

ETOPS Redefined

A new name and sweeping new rules for 'extended operations.'

BY PATRICK CHILES



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After more than two decades of long-range flight operations governed by a series of advisory circulars, policy letters and draft policies, the U.S. Federal Aviation Administration (FAA), with much international input, has revised its regulations to provide definitive guidance to long-haul operators. ETOPS, an acronym previously describing *extended-range twin-engine operations*, has been redefined to mean *extended operations*, the name applied to this package of regulations for all commercial multi-engine airplanes.

The development of the new rules not only has been anticipated by U.S. commercial aircraft operators but also has been closely watched by other civil aviation authorities. Australia, Canada and New Zealand intend to publish similar rules this year. Europe's Joint Aviation Authorities is developing

recommended requirements that will be harmonized with the FAA's. The International Civil Aviation Organization is crafting a proposal for member states that would consider these new rules.

The wide-ranging package of changes to U.S. Federal Aviation Regulations (FARs) Parts 1, 21, 25, 33, 121 and 135 is the product of a nearly seven-year rule-making process guided by recommendations of an FAA/industry aviation rule-making advisory committee (ARAC). The new ETOPS requirements, most of which took effect in February 2007, apply to a larger number of operators and to a greater range of operations.

The new rules have provisions to increase maximum allowable diversion times for air carriers that have been conducting ETOPS flights. The more significant changes affect three- and

four-engine airplanes, and Part 135 on-demand operators, which previously were not under the ETOPS umbrella.

As of early 2007, commercial aircraft operators and manufacturers are still examining the final rule to determine its impact. There is much to digest, so we will attempt here to describe the implications for the operator, focusing on the issues of most concern for those previously not affected by ETOPS.

Increased Diversion Times

The FAA first allowed operators to fly twin-engine airplanes on routes that did not remain within 60 minutes of an adequate alternate airport at single-engine speed in 1977, when it allowed a deviation time of up to 75 minutes for Caribbean operations.

Clearly, turbine engines and time-limited aircraft systems had become

more reliable over decades of operation. In 1985, the FAA recognized this and issued Advisory Circular 120-42, detailing how airlines could get permission to operate routes with maximum diversion times up to 120 minutes, opening up the North Atlantic to twin-engine airplanes. A subsequent revision allowing for maximum diversion times up to 180 minutes — which eventually was further revised to allow special increases to 207 minutes — opened the door to Pacific routes.

Today, twin-engine airplanes largely have displaced three- and four-engine airplanes on North Atlantic routes and have claimed a healthy share of Pacific traffic. The 2007 rules retain many of the existing maximum diversion times while extending the maximum diversion time to 240 minutes and more in some situations.

While ETOPS became accepted practice, none of its provisions were codified as FARs. As extended operations became increasingly common, it became clear that formal rule making was needed to clarify the requirements. It also became generally accepted that the safety principles used in ETOPS had great merit for use in other types of remote operations. For example, interest in transpolar routes that became viable after the collapse of the Soviet Union prompted the FAA to issue a policy letter detailing rules applying to all airplanes for, among other things, systems endurance, alternate airports and protection for passengers in the event of a diversion in extreme climes.

The ARAC codified existing procedures and “industry best practices” into a proposed comprehensive operating standard that was released in November 2003. The proposal generated vigorous public comment, which was not surprising considering its scope. In particular, operators of three- and four-engine airplanes and those operating under Part 135 would now have to carefully consider maximum diversion times instead of just equal-time points (ETPs), at which the diversion times to designated en route alternates are equal.

Aware of the many questions — especially by newly affected operators — about complying with the new rules, the FAA is working on a

new advisory circular, anticipated by mid-year, as well as new handbook guidance for its operations and maintenance inspectors. The fundamental requirements are already familiar to U.S. air carriers.

