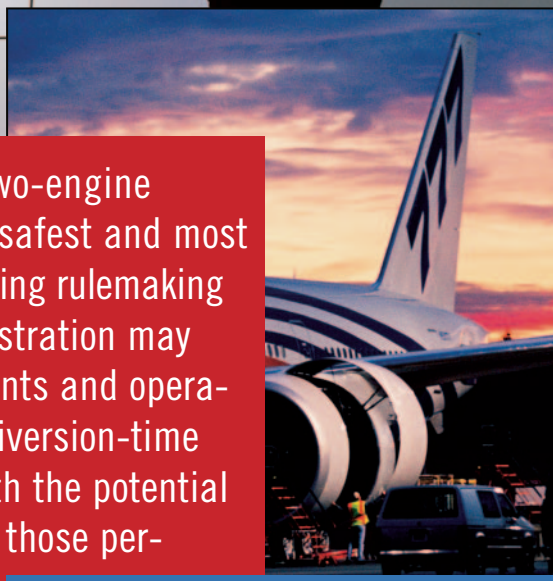
NEW ETOPS REGULATIONS



Extended-range operations with two-engine airplanes (ETOPS) rank among the safest and most reliable of all flight operations. Pending rulemaking by the U.S. Federal Aviation Administration may expand these reliability enhancements and operational protections to *all* extended-diversion-time operations (i.e., flying on routes with the potential for an extended diversion), not just those performed with two-engine airplanes.

As airplane range capabilities continue to increase, flights across remote regions of the world are becoming more common. The global aviation community—which collaboratively defined and proposed this U.S. rulemaking—believes that applying ETOPS rules to all extended-diversion-time operations will raise the industry to a higher and uniform standard.

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On December 16, 2002, the Aviation Rulemaking Advisory Committee (ARAC)—an advisory committee of the U.S. Federal Aviation Administration (FAA)—presented to the FAA its findings and recommendations on extended operations (i.e., operations on routes with the potential for an extended-duration diversion). Initiated by the FAA tasking statement of June 14, 2000, this proposed U.S. rulemaking marks the culmination of more than two years of global collaboration to review current requirements for extended-range operations with two-engine airplanes (ETOPS) and propose updated and standardized requirements that will embrace *all* extended-diversion-time operations, not just those performed with two-engine airplanes.

The ARAC ETOPS Working Group comprised expert representatives from many of the world's airlines, airframe and engine manufacturers, pilots' associations, regulatory authorities, and nongovernmental organizations. In keeping with its proposal that the extended-operations protections be applied broadly to protect all airplanes, regardless of the number of engines, the ETOPS Working Group further recommended that the term *ETOPS* itself be redefined to simply mean *extended operations*. (See "ARAC ETOPS Working Group Participants," p. 7.)

