on a particular airplane model. The FAA does not want to preclude an engine manufacturer from the option of obtaining engine ETOPS eligibility without a defined airplane application.

GE expressed a concern with repairs to and parts installed on engines from sources other than the engine Type Certificate (TC) holder. These would include engine parts approved by the FAA under a Parts Manufacturing Approval (PMA) or engine repairs approved by a Designated Engineering Representative, which are not reported to the holder of the TC. GE expressed concern that common cause multiple failures may be masked by calculating the reliability of an entire fleet, while a certain segment may be afflicted by unreliable parts from a supplier other than the engine TC holder. This should not be acceptable for the types of operations conducted under ETOPS where high reliability is necessary. The commenter also stated the results of the 3,000-cycle test could also be affected if other than GE parts are installed in the field. GE asks the FAA for either supplemental rulemaking or a safety determination on other engine parts.

The FAA does not agree that additional rulemaking is necessary to specifically address PMA or repaired parts usage in ETOPS operations. PMA parts comply with the applicable airworthiness standards and are approved as replacements for corresponding TC holder parts. Repairs approved by the FAA or a Designated Engineering Representative must also meet the applicable airworthiness standards. Likewise, follow-on TC holder parts and repairs meet those same standards whether processed as major or minor type design changes. Note that major design changes by a non-TC holder can only be processed as a Supplemental Type Certificate (STC), which must also meet the applicable airworthiness standards. With respect to service difficulty reporting, the FAA monitors service data to identify unsafe conditions and other situations affecting ETOPS operations. This data is collected from TC holders, operators, repair stations, PMA holders, and other sources as applicable. The FAA will take appropriate corrective action to eliminate identified unsafe conditions or other situations negatively affecting ETOPS operations.

C. ETOPS Reporting Requirements for Manufacturers (Part 21)

To support the FAA's safety monitoring program for airplanes in service, the NPRM proposed a new § 21.4 for reporting, tracking and resolving problems on ETOPS approved airplanes. These requirements apply to the type certificate holder of an airplane approved for ETOPS, and the type certificate holder of an engine installed on an airplane approved for ETOPS. These requirements are separate from the ETOPS reporting that an airline must do under parts 121 and 135.

Section 21.4 is organized into two parts. The first part defines requirements for reporting, tracking, and resolving problems on an airplane-engine combination approved using the Early ETOPS approval method in part 25. The second part defines general reporting requirements for all airplanes approved for ETOPS, including the reporting of engine IFSD rates the FAA uses to monitor propulsion system reliability.

1. Early ETOPS: Reporting, Tracking, and Resolving Problems

ALPA recommended revising proposed paragraph 21.4(a)(1) to reflect the original ARAC philosophy that the tracking requirements were not limited to ETOPS significant systems. ALPA recommended that the rule be revised to require the prompt identification of ETOPS significant problems.

The list of occurrences that must be reported and resolved under § 21.4(a) are defined in paragraph (a)(6). The type certificate holder must report these occurrences and propose solutions to the FAA to resolve the cause of each occurrence regardless of which airplane or propulsion system caused the event. The significance of these occurrences to ETOPS is implicit by their inclusion in the list. Therefore, it is not necessary to change the rule as ALPA recommended. However, we have revised this paragraph to delete reference to ''ETOPS significant systems'' to clarify that the type certificate holder of an Early ETOPS airplane-engine combination must use a system for reporting, tracking, and resolving each problem resulting in one of the occurrences specified in paragraph (a)(6) of this section. For consistency, we have made a similar change to the related sections in part 25 appendix K (K25.2.2(h)(1)(i) and K25.3.2(e)(1)(i)) for the problem tracking and resolution system required for the Early ETOPS type design approval method.

The JAA and the UK CAA recommended removing the words ''Early ETOPS'' from the heading of § 21.4(a) and ''without service experience'' from the first sentence because they imply that the requirements would only apply to new type-certificated airplanes. The commenters asserted that the ETOPS reporting should apply to all manufacturers holding an ETOPS approval. Paragraph (a) only applies to airplanes approved for ETOPS without service experience. This paragraph codifies the special conditions applied to the Boeing Model 777 airplane for Early ETOPS certification. Paragraph (b) of § 21.4 defines the reporting requirements for all two-engine airplanes approved for ETOPS.

Boeing recommended the FAA insert ''significantly'' after ''systems that have changed'' in § 21.4(a)(3) to give the FAA authority to allow an applicant to exclude reporting on systems with only minor changes that do not affect system reliability on derivative airplanes or engines. We disagree with Boeing's comment. This rule already allows an applicant to not report on unchanged areas of a derivative airplane as agreed to by the FAA. Adding the word ''significantly'' as Boeing suggests adds nothing to the proposed language that would help an applicant or the FAA differentiate what specific changes would not require reporting under the rule from those that would. However, we have clarified what is meant by a derivative airplane or engine in the rule. A derivative airplane or engine is one where the changes are not so significant as to require an application for a new type certificate in accordance with § 21.19. We have added a table in § 21.4(a)(3), and in part 25, appendix K, to clarify the applicability of the problem reporting, tracking, and resolution system for derivative airplanes and engines.

Boeing recommended § 21.4(a)(4) should make it clear that the type certificate holder, not the operator, is responsible for tracking the data. We agree and have revised this section to refer to the type certificate holder throughout. Since § 21.4 applies to airplanes that have already received a type certificate, the airplane or engine manufacturer is no longer an ''applicant'' but a type certificate holder.

The JAA and UK CAA stated that the list of reportable occurrences in § 21.4(a)(6) implies in-flight shutdown events do not include the inability to control the engine or obtain desired thrust or precautionary thrust reductions. They contended this contradicts the definition of in-flight shutdown in part 1 and recommended the FAA revise the rule to make it clear that these events are also in-flight shutdowns. These commenters are correctly interpreting our intent that the inability to control the engine or obtain desired thrust or precautionary thrust reductions are separate from in-flight shutdowns. The revised part 1 definition of ''in-flight shutdown'' clarifies our intent that this reporting requirement does not contradict the definition.

The NPRM included a parenthetical exception to the proposed requirement to report precautionary thrust reductions, which would exclude precautionary thrust reductions for normal troubleshooting as allowed in the aircraft manual. The ARAC provided no justification for this exception in its recommended rule, upon which the NPRM was based. We believe ARAC intended that this exception cover special flights conducted for maintenance purposes to evaluate airplane problems that occurred on a previous flight. Such a flight may include a thrust reduction. However, we do not see how an intentional thrust reduction for maintenance troubleshooting purposes could be confused with the intent of this requirement in § 21.4(a)(6), which would be a thrust reduction in direct response to a problem in flight in order to mitigate that problem. Also, the exception is so broadly written that some parties may infer that any precautionary thrust reduction is for normal troubleshooting purposes so as to avoid reporting an occurrence. After further consideration, we have decided to delete this exception from the final rule.

GE stated that the majority of in-flight shutdowns are not restartable and the requirement to report degraded ability to start an engine in flight appears to address a situation where there is an in-flight shutdown of an engine that is restartable, but with degraded start capability and a need to restart that engine. GE contended that ETOPS does not rest on the engine being restartable, it rests on the engine being reliable so there is no need to restart that engine. GE stated that this requirement diverts resources from higher priority safety issues. The FAA disagrees with GE. Many engines are shutdown for indications that later turn out to be false. If there is a subsequent problem with another engine, the ability to restart an engine improves safety by giving the flight crew more landing options. If an engine flames out during cruise, but is otherwise operational, restarting the engine may allow the flight to continue without a diversion. Thus, it is critical to know about and correct problems that degrade an engine's capability to restart in flight.

Boeing recommended combining the requirement to report failures of a backup system with reporting of a complete loss of any electrical power generating system or hydraulic power system. Boeing said there is no clear definition of ''primary'' and ''backup'' systems and that the backup function could be provided by another equivalent primary system. We agree with Boeing that these sections may not clearly state the intended requirement. We also agree that they may be combined into one. In order to clarify the rule, we have replaced the two NPRM sections with the following wording:

''Loss of any power source for an ETOPS group 1 significant system, including any power source designed to provide backup-power for that system.''

2. Reliability of Two-Engine Airplanes

We rearranged § 21.4(b)(1) and (b)(2) to clarify the intent of the rule. We have moved the requirement for FAA approved corrective actions for causes of in-flight shutdowns from paragraph (b)(1) to (b)(2). We also clarified that the requirement on the type certificate holder under this paragraph is to issue appropriate service information to the operators. The implementation of such service information would be conducted under the operating certificate for the operator.

X. Operator Maintenance Requirements

A. Continuous Airworthiness Maintenance Program (CAMP)

The premise of an ETOPS maintenance program is to continually provide airworthy airplanes that will prevent mechanically related diversions. Under this concept, engines are designed and tested to assure an acceptable level of in-flight shutdowns in the worldwide fleet. Similarly, other key airplane systems are designed and tested for enhanced airplane reliability. ETOPS maintenance practices reduce diversions through disciplined procedures like engine condition monitoring, oil consumption monitoring, aggressive resolution of any identified reliability issues, and procedures that avoid human error during the maintenance of airplane systems and engines.

Maintenance issues are addressed in § 121.374 of the final rule. Before flying ETOPS, a certificate holder operating two engine airplanes must develop an ETOPS ''continuous airworthiness maintenance program'' (CAMP) and provide the necessary training to ensure those airplanes are maintained at the highest level of safety. The elements of an ETOPS-approved CAMP begin with a basic CAMP that is approved for use in non ETOPS operation, which is then supplemented for ETOPS with: (1) A system to ensure compliance with the minimum requirements set forth in the CMP document or the type design document for each airplane and engine combination; (2) an ETOPS pre-departure service check; (3) procedures limiting dual maintenance; (4) procedures verifying corrective action to ETOPS significant systems; (5) ETOPS task identification; (6) centralized maintenance control procedures; (7) an ETOPS parts control program; (8) a reliability or enhanced continuing analysis and surveillance system (CASS); (9) propulsion system monitoring; (10) an engine condition monitoring program; (11) an oil consumption monitoring program; (12) an APU in-flight start program; (13) maintenance training for ETOPS; (14) an ETOPS maintenance document; and (15) procedures to have the initial program and subsequent revisions approved by the FAA's certificate holding district office (CHDO).

The requirement is to ''develop and follow a continuous airworthiness maintenance program based on the manufacturer's maintenance program or one currently approved for the operator and be supplemented for ETOPS for each airframe and engine combination.'' Each operator's current maintenance program must be approved by its principal maintenance inspector via operations specifications. Continental and United commented that it was the understanding of the ARAC that each operator's approved ETOPS maintenance program would, by in-service demonstration, be accepted. If the currently approved program contains all maintenance elements necessary for ETOPS, then it will be adequate without change. However, after evaluating its current program, an operator may have to supplement its program to incorporate any missing ETOPS elements prior to operating ETOPS.

There were comments by the aviation industry supporting incorporation of the ETOPS supplemental requirements for two-engine airplanes. However, Airbus, UK CAA, JAA, Singapore Airlines and others commented negatively regarding the same requirements for three- and four-engine airplanes. Some comments suggested that because long range operations with three- and four-engine airplanes for the past 30 to 50 years has been so successful, there is no justification for incorporation of the ETOPS supplements. Qantas agreed with the approval requirements for ETOPS and notes that the robust maintenance programs have contributed to the success of ETOPS. It found, however, that this success has brought on increased operational restrictions for political reasons that are not based on safety.

The FAA strongly believes that all operators would benefit from an ETOPS maintenance program. However, the FAA agrees with many of the commenters that the cost of implementing this new requirement for airplanes with more than two engines would be significant. The FAA has determined that this cost cannot be justified based on the current level of safety achieved by the combination of engine reliability and the engine redundancy of this fleet of airplanes.

Airbus and UK CAA cited confusion regarding when ETOPS maintenance requirements apply. The elimination of ETOPS maintenance program requirements for all part 121 operations for airplanes with more than two-engines eliminates most of the confusion. Part 121, Appendix P has also been amended to provide any remaining clarification necessary. An operator's maintenance program for all two-engine ETOPS airplanes, regardless of diversion time, must comply with § 121.374.

B. Limitations on Dual Maintenance

The FAA has included provisions in today's rule to prevent dual maintenance on two-engine ETOPS significant systems during the same routine or non-routine visit. This requirement is a codification of existing policy and is necessary to recognize and preclude common cause human failure modes without proper verification processes or operational test prior to conducting ETOPS.

Many ETOPS maintenance requirements focus on preventing human error from threatening flight safety. Of these, common cause failures, where the same mistakes are made more than once during maintenance, are the greatest threat to long-range operational safety in these airplanes. Since 1982, the FAA has recorded ten multiple engine failure events resulting from maintenance errors.

FedEx, KLM, and IATA commented that additional ETOPS dual maintenance limitations are unnecessary since requirements are found in existing maintenance programs such as those identified in the manufacturers Maintenance Planning Document (MPD).

The FAA disagrees that dual maintenance limitations for all ETOPS operations are unnecessary. We also disagree that dual maintenance limitations for ETOPS already exist and are identified in an airplane's MPD. The FAA agrees an MPD appendix provides a critical systems list. However, the tasks identified in that list do not necessarily include all ETOPS significant systems.

It is not the intent of the rule to specifically require a certain number of mechanics per airplane. It is incumbent on the operator to have processes in place to avoid common cause failure modes. Section 121.374(c)(ii) addresses those situations where dual maintenance cannot be avoided, providing specific requirements under those circumstances. Operators need to identify their ETOPS significant systems with the assistance of the manufacturers in order to adequately address dual maintenance requirements that may arise during scheduled and unscheduled maintenance.

FedEx noted part 121 operators already have a Required Inspection Item (RII) program to eliminate maintenance errors and believes this program will discover any problems arising from dual maintenance. Although the FAA agrees an operator's current RII procedures may be used as one method to ensure proper maintenance of ETOPS significant systems, it is not necessarily sufficient by itself to avoid dual maintenance risks. Furthermore, the FAA does not believe ETOPS certificate holders would want to include all their ETOPS significant system items into their RII program, nor is the FAA advocating it. Verification of ETOPS dual maintenance, when unavoidable, can include an RII visual inspection as one method of verification, but additional methods may need to be employed to meet ETOPS dual maintenance ground verification requirements.

ATA, United, Continental and others suggested we change the NPRM's proposed dual maintenance provisions. The FAA agrees and has revised the final rule language. The FAA's intent is for operators to package routine maintenance tasks so dual maintenance is never scheduled on the same maintenance visit.

Obviously, it is best never to perform dual maintenance since a major cause of airplane diversions and turnbacks due to mechanical failures is common-cause human factors. However, the FAA understands unforeseen situations may arise necessitating unscheduled dual maintenance on an airplane. The FAA expects operators to have in place procedures that prevent identical mistakes being made on two systems when dual maintenance is accomplished. These procedures must be included in the operator's ETOPS Maintenance Document.

C. Maintenance Actions

1. ETOPS Pre-Departure Service Check

ATA stated the pre-departure check is specifically designed for a two-engine airplane and to extend this check to the three- and four-engine airplane is confusing and may contribute to human error. FedEx, KLM and IATA commented that this check would add man-hours and costs due to the new oil consumption, verification, and dual maintenance requirements associated with the pre-departure service check.

The FAA, as stated previously, has removed this requirement along with all ETOPS maintenance program elements for airplanes with more than two engines. For two-engine ETOPS the FAA believes the pre-departure service check is a significant factor in ETOPS' past success. The specific content of the check is developed by each ETOPS operator and based on ETOPS significant systems verification and historical operational data. Accordingly, the check's content varies significantly among operators.

The operator's ETOPS maintenance program should include necessary training requirements and work form task identification to eliminate confusion. This is one reason for having each operator develop a pre-departure check tailored to its own operation based upon the equipment and performance history of the operator's fleet.

2. Engine Condition Monitoring Program

ATA commented it is unnecessary for three- and four-engine airplanes to have an engine condition monitoring program since current practices have served the part 121 operators adequately for the last 30 years. Many certificate holders currently use engine condition monitoring programs for their three- and four-engine airplanes as an economic tool to detect engine deterioration and to reduce full thrust take off requirements. The ETOPS engine condition monitoring program is required to ensure engine inoperative flight can be safely conducted in the event of long diversions.

The FAA acknowledges these comments and has removed this requirement along with all ETOPS maintenance program elements for airplanes with more than two engines.

3. Oil Consumption Monitoring Program

ATA, FedEx, KLM and IATA commented that it is unnecessary for airplanes with more than two engines to have an oil consumption monitoring program since current practices have served the part 121 operators adequately for the last 30 years. Additionally, commenters said that with the current IFSD rate there is no justification for requiring such a program.

The FAA agrees with these comments and has removed this requirement along with all ETOPS maintenance program elements for airplanes with more than two engines.

4. Verification Procedures

ATA stated the FAA provided no justification for its proposed verification program and additionally stated that any safety issue that arises in the future can be specifically dealt with through the AD process. It appears the commenter may be confusing the AD process with routine maintenance procedures. This type of verification is in no way related to an AD.

ATA and others commented that there is no justification for having a verification program for airplanes with more than two engines that goes beyond what is already required by a CASS.

The FAA agrees with these comments and has removed this requirement along with all ETOPS maintenance program elements for airplanes with more than two engines

5. Task Identification

Commenters said recommended ETOPS-specific tasks should be clearly defined for two-engine airplanes, but not for three- and four-engine airplanes. The FAA agrees with these comments and has removed this requirement along with all ETOPS maintenance program elements for airplanes with more than two engines

6. Configuration Maintenance and Procedures (CMP) Document

IATA, FedEx, KLM and others directed comments toward the certificate holder's requirement to have a ''system to ensure compliance with CMP.'' We believe that many of the comments stemmed from a misunderstanding of the requirement. The CMP document is a type certification document that some manufactures have produced to establish a specific standard for a particular make and model airplane-engine combination intended for ETOPS operations. A certificate holder must evaluate the CMP documents, if applicable, and incorporate the CMP requirements. This requirement has been applicable to two-engine operations throughout the history of ETOPS.

However, an existing three-or four-engine airplane may not have a CMP document. Accordingly, there is no requirement to comply with a CMP. For airplanes with more than two engines, this CMP requirement is included in the event that manufacturers develop a CMP document for existing three- and four-engine airplanes and for new airplanes being type certificated for ETOPS operations that may have a CMP document. The FAA does not intend for operators to develop their own CMP, which would be tantamount to re-certification Compliance with a CMP is comparable to compliance with a manufacturer's Instructions for Continued Airworthiness (ICA), which the FAA already requires all operators to comply with. Accordingly, the FAA has decided to require compliance with the CMP for any airplane used in ETOPS when a CMP is available.

FedEx, KLM and IATA recommended that an ETOPS minimum system/subsystem list be provided by the manufacturer, approved by the FAA, and made part of the CMP. The FAA believes that an ETOPS minimum system/subsystem list, otherwise referred to as an ETOPS significant systems list, may be developed by the manufacturers, and approved by the FAA as part of future aircraft certifications. It is impractical to develop such a list at this time. The final rule requires that each certificate holder, in coordination with the manufacturers and their CHDO, develop a list tailored to the certificate holder's operation. The FAA believes the list should not be part of a CMP because not all ETOPS airplanes will have a CMP. Rather, the list should be contained in the certificate holder's ETOPS Maintenance Document.

IATA, Boeing, FedEx and KLM commented that since there are no CMP documents for three- and four-engine aircraft, there is no parts control program. The FAA agrees that with no CMP, there is no issue of ETOPS parts control for airplanes that do not have a CMP. However, Continental went further and suggested that once all aircraft are modified with the new time duration parts, there is no need for a parts control program. The FAA disagrees. All ETOPS operators must have an ongoing parts control program to ensure an ETOPS airplane is maintained and to account for all sources of supply, including parts borrowing and parts pooling.

7. Training and Documentation

ATA did not support additional training requirements for three- and four-engine airplanes, stating that the existing training has served the industry well. ATA had the same comment for procedural changes. The FAA agrees with these comments and has removed this requirement along with all ETOPS maintenance program elements for airplanes with more than two engines

D. Operator Reporting Requirements

The final rule includes certain proactive safety requirements to prevent the occurrence of unsafe conditions that may occur in ETOPS service instead of reacting to unsafe conditions after they occur.

For example, the FAA uses a world fleet IFSD rate, as defined in part 25, to monitor airplane propulsion system reliability. This final rule contains IFSD rates in § 121.374, above which an operator must submit a report to the CHDO, reporting the operator's investigation and any necessary correction action taken.

Various comments were made relative to the need for an ETOPS reliability program for three- and four-engine airplanes, the structure of the program, and the reporting requirements of the program. Because the FAA has decided that the additional engines establish a sufficient level of redundancy to merit not imposing additional engine-related requirements on operators of airplanes with more than two engines, we have removed the reliability program requirement, including IFSD rate reporting, along with all ETOPS maintenance program elements for airplanes with more than two engines.

United and Continental discussed the maintenance reporting requirements in § 121.374 with American requesting withdrawal of the requirements, believing it is redundant to § 121.703. During ARAC meetings, there was considerable discussion about these reporting requirements. Since § 121.703 does not already contain all the requirements found in current ETOPS policy, the final rule codifies current policy, creating a new section for a reporting program that has successfully served the industry for many years without ambiguity. In particular, the reporting requirements for ''problems with systems critical to ETOPS'' and ''any other event detrimental to ETOPS'' were taken directly from AC 120–42A and the ARAC proposal. The FAA needs to be aware of significant mechanical failures that could affect the safety of an ETOPS flight, regardless of whether it occurs in the air or on the ground. Since we have decided against imposing maintenance requirements on operators using airplanes with more than two engines, this reporting requirement does not apply to those operations.

Responding to requests by ATA, Continental and United, the agency has revised several reporting requirements in the final rule involving airplane diversions or turnbacks due to mechanical reasons and their effect on future ETOPS operations.

In addition, the final rule adopts the term ''ETOPS significant systems'' to address the ambiguities found by many commenters including Fed Ex, Boeing, Singapore Airlines, ALPA and IATA. The key intent of the program is to discover mechanical failures on ETOPS airplanes so they can be appropriately addressed in the operator's maintenance program.

United and Continental disputed the 72-hour reporting requirement, asserting that it does not allow enough time for an operator to determine the cause of the occurrence, take corrective action, and report that action to the FAA. This requirement is solely to report the event, not determine its root cause and take action within a certain time limit. This initial reporting requirement is not intended to include the final solution but to notify the CHDO of all problems associated with ETOPS. The FAA understands many ETOPS diversions are for reasons other than mechanical failures. The certificate holder needs to identify in its ETOPS maintenance document, how these flights will continue after a diversion for non-mechanical reasons, such as a medical emergency.

XI. Operational Requirements (Part 121)

A. Route Limitations

The FAA proposed to define ''ETOPS area of operation'' to mean, for turbine-engine-powered-airplanes with two engines, an area beyond 60 minutes from an adequate airport, or for turbine-engine-powered-airplanes with more than two engines, an area beyond 180 minutes from an adequate airport. These areas are further defined as within the authorized ETOPS maximum diversion time approved for the operation being conducted and are the basis for FAA approval of ETOPS authorities for operators. Finally, ETOPS area of operation was to include the North Polar and South Polar areas. An ETOPS area of operation is calculated at an approved one-engine inoperative cruise speed under standard conditions in still air. The FAA further proposed that operations in these areas must be approved by the Administrator and would be authorized in the certificate holder's operations specifications based on the criteria defined in part 121, appendix P.

KLM commented the ARAC did not complete its task assignment, which was to revise the 60-minute requirement because modern aircraft are much more reliable. They further stated that modern aircraft should be allowed to operate at least 90 minutes without the ETOPS burden. These subjects were not part of the ARAC tasking statement and were not included in their proposal to the FAA. Since we did not consider any changes to the current ETOPS authorizations in the NPRM beyond those recommended by the ARAC, KLM's suggestions are beyond the scope of the final rule.

JAA and UK CAA did not support the application of ETOPS by area. These commenters posited it is preferable to set a safety standard for ETOPS operations in general, without specifying specific geographic areas of applicability. ALPA suggested that the wording in the definition be changed to ''areas of ETOPS applicability''.

The ETOPS authority granted an air carrier since 1985 has always been based on an airplane/engine combination, a specific diversion time, and the area of operation for which the approval is valid. The ''area of ETOPS applicability'' concept was developed and recommended by the ETOPS ARAC. Although we have maintained the relationship between ETOPS approvals and specific geographic areas in most ETOPS authorities, we have modified the definition of ''ETOPS area of operation'' to exclude the North and South Polar areas and have removed the specific definition of ''ETOPS Area of Applicability.'' Operations in the polar areas now have certain requirements in this rule based on the codification of current polar policy guidance but are not subject to other ETOPS requirements unless they meet the ''distance from adequate airports'' criteria of 121.161.[22]

Airbus and IATA supported clear and concise requirements for ETOPS approvals. However, these commenters and others, stated there is no safety justification for applying the requirements for two-engine airplanes to three- and four-engine airplanes that have built-in redundancies. We do not agree with the commenters that ETOPS should not be applied under any conditions to airplanes with more than two engines. The basic concept of ETOPS is to prevent a diversion but, if a diversion is required, to protect that diversion. As discussed earlier, the diversion rate for all airplane-related and non-airplane-related causes are comparable between two-engine airplanes and airplanes with more than two engines. Therefore, the concept of precluding and protecting the diversion has equal validity, regardless of the number of engines. In addition, the ETOPS requirements for three- and four-engine aircraft apply only to passenger operations and then only when these operations are greater than 180 minutes from an alternate airport. Applied to current technology aircraft and engines, such operations encompass only a very few, distinct areas of the world. More importantly, these areas, which comprise the South Pacific between the west coast of the United States and Australia, the South Atlantic and South Polar region, are indicative of demanding operations over remote areas with minimal operational infrastructure. In the case of the Poles, the areas also include harsh operating conditions.

B. ETOPS Alternate Airports

1. Determination of ETOPS Alternate Airports

The FAA proposed to codify the definition of ''adequate airport'' found in AC 120.42A. Although the term is used elsewhere in part 121, its use is not unique to ETOPS. It has not been defined previously in part 121.

Airbus is concerned with the inclusion of military airports in the definition. It questions the ability of a military airport to support a recovery plan and recommends that the rule be amended to indicate that the operator must obtain written permission from the responsible military authority to use a military airport for an en-route ETOPS alternate airport, for safety audit and training, and for implementing a recovery plan. JAA and JAL made similar comments. UK CAA makes a similar comment but adds that a military airport should meet the public protection requirements of § 121.97. Other commenters such as FedEx, Singapore Airlines and IATA professed confusion over the definition and request clarification.

The FAA believes much of the confusion relates to the criteria required

[22] NACA also commented that the definition of ''ETOPS area of operation'' includes the entire NOPAC and the North Pacific. This commenter objected to any new requirements for three- and four-engine airplanes that previously had approved operations specifications. NACA did not see the correction made to this section that was published in the **Federal Register** 11/18/2003. NOPAC and North Pacific are not designated as applicable for ETOPS. ETOPS in these areas is defined as a function of distance from adequate alternates and not the simple transiting of these areas.

for an ETOPS alternate airport and those required for the more general ''adequate airport.'' An adequate airport may not be appropriate for an ETOPS diversion because it cannot support a recovery plan, cannot provide sufficient rescue and firefighting support, or is experiencing inclement weather conditions. ''Adequate airport'' should not be defined in terms specific to ETOPS because this new definition is intended to cover the term wherever it is used in part 121, not just in meeting ETOPS requirements. The criteria for the designation and use of ETOPS alternate airports are contained in § 121.624. The requirements of § 121.624 apply to all ''adequate airports'' (including those that are military airports) and must be met before a military airport may be designated as an ETOPS alternate for that flight. The FAA agrees that the proposed definition was unclear and has amended it to state that an alternate airport must meet the requirements of § 121.97. A certificate holder must comply with § 121.97 for each airport it uses, including military airports, and so it is unnecessary to repeat this limitation on the use of military airports in the definition of an adequate airport.

The FAA proposed that an airplane could not be dispatched for an ETOPS flight unless the ETOPS alternate airports could be reached within the maximum diversion time under which the flight is to be dispatched. Each required ETOPS alternate airport must be listed in the dispatch or flight release and meet the specified criteria, including passenger protection, and weather minima.

The FAA proposed that an airport listed as an ETOPS alternate airport must have weather forecasts that are at or above the minimums specified in the operator's operations specifications. Both JAA and UK CAA supported this aspect of the proposal. Airbus and JAA commented that this section would require an operator to consider all adequate airports within the diversion limits of that operator and some airports may not support a recovery plan without the investment of considerable resources with no safety benefits. ATA also suggests clarification of what a carrier must do in considering whether an adequate airport can be an ETOPS alternate airport for the purpose of a particular flight. Airbus suggests that either the definition of ''adequate airport'' be amended to include a passenger recovery plan, or § 121.624 be amended to require operators to consider all adequate airports capable of supporting a passenger recovery plan. JAA also recommends the FAA revise the definition of an adequate airport to require that such an airport should have the necessary infrastructure to support a passenger recovery plan.

The requirement for the operator to consider all adequate airports within the diversion limits of the operation will likely be accomplished when route planning is conducted for a proposed departure and destination airport. It is not the intent of this rule that an operator make a determination that all adequate airports within a diversion limit fulfill the requirements of an ETOPS alternate airport. It is only necessary that every adequate airport in an operator's operations specification be used in determining those that, in fact, qualify for designation as ETOPS alternate airports during dispatch. This information will then be used at the dispatch or flight planning stage for the given flight to determine which airport meeting the alternate weather criteria will be designated as the ETOPS alternate airport. Accordingly, the FAA does not agree that the definition of ''adequate'' airport needs to be changed.

ATA, IATA and several carriers requested the FAA include suggestions from the ARAC that alternate weather criteria provide guidance for relief from most conditional elements of an airport's weather forecast. ATA, IATA, and United commented that the ARAC also included a revised method of determining alternate minima, based on applying Category II and III approaches.

The ETOPS ARAC developed a weather criteria table for use by operators to determine appropriate weather criteria needed in order to designate airports as ETOPS alternate airports. The FAA has adopted this table, and it will be contained in the advisory material. The FAA intends to formulate operator operations specifications for ETOPS alternate weather criteria based on this standard. The table includes a provision on how to handle conditional (PROB40 and TEMPO)[23] forecasts, and permits the use of weather visibility minimums of 700m rather than 800m to allow for variations in the international metric weather forecasting standard. This flexibility has been maintained. The ETOPS alternate weather criteria table contains the provision for Category II and III approaches, as well as single or separate runway criteria.

ATA and Fed Ex also commented that the ARAC recommended the consideration of the use of GPS/RNAV. Singapore, IATA, and United recommended that GPS/RNAV be considered at airports where other navigational aids are not available. ARAC did not include such approaches in its final proposal, and we believe that the request to allow GPS/RNAV approaches is beyond the scope of this regulatory change. Operators may request to receive this authorization through the FAA, which would be reflected in the operator's operations specifications.

JAA recommended the extension of diversion time when necessary to allow operators to reach an adequate airport or when necessary to allow applicants to disregard airports that present unacceptable standards that may impose passenger safety risks.

The FAA cannot agree with the recommendation. The ETOPS rules are predicated on the ability of the airplane and its systems to support a possible diversion during the particular operation. Arbitrary extension of diversion times is contrary to the entire premise behind ETOPS, i.e., management of risk by an operator that is controlled through an approved ETOPS program. In addition, the pilot-in-command can exercise his command authority to proceed to another airport if he decides that proceeding on is as safe or safer than landing sooner. However, airports should not be designated as ETOPS alternate airports by the operator if they do not meet the required minimum standards for use.

Japan Airlines commented that some airports may not report as open when dispatching is taking place but may be quite normal and usable en route. This commenter suggested the language should reflect an operator looking at ''expected field conditions'' instead of ''filed condition reports.'' The FAA does not agree, and the final rule keeps the NPRM language. The agency's intent is to direct the operator to use specific field condition reports to determine actual conditions at an airport. It is not the FAA's intent to preclude an operator from using an airport assumed to be open at time of use, ''from the earliest to the latest possible landing time'' as stated in the rule language.

Qantas disagrees with the proposed weather requirements, stating that the older a weather forecast, the more inaccurate it is likely to be. Qantas also notes omissions from the NPRM. For example, the NPRM does not mention Safety Height Planning to account for some areas of the world where special tracking procedures are required due to terrain. Also, the NPRM requires a descent to 10,000 feet when many aircraft have passenger oxygen systems that allow extended operations at 14,000 feet.