Gaining Approval

Initial approval generally requires a carrier to have at least one year of operating experience with a specific airplane to gain authority for a 120-minute diversion time and then another year of experience before gaining authority for 180 minutes. Accelerated approval is possible in six months, with the intent of validating sound processes for extended operations and ensuring a carrier’s commitment to them. These processes focus on the concept of precluding in-flight failure of engines and other critical systems, and protecting the aircraft and occupants in the event of a diversion.

Operational planning is fairly straightforward. Generally, the route of flight must remain within the approved maximum diversion time, computed using an approved single-engine cruise speed in still air and standard atmospheric conditions (Figure 1, page 14). For flag and supplemental ETOPS, Part 121.646(b) requires air carriers to plan for a sufficient fuel supply to divert to and land at an adequate airport after one of the following occurs at the most critical

The Narsarsuaq, Greenland, airport might serve as a safe haven for a light jet on an on-demand ETOPS flight over the North Atlantic.



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point on the route: an engine failure; a rapid cabin decompression necessitating descent to a safe altitude, typically 10,000 ft; or an engine failure *and* a rapid decompression.

Once the operating area is defined, the carrier is responsible for prudent flight planning with accurate forecast models and thorough operational control. Part 121.624(a) states that sufficient ETOPS alternates must be included in the flight release to ensure that the aircraft remains within the authorized maximum diversion time, based on the alternate weather minimums listed in the carrier's operations specifications (ops specs). Once the flight is under way, conditions at the alternate airports can go down to operating minimums — the published instrument approach

minimums. A pilot-in-command for a supplemental carrier or a dispatcher for a flag carrier must update the flight plan as needed for in-flight contingencies, such as changing an ETOPS alternate because of weather conditions.

For twin-engine airplanes operated under Part 121, the ETOPS diversion time threshold is unchanged from the original 60 minutes. Passenger airplanes with more than two engines and Part 135 twins have a 180-minute diversion time threshold. Any operations planned beyond those thresholds require ETOPS approval.

In addition to the obvious concern for an engine failure, route planning must consider the most time-limited aircraft system. For example, diversion time cannot exceed the time limit of cargo fire suppression minus 15 minutes, which means that the fire suppression system must be certified to 195 minutes duration for 180-minute approval.

Operations items to be validated through the approval process include:

- A proven flight planning program and dispatch program appropriate to ETOPS;
- Availability of meteorological information and an ETOPS-specific minimum equipment list (MEL);
- Initial and recurrent training, and a line-check program for ETOPS flight operations personnel; and,
- Assurance that flight crews and dispatch personnel are familiar with the ETOPS routes to be flown.

Accelerated Approval

Maintenance programs are still the keystone of any successful ETOPS program. The FAA wants to see a commitment to sound processes, demonstrated best practices and continuous monitoring for accelerated approval.

However, the FAA was convinced by comments pointing out the safe operating history of airplanes with more than two engines and agreed that carriers do not have to adopt ETOPS maintenance programs for those aircraft. Also, all-cargo

