



CIVIL AVIATION AUTHORITY OF BOTSWANA

GENERAL

ADVISORY

CIRCULAR

CAAB Document GAC-013

REQUIREMENTS FOR EXTENDED-RANGE OPERATIONS WITH TWO ENGINE AIRCRAFT (ETOPS)

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1. PURPOSE

This Advisory Circular provides guidance to an operator for extended-range operations with two engine aircraft to ensure compliance with Regulations 70 of the Botswana Civil Aviation (Aircraft Operation) Regulations, 2013, and Advisory circular No. CAAB Document OAC-001.

2. STATUS OF THIS ADVISORY CIRCULAR

This GAC is an original issuance.

3. EFFECTIVE DATE

This GAC becomes effective immediately.

4. APPLICABILITY

This GAC is applicable to all individuals, operators, organizations and other entities seeking authority to operate two-engine aeroplanes for more than 60 minutes at single engine cruise speed (under standard conditions in still air) from an adequate airport regardless of the terrain.

5. RELATED REGULATIONS

Copies may be obtained from the Government Printer.

- Civil Aviation (Aircraft Operations) Regulations, 2013: Regulations 70 and 71.

6. RELATED PUBLICATIONS

Copies may be obtained from Document Sales Unit, ICAO, 999 University Street, Montreal, Quebec, Canada H3C 5H7.

- ICAO Annex 6

7. DEFINITIONS AND ACRONYMS

7.1 The following definitions are used in this circular

Authority means the CAAB, unless otherwise specified.

Chicago Convention means the Convention on International Civil Aviation.

7.2 The following acronyms are used in this circular

AC Advisory Circular

AOC Air Operator Certificate

AMO Approved Maintenance Organization

CAAB Civil Aviation Authority of Botswana

CARs (Botswana) Civil Aviation Regulations

ICAO International Civil Aviation Organization

MEL Minimum Equipment List

Advisory Circulars (ACs) are intended to provide advice and guidance to illustrate an acceptable means, but not necessarily the only means, of complying with the regulations, or to explain certain regulatory requirements by providing informative, interpretative and explanatory material. Where a regulation contains the words "prescribed by the Authority," the AC may be considered to prescribe a viable method of compliance, but status of that "prescription" is always "guidance" (never regulation).

8. BACKGROUND

- 8.1 Extended-range operations with two engine aircraft (ETOPS) means operations conducted over a route containing a point **further than 60/120/180 minutes** flying time at normal one-engine inoperative cruise speed (in still air) from an adequate airport.
- 8.2 Before an approval for ETOPS is considered, the operator must assess its overall safety record, past performance, training and maintenance programmes.
- 8.3 The data gathered should substantiate the operator's ability and competence to safely conduct and support the operations. The operator should further substantiate that the type design reliability and the performance of the proposed airplane/engine combination have been evaluated in accordance with the requirements of Regulation 70 of the Civil Aviation (Operations of Aircraft), Regulations, 2013 and found suitable for extended range operations.
- 8.4 Any reliability assessment obtained, either through analysis or service experience, should be used as guidance in support of operational judgments regarding the suitability of the intended operation.
- 8.5 Assessment for approval of ETOPS is conducted to determine compliance with Regulations, maintenance and operational requirements as determined by the Authority and manufacturers recommended schedules.

9. THE APPLICATION PACKAGE

- 9.1 **Supplemental maintenance programme:** The programme must include additional ETOPS requirements for the aircraft being considered on top of the normal approved maintenance programme.
- 9.2 **Verification Programme:** The programme must have procedures that would preclude an aircraft from being dispatched for extended range operation unless appropriate corrective action has been taken and verified, after any of the following situations-
 - (a) A propulsion system shutdown
 - (b) A primary system failure
 - (c) Any significant adverse trends/repeat problems from a previous flight.
- 9.3 **Airframe/Engine condition monitoring programme:** Condition monitoring should provide a system for data collection that ensures timely analysis and correction of engine problems. The programme should accomplish the following-
 - (a) Prevent in-flight shutdowns of powerplant systems through detection of early stage deterioration
 - (b) Ensure that engine limit margins are maintained so that a prolonged single-engine diversion may be conducted without exceeding approved engine limits (i.e. rotor speeds, exhaust gas temperature, etc.) at all approved power levels and expected environmental conditions.
- 9.4 **Reliability programme:** The programme must be an event-oriented reliability designed primarily to identify and prevent problems. This programme must incorporate reporting criteria for use by the operator and the Authority as a measure of extended range reliability. The ETOPS reliability programme can be a supplement to an existing programme if it is an event-oriented programme.