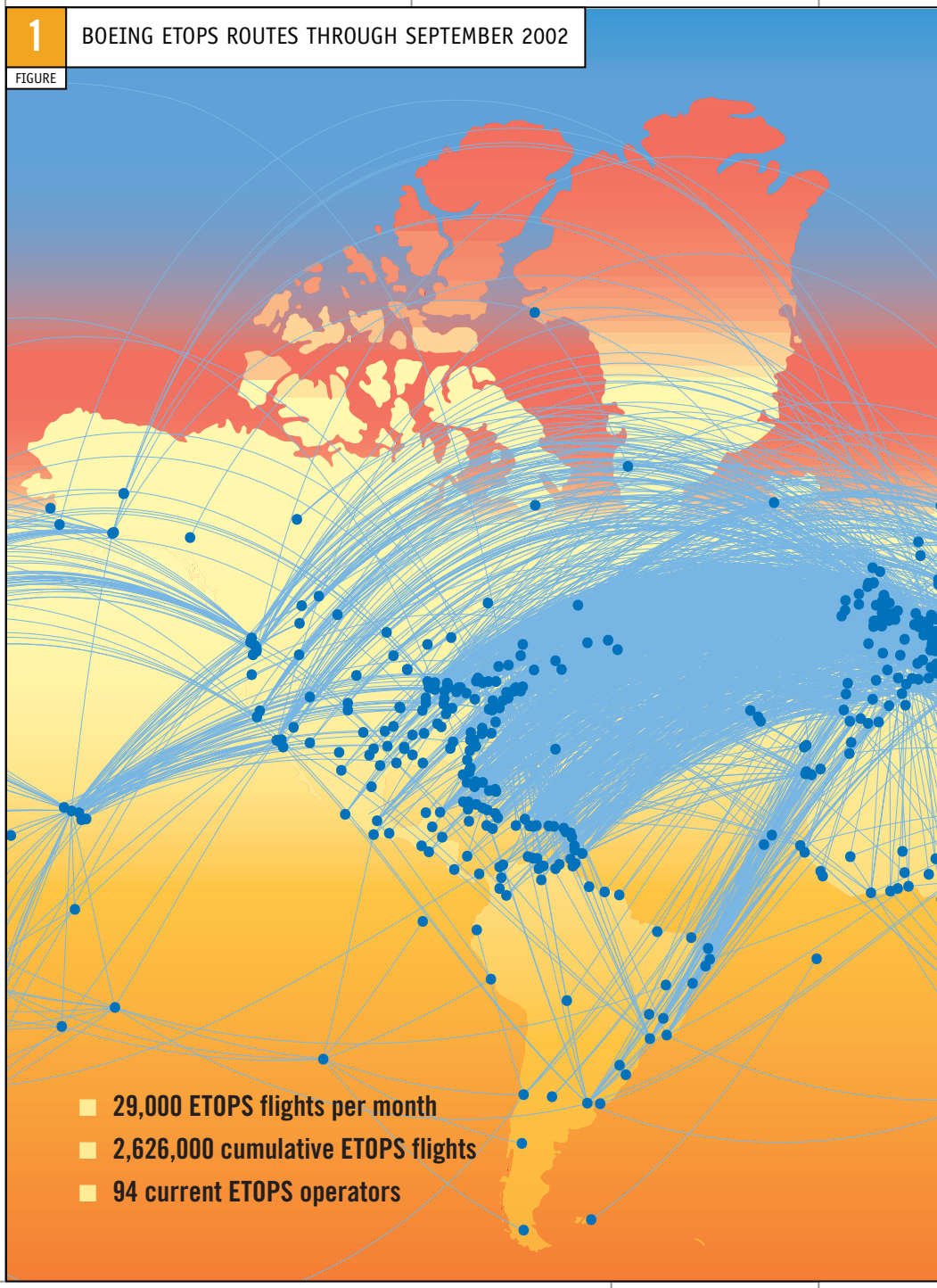
The FAA will evaluate the proposed ARAC findings and recommendations, make whatever changes it deems appropriate, and publish the results in a Notice of Proposed Rulemaking (NPRM) for public review and comment. Following comment resolution, the FAA is expected to enact new extended-operations rules, perhaps as soon as late 2004.

This article discusses the reasons behind this global activity and describes the specific regulatory changes that the ARAC has proposed.

THE ETOPS PARADIGM SHIFT

When the conservative ETOPS program began in 1985, its intent was to ensure that the safety of two-engine airplanes would match that of three- and four-engine airplanes on long-range transoceanic routes. Implicit in the ETOPS rules was the initial assumption that turbine-powered airplanes with

FIGURE 1 BOEING ETOPS ROUTES THROUGH SEPTEMBER 2002



two engines were inherently less safe than those with three or more engines. As a result, a separate set of more stringent requirements was deemed necessary for operating two-engine airplanes on routes with the potential for an extended-duration diversion.

Since then, however, extensive ETOPS service experience has brought about a profound revision to that initial thinking. After nearly two decades of highly successful ETOPS around the world, the global aviation community today views ETOPS in a different light. Characterizing this profound data-driven paradigm shift are the present-day industry perceptions that

1. ETOPS is the state of the art in intercontinental air travel.
2. Engine reliability is no longer the single focus of safety concerns.
3. A uniform standard is desirable for all extended operations.

1 ETOPS IS THE STATE OF THE ART IN INTERCONTINENTAL AIR TRAVEL

ETOPS is the dominant mode of transatlantic flight operations today and accounts for a rapidly growing component of transpacific and other operations as well. Since 1985, more than 3 million ETOPS flights have been logged using the twinjets of several manufacturers. Today, about 125 operators worldwide log an additional 1,100 ETOPS flights each day. Of this industry total, Boeing twinjets alone have performed more than 2.6 million ETOPS flights, and 94 Boeing operators fly nearly 1,000 more each day (fig. 1).

