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REGIÃO ADMINISTRATIVA ESPECIAL DE MACAU
民航局
AUTORIDADE DE AVIAÇÃO CIVIL
CIVIL AVIATION AUTHORITY

AC
No. : AC/OPS/018R00
Date : 01 Feb 2011

AERONAUTICAL CIRCULAR
CIVIL AVIATION AUTHORITY – MACAO, CHINA

SUBJECT:

OPERATIONAL APPROVAL OF

EXTENDED RANGE OPERATIONS (ETOPS)

EFFECTIVE DATE:

01 Feb 2011

CANCELLATION:

Nil.

GENERAL:

The President of Civil Aviation Authority – Macao, China, in exercise of his power under Paragraph 89 of the Air Navigation Regulation of Macao (ANRM) and Article 35 of the Statutes of Civil Aviation Authority, approved by the Decree-Law 10/91/M, established this Aeronautical Circular (AC).

1 Introduction

According to the ANRM Part V paragraph 28(5), except under and in accordance with the terms of a written authorization granted by AACM to the operator, a Macao registered aeroplane, having two turbine engines, shall not fly in extended range operation for the purpose of commercial air transport unless it will, in the meteorological conditions expected for the flights, at any point along the route or any planned diversion wherefrom, not be more than 60 minutes flying time at single engine cruise speed to an adequate aerodrome.

In order to satisfy the need of the operators wishing to operate Extended Range Operations, the purpose of this AC is to define the requirements and considerations of conducting ETOPS operations, and to provide guidelines for the issuance of ETOPS operational approval.

The primary concept depicted in this AC for evaluating extended range operation with two-engine aeroplanes is to ensure that two-engine aeroplanes are consistent with the level of safety required for current extended range operation with three and four-engine turbine powered aeroplanes without unnecessarily restricting operation.

2 Applicability

In general terms, this AC is applicable to all Macao registered aeroplanes, having two turbine engines with maximum authorized take-off weight exceeds 5,700 kg, and are flying for the purpose of commercial air transport.

3 Overview

The approval process which results in the issuance of ETOPS operational approval consist of the following phases:

(a) Pre-application

(b) Formal Application

(c) Technical Evaluation

(d) Demonstration/Validation of Operator ETOPS Maintenance and Operations Capability

(e) Decision on application – Issuance of ETOPS Operational Approval

Operator shall set up a pre-application meeting with AACM, to facilitate its details planning and work schedule of the proposed operation, prior to the submission of a formal application, in which AACM will make the operator fully aware of the regulatory requirements which must be met in order to obtain the desired operational approval.

After the pre-application meeting, if the operator intends to proceed with the application process, a formal application shall be submitted to AACM, with all required supporting documentation, at least 3 months before the proposed start of extended range operation. Upon receipt of the submitted documentation, AACM will initiate the technical evaluation phase by assessing the operator's programmes on both airworthiness and operations aspects to ensure that the operator's programmes and procedures are established in accordance with all the requirements set forth in this AC and are adequate for the issuance of ETOPS operational approval.

4 Definitions

- Aerodrome

  (a) Adequate. For the purpose of this AC, an adequate aerodrome is an aerodrome, which the operator of the aeroplane considers to be adequate, having regard to the performance requirements applicable at the expected landing weight or mass. In particular, it should be anticipated that at the expected time of use:

  (i) The aerodrome will be available, and equipped with necessary ancillary services, such as ATC, sufficient lighting, communications, weather reporting, navaids and emergency services. Rescue and Fire Fighting Services (RFFS) equivalent to a minimum of ICAO category 4 (for RFFS not located on the aerodrome; capability of meeting the aeroplane within 30 minutes notice) or the relevant aeroplane category if lower; and

  (ii) At least one letdown aid (ground radar would so qualify) will be available for an instrument approach.

  (b) Suitable. For the purpose of this AC, a suitable aerodrome is an adequate aerodrome with weather reports, or forecasts, or any combination thereof, indicating that the weather conditions are at or above the minima defined in Appendix B of this AC, and the field condition reports indicate that a safe landing can be accomplished at the time of the intended operation.

- Auxiliary Power Unit (APU)

  A gas turbine engine intended for use as a power source for driving generators, hydraulic pumps and other aeroplane accessories and equipment and/or to provide compressed air for aeroplane pneumatic systems.