- 9.5 **Engine/APU oil consumption monitoring programme:** this must monitor oil consumption on a flight-by-flight basis. The monitoring must take into account the amount of oil added at the departing ETOPS stations with a reference to the running average consumption. Additionally, prior to each extended range leg, the programme must verify the oil system integrity.
- 9.6 **Extended range parts control programme:** The programme should ensure that distinct ETOPS parts, as required by the type design criteria, are utilised to maintain the integrity of the systems that are unique to ETOPS. This programme must consider verification of parts placed on aircraft through parts borrowing and pooling agreements.
- 9.7 **Maintenance training programme:** the operator should have a training programme which focuses on extended range awareness for all personnel involved in the extended range maintenance programme. This may be included in the normal training programme but it should emphasize the special nature of extended range maintenance requirements.
- 9.8 **Continuing analysis and surveillance programme:** The operator's normal continuing analysis and surveillance programme should be supplemented to require regular surveillance of the extended range programme. This supplemented programme must ensure the continuing integrity of the ETOPS maintenance programme while allowing for programme adjustment, as required.

10. PROCEDURES

10.1 Pre-requisites

- (a) A qualified maintenance engineer.
- (b) Knowledge of Regulations 70 of the Botswana Civil Aviation (Aircraft Operations) Regulations, 2013
- (c) Familiarity with the type of equipment/operations of the organisation.

10.2 Co-ordination:

These tasks require close co-ordination with the following:

- (a) Airworthiness and Flight Operations Sections of the Civil Aviation Authority of Botswana.
- (b) For leased aircraft - the appropriate State Airworthiness Authority.
- (c) State of design Authority.

10.3 References:

- (a) The Civil Aviation (Aircraft Operations) Regulations, 2013.
- (b) Operator's AOC approved Operations Manual;
- (c) Operators Approved Maintenance Control Manual;
- (d) Engineering Support Approved Maintenance Procedures manual;
- (e) Service Bulletins, Maintenance Manual, MEL.

10.4 Procedures:

10.4.1 The Operator shall verify the compliance of the aircraft/engine combination with the configuration for ETOPS substantiate data provided that the aircraft type design reliability and the performance of aircraft/engine combination have been evaluated and that there is evidence of its approval and use for ETOPS in other Contracting States.

10.4.2 The operator's maintenance programme current and supplemental, and other manuals shall meet ETOPS requirements:

- (a) The basic maintenance programme/schedule with additional ETOPS requirements recommended by manufacturer for the aircraft type.
- (b) Maintenance procedures that prevent actions such as changing oil filters, chip detectors, fuel controls, etc., from being done simultaneously on both engines.
- (c) The operator's supplemental maintenance programme should cater for the verification programme to include:
 - A list of primary systems
 - Conditions that require verification flights
 - Procedures for initiating verification actions
 - Procedures that monitor and evaluate corrective actions
 - Procedures that verify the implementation of corrective actions
 - Procedures that preclude repeat items from recurring
 - Procedure that identify and reverse the adverse trends.
- (d) Engine condition monitoring programme to cover:
 - Scope of programme, e.g., data collection and analysis
 - Notification procedures for deterioration
 - Deterioration monitoring limits for internal engine parts
- (e) Reliability programme to include:
 - Reporting criteria
 - Procedures to ensure reporting of significant individual events (engine shutdowns, flight diversions, etc.)
- (f) Engine /APU oil consumption monitoring programme which will cover:
 - Established limits of consumption
 - Procedures for use and verification prior to the start of each extended range leg
- (g) Extended range parts control which will look into:
 - Methods of verification of proper parts
 - Control procedures during parts pooling and borrowing (robbing)
- (h) Review maintenance training programme to ensure:
 - Personnel are aware that they have ETOPS approval
 - Personnel, including contract personnel e.g. Contracted AMOs personnel are adequately trained on the special programmes required by an ETOPS approval.