This vast service experience reveals that ETOPS ranks among the safest and most reliable of all flight operations. This success results from the *preclude and protect* philosophy of ETOPS, which enhances flight operations in two ways:

- ETOPS-related design improvements and maintenance practices increase airplane systems and engine reliability, making it less likely that an airplane will need to divert from its intended course and land at an alternate airport.
- ETOPS operational requirements introduce proactive measures that protect the airplane, passengers, and crew should a diversion occur.

This philosophy has indirectly benefited the entire industry. All commercial operations today — including those performed with three- and four-engine airplanes — benefit from gains in the reliability and robustness of airplane engines and systems initially achieved through ETOPS programs.

Operators flying three- and four-engine airplanes are not currently required to meet the high ETOPS standard. Nevertheless, some operators already comply with key ETOPS safety enhancements on a voluntary basis. This elective application of ETOPS best practices suggests that the maintenance and operational benefits of ETOPS are well recognized by the global industry and that operators find them cost effective.

2 ENGINE RELIABILITY IS NO LONGER THE SINGLE FOCUS OF SAFETY CONCERNS

In the past, concerns about flight safety focused first and foremost on the reliability of propulsion systems. When ocean-spanning commercial flight operations began after World War II, that narrow focus was appropriate in light of the limited reliability of piston engines. During the 1940s and 1950s, in fact, piston engine–related events were the predominant cause of airliner accidents and contributed to a worldwide fleet hull-loss accident rate that was some 60 times higher than today's.

The limited reliability of piston engines led to an operating restriction being placed on two-engine airplanes 50 years ago. The intent of the so-called 60-Minute Rule of 1953 (U.S. Federal Aviation Regulation [FAR] 121.161) was to bar two-engine propeller airplanes, such as the Douglas DC-3, from flying extended routes then more safely served by four-engine propeller types, such as the DC-4. That piston-era operating restriction remains in effect at the time of this writing.

During the late 1950s, however, the transition to turbine power brought about a quantum leap in propulsion system reliability. Engine reliability has continued to improve in the jet age, so much so that today's high-bypass-ratio fanjet engines are at least 50 times more reliable than the large piston engines that inspired the 60-Minute Rule.

By the 1970s, advancing technology had set the stage for two-engine, turbine-powered airplanes to safely exceed the 60-min operating restriction. The result was ETOPS, which began in 1985 with 120-min diversion authority and the requirement for an average engine in-flight shutdown (IFSD) rate of just 0.05 per 1,000 engine-hours. With 180-min ETOPS authority, which followed in 1988, an even more stringent reliability target of just 0.02 IFSDs per 1,000 engine-hours was specified.

In this way, ETOPS drove manufacturers and operators alike to pursue dramatic gains in propulsion system reliability. The industry met this challenge and bettered it. During the past few years, in fact, the average IFSD rate of the worldwide 180-min ETOPS fleet has typically been at or below 0.01 IFSDs per 1,000 engine-hours — twice the reliability required for such operations. So profound has this trend been that propulsion reliabilities unachievable just 15 years ago are today routine in the modern twinjet fleet.

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In light of these advances, and because the safety and reliability of two-engine airplanes equal or exceed those of three- or four-engine airplanes, the industry no longer views propulsion system reliability as the primary safety and reliability concern in extended operations. Instead, current rulemaking recognizes that a variety of airplane systems and operational issues (e.g., cargo fire suppression capability, weather conditions and facilities at alternate airports) are relevant to overall safety and reliability on routes with the potential for an extended diversion.

3 A UNIFORM STANDARD IS DESIRABLE FOR ALL EXTENDED OPERATIONS

All airplanes flown on extended-diversion-time routes face similar operating challenges in terms of weather, terrain, and limitations in navigation and communications infrastructure. Given that the operating environment is common to all extended operations, and that all categories of jetliner are safe, the global aviation community believes a uniform standard is desirable for extended operations. The global community further recognizes that applying ETOPS requirements to all airplanes — not just those with two engines — will raise the industry to a higher and uniform standard.