- ETOPS Configuration, Maintenance and Procedures (CMP) Standard

  The particular aeroplane configuration minimum requirements including any special inspection, hardware life limits, Master Minimum Equipment List (MMEL) constraints, and maintenance practices found necessary to establish the suitability of an airframe-engine combination for extended range operation.

- Extended Range Operations

  For the purpose of this AC, extended range operations are those flights conducted over a route that contains a point further than one hour flying time at the approved one-engine-inoperative cruise speed (under standard conditions in still air) from an adequate aerodrome.

- Engine

  A unit used or intended to be used for aircraft propulsion. It consists of at least those components and equipment necessary for functioning and control, but excludes the propeller/rotors (if applicable).

- Extended Range Entry Point

  The extended range entry point is the point on the aeroplane's outbound route which is one hour flying time at the approved one-engine-inoperative cruise speed (under standard conditions in still air) from an adequate aerodrome.

- Maintenance Personnel

  Mechanics, Licensed Ground Engineers, Maintenance Support Personnel.

- In-flight Shutdown (IFSD)

  When an engine ceases to function in flight and is shutdown, whether self-induced, crew initiated or caused by some other external influence (i.e., In Flight Shutdown (IFSD) for all causes; for example: due to flameout, internal failure, crew-initiated shutoff, foreign object ingestion, icing, inability to obtain and/or control desired thrust).

- ETOPS Significant System

  (a) A system for which the fail-safe redundancy characteristics are directly linked to the number of engines, e.g., hydraulic system, pneumatic system, electrical system.

  (b) A system that may affect the proper functioning of the engines to the extent that it could result in an in-flight shutdown or uncommanded loss of thrust, e.g., fuel system, thrust reverser or engine control or indicating system, engine fire detection system.

  (c) A system which contributes significantly to the safety of flight and a diversion with one engine inoperative, such as back-up systems used in case of additional failure during the diversion. These include back-up or emergency generator, APU or systems essential for maintaining the ability to cope with prolonged operation at single engine altitudes, such as anti-icing systems.

  (d) A system for which certain failure conditions may reduce the safety of a diversion, e.g. navigation, communication, equipment cooling, time limited cargo fire suppression, oxygen system.

(e) A system includes all elements of equipment necessary for the control and performance of a particular major function. It includes both the equipment specifically provided for the function in question and other basic equipment such as that necessary to supply power for the equipment operation.

(i) Airframe System

Any system on the aeroplane that is not a part of the propulsion system.

(ii) Propulsion System

The aeroplane propulsion system includes each component that is necessary for propulsion; components that affect the control of the major propulsion unit; and components that affect the safe operation of the major propulsion units.

- Approved One-Engine-Inoperative Cruise Speed

The approved one-engine-inoperative cruise speed for the intended ETOPS operation must be a speed, within the certificated limits of the aeroplane, selected by the operator and approved by AACM. The operator must use this speed in:

(a) Establishing the outer limit of the area of operation and any dispatch limitation;

(b) Calculation of single engine fuel requirements in respect of fuel and oil supply;

(c) Establishing the level off altitude (net performance) data. This level off altitude must clear any obstacle en-route by margins as specified in the operational requirements.

- Equal-time Point

An equal-time point is a point on the aeroplane route which is located at the same flying time (in forecasted atmospheric conditions) from two suitable diversion aerodromes.

- Threshold Time

60 minutes

5 Approval Basis

Each operator desiring approval for extended range operations must show that the particular airframe-engine combination is sufficiently reliable, in which systems required for extended range operation shall be shown to be designed to a fail-safe criteria and to be continuously maintained and operated at levels of reliability appropriate for the intended operation.

5.1 Type Design Approval

The process which will normally lead to the type design ETOPS Approval can be divided into two steps:

(a) Eligibility for ETOPS – to ensure design features of the particular airframe-engine combination are suitable for the intended operation.

(b) Capability for ETOPS – to ensure the particular airframe-engine combination, having been recognized eligible for ETOPS, can achieve a sufficiently high level of reliability in service so that safe extended range operation may be conducted.

Evidence that the type design of the aeroplane is approved for extended range operation is normally reflected by a statement in the approved Aeroplane Flight Manual (AFM) and Type Certificate Data sheet which references the CMP standard requirements for extended range operations.