[23] PROB40 is the probability of 40%. TEMPO is a temporary condition.

The FAA does not understand the comment on special tracking procedures. The en-route fuel supply requirement of § 121.646 (b) requires a descent following a rapid decompression to a safe altitude in compliance with the oxygen supply requirements of § 121.333. This would accommodate an altitude higher than 10,000 feet if the operator were equipped with an augmented passenger oxygen system.

2. Passenger Recovery Plans

The FAA proposed in the NPRM that all U.S. flag and supplemental operations include a passenger recovery plan applicable to each approved en-route alternate airport listed in the air carrier's operations specifications. This proposal was not limited to ETOPS operations. Airbus commented the FAA has defined neither the purpose nor scope of such plans nor the approval process. Along with several other commenters, it also stated that it finds it difficult to comment on details yet to be defined for a recovery plan. Airbus, JAA, KLM and other commenters also posited that such plans should only pertain to airports in harsh environments or to airports located in areas where a diversion conducted without specific advance planning might result in a hazard to passengers. They believe that there is no safety justification for any other plans and to include all airports creates an administrative burden with no safety justification. UK CAA makes similar comments. Airbus further stated there is no justification for requiring a plan for airports other than ETOPS alternate airports, and does not support any other application. Airbus further stated that the costs of this rule would be prohibitive and the FAA should include all costs of developing passenger recovery plans in the rule. Air New Zealand supported the concept of the need for a plan that addresses the shelter, well-being, and recovery of passengers.

The FAA agrees in principle with the concept that such plans need to particularly address only those airports that would present a challenge to protecting passengers in the event of a diversion. The FAA accepts the premise that the general application of this philosophy is satisfied for the majority of airports by generic contingency planning by operators. Consequently we have limited the requirement for recovery plans in this rulemaking A specific recovery plan is only required for ETOPS alternate airports used in ETOPS greater than 180 minutes and for diversion airports that support operations in the North Polar and South Polar areas. The FAA does not agree that this requirement should apply only to ETOPS alternates. Current FAA policy for Polar flying requires that ''a sufficient set of alternate airports'' must be able to ''provide for the physiological needs of the passengers and crew for the duration until safe evacuation''. No safety justification has been given for the elimination of this requirement during the ARAC process or by the commenters, and it is retained in this rulemaking for all airplanes not engaged in all-cargo operations. The regulatory evaluation supporting this final rule includes the estimated costs of providing these specific passenger recovery plans. Airbus, IATA, and several operators believe that cargo operators should be exempted from the requirement for passenger recovery plans. We agree that passenger recovery plans are not necessary for all-cargo operators. The language in § 121.135 has been changed to specify only ''passenger'' flag and supplemental operations.

ALPA noted that some operations may have only one choice for diversion and therefore it is critical that alternate airports have the capabilities, services, and facilities to safely support the diversion. The FAA agrees. The rule stated this requirement for all alternate airports in the North Polar and South Polar areas and for ETOPS greater than 180 minutes.

ATA commented that with its limited operations, any rigid requirements would add significant costs. Therefore, this operator requested a compliance period of 18 months. The FAA agrees that a delayed compliance period is appropriate but considers 18 months excessive. The FAA has changed the rule to allow U.S. flag and supplemental air carriers a 12-month implementation period to develop airport specific passenger recovery plans.

FedEx and IATA commented the FAA should accept regional plans rather than require airport specific plans and that facilities on site that protect passengers from the elements for 48 hours should be acceptable.

The FAA does not believe the designation and use of certain airports in extreme climatic areas can be covered adequately by a ''regional'' type plan. The FAA agrees that current contingency planning is sufficient to eliminate the need for regional plans for most operations but agrees with most commenters that specific plans are appropriate for airports in harsh environments or to airports located in areas where advanced planning could be hazardous to passengers. For this reason the requirement for a regional plan has been eliminated from this rulemaking. The ARAC considered the possible costs and logistics for recovery plans and recommended that 48 hours is sufficient time to effect passenger recovery. The FAA agrees with this premise.

IATA commented that limiting the airports to those that offer sufficient shelter and can satisfy the physiological needs of passengers may reduce the number of airports that can be considered. This commenter believes the capabilities of the aircraft (blankets, dinghies, etc.) should be considered.

There is no question that onboard equipment such as blankets can be used for the safety and comfort of passengers for a short period of time. However, in a diversion, advanced planning should dictate there would be sufficient availability of facilities for the protection of passengers and crew. A plan depending on long-term use of the airplane hull to protect passengers and crew from the elements is not considered acceptable.

The FAA proposed to clarify the ''public protection'' requirement of § 121.97 to include data showing 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.

FedEx commented the FAA is demanding data that is not available in such detail at all airports around the world. JAA seeks clarification as to the detail of such required information.

That is, what is ''adequate'' in areas of severe climate? Several commenters suggested an enhanced definition of ''adequate'', to include severe climate area, and typical weather and seasonal variations. The JAA maintained that a more enhanced definition could then be used to define an operation as ETOPS or non-ETOPS.

Providing ''public protection'' data is a current regulatory requirement. However, in response to this concern, the FAA is limiting this expanded requirement only to airports used by passenger-carrying airplanes for ETOPS beyond 180 minutes and for operations in the North Polar and South Polar areas. By definition, airports used in these operations are either in remote or demanding areas of the world. By their nature such airports will require extra attention to the safety of passengers in a diversion scenario. It is incumbent on all passenger-carrying operators to have contingencies for such an event. It is expected that more than one carrier will serve such routes and the data will be shared and readily available. We agree in principle with the JAA's comment, but do not agree that it is necessary to change the definition of ''adequate airport''. The ''public protection'' requirements of this rule have always applied to all airports used by an operator. The expanded definition of this rulemaking likewise does not differentiate with regard to weather extremes.

3. Rescue and Firefighting Services (RFFS)

The FAA proposed in the NPRM to codify current two-engine ETOPS RFFS criteria for all ETOPS alternate airports. ICAO Category 4 RFFS at alternate airports would be required for ETOPS operations up to 180-minute diversion length. For all ETOPS beyond 180 minutes ICAO Category 7 services would be required.[24]

Current RFFS standards for airports are contained in part 139. These requirements are indexed to a formula based on aircraft width and length and the number of operations of a particular type of airplane at the airport. Section 121.590 specifies the conditions U.S. domestic, flag and supplemental carriers must use in their operations at part 139 certified airports and imposes these requirements on destination airports but not on alternate airports. AC 120–42A placed RFFS requirements on alternate airports used in ETOPS.

KLM noted that in the case of a fire in the cargo hold, the plane will divert to the nearest airport, which may not be the designated category 7. Qantas claims that since the introduction of ETOPS there has never been an ETOPS related incident where RFFS were required. ATA and many operators did not support the NPRM requirement for Category 7 for ETOPS greater than 180 minutes and recommend that the less stringent criteria for current two-engine 207-minute ETOPS apply. IATA and FedEx commented that there is no scientific reason to connect RFFS to the length of the diversion. KLM made a similar comment. IATA noted that if an operator needed to rely on airports with a greater than category 4 RFFS, the proposed rule might result in forcing the selection of an alternate airport further from the planned route than necessary. ALPA, however, supported an ICAO category 7 capability for all ETOPS alternate airports.

[24] Although not completely equivalent to part 139, ICAO RFFS categories are applied in a similar manner. ICAO category 4 is generally equivalent to part 139 Index A and is defined as suitable for the needs of an ATR–42 or equivalent airplane. It can consist of 1 truck and 500 lbs. of halon and 100 gallons of AFFF (fire fighting foam). ICAO category 7 is generally equivalent to Index C, suitable for a B–757 and can consist of two trucks and 3000 gallons of AFFF.

The requirement for RFFS levels for ETOPS below 180 minutes and for 207 minutes are well known and set the precedent for these rules. It is the FAA's position that such requirements are applicable for all long range operations defined by this rule. The captain (pilot in command) of any flight, ETOPS included, is allowed by regulation to land the plane safely wherever necessary in an emergency. The purpose of this rule is to ensure that all alternate airports supporting these demanding operations have a reasonable minimum capability. The FAA does not believe it can justify the requirement to have an increased RFFS level of ICAO category 7 at each designated ETOPS alternate airport for ETOPS beyond 180 minutes. Although the recommendation for a category 7 RFFS capability in the ARAC report was accepted by the FAA, several commenters have pointed out the restrictions and limitations that such a requirement presents to the planning and conduct of ETOPS beyond 180 minutes. There is, however, overall support for the requirement to have RFFS capability at ETOPS alternate airports, and there is general acceptance that the ICAO category 4 represents the minimum acceptable level.

The proposed RFFS requirement was developed as a logical extension of the standard establishment for the 207-minute ETOPS policy. The FAA continues to believe that it is important that there be at least one airport available with sufficient RFFS capability to deal with a significant safety hazard. Accordingly, the FAA has amended § 121.106 to be consistent with the RFFS requirements established for the 207-minute ETOPS policy. For ETOPS beyond 180 minutes, ICAO category 4 would be required with at least one adequate airport within the authorized diversion time having a RFFS category 7 capability. This change will allow for optimum route planning as well as providing the flight crew with available alternate airport options in the event a situation requires a higher RFFS capability.

Omni commented that the majority of ETOPS diversions are for medical emergencies, yet there are no requirements for adequate medical care on the ground. This commenter also found an airport may downgrade its declared fire fighting capabilities at some point without the knowledge of the operator, or that an airport may be unable to inform operators of downgrades because of lack of authority from the State Civil Aviation Authority. Qantas noted GPS or Required Navigation Performance (RNP) approaches would make landing much safer, yet no requirements for these approaches appear in the NPRM.

There is no regulated plan for a medical emergency because the FAA cannot assess the relative risk associated with medical emergencies. These are events that defy risk analysis. Certain guidelines have been codified for passenger recovery and public protection in today's rule the FAA considers adequate. Regulating the standards for airport approaches as urged by Qantas is beyond the scope of this regulation.

C. Crewmember and Dispatcher Training

Today's rule requires training for crewmembers and dispatchers in their roles and responsibilities in the certificate holder's passenger recovery plan.

JAA, UK CAA, and United supported such a requirement. FedEx and IATA concur with additional training for pilots and dispatchers, but note that training for pilots of three- and four-engine airplanes may result in a tradeoff with other training. Therefore, they requested training only in fields where there is an obvious justification or safety benefit. American Trans Air concurred with the training requirement but requests a compliance period of 18 months.

The FAA agrees that air carriers need a reasonable compliance period to make necessary adjustments as a result of a new rule. However we do not agree with the proposed 18-month period, and instead will allow a 12-month compliance period from the effective date of the rule. We also understand that an air carrier may need to adjust the pilot training syllabus in order to accommodate the new training unit for three- and four-engine flight crews. This should not be a significant change. Therefore, it should not be a significant cost to operators.

Northwest assumed that its experience on trans-oceanic flights is sufficient, but if additional training is required by the certificate management office, then it would like to do so through bulletins and written procedures to minimize costs. It is the FAA's position that the training syllabus as well as the means to provide that training is within the air carrier's discretion. It can and should be tailored to fit within the existing training and operational experience of the carrier.

Qantas commented that the NPRM did not consider the simplified ETOPS training rules that have been in place in Australia for 18 years that require little or no training. These rules have resulted in no ETOPS-related incidents. Qantas further noted that the pilot and dispatcher are only a small component of the diversion process.

The FAA agrees with the commenter that straightforward and understandable rules establishing minimum acceptable standards are needed. We believe today's rule establishes those standards. We do not agree, however, that established standards, no matter how ''simplified'' they may be, need not be part of pilot and dispatcher training. The FAA is well aware that for ETOPS, and in particular with an ETOPS flight that encounters the need to divert, it is the entire company that mobilizes to support that diversion. Both the pilot and the dispatcher are a critical part of the diversion and need to be trained accordingly.

D. Communications Requirements

The FAA proposed that a certificate holder conducting U.S. flag operations provide voice communications for ETOPS flights. For ETOPS beyond 180 minutes the certificate holder must have a second communication system that provides immediate SATCOM with ''landline telephone-fidelity''. Section 121.122 extends this ETOPS beyond 180 minutes requirement to supplemental passenger-carrying operations and to two-engine all-cargo operations.

Continental and other commenters objected to the prescriptive requirement for SATCOM. They suggested a more flexible requirement for voice-based systems. ATA, Airbus, and other commenters urged the FAA to coordinate any new ETOPS communication requirements with the Terminal Area Operations Aviation Rulemaking Committee (TAOARC) recommended language.

The FAA has coordinated the amendment to §§ 121.99 and 121.122 with the parallel activity by the TAOARC and Area Navigation (RNAV) rulemaking initiative (Docket No. FAA–2002–1–4002). As of this writing, the RNAV final communications rule (§ 121.99) has not been finalized. The FAA has determined that there is a significant safety benefit associated with an ETOPS flight having the ability to communicate via a satellite based voice system, especially for those situations that occur while on long, remote ETOPS routes. The need for safety is best served through information and technical assistance that is clearly and rapidly transmitted to the flight crew in a way that requires the least amount of distraction to piloting duties best serves the need for safety. The FAA has determined that the best way to assure clear and timely communication in general is via voice communication. Other than the area north of 82 degrees latitude, satellite communications provides the best means to provide that capability because it is not limited by distance.

FedEx, IATA, United, and Continental and others noted that SATCOM may not be useable beyond 82 degrees North latitude, and is thus ineffective for operations in Polar areas. The FAA recognizes the limitations of SATCOM in the North Polar Area above this latitude, and in such an area an alternate communication system such as HF voice or data link is to be used. The relatively short period of time that the flight is above latitude 82 degrees North in relation to the total planned flight time is a small fraction of the total flight. The ability to use SATCOM for all other portions of the flight, which for some routes could be longer than 15 hours duration, is advantageous to the flight. For flights above 82 degrees latitude the operator must also ensure that communications requirements can be met by the most reliable means available, taking into account the potential communication disruption due to solar flare activity.

Several commenters noted that the proposed communication requirements are more restrictive than the current 207-minute policy letter. Continental asserted that ARAC recognized that SATCOM was costly and arbitrary and chose to recommend it because it was first specified in the 207-minute operations letter. In its development of the 207-minute policy, the FAA and industry agreed that the areas of the world defined by ETOPS greater than 180 minutes were remote areas where the safety benefits of SATCOM would be significant. There is considerable difference in the level of operational authority allowed with the 207-minute North Pacific area of operation (NOPAC) authority, which is a limited extension of the 180-minute ETOPS authority and an infrequent operation and that of the proposed approval for beyond 180-minute operations. ETOPS authorizations in Appendix P to part 121 for greater than 180 minutes allows operations on a continuous basis up to the certified time-limited system capability of the airplane.

IATA and FedEx proposed that operators of three- and four-engine airplanes be allowed to continue ETOPS without SATCOM for a period not to exceed 6 years. JAL proposed a similar exemption consistent with the 6 months allowed in § 121.633 for system planning. We agree with the commenters that a period of time should be allowed for the air carrier to install the required satellite communication system on airplanes not currently subject to ETOPS authorization restrictions but believe 6 years is too long a period of time. We have amended §§ 121.99 and 121.122 to allow for a 12-month installation period for airplanes with more than two engines used for ETOPS.

ATA commented that HF voice and HF data link communication are sufficient for the safety of ETOPS. We agree that the use of data link for communications is a very effective tool especially when used to transfer blocks of data such as revised flight plans or updated winds aloft data or to downlink airplane performance data. It is also very effective when used for controller pilot data link communication to transmit air traffic service clearances and flight crew responses using pre-stored messages. However, data link becomes more cumbersome when used in free text message form. The use of data link (both HF and SATCOM) is limited by message length and ability to clearly state the issue or message, and tasks the flight crew more than voice communication by requiring full attention to the task of interacting with a small and compact keypad. Turbulence and airplane maneuvering compounds the difficulty in using the device without error. Its use also necessitates crew coordination/verification of message content prior to sending the message. This is extremely distracting during a time of flight that requires the pilot's focused attention to the problem at hand. In comparison, the use of voice SATCOM allows clear and immediate conversation that can quickly convey the situation and needs for the flight.

Omni commented that the proposal does not meet its intended safety purpose: it requires an operator to structure its operations around the availability of SATCOM rather than more sophisticated communications systems. Moreover, this commenter and Airbus found the FAA did not clearly define ''landline fidelity'' in quantifiable terms. Several commenters stated that flight watch [25] can be adequately conducted with HF voice communication, and that in most regions of the globe there are adequate ground and communication facilities available.

The use of SATCOM is a new requirement that applies only to ETOPS conducted beyond 180 minutes. The other available communication systems

[25] Flight watch is a shortened term for use in air-ground contacts to identify a flight service station providing ''En-route Flight Advisory Service (Weather)''.

in use (VHF and HF voice and data link) all have significant limitations. VHF has poor range capability. HF two-way voice communications are routinely degraded by voice distortion, background noise, static, and can be unclear and unintelligible due to atmospheric conditions and frequency clutter. Voice SATCOM allows for immediate clarification by use of questions and dialogue that will result in important and relevant information being clearly transmitted. This occurs with minimum workload and distraction to the flight crew from their piloting duties. It is by many factors over, a quantum leap improvement in communications that can greatly benefit the safety of a flight; particularly an ETOPS flight that could be 4 or more hours from a landing site. The capabilities of SATCOM to connect with the communications satellite are not hindered by the altitude of the airplane, and are useable on the ground following a diversion. The communication benefits are clear.

The words selected in the rule ''of landline telephone-fidelity'' are to convey to the average person in the United States the communication qualities expected. A person knowledgeable of the communication qualities of SATCOM understands the equivalent relationship in comparison to landline telephone fidelity. The quantifiable term ''landline telephone-fidelity'' is in reference to the experience one would have using the telephone system in the United States. The FAA disagrees with the comment that the rule would require operators to structure its operations around the availability of SATCOM before considering alternatives. The rule language does not restrict operations based on the availability of satellite based voice communication.

Airbus, IATA and FedEx commented that although operators may initially ensure communication infrastructures, demonstrating the reliability and response time to local air traffic personnel on a continuing basis may be an impossible task. The FAA does not understand the commenters' objection to § 121.122(a). The requirement for the air carrier to identify the ground- or satellite-based communication installations to ensure reliable and rapid communications with air traffic services has been a long-standing requirement for U.S. flag air carriers (§ 121.99(a)).

Boeing recommended deleting the word ''additional'' to dispel any interpretation of needing a second satellite-based communication system.

It is not possible for an air carrier to have a SATCOM system installed in place of the communication system required by § 121.99(a) because SATCOM does not have broadcast capability. If, however, an air carrier has already installed SATCOM as an additional communications system, as Boeing suggests, to meet the requirement of § 121.99(c), then there would not be a requirement for a second ''additional'' system to satisfy § 121.99(d). The air carrier is not required to install two ''additional'' satellite-based communication systems to meet the regulatory requirement. The FAA requires the additional voice communication system to be a satellite-based system.

Airbus also noted that operators may have to bear expenses charged by owners of satellite systems, particularly in Polar areas, a cost not included in the FAA's economic evaluation. JAA also urged the FAA to consider these prescriptive requirements in its cost/benefit analysis. The FAA agrees, and the Final Regulatory Evaluation includes the costs for installation and use of SATCOM.

ATA objected to a requirement for SATCOM for supplemental operators, while ALPA supports such a requirement. As stated earlier, the FAA has agreed that for the particular case of all-cargo, supplemental operations on airplanes with more than two engines the cost of the ETOPS requirements such as SATCOM cannot be justified. This communication requirement has been withdrawn from this rule

E. Time-Limited System Planning and the Critical Fuel Scenario

The FAA proposed that planned ETOPS diversion times not exceed the time limit specified in the airplane's most time limited system minus 15 minutes. In the case of cargo fire-suppression systems for airplanes with more than two engines, the proposal allowed 6 years for compliance. The FAA anticipates that the most time-limited system would typically be either the cargo fire suppression system if required, or the en-route fuel supply. Current two-engine ETOPS guidance codified in this rule for operations up to 180 minutes bases diversion times on a one-engine inoperative cruise speed (under standard conditions in still air). Required system capabilities are then based on this calculation. The rule requires wind to be considered for ETOPS beyond 180 minutes to ensure that system time limits are not exceeded. Since data has shown the likelihood of a simultaneous engine failure and cargo fire to be extremely remote, for ETOPS beyond 180 minutes, the cargo fire suppression system requirement is based on an all engine operating speed calculating the effect of wind.

The FAA proposed to define ''one engine inoperative cruise speed'' for ETOPS as 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.

FedEx, Singapore Airlines, JAL, and IATA recommended the FAA develop more detailed information for determining one-engine inoperative cruise speeds to increase operational flexibility. These commenters also recommended the FAA establish conditions or scenarios for calculating the maximum approved distances (using still air) associated with one-engine inoperative operations.

The definition is already flexible in that the certificate holder selects the speed as long as that speed is within the certified operating limits for the airplane. This gives operational flexibility for different areas of operation where the engine inoperative net level-off altitude may require consideration of terrain and other factors. The certificate holder must also get FAA approval to use that speed. This selected and approved speed is also the speed used to determine the critical fuel reserves required for ETOPS by § 121.646(b). While this approval gives the certificate holder flexibility, it would not be acceptable to the FAA for a certificate holder to designate the fastest possible speed in order to achieve the largest ETOPS area of operation, and then use a slower speed in determining critical fuel reserves to reduce the amount of fuel reserves. The speed used by the certificate holder to determine the critical fuel reserves must be the same speed used to determine the ETOPS area of operation in that geographical area.

Air New Zealand commented that the proposed requirement for ETOPS flights beyond 180 minutes for cargo suppression time to be adjusted for wind and temperature is unreasonable. FedEx and United echo this objection.

The ETOPS ARAC Working Group deliberated extensively over the concept of applying wind and temperature values in calculating ETOPS distances. The conclusion reached was that for ETOPS up to and including 180 minutes, the present standard of calculating the distance in still air was adequate and should continue. However with the diversion times increasing to 240 minutes and beyond, it was deemed appropriate to require diversion time computations for longer ETOPS distances to account for winds and temperature, because the total effect on long flights could be considerable. The FAA has accepted the ARAC recommendation. The FAA does not agree with the commenter that calculations with actual and forecast wind and temperature are unreasonable. All fuel planning and critical fuel reserves needs are already computed based on forecast wind data.

The FAA also agrees that the planning for an ETOPS flight beyond 180 minutes is more complex in that wind and temperature are factored into determining an all engine speed distance as well as an engine-inoperative speed distance. The FAA expects that an airline would first conduct a route planning exercise for each planned city pairing to determine the diversion authority needed in still air conditions. If the route or segments of the route exceed 180 minutes based on one engine inoperative speed and still air, then a secondary planning exercise (that may be required seasonally) should be conducted that factors in expected winds and temperatures on that route. The distance between adequate alternate airports on the route is converted into time (minutes) computed for an all engine cruise speed, as well as an engine inoperative speed. The number of minutes cannot exceed the time-limited system (cargo fire suppression and the other most limiting system) that is identified in the airplane flight manual less the 15-minute pad. The operator needs to determine how much system capability is required for the planned route and equip its airplane to have sufficient margins. The FAA expects that manufacturers will provide system capability with a margin greater than the 15 minutes required by the rule so that the operator has more flexibility when unforecast adverse winds are encountered. Thus, the operator, in coordination with the manufacturer, needs to determine how much extra margin should be allocated to provide greater flexibility when encountering the unexpected on the planned routes. Finally for the actual flight, the operator's flight planning must be within the airplane systems capability for the selected ETOPS alternate airports on the planned route based on diversion times that are calculated using known or forecast winds and temperature conditions. Airplane flight manual system limits must be adhered to. Any segment planning that provides only a minimum of excess time-limited system capability compared to the maximum distance from an airport on the route should be backed up with an alternate course of action.

ALPA, FedEx, Singapore, and IATA commented that there is no fire suppression limit for ETOPS up to and including 180 minutes. Because of this, FedEx and United suggested a fire suppression time guideline beyond 180 minutes rather than final limit. ALPA, on the other hand, stated this limit should be applied to operations up to 180 minutes as well as those over 180 minutes. United requested clarification that this requirement is an amendment to part 25.

The FAA acknowledges the apparent disparity created by applying time-limited systems capability, such as cargo fire suppression capability, only to those three- and four-engine airplanes conducting ETOPS and not to those airplanes operating 180 minutes or less. Since the overwhelming number of airplanes with three or four engines will not be used in ETOPS, the FAA recognizes that the costs to retrofit the cargo fire suppression system for all of the other airplanes would be significant, and simply overwhelm the benefit that would be derived.

In response to FedEx and United's comment, the principle of requiring system capabilities that are sufficient to support the operation and to protect the operation from occurrences that are not extremely improbable is a basic tenet of all previous ETOPS guidelines. These have been instrumental in the success of current ETOPS in the absence of rulemaking. Now tasked with developing regulatory language for such operations, the FAA finds it prudent to define them as rules and not guidelines. This is a part 121 limitation on the operation. The only part 25 requirement is to place this time capability into the airplane flight manual.

ATA recommends that the cargo suppression requirements be revised to apply only to airplanes that do not incorporate procedures for fire suppression through oxygen starvation. This section should clearly state that its provisions apply only to Class C cargo compartments. Boeing, IATA, and many operators make similar comments. Northwest comments that since the majority of all-cargo operations have only Class E compartments, they should be excluded from this requirement. The FAA agrees that the intent of ARAC and the final rule would only apply to those cargo and baggage compartments that have an ''active'' fire suppression system installed, i.e., systems that incorporate fire-suppressing agents in containers that limit the length of time that these agents can suppress a fire. Most airplanes used in part 121 passenger-carrying service have only Class C cargo or baggage compartments, or Class D compartments retrofitted with time-limited fire suppression systems. Some all-cargo two-engine airplanes may have Class C compartments or retrofitted Class D compartments, although most have only Class E compartments. Class E compartments may only be installed in all-cargo airplanes. The rule announced today requires that carriers determine—in terms of time—the most limiting fire suppression system capability. This rule does not apply to Class E compartments, whose method of extinguishing a fire is not time-limited.

Boeing suggested adding ''or CMP'' to paragraphs (a), (b), and (c) to permit ETOPS operators to continue their operations without potential disruption. Boeing also suggested the proposed rule should allow the all engine speed for determining allowable ETOPS time to an alternate airport for time-limited systems other than the cargo fire suppression system. Their premise is that there may be other non-engine related time-limited systems that would be appropriate to consider as all-engine operations for calculating the ETOPS time to an alternate airport.

The FAA agrees that the time-limited system capability may be included in the CMP document, and has amended the rule accordingly. The FAA does not agree that § 121.633(c) should be changed as suggested. Diversion lengths have always been limited by the most time-limited system, which has historically been the cargo fire suppression system. During ETOPS ARAC discussions material was presented to show that the probability of an engine failure and a simultaneous cargo fire both occurring at the most critical point in flight was extremely improbable. This analysis supported the decision to separate diversion lengths for cargo fire suppression system capability from other time-limited systems capability. This was accomplished by allowing the use of all-engine speed calculation for the cargo fire suppression limit, and the one-engine inoperative speed calculation for the other most limiting systems. There has not been any other time-limited system identified by anyone that would justify a similar procedure as is allowed for the cargo fire suppression system.

FedEx, KLM, and IATA commented that the proposed cargo fire suppression system might be technically and/or economically difficult to accomplish. These commenters suggested an 8-year compliance period. Boeing recommended ''grandfathering'' three- and four-engine airplanes for paragraph (c) of § 121.633 because the installation of such systems would essentially require recertification of airplanes manufactured over 30 years ago.

The FAA agrees that older and current three- and four-engine airplanes should be given consideration in application of this rule. However, the commenters have not submitted any data to support their position and the FAA cannot independently justify extending this exemption to 8 years based on the data it has. The 6-year period was a recommendation from industry following extensive discussion and debate.

FedEx, United, and IATA also suggested that the manufacturer should provide a list of time-limited systems to enable a consistent industry application of this rule.

The rule requires that the manufacturer provide the systems limit in the airplane flight manual for the cargo fire suppression system, and the next most time-limited system that is installed on the airplane. The FAA does not anticipate a need to account for more than the top two time-limited systems, although a manufacturer is welcome to provide more information if it so chooses.

FedEx, KLM, and IATA asked about the diversion considerations caused by headwinds and whether the flight should be cancelled if this factor cannot be accommodated. The FAA clarified that the time limited system capability that is stated in the airplane flight manual cannot be exceeded. If the airplane systems capability is not adequate for the intended route, then the flight cannot proceed. The operator must ensure that the airplanes systems capability is sufficient for the intended route.

KLM commented that the only time-limiting system that can be justified is the cargo hold fire suppression. They stated that oxygen cannot be limiting since this has to be covered by procedures. The FAA cannot agree. Although the best-known and understood limiting capability system is the cargo fire suppression system, the manufacturer must still identify the next most limiting system, because the incident requiring diversion may be unrelated to a fire in the cargo hold. For some airplanes this second limiting factor may be the fuel load capability of the airplane, which needs as a minimum the capability to support the required ETOPS critical fuel reserves.

UK CAA and the JAA agreed with the proposal but noted that UK CAA airplanes incorporate the required 15 minutes within the calculation of all time-limited functions. Commenters stated that the 15 minutes should not be incorporated twice. The FAA agrees that the European regulation should not require the 15-minute pad twice. These and other issues require harmonization to be resolved in follow-on discussions that would determine applicability.

The FAA proposed to define ''maximum diversion time'' to mean, for the purposes of ETOPS in part 121, the diversion time, under standard conditions in still air at the one-engine inoperative cruise speed. JAA and UK CAA found this definition misleading as it refers only to still air time. These commenters suggested that an approved still airtime be given to operators and that the maximum diversion time be defined as the system limit (to be determined on the day of the flight in the forecast conditions).

We generally agree with this comment. For ETOPS beyond 180 minutes use of this term is only applicable to prior ETOPS route planning, not day-to-day operations. Accordingly, the definition is clarified to read, ''for ETOPS route planning,'' thus applying to all ETOPS planning (including operations beyond 180 minutes). This does not contradict the new § 121.633, which applies to day-to-day operations since the term ''maximum diversion time'' is not used in that section.

Today's rule requires in § 121.646 that an airplane have enough fuel on board, assuming combinations of an engine failure and a rapid decompression at the most critical point of the route, to land at an adequate airport with enough additional fuel to hold for 15 minutes at 1500 feet above field elevation. It adds additional fuel requirements to compensate for wind, icing, and an APU unit, if one is required as a power source. This subject has been termed the ''critical fuel scenario'' and has been a significant part of two-engine ETOPS guidance from AC120.42A. Based on the weather forecasting techniques of the early 1980s, the advisory circular required very conservative calculations for wind and icing effects. The advisory circular required a 5% fuel addition to total fuel to account for wind forecast errors and required the operator to assume icing and ice drag for the entire scenario. However, winds-aloft forecasting has improved dramatically in the last twenty years. The use of these products and techniques has reduced the need for such conservative calculations and the FAA is requiring only a 5% adjustment to the forecast wind if approved techniques are employed. Based on studies done by the Atmospheric Environment Service of Canada such as CASP II, the probability of a continuous or repetitive significant icing encounter is very small on a long flight segment. For these reasons the proposed icing calculations have been reduced to the effects of ice drag during only 10% of the time ice is forecast or the use of icing systems during the entire time of forecast icing.

ATA, Northwest, United, and IATA commented that the requirement for an additional 15 minutes of fuel for the three- and four-engine airplane for more than 90 minutes, but less than 180 minutes, will add costs to operators. ATA suggested that the current fuel requirements be retained for these aircraft.

The FAA accepts the comment that the additional 15 minutes of holding fuel is a new requirement that has been added to § 121.646(a) to require sufficient fuel for a decompression scenario. However, the added 15-minute holding-fuel requirement does not represent an additional cost to operators. Part 121 currently has two separate fuel requirements that apply to three- and four-engine operators conducting U.S. flag and supplemental operations. Section 121.645(b)(4) requires fuel for 30 minutes at holding speed at 1,500 feet with all engines operating. Section 121.193(c)(2)(iv) requires fuel to fly with two engines inoperative to an airport to arrive 1500 feet directly overhead and then fly for an additional 15 minutes at cruise power. The requirement of § 121.646(a) for holding fuel is a value less than fuel reserves already required for the operation and therefore is not an additional cost to the operator.

