



Extended Range Operation with Two-Engine Airplanes (ETOPS)

New ETOPS Rule Status

2003 DER Seminar
Propulsion Break-out Session

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Summary of ARAC ETOPS Recommendations

After 2 ½ years of intense efforts ARAC submitted its recommendations to the FAA on December 16, 2002

- Codifies the requirements in current ETOPS AC
- Extends twins ETOPS to 240 minutes and beyond for certain parts of the world
- ETOPS acronym re-defined to “Extended Operations”
- Extended Operations Applies to airplanes with more than two engines if they are operating on routes that are further than 180 minutes from an alternate . (Routes greater than 180 min are in remote areas of the world that are uniquely challenging to operation)

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Summary of ARAC ETOPS Recommendations

Structure of ARAC Recommendation

- Background,
- ARAC ETOPS WG Work Plan
- General discussion of Proposals
- Recommendation & Rationale
- Part 1** (Definitions and abbreviations)
- Part 21** (Certification procedures for products....)
- Part 25** (Airworthiness Standards: transport category airplanes)
- Part 33** (Airworthiness Standards: aircraft engines)
- Part 121** (Operating requirements: Domestic, flag and supplemental operations)
- Part 135** (Operating requirements: Commuter and on demand operations ...)

Regulations

- Part 1**
- Part 21**
- Part 25**
- Part 33**
- Part 121**
- Part 135**
- Advisory Circulars
- Part 25**
- Part 33**
- Part 121 (AC 120-XX)**
- Part 135**

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Status of FAA ETOPS Rulemaking

- ✍ **FAA team formed in February 2003 to review ARAC recommendations**
- ✍ **Team formed from the following FAA Organizations:**
 - ✍ FAA Headquarters
 - ☞ Office of Rulemaking (Tech. Writer – Administrative Focal)
 - ☞ Air Transport Division (Eric van Opstal – Team Leader)
 - ☞ Aircraft Maintenance Division (Parts 121 & 135)
 - ☞ Office of the Chief Counsel (Lawyer)
 - ☞ Office of Aviation Policy and Plans (Economist)
 - ✍ Transport Airplane Directorate (ANM)
 - ✍ Engine & Propeller Directorate (ANE)

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Status of FAA ETOPS Rulemaking

Ground rules for FAA review of ARAC recommendation

- ✍ **Be as faithful as possible to the original intent of the ARAC proposal.**
- ✍ **Any changes must be justified.**
- ✍ **Criteria for changes to the ARAC recommendation:**
 - ✍ Safety issues
 - ✍ Missing pieces
 - ✍ Legal sufficiency
 - ✍ Clarification with no change in intent or requirements

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Status of FAA ETOPS Rulemaking

- ✍ **FAA team completed draft NPRM June 5, 2003.**
- ✍ **FAA Administrator has signed the NPRM.**
- ✍ **Further review required before publication of NPRM:**
 - ✍ Office of the Secretary of Transportation (OST)
 - ✍ Office of Management and Budget (OMB)
- ✍ **Expect publication of NPRM within next six months**

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Extended Range Operation with Two-Engine Airplanes (ETOPS)

Supplemental Slides: Summary of ARAC ETOPS Recommendations

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Summary of ARAC ETOPS Recommendations

Explanation of Terminology

- ✦ **ETOPS – ExTended OPerationS** – regardless of the number of engines. Twinjets start at 60 minutes, and three- and four-engine jets start at 180 minutes from the nearest airport. Applies to Polar Areas.
- ✦ **LROPS** – Usually denotes long-range operations, but is not used in the new regulations.
- ✦ **Suitable Airport** – Special ETOPS definition replaced by standard everyday definition, and ETOPS Alternate defined instead.
- ✦ **ETOPS Alternate** – An airport that meets the requirements (including weather) for a safe landing.
- ✦ **Polar Area** - North of 78 N or South of 60 S

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ARAC ETOPS Recommendations Definitions

✍ Add the following definitions to Code of Federal Regulations (CFR) Part 1

- ✍ Extended Operations (ETOPS)
- ✍ In-Flight Shutdown (IFSD)
- ✍ Early ETOPS
- ✍ ETOPS Configuration, Maintenance, and Procedures Standard (CMP)
- ✍ ETOPS Significant Systems

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ARAC ETOPS Recommendations Definitions

✍ **Extended Operations (ETOPS)**

- ✍ Change the term "ETOPS" to an acronym that encompasses all extended airline operations including twins and airplanes with more than two engines.