5.2 In-service Experience

It is necessary for each operator desiring approval for extended range operation to show that it has obtained sufficient maintenance and operations experience with that particular airframe-engine combination to conduct safely these operations.

5.3 Continuing Airworthiness and Operational Approval

Since the type design approval does not reflect a continuing airworthiness or operational approval to conduct extended range operation. Therefore, before approval, each operator shall demonstrate its ability to maintain and operate the aeroplane so as to achieve the necessary reliability, and to train its personnel to achieve the competence in extended range operations. The continuing airworthiness and operational approval to conduct extended range operations is made through the mechanism outlined in Section 6 (Operational Approval Considerations) of this AC.

6 Operational Approval Considerations

In relation to the maximum diversion time authorized for the operational approval of extended range operation, three categories of operational approval are introduced in this AC:

(a) Operational approval for extended range operations with a maximum diversion time of 90 minutes or less to an en-route alternate (at the approved one-engine-inoperative cruise speed under standard conditions in still air);

(b) Operational approval for extended range operations with a maximum diversion time above 90 minutes up to 120 minutes to an en-route alternate (at the approved one-engine-inoperative cruise speed under standard conditions in still air);

(c) Operational approval for extended range operations with a maximum diversion above 120 minutes up to 180 minutes to an en-route alternate (at the approved one-engine-inoperative cruise speed under standard conditions in still air).

6.1 In-service Experience for Operational Approval

Each operator requesting Approval shall have appropriate experience. A summary must be provided to AACM, indicating its capability to maintain and operate the specific airframe-engine combination for the intended extended range operation. This summary shall include experience with the engine type or related engine types, experience with the aeroplane systems or related aeroplane systems, or experience with the particular airframe-engine combination on non-extended range routes.

In general, not less than 12 consecutive months experience shall be required before authorization of 90 minutes or 120 minutes maximum diversion time, unless the operator can show compensating factors. The factors to consider may include calendar time, total number of flights, operator's diversion events, record of the airframe-engine combination with other operators, quality of operator's programmes and route structure. However, the operator will still need, in the latter case, to demonstrate its capability to maintain and operate the new airframe-engine combination at a similar level of reliability.

In considering an application from an operator to conduct extended range operations, an assessment will be made of the operator's over-all safety record, past performance, training and maintenance programmes. The data provided with the request shall substantiate the operator's ability and competence to safely conduct and support these operations and shall include the means used to satisfy the considerations outlined in this

section. Any reliability assessment obtained, either through analysis or service experience, will be used as guidance in support of operational judgments regarding the suitability of the intended operation.

6.2 Assessment of the Operator's Propulsion System Reliability

Following the accumulation of adequate operating experience by the world fleet of the specified airframe-engine combination, and the establishment of an IFSD rate in accordance with Appendix A for use in ensuring the propulsion system reliability necessary for extended range operations, an assessment will be made of the operator's ability to achieve and maintain this level of propulsion system reliability.

This assessment will include trend comparisons of the operator's data with other operators as well as the world fleet average values, and the application of a qualitative judgment that considers all of the relevant factors. The operator's past record of propulsion system reliability with related types of engines will also be reviewed, as well as its record of achieved systems reliability with the airframe-engine combination for which authorization is sought to conduct extended range operations.

6.3 Engineering Modifications and Maintenance Programme Considerations

Although these considerations are normally part of the operator's continuing airworthiness programme, the maintenance and reliability programme may need to be supplemented in considerations of the special requirements of extended range operation set forth in Appendix C. The following items, as part of the operator's programme, will be reviewed to ensure that they are adequate for extended range operations:

6.3.1 Engineering Modifications

The operator shall provide to AACM all titles and numbers of all modifications, additions, and changes which were made in order to substantiate the incorporation of the CMP standard in the aeroplanes used in extended range operation.

6.3.2 Maintenance and Training Procedures

Maintenance and training procedures, practices, or limitation established to qualify for extended range operations shall be submitted to AACM for approval. Any substantial changes to these arrangements shall also be submitted to AACM 30 working days before such changes are adopted.