BALPA commented that the reduction of the 5% additional fuel for wind is overly optimistic given the ICAO standard of a 20% forecasting error and the fact that typically fuel-indicating systems are accurate only to a 1–1.5% scale. BALPA suggested that the critical fuel calculation have an additional sum of fuel to allow for an overall error of not less than 3% of the calculated fuel from the critical point to the alternate airport. Qantas however, supported the reduction in critical fuel values. Qantas also concurred with an additional fuel requirement if an APU unit is required. UK CAA commented the FAA should either retain the 5% fuel factor or use a reduction analysis based on historical data and proof that the operator is using the World Area Forecasting System unequivocally.

The FAA concurs with the ETOPS ARAC conclusion that the industry has a better and more accurate wind forecast ability than previously available. This enhanced capability justifies the change in determining fuel required for a flight. The FAA does not accept BALPA's recommendation to increase the contingency fuel to a 3% value as proposed. Likewise, the FAA does not agree with the UK CAA. The basis for the contingency fuel values in § 121.646(b) is the service experience gained in ETOPS for almost two decades and the vast improvement in accuracy of the World Area Forecasting System wind forecasting.

FedEx, Singapore, and IATA commented that in the current regulatory language additional fuel for icing is implied for operations beyond 90 minutes and is now required in ETOPS. They have requested clarification. To clarify, the intent to include icing in § 121.646(a) is to clearly state that the fuel required to operate engine and wing anti-ice systems as well (as to account for the induced drag from ice accumulation on unheated surfaces) must be included. The FAA has, however, modified the language of this section to be consistent with the language used in other sections of part 121. Section 121.646(a) is modified to read: ''* * * considering wind and other weather conditions expected, it has enough fuel * * *''. The intent with this change remains the same in that if icing conditions are expected, then the fuel requirements for this condition need to be accounted for in the fuel calculation.

FedEx, Singapore, IATA, and Japan Airlines commented that the rationale for adopting a 90-minute threshold for three- and four-engine airplanes is not clearly addressed. The 180-minute threshold seems to be based on the ETOPS threshold for rapid decompression, which several commenters found unreasonable. The rationale for selecting the 90-minute threshold in § 121.646(a) is based on § 121.193(c), that established the 90-minute threshold for three- and four-engine airplanes.

Qantas questioned the need to allow extra fuel for decompression and a simultaneous engine failure, noting that most engine failures occur at times of major thrust. Qantas suggested that in the extremely unlikely event that these two events should occur simultaneously, the flight variable reserve would suffice. The FAA does not agree with this rationale. The connection with the loss of an engine combined with the loss of pressurization has previously occurred due to an uncontained engine failure. Such a failure can occur on all airplanes, especially four-engine airplanes where the inboard engines are located in closer proximity to the fuselage. In determining the critical fuel reserve required for ETOPS, § 121.646(b) requires the operator to use the greater fuel burn rate between flying all engines unpressurized versus flying one-engine inoperative unpressurized. Planning for this type of failure ensures that sufficient fuel is onboard to fly to and land at an alternate airport. This fuel planning allows the other contingency fuel requirements to be available to the pilot for the non-planned variables.

Qantas commented the FAA has overlooked two factors: additional oxygen for passengers and high or mountainous terrain areas where longer decompression tracks will be required. The FAA crew and passenger supplemental oxygen requirements are contained in §§ 121.329 and 121.333 of current regulations. These requirements are applicable to all flights. Special escape tracks over high or mountainous terrain are necessary in the event the flight cannot maintain the necessary obstruction clearances due to an engine loss or loss of pressurization. Such routes require approval by the FAA, and are listed in the operator's operations specifications.

Transport Canada commented that future technology aircraft may allow airplanes to fly decompression profiles at altitudes higher than 15,000 feet. Therefore, Transport Canada proposed that analysis be done to verify altitudes greater than 15,000 feet and whether the 5% alternative still remains valid. The FAA agrees that continued assessments as to the accuracy of wind forecasts would be needed. If data indicates that a desired level of accuracy has not been achieved, then appropriate fuel margins up to the standard 5% value are appropriate.

F. Dispatch or Flight Release

1. Original Dispatch or Flight Release, Re-Dispatch or Amendment of Dispatch or Flight Release

The FAA proposed that before passing the ETOPS entry point, weather conditions at alternate airports must be evaluated to ensure that they are at or above the operating minimums specified in the operator's operations specifications. This rule codifies current ETOPS requirements expressed in AC 120–42A.

ATA requested the FAA clarify its intent concerning the ETOPS entry point to include the intended authority of the captain and dispatcher to determine the suitability of an en-route alternate airport. FedEx, United, Singapore and IATA made a similar comment, saying that it is not clear whether weather changes at alternate airports, once the ETOPS entry point is passed, may require a turn back.

The FAA agreed that clarification is needed for the situation where the flight has passed the ETOPS entry point.[26] An operator is not required to turn back once the flight has gone beyond the ETOPS Entry Point if an unexpected worsening of the weather at the designated ETOPS alternate airport drops the airport below operating landing minima (or any other event occurs that makes the runway at that airport unusable). The FAA expects that the pilot-in-command, in coordination with the dispatcher if appropriate, will exercise judgment in evaluating the situation and make a decision as to the safest course of action. This may be a turn back, re-routing to another ETOPS alternate airport, or continuing on the planned route. Should the operator become aware of a potential weather problem prior to the airplane entering the ETOPS stage of the flight, the rule allows the operator to designate a different alternate airport at the ETOPS entry point in order to continue the flight.

UK CAA recommended that the requirement be amended to say that the flight crew are to remain informed of changes in conditions at designated en-route alternate airports. If conditions are identified that preclude safe approach and landing, the crew should take an appropriate action. The FAA believes that the language of the NPRM and final rule adequately convey a practice that has been required for all two-engine ETOPS conducted up to 180 minutes as well as the 207-minute ETOPS policy letter.

Airbus and JAA found this requirement impractical for polar routes, where the ETOPS alternate airport may be located outside the ETOPS area. Airbus therefore recommended the FAA exclude polar flights with a diversion time not exceeding 60 minutes for a two-engine airplane or 180 minutes for a three-or four-engine airplane from the scope of this requirement. The FAA agrees that the original intent of the NPRM—to establish the Polar Areas as areas where the ETOPS rules apply—created confusion. We have therefore abandoned this concept. The

[26] Section 121.7 defines ETOPS Entry Point as the first point on the route of an ETOPS flight, determined using a one-engine inoperative cruise speed under standard conditions in still air, that is—

(1) More than 60 minutes from an adequate airport for airplanes with two engines; or

(2) More than 180 minutes from an adequate airport for airplanes with more than two engines.

application of the ETOPS rules for these areas are no different than for any other area of the world and are only required for two-engine airplanes whose routes take them farther than 60 minutes from an adequate airport and for passenger airplanes with more than two engines whose routes take them farther than 180 minutes from an adequate airport. The FAA believes that the particular requirements of current polar policy codified in this rule are sufficient to ensure the safety of all other non-ETOPS flights in these areas.

2. Dispatch Release: U.S. Flag and Domestic Operations

In the NPRM, the FAA proposed adding ETOPS approvals to the items that must be included in a flight dispatch release. A flight dispatch release for each flight is a regulatory requirement for each certificate holder conducting domestic or flag operations. It must contain information on the flight, list the airports to be used by the flight including alternates, and contain pertinent weather and maintenance information. It must be signed by both the pilot and dispatcher.

Qantas commented that this requirement is unnecessary, arguing the pilot already knows of the ETOPS approvals for a particular fleet. The pilot-in-command should be notified only when there are changes. Qantas objected to application of this requirement to supplemental operations. United agreed with the proposal and suggested that it simply be added to the Flight Plan Forecast.

The purpose of the requirement to show the ETOPS time basis on the dispatch or flight release is to ensure that the status of the equipment, flight planning, and crew qualification all match for the planned flight. The time an ETOPS flight is released for flight requires that all personnel involved be focused on that flight's requirements. The dispatch and flight planning process considers not only the airline's approved ETOPS authority, but also the status of the airplane and its equipment to meet those standards. The dispatch and flight planning personnel, the maintenance personnel, and the flight crew must all be aware of what is required for the flight so that last minute adjustments or decisions are correctly applied. We agree that the use of the Flight Plan Forecast is the most logical method of compliance.

G. Engine Inoperative Landing

Today's rule requires that under certain circumstances a pilot must land the airplane at the nearest suitable airport as soon as a safe landing can be made. The FAA proposed a change in the wording of this rule from ''* * * whenever the rotation of an engine is stopped to prevent possible damage,'' to ''whenever an engine is shut down to prevent possible damage.'' This minor revision was made to delete the reference to stopping the rotation of an engine, which applies only to propeller driven airplanes, and adding a reference to engine shutdown, which applies to all airplane engines. In the final rule this application is extended to all relevant paragraphs in § 121.565.

Although JAA and UK CAA supported the proposal, many operators took the opportunity to discuss the term ''suitable'' in the rule language. They commented that while this section is consistent with today's ETOPS operations, the ARAC and ICAO Operations Panel recommended a more flexible plan by allowing the pilot to determine the optimum airport based on factors such as weather or facilities. These commenters believe that the pilot should be able to choose the most appropriate airport if the diversion time is only slightly different. Omni makes a similar comment. Boeing commented that it assumes the FAA will define ''*nearest* suitable airport'' in its advisory circular.

The FAA understands the commenters' concern about determining what would be the best airport for diversion. The ETOPS ARAC Working Group recommended to the FAA material that provides guidance and clarification to pilots to determine the ''suitability'' of an airport for landing. The FAA believes such material is better suited to an advisory circular. The FAA does not require any pilot to land at an airport that the pilot-in-command does not deem to be suitable. The requirement of § 121.565(a) does require landing at the ''*nearest* suitable airport''. However, a pilot-in-command may exercise his command authority to land at an airport other than the nearest suitable airport, and then file a report as required by § 121.565(d).

XII. ETOPS Authorization Criteria

The final rule creates a new Appendix P to part 121, which specifies the criteria the FAA Administrator will evaluate in approving ETOPs operations. These ETOPs authorities must be listed in the certificate holder's operations specifications. Appendix P is divided into three sections, approvals for two-engine airplanes, approvals for passenger-carrying airplanes with more than two engines, and approvals for all airplanes in Polar operations.

A. ETOPS Approvals for Part 121 Operations—Airplanes With Two Engines

The FAA proposed certain criteria for extended operations, from 60 minutes to more than 240 minutes, for two-engine airplanes. We have codified the step ETOPS approvals in AC 120–42A (75, 120, 138, 180, and 207 minutes), added a 90 minute approval for Micronesia, and have expanded the operation of two-engine airplanes to include new authorities of 240 minutes and ''greater than 240 minutes''. Like all previous approvals discussed in section I of the preamble, these new authorities are area specific and have operator experience and minimum equipment (MEL) requirements.

Additionally, we have added to the NPRM language a reference to the propulsion system reliability for ETOPS that is required by § 21.4(b)(2) and which comes from the original guidance of AC120–42A, paragraph 10(b). This guidance required that before the FAA grants ETOPS operational approval, an assessment should be made of the applicant's ability to achieve and maintain the demonstrated level of propulsion system reliability of the world fleet. This determination can be based on service experience, ETOPS process validation or a combination of both and will be addressed in advisory material. This language is now codified in the final rule in part 121, Appendix P, section I, paragraph (a).

IATA and United correctly noted that allowing 138-minute ETOPS to be applied in any geographical location adds flexibility. The 138-minute diversion authority is no longer restricted to the North Atlantic area of operation. The operator may request the use of 138-minute ETOPS in geographical areas that have sufficient adequate airports that could, for the given flight, be used as ETOPs alternate airports within 138-minutes diversion distance.

United commented that the proposal to add all of the 207-minute ETOPS requirements on all operations beyond 180 minutes may be too restrictive to some operators. United also contended that the 207-minute ETOPS should be allowed in all areas where the operator is authorized to conduct 240-minute ETOPS. This should apply to the polar region and South Pacific.

The development of the 207-minute ETOPS authority was in response to a request from United and others and was a joint effort between the FAA, ATA and several U.S. carriers. Its goal was to develop methodologies to extend ETOPS beyond 180 minutes while maintaining the level of safety in the operation. The FAA does not agree with the expansion of 207-minute ETOPS as suggested. The 207-minute diversion authority was developed to deal with a particular problem in the NOPAC. The FAA approved the use of a 207-minute ETOPS in NOPAC based on safety benefits for the flight. Airlines could dispatch the flight on a preferred air traffic route that actually placed the flight in closer proximity to a greater number of adequate airports located in northern Russia and the Aleutians even though the flight was up to 207 minutes from its declared ETOPS alternate airport at its farthest point. This type of dispatch is limited to only those flights where the normal 180-minute dispatch will not work. Since this safety argument was only applied to NOPAC, it would not be appropriate to have the 207-minute NOPAC authority apply to other areas that have different conditions. More importantly, for the case of 207-minute ETOPS, the airplane-engine combination need only be ETOPS type design approved for 180-minutes. For other two-engine ETOPS approvals for beyond 180-minutes, the airplane-engine combination needs to have a world fleet IFSD rate of 0.01 per 1,000 engine hours, and also be ETOPS type design approved for a minimum of 240 minutes.

Both United and Continental commented that in the absence of a rule expanding the 207-minute authority, the FAA should expand the 240-minute ETOPS areas of approval. Further, United requested that this extension apply to areas of the South and Central Pacific as well as the North Pacific. United also commented that the area of the North Pacific should be expanded from the current proposal of 40° N latitude to those routes north of the equator between North America and Asia and between Hawaii and Asia.

The FAA agrees with the commenters that it is necessary to clarify the areas where both the 207-minute and 240-minute ETOPS authority may be exercised. Likewise we have agreed to expand both areas of operation. The FAA has modified the 207-minute ETOPS authority to cover the ''North Pacific area of operations'', defined as Pacific Ocean areas north of 40° N latitudes including NOPAC air traffic routes, and published PACOTS (Pacific Organized Track System) tracks between Japan and North America. The FAA has modified Appendix P to allow 240-minute ETOPS for the Pacific Ocean area north of the equator.

United commented that the IFSD rate for the 240-minute ETOPS in a small fleet could cause an operator to lose ETOPS authority for 12 months with just one IFSD. However, if the 207-minute ETOPS were available in areas other than the north Pacific, it would allow operators to employ the lesser 207-minute ETOPS IFSD target rate. The FAA agrees that this is a legitimate concern for a small fleet IFSD, but the FAA will not manage ETOPS approvals only by operator IFSD rates. Many factors are considered, especially the commitment and proactive response by the operator to determine the root cause of each failure. Once the cause has been determined, planned corrective actions are taken as well as a means to ensure that the problem is fixed. There may be no safety need to change the operator's ETOPS authority provided the operator shows that it is effectively managing the problem. The FAA does not see this as a valid reason to expand the 207-minute ETOPS area of authority.

United commented further that the existence of special MEL requirements for 120, 180, and presumably 240-minute ETOPS means that additional ''must be available'' MEL requirements would be added for 240-minute ETOPS. Any amendment to the MMEL for 240-minute ETOPS will be processed through the FAA FOEB process.

Airbus stated that the proposal was not specific in the amount of prerequisite ETOPS experience required of two-engine operators applying for routes between 180 and 240 minutes. Airbus also questioned the criteria an operator must use to determine what ''extreme weather'' conditions would allow an operator to utilize 240-minute ETOPS authority in the Pacific Ocean areas north of the equator. They suggested that the choice to select more distant diversion airports be predicated on medical data-link and cargo hold monitoring capabilities on the airplane.

The rule requires that all operators requesting ETOPS approval beyond 180 minutes must have existing 180-minute ETOPS approval for the airplane-engine combination in their application. The FAA believes this is satisfactory. Rather than requiring a minimum experience level and allowing for reductions based on compensating factors similar to past guidance, the FAA believes that the language is satisfactory to limit any accelerated approval process to an initial authority beyond 180 minutes while still leaving the approval decision to the particular merits of the operator's application. The FAA believes that the discussion of what constitutes acceptable criteria to extend diversion times to 240 minutes can be discussed within the context of advisory language. As stated in the rule language, the definition of extreme weather ''must be established by the certificate holder and accepted by the FAA.''

Qantas found the limits in Appendix P arbitrary and not based on any scientific method. They posited that the historical and safety analysis would show that 120-minute ETOPS should be the starting point for two-engine airplanes and that the smaller step approvals for modern airplanes (60-, 75-, and 90-minute) are inappropriate and should be withdrawn. There should also be grandfathering rights for operators who have flown ETOPS routes for decades, requiring no additional approval processes.

Qantas has not provided sufficient data to support its premise. Past progress and successes achieved in ETOPS have been due to the deliberate and limited step process of extending diversion lengths in response to improvements in type design and the needs of the operational environment. The FAA believes maintaining current ETOPS authorities adds flexibility for an operator to choose ETOPS approvals that match their specific needs. Changing the threshold for two-engine ETOPS was not part of the ARAC tasking and is beyond the scope of this rulemaking. The success of past ETOPS shows the importance of the operator's continued airworthiness maintenance program that is a requirement for all ETOPS authority levels. We therefore do not accept the recommendation that the ETOPS threshold for two-engine airplanes should start at 120 minutes. It is not necessary to address grandfathering since there is no language in the NPRM or this rule that requires new ETOPS approvals for airplanes or operators to continue flying routes for which they already have ETOPS approval. As stated earlier in this preamble we have added a new § 121.162 which clarifies the ability of current ETOPS qualified operators to continue operating their ETOPS routes without a new approval process.

B. ETOPS Approvals for Part 121 Operations—Passenger-Carrying Airplanes With More Than Two Engines

The FAA proposed certain criteria for extended operations for airplanes with more than two engines. These criteria include certification requirements for the airplane-engine combination, requirements for en-route flight planning to ETOPS alternate airports based on system limitations, an ETOPS maintenance program and certain system and MEL requirements.

FedEx, IATA, and KLM noted that adding three- and four-engine airplanes to ETOPS will add maintenance and other training requirements for these airplanes. The FAA agrees in part to the comment regarding possible additional training for employees. The FAA strongly believes that all operators would benefit from an ETOPS maintenance program. However, the FAA agrees with many of the commenters that the cost of implementing this new requirement for airplanes with more than two engines would be significant. The FAA has determined that this cost cannot be justified based on the current level of safety achieved by the combination of engine reliability and the engine redundancy of this fleet of airplanes. Therefore, the requirement for an ETOPS maintenance program for airplanes with more than two engines in ETOPS has been withdrawn. The remaining costs have been calculated and are presented in the final regulatory evaluation for today's rule. If the operator is an existing two-engine ETOPS operator, the training burden should be minimal. If the operator is a new ETOPS operator, the burden will be more substantial but is necessary to ensure safe operation. The individual operators, with concurrence from the FAA principal inspectors, will determine what, if any, additional training employees will require. It will be up to each individual operator to develop a training program that suits its operation.

JAA commented the FAA should introduce a compliance time for operators of three- and four-engine airplanes to meet the requirements of this section that will not disrupt operations. This commenter also requested the FAA add a paragraph to this section that addresses greater than 240-minute operations as it did for the two-engine airplane. The FAA agrees that a compliance period is justified for those operators with airplanes with more than two engines conducting ETOPS. We are adopting a compliance period of 1 year following publication of today's rule. There is no need to address those operations beyond 240 minutes in section II in the same manner as for two-engine ETOPS in section I because the rule does not require the operator to do anything more than designate the nearest available ETOPS alternate airport on the planned route of flight. However the rule language has been modified to drop the reference to a specific 240-minute approval since this might cause confusion.

Qantas opined this is a commercially-based rule and has no safety relevance for more than two-engine airplanes that have been operating safely for years. They stated that the rule would all but stop flights between Australia and the U.S., Australia and South America, and Australia and Africa. Qantas stated that restrictions based on a time limit from an alternate airport is arbitrary and that the rule should be based on reliability requirements. They noted that the NPRM does not address the major cause of diversions—passenger requirements. Qantas posited that paramedics may be required on flights in the future, and this would have a greater impact than any flight time limit to a diversion airport. Qantas also noted there has never been an on-board fire, yet the NPRM would require cargo compartment fire protection while ignoring passenger compartment fires.

The FAA does not accept the assertion that this rule is commercially based or has no safety basis for ETOPS operational application for airplanes with more than two engines. These same requirements have been in place for two-engine engine ETOPS for many years and the commenter has not shown justification for limiting its use to two-engines. The FAA reiterates its position that the risk analysis shows that three- and four-engine operations are similar enough to demand certain, common application of the rules. Throughout this rule the FAA has based its reasoning on the safety risk associated with long range flying over remote and hazardous areas that are far from adequate airports. We agree that some of those areas mentioned by the commenter would be subject to these new ETOPS rules under certain conditions. It will be the operator's choice to accept the rule requirements or reroute to avoid their application. The FAA believes that no rule could ever address all issues that would cause a diversion. However, the examples given by the commenter are further justification for this rule and the need to protect those listed diversions when they occur.

C. ETOPS Approvals for Part 135 Operations

The rule incorporates a new § 135.364 which stated that no certificate holder may operate an airplane other than an all-cargo airplane with more than two engines on a planned route that exceeds 180 minutes flying time (at the one-engine inoperative cruise speed under standard conditions in still air) from an adequate airport outside the continental United States unless the operation is approved by the FAA in accordance with Appendix G of this part, Extended Operations (ETOPS). The FAA has revised the part 135 rule to be consistent with part 121 operations to exclude all-cargo operations on airplanes with more than two engines from the ETOPS requirements and has limited the ETOPS maintenance program requirements to two-engine ETOPS airplanes. Appendix G defines ETOPS requirements for such things as operator experience, airplane certification, operational procedures and training of personnel. New language has been added to § 135.411 that requires two-engine airplanes used in ETOPS to conform to the additional maintenance requirements of the same Appendix G.

Airbus commented that currently part 135 operators do not need approval for ETOPS flights since the current ETOPS operations are deviations from § 121.166. There is no FAA guidance for, and FAA inspectors have not approved, any part 135 ETOPS flights. Dassault echoed this observation, stating that the cost assumptions in the draft regulatory evaluation were accordingly incorrect. Airbus noted, however, that there may currently be long-range business jets that fly from the West Coast of the U.S. to Australia. NBAA commented that the primary cost for operations with airplanes that meet the ETOPS requirements will be maintenance-related.

The FAA acknowledges that this rule imposes new requirements on part 135 operations. However, along with ARAC, the FAA has determined that part 135 operations in remote areas pose the same risk to crew and passengers as part 121 operations. Recognizing that many part 135 operations are not frequently recurring, as is the case with part 121 scheduled service operations, the rule imposes fewer restrictions on part 135 ETOPS than on part 121 ETOPS. The FAA agrees that a major cost of implementing an ETOPS program is the cost to develop and apply an ETOPS maintenance program. The FAA has determined that based on the probability of critical loss of thrust for two-engine airplanes the cost of an ETOPS maintenance program is justified. However, because of the combination of current engine reliability and engine redundancy, the FAA has decided against adopting an ETOPS maintenance requirement for airplanes with more than two engines.

The Final Regulatory Evaluation assesses the cost of the rule for part 135 operators as new costs since no ETOPS restrictions have been imposed on these operators until now.

135.364 Maximum distance from an airport.

The FAA proposed that no part 135 operation could be conducted outside the continental U.S. unless the planned route remains within 180 minutes flying time from an airport meeting the ETOPS requirements of §§ 135.385, 135.387, 135.393 or 135.395 (as applicable), and

§§ 135.219 or 135.221 (as applicable). In response to many commenters concerns with the cost justification of the proposal, the FAA has withdrawn this requirement for all-cargo operations in airplanes with more than two engines.

Netjets requests that the rule be revised to require that at no time will the airplane be operated in such as manner that it cannot reach a suitable airport from the Equal Time Point [27] of the planned route. The FAA notes that equal time points are based on an engine failure only. Accordingly, it is inappropriate to consider that engine failure or a loss of pressurization can only occur separately in determining necessary fuel reserves. The regulatory standard required by the ICAO Annex 6 is for a threshold to be established by the State that clearly defines when ETOPS requirements and standards take effect for all two-engine airplanes. Section 135.364 establishes that threshold and is consistent with many years of FAA/JAA deliberation that involved the U.S. industry on this matter. The wording is such that consideration by users is not necessary until flights are planned that are outside of the continental United States.

Part 135, Appendix G, Certificate holder experience prior to conducting ETOPS.

The FAA proposed 12 months of international operating experience in transport category turbine engine powered airplanes (excluding Canada and Mexico, but including Hawaii), 6 months of which could be domestic (if conducted before the effective date of the rule); or ETOPS experience in other aircraft as approved by the Administrator.

NetJets commented that these requirements do not recognize the exemplary safety record of part 135 operators currently conducting ETOPS operations and that full credit should be given to current operations. NATA disagreed with the exclusion of Canada and Mexico, noting that flights over these countries could include remote areas.

Netjets stated it can reach the same objective of having the full 12-month credit apply to all its ''ETOPS'' type flights because of the delayed effective date of this rule. The FAA will not require compliance with part 135 ETOPS until 1 year following the publication of the rule, allowing for more operating experience that will be creditable. In response to NATA, the intent of the rule is to ensure a carrier's ability to deal not only with routes over remote areas, but also routes in dissimilar, international airspace. If ETOPS requirements were to apply to such routes in these countries, then current flights to those countries would also satisfy the experience requirement.

Part 135 Appendix G.—Airplane requirements.

In the NPRM, the FAA proposed that any airplane added to an operator's operations specifications 8 years after the effective date of the final rule must meet the certification standards of § 25.1535. The NPRM proposed that those aircraft added on or before 8 years must only meet certain electrical and fuel redundancies.

Gulfstream commented the FAA should change the 8-year compliance date to 10 years or make the certification applicable to airplanes certificated 5 years after the effective date of the rule. In a related comment, NBAA commented that there is no safety justification for this requirement. This commenter found that the rule does not recognize the actual useful life of turbine-powered business airplanes. The association posited that continuing ETOPS operations beyond 8 years should be based on operator experience and its safety record.

The FAA partially agrees with the commenter about the useful life of these airplane types. Thus, we have changed the basis for grandfathering current part 135 airplanes. The criterion is now based on a ''manufactured date'' rather than the time an airplane is placed on a certificate holder's operations specifications.

Airbus commented that the NPRM discussion falsely stated that current 135 operations are restricted from those operations proposed to be regulated by this rule. NetJets and Actus Aviation stated that the rule will restrict the current mainland to Hawaii operations of certain types of their aircraft.

The FAA agrees that the NPRM was incorrect in assuming that part 135 operations defined as ETOPS in this rule were previously restricted. The FAA has corrected that assumption in the analysis of this final rule and agrees with the commenter and others that this rule will impose costs on those operators who chose to operate in ETOPS.

The question of whether or not operations between the mainland U.S. and Hawaii are defined as ETOPS for part 135 operators is dependent on the computed single engine cruise speeds for their airplanes. The FAA does not agree that the majority of those airplanes whose range and endurance legitimately qualifies them for such operations would be considered ETOPS in this case. But the FAA does agree that there is difficulty in obtaining sufficient single engine data across all fleets of airplanes to accurately account for the cost of the rule's application in this case. Without this data there is no way to calculate the costs and which operators would be affected. In consideration of this fact and because of a lack of incident data in this operation, the rule provides a grandfathering provision for all those airplanes manufactured up to eight years beyond the effective date of this rule. Further, the fuel and electric requirements for airplanes added to an operator's operation specifications between the effective date of the rule and 8 years later, contained in the NPRM, have been deleted.

Gulfstream commented that the proposed rule implies that compliance with Appendix G will be retroactive to existing operators approved for more than 180-minute ETOPS. This commenter asks the FAA provide relief in the form of an alternate means of compliance for the operator that cannot meet portions of the rule that provide no safety benefit. The rule does not impose a retroactive requirement within Appendix G for operators to conduct ETOPS. Paragraph (c)(2) of Appendix G gives consideration for the use of existing airplanes in ETOPS. The FAA fully understands that it would not be economically feasible to require any retrofit on existing airplanes to the new part 25 ETOPS requirements. This is why it is grandfathering airplanes manufactured up to 8 years after the effective date of the rule and used in part 135.

NATA questioned the intent of the rule that the operator has available, in flight, current weather and operational information for all airports. This commenter found the requirement vague and asked what equipment would be acceptable. They questioned whether the communications equipment required by new Appendix G is sufficient. The FAA has not considered requiring any additional communications equipment for the flight crews to use in-flight to update weather reports and other operational information. The communications required by paragraph (F) in Appendix G should meet all communication needs.

Both NBAA and NATA questioned the intent of the rule as it pertains to the requirements for weather analysis at the ETOPS entry point and beyond. NATA questioned what is the basis of determining whether or not an en-route alternate airport is ''above minimums.''

[27] Equi-Time Point is a point on the route of flight where the flight time, considering wind, to each of two selected airports is equal.

NATA recommended a requirement that the airport be at or above approach minima, not alternate airport minima.

NATA appeared to confuse the ETOPS dispatch requirements of an ETOPS alternate in part 121 with this rule language. Part 135 requires only that the alternate be ''at or above operating minimums''. The FAA agrees that clarification is needed for the situation where the flight has passed the ETOPS Entry Point. As with part 121 operations, once the flight has gone beyond the ETOPS Entry Point, an unexpected worsening of the weather at the designated ETOPS alternate to below operating landing minima, or any event that makes the runway at that airport unusable does not require a turn back by this regulation. It is expected that the pilot-in-command, in coordination with the dispatcher if appropriate, will exercise judgment in evaluating the situation and make a decision as to the safest course of action. This may be a turn back, or re-routing to another ETOPS alternate, or continuing on its planned routing.

Dassault disagreed with the requirement for sufficient fuel to fly to an alternate airport at cruise speed assuming a rapid decompression and a simultaneous engine failure at the most critical point. We discussed the potential for simultaneous failure of these systems earlier in this document. The purpose of the ETOPS critical fuel reserves is to protect that flight by ensuring that it will have sufficient fuel to fly to an alternate airport. Having an ETOPS alternate airport designated for use, and then not carrying sufficient fuel to make that alternate viable for a possible failure scenario is not managing known risks to the operation.

UK CAA commented on the 5% fuel factor for wind by saying that it should remain in place for events that cannot be predicted, unless the operator produces historical data to show that the extra fuel is superfluous (fuel remaining at the critical point), or the operator proves that the World Area Forecasting System is unequivocally being used in the flight plan. The FAA does not agree. The basis for the contingency fuel values in paragraph (G) of Appendix G is the service experience gained in ETOPS for almost two decades, and the vast improvement in accuracy of the World Area Forecasting System wind forecasting. For those operators that cannot show the use of a wind model acceptable to the FAA, then 5% of the total ETOPS fuel is to be added to compensate for errors in wind forecast data.

NBAA agreed with the FAA's proposal for extra fuel for anti-icing systems; however, it notes that not all of its members' airplane flight manuals have information on increased fuel burn due to anti-icing systems. This commenter opined the FAA should not require a performance factor that operators cannot figure out from the airplane flight manual. The FAA agrees that performance data for the particular airplane is necessary for operators to apply correct values when determining fuel requirements. Airplanes that have the range and technology to undertake operations of this complexity and stage length are limited and unique to the industry. The FAA is aware of significant performance history and supporting manufacturer data for most of these types. The FAA has also been assured by manufacturers and GAMA that this data will be available for those airplanes that qualify for ETOPS. The FAA will not require the application of part 135 ETOPS until 1 year following the publication of the final rule.

Part 135, Appendix G, Definitions.

The FAA proposed definitions for ETOPS and ETOPS dual maintenance. For this final rule, the definition of ETOPS Alternate Airport and ETOPS Entry Point have been added for clarification, while limitations on dual maintenance are now specified rather than defined. For part 135, any passenger-carrying operation outside the continental United States more than 180 minutes flying time (in still air at normal cruise speed with one engine inoperative) from an airport is considered ETOPS. This operation is further limited to a maximum of 240 minutes.

JAA, UK CAA, and Airbus commented that the definition of ETOPS would limit the maximum diversion time for part 135 airplanes to 240 minutes and argued that this limitation for three- and four-engine airplanes should be removed. NBAA likewise disagreed with the maximum 240-minute diversion, noting that operations that have been flown beyond the 240-minute limit would now be prohibited. They also opined that a restriction on airplanes with more than two engines is unnecessary. NBAA stated it would support some limited additional requirement, such as limitations on dual maintenance for ETOPS critical components, to allow approval beyond 240-minute operations.