✍ **In-flight Shutdown (IFSD)**

- ✍ Incorporate current definition of IFSD from AC 120-42A into the rule.

✍ **Early ETOPS**

- ✍ Obtaining ETOPS type design certification without first gaining service experience on the airplane/engine combination to be certified.

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ARAC ETOPS Recommendations Definitions

✍ **ETOPS Configuration, Maintenance and Procedures Standard (CMP)**

- ✍ Incorporate term from AC 120-42A into rule

✍ **ETOPS Significant Systems**

- ✍ **Group 1 Systems:** Related to the number of engines on the airplane or the consequences of an engine failure make the system's capability important for an ETOPS flight.
- ✍ **Group 2 Systems:** Not related to the number of engines, but are important to the safe operation of the airplane on an ETOPS flight.

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ARAC ETOPS Recommendations Problem Reporting

- ✍ **Add new Section 21.4 to CFR Part 21 to define new manufacturer problem reporting requirements based on types of problems reported in compliance with Boeing 777 ETOPS special conditions during Early ETOPS period.**
- ✍ **Transition to periodic ETOPS fleet reliability reporting upon achievement of a minimum of 250,000 engine-hours service experience combined with acceptable engine inflight shutdown rate**
- ✍ **Monitor and report engine world fleet 12 month rolling average inflight shutdown rate**

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ARAC ETOPS Recommendations Proposed Type Design Requirements

- ✍ **Amend CFR Part 25 to define three paths for obtaining ETOPS type design approval**
 - ✍ Traditional service experience based approval (AC 120-42A)
 - ✍ Boeing 777 ETOPS special conditions “Early ETOPS” process
 - ✍ Combination of service experience and Early ETOPS process

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ARAC ETOPS Recommendations Proposed Type Design Requirements

- ✍ **Add pertinent engine requirements from the 777 ETOPS special conditions into CFR Part 33**
 - ✍ Design to minimize the occurrence of failures, malfunctions, or maintenance errors that could result in engine inflight shutdown, loss of thrust control, or other power loss
 - ✍ 3000 cycle engine endurance test (in conjunction with corresponding airplane requirement for 3000 cycle test of combined engine and installation hardware)

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ARAC ETOPS Recommendations Proposed Operational Requirements

- ✍ Amend CFR Parts 121 and Part 135

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ARAC ETOPS Recommendations Proposed Operational Requirements

ETOPS for Twins

- ✍ Retains current 75, 120, 138, 180, 207 minutes
- ✍ Adds 90 min for Micronesia
- ✍ Adds 240 min 'case by case basis' on North of NOPAC and Polar
- ✍ Adds 240 minutes and beyond 240 minutes up to design limit, on routes in the Pacific oceanic areas between the US west coast and Australia, New Zealand and Polynesia;
- ✍ south Atlantic oceanic areas; Indian Oceanic areas; oceanic areas between Australia and South America.

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ARAC ETOPS Recommendations Proposed Operational Requirements

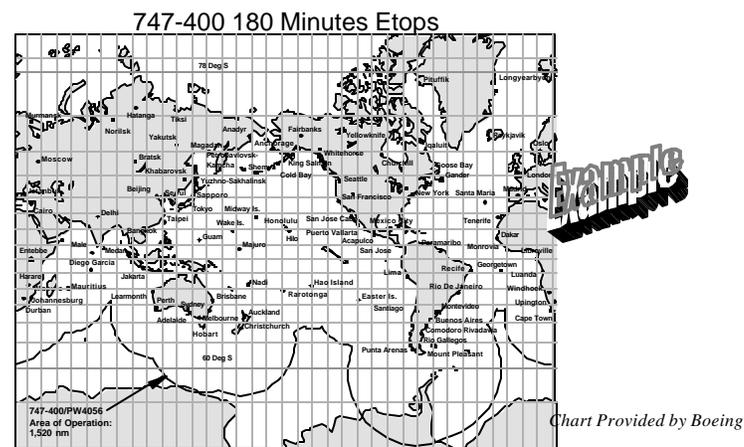
ETOPS for Tris & Quads

- ☞ Applicable on routes that require more than 180 minutes from the nearest adequate alternate airport
- All Polar Operations
- ☞ Should plan to operate under 240 minutes, can exceed only if unable to operate under 240 minutes

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ARAC ETOPS Recommendations Proposed Operational Requirements



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ARAC ETOPS Recommendations Proposed Operational Requirements

Communications

(Routes that require more than 180 min diversion are in remote areas.)