6.3.3 Reliability Reporting Programme

The reliability reporting programme as supplemented and approved, shall be implemented prior to and continued after approval of extended range operation. Data from this process should result in a suitable summary of problem events, reliability trends and corrective actions and be regularly provided to AACM and to the relevant airframe and engine manufacturers. Appendix C contains additional information concerning propulsion and airframe system reliability monitoring and reporting.

6.3.4 Modification and Inspections Implementation

There shall be procedures for the prompt implementation of modifications and inspections which would maintain the reliability objective for the propulsion and airframe systems as a consequence of Airworthiness Directive (AD) actions and revised CMP standards. Other recommendations made by the engine and airframe manufacturers shall also be considered for prompt implement, and this would apply to both installed and spare parts.

6.3.5 Aeroplane Dispatch Procedures

Procedures and centralized control processes shall be established which would preclude an aeroplane being dispatched for extended range operation after propulsion system shutdown or primary airframe system failure on a previous flight, or significant adverse trends in system performance, without appropriate corrective action having been taken. Confirmation of such action as being appropriate, in some cases, may require the successful completion of one or more non-revenue or non-ETOPS revenue flights (as appropriate) prior to dispatch on an extended range operation.

6.3.6 Maintenance Programme

The operator's maintenance programme shall ensure that the airframe and propulsion systems will continue to be maintained at the level of performance and reliability necessary for extended range operations.

6.3.7 Engine Condition Monitoring

An engine condition monitoring programme shall be developed which may include hard time inspection intervals for component condition which is not otherwise observable and which could adversely affect failure rates.

6.3.8 Oil Consumption Monitoring

There shall be an engine and APU (where appropriate) oil consumption monitoring programme.

6.4 Flight Preparation and In-flight Considerations

The flight dispatch considerations specified herein are in addition to, or amplify, the operational requirements and specifically apply to extended range operations. Although many of the considerations in this AC are currently incorporated into approved programmes for other aeroplanes or route structures, the unique nature of extended range operations with two-engine aeroplanes necessitates a re-examination of these operations to ensure that the Approved programmes are adequate for this purpose.

6.4.1 Minimum Equipment List (MEL)

System redundancy levels appropriate to extended range operations shall be reflected in the operator's Minimum Equipment List (MEL). For aeroplane already in operational services, the existing MEL shall be re-evaluated and adjusted appropriately to reflect system redundancy levels necessary for extended range operations. Systems considered to have a fundamental influence on flight safety shall include, but are not limited to, the following:

(a) Electrical, including battery;

(b) Hydraulic;

(c) Pneumatic;

(d) Flight instrumentation;

(e) Fuel;

(f) Flight control;

(g) Ice protection;

(h) Engine start and ignition;

(i) Propulsion system instruments;

(j) Navigation and communications;

(k) Auxiliary power-unit;

(l) Air conditioning and pressurization;

(m) Cargo fire suppression;

(n) Engine fire protection;

(o) Emergency equipment; and

(p) Any other equipment necessary for extended range operations.

6.4.2 Communication and Navigation Facilities

An aeroplane shall not be dispatched on an extended range operation unless:

(a) Communications facilities are available to provide under normal conditions of propagation at the appropriate one-engine-inoperative cruise altitudes, reliable two-way voice communications between the aeroplane and the appropriate air traffic control unit over the planned route of flight and the routes to any suitable alternate to be used in the event of diversion;

(b) Non-visual ground navigation aids are available and located so as to provide, taking account of the navigation equipment installed in the aeroplane, the navigation accuracy necessary for the planned route and altitude of flight, and the routes to any alternate and altitudes to be used in the event of diversion for whatever reason; and

(c) Visual and non-visual aids are available at the specified alternates for the authorized types of approaches and operating minima.

6.4.3 Fuel and Oil Supply

(a) General

An aeroplane shall not be dispatched on an extended range operation unless it carries sufficient fuel and oil to meet the operational requirements set forth in the ANRM, and any additional fuel that may be determined in accordance with subparagraph (b) below, "Critical Fuel Reserves". In computing fuel requirements, at least the following shall be considered as applicable:

(i) Current forecast winds and meteorological conditions along the expected flight path at the appropriate one-engine-inoperative cruise altitude and throughout the approach and landing;

(ii) Any necessary operation of ice protection systems and performance loss due to ice accretion on the unprotected surfaces of the aeroplane;

(iii) Any necessary operation of Auxiliary Power Unit (APU);

(iv) Loss of aeroplane pressurization and air conditioning; consideration shall be given to flying at an altitude meeting oxygen requirements in the event of loss of pressurization;

(v) An approach followed by a missed approach and a subsequent approach and landing;

(vi) Navigational accuracy necessary; and

(vii) Any known Air Traffic Control (ATC) constraints.