The FAA continues to believe that three- and four-engine airplanes conducting ETOPS should be limited to 240-minute diversion authority. This subject was discussed extensively during the ARAC process, and the same conclusion was reached each time. The industry agreed that for operations conducted under part 135, a 240-minute diversion limit was sufficient. It was the consensus of the industry that the 240-minute diversion limit met the industry needs. Part 135 on-demand flight operations have few restrictions on the type of airport required for use. Thus, the number of airports that could be used as an ETOPS alternate airport is far greater than what is available for a part 121 ETOPS operator. For the part 135 ETOPS operator, the airport is not required to have part 139 equivalent safety standards. Likewise, part 135 on-demand operators are not required to have a minimum RFFS capability at the selected ETOPS alternate airports. Because of the different performance capabilities with small turbojet airplanes used in part 135 on-demand ETOPS, the minimum airport runway length is far less, typically around 5,000 feet. Thus there are many more airports available in all areas of the world that may be used as an ETOPS alternate airport by the part 135 ETOPS operator. As a result, the 240-minute limit will not restrict flight operations, and a diversion time exceeding 240-minutes is not supported. Although NBAA now disagrees with the 240-minute limit, this organization supported the ARAC proposal.

NATA and NBAA commented that the manufacturer, not the operator, must determine the air speeds necessary for ETOPS approval. They stated they are not aware of any publicly approved data to meet this need and that the lack of information on air speeds prevents any meaningful comment on the effect of the proposed rule on part 135 on-demand operators. Without the ability to determine a 180-minute range, no operator can comply with the proposed regulations.

The FAA agrees with the commenter that the manufacturer must develop the required data on engine-inoperative cruise speeds. The General Aviation Manufacturers Association (GAMA) organization has assured the FAA that the manufacturers will have this data available to operators before this rule is effective. The FAA is committed to provide the necessary time for part 135 operators to evaluate the applicability of the rule to their operation, and to make any necessary ETOPS program and associated training program changes. This time will also be available to manufacturers to develop and publish the necessary performance data. The FAA has adjusted the effective date of the part 135 rule for the operational requirements to be 1 year from the effective date. Likewise, the FAA has expanded the grandfathering criteria of the NPRM to provide a uniform application between parts 121 and 135. Those airplanes manufactured up to 8 years after the effective date of this rule do not have to comply with the airworthiness requirements of this rule.

NATA requested the regulation specifically state how the 180-minute distance is calculated once ETOPS speeds are available. For example, the preamble stated the ETOPS threshold is based on ''a single-engine inoperative speed in still air and standard conditions''; Appendix G fails to state the standard conditions and only ''still air'' is indicated.

Calculations made to determine the distance represented by 180 minutes should use standard conditions and still air. Section 135.364 has been changed to reflect this requirement. In calculating the distance flown at the selected one-engine inoperative cruise speed, the operator may select a speed provided by the manufacturer that best suits the area of operation being flown. A slower speed will result in a higher engine-inoperative service ceiling, but in less distance flown. A slower speed may be required when terrain clearance is an issue. Conversely, the selection of the fastest speed will result in a further distance flown, but at a much lower engine-inoperative ceiling. The selection of a higher speed will also result in a higher fuel burn, and that fuel burn rate for the planned one-engine inoperative speed must be used in the ETOPS critical fuel calculation. This calculation can result in a larger critical fuel reserve requirement for the flight, and that may impact the useable payload for that flight. Since the operator is in the best position to know what factors to consider on a particular flight, the FAA has provided operators with the flexibility to make those determinations.

D. Airplane Approvals in the North Polar and South Polar Areas

1. Part 121 Operations

The current FAA Polar Policy letter guidance, discussed earlier in this document, is codified in this section and is expanded to include the South Pole.

Qantas and IATA commented that Polar operations are unique and therefore, requirements for operations in this area should be addressed in a separate rule. While the polar requirements could be addressed in another rule, they were proposed in the NPRM and the FAA does not believe there is any reason to further delay their adoption. Operations in these areas are necessarily conducted over parts of the globe subject to hazardous conditions and have many of the same characteristics as areas of the world containing routes that are greater than 180 minutes from adequate airports. The current polar guidance codified in this rule contains requirements specific to these areas, including some ETOPS-like requirements such as passenger recovery plans and diversion planning.

The South Polar area by this rule is defined in this rule as the area South of 60° S latitude. The FAA is aware that there is not a great amount of industry experience conducting flight operations in this area of the world. However the forecast for traffic growth prepared by both major airplane manufacturers indicate that the South Polar area, like the North Pole, will become a major region for commercial air transportation as direct routes over the polar cap to, from, and between South America, Australia, New Zealand, and South Africa are established. The rules that will apply to the South Polar area provide a proven safety process for these future operations.

Several commenters, including JAA, NACA, and Airbus, noted that meeting the ETOPS planning, equipage, and operational requirements for polar areas may not be practical, and may give some operators an economic advantage. FedEx found while the dispatch requirements may be reasonable, other ETOPS requirements, such as maintenance and reporting, should not be an issue for three- and four-engine airplanes operating in the Polar region today.

The Polar policy letter already requires planning, equipage and operational requirements similar to ETOPS in these areas and the rule codifies such practices in this section III. To the extent some operators may face greater costs than others, the FAA has made certain changes to the NPRM necessary to address the economic burden on those operators. Specifically, for the polar areas where flight operations can be conducted at less than 180 minutes, Appendix P, section II has been changed to eliminate ETOPS requirements from polar route approval. If the operator flight plans the route in a manner that would classify the operations as ETOPS under other circumstances, the operator must meet both the ETOPS requirements and the polar requirements established by this rule.

FedEx commented that the NPRM would require any aircraft operating north of 78° N latitude to comply with these requirements, yet it has operations specifications that already address operations in Polar areas. FedEx believes that the NPRM addresses passenger-carrying aircraft and that these issues have already been addressed for all-cargo operations.

The commenter's reference to current operations specifications represents the current FAA Polar Policy codified in this rule. Because the FAA intends all operations in the polar areas to be governed by the agency's polar policy, we believe it is more appropriate to regulate these operations through a rule of general applicability rather than by operations specifications. The Polar policy outlined in Appendix P, Section III of this rule apply to all air carrier operations in these areas including all-cargo operations.

JAA fully supported the concern of the FAA concerning the use of airports in severe weather conditions, but found that the proposed rule does not achieve its intended purpose in that it does not account for the variability of airports in Polar regions. Some airports may present an unacceptable level of risk, regardless of the season, and others are safe during the summer, but not otherwise. While the JAA takes into account safety precautions (based on seasonal, wind and temperature factors) for specific airports, the NPRM does not take such factors into account.

The FAA does not agree with the conclusion reached by the JAA that today's rule fails to meet the intended purpose of applying safety precautions to those airports designated for use as alternates that are in severe climate areas. The FAA fully understands the JAA/European approach to designated airports located in severe climate areas, i.e., operators need only consider specified alternate airports already deemed adequate by the JAA. We believe the FAA rule is sufficiently robust, and ultimately places the responsibility with the operator as to the required amount of detail and preparation necessary for passenger protection and recovery. The operator also has the flexibility to modify the procedures if seasonal variations for that airport exist. The JAA draft proposal as currently written does not require any preparation for those airports used as ETOPS alternate airports that are not determined to be severe climate airports. We believe that this system might encourage some operators to avoid those ''designated severe climate airports'' to avoid the need for a passenger recovery plan, even when the use of that airport may be the most appropriate action for the given problem encountered.

2. Part 135 Operations

This rule likewise codifies the current FAA Polar Policy letter guidance for part 135 operations in § 135.98. This section covers only the North Polar area and although the operation is not considered ETOPS, certificate holders must follow these standards whenever a route is flown and a portion of the route traverses this area. The FAA proposed that, except for intrastate operations within the State of Alaska, any operations in the region north of 78° N latitude, designated as Polar, must be authorized by the Administrator and have certain items addressed in the operator's operation specifications. Included in these items were identification of alternate airports, recovery plans, specific communication systems, changes to the operator's MEL including the requirement for special equipment and consideration of solar flare activity.

Dassault commented that the proposal implies that an operator may not enter the Polar area unless the weather and operating conditions of the required alternate airports are reviewed and are expected to be above minimums specified in the operations specifications. It recommended the FAA specify the type of weather in the weather information requirement. Dassault also commented the FAA should consider a reduced recovery plan for airplanes with a maximum seating capacity of 19 or fewer passengers. Dassault goes on to say the FAA should allow a 1-year compliance period for setting up an MEL that takes Polar operations into account which becomes effective one year after, and apply only to those airplanes that were added to the operator's operations specifications, 8 years after the effective date of the rule. Dassault noted the proposal would require considerations during solar flare activity and recommends the FAA allow a predictive method for evaluation of radiation, since measuring equipment is not yet available on the market. Finally, Dassault recommended the requirement for Polar equipment only apply to the crewmembers, and the FAA should specify the contents of the Polar kit.

The FAA does not agree that the rule need be so detailed that it specifies the weather information required. In general it is understood that the weather reports should provide the present weather conditions including surface winds, any adverse trends, and the updated weather forecast for the expected time of use, if available. In addition, field condition reports should be obtained. The pilot will need to evaluate this information to determine that the weather minimums required for the instrument approach can be met.

The FAA agrees that the recovery plan for a part 135 passenger-carrying operator will require far less complexity than a plan for a similar part 121 operator because of the limited number of passengers. However, it does not agree that a further reduced plan is appropriate if the maximum seating capacity is less than 20. Currently, part 135 applies to certain passenger-carrying airplanes with a maximum seating capacity of 30 or less. Should the FAA change the current restriction on seating capacity in part 135 operations, it may consider permitting a tailored passenger recovery plan based on the seating capacity of a particular airplane.

In response to Dessault's comment, the FAA has determined that a 1-year compliance period is acceptable for development of an MMEL and MEL. As discussed earlier, the certification requirements of this rule apply specifically to those aircraft manufactured 8 years after publication of today's rule. The FAA is not requiring operators to equip their airplanes with radiation measuring equipment. There is advisory material already available to set up a predictive system for measuring solar flare activity. AC 120–52, Radiation Exposure of Air Carrier Crewmembers, and AC 120–61, Crewmember Training on In-Flight Radiation Exposure, are excellent resources for the operator to consult in developing a system and any necessary training. Likewise, today's rule does not require a part 135 operator to keep any ''polar kits'' on board the airplane. Rather, cold weather anti-exposure suits are for use by the crewmembers. No provision is made for passengers, although operators may choose to provide such suits should they transport passengers through the polar regions.

XIII. Comments on the Costs and Benefits of the Proposed Rule

Many commenters noted that current part 121 and part 135 regulations do not prohibit operations beyond 180 minutes and that the initial regulatory assessment was wrong. The FAA acknowledges the error and the final regulatory evaluation does not attribute any cost savings to more efficient routings. The following is a summary of the proposed provisions that would entail costs and an analysis of the comments concerning economic impacts from the NPRM.

In response to the certifications requirements of the proposed rule, Airbus and other commenters stated the proposed rule might be understood to require manufacturers of current generation ETOPS aircraft to apply retroactively for type design approval under this section and appendix K, which would impose very high costs. Airbus estimated costs for manufacturers at $500,000 per aircraft family to perform an assessment of all time-limited systems in normal and degraded system configurations, with a full numerical system safety assessment of all aircraft systems in the order of $1 million per aircraft family. Any design change found necessary as a result of these assessments would increase this cost.

The FAA has recognized that existing aircraft designs may have difficulty complying with the new part 25 requirements and has added § 25.3. Airplanes with existing type certificates at the time this rule becomes effective are exempted from some or all of the new part 25 requirements. Therefore the FAA does not find that these system-wide costs will be incurred.

Airbus and Dassault commented that the icing requirements in the proposal go beyond the current requirement and would require analytical and flight test assessment. Airbus stated that manufacturers would incur costs in the order of $1.5 million per aircraft family to complete an analysis and a flight demonstration of icing on unprotected areas of the airplane in order to comply with this provision.

The FAA agrees that this requirement may add additional analysis to the certification of a new airplane to meet the requirements of the rule. However, evaluating ice accumulation on an airplane in icing conditions is required for a new part 25 airplane regardless of whether it's ETOPS certified. The effect of the ETOPS rule will be to add another criterion for determining the size of the ice shapes simulated during certification testing. The ETOPS environment will not necessarily be the most critical condition for the maximum ice accumulation. An applicant will determine the maximum ice accretion on an airplane during an ETOPS diversion and compare that to the maximum accretion from other icing conditions used for basic part 25 compliance. The additional costs associated with flight testing an airplane for ETOPS icing will be minor since an applicant will likely only test the most critical ice accretion from all these conditions as is done for basic part 25 certification.

UPS stated that the installation of a low fuel alerting system ''would require extensive modifications to three- and four-engine aircraft to add flight management computers that will allow the system to provide the required flight deck alerts * * *'' but did not provide any cost information. Airbus stated that the design and certification costs would be in the order of $2.5 million per aircraft family not yet fitted with any of the prescribed alerts and up to $1 million per aircraft family partly compliant. The FAA estimates the cost of a full retrofit will be $200,000 per aircraft; the cost of a partial retrofit will be up to $110,000 per aircraft.

Dassault recommended allowing alternate solutions to the fuel alert display.

The FAA recognizes that some existing airplanes may have difficulty in complying with this requirement without substantial airplane system modifications. Older three-crew airplanes, in particular, have a flight engineer who monitors fuel quantity throughout a long flight and the FAA considers this additional crewmember to be an acceptable alternative to the automatic low fuel alerting for those airplanes. As such, the requirement for a low fuel alerting system does not apply to three- and four-engine airplanes with a required flight engineer, or to three- and four-engine airplanes with existing type certificates manufactured up to eight years after the effective date of this rule. This rule will also not apply to two-engine airplanes with existing type certificates being approved for ETOPS up to 180-minutes. However, all newly type-certificated airplanes, and two-engine airplanes being approved for ETOPS greater than 180 minutes must comply. The FAA will continue to use its estimate of $2.25 million that substantially agrees with Airbus' estimate.

Air New Zealand, Dassault, JAA, New World Jet, Northwest, and United made comments on various technical aspects of the APU requirements. KLM commented that the NPRM is unclear if existing three- and four-engine aircraft on long range routes must have an APU In-flight Start Capability, noting that MD11s have an APU in-flight start capability below and up to flight level (FL) 250 and all 747–400s APUs do not have an in-flight start capability at all. This requirement will have a large cost impact that is not addressed in the NPRM. FedEx made a similar statement. UPS noted that APUs are not currently installed on its DC8 fleet, and it is unclear whether this proposal would require installation for ETOPS. ATA noted those efforts would include design or adaptation of an APU, development of new interface equipment, and extensive ground and flight testing. The effort also would include potentially extensive aircraft structural modifications to accommodate the APU installation.

The FAA has amended the final rule language to make it clear that an APU in-flight start and run program is only required if APU in-flight start and run capability is required by the type certificate for ETOPS. ETOPS requires that the airplane must be equipped with at least three independent sources of electrical power. For airplanes that must use the availability of the APU to satisfy this requirement, an APU in-flight start and run program is required. Since current models of the 747–400 satisfy this certification requirement without the APU, no such program is required. The rule is written to take into account possible future airplane designs or existing airplane modifications which would make this requirement applicable. The cost of designing an APU program for a new model is minimal. The final economic evaluation does not include any costs related to the APU requirement.

Boeing proposed changing the requirements to obtain certification for a two-engine airplane for ETOPS to state that a flight test must be conducted to validate the adequacy of the airplane's flying qualities, performance and the flight crew's ability to safely conduct an ETOPS diversion with an engine inoperative and under non-normal worst case ETOPS significant system failure conditions. The FAA agrees that the intent of the flight testing is to evaluate ETOPS significant systems. We have included the cost of this testing.

In response to Boeing, the Air Line Pilots Association, International (IALPA), and the BALPA comment on the post-airplane demonstration inspection requirement, the FAA has changed the first sentence of paragraph K25.2.2(g)(4) to require that the ETOPS significant systems must undergo on-wing inspections in accordance with the tasks defined in the Instructions for Continued Airworthiness required by § 25.1529 to establish the ETOPS significant system condition for continued safe operation. The engines must also undergo a gas path inspection. These inspections must identify 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 (l) of section K25.2. The costs of these assessments are contained in the final rule.

The FAA's preliminary economic assessment for additional voice communication equipment for all ETOPS operations beyond 180 minutes estimated the installed cost per unit at $223,000 or $209,000, discounted. The operating costs per unit include weight-related fuel consumption, a fixed monthly fee, and a variable usage charge. The FAA estimated that revenues derived from passenger use of the SATCOM capabilities or improved maintenance procedures made possible by the new system would offset the variable usage fee. The annual operating costs per unit were estimated at approximately $2,500 ($2,000 fixed fee + $500 fuel cost). Atlas Air estimated that the first-year cost of installing and maintaining SATCOM would be roughly $225,000 per aircraft. FedEx estimated the unit cost of installing SATCOM and alternate communication capabilities at $263,035 and annual costs of $3,035. ATA surveyed members and reported an average one-time charge of $329,892. (A key assumption in ATA's estimate is an anticipated need to install a dual HF/DL communication system in addition to the SATCOM at an additional cost of $105,000 per unit.) ATA members did not take issue with the FAA's estimate of annual recurring charges. Airbus stated, depending on the SATCOM system, charges-per-minute may be incurred which may also include air traffic system use. FedEx, and IATA requested that three- or four-engine operators not meeting the requirement be permitted to continue ETOPS for a period not to exceed 6 years from the rule's effective date. Commenters also said that SATCOM was ineffective in Polar areas.

The FAA does not agree that a dual HF/DL system will need to be installed under the requirements of this rule. Adjusting FedEx's estimate by the $105,000 it included in its estimate reduces its estimate to $158,035, significantly below the FAA's estimate. The same adjustment to the ATA cost estimate results in a cost of $224,892, also below the FAA estimate. These lower estimates reflect lower initial equipment costs. The higher fuel costs cited by FedEx result in an additional cost of fuel of approximately $160 per year. The FAA also does not agree with Airbus' assertion that the variable use costs were not addressed; the FAA believes these costs will be offset as noted above. The FAA, in order to be conservative, will retain its higher initial cost estimate and we have substituted fuel price projections provided by the Office of Management and Budget, which are higher than FedEx's estimate.

As discussed earlier, the FAA does not agree to the 6-year phase-in period requested for the communications equipment; we allow a 12-month installation period for three- and four-engine airplanes used for ETOPS.

The FAA agrees that for the polar areas, three- and four-engine passenger carrying operators do not have to meet the ETOPS requirements provided the flight operations are planned not to exceed 180-minutes to an ETOPS alternate airport. The FAA has amended Appendix P to clarify this fact. As stated earlier, all-cargo operations using airplanes with more than two engines never have to comply with ETOPS requirements.

The FAA did not assign any cost to the fire fighting requirements proposed in the NPRM. Omni International stated the additional costs to upgrade the capabilities of an aerodrome, including the cost of training additional personnel, are not one that a municipality or State will entertain willingly on the off chance that an aircraft might divert there. It is entirely conceivable that carriers like Omni will be compelled to bear these costs either through consortia established to protect the integrity of an ETOPS route, or through radical increases in user's fees like navigation charges.

The FAA has amended § 121.106 to be in-line with the RFFS requirements established for the 207-minute ETOPS policy. For ETOPS beyond 180-minutes, the minimum acceptable RFFS for ETOPS alternates remains at ICAO category 4 as long as the aircraft remains within the authorized diversion time (for that flight) to an adequate airport that has a ICAO category 7 RFFS capability or higher. Since operators currently do not fund RFFS operations and the agency cannot speculate on future conditions, the FAA does not find a cost to be associated with this change.

A commenter stated that the public protection requirements of the NPRM demand data regarding the provision of public protection including facilities to a detail that is not available in all parts of the world but are obviously required to complete the proposed aerodrome specific passenger recovery plans.

The FAA clarifies that additional data may be required to complete the passenger recovery plan. However, the airline is responsible to obtain the data under the existing regulation, even if that requires visiting some airports. Furthermore, it is expected that more than one carrier will serve such routes and the data will be shared and readily available.

The rule will require certificate holders with passenger operations beyond 180 minutes from an ETOPS alternate airport or operating in a polar area to prepare passenger recovery plans that are robust enough to handle a diversion. The FAA estimated that the initial development of a plan would cost $7,500 and $3,000 annually to maintain the robustness of each plan. In a discussion of the benefits, the FAA sought information on the costs of diversions and provided a hypothetical ''worse case'' scenario of recovery costs as high as $1 million. FedEx, IATA, and KLM stated that in some cases this would require a spare aircraft and/or crew with all related costs. American Trans Air stated that this requirement would require the addition of full time employees at significant costs. It also requested an 18-month phase-in period. The ATA stated that, based on the ''worse case'' scenario, costs and the number of projected diversions of three- and four-engine airplanes would result in costs of $2.05 million. The Association also stated that 73 percent of ETOPS-candidate three- and four-engine airplanes of ATA members are all-cargo operators.

The FAA requested information on the number and cost of diversions. While the possibility exists that a spare aircraft may be needed, the history of mechanically related diversions indicates that this will be a rare event and the need for a spare aircraft even rarer. The commenters provided no cost information so the FAA cannot consider this issue. The FAA does not agree with American Trans Air's assertion for the need to add full-time employees because of this provision. The estimated hours necessary to set-up and maintain recovery plans do not warrant full-time employees and it should be noted that expert contract employees can be retained to develop and respond to this requirement. The FAA acknowledges ATA's estimate of all-cargo operations and has removed the passenger recovery plan requirement for such operations.

The FAA however does not oppose that the air carrier passenger recovery plan being a part of the air carrier's emergency response plan. The FAA cannot use the ''worst case'' cost offered by the ATA since it is unsubstantiated.

The FAA requested comments and supporting data on the impact of the requirement that all MEL items, the Fuel Quantity Indicating System, and the communication system must be operational. American Trans Air stated that the proposed regulation would restrict and/or remove its L1011 aircraft from North Polar Operations. Airbus commented that the cost for operators to modify two-engine aircraft and long-range three- and four-engine aircraft procedures, documentation, training and the software applications that they use in fuel planning, flight planning, and other related activities has not been taken into account in the Economic Impact Assessment. The lead-time for the companies that supply computerized flight-plan and map plotting systems to release new versions of their applications compliant with the new rules is 12 months after the publications date of the rule. The cost of the updating the necessary software applications ranges from $7,000 to $15,000 depending on the application and supplier. The overall cost of documentary modifications and re-issuing of documents and manuals is estimated to $200,000 for an operator with one ETOPS aircraft. The lead-time is in the order of 6 months. Fuel reserve training is estimated at $200,000 and passenger recovery training is estimated at $100,000 for a fleet of six aircraft. In addition, three- and four-engine aircraft operators would have to undergo a full process of operational assessment and approval including an assessment of their service experience and reliability record. This assessment is comparable to an ETOPS assessment for a first approval under current ETOPS criteria and requires 6 months notice with FAA. The overall cost of the approval process is estimated to cost $500,000 per applicant based on data from former ETOPS assessments. Three- and four-engine aircraft operators would have to train their flight crew, dispatchers, maintenance personnel and cabin crew to the entire extent of the operation and maintenance rules instead of just to the modified elements. The overall cost for a fleet of six four-engine aircraft of one type is estimated at $2.5 million.

The FAA is allowing delayed compliance to minimize the costs to operators. The commenter does not explain the basis for its estimated costs. Existing regulations in section 121 already require operators of airplanes with more than two engines to take into consideration adequate airports along the route in the event of one or two engines becoming inoperative. The new requirement for ETOPS en-route alternate airports does not constitute a big impact; the final regulatory evaluation includes a per flight charge to account for this task. Existing regulations require fuel reserves. The commenter has not shown how the incremental cost of the new passenger recovery training requirements will be $100,000. However, the FAA has included the cost of four hours of initial ETOPS training for pilots and dispatchers in the final rule in addition to passenger recovery training for pilots, dispatchers, and flight attendants where applicable. If the operator intends to only fly the North or South Pole at or below 180 minutes, there are no additional ETOPS requirements. Operators currently serving the North

Pole must meet current polar policy guidance and its operational requirements such as having a recovery plan, listing en-route alternate airports, and having effective communication capability for all portions of the flight route. For operators desiring to operate ETOPS in any other geographical area subject to ETOPS, an ETOPS application process will need to be completed. The commenter did not explain what they mean by data from former ETOPS assessments and has not provided detail to support this cost estimate.

The FAA believes it is reasonable to assume that an operator will make a decision that minimizes costs and creates the most efficient operations. Experience with other rules in part 121 provide evidence that operators do not train every flight crewmember and every maintenance person on every new rule. However, we cannot determine that only four airplanes and five mechanics per airplane used in the initial economic assessment accurately reflect the most efficient operation. Therefore, in order not to underestimate the costs of the final rule, we assume that the operator will have to train a full crew and ground personnel and equip all or most airplanes for ETOPS.

FedEx and IATA recommended that ETOPS regulations not be applied to airplanes with more than two engines. The FAA does not agree completely with the commenter that ETOPS should not be applied to airplanes with more than two engines. The basic concept of ETOPS is to preclude the diversion and, if a diversion is required, to protect that diversion. We do however agree that for airplanes with more than two engines, passenger carrying operations may be excluded from the ETOPS maintenance program requirements and that all-cargo operations may be excluded from all ETOPS requirements.

The concept of precluding and protecting the diversion has equal validity among all passenger-carrying airplanes, regardless of the number of engines. In addition, the increased frequency of operations on routes that are distant from en-route airports and the recent opening of routes over the Canadian and Russian far North bring additional challenges that affect the operations of all airplanes, regardless of the number of engines. Even though these passenger-carrying airplanes with more than two engines have operated safely and successfully on long range routes in all areas of the world for many decades, it is reasonable to expect airplanes with more than two engines to designate the nearest alternate airport, and be flight planned at 240-minute diversion authority, if possible. The application of such ETOPS concepts as recovery plans; designating the nearest alternate airport, and pre-flight planning to operators of airplanes with two-or-more engines will enhance the safety of their operations and benefit the industry.

Section 121.374 sets forth the ETOPS maintenance elements: CMP; CAMP; monitoring of propulsion system, engine condition, and oil consumption; APU in-flight start program; maintenance training; and procedural changes approval. While many of these elements are a normal part of an operator's maintenance program, some may need to be supplemented in consideration of the special requirements of ETOPS. Airbus commented that these additions would require that operators engaged in any of the ETOPS operations covered in Appendix P of part 121 apply all ETOPS maintenance elements. The FAA acknowledges possible confusion regarding the maintenance elements required in appendix P. Section 121.374 has been amended. An operator's maintenance program for all two-engine ETOPS airplanes, regardless of diversion time, must comply with § 121.374. An operator of three- and four-engine airplanes operating beyond 180 minutes will not be required to have an ETOPS maintenance program.

FedEx noted three- and four-engine aircraft, pursuant to the provisions of a CMP, do not have parts and systems that must be equipped on aircraft in ETOPS operations. Presumably, the manufacturers will develop and offer these parts for sale once a CMP has been created. FedEx anticipates buying and storing these parts will be very expensive. FedEx also estimated certification costs (including the costs of developing CMP documents, and certification of aircraft parts and systems) as a one-time cost of $4,962,000. The development of ETOPS parts Control Programs, maintenance training, creation of centralized maintenance control system, additional parts inventory, performance of pre-departure service checks and other § 121.374 programs would be $17,033,000 as a one-time cost, and $847,000 per year.

The FAA does not agree. As stated in the preamble, if there is no CMP document for an existing airplane, then there is no requirement to comply with a CMP. The certification costs are a cost to manufacturers and not operators. These costs are discussed in parts 21, 25, and 33. Most likely the existing IPC program will satisfy the ETOPS parts control needs. Most airlines already have a centralized maintenance control program and if they do not it will require minimal cost to establish and the operator has a year to accomplish it. The FAA does not have a specific ETOPS parts inventory requirement.

Continental noted the time estimated by the FAA of 6 weeks to create the pre-departure check does not include the timeframe for FAA approval. When the FAA approval time is factored in development time would be 14 weeks. The FAA has provided a 1-year period to implement the maintenance requirements. The FAA also estimated the continuing costs of several elements of the CAMP program. A pre-departure check was estimated to take two staff-hours at a cost of $90.

ATA did not concur with proposed pre-departure check for three- and four-engine airplanes. It posited utilizing the proposed ETOPS pre-departure service check would prevent none of the incidents cited in the proposal risk analysis. The FAA has agreed to withdraw this requirement and all other elements of the ETOPS maintenance program for airplanes with more than two engines in ETOPS.

FedEx commented that it agrees with the additional training for passenger recovery training for crewmembers and dispatchers of three- and four-engine aircraft pilots as required, as well as generally on ETOPS procedures. Northwest stated that it would like to minimize cost and operational impact by training through bulletins and written procedures.

We understand that an air carrier may need to adjust the pilot training syllabus in order to accommodate the new training unit for three- and four-engine flight crews. We have included the costs of 4 hours of initial pilot and dispatcher training and recurring costs for ETOPS related training, and 1 hour for passenger recovery training for pilots and dispatchers and one-half hour for flight attendants for those operators conducting ETOPS greater than 180 minutes from an ETOPS alternate airport and for operations in the polar areas.

The training syllabus, as well as the means to provide that training, is at the discretion of the air carrier, as it should be tailored to fit within existing training and operational experience.

Airbus stated the cost of training cabin and flight crews for their roles in the passenger recovery plan is estimated to be $100,000 for a fleet of six ETOPS aircraft not involved in Polar and NOPAC operations using airports subject to extreme Polar weather.

Airbus did not provide supporting data, and the FAA cannot accept its estimate. This requirement will only entail minimum training of cabin and flight crews. An air carrier's existing emergency response plan includes many of the elements of a passenger recovery plan. In addition, there are expert contract services available to implement the passenger recovery plan. The FAA has included initial training and recurring training costs for pilots, flight attendants and dispatchers for those operators conducting ETOPS greater than 180 minutes from an ETOPS alternate airport and for operations in the polar areas in the final regulatory evaluation.

Several carriers including Atlas Air, Omni International, FedEx, and UPS included aggregate costs of training maintenance, crewmembers, flight attendants, dispatchers, and other operational personnel covering all or significant portions of their fleets.

The FAA in this final regulatory evaluation has estimated the cost of training all maintenance personnel, all dispatchers, all international pilots and flight attendants, and included all or significant portions of operators fleets that have operation specifications for affected areas and have or may have conducted flights in the affected areas during a one-year period.

Airbus stated that the requirement to consider all alternate airports in its dispatch or flight release would result in a severe increase in the cost of implementing the rule. Airbus recommends that the definition of an adequate airport be amended such that these airports would be required to have the infrastructure and services necessary to support a passenger recovery plan. Alternatively, the rule might be amended to require that the operator consider all adequate airports ''capable of supporting a passenger recovery plan for the concerned aircraft.''

The FAA does not agree. The requirement to consider all adequate airports in an operator's selection of ETOPS alternates for a specific flight will likely occur during the route planning stage and will be a minimal addition to the route planning process. It is a requirement of the rule that only adequate airports that meet such passenger recovery criteria be used as ETOPS alternate airports during the dispatch planning. The final regulatory evaluation includes a computer programming cost.

The final rule requires that flight plans for ETOPS beyond 180 minutes be calculated based on certain criteria so that the resulting time not exceed the time specified in the airplane flight manual for the airplane's cargo fire suppression time minus 15 minutes. Three- and four-engine airplanes not meeting this requirement will have a period not to exceed 6 years from the date of this regulation to meet the requirement. The FAA estimated the cost of the upgrade kit and an additional Halon bottle at $75,000 plus a $1,400 installation cost per aircraft. Additional fuel costs will also be incurred. ATA's survey of its members indicated an average of $62,500 for parts. Atlas Air estimated first year cargo fire suppression cost at $81,200. FedEx estimated installation of fire suppression upgrades at $54,800 per aircraft and annual costs of $1,450. They indicate that the time to modify the cargo fire extinguishing system should be at least 8 years. IATA and KLM agree with the 8-year time frame.

The ATA survey results were 17 percent lower than the FAA estimate with an average ten-year total cost per aircraft eight percent less than the FAA estimate. The Atlas Air and FedEx estimates were also lower. In order to not underestimate the costs of installing the fire suppression system, the FAA will retain its estimate of installation costs and revise its annual cost to reflect higher fuel costs. The FAA does not agree with the request to extend the installation deadline by an additional 2 years.