- ✍ Going beyond the simple “reliable communications,” the new rule emphasizes voice communication and encourages adoption of technology improvements.
- ✍ Requires the most reliable communication technology for operations beyond 180 minutes, as well as alternative systems. Examples: SATCOM voice, SATCOM or HF datalink
- ✍ The intent of the rule is not to require continual, incremental upgrades.

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ARAC ETOPS Recommendations Proposed Operational Requirements

Consistent Dispatch/Enroute Requirement for all airplanes

- ✍ ETOPS alternate airports must be verified as meeting all landing requirements (including weather) at dispatch.
- ✍ Also, alternate airports must have the capabilities, services and facilities to safely support the airplane and passengers.
- ✍ Alternate airport criteria (landing minima only) must be verified again as the airplane enters the ETOPS phase of flight.
- ✍ Twinjets have always had this requirement on ETOPS flights. It is now being extended to three- and four-engine jets.

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ARAC ETOPS Recommendations Proposed Operational Requirements

FAR 121.565 requires all airplanes to divert to the nearest suitable airport in case of engine failure. However airplanes with more than two engines may continue to another airport if it is equally safe

ARAC added guidance to 'suitability'

Pilot in Command has the Final Authority and Responsibility for the safe operation

The following factors and others may be relevant in determining whether an airport is suitable or not:

- Airplane configuration / weight / systems status / fuel remaining
 - Wind and weather conditions en route at the diversion altitude
 - Minimum altitudes en route to the diversion airport
 - Fuel burn to the diversion airport
 - Airport nearby terrain, weather and wind
 - Runways available and runway surface condition
 - Approach nav aids and lighting available
 - RFFS at the diversion airport
 - Facilities for passenger and crew disembarkation and accommodations
 - Pilot's familiarity with the airport
 - Information about the airport provided to the pilot by the certificate holder
- When operating a two engine airplane with one engine inoperative, none of the following factors may be considered sufficient justification to fly beyond the nearest suitable airport:
- The fuel supply is sufficient to fly beyond the nearest suitable airport
 - Passenger accommodation other than passenger safety
 - Availability of maintenance / repair resource

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ARAC ETOPS Recommendations Proposed Operational Requirements

Tris and Quads Fuel Scenario Updated to ICAO Standard

Applies to Non-Extended Operations

- ✍ On Routes beyond 90 min from the nearest alternate, all engine speed
- ✍ Fuel considering the following scenario
 - ✍ Decompression at the critical point
 - ✍ Emergency descent to 10,000ft *
 - ✍ Cruise at 10,000ft*
 - ✍ Descent to 1,500 ft
 - ✍ Hold 15 min at 1,500ft
 - ✍ Approach and land

* Higher if sufficient supplemental oxygen

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ARAC ETOPS Recommendations Proposed Operational Requirements

Critical Fuel Scenario Applies to All ETOPS

Fuel considering the following scenario

Decompression at the critical point		Greater of one eng inoperative, decompression with and
Emergency descent to 10000ft *		without one eng inoperative;
Cruise at 10000ft*	+	-5% wind factor
Descent to 1500 ft		-Icing for 10% of time for
Hold 15 min at 1500ft		which icing is forecast
Approach and land		

* Higher if sufficient supplemental oxygen

Change from current Twin ETOPS

- 5% wind factor instead of 5% pad on critical fuel for wind errors
- Icing for 10% of time for which icing is forecast instead of the current icing requirement
- Fuel for approach & land instead of one missed approach, approach & land

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ARAC ETOPS Recommendations Proposed Operational Requirements

Maintenance

- ✍ **Minimum requirements in the CMP (Configuration Maintenance Procedures)**
- ✍ **Pre-departure checks, if applicable**
- ✍ **Dual Maintenance**
- ✍ **Event oriented ETOPS reliability program**
- ✍ **Monitor Inflight shutdown (IFSD)**
- ✍ **Engine Condition Monitoring Plan**
- ✍ **Oil Consumption Monitoring**
- ✍ **APU reliability program, if appropriate**

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ARAC ETOPS Recommendations Proposed Operational Requirements