Note: APU oil consumption shall also be considered as necessary.

(b) Critical Fuel Reserves

In establishing the critical fuel reserves, operator shall determine the fuel necessary to fly to the most critical point and execute a diversion to a suitable alternate under the conditions outlined in subparagraph (c) regarding the "Critical Fuel Scenario".

(c) Critical Fuel Scenario

The following describes a scenario for a diversion at the most critical point. Operator shall confirm that the scenario to be used when calculating the critical fuel reserve necessary. It is operationally the most critical when considering both time and aeroplane configuration:

(i) At the critical point, consider simultaneous failure of one propulsion system and the pressurization system (critical point based on time to a suitable alternate at the approved one-engine-inoperative cruise speed).

(ii) Immediate descent to and continued cruise at 3,048 m (10,000 feet) at the relevant one-engine-inoperative cruise speed or continued cruise above 3,048 m (10,000 feet) if the aeroplane is equipped with sufficient supplemental oxygen in accordance with the operational requirements.

(iii) Upon approaching the ETOPS en-route alternate, descent to 457 m (1,500 feet) above destination, hold for 15 minutes, initiate an approach followed by a missed approach and then execute a normal approach and landing.

Note: The critical fuel scenario shall allow for a contingency figure of 5 per cert added to the calculated fuel burn from the critical point to allow for errors in wind forecasts to the items listed in subparagraph (a) above. Furthermore, unless the operator has an established value for in-service deterioration in cruise fuel mileage, additional 5 per cent penalty in fuel mileage shall be added to account for any Configuration Deviation List items, both airframe and engine anti-icing; and ice accumulation on unprotected surfaces if icing conditions are likely to be encountered during the diversion.

6.4.4 Alternate Aerodromes

An aeroplane shall not be dispatched on an extended range operation unless the required take-off, destination and alternate aerodromes, including suitable en-route alternate aerodromes to be used in the event of propulsion system failure or aeroplane system failure(s) which require a diversion, are listed in the cockpit documentation (e.g. operational flight plan). Suitable en-route alternates shall also be identified and listed in ATS flight plan and dispatch release (if applicable) for all cases where the planned route of flight contains a point more than one hour flying time at the one-engine-inoperative speed from an adequate aerodrome. Since these suitable en-route alternates serve a different purpose than the destination alternate aerodrome and would normally be used only in the event of an engine failure or the loss of primary aeroplane systems, an aerodrome shall not be listed as a suitable en-route alternate unless:

(a) The landing distances required as specified in the AFM for the altitude of the aerodrome, for the runway expected to be used, taking into account wind conditions, runway surface conditions, and aeroplane handling characteristics, permit the aeroplane to be stopped within the landing distance available as declared by the aerodrome authorities and computed in accordance with the operational requirements;

(b) The aerodrome services and facilities are adequate for the operator's approved approach procedure(s) and operating minima for the runway expected to be used;

(c) The latest available forecast weather conditions for a period commencing one hour before the established earliest time of landing and ending one hour after the established latest time of landing at that aerodrome, equals or exceeds the authorized planning minima for en-route alternate aerodromes calculated in accordance with Appendix B of this AC. In addition, for the same period, the forecast crosswind component, including gusts, for the landing runway expected to be used shall not exceed the maximum permitted crosswind for single engine landing taking into account the runway condition (dry, wet or contaminated);

(d) During the course of the flight, the flight crews are to continue to remain informed of any significant changes in conditions at designated en-route alternates. Prior to proceeding beyond the extended range entry point, the forecast weather for the time periods established in subparagraph (c) above, aeroplane status, fuel remaining, runway surface conditions, landing distances and aerodrome services and facilities at designated en-route alternates shall be evaluated. If any conditions are identified (such as weather forecast below landing minima) which would preclude safe approach and landing, then the pilot shall take an appropriate course of action.