The final rule prohibits the dispatch or release of a flight by an airplane with more than two engines for more than 90 minutes at full cruise speed unless it has adequate fuel, considering wind and weather conditions, assuming a rapid decompression, followed by descent to a safe altitude to fly to an adequate airport, including enough fuel to hold for 15 minutes at 1,500 feet. ETOPS flights greater than 180 minutes have to comply with similar conditions in flight planning. The FAA estimated flight-planning costs to be minimal since they are generally computerized. Airbus commented the cost of retraining dispatchers and flight crews on the new fuel reserves and dispatch criteria is estimated to be $150,000 for a fleet of six ETOPS aircraft of one type. The lead-time is 3 months after the new software applications have been deployed and validated. FedEx noted this additional rule will increase rapid decompression fuel requirements for three- and four-engine aircraft, with the addition of 15 minutes holding fuel at 1500 feet whenever the aircraft is operated more than 90 minutes but less than 180 minutes from an adequate airport. This rule represents a cost not required in current operations. Northwest requested further review of the increase to the decompression fuel requirements for three- and four-engine aircraft. This all engine reserve is not currently required and represents an additional cost (either fuel cost to carry or payload limiting) to operators.

The FAA disagrees. The added 15 minutes of holding fuel does not represent an additional cost to operators. There is currently within part 121 two separate fuel requirements that apply to 3- and 4-engine operators conducting flag and supplemental operations. The requirement of § 121.646(a) for holding fuel is a lesser amount of fuel reserves already required for the operation and is therefore not an additional cost to the operator.

Appendix P to part 121 sets forth the ETOPS approval requirements and limitations for various areas of operation and diversion time limits. Airbus stated that the retroactivity of type design requirements would impose very high costs for existing ETOPS aircraft and for three- or four-engine aircraft. It recommends a compliance time of at least 6 years for all two-engine ETOPS aircraft already assessed or in the process under current criteria and at least 8 years for three-or four-engine aircraft.

The FAA is not making the type design requirements retroactive as explained earlier in the preamble.

The rule will require a part 135 operator to be ETOPS certified for operations outside the continental United Stated unless the route is planned to remain with 180 minutes flying time of an adequate airport or the operation involves an all-cargo operation aboard an airplane with more than two engines. NATA believes that this will require proof that a flight was below the 180 minute threshold. The FAA, however, holds that it is the responsibility of the operator to determine what is and is not ETOPS. If it is, then they must flight plan accordingly. There is no requirement to prove a flight is not ETOPS. The rule does not impose any burden of proof in this case and therefore there is no additional paperwork or associated cost.

Part 135 operators will have to comply with the continuous maintenance program and the requirements of Appendix G if the operations use two-engine airplanes. NetJets stated the cost/benefit analysis does not adequately address the added costs of maintaining ''9 passenger seat or less'' aircraft under a continuous maintenance program currently required for aircraft with ''10 or more'' passenger seats. These costs not only include the actual development and approval of the program, but the added costs associated with maintaining personnel for the program. Also, the ''dual maintenance'' requirement will mandate that more maintenance technicians be made available for maintenance conducted on ETOPS aircraft. This cost is not addressed in the cost/benefit analysis.

The FAA's database indicates that only 37 operators have aircraft that currently meet the aircraft requirements but do not meet the maintenance provisions for aircraft type certificated for 10 or more seats that is a requirement for operations beyond 180 minutes. None are authorized for operations in the Polar regions. The only other route beyond the ETOPS 180-minutes threshold is a portion of the South Pacific, which can be avoided by some additional flying time. The FAA concludes that these operators can continue to fly non-ETOPS international routes and therefore will not incur ETOPS-related costs. Also the FAA has eliminated the ETOPS maintenance requirements for ETOPS on passenger-carrying airplanes with more than two engines.

ETOPS flights beyond 180 minutes but planned to remain within 240 minutes have, in addition to the maintenance requirements, certain planning, operational, experience, and equipment requirements. Dassault commented that the check required immediately before a flight and certified by an ETOPS qualified maintenance person is unrealistic for part 135 operators who do not fly ETOPS routes on a regular basis.

The FAA disagrees that a pre-departure service check is unrealistic for 135 operators. Part 135 operators are already required to have procedures in place to ensure that maintenance is performed by properly qualified maintenance personnel. Allowing a pilot to perform a pre-departure service check degrades the importance of the check and places a safety critical task below the level of performance required to change a tire or replace a light bulb for reading.

NetJets, Inc., commented that it manages and/or operates approximately 500 turbojet aircraft in fractional ownership programs and part 135 operations. The flight operations of approximately 220 of those aircraft will be directly impacted by this proposed rule. The most significant impact is for operations conducted between the west coast of the United States and Hawaii. In 2003, they conducted more than 760 flights to and from Hawaii and the contiguous U.S. At the present pace, more than 1100 flights will occur in 2004. Based on the data available at this time, approximately 75–80% of these flights will not be possible if the proposed rule is adopted as written. It is estimated that over the 10-year period following adoption of the proposed rule, 21,420 flights would be eliminated. Actus Aviation stated that residents of the state of Hawaii rely on long-range air ambulance flights to transport them to the mainland where more advanced critical medical treatment is available. Currently part 135 operators are utilizing Lear 36 aircraft and 1125 Astra Jets to fly these missions. Actus believes that if this rule becomes final, the next aircraft to conduct the flights would be a Falcon 50 or larger aircraft. The cost differential between the Astra and a Falcon 50 would be a minimum of $1,000 per hour.

The FAA has corrected its assumption that operations between the west coast and Hawaii would be classified as ETOPS. The question of whether or not operations between the mainland U.S. and Hawaii are defined as ETOPS for part 135 operators is dependent on the computed single-engine cruise speeds for their airplanes. The FAA does not agree that the majority of those airplanes whose range and endurance legitimately qualifies them for such operations would be considered ETOPS in this case. But the FAA does agree that there is difficulty in obtaining sufficient single-engine data across all fleets of airplanes to accurately account for the cost of the rules application in this case. Without this data there is no way to calculate the costs and which operators would be affected. In consideration of this fact and because of a lack of incident data in this operation, the rule provides an exemption for all those airplanes listed on an operator's operations specification for up to eight years beyond the effective date of this rule. Further, the fuel and electric requirements for airplanes added to an operator's operation specifications between the effective date of the rule and 8 years later, contained in the NPRM, have been deleted.

NetJets was also concerned that all maintenance personnel performing maintenance on ETOPS aircraft must be trained in accordance with the certificate holder's ETOPS maintenance training program. The vast majority of maintenance work for part 135 operators is conducted by repair stations and/or manufacturer service centers, which places a substantial training burden on the certificate holder. Coupled with the fact that all manual changes would require approval before adoption, NetJets asserted that a very ponderous maintenance requirement is being proposed.

The FAA finds that the operator is already required to train persons performing preventative maintenance functions in accordance with § 135.433. The amount of additional burden for ETOPS-specific training depends on the type of training program the operator chooses to incorporate. The FAA has limited the ETOPS maintenance requirements to only two-engine operations in part 135.

TriCoastal Air, a part 135 on-demand air cargo carrier, stated that the two Lear 35As operated by that firm are capable of exceeding the 180-minute range. This carrier estimated that compliance with this rule was estimated at $150,000 per aircraft not including the cost of pilot training. The commenter realized the possible payback in terms of monies saved from fuel stops, but noted that it simply does not have the financial resources for the upfront investment.

The rule provides an exemption for all airplanes that are manufactured up to 8 years beyond the effective date of this rule. In addition, part 135 operators are likewise given 8 years to comply. In view of the fact that the only route beyond the ETOPS 180-minutes threshold is located in a portion of the South Pacific, the operator can maintain the safety of its operations by avoiding this area.

NetJets questioned the basis for the estimated cost savings; it finds the 2 hours of flying time per round trip for operations beyond 180 minutes to be inaccurate. The FAA has corrected that assumption in the analysis of this final rule and agrees that this rule will impose costs on those operators who chose to operate in ETOPS.

XIV. Rulemaking Notices and Analyses

Economic Summary

Proposed changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 directs each Federal agency to 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 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 also requires agencies to consider international standards and, where appropriate, use them as the basis of U.S. standards. Fourth, the Unfunded Mandates Reform Act of 1995 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, the FAA has determined this rule (1) has benefits that justify its costs, is a ''significant regulatory action'' as defined in section 3(f) of Executive Order 12866 and is ''significant'' as defined in DOT's Regulatory Policies and Procedures; (2) will not have a significant economic impact on a substantial number of small entities; (3) will not place U.S. operators at a significant competitive disadvantage to foreign operators of three- and four-engine airplanes; and (4) does not impose an unfunded mandate on state, local, or tribal governments, or on the private sector. These analyses, available in the final regulatory evaluation supporting today's rule, are summarized below.

Total Costs and Benefits of This Rulemaking

The total costs to the industry are estimated at $20.2 million over a 16-year period or $11.9 million, in present value. These costs assume:

- An Operator of four-engine airplanes that has conducted operations in the South Pacific area beyond 180-minutes will elect to incur extra flying time costs rather than comply with the ETOPS requirements.
- No Part 135 operator will seek North polar area authorization or serve the South Pacific area beyond 180-minutes.
- There are two ''makes'' of U.S. manufactured three-or four-engine airplanes (B–747, MD–11) that will obtain supplemental certification.
- Only one ''major'' business airplane manufacturer will comply with the aircraft manufacturing provisions of the rule.

Who is Potentially Affected by This Rulemaking

- Part 121 operators with operations beyond 180 minutes from an alternate airport or operating in the polar regions
- Part 135 operators with operations beyond 180 minutes from an alternate airport or operating in the North Polar Region
- Engine and airplane manufacturers

Our Costs Assumptions and Information

A number of fundamental changes since the NPRM regulatory evaluation have been made to the cost assumptions in the preparation of this final regulatory evaluation as outlined below:

- Current Parts 121 regulations for airplanes with more than two engines and 135 regulations do not impose requirements for operations beyond 180-minutes from a suitable airport. The NPRM assumed that policy letters and operation specifications prevented operations beyond 180 minutes, and thus cost savings would result from more efficient routings.
- Type design requirements are not retroactive. Airplanes manufactured up to eight years after the effective date of the rule are grandfathered.
- Recovery plans are required for all part 121 operators with operations beyond 180 minutes or in a polar area. The initial regulatory assessment incorrectly estimated the cost of recovery plans as only for ETOPS operations on a single route.
- Recovery plan training hours were incorrectly estimated in the initial regulatory assessment and no training hours were estimated for ETOPS training. The final regulatory assessment corrects these mistakes.
- The NPRM assumed only one route for all operations specification holders. In the regulatory evaluation for this final rule, activity is based on FAA internal records of flight operations. If an operator did not conduct ETOPS area flights, no costs are estimated for that operator.
- Hourly wage estimates for most positions are based at the 75th percentile level rather than the mean level used in the NPRM. Adjustments to these base rates for benefits and overhead costs are the same as the initial evaluation. Pilot and flight attendant wage estimates based on industry input; other wages based on Bureau of Labor Statistics data.
- Airplanes cost estimates are based on the number of planes operated by a Part 121 carrier. Communication equipment costs exclude airplanes that, according to industry information, already have the equipment installed. Part 135 cost estimates are calculated on an assumed fleet size.
- The cost analysis has been extended to 16 years to include the effects of the cargo fire suppression provisions that have a six-year phase-in.

In addition to changes to the cost assumptions, a number of regulatory changes to the final rule affect the costs of the rule. These are discussed in the ''Changes from the NPRM to the Final Rule'' section.

Alternatives Considered

The basic framework of the ETOPS rule represents the consensus of a working group consisting of over 50 members, including U.S. and foreign airlines, aircraft and engine manufacturers, pilot unions, industry associations, international regulatory bodies, and the FAA. During the course of their discussions many alternatives were considered and the NPRM reflected their views. In general, the more than 50 commenters to the NPRM agreed with the framework of the NPRM but disputed specific provisions.

The FAA rejected some of the proposals but adopted a number that significantly change provisions of the final rule and are discussed in the ''Changes from the NPRM to the Final Rule'' section.

Benefits of This Rulemaking

The upgraded fire suppression and communications systems, coupled with ETOPS procedures and planning will help reduce the risks of flying over remote areas, distant from alternate airports. The cargo and baggage compartment fire suppression system requirement will ensure that all ETOPS airplanes will have fire suppression systems capable of putting out fires and suppressing any chance of re-ignition for the longest duration diversion that the airplane is approved for. The SATCOM requirement will result in a significant improvement in communications that can greatly benefit the safety of an ETOPS flight that could be three or more hours from a landing site. The ETOPS safety enhancements contained in this rule focus on defining methods of preventing potential threats caused by known sources of potential failures.

The passenger recovery plan will ensure the safety of the passengers and crew. The FAA is projecting that there could be between 220 and 300 diversions during the next sixteen years for ETOPS flights. Some of these diversions may involve airports that are in rather remote locations, where it would not be safe to off-load passengers and crew until help arrived and where it may not be safe to keep them on-board the aircraft either.

Cost Summary

The Part 121 operators with passenger operations beyond 180 minutes from an ETOPS alternate airport will incur costs for passenger recovery plans and related training totaling $158,000 or $94,000, present value. The total cost to operators in the South polar area is estimated at $305,000 or $185,000, present value excluding passenger recovery related costs. The costs to the operators that have conducted operations in the area of the South Pacific where some flights may exceed 180-minutes from an alternate airport will be $1.386 million or $735,000, present value. The total cost to Part 121 operators is estimated at $1.9 million or $1.0 million, present value over a 16-year period.

Part 135 operators seeking to avoid operating over 180-minutes from an alternate airport will incur extra flying time costs of $396,000 or $224,000, present value.

A business aircraft manufacturer will incur reporting and investigation costs that will be required by the provisions of Part 21 estimated at $5.3 million or $3.1 million, present value. The manufacturer will also incur airplane ETOPS certification costs of $5.4 million. This would consist of design costs of $4.5 million, and assessment and validation costs of $900,000. Engine certification costs (for a model that does not require Early ETOPS) to make an engine ETOPS eligible will cost $1.4 million or $800,000, present value. This will consist of design and certification costs of $1.0 million and establishing engine condition monitoring procedures at a cost of $375,000. The total cost to a business aircraft manufacturer for reporting and investigation, and airframe and engine certification will be $12.1 million or $7.1 million, present value. The absence of any significant activity in the North polar area or in other areas beyond 180 minutes from an alternate will result in only one manufacturer complying with the provisions of the rule.

The manufacturer of an existing four-engine airplane will incur additional reporting costs under part 21 of $3.7 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-minutes ETOPS and other required costs of $200,000 for a total cost of $5.8 million, or $3.6 million, present value.

Benefits

The FAA is projecting that there could be between 220 and 300 diversions during the next 10 years involving multi-engine aircraft performing an ETOPS operation. Some of the ETOPS operations have alternate airports, which are beyond 180 minutes and these airports are in rather remote locations, where it would not be safe to off-load passengers and crew until help arrived and it may not be safe to keep them on-board the aircraft either. Some of the above diversions are bound to happen at a remote airport where this might be the case. Therefore, the FAA is requiring operators to develop airport specific passenger recovery plans for ETOPS alternate airports beyond 180-minutes.

The historical rate of occurrence of in-flight cargo and baggage compartment fires is approximately 1×10^{-7} per flight hour. Since these events cannot be considered extremely improbable the possibility must be addressed. For this reason, aircraft cargo and baggage compartment fire suppression systems must be capable of putting out fires and suppressing any chance of re-ignition for the longest duration diversion for which the aircraft is approved. Currently this is not the case for some three- and four-engine aircraft used in ETOPS operations. This rule will require that all aircraft have a fire suppression capability to put out the fire and suppress any re-ignition during the longest duration diversion.

Final 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.

The final rule will not have a significant economic impact on a substantial number of airframe and engine manufacturers or part 121 and part 135 operators. 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 0Administration 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, and U.S. Airways.

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, and U.S. Airways.

Two part 121 operators that have operation specifications to serve the South polar area are small entities. To assess the cost impact to these airlines, the FAA uses the highest estimated annual cost to operators in the period of analysis. This analysis indicates that neither of these carriers will experience a significant economic impact. One non-scheduled part 121 operators that operate in the South Pacific area is not a small entity. It also will not incur significant avoidance costs to continue operating in the area. The FAA, therefore, certifies that the final rule will not have a significant economic impact on a substantial number of small part 121 operators.

One of the 14 part 135 operators with flight activity in the South Pacific is a large entity and the 13 others are small entities under the SBA criteria. We determined annual revenues for six of the 13 small entities and the amounts ranged from $1.4 million to $50 million. We believe the revenues of none of the operators with unknown revenues are less than the lowest amount of $1.4 million. Two of the operators with unknown revenues flew three flights in the area where some flights may exceed 180-minutesd from an alternate airport and the rest flew two or less. Even if all three flights were to incur avoidance costs (which is unlikely since only 20 percent of flights may encounter conditions requiring extra flying time) the total cost will be only seven-tenths of one percent of the estimated revenues of $1.4 million. None of the operators with known revenues will incur significant costs. The FAA therefore certifies that the final rule will not have a significant economic impact on a substantial number of small part 135 operators.

International Trade Impact Assessment

The Trade Agreements 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. The FAA has assessed the potential effect of this final rule and concludes that these requirements may have some potential affect on a small number of U.S. operators under certain conditions unless other countries adopt similar aviation regulations. The requirements imposed on both domestic and foreign airframe and engine manufacturers create no obstacles to the foreign commerce of the United States.

Unfunded Mandates 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.’’ The FAA currently uses an inflation-adjusted value of $128.1 million in lieu of $100 million. The Trade Agreements 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. The FAA has assessed the potential effect of this final rule and concludes that these requirements may have some potential affect on a small number of U.S. operators under certain conditions unless other countries adopt similar aviation regulations. The requirements imposed on both domestic and foreign airframe and engine manufacturers create no obstacles to the foreign commerce of the United States.

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

Executive Order 13132, Federalism

The FAA has analyzed this final rule under the principles and criteria of Executive Order 13132, Federalism. We determined that this action will not have a substantial direct effect on the States, or 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 does not have federalism implications.

International Compatibility

In keeping with U.S. obligations under the Convention on International Civil Aviation, it is FAA policy to comply with ICAO Standards and Recommended Practices to the maximum extent practicable. The FAA has determined that there are no ICAO Standards and Recommended Practices that correspond to these regulations.

Plain English

Executive Order 12866 (58 FR 51735, Oct. 4, 1993) requires each agency to write regulations that are simple and easy to understand. To the extent possible, the regulations adopted today meet these criteria. However, in some instances terms that are not readily understandable to the general public have been used. Today’s rule imposes no obligation on the general public. The entities regulated under this final rule, airplane and engine manufacturers and air carriers and on-demand operators, are familiar with the terminology included in the regulation. Accordingly, the FAA believes the regulation meets the requirements of Executive Order 12866.

Environmental Analysis

FAA Order 1050.1E identifies FAA actions that are categorically excluded from the preparation of an environmental impact statement under the National Environmental Policy Act (NEPA) in the absence of extraordinary circumstances. The FAA has determined that this rulemaking action qualifies for the categorical exclusion and involves no extraordinary circumstances.

Regulations That Significantly Affect Energy Supply, Distribution, or Use

The FAA has analyzed this final rule under Executive Order 13211, Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution, or Use (May 18, 2001). We have determined it is not a ‘‘significant energy action’’ under the executive order because it is not a ‘‘significant regulatory action’’ under Executive Order 12866, and it is not likely to have a significant adverse effect on the supply, distribution, or use of energy.

Paperwork Reduction Act

As required by the Paperwork Reduction Act of 1995 (44 U.S.C. 3507(d)), the FAA has submitted a copy of the new information collection requirements(s) in this final rule to the Office of Management and Budget for its review.

The FAA included a detailed discussion of the new information collection requirements of the proposed rule at 68 FR 64782, November 14, 2003. No comments were received on these estimated requirements.

However, with certain revisions to the proposal, the FAA finds that the information collection burden on the public will be less than originally estimated in the NPRM. Some of the reasons for this are that type design requirements are not retroactive; therefore, there is no paperwork burden for recertification of airplanes used in existing ETOPS. In addition, based on operator comment and internal FAA research, this paperwork estimate is based on actual activity levels of individual operators rather than averages for potential fleet operation. Regional recovery plans also have been omitted from the final rule, reducing that burden. The following chart shows the record keeping requirements of today’s final rule.

SUMMARY OF INITIAL AND TOTAL PAPERWORK HOURS AND COSTS

Category	Initial hours	Initial cost	Sixteen year hours	Sixteen year costs
Part 121				
Passenger Recovery Plans	200	$20,600	1,320	$135,960
Recovery Training	55	8,960	132	21,504
South Polar—flare planning	200	20,000	480	132,000
South Polar—fuel strategies	200	20,000	480	132,000
§ 121.415 training:				
Pilots	200	34,600	480	83,040
Dispatchers	20	1,240	48	2,976
§ 121.415 computer planning		29,200		438,000
Part 21				
ETOPS Reporting	4,160	187,200	66,560	2,995,200
Investigations	2,000	146,000	32,000	2,336,000
Part 25				
Electrical system design	30,000	2,250,000	30,000	2,250,000
Fuel system design	30,000	2,250,000	30,000	2,250,000
System assessments	12,000	898,000	12,000	898,000
Part 33				
Engine Monitoring	5,000	375,000	5,000	375,000
Part 135				
South Pacific Operations	64	4,608	288	20,736
Total				12,049,416

XV. Appendix of Tables

TABLE 1.—APPLICABILITY OF FINAL RULE

	Current requirements			Final Rule		
	Up to 60 minutes	Beyond 60 minutes up to 180 minutes	Beyond 180 minutes	Up to 60 minutes	Beyond 60 minutes up to 180 minutes	Beyond 180 minutes
Part 121 two-engine.	Section 121.161 applies.	Advisory material and policy letters.	Currently restricted.		Would codify previous ETOPS guidance with some reductions in requirements*.	New ETOPS rules would apply. Airport specific PRP.
Part 121 more than two-engine.	No current regulation.	No current regulation.	No current regulation.		(From 90–180 minutes) New requirement: Fuel for depressurization.	New ETOPS rules would apply to passenger-carrying operations only. Airport specific PRP. No ETOPS maintenance program.
Part 135	No current regulation.	No current regulation.	No current regulation.	No change	No change	New ETOPS rules would apply. All-cargo airplanes with more than two engines excluded. PRP in North Polar region only. No ETOPS maintenance program for airplanes with more than two engines.

PRP = passenger recovery plan.
*a. Fuel requirements for icing and wind calculations in the critical fuel scenario have been reduced.
b. The area of applicability for 207-minute ETOPS has been increased.

TABLE 2.—PART 121 AND PART 135 OPERATIONAL REQUIREMENTS TIMETABLE

Requirement	Compliance date	
Part 121	Airplanes with two engines	Airplanes with more than two engines
Part 1 & 121.7 Definitions	30 days	30 days.
121.97 Airport required data	1 year	1 year.
121.99 & 121.122 SATCOM	1 year (except for 207-minute ETOPS approval in the North Pacific area of operation).	1 year.
121.106 Rescue and firefighting equipment at alternate airports	30 days	30 days.
121.135 Passenger recovery plan	1 year	1 year.
121.161 Airplane limitations	30 days	1 year.
121.162 ETOPS Type Design Approval	30 days	8 years.
121.374 Maintenance	30 days	Not required.
121.415 Crew training	1 year	1 year.
121.565 Reporting—engine inoperative landing	30 days	30 days.
121.624 ETOPS alternates	30 days	30 days.
121.625 Alternate weather minimums	30 days	30 days.
121.631 Dispatch	30 days	30 days.
121.633 Cargo fire suppression	30 days	6 years.
121.646 En-route fuel supply	30 days	30 days.
121.687 & 689 Contents of dispatch	30 days	30 days.
Part 135	All airplanes	
135.98 North Polar Operations	1 year.	
135.345 Passenger Recovery Training	1 year.	
135.364 Maximum Flying Time	1 year.	
135.411 Applicability	1 year.	
Part 135 Appendix G (General)	1 year.	
a. Time-Limited Systems	8 years.	
b. Airplane Requirements	8 years.	

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Table 3
Certification Requirements.

	Description	Compliance required
All airplanes	**Airplane and Engine Manufacturer Reporting Requirements (Section 21.4)**	General rule is effective 30 days after publication
	Part 25 Airplane Certification Requirements	General rule is effective 30 days after publication. All airplanes with applications for original type certification submitted after effective date must comply with all part 25 requirements for ETOPS type design approval.
Airplanes with two engines	**Two-engine airplanes that have received ETOPS approval for up to 180 minutes before effective date of the rule (Including 207-minute operations in the North Pacific)**	Grandfathered
	Airplanes with existing type certificates on the effective date of the rule and application for ETOPS approval up to 180 minutes submitted after effective date of the rule (Including 207-minute operations in the North Pacific)	Must comply with all part 25 requirements except 1) Fuel system pressure and flow requirements; 2) Low fuel alerting; 3) Engine oil tank design
	Application for an original type certificate submitted before effective date of the rule and application for ETOPS approval up to 180 minutes submitted after effective date of the rule (Including 207-minute operations in the North Pacific)	Must comply with all part 25 requirements except 1) Fuel system pressure and flow requirements; 2) Low fuel alerting; 3) Engine oil tank design

	Application for ETOPS approval greater than 180 minutes submitted after effective date of the rule regardless of type certification status on the effective date of the rule	Must comply with all part 25 requirements
Airplanes with more than two engines	**Airplanes manufactured before 8 years after the effective date of the rule**	Grandfathered
	Airplanes manufactured on or after 8 years after the effective date of the rule	Must comply with all part 25 requirements except airplanes configured for a required flight engineer are exempt from low fuel alerting requirement

Table 4
Comparison of current ETOPS guidance; regulations proposed by the NPRM; and final rule

	Under current advisory circulars and policy			Under the proposed regulation (NPRM)			Under the Final Rule		
ETOPS requirement	**Two-engines**	**More than two engines**	**part 135 operations**	**Two-engines**	**More than two engines**	**part 135 operations**	**Two-engines**	**More than two engines**	**Part 135 Operations**
Applicability	More than 60 minutes from an adequate airport	Does not apply	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	No change from NPRM	All-cargo operations excluded.	All-cargo operations in airplanes with more than two engines excluded
Effectivity: Operations	At time of application	Does not apply	Does not apply	At time of application	At time of application	At time of application	No change from NPRM	Up to 1 year from compliance date.	1 year from compliance date.

ETOPS requirement	Under current advisory circulars and policy			Under the proposed regulation (NPRM)			Under the Final Rule		
	Two-engines	**More than two engines**	**part 135 operations**	**Two-engines**	**More than two engines**	**part 135 operations**	**Two-engines**	**More than two engines**	**Part 135 Operations**
Airplanes	All airplanes	Does not apply	Does not apply	All airplanes	All airplanes	1. Remain on original owner's ops specs: grandfathered 2. Added to ops specs less than 8 years after rule is effective: grandfathered except must meet certain fuel and electrical requirements 3. Airplanes added after eight years must comply with part 25.	1. Airplanes with existing ETOPS approvals on the effective date grandfathered 2. Airplanes with existing type certificates or original type certificate applications received before effective date, for ETOPS approval of up to 180-minutes (Including 207-minute operations in the North Pacific), must comply with part 25 except low fuel alerting, engine fuel pump inlet pressure, and oil tank cap 3. Airplanes with original type certificate applications received after effective date, or for ETOPS approval beyond 180-minutes, must comply with all part 25 requirements.	1. Airplanes with existing type certificates manufactured up to 8 years after effective date grandfathered 2. Airplanes with existing type certificates manufactured after 8 years must comply with all of part 25 except that such airplanes configured with a required flight engineer exempt form low fuel alerting. 3. Airplanes with original type certificate applications received after effective date must comply with all of part 25.	1. Airplanes manufactured up to 8 years after the effective date: grandfathered. 2. Airplanes manufactured after 8 years must comply with all of part 25.
Terminology	ETOPS (Extended Range Operation With Two-Engine Airplanes)	ETOPS does not currently apply to airplanes with more than two engines	ETOPS does not currently apply to part 135 operations	ETOPS (Extended Operations)	ETOPS (Extended Operations)	ETOPS (Extended Operations)	No change from NPRM.	No change from NPRM other than definition of ETOPS to exclude all-cargo operations on airplanes with	No change from NPRM.

	Under current advisory circulars and policy			Under the proposed regulation (NPRM)			Under the Final Rule		
ETOPS requirement	Two-engines	More than two engines	part 135 operations	Two-engines	More than two engines	part 135 operations	Two-engines	More than two engines	Part 135 Operations
								more than two engines.	
Maximum permissible time from an adequate airport	207 minutes	Not regulated	Not regulated	240 minutes with certificate holder approval, beyond 240 minutes with route specific approval	To maximum system limitation	240 minutes	Expanded area of applicability for 240-minute authority	No change from NPRM.	No change from NPRM.
Cargo and baggage compartment fire suppression	Diversion limit plus 15 minutes	Not regulated	Not regulated	Diversion limit plus 15 minutes.	Diversion limit plus 15 minutes (6 year compliance period)	Diversion limit plus 15 minutes	No change from NPRM.	No change (6 year compliance period)	No change (8 Year compliance period)
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	ICAO category 4 up to 180 minutes, category 7 for at least one adequate airport beyond 180 minutes		No change from NPRM
Passenger recovery plan	Required for Polar operations	Required for Polar operations	Required for Polar operations	Required for all US flag and supplemental operations regardless of distance from airport		Required in North Polar Area	Required for ETOPS greater than 180 minutes and for operations in the North and South Polar areas for passenger-carrying operations.		No change from NPRM
Engine reliability standards	IFSD rates: 0.05/1000 hrs for 120 min, 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	No change from NPRM	No change from NPRM	No change from NPRM
Areas of designated ETOPS applicability	Polar	Polar	Polar	Polar	Polar	Polar	none		none
Time-limited systems	Per type design approval limit for the airplane (up to 207 min).	No requirement	No requirement	Specified in part 25, Appendix K	Specified in part 25, Appendix K	Specified in part 25, Appendix K	No change from NPRM.	No change from NPRM.	No change from NPRM.
Dispatch weather requirements for alternate airport	Applies to all ETOPS	No requirement	No requirement	Applies to all ETOPS (reduced requirements)	Applies to all ETOPS	Applies to all ETOPS	No change from NPRM.	No change from NPRM.	No change from NPRM.
ETOPS maintenance program	Required for all ETOPS	No requirement	No requirement	Required for all ETOPS	Required to all ETOPS	Required for all ETOPS	No change from NPRM.	Not required for 3-and 4-engine ETOPS	Not required for 3- and 4-engine ETOPS

	Under current advisory circulars and policy			Under the proposed regulation (NPRM)			Under the Final Rule		
ETOPS requirement	**Two-engines**	**More than two engines**	**part 135 operations**	**Two-engines**	**More than two engines**	**part 135 operations**	**Two-engines**	**More than two engines**	**Part 135 Operations**
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.	No change from NPRM.	No change from NPRM	No change from NPRM.
Critical Fuel Scenario	Required for all ETOPS.	No requirement	No requirement	Applies for all ETOPS (reduced requirements)	Applies for all ETOPS.	Applies for all ETOPS.	No change from NPRM.	No change from NPRM.	No change from NPRM.