- (i) Review continuing analysis and surveillance programme to ensure it includes the following:
 - The continued integrity of the ETOPS maintenance programme
 - The adjustments are made, as required, to the ETOPS programme.

10.4.3 Review general procedures that will accomplish the following:

- (a) Precludes simultaneous actions from being applied to multiple similar elements in any ETOPS-critical system
- (b) Identify ETOPS-related tasks on routine work forms and related instructions
- (c) Develop an ETOPS over-water service check to verify the status of the aircraft and ensure certain critical items are acceptable.

10.5 **Analyses of the Results**

- (a) Evaluate assessment findings. Review any deficiencies found.
- (b) Record and recommend as appropriate to the Quality Manager (QM).

10.6 **OUTCOME**

When the QM ascertains that the recommendations given are positive, he will then make an appropriate application to the Authority for approval to conduct ETOPS operations.

11. **AIRWORTHINESS ASPECTS OF ETOPS**

11.1 **General**

An Aircraft operator will not operate a two-engine aeroplane in an ETOPS configuration unless it is issued with an approval by the Authority in accordance with Regulation 70 of the Civil Aviation (Aircraft Operation) Regulations, 2013.

11.2 **ETOPS Approval Procedures**

Operators requesting approval for Extended Range (ER) operations with two-engine aeroplanes shall submit their requests, with the required supporting documentation to the Authority at least 90 days prior to the proposed start of extended range operations. In addition, the operator shall maintain and dispatch an ETOPS aircraft in accordance with an approved maintenance, reliability and training program. The operator shall demonstrate that the maintenance checks, servicing, and programs called for will be properly conducted at representative departure and destination airports.

11.3 **ETOPS MAINTENANCE AND RELIABILITY REQUIREMENTS**

11.3.1 **General**

11.3.1.1 The maintenance program shall contain the standards, guidance and direction necessary to support the intended operation. Maintenance and personnel involved must be made aware of the special nature of ETOPS and have the knowledge, skills and ability to accomplish the requirements of the program.

11.3.1.2 The Airworthiness section having jurisdiction over the Air Operator must assess the operator's maintenance program as being suitable to support the proposed ETOPS operation before the operational approval for ETOPS can be granted.

11.3.2 ETOPS Maintenance Program

The basic maintenance program for the aircraft being considered for ETOPS is the continuous airworthiness maintenance program currently approved for that operator, for the make and model airframe/engine combination. The maintenance program must be reviewed to ensure that it provides an adequate basis for development and inclusion of specific ETOPS maintenance requirements.

- (a) ETOPS related tasks must be identified on the operator's routine work forms and related instructions.
- (b) ETOPS related procedures, such as involvement of centralized maintenance control or technical dispatch, must be clearly defined in the operator's maintenance program.
- (c) An ETOPS service check must be developed to verify that the status of the aeroplane and certain critical items are acceptable. An ETOPS qualified maintenance person prior to an ETOPS flight will accomplish this check.
- (d) Log books will be reviewed and documented, as appropriate; to ensure proper MEL procedures, deferred items and maintenance checks, and that system verification procedures have been properly performed.

11.3.3 ETOPS Manual

11.3.3.1 The operator shall develop a manual, or submit suitable amendments to existing manuals, for use by personnel involved in ETOPS. This manual need not include, but should at least reference, the maintenance program and other requirements described by this Advisory circular, and clearly indicate where they are located in the operator's manual system.

11.3.3.2 All ETOPS requirements, including supportive program procedures, duties and responsibilities, must be identified as being ETOPS sensitive and be subject to revision control. This manual should be submitted to the Authority for approval with sufficient lead time prior to the scheduled commencement of ETOPS flights.

11.3.4 Oil Consumption Program

The operator's oil consumption program should reflect the manufacturer's recommendations and be sensitive to oil consumption trends. It should consider the amount of oil added at the departing ETOPS stations with reference to the running average consumption; i.e. the monitoring must be continuous up to, and including, oil added at the ETOPS departure station. If oil analysis is required for this make and model, it should be included in the program.