(e) In addition, the operator's programme shall provide flight crews with information on adequate aerodromes appropriate to the route to be flown which are not forecast to meet the planning en-route alternate weather minima outlined in Appendix B. Aerodrome facility information and other appropriate planning data concerning these aerodromes shall be provided to flight crews for use when executing a diversion.

Note: The alternate aerodromes shall be chosen in order to make it possible for the aeroplane to reach the alternate while complying with the requirements, especially with regard to performance (flight over obstacles) and/or oxygen considerations. Equal-time point(s) shall be evaluated and indicated on the operational flight plan, with the considerations of effects of wind and temperature at the one-engine-inoperative cruise altitude.

6.4.5 Aeroplane Performance Data

No aeroplane shall be dispatched on an extended range flight unless the operator's Operations Manual contains sufficient data to support the critical fuel reserve and area of operations calculation. Such data shall include:

(a) Detailed one-engine-inoperative performance data, including fuel flow for standard and non-standard atmospheric conditions and as a function of airspeed and power setting, where appropriate, covering:

(i) Drift-down (includes net performance);

(ii) Cruise altitude coverage including 3,048 m (10,000 feet);

(iii) Holding;

(iv) Altitude capability (includes net performance); and

(v) Missed approach.

(b) Detailed all-engine-operating performance data, including nominal fuel flow data, for standard and non-standard atmospheric conditions and as a function of airspeed and power setting, where appropriate, covering:

(i) Cruise altitude coverage including 3,048 m (10,000 feet); and

(ii) Holding.

(c) Details of any other conditions relevant to extended range operation which can cause significant deterioration of performance, such as ice accumulation on the unprotected surfaces of the aeroplane, Ram Air Turbine (RAT) deployment, thrust reverser deployment, etc.

(d) The altitudes, airspeeds, thrust settings, and fuel flow used in establishing the ETOPS area of operations for each airframe-engine combination must be used in showing the corresponding terrain and obstruction clearances in accordance with the operational requirements.

6.5 Training and Evaluation Programme

6.5.1 Flight Crews

The operator's training programme in respect to extended range operation shall provide initial and recurrent training for flight crew members, followed by subsequent evaluations and proficiency checks in the following areas:

(a) Introduction to ETOPS regulations;

(b) Routes and aerodromes to be used in the ETOPS area of operations;

(c) Performance:

  (i) Flight planning, including all contingencies; and

  (ii) Flight performance progress monitoring.

(d) Procedures:

  (i) Diversion Procedures and Diversion "Decision making";

  (ii) Use of appropriate navigation and communication system;

  (iii) Abnormal and emergency procedures to be followed in the event of foreseeable failures, including:

    (A) Procedures for single and multiple failures in flight that would precipitate go/no-go and diversion decisions. If standby sources of electrical power significantly degrade cockpit instrumentation to the pilots, then approved training, which simulates approach with the standby generator as the sole power source, shall be conducted during initial and recurrent training;

    (B) Operational restrictions associated with these failures, including any applicable MEL considerations;

    (C) Procedures for air start of the propulsion systems, including the APU, if required; and

(D) Crew incapacitation.

(iv) Use of emergency equipment, including protective breathing and ditching equipments;

(v) Procedures to be followed in the event that there is a change in conditions at designated en-route alternates which would preclude safe approach and landing;

(vi) Understanding and effective use of approved additional or modified equipment required for extended range operations;

(vii) Fuel management procedures to be followed during the en-route portion of the flight, in which independent cross-check of fuel quantity indicators shall be included.

In addition to initial and recurrent training given to crew members, operators shall arrange an annual evaluation in order to ensure that the level of awareness on matters relating to extended range operations is kept at a satisfactory level. Such evaluation must include a written test paper, which may be included in the annual line check.

6.5.2 Flight Operations Officers/Dispatchers

In relation to the ETOPS training for flight operations officers/dispatchers, operator shall provide appropriate initial and recurrent training in the following areas:

(a) Introduction to ETOPS regulations;

(b) Routes and aerodromes to be used in the ETOPS area of operations;

(c) Aeroplane performance;

(d) Fuel requirements;

(e) Flight planning;

(f) Dispatch considerations, including MEL, CDL and en-route alternate selection-weather minima; and

(g) Diversion procedures.