Table 5
Design Requirements Objectives

Design Requirements Objectives
Prevent Diversions
Diversion Safety

Part 25 | **Part 33** | **Part 21**

Design to reliably provide functions necessary for safe ETOPS flight. (SE)(EE)(CM)	**Eliminate sources of airplane diversions that occurred in current or past designs**	**Ground and flight testing**	**Reporting and correcting design problems**	**Demonstrated Reliability**
Comply with part 25 considering maximum flight and diversion time [K25.1.1]	Propulsion System Assessment (Two-engine airplanes only) [K25.2.1(b)] (SE)	Airplane fight test [K25.2.1(e) and K25.3.1(c)] **(SE)(CM)**	Problem Tracking and Resolution System (during airplane type certification) [K25.2.2(h) and K25.3.2(e)] **(EE)(CM)**	Required Service Experience [K25.2.1(a) and K25.3.1(a)] **(SE)** [K25.2.3(a) and K25.3.3(a)] **(CM)**
Human factors considerations with system failures for maximum length diversions [K25.1.2]	Airplane Systems Assessment [K25.2.1(c) and K25.3.1(b)] **(SE)**	Propulsion System Validation Test (Two-engine airplanes only) [K25.2.2(d) and] § 33.201(c)] **(EE)(CM)**	Early ETOPS: Reporting, Tracking, and Resolving Problems (after issuance of type certificate) [§ 21.(4)(a)] **(EE)(CM)**	World Fleet In-flight shutdown Rates (Two-engine airplanes only) [K25.2.1(b)] **(SE)** [§ 21.4(b)(2)] **(SE)(EE)(CM)**
Operation in Icing [K25.1.3(a)]	Relevant Experience Assessment Two-engine airplanes only) [K25.2.2(a)] [§ 33.201(b)] **(EE)(CM)**	New Technology Testing [K25.2.2(e) and K25.3.2(b)] (EE)(CM)	Reliability Reporting of Two-engine Airplanes [§ 21.(4)(b)] **(SE)(EE)(CM)**	Acceptance Criteria [K25.2.2(i) and K25.3.2(f)] **(EE)(CM)**
Electrical Power Supply [K25.1.3.(b)]	Propulsion System Design (Two-engine airplanes only) [K25.2.2(b)] [§ 33.201(a)] **(EE)(CM)**	APU Validation Test [K25.2.2(f) and K25.3.2(c)] **(EE)(CM)**		
Time Limited Systems [K25.1.3(c)]	Maintenance and Operational Procedures [K25.2.2(c) and K25.3.2(a)] **(EE)(CM)**	Airplane Demonstration [K25.2.2(g) and K25.3.2(d)] **(EE)**		
Fuel System Design [K25.1.4(a)]				
APU Design [K25.1.4(b)]				
Engine Oil Tank Design [K25.1.4(c)] [§ 33.71(c)(4)]				
Engine Condition Monitoring [K25.1.5] [§ A33.3(F)(c)]				
Configuration, Maintenance and Procedures (CMP) [K25.1.6)]				
Airplane Flight Manual Requirements [K25.1.7]				

Service Experience Method (SE) | **Early ETOPS Method (EE)** | **Combined Method (CM)**

Two-engine airplanes Part 25, Appendix K, Section K25.2

Airplanes with more than two engines Part 25, Appendix K, Section K25.3

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TABLE 6.—PART 25, APPENDIX K REVISED NUMBERING

NPRM (old Appendix L)	Final Rule (Appendix K)
Section I	K25.1.
§ 25.1535(a)	K25.1.1.
§ 25.1535(b)	K25.1.2.
(a)	K25.1.3.
(a)(1)	K25.1.3(a).
(a)(2)	K25.1.3(b).
(a)(3)	K25.1.3(c).
(b)	K25.1.4.
(b)(1)	K25.1.4(a).
(b)(2)	K25.1.4(b).
(b)(2)(i)	K25.1.4(b)(1).
(b)(2)(ii)	K25.1.4(b)(2).
(b)(3)	K25.1.4(c).
(c)	K25.1.5.
(d)	K25.1.6.
(e)	K25.1.7.
Section II	K25.2.
(a)	K25.2.1.
(a)(1)	K25.2.1(a).
(a)(2)	K25.2.1(c).
(a)(3)	K25.2.1(d).
(a)(4)	K25.2.1(b).
(a)(5)	K25.2.1(e).
(b)	K25.2.2.
(b)(1)	K25.2.2(a).
(b)(2)	K25.2.2(b).
(b)(3)	K25.2.2(c).
(b)(4)	K25.2.2(d).
(b)(5)	K25.2.2(e).
(b)(6)	K25.2.2(f).
(b)(7)	K25.2.2(g).
(b)(9)	K25.2.2(i).
(c)	K25.2.3.
Section III	K25.3.
(a)	K25.3.1.
(a)(1)	K25.3.1(a).
(a)(2)	K25.3.1(b).
(a)(3)	K25.3.1(c).
(b)	K25.3.2.
(b)(1)	K25.3.2(a).
(b)(2)	K25.3.2(b).
(b)(3)	K25.3.2(c).
(b)(4)	K25.3.2(d).
(b)(5)	K25.3.2(e).
(b)(6)	K25.3.2(f).
(c)	K25.3.3.

XVI. The Final Rule

List of Subjects

14 CFR Part 1

Air transportation.

14 CFR Part 21

Aircraft, Aviation safety, Exports, Imports, Reporting and recordkeeping requirements.

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, 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 Amendment

■ For the reasons discussed in the preamble, the Federal Aviation Administration amends 14 CFR parts 1, 21, 25, 33, 121, and 135 as follows:

PART 1—DEFINITIONS AND ABBREVIATIONS

■ 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 following definitions in alphabetical order to read as follows:

§ 1.1 General definitions.

* * * * *

Configuration, Maintenance, and Procedures (CMP) document means a document approved by the FAA that contains minimum configuration, operating, and maintenance requirements, hardware life-limits, and Master Minimum Equipment List (MMEL) constraints necessary for an airplane-engine combination to meet ETOPS type design approval requirements.

* * * * *

Early ETOPS means ETOPS type design approval obtained without gaining non-ETOPS service experience on the candidate airplane-engine combination certified for ETOPS.

* * * * *

ETOPS Significant System means an airplane system, including the propulsion system, the failure or malfunctioning of which could adversely affect the safety of an ETOPS flight, or the continued safe flight and landing of an airplane during an ETOPS diversion. Each ETOPS significant system is either an ETOPS group 1 significant system or an ETOPS group 2 significant system.

(1) An ETOPS group 1 Significant System—

(i) Has fail-safe characteristics directly linked to the degree of redundancy provided by the number of engines on the airplane.

(ii) Is a system, the failure or malfunction of which could result in an IFSD, loss of thrust control, or other power loss.

(iii) Contributes significantly to the safety of an ETOPS diversion by providing additional redundancy for any system power source lost as a result of an inoperative engine.

(iv) Is essential for prolonged operation of an airplane at engine inoperative altitudes.

(2) An ETOPS group 2 significant system is an ETOPS significant system that is not an ETOPS group 1 significant system.

Extended Operations (ETOPS) means an airplane flight operation other than an all-cargo operation in an airplane with more than two engines during which a portion of the flight is conducted beyond a time threshold identified in part 121 or part 135 of this chapter that is determined using an approved one-engine-inoperative cruise speed under standard atmospheric conditions in still air.

* * * * *

In-flight shutdown (IFSD) means, for ETOPS only, when an engine ceases to function (when the airplane is airborne) and is shutdown, whether self induced, flightcrew initiated or caused by an external influence. The FAA considers IFSD for all causes: for example, flameout, internal failure, flightcrew initiated shutdown, foreign object ingestion, icing, inability to obtain or control desired thrust or power, and cycling of the start control, however briefly, even if the engine operates normally for the remainder of the flight. This definition excludes the airborne cessation of the functioning of an engine when immediately followed by an automatic engine relight and when an engine does not achieve desired thrust or power but is not shutdown.

* * * * *

■ 3. Amend § 1.2 by adding the following abbreviations in alphabetical order to read as follows:

§ 1.2 Abbreviations and symbols

* * * * *

AFM means airplane flight manual.

* * * * *

APU means auxiliary power unit.

* * * * *

ATS means Air Traffic Service.

CAMP means continuous airworthiness maintenance program.

* * * * *

CHDO means an FAA Flight Standards certificate holding district office.

CMP means configuration, maintenance, and procedures.

* * * * *

Equi-Time Point means a point on the route of flight where the flight time, considering wind, to each of two selected airports is equal.

ETOPS means extended operations.

* * * * *

IFSD means in-flight shutdown.

* * * * *

MEL means minimum equipment list.

* * * * *

NOPAC means North Pacific area of operation.

* * * * *

OPSPECS means operations specifications.

PACOTS means Pacific Organized Track System.

* * * * *

PTRS means Performance Tracking and Reporting System.

* * * * *

RFFS means rescue and firefighting services.

* * * * *

SATCOM means satellite communications.

* * * * *

PART 21—CERTIFICATION PROCEDURES FOR PRODUCTS AND PARTS

■ 4. 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, 44701–44702, 44707, 44709, 44711, 44713, 44715, 45303.

■ 5. Add § 21.4 to read as follows:

§ 21.4 ETOPS reporting requirements.

(a) *Early ETOPS: reporting, tracking, and resolving problems.* The holder of a type certificate for an airplane-engine combination approved using the Early ETOPS method specified in part 25, Appendix K, of this chapter must use a system for reporting, tracking, and resolving each problem resulting in one of the occurrences specified in paragraph (a)(6) of this section.

(1) The system must identify how the type certificate holder will promptly identify problems, report them to the responsible FAA aircraft certification office, and propose a solution to the FAA to resolve each problem. A proposed solution must consist of—

(i) A change in the airplane or engine type design;

(ii) A change in a manufacturing process;

(iii) A change in an operating or maintenance procedure; or

(iv) Any other solution acceptable to the FAA.

(2) For an airplane with more than two engines, the system must be in place for the first 250,000 world fleet engine-hours for the approved airplane-engine combination.

(3) For two-engine airplanes, the system must be in place for the first 250,000 world fleet engine-hours for the approved airplane-engine combination and after that until—

(i) The world fleet 12-month rolling average IFSD rate is at or below the rate required by paragraph (b)(2) of this section; and

(ii) The FAA determines that the rate is stable.

(4) For an airplane-engine combination that is a derivative of an airplane-engine combination previously approved for ETOPS, the system need only address those problems specified in the following table, provided the type certificate holder obtains prior authorization from the FAA:

If the change does not require a new airplane type certificate and . . .	Then the Problem Tracking and Resolution System must address . . .
(i) Requires a new engine type certificate	All problems applicable to the new engine installation, and for the remainder of the airplane, problems in changed systems only.
(ii) Does not require a new engine type certificate	Problems in changed systems only.

(5) The type certificate holder must identify the sources and content of data that it will use for its system. The data must be adequate to evaluate the specific cause of any in-service problem reportable under this section or § 21.3(c) that could affect the safety of ETOPS.

(6) In implementing this system, the type certificate holder must report the following occurrences:

(i) IFSDs, except planned IFSDs performed for flight training.

(ii) For two-engine airplanes, IFSD rates.

(iii) Inability to control an engine or obtain desired thrust or power.

(iv) Precautionary thrust or power reductions.

(v) Degraded ability to start an engine in flight.

(vi) Inadvertent fuel loss or unavailability, or uncorrectable fuel imbalance in flight.

(vii) Turn backs or diversions for failures, malfunctions, or defects associated with an ETOPS group 1 significant system.

(viii) Loss of any power source for an ETOPS group 1 significant system, including any power source designed to provide backup power for that system.

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

(x) Any unscheduled engine removal for a condition that could result in one of the reportable occurrences listed in this paragraph.

(b) *Reliability of two-engine airplanes*—(1) *Reporting of two-engine airplane in-service reliability.* The holder of a type certificate for an airplane approved for ETOPS and the holder of a type certificate for an engine installed on an airplane approved for ETOPS must report monthly to their respective FAA type certificate holding office on the reliability of the world fleet of those airplanes and engines. The report provided by both the airplane and engine type certificate holders must address each airplane-engine combination approved for ETOPS. The FAA may approve quarterly reporting if the airplane-engine combination demonstrates an IFSD rate at or below those specified in paragraph (b)(2) of this section for a period acceptable to the FAA. This reporting may be combined with the reporting required by § 21.3. The responsible type certificate holder must investigate any cause of an IFSD resulting from an occurrence attributable to the design of its product and report the results of that investigation to its FAA office responsible for administering its type certificate. Reporting must include:

(i) Engine IFSDs, except planned IFSDs performed for flight training.

(ii) The world fleet 12-month rolling average IFSD rates for all causes, except planned IFSDs performed for flight training.

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

(2) *World fleet IFSD rate for two-engine airplanes.* The holder of a type certificate for an airplane approved for ETOPS and the holder of a type certificate for an engine installed on an airplane approved for ETOPS must issue service information to the operators of those airplanes and engines, as appropriate, to maintain the world fleet 12-month rolling average IFSD rate at or below the following levels:

(i) A rate of 0.05 per 1,000 world-fleet engine-hours for an airplane-engine combination approved for up to and including 120-minute ETOPS. When all ETOPS operators have complied with the corrective actions required in the configuration, maintenance and procedures (CMP) document as a condition for ETOPS approval, the rate to be maintained is at or below 0.02 per 1,000 world-fleet engine-hours.

(ii) A rate of 0.02 per 1,000 world-fleet engine-hours for an airplane-engine combination approved for up to and including 180-minute ETOPS, including airplane-engine combinations approved for 207-minute ETOPS in the North Pacific operating area under appendix P, section I, paragraph (h), of part 121 of this chapter.

(iii) A rate of 0.01 per 1,000 world-fleet engine-hours for an airplane-engine combination approved for ETOPS beyond 180 minutes, excluding airplane-engine combinations approved for 207-minute ETOPS in the North Pacific operating area under appendix P, section I, paragraph (h), of part 121 of this chapter.

PART 25—AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY AIRPLANES

■ 6. The authority citation for part 25 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701, 44702 and 44704.

■ 7. Add § 25.3 to subpart A to read as follows:

§ 25.3 Special provisions for ETOPS type design approvals.

(a) *Applicability.* This section applies to an applicant for ETOPS type design approval of an airplane:

(1) That has an existing type certificate on February 15, 2007; or

(2) For which an application for an original type certificate was submitted before February 15, 2007.

(b) *Airplanes with two engines.* (1) For ETOPS type design approval of an airplane up to and including 180 minutes, an applicant must comply with § 25.1535, except that it need not comply with the following provisions of Appendix K, K25.1.4, of this part:

(i) K25.1.4(a), fuel system pressure and flow requirements;

(ii) K25.1.4(a)(3), low fuel alerting; and

(iii) K25.1.4(c), engine oil tank design.

(2) For ETOPS type design approval of an airplane beyond 180 minutes an applicant must comply with § 25.1535.

(c) *Airplanes with more than two engines.* An applicant for ETOPS type design approval must comply with § 25.1535 for an airplane manufactured on or after February 17, 2015, except that, for an airplane configured for a three person flight crew, the applicant need not comply with Appendix K, K25.1.4(a)(3), of this part, low fuel alerting.

■ 8. Add § 25.1535 to read as follows:

§ 25.1535 ETOPS approval.

Except as provided in § 25.3, each applicant seeking ETOPS type design approval must comply with the provisions of Appendix K of this part.

■ 9. Add Appendix K to read as follows:

Appendix K to PART 25—EXTENDED OPERATIONS (ETOPS)

This appendix specifies airworthiness requirements for the approval of an airplane-engine combination for extended operations (ETOPS). For two-engine airplanes, the applicant must comply with sections K25.1 and K25.2 of this appendix. For airplanes with more than two engines, the applicant must comply with sections K25.1 and K25.3 of this appendix.

K25.1 *Design requirements.*

K25.1.1 *Part 25 compliance.*

The airplane-engine combination must comply with the requirements of part 25 considering the maximum flight time and the longest diversion time for which the applicant seeks approval.

K25.1.2 *Human factors.*

An applicant must consider crew workload, operational implications, and the crew's and passengers' physiological needs during continued operation with failure effects for the longest diversion time for which it seeks approval.

K25.1.3 *Airplane systems.*

(a) *Operation in icing conditions.*

(1) The airplane must be certificated for operation in icing conditions in accordance with § 25.1419.

(2) The airplane must be able to safely conduct an ETOPS diversion with the most critical ice accretion resulting from:

(i) Icing conditions encountered at an altitude that the airplane would have to fly following an engine failure or cabin decompression.

(ii) A 15-minute hold in the continuous maximum icing conditions specified in Appendix C of this part with a liquid water content factor of 1.0.

(iii) Ice accumulated during approach and landing in the icing conditions specified in Appendix C of this part.

(b) *Electrical power supply.* The airplane must be equipped with at least three independent sources of electrical power.

(c) *Time limited systems.* The applicant must define the system time capability of each ETOPS significant system that is time-limited.

K25.1.4 *Propulsion systems.*

(a) *Fuel system design.* Fuel necessary to complete an ETOPS flight (including a diversion for the longest time for which the applicant seeks approval) must be available to the operating engines at the pressure and fuel-flow required by § 25.955 under any airplane failure condition not shown to be extremely improbable. Types of failures that must be considered include, but are not limited to: crossfeed valve failures, automatic fuel management system failures, and normal electrical power generation failures.

(1) If the engine has been certified for limited operation with negative engine-fuel-pump-inlet pressures, the following requirements apply:

(i) Airplane demonstration-testing must cover worst case cruise and diversion conditions involving:

(A) Fuel grade and temperature.

(B) Thrust or power variations.

(C) Turbulence and negative G.

(D) Fuel system components degraded within their approved maintenance limits.

(ii) Unusable-fuel quantity in the suction feed configuration must be determined in accordance with § 25.959.

(2) For two-engine airplanes to be certificated for ETOPS beyond 180 minutes, one fuel boost pump in each main tank and at least one crossfeed valve, or other means for transferring fuel, must be powered by an independent electrical power source other than the three power sources required to comply with section K25.1.3(b) of this appendix. This requirement does not apply if the normal fuel boost pressure, crossfeed valve actuation, or fuel transfer capability is not provided by electrical power.

(3) An alert must be displayed to the flightcrew when the quantity of fuel available to the engines falls below the level required to fly to the destination. The alert must be given when there is enough fuel remaining to safely complete a diversion. This alert must account for abnormal fuel management or transfer between tanks, and possible loss of fuel. This paragraph does not apply to airplanes with a required flight engineer.

(b) *APU design.* If an APU is needed to comply with this appendix, the applicant must demonstrate that:

(1) The reliability of the APU is adequate to meet those requirements; and

(2) If it is necessary that the APU be able to start in flight, it is able to start at any altitude up to the maximum operating altitude of the airplane, or 45,000 feet, whichever is lower, and run for the remainder of any flight .

(c) *Engine oil tank design.* The engine oil tank filler cap must comply with § 33.71(c)(4) of this chapter.

K25.1.5 *Engine-condition monitoring.*

Procedures for engine-condition monitoring must be specified and validated in accordance with Part 33, Appendix A, paragraph A33.3(c) of this chapter.

K25.1.6 *Configuration, maintenance, and procedures.*

The applicant must list any configuration, operating and maintenance requirements, hardware life limits, MMEL constraints, and ETOPS approval in a CMP document.

K25.1.7 *Airplane flight manual.*

The airplane flight manual must contain the following information applicable to the ETOPS type design approval:

(a) Special limitations, including any limitation associated with operation of the airplane up to the maximum diversion time being approved.

(b) Required markings or placards.

(c) The airborne equipment required for extended operations and flightcrew operating procedures for this equipment.

(d) The system time capability for the following:

(1) The most limiting fire suppression system for Class C cargo or baggage compartments.

(2) The most limiting ETOPS significant system other than fire suppression systems for Class C cargo or baggage compartments.

(e) This statement: ''The type-design reliability and performance of this airplane-engine combination has been evaluated under 14 CFR 25.1535 and found suitable for (identify maximum approved diversion time) extended operations (ETOPS) when the configuration, maintenance, and procedures standard contained in (identify the CMP document) are met. The actual maximum approved diversion time for this airplane may be less based on its most limiting system time capability. This finding does not constitute operational approval to conduct ETOPS.''

K25.2. *Two-engine airplanes.*

An applicant for ETOPS type design approval of a two-engine airplane must use one of the methods described in section K25.2.1, K25.2.2, or K25.2.3 of this appendix.

K25.2.1 *Service experience method.*

An applicant for ETOPS type design approval using the service experience method must comply with sections K25.2.1(a) and K25.2.1(b) of this appendix before conducting the assessments specified in sections K25.2.1(c) and K25.2.1(d) of this appendix, and the flight test specified in section K25.2.1(e) of this appendix.

(a) *Service experience.* The world fleet for the airplane-engine combination must accumulate a minimum of 250,000 engine-hours. The FAA may reduce this number of hours if the applicant identifies compensating factors that are acceptable to the FAA. The compensating factors may include experience on another airplane, but experience on the candidate airplane must make up a significant portion of the total service experience.

(b) *In-flight shutdown (IFSD) rates.* The demonstrated 12-month rolling average IFSD rate for the world fleet of the airplane-engine combination must be commensurate with the level of ETOPS approval being sought.

(1) For type design approval up to and including 120 minutes: An IFSD rate of 0.05 or less per 1,000 world-fleet engine-hours, unless otherwise approved by the FAA. Unless the IFSD rate is 0.02 or less per 1,000 world-fleet engine-hours, the applicant must provide a list of corrective actions in the CMP document specified in section K25.1.6 of this appendix, that, when taken, would result in an IFSD rate of 0.02 or less per 1,000 fleet engine-hours.

(2) For type design approval up to and including 180 minutes: An IFSD rate of 0.02 or less per 1,000 world-fleet engine-hours, unless otherwise approved by the FAA. If the airplane-engine combination does not meet this rate by compliance with an existing 120-minute CMP document, then new or additional CMP requirements that the applicant has demonstrated would achieve this IFSD rate must be added to the CMP document.

(3) For type design approval beyond 180 minutes: An IFSD rate of 0.01 or less per 1,000 fleet engine-hours unless otherwise approved by the FAA. If the airplane-engine combination does not meet this rate by compliance with an existing 120-minute or 180-minute CMP document, then new or additional CMP requirements that the applicant has demonstrated would achieve this IFSD rate must be added to the CMP document.

(c) *Propulsion system assessment.* (1) The applicant must conduct a propulsion system assessment based on the following data collected from the world-fleet of the airplane-engine combination:

(i) A list of all IFSD's, unplanned ground engine shutdowns, and occurrences (both ground and in-flight) when an engine was not shut down, but engine control or the desired thrust or power level was not achieved, including engine flameouts. Planned IFSD's performed during flight training need not be included. For each item, the applicant must provide—

(A) Each airplane and engine make, model, and serial number;

(B) Engine configuration, and major alteration history;

(C) Engine position;

(D) Circumstances leading up to the engine shutdown or occurrence;

(E) Phase of flight or ground operation;

(F) Weather and other environmental conditions; and

(G) Cause of engine shutdown or occurrence.

(ii) A history of unscheduled engine removal rates since introduction into service (using 6- and 12-month rolling averages), with a summary of the major causes for the removals.

(iii) A list of all propulsion system events (whether or not caused by maintenance or flightcrew error), including dispatch delays, cancellations, aborted takeoffs, turnbacks, diversions, and flights that continue to destination after the event.

(iv) The total number of engine hours and cycles, the number of hours for the engine with the highest number of hours, the number of cycles for the engine with the highest number of cycles, and the distribution of hours and cycles.

(v) The mean time between failures (MTBF) of propulsion system components that affect reliability.

(vi) A history of the IFSD rates since introduction into service using a 12-month rolling average.

(2) The cause or potential cause of each item listed in K25.2.1(c)(1)(i) must have a corrective action or actions that are shown to be effective in preventing future occurrences. Each corrective action must be identified in the CMP document specified in section K25.1.6. A corrective action is not required:

(i) For an item where the manufacturer is unable to determine a cause or potential cause.

(ii) For an event where it is technically unfeasible to develop a corrective action.

(iii) If the world-fleet IFSD rate—

(A) Is at or below 0.02 per 1,000 world-fleet engine-hours for approval up to and including 180-minute ETOPS; or

(B) Is at or below 0.01 per 1,000 world-fleet engine-hours for approval greater than 180-minute ETOPS.

(d) *Airplane systems assessment.* The applicant must conduct an airplane systems assessment. The applicant must show that the airplane systems comply with § 25.1309(b) using available in-service reliability data for ETOPS significant systems on the candidate airplane-engine combination. Each cause or potential cause of a relevant design, manufacturing, operational, and maintenance problem occurring in service must have a corrective action or actions that are shown to be effective in preventing future occurrences. Each corrective action must be identified in the CMP document specified in section K25.1.6 of this appendix. A corrective action is not required if the problem would not significantly impact the safety or reliability of the airplane system involved. A relevant problem is a problem with an ETOPS group 1 significant system that has or could result in, an IFSD or diversion. The applicant must include in this assessment relevant problems with similar or identical equipment installed on other types of airplanes to the extent such information is reasonably available.

(e) *Airplane flight test.* The applicant must conduct a flight test to validate the flightcrew's ability to safely conduct an ETOPS diversion with an inoperative engine and worst-case ETOPS Significant System failures and malfunctions that could occur in service. The flight test must validate the airplane's flying qualities and performance with the demonstrated failures and malfunctions.

K25.2.2 *Early ETOPS method.*

An applicant for ETOPS type design approval using the Early ETOPS method must comply with the following requirements:

(a) *Assessment of relevant experience with airplanes previously certificated under part 25.* The applicant must identify specific corrective actions taken on the candidate airplane to prevent relevant design, manufacturing, operational, and maintenance problems experienced on airplanes previously certificated under part 25 manufactured by the applicant. Specific corrective actions are not required if the nature of a problem is such that the problem would not significantly impact the safety or reliability of the airplane system involved. A relevant problem is a problem with an ETOPS group 1 significant system that has or could result in an IFSD or diversion. The applicant must include in this assessment relevant problems of supplier-provided ETOPS group 1 significant systems and similar or identical equipment used on airplanes built by other manufacturers to the extent such information is reasonably available.

(b) *Propulsion system design.* (1) The engine used in the applicant's airplane design must be approved as eligible for Early ETOPS in accordance with § 33.201 of this chapter.

(2) The applicant must design the propulsion system to preclude failures or

malfunctions that could result in an IFSD. The applicant must show compliance with this requirement by analysis, test, in-service experience on other airplanes, or other means acceptable to the FAA. If analysis is used, the applicant must show that the propulsion system design will minimize failures and malfunctions with the objective of achieving the following IFSD rates:

(i) An IFSD rate of 0.02 or less per 1,000 world-fleet engine-hours for type design approval up to and including 180 minutes.

(ii) An IFSD rate of 0.01 or less per 1,000 world-fleet engine-hours for type design approval beyond 180 minutes.

(c) *Maintenance and operational procedures.* The applicant must validate all maintenance and operational procedures for ETOPS significant systems. The applicant must identify, track, and resolve any problems found during the validation in accordance with the problem tracking and resolution system specified in section K25.2.2(h) of this appendix.

(d) *Propulsion system validation test.* (1) The installed engine configuration for which approval is being sought must comply with § 33.201(c) of this chapter. 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; and

(ii) Completely disassembled and the propulsion system hardware inspected to determine whether it meets the service limits specified in the Instructions for Continued Airworthiness submitted in compliance with § 25.1529.

(2) The applicant must identify, track, and resolve each cause or potential cause of IFSD, loss of thrust control, or other power loss encountered during this inspection in accordance with the problem tracking and resolution system specified in section K25.2.2 (h) of this appendix.

(e) *New technology testing.* Technology new to the applicant, including substantially new manufacturing techniques, must be tested to substantiate its suitability for the airplane design.

(f) *APU validation test.* If an APU is needed to comply with this appendix, one APU of the type to be certified with the airplane must be tested for 3,000 equivalent airplane operational cycles. Following completion of the test, the APU must be disassembled and inspected. The applicant must identify, track, and resolve each cause or potential cause of an inability to start or operate the APU in flight as intended in accordance with the problem tracking and resolution system specified in section K25.2.2(h) of this appendix.

(g) *Airplane demonstration.* For each airplane-engine combination to be approved for ETOPS, the applicant must flight test at least one airplane to demonstrate that the airplane, and its components and equipment are capable of functioning properly during ETOPS flights and diversions of the longest duration for which the applicant seeks approval. This flight testing may be performed in conjunction with, but may not substitute for the flight testing required by § 21.35(b)(2) of this chapter.

(1) The airplane demonstration flight test program must include:

(i) Flights simulating actual ETOPS, including flight at normal cruise altitude, step climbs, and, if applicable, APU operation.

(ii) Maximum duration flights with maximum duration diversions.

(iii) Maximum duration engine-inoperative diversions distributed among the engines installed on the airplanes used for the airplane demonstration flight test program. At least two one-engine-inoperative diversions must be conducted at maximum continuous thrust or power using the same engine.

(iv) Flights under non-normal conditions to demonstrate the flightcrew's ability to safely conduct an ETOPS diversion with worst-case ETOPS significant system failures or malfunctions that could occur in service.

(v) Diversions to airports that represent airports of the types used for ETOPS diversions.

(vi) Repeated exposure to humid and inclement weather on the ground followed by a long-duration flight at normal cruise altitude.

(2) The airplane demonstration flight test program must validate the adequacy of the airplane's flying qualities and performance, and the flightcrew's ability to safely conduct an ETOPS diversion under the conditions specified in section K25.2.2(g)(1) of this appendix.

(3) During the airplane demonstration flight test program, each test airplane must be operated and maintained using the applicant's recommended operating and maintenance procedures.

(4) At the completion of the airplane demonstration flight test program, each ETOPS significant system must undergo an on-wing inspection or test in accordance with the tasks defined in the proposed Instructions for Continued Airworthiness to establish its condition for continued safe operation. Each engine must also undergo a gas path inspection. These inspections must be conducted in a manner to identify abnormal conditions that could result in an IFSD or diversion. The applicant must identify, track and resolve any abnormal conditions in accordance with the problem tracking and resolution system specified in section K25.2.2(h) of this appendix.

(h) *Problem tracking and resolution system.* (1) The applicant must establish and maintain a problem tracking and resolution system. The system must:

(i) Contain a process for prompt reporting to the responsible FAA aircraft certification office of each occurrence reportable under § 21.4(a)(6) encountered during the phases of airplane and engine development used to assess Early ETOPS eligibility.

(ii) Contain a process for notifying the responsible FAA aircraft certification office of each proposed corrective action that the applicant determines necessary for each problem identified from the occurrences reported under section K25.2.2. (h)(1)(i) of this appendix. The timing of the notification must permit appropriate FAA review before taking the proposed corrective action.

(2) If the applicant is seeking ETOPS type design approval of a change to an airplane-engine combination previously approved for ETOPS, the problem tracking and resolution system need only address those problems specified in the following table, provided the applicant obtains prior authorization from the FAA:

If the change does not require a new airplane type certificiate and . . .	Then the Problem Tracking and Resolution System must address . . .
(i) Requires a new engine type certificate	All problems applicable to the new engine installation, and for the remainder of the airplane, problems in changed systems only.
(ii) Does not require a new engine type certificate	Problems in changed systems only.

(i) *Acceptance criteria.* The type and frequency of failures and malfunctions on ETOPS significant systems that occur during the airplane flight test program and the airplane demonstration flight test program specified in section K25.2.2(g) of this appendix must be consistent with the type and frequency of failures and malfunctions that would be expected to occur on currently certificated airplanes approved for ETOPS.

K25.2.3. *Combined service experience and Early ETOPS method.*

An applicant for ETOPS type design approval using the combined service experience and Early ETOPS method must comply with the following requirements.

(a) A service experience requirement of not less than 15,000 engine-hours for the world fleet of the candidate airplane-engine combination.

(b) The Early ETOPS requirements of K25.2.2, except for the airplane demonstration specified in section K25.2.2(g) of this appendix; and

(c) The flight test requirement of section K25.2.1(e) of this appendix.

K25.3. *Airplanes with more than two engines.*

An applicant for ETOPS type design approval of an airplane with more than two engines must use one of the methods described in section K25.3.1, K25.3.2, or K25.3.3 of this appendix.

K25.3.1 *Service experience method.*

An applicant for ETOPS type design approval using the service experience method must comply with section K25.3.1(a) of this appendix before conducting the airplane systems assessment specified in K25.3.1(b), and the flight test specified in section K25.3.1(c) of this appendix.

(a) *Service experience.* The world fleet for the airplane-engine combination must accumulate a minimum of 250,000 engine-hours. The FAA may reduce this number of hours if the applicant identifies compensating factors that are acceptable to the FAA. The compensating factors may include experience on another airplane, but experience on the candidate airplane must make up a significant portion of the total required service experience.

(b) *Airplane systems assessment.* The applicant must conduct an airplane systems assessment. The applicant must show that the airplane systems comply with the § 25.1309(b) using available in-service reliability data for ETOPS significant systems on the candidate airplane-engine combination. Each cause or potential cause of a relevant design, manufacturing, operational or maintenance problem occurring in service must have a corrective action or actions that are shown to be effective in preventing future occurrences. Each corrective action must be identified in the CMP document specified in section K25.1.6 of this appendix. A corrective action is not required if the problem would not significantly impact the safety or reliability of the airplane system involved. A relevant problem is a problem with an ETOPS group 1 significant system that has or could result in an IFSD or diversion. The applicant must include in this assessment relevant problems with similar or identical equipment installed on other types of airplanes to the extent such information is reasonably available.

(c) *Airplane flight test.* The applicant must conduct a flight test to validate the flightcrew's ability to safely conduct an ETOPS diversion with an inoperative engine and worst-case ETOPS significant system failures and malfunctions that could occur in service. The flight test must validate the airplane's flying qualities and performance with the demonstrated failures and malfunctions.

K25.3.2 Early ETOPS method.