If the APU is required for ETOPS operation, it must be added to the oil consumption program.

11.3.5 Engine Condition Monitoring

This program will describe the parameters to be monitored, method of data collection and corrective action process. The program should reflect manufacturer's instructions and industry practice. This monitoring will be used to detect deterioration at an early stage to allow for corrective action before safe

operation is affected. The program must ensure that engine limit margins are maintained so that a prolonged single-engine diversion may be conducted without exceeding approved engine limits (i.e. rotor speeds, exhaust gas temperature) at all approved power levels and expected environmental conditions. Engine margins preserved through this program must also account for the effects of additional engine loading demands (e.g. anti-icing, electrical, etc.) which may be required during the single-engine flight phase associated with the diversion.

11.3.6 Verification Program after Maintenance

The operator will develop a verification program that includes procedures to ensure appropriate corrective action following an engine shutdown, primary system failure or adverse trend(s) for any prescribed event(s) which require a verification flight, or other action, and establish means to assure their accomplishment. A clear description of who must initiate verification actions and the section or group responsible for the determination of what action is necessary must be identified in the program. Primary systems or conditions requiring verification actions must be described in the operator's ETOPS manual.

11.3.7 Reliability Program

11.3.7.1 An ETOPS reliability program will be developed or the existing reliability program supplemented as applicable. This program should be designed with early identification and prevention of ETOPS related problems as the primary goal as well as ensuring that the minimum ETOPS reliability levels are maintained. The program should be event – oriented and incorporate reporting procedures for significant events detrimental to ETOPS flights. An ETOPS reporting program will be established by the operator to ensure that the Authority is notified at least monthly, or more often if events reportable through this program are identified.

11.3.7.2 In addition to the Airworthiness standards requirements, the following items will be included in the reporting program:

- (a) In-flight shutdowns or flameouts;
- (b) Diversion or turn back;
- (c) Un-commanded power changes or surges;
- (d) Inability to control the engine or obtain desired power;
- (e) Problems with systems critical to ETOPS (engine bleed air, pressurization electrical power, etc.)

11.3.7.3 The report will also identify the following:

- (a) Aircraft identification;
- (b) Engine identification (make and serial number);
- (c) Total time, cycles and time since last shop visit;
- (d) For systems, time since overhaul or last inspection of the defective unit;
- (e) Phase of flight; and
- (f) Corrective action.

11.3.8 Contracted Maintenance and Reliability

11.3.8.1 Operators who contract any part of their maintenance and/or reliability programs, necessary to support their ETOPS approval, to any other organization, remain responsible for ensuring that all elements of this program are addressed and continue to meet the applicable requirements.

- 11.3.8.2 For those operators whose ETOPS approval is based on reliability levels established by other organizations, the Authority will not consider ETOPS approval beyond that issued to these organizations by their respective airworthiness authority.

11.3.9 Propulsion System Monitoring

- 11.3.9.1 The operator's assessment of propulsion systems reliability for the extended range fleet should be made available to the CAAB (with supporting data) on at least a monthly basis, to ensure that the approved maintenance program continues to maintain a level of reliability necessary for extended range operation.
- 11.3.9.2 The assessment will include, as a minimum, engine hours flown in the period, in flight shut-down rate for all causes and engine removal rate, both on a 12 month moving average basis. Where the combined extended range fleet is part of a larger fleet of the same aircraft/engine combination, data from the operator's total fleet will be acceptable. However, the reporting requirements of the reliability program must still be observed for the extended range fleet.
- 11.3.9.3 Any adverse sustained trend would require an immediate evaluation to be accomplished by the operator in consultation with the Authority. The evaluation may result in corrective action or operational restrictions being applied.

Note: Where statistical assessment alone may not be applicable, e.g. when the fleet size is small, the operator's performance will be reviewed on a case-by-case basis.

11.3.10 Maintenance Training

Maintenance training will focus on the special nature of ETOPS. This training should be included as an integral part of the operator's maintenance training program. The goal of this element of the program is to ensure that all personnel who are assigned ETOPS responsibilities (including dispatch, parts control and any other ETOPS related area) are provided with the necessary training so that ETOPS maintenance tasks are properly accomplished. Qualified maintenance personnel are those that have completed the operator's extended range training program and have satisfactorily performed extended range tasks under supervision, within the framework of the operator's approved procedures for Personnel Authorization.