Although diversions are rare, any airplane might someday need to divert to an airport other than its intended destination for various reasons (e.g., passenger illness, smoke in the flight deck or cabin, turbulence, adverse winds, weather, fuel leak, cargo fire, in-flight engine failure or shutdown). Thus, the dual ETOPS philosophy of precluding diversions and protecting the passengers, crew, and airplane on those rare occasions when diversions do occur is applicable to all extended operations, not just those performed with two-engine airplanes.

As a result of ETOPS, the industry has achieved significant improvements in the reliability and robustness of airplane engines and systems. However, such efforts can never entirely prevent diversions because most are unrelated to the airplane, its systems, or its engines. In fact, fewer than 10 percent of all diversions during extended operations are airplane related, and fewer than 3 percent are the result of an in-flight engine failure or shutdown. In general, of course, engine failures tend to occur during takeoff and initial climb rather than during the cruise phase of flight where ETOPS is flown.

TABLE 1 PROPOSED ARAC RULEMAKING AND GUIDANCE

ETOPS authorization	Modify existing rule FAR 121.161 to codify ETOPS in the U.S. federal aviation regulations; describe the redefinition of ETOPS and the updated requirements being proposed for the authorization of all extended operations.
Definitions	Add a new rule, FAR 121.7, to add the definitions of ETOPS-applicable terms to ensure understanding of and compliance with the updated ETOPS requirements now being proposed.
Communications	Add a new rule requiring voice communications, where available, and the most reliable communications technology, voice based or data link, for all extended operations beyond 180 min; require that another form of communications be available in case communication is not possible with the most reliable technology.
Dispatch	Add a new rule specifying dispatch or flight-release requirements for weather at ETOPS alternate airports; further require that weather be updated at the start of the ETOPS phase of flight to verify the continuing availability of a valid ETOPS alternate.
Propulsion-related diversions	Issue new guidance clarifying the requirements for twinjet diversion in the event of an in-flight engine failure or shutdown; specify what factors shall and shall not be considered sufficient justification for the crew to fly beyond the nearest suitable alternate airport.
Fuel reserve	Add a new rule specifying the reserve fuel to be carried to protect the airplane in the event of a cabin depressurization followed by an extended diversion at low altitude to an alternate airport.
Maintenance	Add a new rule making ETOPS maintenance standards applicable to all airplanes flown in extended operations.
Passenger recovery plan	Modify existing rules FARs 121.135 and 121.97 to require all extended operators to develop a plan that ensures the well-being of passengers at diversion airports and provides for their safe retrieval without undue delay. Modify existing rule FAR 121.415 to require training for crew members and dispatchers in their roles and responsibilities in the operator's passenger recovery plan.
Cargo fire suppression	Add a new rule requiring that ETOPS diversion times shall not exceed the time limit, minus 15 min, specified in the Airplane Flight Manual for that airplane's most time-limited system, which is typically cargo fire suppression.
Performance data	Modify existing rule FAR 121.135 to require all ETOPS operators to have the applicable performance data available to support their extended operations.
Polar operations	Modify existing rule FAR 121.161 to define polar-area zones of ETOPS applicability in which ETOPS requirements apply at all times. This requirement applies to all operations north of 78°N latitude (North Pole) and south of 60°S latitude (South Pole).
Rescue and fire fighting	Modify existing rule FAR 121.106 to require rescue and fire-fighting equipment to be available at any airport designated as an ETOPS en route alternate.
Other proposed changes	Modify the rules governing transport-category airplane and engine design to incorporate ETOPS enhancements that reduce the rate of airplane diversions and protect airplanes when they divert.