An applicant for ETOPS type design approval using the Early ETOPS method must comply with the following requirements:

(a) *Maintenance and operational procedures.* The applicant must validate all maintenance and operational procedures for ETOPS significant systems. The applicant must identify, track and resolve any problems found during the validation in accordance with the problem tracking and resolution system specified in section K25.3.2(e) of this appendix.

(b) *New technology testing.* Technology new to the applicant, including substantially new manufacturing techniques, must be tested to substantiate its suitability for the airplane design.

(c) *APU validation test.* If an APU is needed to comply with this appendix, one APU of the type to be certified with the airplane must be tested for 3,000 equivalent airplane operational cycles. Following completion of the test, the APU must be disassembled and inspected. The applicant must identify, track, and resolve each cause or potential cause of an inability to start or operate the APU in flight as intended in accordance with the problem tracking and resolution system specified in section K25.3.2(e) of this appendix.

(d) *Airplane demonstration.* For each airplane-engine combination to be approved for ETOPS, the applicant must flight test at least one airplane to demonstrate that the airplane, and its components and equipment are capable of functioning properly during ETOPS flights and diversions of the longest duration for which the applicant seeks approval. This flight testing may be performed in conjunction with, but may not substitute for the flight testing required by § 21.35(b)(2).

(1) The airplane demonstration flight test program must include:

(i) Flights simulating actual ETOPS including flight at normal cruise altitude, step climbs, and, if applicable, APU operation.

(ii) Maximum duration flights with maximum duration diversions.

(iii) Maximum duration engine-inoperative diversions distributed among the engines installed on the airplanes used for the airplane demonstration flight test program. At least two one engine-inoperative diversions must be conducted at maximum continuous thrust or power using the same engine.

(iv) Flights under non-normal conditions to validate the flightcrew's ability to safely conduct an ETOPS diversion with worst-case ETOPS significant system failures or malfunctions that could occur in service.

(v) Diversions to airports that represent airports of the types used for ETOPS diversions.

(vi) Repeated exposure to humid and inclement weather on the ground followed by a long duration flight at normal cruise altitude.

(2) The airplane demonstration flight test program must validate the adequacy of the airplane's flying qualities and performance, and the flightcrew's ability to safely conduct an ETOPS diversion under the conditions specified in section K25.3.2(d)(1) of this appendix.

(3) During the airplane demonstration flight test program, each test airplane must be operated and maintained using the applicant's recommended operating and maintenance procedures.

(4) At the completion of the airplane demonstration, each ETOPS significant system must undergo an on-wing inspection or test in accordance with the tasks defined in the proposed Instructions for Continued Airworthiness to establish its condition for continued safe operation. Each engine must also undergo a gas path inspection. These inspections must be conducted in a manner to identify abnormal conditions that could result in an IFSD or diversion. The applicant must identify, track and resolve any abnormal conditions in accordance with the problem tracking and resolution system specified in section K25.3.2(e) of this appendix.

(e) *Problem tracking and resolution system.* (1) The applicant must establish and maintain a problem tracking and resolution system. The system must:

(i) Contain a process for prompt reporting to the responsible FAA aircraft certification office of each occurrence reportable under § 21.4(a)(6) encountered during the phases of airplane and engine development used to assess Early ETOPS eligibility.

(ii) Contain a process for notifying the responsible FAA aircraft certification office of each proposed corrective action that the applicant determines necessary for each problem identified from the occurrences reported under section K25.3.2(h)(1)(i) of this appendix. The timing of the notification must permit appropriate FAA review before taking the proposed corrective action.

(2) If the applicant is seeking ETOPS type design approval of a change to an airplane-engine combination previously approved for ETOPS, the problem tracking and resolution system need only address those problems specified in the following table, provided the applicant obtains prior authorization from the FAA:

If the change does not require a new airplane type certificate and . . .	Then the Problem Tracking and Resolution System must address . . .
(i) Requires a new engine type certificate	All problems applicable to the new engine installation, and for the remainder of the airplane, problems in changed systems only.
(ii) Does not require a new engine type certificate	Problems in changed systems only.

(f) *Acceptance criteria.* The type and frequency of failures and malfunctions on ETOPS significant systems that occur during the airplane flight test program and the airplane demonstration flight test program specified in section K25.3.2(d) of this appendix must be consistent with the type and frequency of failures and malfunctions that would be expected to occur on currently certificated airplanes approved for ETOPS.

K25.3.3 *Combined service experience and Early ETOPS method.*

An applicant for ETOPS type design approval using the Early ETOPS method must comply with the following requirements:

(a) A service experience requirement of less than 15,000 engine-hours for the world fleet of the candidate airplane-engine combination;

(b) The Early ETOPS requirements of section K25.3.2 of this appendix, except for the airplane demonstration specified in section K25.3.2(d) of this appendix; and

(c) The flight test requirement of section K25.3.1(c) of this appendix.

PART 33—AIRWORTHINESS STANDARDS: AIRCRAFT ENGINES

■ 10. The authority citation for part 33 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701–44702, 44704.

■ 11. 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 an applicant seeking eligibility for an engine to be installed on an airplane approved for ETOPS, the oil tank must be designed to prevent a hazardous loss of oil due to an incorrectly installed oil tank cap.

* * * * *

■ 12. Revise § 33.90 to read as follows:

§ 33.90 Initial maintenance inspection test.

Each applicant, except an applicant for an engine 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 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 conducted in accordance with § 33.201 (c) through (f).

■ 13. Add subpart G to read as follows:

Subpart G—Special Requirements: Turbine Aircraft Engines

§ 33.201 Design and test requirements for Early ETOPS eligibility.

An applicant seeking type design approval for an engine to be installed on a two-engine airplane approved for ETOPS without the service experience specified in part 25, Appendix K, K25.2.1 of this chapter, must comply with the following:

(a) The engine must be designed using a design quality process acceptable to the FAA, that ensures the design features of the engine minimize the occurrence of failures, malfunctions, defects, and maintenance errors that could result in an IFSD, loss of thrust control, or other power loss.

(b) The design features of the engine must address problems shown to result in an IFSD, loss of thrust control, or other power loss in the applicant's other relevant type designs approved within the past 10 years, to the extent that adequate service data is available within that 10-year period. An applicant without adequate service data must show experience with and knowledge of problem mitigating design practices equivalent to that gained from actual service experience in a manner acceptable to the FAA.

(c) Except as specified in paragraph (f) of this section, the applicant must conduct a simulated ETOPS mission cyclic endurance test in accordance with an approved test plan on an engine that substantially conforms to the type design. The test must:

(1) Include a minimum of 3,000 representative service start-stop mission cycles and three simulated diversion cycles at maximum continuous thrust or power for the maximum diversion time for which ETOPS eligibility is sought. Each start-stop mission cycle must include the use of take-off, climb, cruise, descent, approach, and landing thrust or power and the use of thrust reverse (if applicable). The diversions must be evenly distributed over the duration of the test. The last diversion must be conducted within 100 cycles of the completion of the test.

(2) 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. For engines with three main engine rotors, the intermediate speed rotor must be independently unbalanced to obtain a minimum of 90 percent of the recommended production acceptance vibration level. The required peak vibration levels must be verified during a slow acceleration and deceleration run of the test engine covering the main engine rotor operating speed ranges.

(3) Include a minimum of three million vibration cycles for each 60 rpm incremental step of the typical high-speed rotor start-stop mission cycle. The test may be conducted using any rotor speed step increment from 60 to 200 rpm provided the test encompasses the typical service start-stop cycle speed range. For incremental steps greater than 60 rpm, the minimum number of vibration cycles must be linearly increased up to ten million cycles for a 200 rpm incremental step.

(4) Include a minimum of 300,000 vibration cycles for each 60 rpm incremental step of the high-speed rotor approved operational speed range between minimum flight idle and cruise power not covered by paragraph (c)(3) of this section. The test may be conducted using any rotor speed step increment from 60 to 200 rpm provided the test encompasses the applicable speed range. For incremental steps greater than 60 rpm the minimum number of vibration cycles must be linearly increased up to 1 million for a 200 rpm incremental step.

(5) Include vibration surveys at periodic intervals throughout the test. The equivalent value of the peak vibration level observed during the surveys must meet the minimum vibration requirement of § 33.201(c)(2).

(d) Prior to the test required by paragraph (c) of this section, the engine must be subjected to a calibration test to document power and thrust characteristics.

(e) At the conclusion of the testing required by paragraph (c) of this section, the engine must:

(1) Be subjected to a calibration test at sea-level conditions. Any change in power or thrust characteristics must be within approved limits.

(2) Be visually inspected in accordance with the on-wing inspection recommendations and limits contained in the Instructions for Continued Airworthiness submitted in compliance with § 33.4.

(3) Be completely disassembled and inspected—

(i) In accordance with the applicable inspection recommendations and limits contained in the Instructions for Continued Airworthiness submitted in compliance with § 33.4;

(ii) With consideration of the causes of IFSD, loss of thrust control, or other power loss identified by paragraph (b) of this section; and

(iii) In a manner to identify wear or distress conditions that could result in an IFSD, loss of thrust control, or other power loss not specifically identified by paragraph (b) of this section or addressed within the Instructions for Continued Airworthiness.

(4) Not show wear or distress to the extent that could result in an IFSD, loss of thrust control, 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 wear or distress must have corrective action implemented through a design change, a change to maintenance instructions, or operational procedures before ETOPS eligibility is granted. The type and frequency of wear and distress that occurs during the engine test must be consistent with the type and frequency of wear and distress

that would be expected to occur on ETOPS eligible engines.

(f) An alternative mission cycle endurance test that provides an equivalent demonstration of the unbalance and vibration specified in paragraph (c) of this section may be used when approved by the FAA.

(g) For an applicant using the simulated ETOPS mission cyclic endurance test to comply with § 33.90, the test may be interrupted so that the engine may be inspected by an on-wing or other method, using criteria acceptable to the FAA, after completion of the test cycles required to comply with § 33.90(a). Following the inspection, the ETOPS test must be resumed to complete the requirements of this section.

■ 14. Add paragraph A33.3(c) to Appendix A to read as follows:

Appendix A to Part 33—Instructions for Continued Airworthiness

* * * * *

A33.3 Content

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(c) *ETOPS Requirements.* For an applicant seeking eligibility for an engine to be installed on an airplane approved for ETOPS, the Instructions for Continued Airworthiness must include procedures for engine condition monitoring. The engine condition monitoring procedures must be able to determine prior to flight, whether an engine is capable of providing, within approved engine operating limits, maximum continuous power or thrust, bleed air, and power extraction required for a relevant engine inoperative diversion. For an engine to be installed on a two-engine airplane approved for ETOPS, the engine condition monitoring procedures must be validated before ETOPS eligibility is granted.

* * * * *

PART 121—OPERATING REQUIREMENTS: DOMESTIC, FLAG, AND SUPPLEMENTAL OPERATIONS

■ 15. 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, 44901, 44903–44904, 44912, 45101–45105, 46105, 46301.

■ 16. Add § 121.7 to read as follows:

§ 121.7 Definitions.

The following definitions apply to those sections of part 121 that apply to ETOPS:

Adequate Airport means an airport that an airplane operator may list with approval from the FAA because that airport meets the landing limitations of § 121.197 and is either—

(1) An airport that meets the requirements of part 139, subpart D of this chapter, excluding those that apply to aircraft rescue and firefighting service, or

(2) A military airport that is active and operational.

ETOPS Alternate Airport means an adequate airport listed in the certificate holder's operations specifications that is designated in a dispatch or flight release for use in the event of a diversion during ETOPS. This definition applies to flight planning and does not in any way limit the authority of the pilot-in-command during flight.

ETOPS Area of Operation means one of the following areas:

(1) For turbine-engine-powered airplanes with two engines, an area beyond 60 minutes from an adequate airport, computed using a one-engine-inoperative cruise speed under standard conditions in still air.

(2) For turbine-engine-powered passenger-carrying airplanes with more than two engines, an area beyond 180 minutes from an adequate airport, computed using a one-engine-inoperative cruise speed under standard conditions in still air.

ETOPS Entry Point means the first point on the route of an ETOPS flight, determined using a one-engine-inoperative cruise speed under standard conditions in still air, that is—

(1) More than 60 minutes from an adequate airport for airplanes with two engines;

(2) More than 180 minutes from an adequate airport for passenger-carrying airplanes with more than two engines.

ETOPS Qualified Person means a person, performing maintenance for the certificate holder, who has satisfactorily completed the certificate holder's ETOPS training program.

Maximum Diversion Time means, for the purposes of ETOPS route planning, the longest diversion time authorized for a flight under the operator's ETOPS authority. It is calculated under standard conditions in still air at a one-engine-inoperative cruise speed.

North Pacific Area of Operation means Pacific Ocean areas north of 40° N latitudes including NOPAC ATS routes, and published PACOTS tracks between Japan and North America.

North Polar Area means the entire area north of 78° N latitude.

One-engine-inoperative-Cruise Speed means a speed within the certified operating limits of the airplane that is specified by the certificate holder and approved by the FAA for —

(1) Calculating required fuel reserves needed to account for an inoperative engine; or

(2) Determining whether an ETOPS alternate is within the maximum diversion time authorized for an ETOPS flight.

South Polar Area means the entire area South of 60° S latitude.

■ 17. Amend § 121.97 by revising paragraph (b)(1)(ii) to read as follows:

§ 121. 97 Airports: Required data.

* * * * *

(b) * * *

(1) * * *

(ii) Public protection. After February 15, 2008, for ETOPS beyond 180 minutes or operations in the North Polar area and South Polar area, this includes facilities at each airport or in the immediate area sufficient to protect the passengers from the elements and to see to their welfare.

* * * * *

■ 18. Amend § 121.99 by revising the section heading and adding paragraphs (c), (d) and (e) to read as follows:

§ 121.99 Communications facilities—domestic and flag operations.

* * * * *

(c) Each certificate holder conducting flag operations must provide voice communications for ETOPS where voice communication facilities are available. In determining whether facilities are available, the certificate holder must consider potential routes and altitudes needed for diversion to ETOPS Alternate Airports. Where facilities are not available or are of such poor quality that voice communication is not possible, another communication system must be substituted.

(d) Except as provided in paragraph (e) of this section, after February 15, 2008 for ETOPS beyond 180 minutes, each certificate holder conducting flag operations must have a second communication system in addition to that required by paragraph (c) of this section. That system must be able to provide immediate satellite-based voice communications of landline-telephone fidelity. The system must be able to communicate between the flight crew and air traffic services, and the flight crew and the certificate holder. In determining whether such communications are available, the certificate holder must consider potential routes and altitudes needed for diversion to ETOPS Alternate Airports. Where immediate, satellite-based voice communications are not available, or are of such poor quality that voice communication is not possible, another communication system must be substituted.

(e) Operators of two-engine turbine-powered airplanes with 207 minute

ETOPS approval in the North Pacific Area of Operation must comply with the requirements of paragraph (d) of this section as of February 15, 2007.

■ 19. Add § 121.106 to read as follows:

§ 121.106 ETOPS Alternate Airport: Rescue and fire fighting service.

(a) Except as provided in paragraph (b) of this section, the following rescue and fire fighting service (RFFS) must be available at each airport listed as an ETOPS Alternate Airport in a dispatch or flight release.

(1) For ETOPS up to 180 minutes, each designated ETOPS Alternate Airport must have RFFS equivalent to that specified by ICAO as Category 4, or higher.

(2) For ETOPS beyond 180 minutes, each designated ETOPS Alternate Airport must have RFFS equivalent to that specified by ICAO Category 4, or higher. In addition, the aircraft must remain within the ETOPS authorized diversion time from an Adequate Airport that has RFFS equivalent to that specified by ICAO Category 7, or higher.

(b) If the equipment and personnel required in paragraph (a) of this section are not immediately available at an airport, the certificate holder may still list the airport on the dispatch or flight release if the airport's RFFS can be augmented to meet paragraph (a) of this section from local fire fighting assets. A 30-minute response time for augmentation is adequate if the local assets can be notified while the diverting airplane is en route. The augmenting equipment and personnel must be available on arrival of the diverting airplane and must remain as long as the diverting airplane needs RFFS.

■ 20. Add § 121.122 to read as follows:

§ 121.122 Communications facilities—supplemental operations.

(a) Each certificate holder conducting supplemental operations other than all-cargo operations in an airplane with more than two engines must show that a two-way radio communication system or other means of communication approved by the FAA is available. It must 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) Except as provided in paragraph (d) of this section, each certificate holder conducting supplemental operations other than all-cargo operations in an airplane with more than two engines must provide voice communications for ETOPS where voice communication facilities are available. In determining whether facilities are available, the certificate holder must consider potential routes and altitudes needed for diversion to ETOPS Alternate Airports. Where facilities are not available or are of such poor quality that voice communication is not possible, another communication system must be substituted.

(c) Except as provided in paragraph (d) of this section, for ETOPS beyond 180 minutes each certificate holder conducting supplemental operations other than all-cargo operations in an airplane with more than two engines must have a second communication system in addition to that required by paragraph (b) of this section. That system must be able to provide immediate satellite-based voice communications of landline telephone-fidelity. The system must provide communication capabilities between the flight crew and air traffic services and the flight crew and the certificate holder. In determining whether such communications are available, the certificate holder must consider potential routes and altitudes needed for diversion to ETOPS Alternate Airports. Where immediate, satellite-based voice communications are not available, or are of such poor quality that voice communication is not possible, another communication system must be substituted.

(d) Operators of turbine engine powered airplanes do not need to meet the requirements of paragraphs (b) and (c) of this section until February 15, 2008.

■ 21. Amend § 121.135 by—

■ a. Redesignating paragraphs (b)(23) and (b)(24) as paragraphs (b)(25) and (b)(26);

■ b. Redesignating paragraphs (b)(10) through (b)(22) as paragraphs (b)(11) through (b)(23); and

■ c. Adding paragraphs (b)(10) and (b)(24) to read as follows:

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* * * * *

(b) * * *

(10) For ETOPS, airplane performance data to support all phases of these operations.

* * * * *

(24) After February 15, 2008, for passenger flag operations and for those supplemental operations that are not all-cargo operations outside the 48 contiguous States and Alaska,

(i) For ETOPS greater than 180 minutes a specific passenger recovery plan for each ETOPS Alternate Airport used in those operations, and

(ii) For operations in the North Polar Area and South Polar Area a specific passenger recovery plan for each diversion airport used in those operations.

* * * * *

■ 22. Amend § 121.161 by revising paragraph (a) and adding paragraph (d) to read as follows:

§ 121.161 Airplane limitations: Type of route.

(a) Except as provided in paragraph (e) of this section, unless approved by the Administrator in accordance with Appendix P of this part and authorized in the certificate holder's operations specifications, no certificate holder may operate a turbine-engine-powered airplane over a route that contains a point—

(1) Farther than a flying time from an Adequate Airport (at a one-engine-inoperative cruise speed under standard conditions in still air) of 60 minutes for a two-engine airplane or 180 minutes for a passenger-carrying airplane with more than two engines;

(2) Within the North Polar Area; or

(3) Within the South Polar Area.

* * * * *

(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 (at a one-engine-inoperative cruise speed under standard conditions in still air) from an Adequate Airport.

(e) Operators of turbine-engine powered airplanes with more than two engines do not need to meet the requirements of paragraph (a)(1) of this section until February 15, 2008.

■ 23. Add new § 121.162 to read as follows:

§ 121.162 ETOPS Type Design Approval Basis.

Except for a passenger-carrying airplane with more than two engines manufactured prior to February 17, 2015 and except for a two-engine airplane that, when used in ETOPS, is only used for ETOPS of 75 minutes or less, no certificate holder may conduct ETOPS unless the airplane has been type design approved for ETOPS and each airplane used in ETOPS complies with its CMP document as follows:

(a) For a two-engine airplane, that is of the same model airplane-engine combination that received FAA approval for ETOPS up to 180 minutes prior to February 15, 2007, the CMP document for that model airplane-engine combination in effect on February 14, 2007.

(b) For a two-engine airplane, that is not of the same model airplane-engine combination that received FAA approval for ETOPS up to 180 minutes before February 15, 2007, the CMP document for that new model airplane-engine combination issued in accordance with § 25.3(b)(1) of this chapter.

(c) For a two-engine airplane approved for ETOPS beyond 180 minutes, the CMP document for that model airplane-engine combination issued in accordance with § 25.3(b)(2) of this chapter.

(d) For an airplane with more than 2 engines manufactured on or after February 17, 2015, the CMP document for that model airplane-engine combination issued in accordance with § 25.3(c) of this chapter.

■ 24. Add § 121.374 to read as follows:

§ 121.374 Continuous airworthiness maintenance program (CAMP) for two-engine ETOPS.

In order to conduct an ETOPS flight using a two-engine airplane, each certificate holder must develop and comply with the ETOPS continuous airworthiness maintenance program, as authorized in the certificate holder's operations specifications, for each airplane-engine combination used in ETOPS. The certificate holder must develop this ETOPS CAMP by supplementing the manufacturer's maintenance program or the CAMP currently approved for the certificate holder. This ETOPS CAMP must include the following elements:

(a) *ETOPS maintenance document.* The certificate holder must have an ETOPS maintenance document for use by each person involved in ETOPS.

(1) The document must—

(i) List each ETOPS significant system,

(ii) Refer to or include all of the ETOPS maintenance elements in this section,

(iii) Refer to or include all supportive programs and procedures,

(iv) Refer to or include all duties and responsibilities, and

(v) Clearly state where referenced material is located in the certificate holder's document system.

(b) *ETOPS pre-departure service check.* Except as provided in Appendix P of this part, the certificate holder must develop a pre-departure check tailored to their specific operation.

(1) The certificate holder must complete a pre-departure service check immediately before each ETOPS flight.

(2) At a minimum, this check must—

(i) Verify the condition of all ETOPS Significant Systems;

(ii) Verify the overall status of the airplane by reviewing applicable maintenance records; and

(iii) Include an interior and exterior inspection to include a determination of engine and APU oil levels and consumption rates.

(3) An appropriately certificated mechanic that is ETOPS Qualified must accomplish and certify by signature, ETOPS specific tasks. A certificated mechanic, with an airframe and powerplant rating, who is ETOPS Qualified must certify by signature, that the ETOPS pre-departure service check has been completed.

(c) *Limitations on dual maintenance.*

(1) Except as specified in paragraph (c)(2), the certificate holder may not perform scheduled or unscheduled maintenance during the same maintenance visit on more than one ETOPS Significant System listed in the ETOPS maintenance document, if the improper maintenance could result in the failure of an ETOPS Significant System.

(2) In the event an unforeseen circumstance prevents the certificate holder from complying with paragraph (c)(1) of this section, the certificate holder may perform maintenance on more than one ETOPS Significant System provided:

(i) The maintenance action on each ETOPS Significant System is performed by a different technician, or

(ii) The maintenance action on each ETOPS Significant System is performed by the same technician under the direct supervision of a second qualified individual; and

(iii) For either paragraph (c)(2)(i) or (ii) of this section, a qualified individual conducts a ground verification test and any in-flight verification test required under the program developed pursuant to paragraph (d) of this section.

(d) *Verification program.* The certificate holder must develop and maintain a program for the resolution of discrepancies that will ensure the effectiveness of maintenance actions taken on ETOPS Significant Systems. The verification program must identify potential problems and verify satisfactory corrective action. The verification program must include ground verification and in-flight verification policy and procedures. The certificate holder must establish procedures to indicate clearly who is going to initiate the verification action and what action is necessary. The verification action may be performed on an ETOPS revenue flight provided the verification action is documented as satisfactorily completed upon reaching the ETOPS Entry Point.

(e) *Task identification.* The certificate holder must identify all ETOPS-specific tasks. An appropriately certificated mechanic that is ETOPS Qualified must accomplish and certify by signature that the ETOPS-specific task has been completed.

(f) *Centralized maintenance control procedures.* The certificate holder must develop and maintain procedures for centralized maintenance control for ETOPS.

(g) *Parts control program.* The certificate holder must develop an ETOPS parts control program to ensure the proper identification of parts used to maintain the configuration of airplanes used in ETOPS.

(h) *Reliability program.* The certificate holder must have an ETOPS reliability program. This program must be the certificate holder's existing reliability program or its Continuing Analysis and Surveillance System (CASS) supplemented for ETOPS. This program must be event-oriented and include procedures to report the events listed below, as follows:

(1) The certificate holder must report the following events within 72 hours of the occurrence to its certificate holding district office (CHDO):

(i) IFSDs, except planned IFSDs performed for flight training.

(ii) Diversions and turnbacks for failures, malfunctions, or defects associated with any airplane or engine system.

(iii) Uncommanded power or thrust changes or surges.

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

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

(vi) Failures, malfunctions or defects associated with ETOPS Significant Systems.

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

(2) The certificate holder must investigate the cause of each event listed in paragraph (h)(1) of this section and submit findings and a description of corrective action to its CHDO. The report must include the information specified in § 121.703(e). The corrective action must be acceptable to its CHDO.

(i) *Propulsion system monitoring.* (1) If the IFSD rate (computed on a 12-month rolling average) for an engine installed as part of an airplane-engine combination exceeds the following values, the certificate holder must do a comprehensive review of its operations to identify any common cause effects and systemic errors. The IFSD rate must be computed using all engines of that type in the certificate holder's entire fleet of airplanes approved for ETOPS.

(i) A rate of 0.05 per 1,000 engine hours for ETOPS up to and including 120 minutes.

(ii) A rate of 0.03 per 1,000 engine hours for ETOPS beyond 120-minutes up to and including 207 minutes in the North Pacific Area of Operation and up to and including 180 minutes elsewhere.

(iii) A rate of 0.02 per 1,000 engine hours for ETOPS beyond 207 minutes in the North Pacific Area of Operation and beyond 180 minutes elsewhere.

(2) Within 30 days of exceeding the rates above, the certificate holder must submit a report of investigation and any necessary corrective action taken to its CHDO.

(j) *Engine condition monitoring.* (1) The certificate holder must have an engine condition monitoring program to detect deterioration at an early stage and to allow for corrective action before safe operation is affected.

(2) This program must describe the parameters to be monitored, the method of data collection, the method of analyzing data, and the process for taking corrective action.

(3) The program must ensure that engine-limit margins are maintained so that a prolonged engine-inoperative diversion may be conducted at approved power levels and in all expected environmental conditions without exceeding approved engine limits. This includes approved limits for items such as rotor speeds and exhaust gas temperatures.

(k) *Oil-consumption monitoring.* The certificate holder must have an engine oil consumption monitoring program to ensure that there is enough oil to complete each ETOPS flight. APU oil consumption must be included if an APU is required for ETOPS. The operator's oil consumption limit may not exceed the manufacturer's recommendation. Monitoring must be continuous and include oil added at each ETOPS departure point. The program must compare the amount of oil added at each ETOPS departure point with the running average consumption to identify sudden increases.

(l) *APU in-flight start program.* If the airplane type certificate requires an APU but does not require the APU to run during the ETOPS portion of the flight, the certificate holder must develop and maintain a program acceptable to the FAA for cold soak in-flight start-and-run reliability.

(m) *Maintenance training.* For each airplane-engine combination, the certificate holder must develop a maintenance training program that provides training adequate to support ETOPS. It must include ETOPS specific training for all persons involved in ETOPS maintenance that focuses on the special nature of ETOPS. This training must be in addition to the operator's maintenance training program used to qualify individuals to perform work on specific airplanes and engines.

(n) *Configuration, maintenance, and procedures (CMP) document.* If an airplane-engine combination has a CMP document, the certificate holder must use a system that ensures compliance with the applicable FAA-approved document.

(o) *Procedural changes.* Each substantial change to the maintenance or training procedures that were used to qualify the certificate holder for ETOPS, must be submitted to the CHDO for review. The certificate holder cannot implement a change until its CHDO notifies the certificate holder that the review is complete.

■ 25. Amend § 121.415 by adding paragraph (a)(4) to read as follows:

§ 121.415 Crewmember and dispatcher training requirements.

(a) * * *

(4) After February 15, 2008, training for crewmembers and dispatchers in their roles and responsibilities in the certificate holder's passenger recovery plan, if applicable.

* * * * *

■ 26. Amend § 121.565 by revising paragraphs (a), (b) introductory text, (b)(2) and (c) to read as follows:

§ 121.565 Engine inoperative: Landing; reporting.

(a) Except as provided in paragraph (b) of this section, whenever an airplane engine fails or whenever an engine is shutdown to prevent possible damage, the pilot in command must land the airplane at the nearest suitable airport, in point of time, at which a safe landing can be made.

(b) If not more than one engine of an airplane that has three or more engines fails or is shut down to prevent possible damage, the pilot-in-command may proceed to an airport that the pilot selects if, after considering the following, the pilot makes a reasonable decision that proceeding to that airport is as safe as landing at the nearest suitable airport:

* * * * *

(2) The altitude, weight, and useable fuel at the time that the engine is shutdown.

* * * * *

(c) The pilot-in-command must report each engine shutdown in flight to the appropriate ground radio station as soon as practicable and must keep that station fully informed of the progress of the flight.

* * * * *

■ 27. Add § 121.624 to read as follows:

§ 121.624 ETOPS Alternate Airports.

(a) No person may dispatch or release an airplane for an ETOPS flight unless enough ETOPS Alternate Airports are listed in the dispatch or flight release such that the airplane remains within the authorized ETOPS maximum diversion time. In selecting these ETOPS Alternate Airports, the certificate holder must consider all adequate airports within the authorized ETOPS diversion time for the flight that meet the standards of this part.

(b) No person may list an airport as an ETOPS Alternate Airport in a dispatch or flight release unless, when it might be used (from the earliest to the latest possible landing time)—

(1) The appropriate weather reports or forecasts, or any combination thereof, indicate that the weather conditions will be at or above the ETOPS Alternate Airport minima specified in the certificate holder's operations specifications; and

(2) The field condition reports indicate that a safe landing can be made.

(c) Once a flight is en route, the weather conditions at each ETOPS Alternate Airport must meet the requirements of § 121.631 (c).

(d) No person may list an airport as an ETOPS Alternate Airport in the dispatch or flight release unless that airport meets the public protection requirements of § 121.97(b)(1)(ii).

■ 28. Revise § 121.625 to read as follows:

§ 121.625 Alternate Airport weather minima.

Except as provided in § 121.624 for ETOPS Alternate Airports, 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 minima specified in the certificate holder's operations specifications for that airport when the flight arrives.

■ 29. Amend § 121.631 by redesignating paragraphs (c) and (d) as paragraphs (f) and (g), respectively, and adding paragraphs (c), (d), and (e) to read as follows:

§ 121.631 Original dispatch or flight release, redispatch or amendment of dispatch or flight release.

* * * * *

(c) No person may allow a flight to continue beyond the ETOPS Entry Point unless—

(1) Except as provided in paragraph (d) of this section, the weather conditions at each ETOPS Alternate Airport required by § 121.624 are forecast to be at or above the operating minima for that airport in the certificate holder's operations specifications when it might be used (from the earliest to the latest possible landing time); and

(2) All ETOPS Alternate Airports within the authorized ETOPS maximum diversion time are reviewed and the flight crew advised of any changes in conditions that have occurred since dispatch.

(d) If paragraph (c)(1) of this section cannot be met for a specific airport, the dispatch or flight release may be amended to add an ETOPS Alternate Airport within the maximum ETOPS diversion time that could be authorized for that flight with weather conditions at or above operating minima.

(e) Before the ETOPS Entry Point, the pilot in command for a supplemental operator or a dispatcher for a flag operator must use company communications to update the flight plan if needed because of a re-evaluation of aircraft system capabilities.

■ 30. Add § 121.633 to read as follows:

§ 121.633 Considering time-limited systems in planning ETOPS alternates.

(a) For ETOPS up to and including 180 minutes, no person may list an airport as an ETOPS Alternate Airport in a dispatch or flight release if the time needed to fly to that airport (at the approved one-engine inoperative cruise speed under standard conditions in still air) would exceed the approved time for the airplane's most limiting ETOPS Significant System (including the airplane's most limiting fire suppression system time for those cargo and baggage compartments required by regulation to have fire-suppression systems) minus 15 minutes.

(b) For ETOPS beyond 180 minutes, no person may list an airport as an ETOPS Alternate Airport in a dispatch or flight release if the time needed to fly to that airport:

(1) at the all engine operating cruise speed, corrected for wind and temperature, exceeds the airplane's most limiting fire suppression system time minus 15 minutes for those cargo and baggage compartments required by regulation to have fire suppression systems (except as provided in paragraph (c) of this section), or

(2) at the one-engine-inoperative cruise speed, corrected for wind and temperature, exceeds the airplane's most limiting ETOPS Significant System time (other than the airplane's most limiting fire suppression system time minus 15 minutes for those cargo and baggage compartments required by regulation to have fire-suppression systems).