11.3.11 ETOPS Parts Control

The operator will develop a parts control program, with support from the manufacturer that ensures that proper parts and configuration are maintained for ETOPS. The program includes verification that parts placed on ETOPS aircraft during parts borrowing or pooling arrangements, as well as those parts used after repair or overhaul, maintain the necessary ETOPS configuration for that aircraft.

11.4 ISSUE OF OPERATIONS SPECIFICATIONS

When the foregoing has been reviewed and found acceptable, a recommendation from the Airworthiness and Flight Operations inspectors shall be forwarded for approval and the applicant shall be issued an Operation Specification to conduct ETOPS operations within specified limitations.


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For/Civil Aviation Authority of Botswana



Date:

End of Advisory Circular

APPLICATION FORM FOLLOWS

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APPENDIX 1: Application Forms

APPLICATION FOR EXTENDED OPERATIONS (ETOPS) OPERATIONAL APPROVAL

Applicants are strongly advised to read the 'ETOPS Notes for Completion' before completing the form. Please complete the form in BLOCK CAPITALS using black or dark blue ink.

This form is designed to elicit all the required information from those operators requiring ETOPS operations approvals. The completed form and supporting documentation should be submitted to the Authority at the address listed in the 'Notes for completion'.

SECTION I OPERATOR/AIRFRAME DETAILS

Section I	Page 1	Operator/Airframe	Details Completion mandatory
Section II	Page 2	ETOPS Notes For Completion	
Section III	Page 2	Signature Block	Completion mandatory
Section IV	Pages 3 to 7	Operator's ETOPS Operations	
Manual Matrix			Completion mandatory

1 Applicant Details - required for all Approval requests

Please give the official name and business or trading name(s), address, mailing address, e-mail address and contact telephone/fax numbers of the applicant. Note: For AOC holders - company name, AOC number and e-mail address will suffice.

2 Aircraft Details - required for all Approval requests

Aeroplane type(s), series and registration mark(s).

Aeroplane Type	Aeroplane Series	Registration

SECTION II ETOPS NOTES FOR COMPLETION

1 Applicability

Extended Operations (ETOPS) applies to operators wishing to use twin-engined aircraft more than 60 minutes' flying time from a suitable diversion aerodrome. Such routes could be long ocean crossings, polar routes or routes where there are limited diversions available.

The requirements for Operator Approval to carry out ETOPS are laid out in Regulation 70 of the Civil Aviation (Aircraft Operations) Regulations, 2013

2 Operator's ETOPS Operations Manual Matrix

Section IV of this application form is the Operator's ETOPS Operations Manual Matrix. All applicants should complete Column 4 of this matrix in full. If more than one type of aircraft/fleet is included in a single application a completed matrix should be included for each aircraft/fleet.

3 Documents to be included with the application

Copies of all documents referred to in Column 4 of the Operator's ETOPS Operations Manual Matrix should be included when returning the completed application form to Civil Aviation Authority of Botswana. Original documents should not be sent, photocopies are sufficient. Do not send complete manuals, only the relevant sections/pages will be required. The issue of an ETOPS approval will incur a charge.

Failure to include all relevant documentation and the correct fee may result in a delay in processing your application.

4 Submissions and Enquiries

Address for submission of documents;

The Director, Flight Safety
Civil Aviation Authority of Botswana
P. O Box 250
Gaborone
Botswana

SECTION III SIGNATURE BLOCK

Please complete your review of your Operations Manual. The ETOPS flight operations minimum requirements are given in the table below. Enter the Operations Manual references in the last column and return the matrix, together with photocopies of the relevant pages of the Operations Manual, to the address given in paragraph 4 of Section II.