6.6 Operational Limitations

6.6.1 Area of Operation

An operator may be authorized to conduct extended range operation with a particular airframe-engine combination within an area where the maximum diversion time, at any point along the proposed route of flight to an adequate aerodrome, is up to 180 minutes or less (as approved by AACM) in still air at the approved one-engine-inoperative cruise speed. The area of operation will be indicated by AACM in the form of authorized ETOPS routes.

6.6.2 Flight Dispatch Limitation

The flight dispatch limitation shall specify the maximum diversion time from a suitable aerodrome to be used when planning a particular extended range operation. The maximum diversion time at the approved one-engine-inoperative cruise speed (under standard conditions in still air) shall not be any greater than the values established by subparagraphs (a) and (b) below. Authorization for operations beyond these values will not be permitted until operational experience, in extended range operations with two-engine aeroplanes, clearly indicates that further credit is appropriate.

(a) Use of Maximum Diversion Time

The procedures established by the operator shall ensure that extended range operations are limited to flight plan routes where the approved maximum diversion time to suitable aerodromes can be met at the approved one-engine-inoperative cruise speed under standard conditions in still air. Operator shall give instructions that:

(i) Upon occurrence of an in-flight shutdown of an engine, the pilot shall promptly initiate diversion to fly to and land at the nearest suitable aerodrome, under the prevailing conditions, at which a safe landing can be made; and

(ii) In the event of a single or multiple primary system failure, the pilot shall initiate the diversion procedure to fly to and land at the nearest suitable aerodrome, under the prevailing conditions, unless it has been justified that no substantial degration of safety results from continuation of the planned flight.

(b) Increase of Maximum Diversion Time

The operator's authorized maximum diversion time may be progressively increased by AACM as the operator gains experience on the particular airframe-engine combination. In the case of operations cleared up to 120 minutes maximum diversion time, 6 consecutive months of satisfactory operations at 120 minutes ETOPS operations is required for an increase of maximum diversion time up to 138 minutes; and another 12 consecutive months satisfactory and extensive operations at a maximum diversion time of not less than 120 minutes is necessary before authorization of maximum diversion time up to 180 minutes. Such request may be approved, on a case by case basis, provided that the operator can demonstrate the additional capabilities in respect to the items outlined in subparagraph (i) to (iii) hereunder.

(i) Dispatch Considerations

(A) Minimum Equipment List (MEL)

The MEL shall reflect adequate levels of primary system redundancy to support the desired 138 minutes or 180 minutes (under standard conditions in still air) operations;

(B) Weather

Operator shall substantiate that the weather information system which it utilizes can be relied upon to forecast terminal and en-route weather with a reasonable degree of accuracy and reliability in the proposed area of operations;

(C) Fuel

The critical fuel scenario shall also consider fuel required for all-engine-operations at 3,048 m (10,000 feet) or above 3,048 m (10,000 feet) if the aeroplane is equipped with sufficient supplemental oxygen.

(ii) Crew Training

(A) Diversion Procedures and Diversion "Decision Making"

Special training to prepare flight crews to evaluate probable propulsion and airframe systems failures shall be conducted to strengthen crew competency in dealing with the most probable operating contingencies, in particular of disparity of operations with maximum diversion time beyond 120 minutes.

(B) Abnormal and Emergency Procedures

Flight crew shall be provided with detailed training, which emphasizes established abnormal and emergency procedures, for each area of operation intended to be used.

(iii) Equipment

(A) VHF/HF, Data Link where available

Operator should consider enhancements to its operational control system as soon as they become feasible.

(B) Automated System Monitoring

The provision of automated aeroplane system status monitoring should be considered in order to enhance the flight crew's ability to make timely diversion decisions.

6.6.3 Contingency Procedures

Contingency procedures shall not be interpreted in any way which prejudices the final authority and responsibility of the pilot in command for the safe operation of the aeroplane.