(c) For turbine-engine powered airplanes with more than two engines, the certificate holder need not meet paragraph (b)(1) of this section until February 15, 2013.

■ 31. 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 a turbine-engine powered airplane with more than two engines for a flight more than 90 minutes (with all engines operating at cruise power) from an Adequate Airport unless the following fuel supply requirements are met:

(1) The airplane has enough fuel to meet the requirements of § 121.645(b);

(2) The airplane has enough fuel to fly to the Adequate Airport—

(i) Assuming a rapid decompression at the most critical point;

(ii) Assuming a descent to a safe altitude in compliance with the oxygen supply requirements of § 121.333; and

(iii) Considering expected wind and other weather conditions.

(3) The airplane has enough fuel to hold for 15 minutes at 1500 feet above field elevation and conduct a normal approach and landing.

(b) No person may dispatch or release for flight an ETOPS flight unless, considering wind and other weather conditions expected, it has the fuel otherwise required by this part and enough fuel to satisfy each of the following requirements:

(1) Fuel to fly to an ETOPS Alternate Airport.

(i) Fuel to account for rapid decompression and engine failure. The airplane must carry the greater of the following amounts of fuel:

(A) Fuel sufficient to fly to an ETOPS 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 § 121.333 of this chapter;

(B) Fuel sufficient to fly to an ETOPS Alternate Airport (at the 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 requirements of § 121.133 of this chapter; or

(C) Fuel sufficient to fly to an ETOPS Alternate Airport (at the 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) Fuel to account for errors in wind forecasting. In calculating the amount of fuel required by paragraph (b)(1)(i) of this section, the certificate holder must increase the actual forecast wind speed by 5% (resulting in an increase in headwind or a decrease in tailwind) to account for any potential errors in wind forecasting. If a certificate holder is not using the actual forecast wind based on a wind model accepted by the FAA, the airplane must carry additional fuel equal to 5% of the fuel required for paragraph (b)(1)(i) of this section, as reserve fuel to allow for errors in wind data.

(iii) Fuel to account for icing. In calculating the amount of fuel required by paragraph (b)(1)(i) of this section (after completing the wind calculation in paragraph (b)(1)(ii) of this section), the certificate holder must ensure that the airplane carries the greater of the following amounts of fuel in anticipation of possible icing during the diversion:

(A) Fuel that would be burned as a result of airframe icing during 10 percent of the time icing is forecast (including the fuel used by engine and wing anti-ice during this period).

(B) Fuel that would be used for engine anti-ice, and if appropriate wing anti-ice, for the entire time during which icing is forecast.

(iv) Fuel to account for engine deterioration. In calculating the amount of fuel required by paragraph (b)(1)(i) of this section (after completing the wind calculation in paragraph (b)(1)(ii) of this section), the airplane also carries fuel equal to 5% of the fuel specified above, to account for deterioration in cruise fuel burn performance unless the certificate holder has a program to monitor airplane in-service deterioration to cruise fuel burn performance.

(2) Fuel to account for holding, approach, and landing. In addition to the fuel required by paragraph (b)(1) of this section, the airplane must carry fuel sufficient to hold at 1500 feet above field elevation for 15 minutes upon reaching an ETOPS Alternate Airport

and then conduct an instrument approach and land.

(3) Fuel to account for APU use. If an APU is a required power source, the certificate holder must account for its fuel consumption during the appropriate phases of flight.

■ 32. 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 diversion time for which the flight is dispatched.

* * * * *

■ 33. 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 diversion time for which the flight is released.

* * * * *

■ 34. Add Appendix P to read as follows:

Appendix P to Part 121—Requirements for ETOPS and Polar Operations

The FAA approves ETOPS in accordance with the requirements and limitations in this appendix.

Section I. *ETOPS Approvals: Airplanes with Two engines.*

(a) *Propulsion system reliability for ETOPS.* (1) Before the FAA grants ETOPS operational approval, the operator must be able to demonstrate the ability to achieve and maintain the level of propulsion system reliability, if any, that is required by § 21.4(b)(2) of this chapter for the ETOPS-approved airplane-engine combination to be used.

(2) Following ETOPS operational approval, the operator must monitor the propulsion system reliability for the airplane-engine combination used in ETOPS, and take action as required by § 121.374(i) for the specified IFSD rates.

(b) *75 Minutes ETOPS*—(1) *Caribbean/Western Atlantic Area.* The FAA grants approvals to conduct

ETOPS with maximum diversion times up to 75 minutes on Western Atlantic/Caribbean area routes as follows:

(i) The FAA reviews the airplane-engine combination to ensure the absence of factors that could prevent safe operations. The airplane-engine combination need not be type-design-approved for ETOPS; however, it must have sufficient favorable experience to demonstrate to the Administrator a level of reliability appropriate for 75-minute ETOPS.

(ii) The certificate holder must comply with the requirements of § 121.633 for time-limited system planning.

(iii) The certificate holder must operate in accordance with the ETOPS authority as contained in its operations specifications.

(iv) The certificate holder must comply with the maintenance program requirements of § 121.374, except that a pre-departure service check before departure of the return flight is not required.

(2) *Other Areas.* The FAA grants approvals to conduct ETOPS with maximum diversion times up to 75 minutes on other than Western Atlantic/Caribbean area routes as follows:

(i) The FAA reviews the airplane-engine combination to ensure the absence of factors that could prevent safe operations. The airplane-engine combination need not be type-design-approved for ETOPS; however, it must have sufficient favorable experience to demonstrate to the Administrator a level of reliability appropriate for 75-minute ETOPS.

(ii) The certificate holder must comply with the requirements of § 121.633 for time-limited system planning.

(iii) The certificate holder must operate in accordance with the ETOPS authority as contained in its operations specifications.

(iv) The certificate holder must comply with the maintenance program requirements of § 121.374.

(v) The certificate holder must comply with the MEL in its operations specifications for 120-minute ETOPS.

(c) *90-minutes ETOPS (Micronesia).* The FAA grants approvals to conduct ETOPS with maximum diversion times up to 90 minutes on Micronesian area routes as follows:

(1) The airplane-engine combination must be type-design approved for ETOPS of at least 120-minutes.

(2) The certificate holder must operate in accordance with the ETOPS authority as contained in its operations specifications.

(3) The certificate holder must comply with the maintenance program requirements of § 121.374, except that a pre-departure service check before departure of the return flight is not required.

(4) The certificate holder must comply with the MEL requirements in its operations specifications for 120-minute ETOPS.

(d) *120-minute ETOPS.* The FAA grants approvals to conduct ETOPS with maximum diversion times up to 120 minutes as follows:

(1) The airplane-engine combination must be type-design-approved for ETOPS of at least 120 minutes.

(2) The certificate holder must operate in accordance with the ETOPS authority as contained in its operations specifications.

(3) The certificate holder must comply with the maintenance program requirements of § 121.374.

(4) The certificate holder must comply with the MEL requirements for 120-minute ETOPS.

(e) *138-Minute ETOPS.* The FAA grants approval to conduct ETOPS with maximum diversion times up to 138 minutes as follows:

(1) *Operators with 120-minute ETOPS approval.* The FAA grants 138-minute ETOPS approval as an extension of an existing 120-minute ETOPS approval as follows:

(i) The authority may be exercised only for specific flights for which the 120-minute diversion time must be exceeded.

(ii) For these flight-by-flight exceptions, the airplane-engine combination must be type-design-approved for ETOPS up to at least 120 minutes. The capability of the airplane's time-limited systems may not be less than 138 minutes calculated in accordance with § 121.633.

(iii) The certificate holder must operate in accordance with the ETOPS authority as contained in its operations specifications.

(iv) The certificate holder must comply with the maintenance program requirements of § 121.374.

(v) The certificate holder must comply with minimum equipment list (MEL) requirements in its operations specifications for ''beyond 120 minutes ETOPS''. Operators without a ''beyond 120-minute ETOPS'' MEL may apply to AFS–200 through their certificate holding district office for a modified MEL which satisfies the master MEL policy for system/component relief in ETOPS beyond 120 minutes.

(vi) The certificate holder must conduct training for maintenance, dispatch, and flight crew personnel regarding differences between 138-minute ETOPS authority and its previously-approved 120-minute ETOPS authority.

(2) *Operators with existing 180-minute ETOPS approval.* The FAA grants approvals to conduct 138-minute ETOPS (without the limitation in paragraph (e)(1)(i) of section I of this appendix) to certificate holders with existing 180-minute ETOPS approval as follows:

(i) The airplane-engine combination must be type-design-approved for ETOPS of at least 180 minutes.

(ii) The certificate holder must operate in accordance with the ETOPS authority as contained in its operations specifications.

(iii) The certificate holder must comply with the maintenance program requirements of § 121.374.

(iv) The certificate holder must comply with the MEL requirements for ''beyond 120 minutes ETOPS.''

(v) The certificate holder must conduct training for maintenance, dispatch and flight crew personnel for differences between 138-minute ETOPS diversion approval and its previously approved 180-minute ETOPS diversion authority.

(f) *180-minute ETOPS.* The FAA grants approval to conduct ETOPS with diversion times up to 180 minutes as follows:

(1) For these operations the airplane-engine combination must be type-design-approved for ETOPS of at least 180 minutes.

(2) The certificate holder must operate in accordance with the ETOPS authority as contained in its operations specifications.

(3) The certificate holder must comply with the maintenance program requirements of § 121.374.

(4) The certificate holder must comply with the MEL requirements for ''beyond 120 minutes ETOPS.''

(g) *Greater than 180-minute ETOPS.* The FAA grants approval to conduct ETOPS greater than 180 minutes. The following are requirements for all operations greater than 180 minutes.

(1) The FAA grants approval only to certificate holders with existing 180-minute ETOPS operating authority for the airplane-engine combination to be operated.

(2) The certificate holder must have previous ETOPS experience satisfactory to the Administrator.

(3) In selecting ETOPS Alternate Airports, the operator must make every effort to plan ETOPS with maximum diversion distances of 180 minutes or less, if possible. If conditions necessitate using an ETOPS Alternate Airport beyond 180 minutes, the route may be flown only if the requirements for the specific operating area in paragraph (h) or (i) of section I of this appendix are met.

(4) The certificate holder must inform the flight crew each time an airplane is proposed for dispatch for greater than 180 minutes and tell them why the route was selected.

(5) In addition to the equipment specified in the certificate holder's MEL for 180-minute ETOPS, the following systems must be operational for dispatch:

(i) The fuel quantity indicating system.

(ii) The APU (including electrical and pneumatic supply and operating to the APU's designed capability).

(iii) The auto throttle system.

(iv) The communication system required by § 121.99(d) or § 121.122(c), as applicable.

(v) One-engine-inoperative auto-land capability, if flight planning is predicated on its use.

(6) The certificate holder must operate in accordance with the ETOPS authority as contained in its operations specifications.

(7) The certificate holder must comply with the maintenance program requirements of § 121.374.

(h) *207-minute ETOPS in the North Pacific Area of Operations.* (1) The FAA grants approval to conduct ETOPS with maximum diversion times up to 207 minutes in the North Pacific Area of Operations as an extension to 180-minute ETOPS authority to be used on an exception basis. This exception may be used only on a flight-by-flight basis when an ETOPS Alternate Airport is not available within 180 minutes for reasons such as political or military concerns; volcanic activity; temporary airport conditions; and airport weather below dispatch requirements or other weather related events.

(2) The nearest available ETOPS Alternate Airport within 207 minutes diversion time must be specified in the dispatch or flight release.

(3) In conducting such a flight the certificate holder must consider Air Traffic Service's preferred track.

(4) The airplane-engine combination must be type-design-approved for ETOPS of at least 180 minutes. The approved time for the airplane's most limiting ETOPS significant system and most limiting cargo-fire suppression time for those cargo and baggage compartments required by regulation to have fire-suppression systems must be at least 222 minutes.

(5) The certificate holder must track how many times 207-minute authority is used.

(i) *240-minute ETOPS in the North Polar Area, in the area north of the NOPAC, and in the Pacific Ocean north of the equator.* (1) The FAA grants approval to conduct 240-minute ETOPS authority with maximum diversion times in the North Polar Area, in the area north of the NOPAC area, and the Pacific Ocean area north of the equator as an extension to 180-minute ETOPS authority to be used on an exception basis. This exception may be used only on a flight-by-flight basis when an ETOPS Alternate Airport is not available within 180 minutes. In that case, the nearest available ETOPS Alternate Airport within 240 minutes diversion time must be specified in the dispatch or flight release.

(2) This exception may be used in the North Polar Area and in the area north of NOPAC only in extreme conditions particular to these areas 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 decide that extreme weather precludes using an airport must be established by the certificate holder, accepted by the FAA, and published in the certificate holder's manual for the use of dispatchers and pilots.

(3) This exception may be used in the Pacific Ocean area north of the equator only for reasons such as political or military concern, volcanic activity, airport weather below dispatch requirements, temporary airport conditions and other weather related events.

(4) The airplane-engine combination must be type design approved for ETOPS greater than 180 minutes.

(j) *240-minute ETOPS in areas South of the equator.* (1) The FAA grants approval to conduct ETOPS with maximum diversion times of up to 240 minutes in the following areas:

(i) Pacific oceanic areas between the U.S. West coast and Australia, New Zealand and Polynesia.

(ii) South Atlantic oceanic areas.

(iii) Indian Ocean areas.

(iv) Oceanic areas between Australia and South America.

(2) The operator must designate the nearest available ETOPS Alternate Airports along the planned route of flight.

(3) The airplane-engine combination must be type-design-approved for ETOPS greater than 180 minutes.

(k) *ETOPS beyond 240 minutes.* (1) The FAA grants approval to conduct ETOPS with diversion times beyond 240 minutes for operations between specified city pairs on routes in the following areas:

(i) The Pacific oceanic areas between the U.S. west coast and Australia, New Zealand, and Polynesia;

(ii) The South Atlantic oceanic areas;

(iii) The Indian Oceanic areas; and

(iv) The oceanic areas between Australia and South America, and the South Polar Area.

(2) This approval is granted to certificate holders who have been operating under 180-minute or greater ETOPS authority for at least 24 consecutive months, of which at least 12 consecutive months must be under 240-minute ETOPS authority with the airplane-engine combination to be used.

(3) The operator must designate the nearest available ETOPS alternate or alternates along the planned route of flight.

(4) For these operations, the airplane-engine combination must be type-design-approved for ETOPS greater than 180 minutes.

Section II. *ETOPS Approval: Passenger-carrying Airplanes With More Than Two Engines.*

(a) The FAA grants approval to conduct ETOPS, as follows:

(1) Except as provided in § 121.162, the airplane-engine combination must be type-design-approved for ETOPS.

(2) The operator must designate the nearest available ETOPS Alternate Airports within 240 minutes diversion time (at one-engine-inoperative cruise speed under standard conditions in still air). If an ETOPS alternate is not available within 240 minutes, the operator must designate the nearest available ETOPS Alternate Airports along the planned route of flight.

(3) The MEL limitations for the authorized ETOPS diversion time apply.

(i) The Fuel Quantity Indicating System must be operational.

(ii) The communications systems required by § 121.99(d) or § 121.122(c) must be operational.

(4) The certificate holder must operate in accordance with the ETOPS authority as contained in its operations specifications.

Section III. *Approvals for operations whose airplane routes are planned to traverse either the North Polar or South Polar Areas.*

(a) Except for intrastate operations within the State of Alaska, no certificate holder may operate an aircraft in the North Polar Area or South Polar Area, unless authorized by the FAA.

(b) In addition to any of the applicable requirements of sections I and II of this appendix, the certificate holder's operations specifications must contain the following:

(1) The designation of airports that may be used for en-route diversions and the requirements the airports must meet at the time of diversion.

(2) Except for supplemental all-cargo operations, a recovery plan for passengers at designated diversion airports.

(3) A fuel-freeze strategy and procedures for monitoring fuel freezing.

(4) A plan to ensure communication capability for these operations.

(5) An MEL for these operations.

(6) A training plan for operations in these areas.

(7) A plan for mitigating crew exposure to radiation during solar flare activity.

(8) A plan for providing at least two cold weather anti-exposure suits in the aircraft, to protect crewmembers during outside activity at a diversion airport with extreme climatic conditions. The FAA may relieve the certificate holder from this requirement if the season of the year makes the equipment unnecessary.

PART 135—OPERATING REQUIREMENTS; COMMUTER AND ON DEMAND OPERATION AND RULES GOVERNING PERSONS ON BOARD SUCH AIRCRAFT

■ 35. 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.

■ 36. Add § 135.98 to read as follows:

§ 135.98 Operations in the North Polar Area.

After February 15, 2008, no certificate holder may operate an aircraft in the region north of 78° N latitude (''North Polar Area''), other than intrastate operations wholly within the state of Alaska, unless authorized by the FAA. The certificate holder's operation specifications must include the following:

(a) The designation of airports that may be used for en-route diversions and the requirements the airports must meet at the time of diversion.

(b) Except for all-cargo operations, a recovery plan for passengers at designated diversion airports.

(c) A fuel-freeze strategy and procedures for monitoring fuel freezing for operations in the North Polar Area.

(d) A plan to ensure communication capability for operations in the North Polar Area.

(e) An MEL for operations in the North Polar Area.

(f) A training plan for operations in the North Polar Area.

(g) A plan for mitigating crew exposure to radiation during solar flare activity.

(h) A plan for providing at least two cold weather anti-exposure suits in the aircraft, to protect crewmembers during outside activity at a diversion airport with extreme climatic conditions. The FAA may relieve the certificate holder from this requirement if the season of the year makes the equipment unnecessary.

■ 37. Amend § 135.345 by removing the word ''and'' from the end of paragraph (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) After February 15, 2008, passenger recovery plan for any passenger-carrying operation (other than intrastate operations wholly within the state of Alaska) in the North Polar area; and

* * * * *

■ 38. Add § 135.364 to read as follows:

§ 135.364 Maximum flying time outside the United States.

(a) After February 15, 2008, no certificate holder may operate an airplane, other than an all-cargo airplane with more than two engines, on a planned route that exceeds 180 minutes flying time (at the one-engine-inoperative cruise speed under standard conditions in still air) from an Adequate Airport outside the continental United States unless the operation is approved by the FAA in accordance with Appendix G of this part, Extended Operations (ETOPS).

(b) For the purposes of this section Adequate Airport means an airport that an airplane operator may list with approval from the FAA because that airport meets the requirements of §§ 135.385, 135.387, 135.393, 135.395, 135.219 and 135.221, as applicable.

■ 39. Amend § 135.411 by adding paragraph (d) to read as follows:

§ 135.411 Applicability.

* * * * *

(d) A certificate holder who elects to operate in accordance with § 135.364 must maintain its aircraft under paragraph (a)(2) of this section and the additional requirements of Appendix G of this part.

■ 40. Add appendix G to read as follows:

Appendix G to Part 135—Extended Operations (ETOPS)

G135.1 *Definitions.*

G135.1.1 *Adequate Airport* means an airport that an airplane operator may list with approval from the FAA because that airport meets the landing limitations of § 135.385 or is a military airport that is active and operational.

G135.1.2 *ETOPS Alternate Airport* means an adequate airport that is designated in a dispatch or flight release for use in the event of a diversion during ETOPS. This definition applies to flight planning and does not in any way limit the authority of the pilot in command during flight.

G135.1.3 *ETOPS Entry Point* means the first point on the route of an ETOPS flight, determined using a one-engine inoperative cruise speed under standard conditions in still air, that is more than 180 minutes from an adequate airport.

G135.1.4 *ETOPS Qualified Person* means a person, performing maintenance for the certificate holder, who has satisfactorily completed the certificate holder's ETOPS training program.

G135.2 *Requirements.*

G135.2.1 *General.* After February 15, 2008, no certificate holder may operate an airplane, other than an all-cargo airplane with more than two engines, outside the continental United States more than 180 minutes flying time (at the one engine inoperative cruise speed under standard conditions in still air) from an airport described in § 135.364 unless—

(a) The certificate holder receives ETOPS approval from the FAA;

(b) The operation is conducted in a multi-engine transport category turbine-powered airplane;

(c) The operation is planned to be no more than 240 minutes flying time (at the one engine inoperative cruise speed under standard conditions in still air) from an airport described in § 135.364; and

(d) The certificate holder meets the requirements of this appendix.

G135.2.2 *Required certificate holder experience prior to conducting ETOPS.*

Before applying for ETOPS approval, the certificate holder must have at least 12 months experience conducting international operations (excluding Canada and Mexico) with multi-engine transport category turbine-engine powered airplanes. The certificate holder may consider the following experience as international operations:

(a) Operations to or from the State of Hawaii.

(b) For certificate holders granted approval to operate under part 135 or part 121 before February 15, 2007, up to 6 months of domestic operating experience and operations in Canada and Mexico in multi-engine transport category turbojet-powered airplanes may be credited as part of the required 12 months of international experience required by paragraph G135.2.2(a) of this appendix.

(c) ETOPS experience with other aircraft types to the extent authorized by the FAA.

G135.2.3 *Airplane requirements.* No certificate holder may conduct ETOPS in an airplane that was manufactured after February 17, 2015 unless the airplane meets the standards of § 25.1535.

G135.2.4 *Crew information requirements.* The certificate holder must ensure that flight crews have in-flight access to current weather and operational information needed to comply with § 135.83, § 135.225, and § 135.229. This includes information on all ETOPS Alternate Airports, all destination alternates, and the destination airport proposed for each ETOPS flight.

G135.2.5 *Operational Requirements.*

(a) No person may allow a flight to continue beyond its ETOPS Entry Point unless—

(1) The weather conditions at each ETOPS Alternate Airport are forecast to be at or above the operating minima in the certificate holder's operations specifications for that airport when it might be used (from the earliest to the latest possible landing time), and

(3) All ETOPS Alternate Airports within the authorized ETOPS maximum diversion time are reviewed for any changes in conditions that have occurred since dispatch.

(b) In the event that an operator cannot comply with paragraph G135.2.5(a)(1) of this appendix for a specific airport, another ETOPS Alternate Airport must be substituted within the maximum ETOPS diversion time that could be authorized for that flight with weather conditions at or above operating minima.

(c) Pilots must plan and conduct ETOPS under instrument flight rules.

(d) *Time-Limited Systems.*

(1) Except as provided in paragraph G135.2.5(d)(3) of this appendix, the time required to fly the distance to each ETOPS Alternate Airport (at the all-engines-operating cruise speed, corrected for wind

and temperature) may not exceed the time specified in the Airplane Flight Manual for the airplane's most limiting fire suppression system time required by regulation for any cargo or baggage compartments (if installed), minus 15 minutes.

(2) Except as provided in G135.2.5(d)(3) of this appendix, the time required to fly the distance to each ETOPS Alternate Airport (at the approved one-engine-inoperative cruise speed, corrected for wind and temperature) may not exceed the time specified in the Airplane Flight Manual for the airplane's most time limited system time (other than the airplane's most limiting fire suppression system time required by regulation for any cargo or baggage compartments), minus 15 minutes.

(3) A certificate holder operating an airplane without the Airplane Flight Manual information needed to comply with paragraphs G135.2.5(d)(1) and (d)(2) of this appendix, may continue ETOPS with that airplane until February 17, 2015.

G135.2.6 *Communications Requirements.*

(a) No person may conduct an ETOPS flight unless the following communications equipment, appropriate to the route to be flown, is installed and operational:

(1) Two independent communication transmitters, at least one of which allows voice communication.

(2) Two independent communication receivers, at least one of which allows voice communication.

(3) Two headsets, or one headset and one speaker.

(b) In areas where voice communication facilities are not available, or are of such poor quality that voice communication is not possible, communication using an alternative system must be substituted.

G135.2.7 *Fuel Requirements.* No person may dispatch or release for flight an ETOPS flight unless, considering wind and other weather conditions expected, it has the fuel otherwise required by this part and enough fuel to satisfy each of the following requirements:

(a) Fuel to fly to an ETOPS Alternate Airport—(1) Fuel to account for rapid decompression and engine failure. The airplane must carry the greater of the following amounts of fuel:

(i) Fuel sufficient to fly to an ETOPS 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,

(ii) Fuel sufficient to fly to an ETOPS Alternate Airport (at the one-engine-inoperative cruise speed under standard conditions in still air) 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 requirements of § 135.157; or

(iii) Fuel sufficient to fly to an ETOPS Alternate Airport (at the one-engine-inoperative cruise speed under standard conditions in still air) assuming an engine failure at the most critical point followed by descent to the one engine inoperative cruise altitude.

(b) *Fuel to account for errors in wind forecasting.* In calculating the amount of fuel required by paragraph G135.2.7(a)(1) of this appendix, the certificate holder must increase the actual forecast wind speed by 5% (resulting in an increase in headwind or a decrease in tailwind) to account for any potential errors in wind forecasting. If a certificate holder is not using the actual forecast wind based on a wind model accepted by the FAA, the airplane must carry additional fuel equal to 5% of the fuel required by paragraph G135.2.7(a) of this appendix, as reserve fuel to allow for errors in wind data.

(c) *Fuel to account for icing.* In calculating the amount of fuel required by paragraph G135.2.7(a)(1) of this appendix, (after completing the wind calculation in G135.2.7(a)(2) of this appendix), the certificate holder must ensure that the airplane carries the greater of the following amounts of fuel in anticipation of possible icing during the diversion:

(1) Fuel that would be burned as a result of airframe icing during 10 percent of the time icing is forecast (including the fuel used by engine and wing anti-ice during this period).

(2) Fuel that would be used for engine anti-ice, and if appropriate wing anti-ice, for the entire time during which icing is forecast.

(d) *Fuel to account for engine deterioration.* In calculating the amount of fuel required by paragraph G135.2.7(a)(1) of this appendix (after completing the wind calculation in paragraph G135.2.7(a)(2) of this appendix), the certificate holder must ensure the airplane also carries fuel equal to 5% of the fuel specified above, to account for deterioration in cruise fuel burn performance unless the certificate holder has a program to monitor airplane in-service deterioration to cruise fuel burn performance.

(e) *Fuel to account for holding, approach, and landing.* In addition to the fuel required by paragraph G135.2.7 (a) of this appendix, the airplane must carry fuel sufficient to hold at 1500 feet above field elevation for 15 minutes upon reaching the ETOPS Alternate Airport and then conduct an instrument approach and land.

(f) *Fuel to account for APU use.* If an APU is a required power source, the certificate holder must account for its fuel consumption during the appropriate phases of flight.

G135.2.8 *Maintenance Program Requirements.* In order to conduct an ETOPS flight under § 135.364, each certificate holder must develop and comply with the ETOPS maintenance program as authorized in the certificate holder's operations specifications for each two-engine airplane-engine combination used in ETOPS. This provision does not apply to operations using an airplane with more than two engines. The certificate holder must develop this ETOPS maintenance program to supplement the maintenance program currently approved for the operator. This ETOPS maintenance program must include the following elements:

(a) *ETOPS maintenance document.* The certificate holder must have an ETOPS maintenance document for use by each person involved in ETOPS. The document must—

(1) List each ETOPS Significant System,

(2) Refer to or include all of the ETOPS maintenance elements in this section,

(3) Refer to or include all supportive programs and procedures,

(4) Refer to or include all duties and responsibilities, and

(5) Clearly state where referenced material is located in the certificate holder's document system.

(b) *ETOPS pre-departure service check.* The certificate holder must develop a pre-departure check tailored to their specific operation.

(1) The certificate holder must complete a pre-departure service check immediately before each ETOPS flight.

(2) At a minimum, this check must:

(i) Verify the condition of all ETOPS Significant Systems;

(ii) Verify the overall status of the airplane by reviewing applicable maintenance records; and

(iii) Include an interior and exterior inspection to include a determination of engine and APU oil levels and consumption rates.

(3) An ETOPS qualified person must accomplish all ETOPS required items specified in the ETOPS pre-departure service check and certify by signature that the check has been completed.

(c) *Limitations on dual maintenance.* (1) Except as specified in paragraph (c)(2) of this appendix, the certificate holder may not perform scheduled or unscheduled maintenance during the same maintenance visit on one or more ETOPS significant system listed in the ETOPS maintenance document, if the improper maintenance of the systems could result in the failure of an ETOPS significant system.

(2) In the event an unforeseen circumstance prevents the certificate holder from complying with paragraph G135.2.8 (c)(1) of this appendix, the certificate holder may perform maintenance on more than one ETOPS significant system provided it:

(i) Has maintenance action on each ETOPS significant system performed by a different technician, or

(ii) Has maintenance action on each ETOPS Significant System performed by the same technician under the direct supervision of a second qualified individual; and

(iii) Conducts a ground verification test and any in-flight verification test required under the program developed pursuant to paragraph G135.2.8 (d) of this appendix.

(d) *Verification program.* The certificate holder must develop a program for the resolution of discrepancies that will ensure the effectiveness of maintenance actions taken on ETOPS Significant Systems. The verification program must identify potential problems and verify satisfactory corrective action. The verification program must include ground verification and in-flight verification policy and procedures. The certificate holder must establish procedures to clearly indicate who is going to initiate the verification action and what action is necessary. The verification action may be performed on an ETOPS revenue flight provided the verification action is documented as satisfactorily completed upon reaching the ETOPS entry point.

(e) *Task identification.* The certificate holder must identify all ETOPS-specific tasks. An ETOPS qualified person must accomplish and certify by signature that the ETOPS-specific task has been completed.

(f) *Centralized maintenance control procedures.* The certificate holder must develop procedures for centralized maintenance control for ETOPS.

(g) *ETOPS parts control program.* The certificate holder must develop an ETOPS parts control program to ensure the proper identification of parts used to maintain the configuration of airplanes used in ETOPS.

(h) *Enhanced Continuing Analysis and Surveillance System (E–CASS) program.* A certificate holder's existing CASS must be enhanced to include all elements of the ETOPS maintenance program. In addition to the reporting requirements of § 135.415 and § 135.417, the program includes reporting procedures, in the form specified in § 135.415(e), for the following significant events detrimental to ETOPS within 72 hours of the occurrence to the certificate holding district office (CHDO):

(1) IFSDs, except planned IFSDs performed for flight training.

(2) Diversions and turnbacks for failures, malfunctions, or defects associated with any airplane or engine system.

(3) Uncommanded power or thrust changes or surges.

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

(5) Inadvertent fuel loss or unavailability, or uncorrectable fuel imbalance in flight.

(6) Failures, malfunctions or defects associated with ETOPS Significant Systems.

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

(i) *Propulsion system monitoring.*

The certificate holder, in coordination 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.

(j) *Engine condition monitoring.*

(1) The certificate holder must establish an engine-condition monitoring program to detect deterioration at an early stage and to allow for corrective action before safe operation is affected.

(2) This program must describe the parameters to be monitored, the method of data collection, the method of analyzing data, and the process for taking corrective action.

(3) The program must ensure that engine limit margins are maintained so that a prolonged engine-inoperative diversion may be conducted at approved power levels and in all expected environmental conditions without exceeding approved engine limits. This includes approved limits for items such as rotor speeds and exhaust gas temperatures.

(k) *Oil consumption monitoring.* The certificate holder must develop an engine oil consumption monitoring program to ensure that there is enough oil to complete each ETOPS flight. APU oil consumption must be included if an APU is required for ETOPS. The operator's consumption limit may not exceed the manufacturer's recommendation. Monitoring must be continuous and include oil added at each ETOPS departure point. The program must compare the amount of oil added at each ETOPS departure point with the running average consumption to identify sudden increases.

(l) *APU in-flight start program.* If an APU is required for ETOPS, but is not required to run during the ETOPS portion of the flight, the certificate holder must have a program acceptable to the FAA for cold soak in-flight start and run reliability.

(m) *Maintenance training.* For each airplane-engine combination, the certificate holder must develop a maintenance training program to ensure that it provides training adequate to support ETOPS. It must include ETOPS specific training for all persons involved in ETOPS maintenance that focuses on the special nature of ETOPS. This training must be in addition to the operator's maintenance training program used to qualify individuals for specific airplanes and engines.

(n) *Configuration, maintenance, and procedures (CMP) document.* The certificate holder must use a system to ensure compliance with the minimum requirements set forth in the current version of the CMP document for each airplane-engine combination that has a CMP.

(o) *Reporting.* The certificate holder must report quarterly to the CHDO and the airplane and engine manufacturer for each airplane authorized for ETOPS. The report must provide the operating hours and cycles for each airplane.

G135.2.9 *Delayed compliance date for all airplanes.* A certificate holder need not comply with this appendix for any airplane until February 15, 2008.

Issued in Washington, DC on January 4, 2007.

Marion C. Blakey,

Administrator.

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