Operations Manual	Subjects	Requirements	Operator's Operations Manual Reference or Document Reference
Part A General	Documents/regulations used in compiling ETOPS Manual/Procedures.		
	Brief description of ETOPS.		
	Definitions	Extended Operations. Adequate aerodrome. Approved one-engine inoperative cruise speed. Threshold distance/time. Adequate ETOPS en- route alternate. Equal time points. Rule distance/time. ETOPS segment. ETOPS significant system. Maximum approved diversion time. Dispatch	
	Criteria.	Company AOC defined operating area. List of certified aircraft types/engine combinations.	
	Approval.	Approved diversion time.	
	Qualifications.	Crew qualifications. ETOPS qualified dispatcher personnel. ETOPS qualified operations staff. ETOPS qualified maintenance personnel.	
	Training (Initial and Recurrent) and checking	Flight crew training and Operations Manuals. Flight crew currency requirements.	
	ETOPS Authorisation	Commander's responsibilities. Statement to show when ETOPS are allowed.	
ETOPS Flight Preparation and Planning	Aircraft serviceability and MEL. Communication and navigation facilities. Critical fuel scenario. Critical fuel reserve. ETOPS alternate aerodrome selection. ETOPS alternate planning minima. Pre-dispatch and post- dispatch weather minima. Computerized flight plan. Delayed dispatch. Maintenance check (pre-departure service check). Verification flights.		

	Flight Crew Procedures	Crew responsibilities. Flight documentation/chart handling. Fuel management. Weather monitoring. Change of routing. Diversion decision-making. Icing. Crew workload management.	
Part B Type Specific	Type-related ETOPS Operations	Identification of ETOPS aeroplanes. Types of ETOPS operations that are approved. Placards and limitations. One-engine inoperative speed.	
	Type-specific Planning Requirements		
	ETOPS Fuel Planning	Including critical fuel scenario.	
	MEL/CDL.	ETOPS-specific MEL/CDL items.	
	Aeroplane Systems	Performance data. Aerodrome technical differences, navigation fit, communications fit.	
	Non-normal Procedures	Navigation failures. Action to be taken on ETOPS-significant system failure. Low fuel scenario. Crew incapacitation.	
Part C Route and Aerodrome Instructions	ETOPS Areas and Routes	Approved area of operation. ETOPS en-route alternates. Performance restrictions and weather minima for en-route alternates. Meteorological facilities/information. Low altitude cruise information. Route minimum diversion altitudes. MSA restrictions. Route-specific oxygen requirements	
Part D Training	Ground, Simulator and Line Training.	General: <ul style="list-style-type: none"> • ETOPS overview. • ETOPS regulations. • ETOPS type design approval. • Definitions. • Approved one-engine inoperative speed. • Maximum approved diversion time. • Operator's approved diversion time. • ETOPS area of operation. • ETOPS routes. • ETOPS alternate aerodromes and weather minima. • Navigation systems accuracy, limitations and operating procedures. • Meteorological facilities and information. • In-flight monitoring and procedures. • Computerised flight plan. • Charts and position plotting. • Equal time point. • Critical fuel. 	

		<p>Normal procedures:</p> <ul style="list-style-type: none"> • Flight planning and dispatch. • ETOPS fuel requirements. • Route alternate selection - weather minima. • MEL - equipment- specific. • ETOPS service check and technical log. • Pre-flight FMS set-up. • Flight performance progress monitoring. • Flight management, navigation and communication systems. • Aeroplane system monitoring. 	
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		<ul style="list-style-type: none"> • Weather monitoring. • In-flight fuel management (to include independent cross-checking of fuel quantity). <p>Non-normal procedures:</p> <ul style="list-style-type: none"> • Diversion procedures and diversion 'decision making'. • Navigation and communication systems, including appropriate flight management devices in degraded modes. • Fuel management with degraded systems. • Procedures for single and multiple failures in flight affecting ETOPS sector entry and diversion decisions. • Operating on standby power. • Operational restrictions associated with system failures including any applicable MEL considerations. 	
	ETOPS Simulator Training and Line Flying Under Supervision.	<p>Pilots conversion course. Annual refresher course.</p>	
	Flight Operations Staff and Dispatchers.	<p>Outline of training syllabus to include:</p> <ul style="list-style-type: none"> • ETOPS regulations. • Operational approval. • Aeroplane performance. • Diversion procedures. • Area of operation. • Fuel requirements. • Dispatch considerations: MEL, CDL, weather minima and alternate airports. • Delayed dispatch. • Documentation 	

Any Further information to Support the Application

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