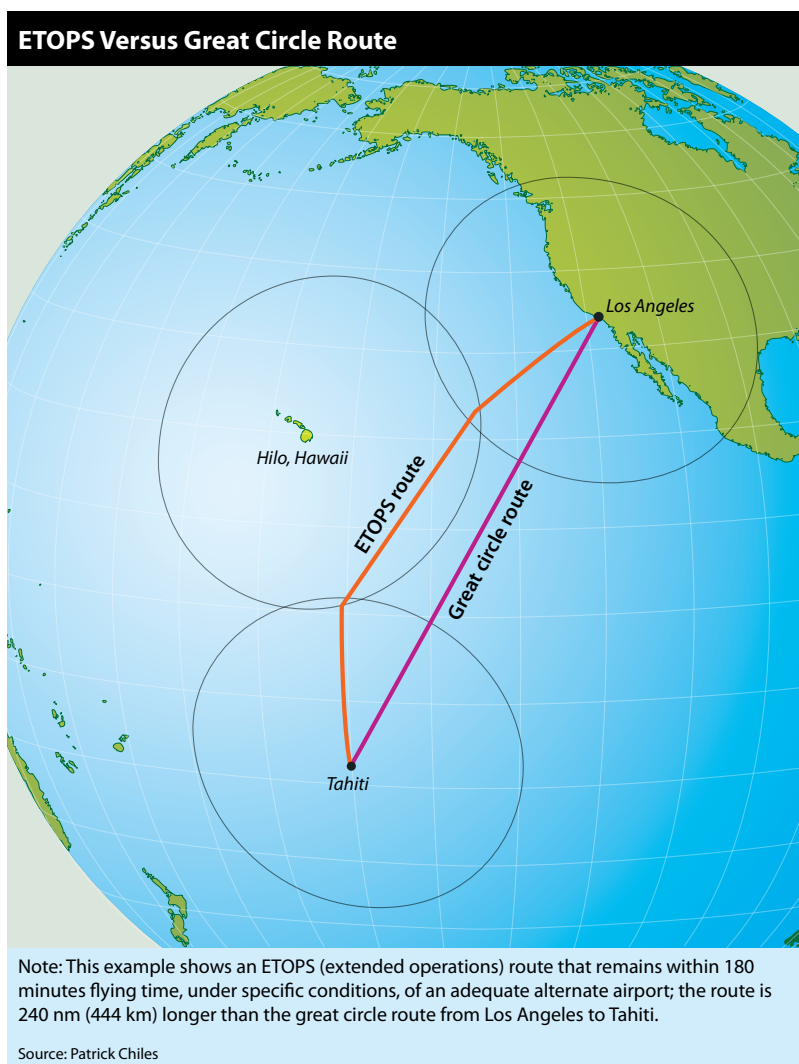


Figure 1

airplanes with more than two engines must meet only the polar operating requirements.

The following items are validated during the accelerated approval process:

- A fully developed maintenance program, including parts tracking and control;
- An ETOPS maintenance manual;
- An oil-consumption-monitoring program;
- An engine-condition-monitoring and -reporting system;
- A plan for resolving discrepancies with the airframe/engine configuration, maintenance and procedures (CMP) document;
- An ETOPS reliability program;
- A propulsion-system-monitoring program. The carrier must establish a high degree of confidence that propulsion system reliability for the requested diversion time can be maintained; and,
- ETOPS-specific qualification programs for maintenance personnel.

The airframe/engine combination must be certified for single-engine operations up to the desired maximum diversion time. This has become common for modern twins. However, it is the carrier's responsibility to keep the aircraft in compliance with the model's CMP document. Developed by the manufacturer, the CMP document includes standards for special inspections, parts control, hardware life limits and maintenance practices that the FAA considers to be the minimum acceptable level for ETOPS.

A significant maintenance requirement is the prohibition against having one technician perform the same task on left and right engines or other redundant critical systems. This protects against a repeatable error resulting in an in-flight shutdown or malfunction. There is also a requirement to use the ETOPS-specific MEL during a predeparture service check prior to each extended operation.



Polar Routes

Extended operations in polar regions also are governed by the new rules, with exceptions for intrastate operations in the state of Alaska. Effective February 2008, carriers operating in the North Polar Area (above 78 degrees north latitude) and South Polar Area (below 60 degrees south latitude) will need the following approvals in their ops specs:

- Designation of en route alternates, with passenger-recovery plans for these alternates;
- Fuel-freeze monitoring procedures;
- Propulsion-system reliability program;
- Ensured communications capability;
- A polar-operations-specific MEL;
- A plan to mitigate crew exposure to radiation during solar flare activity; and,
- Provisions for at least two cold-weather exposure suits for crewmembers.

Development of passenger-recovery plans could be a greater hurdle for a Part 121 carrier than a Part 135 operator because of the greater number of passengers. A carrier might have to keep an aircraft on standby for recovery operations. Carriers that already have authority to operate in

Operators seeking polar ETOPS approval must evaluate adequate alternates, such as the airport in Stord, Norway.

areas of magnetic unreliability and the North Polar track system should not assume that they may continue to operate as before.