ARAC ETOPS WORKING GROUP PARTICIPANTS

AIRLINES

U.S. — American Airlines, American Trans Air, Continental Airlines, Delta Air Lines, Northwest Airlines, United Airlines, United Parcel Service, and US Airways

Non-U.S. — All Nippon Airways, along with British Airways, KLM Royal Dutch Airlines, and Scandinavian Airlines System, representing the Association of European Airlines (AEA)

INDUSTRY ASSOCIATIONS

European Association of Aerospace Industries (AECMA), General Aviation Manufacturers Association (GAMA), International Civil Aviation Organization (ICAO), National Business Aviation Association (NBAA), Air Transport Association (ATA), National Air Transportation Association (NATA), National Air Carriers Association (NACA), and International Federation of Air Line Dispatchers' Associations (IFALDA)

MANUFACTURERS

Airframe — Airbus Industrie, The Boeing Company, Bombardier, Cessna, and Gulfstream
Engine — GE Aircraft Engines, Pratt & Whitney, and Rolls-Royce

PILOTS' ASSOCIATIONS

Air Line Pilots Association (ALPA), Independent Association of Continental Pilots (recently merged with ALPA), Allied Pilots Association (APA), Coalition of Airline Pilots Associations (CAPA), International Federation of Air Line Pilots' Associations (IFALPA)

REGULATORS

U.S. Federal Aviation Administration (FAA), Transport Canada, Joint Aviation Authorities (JAA) of Europe as represented by the U.K. Civil Aviation Authority (CAA), Direction Générale de l'Aviation Civile (DGAC) France, and Civil Aviation Safety Authority (CASA) Australia

OTHER PARTIES

Air Crash Victims Families Association (ACVFA)

PROPOSED U.S. REGULATORY CHANGES

This paradigm shift created growing awareness around the world that the regulatory framework currently governing twinjet and other extended operations should be reviewed. Consequently, the FAA — which meets its responsibility to update regulations through the proven ARAC process — initiated the collaborative ARAC activity previously described.

The ARAC-proposed regulations (table 1) might change as a result of the current FAA review and pending NPRM comment processes. We at The Boeing Company are proud to have participated in this global ARAC effort, which will make flying even safer and more reliable in the coming years. Pages 8 through 10 detail the proposed changes.

ETOPS Authorization

The ARAC has recommended that FAR 121.161 (the 60-Minute Rule) and associated guidance and advisory material be revised to

- Establish the basis and requirements for operating twin-engine, turbine-powered airplanes beyond 60 min of flying time (at single-engine cruise speed with no wind and in standard conditions) of an adequate alternate airport.
- Apply this same regulatory framework to the operation of turbine-powered airplanes with more than two engines beyond 180 min (at one-engine-inoperative cruise speed with no wind and in standard conditions) of an adequate alternate airport, and also make it applicable to all operations in polar areas (see Polar Operations, p. 10).
- Make the designed and certified operating capabilities of the airplane type the basis for determining the maximum diversion authority of that type.
- Define allowable diversion authorizations for different regions of the world based on the overall operational needs of each region.
- Apply current ETOPS best practices to all extended operations.

It should be noted that, although these proposed ETOPS requirements are consistent for all jetliners, the threshold varies at which they would take effect. For two-engine airplanes operating under FAR Part 121, ETOPS will be in effect — as is currently the case — on routes where the airplane is at some point more than 60 min flying time from an alternate airport. For FAR Part 121 operations by airplanes with three or more engines, these new ETOPS rules will apply on routes that are at some point more than 180 min from an alternate airport. They also will apply to all operations in the polar regions (i.e., the areas north of 78°N latitude and south of 60°S latitude).

Definitions

The ARAC has proposed that ETOPS-applicable definitions be added to FAR Part 121. Many of the terms used in the new regulations and guidance material for ETOPS are unique to extended operations and demand precise definition to ensure common understanding and proper compliance.

To encompass all extended-diversion-time operations, not just those flown with two-engine airplanes, the term *ETOPS* would be redefined as *extended operations* (as used in this article) and shall no longer mean *extended-range operations with two-engine airplanes*. Another noteworthy change is the addition of the term *ETOPS alternate*, which is an airport that meets stated requirements for planned diversion use and at which the weather conditions are at or above the operating minimums specified for a safe landing. This new term would replace the current ETOPS term *suitable*, which denotes an alternate airport that is both above required weather minimums and available for diversion use. Under the new rules, *suitable* would no longer have an ETOPS-specific meaning; where it appears in the new regulations and associated guidance material, therefore, it should be interpreted only according to its broadly accepted, everyday definition.