IFSD is used to trigger a defined process

- ✍ Conduct an investigation into common cause effects or systemic errors when the operator's IFSD rate exceeds a threshold.
 - ☞ Threshold levels for two engine aircraft are:
 - ✍ .05/1000 engine hours up and including 120 min
 - ✍ .03/1000 engine hours between 120 and 180 min, and 207 min
 - ✍ .02/1000 engine hours beyond 180 min except 207 min
 - ☞ Threshold level for three engine aircraft is .2/1000 engine hours
 - ☞ Threshold level for four engine aircraft is .1/1000 engine hours
- ✍ Working Group recognized the deficiency in current AC120-42A and has proposed clear rules, guidance material

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ARAC ETOPS Recommendations Proposed Operational Requirements

ARAC Clears Misconception on IFSD

- ✍ **Focus must be on Events**
 - ✍ Design problems can affect the whole fleet. An operator which experiences a type design related event should not be operationally penalized by the Administrator for a problem that is design related and may not be of their making.
 - ✍ Maintenance or operational problems may be wholly, or partially, the responsibility of the Operator. If an Operator has an unacceptable IFSD rate risk attributed to maintenance or operational practices, then action carefully tailored to that Operator may be required.

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ARAC ETOPS Recommendations Proposed Operational Requirements

Diversion Recovery Plan

- ✍ A generic regional plan to handle diversion scenario in the region (Required for all (ETOPS or non-ETOPS))
- ✍ More detailed plan for polar operations (and north of NOPAC for beyond 180 min operations). The operator should be able to demonstrate its ability to launch and conduct the recovery plan on its initial application for polar route approval.

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ARAC ETOPS Recommendations Proposed Operational Requirements

180 Minute or Less Area of Operation

Greater than 180 Minute Area of Operation

Twin Engine Airplane

- No change to current operation
- Still Air Distance
 - Standard day
 - Length of diversion + 15 minutes
 - One engine inoperative speed

- Length of diversion + 15 minutes
- One engine inoperative speed
- Consider wind and temperature

Tri and Quad Engine Airplanes

No change to current operation

- Length of diversion + 15 minutes
- One engine inoperative speed
- Consider wind and temperature

**Maximum Diversion Time Must be Less than
Time Limited Systems**

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ARAC ETOPS Recommendations Proposed Operational Requirements

Twin Engine Airplane

**180 Minute or Less
Area of Operation**

No change to current operation
•Still Air Distance
•Standard day
•Length of diversion + 15 minutes
•One engine inoperative speed

**Greater than 180
Minute Area of
Operation**

Consider wind and temperature
All engine operating speed

**Tri and Quad Engine
Airplanes**

No change to current operation

Consider wind and temperature
All engine operating speed

Tris & Quads must comply within 6 years
Cargo Fire Suppression Sufficient to cover
Maximum Diversion Time

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ARAC ETOPS Recommendations Proposed Operational Requirements

ETOPS Performance Data

- ✍ **No change from current twins requirement**
 - ✍ Detailed one-engine inoperative performance data including fuel flow for standard and nonstandard atmospheric conditions and as a function of airspeed and power setting, where appropriate
 - ✍ Detailed all-engine-operating performance data, including nominal fuel flow data, for standard and nonstandard atmospheric conditions and as a function of airspeed and power setting, where appropriate
 - ✍ Details of any other conditions relevant to ETOPS operations which can cause significant deterioration of performance

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ARAC ETOPS Recommendations Proposed Operational Requirements

ETOPS Applies to all Airplanes on Polar Operations

- ✍ Airport requirements for enroute alternates
- ✍ Airline recovery plan for passengers at diversion alternates
- ✍ Fuel freeze strategy and monitoring
- ✍ Communication capability
- ✍ Minimum Equipment List considerations
- ✍ Airline training issues specific to polar operations
- ✍ Long range crew requirements
- ✍ Dispatch and crew considerations during solar flare activity
- ✍ Special equipment requirements
- ✍ Validation requirements for area approval

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ARAC ETOPS Recommendations Proposed Operational Requirements

Rescue / Fire Fighting

- ✍ **RFF level of 4 up to 180 min**
 - ✍ (though not required but make attempt to find at least one adequate airport RFF 7)
- ✍ **RFF level of 4 for 207 min also but at least one adequate airport of RFF 7**
- ✍ **RFF level of 7 for operations beyond 180 min (except 207 min for twins)**
- ✍ **30 min response time if equipment not located at airport**

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ARAC ETOPS Recommendations Proposed Operational Requirements

Flight Crew Training

- ✍ ETOPS Unique Requirements**
- ✍ Diversion Decision Making**
- ✍ Passenger Recovery Plan**

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