Part 121 Differences

There are some new requirements for Part 121 carriers. Among the most significant is that the planning for passenger flights in airplanes with more than two engines must consider maximum diversion times, instead of the simpler ETP fuel planning. These aircraft now require ETOPS approval if the carrier intends to operate them on routes exceeding a 180-minute diversion time.

There also are allowances for increasing the maximum diversion time. During the ARAC process, carriers had asked for expanded ability to exceed 180 minutes, which the FAA accommodated by allowing maximum diversion times up to 240 minutes in specific areas, along with other operating and MEL requirements. The carrier must already have 180-minute approval and may exceed it only if day-of-flight conditions, considering wind, necessitate going farther. For specific preapproved city pairs, it will even be possible to exceed 240 minutes.

Similar to provisions in the old advisory circular, the new rule mandates compensation for the effects of wind, icing and auxiliary power unit fuel consumption. These factors have been reduced as the FAA has recognized substantial improvements in wind and temperature forecasting models over the last two decades. Diversion fuel burn calculations previously had to be increased by 5 percent to allow for wind-forecasting errors. The requirement now is to increase forecast tail wind or head wind component speed by 5 percent, which reduces the fuel requirements. Similarly, carriers must account for ice drag penalties during

10 percent of the divert segment only if icing is forecast.

Part 135 Requirements

The new Part 135.364 likely will have a dramatic impact on charter operators. Effective February 2008, passenger charter flights conducted beyond 180 minutes of an adequate airport will require ETOPS approval. The FAA believes that the higher diversion-time threshold is justified because charter operators are not limited to using Part 139-approved airports, so a greater range of alternate airports will be available. Maximum allowable diversion time is 240 minutes.

What remains to be seen is how many Part 135 operators will be able to avoid being forced into an ETOPS program. In effect, that will be determined by the manufacturers. General aviation turbine airplanes usually are not provided with the variety of one-engine-inoperative (OEI) performance data that accompanies large transport aircraft. OEI performance is often based only on the best lift/drag ratio speed or long-range cruise speed. This will probably not be adequate over more remote areas with a 180-minute maximum diversion time. At those speeds, the North Atlantic won't be out of reach, but a trip from Los Angeles to Hawaii could easily exceed the 180-minute maximum diversion time.

Implementation of the Part 135 ETOPS rule is being delayed for one year to allow manufacturers enough time to create more speed profiles. The as-yet-unknown factor will be fuel capacity. In addition to the fuel implications of faster engine-out speeds, the required assumption of a simultaneous cabin decompression will drive the diversion altitude even lower. Exact figures are not available, but there is good reason to believe that the increased fuel consumption could require

that the payload be reduced or that the trip be canceled.

Charter operators that have been conducting transoceanic trips may find themselves unable to comply with ETOPS requirements, depending on data their manufacturers generate this year.

If a Part 135 operator finds it necessary to gain ETOPS approval, it will have to meet the same maintenance requirements as the airlines. Conducting predeparture service checks with ETOPS-trained mechanics when operating away from home base will be a serious consideration. Lacking an airline's in-house maintenance resources, charter operators may consider carrying flight mechanics in addition to arranging for more qualified vendors.

In addition to delaying implementation for a year, FAA included an eight-year grandfather clause for newly manufactured airplanes operated under Part 135. This was expected since the large majority of these aircraft have not been subject to an ETOPS configuration management plan.

A New Chapter

The FAA's codification, refinement and expansion of requirements for extended operations — and similar efforts under way worldwide — begin a new chapter in long-range flight. The pioneering flights by Piedmont and TWA in the 1980s have led to well-established safety practices, improved operating economies and more opportunities for point-to-point travel between a greater variety of airports. Looking to the future, harmonizing standards across the different national regulators will enhance safety for all operators. ●

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