It should be noted that *long-range operations* (*LROPS*) is not proposed as an ETOPS term. Although used by some segments of the global industry, LROPS currently does not appear or have legal standing in the FARs. The ARAC ETOPS Working Group did not propose adding LROPS because the term would be misleading — extended operations are defined by distance to an alternate airport, not by overall length of flight — and because it invites confusion with the similar but unrelated term *ultra-long-range operations*, which deals primarily with flight crew duty time, crew rest, and other human-factors issues.

Communications

Current regulations require reliable communications. Recognizing that advances in technology occur and that verbal communications can be particularly valuable, the proposed rule promotes the adoption of voice communications for extended operations.

This proposed rule states that the most reliable communications technology — voice based or data link — shall be installed in all airplanes operating beyond 180 min from an alternate airport. Alternative means of communication must also be available in the event the most reliable means is not available for any reason (e.g., lack of satellite coverage). Examples of these communications technologies (e.g., SATCOM voice link, SATCOM data link, HF data link) are given in the associated guidance material.

The proposed rule is *not* intended to require operators to continually upgrade existing installations on an incremental basis. Rather, the rule is meant to further the adoption, as appropriate, of new technologies that significantly enhance the quality and reliability of communications. One example of such innovation is today's transition from HF radio to satellite-based technologies.

Dispatch

The ARAC has proposed a new regulation specifying airplane dispatch requirements for ETOPS alternate airports. The operator would have to select en route alternate airports that meet the weather requirements set forth in its operations specifications.

Because alternate airport weather is checked before airplane departure, and weather conditions can vary over time, the conservative weather minimums required for dispatch are higher than those that would be required to perform an instrument approach at that alternate airport. As proposed, this dispatch rule further requires the crew to verify the continuing availability of a valid alternate airport by means of en route weather updating at the beginning of the ETOPS phase of flight. For this en route updating, the crew would be required to ascertain only that the planned alternate is

above normal landing minimums, not above the higher minimums applied before dispatch.

One of the distinguishing features of ETOPS is the identification of and reliance on alternate airports to which airplanes can divert should an unscheduled landing become desirable or necessary. Under this proposed regulation, operators flying three- and four-engine airplanes in extended operations would be required to designate ETOPS alternate airports within 240 min, or if beyond 240 min, designate the nearest available ETOPS alternate.

Propulsion-Related Diversions

The ARAC has proposed no substantive change to the rule that governs diversion following an in-flight engine failure or shutdown. However, the committee did offer guidance to further clarify existing diversion requirements for two-engine airplanes in the event of engine failure or shutdown.

To aid flight crews, the proposed guidance lists factors (e.g., airplane condition and systems status, weather conditions en route, terrain and facilities at the alternate airport) that the pilot in command should consider when deciding which alternate airport to divert to. To ensure that safety always remain paramount, the ARAC further identified factors that shall *not* be considered sufficient justification for flying beyond the nearest available alternate airport (e.g., additional range capability based on remaining fuel supply, passenger accommodations beyond basic safety, maintenance and repair facilities at the available alternate airports).

Fuel Reserve

The ARAC has proposed that all airplanes flown in extended operations shall carry an ETOPS fuel reserve to protect the passengers, crew, and airplane in the event of a cabin depressurization followed by a low-altitude diversion.

Cabin depressurization is a very rare event that can occur on any jetliner and is largely unrelated to the number of engines. If it does occur, the flight crew must immediately descend to an appropriate altitude, as defined by oxygen availability or oxygen systems capability. A diversion is then generally required because of the increased fuel consumption of turbine engines at low altitudes and the corresponding reduction in range.

This ETOPS fuel reserve requirement assumes that decompression would occur at the most critical point along the route in terms of total fuel consumption (a concurrent engine failure is further assumed if it would add to the total). The reserve thus calculated would ensure sufficient fuel for an extended low-altitude diversion followed by a descent to 1,500 ft at the alternate airport, a 15-min hold, and an approach and landing. Further allowance is made for possible airframe icing and wind forecasting error.

Following extensive review of data related to the accuracy of wind forecasting, as well as review of the icing scenario based on the Canadian Atlantic Storms Program (CASP II), the ARAC proposed revising the ETOPS fuel reserve requirement. Under this proposed rule, two-engine airplanes on extended operations would carry somewhat less reserve fuel than in the past. Airplanes with more than two engines would be required to carry an ETOPS fuel reserve for the first time, although many three- and four-engine operators do currently carry a depressurization fuel reserve as a matter of internal airline policy.

Maintenance

The ARAC has proposed making current twin-engine ETOPS maintenance standards applicable to all airplanes flown in extended operations. This would require three- and four-engine operators to also have an ETOPS maintenance program in place before flying routes with the potential for an extended diversion.

ETOPS maintenance requirements have significantly reduced the incidence of in-flight engine failures. Such events can be enormously costly and disruptive for airlines, which is why some operators of three- and four-engine airplanes have already voluntarily raised their maintenance standards to ETOPS levels.

Passenger Recovery Plan

The ARAC has proposed that all extended operators shall develop a plan to ensure the well-being of passengers and crewmembers at diversion airports. This plan should address their safety and comfort at that airport in terms of the facilities and accommodations and their retrieval from that airport.

Currently, passenger recovery plans are required only for cross-polar operations. Because diversions can occur anywhere, however, the ARAC has proposed that every operator flying routes over remote areas of the world should anticipate the possibility of a diversion within those regions and devise a plan outlining how it would recover the passengers, crew, and airplane.

Cargo Fire Suppression

To further ensure safety, the ARAC has proposed that all time-critical systems aboard airplanes flown in extended operations shall have sufficient capability to protect the airplane throughout the longest potential diversion for that route. In particular, each flight shall have continuous fire suppression capability for a period equivalent to the maximum planned diversion time plus an additional 15 min to cover approach and landing at the alternate airport.

Two-engine airplanes flown in extended operations have met this requirement since 1985. In contrast, although all jets have fire suppression systems, those with more than two engines are not currently required to carry sufficient fire suppressant during extended operations to protect the airplane continuously throughout a maximum-duration diversion.

The ARAC has proposed that three- and four-engine airplane operators that do not currently comply with this requirement shall have six years after ETOPS regulations take effect to bring their existing fleets into compliance with this new rule.

Many airplane systems enhance safety during flight. Of these, cargo fire suppression is generally the most time-limited.

Proposed changes (continued)
Applying ETOPS cargo fire suppression requirements to all extended operations can thus further protect passengers, crews, and airplanes on routes with extended diversion times.

Performance Data

The ARAC has proposed that existing regulations be modified to require that performance data be available to support all phases of extended operations. Flight crews and dispatchers must have data available that describe the specific performance of the airplane in normal and non-normal situations, including those that might be encountered during an extended diversion.

Polar Operations

The ARAC has recommended that the North Polar area (i.e., everything north of 78°N latitude) shall be designated an area of ETOPS applicability. The same designation shall be applied to the South Pole and surrounding region (i.e., everything south of 60°S latitude).

Within these areas, ETOPS requirements shall apply to all airplanes, regardless of the number of engines or distance from an adequate airport. This proposed requirement recognizes the challenges associated with these areas and sets forth steps to protect diversion.

Polar operators require training and expertise to support airplane diversions and their subsequent recovery. These operators must consider requirements for en route alternate airports, a strategy for and monitoring of fuel freeze, a passenger recovery plan, and reliable communications capability.

Rescue and Fire Fighting

The ARAC has proposed a rule specifying rescue and fire fighting (RFF) requirements at ETOPS en route alternate airports. If adopted, this rule will further ensure the safety of all airplanes when flying extended operations, regardless of how many engines an airplane has.

Before dispatch, ETOPS operators have always had to designate alternate airports that are above ETOPS-specified weather minimums. In addition, these designated alternates must provide the necessary facilities and equipment to ensure the safety and well-being of the passengers and crew throughout an extended diversion, after landing at the alternate airport, and for as long as they remain at that airport before being retrieved. RFF capability is a key element of this protection.

During nearly two decades of ETOPS and more than three million ETOPS twinjet flights around the globe, there has not been a single landing accident following an extended diversion from the ETOPS phase of flight. The fact that RFF services have not been needed does not mean that such an event will never happen. Therefore, the ARAC finds it prudent to formalize RFF requirements for alternate airports in the regulations.

Other Proposed Changes

The proposed regulatory changes described above would affect FAR Part 121, the section of the FARs governing the operation of transport-category airplanes. In response to the FAA tasking statement, the ARAC ETOPS Working Group also has proposed changes to other parts of the FARs.

In particular, the ARAC has proposed changes to FAR Part 25, which governs the design and testing of transport-category airplanes, and FAR Part 33, which governs engine design and testing. If adopted, these regulatory modifications will benefit the development of future transport airplanes—regardless of the number of engines—by formalizing ETOPS-inspired improvements that have been shown in service to further protect airplanes and reduce the likelihood that they will need to divert.

The ARAC has further recommended that operators must comply with all rules within FAR Parts 25 and 33 when considering the longest flight and longest diversion time for which approval is sought. The rigor of this practice will ensure that all airplanes designed to these requirements will have the necessary redundancy and reliability to ensure safe extended operations.

To further protect airplanes during extended operations, the ARAC has identified the factors that ensure high levels of safety on flights with the potential for a long diversion. In the case of two-engine airplanes, the most significant element is propulsion system reliability.

Using several methods to assess risk, the ARAC concluded that diversion time can be significantly increased without added risk if the IFSD rate is sufficiently low. An IFSD rate of 0.01 per 1,000 engine-hours—or twice the engine reliability level required for 180-min ETOPS—has been determined to allow unconstrained operations with two-engine airplanes. Currently, the world-fleet average IFSD rates for the 767 and 777, which together perform the majority of ETOPS, are both below this threshold.

Other key elements that support extended diversion times are proper testing and validation of an airplane type (i.e., airframe-engine combination) to ensure ETOPS safety at service entry. The Boeing 777 Early ETOPS program processes provided a successful template on which to base future such programs. Consequently, the design, analysis, and test features from the 777 Early ETOPS program are incorporated in the proposed ETOPS regulations.

OTHER INDUSTRY EFFORTS

In addition to this ETOPS-related ARAC–FAA rulemaking, the European Joint Aviation Authorities (JAA) are developing standards for extended operations. In light of the ARAC, JAA, and other efforts taking place around the world, the International Civil Aviation Organization (ICAO)—a branch of the United Nations—is reviewing the current annexes and associated guidance materials and plans to propose changes as appropriate for all airplanes. The Boeing Company supports the harmonization of aviation standards among regulatory authorities worldwide and actively supports these JAA and ICAO efforts.

About the Authors

SUMMARY

As airplane range capabilities continue to increase, and flights become more common in remote regions of the world, expanding ETOPS to embrace *all* extended-diversion-time operations — not only those involving two-engine airplanes — will raise the industry to a higher and uniform standard.

The proposed U.S. ETOPS regulations reflect broad recognition within the global aviation community that ETOPS-related practices can further enhance the safety and reliability of all operations on routes with extended diversion times. The proposed rules recognize the high standard of safety that has been achieved during nearly two decades of highly successful twinjet operations worldwide and are the next logical step in enhancing aviation safety.

The FAA will evaluate these ARAC-proposed regulations, make whatever changes it deems appropriate, and publish the results in an NPRM for public review and comment. After comment resolution, the FAA is expected to enact the new ETOPS rules, perhaps as soon as late 2004.

Capt. Chester "Chet" Ekstrand is vice president in charge of Regulatory Affairs for Boeing Commercial Airplanes. He is responsible for issues and initiatives related to operational safety and serves as the company's focal for ETOPS. Capt. Ekstrand's expertise in working with the industry and regulatory authorities worldwide contributed significantly to the precedent-setting early ETOPS certification of the 777. Former positions include vice president of Communication, Navigation, Surveillance/Air Traffic Management and Extended-Range Twin-Engine Operations; vice president of Government and Industry Technical Affairs; director of Flight Crew Operations; chief pilot, flight training; and chief pilot, technical.

Mohan Pandey, senior manager of Operational Regulatory Affairs, has played a key role in almost every ETOPS operational issue. He led Boeing participation in the ARAC ETOPS Working Group and currently serves as a member of the JAA and ICAO ETOPS committees as well as the JAA Operational Steering Team. Mr. Pandey is a 30-year veteran of the aviation industry and has held a variety of positions since joining Boeing in 1980.