6.7 Operations Manual

Operator's Operations Manual shall clearly state that, without the appropriate and relevant approval, executing extended range operations is not allowed. Information in the operations manual for extended range operations shall specifically include provisions covering at least the following:

(a) Designation of the particular airframe-engine combination, including specification of modifications required for extended range operations;

(b) Authorized ETOPS area of operations (e.g. authorized ETOPS routes) ;

(c) Minimum altitudes to be flown along planned and diversionary routes, and maximum altitudes if restricted by ETOPS considerations (e.g. APU start capability);

(d) The maximum diversion time, at the approved one-engine-inoperative cruise speed (under standard conditions in still air), that any point on the route the aeroplane may be from a suitable aerodrome for landing;

(e) The power setting, speeds, and flight levels to be used after the failure or shutdown of an engine;

(f) Aerodromes nominated for use, including alternates, and associated instrument approaches, operation minima, and planning minima;

(g) Reference to the approved maintenance schedule requirements for extended range operations, including those items specified in the type design approval of the ETOPS variant;

(h) Identification of aeroplane designated for extended range operations by make and model, as well as by serial number and registration;

(i) Minimum qualifications for operations personnel (e.g. flight crew and flight operations officer/dispatcher, etc.) to conduct extended range operations;

(j) Guidance on minimum acceptable system and equipment levels of serviceability in order to continue an extended range operation in the event of an in-flight failure;

(k) Procedures to enable the flight to be conducted on an alternative rule as "non-ETOPS" operation, i.e. not more than one hour from a suitable alternate. Otherwise, a statement shall be stated in the Operations Manual that non-ETOPS flights are not approved on that route.

6.8 Validation of Operator ETOPS Maintenance and Operations Capability

The operator shall demonstrate to AACM, using the specified airframe-engine combination or preferably by use of an approved simulator, that it has the competence and capability to safely conduct and adequately support the intended operation. The following emergency conditions shall be demonstrated during the validation flight unless successful demonstrations of these conditions have previously been carried out in an approved simulator:

(a) Total loss of thrust of one engine, (simulated in the aeroplane by setting zero thrust on the simulated failed engine);

(b) Total loss of engine-generated electrical power; and

(c) Any other condition considered to be equivalent in airworthiness, crew workload, or performance risk.

In the meantime, prior to be granted the ETOPS operational approval, the operator shall also demonstrate its ETOPS flight dispatch practices, policies, procedures, as well as the ETOPS maintenance checks, servicing and programmes called for in Appendix C are properly established and conducted for operations to and from representative departure and destination aerodromes.

6.9 Provision of Operating Data

Operator shall collate data in order to provide statistics to AACM for each year ending 31st December, in which information required to be provided includes the following:

(a) Number of extended range flights operated in the year;

(b) Incident experienced which were relevant to extended range operations;

(c) Details of any diversion from an extended range operations; and

(d) The number of occasions (with details) when flights were not dispatched on extended range operations due to aeroplane unserviceability or weather below planning minima at the available adequate alternates.

6.10 Continuing Surveillance

The fleet average In-Flight Shut Down (IFSD) rate for the specified airframe-engine combination will continue to be monitored in accordance with Appendices A and C of this AC. As with all other operations, AACM will monitor all aspects of the extended range operations that it has authorized to ensure that the levels of reliability achieved in extended range operations remain at the necessary levels as specified in appendix A, and that the operation continues to be conducted safely.

In the event that an acceptable level of reliability is not maintained, if significant adverse trends exist, or if significant deficiencies are detected in the type design or the conduct of the ETOPS operation, AACM will require the operator to take all necessary action to resolve the problems in a timely manner, or will withdraw the authorization for extended range operations.

6.11 Issuance of Operational Approval

An ETOPS operational approval will only be issued if both flight operations and airworthiness have satisfactory results from their technical evaluation and validation of operator's ETOPS Maintenance and Operations Capability. Operational approval will be granted by AACM through the issuance of a variation of the AOC Operations Specifications (OPS SPEC).

6.12 Variation to Existing ETOPS Operational Approval

If operator wishes to apply for any of the following variations to its existing ETOPS operational approval, formal application must be submitted to AACM at least 30 working days prior to the desired variation(s):

(a) Increase of maximum diversion time to existing ETOPS operational approval; and/or

(b) Inclusion of extra airframe-engine combination(s) to existing ETOPS operational approval.

AACM will carry out relevant assessment(s) to substantiate whether the operator's programmes, procedures and experience are adequate for the proposed variation(s). Upon satisfactory results from the assessment(s), the relevant amended page(s) of AOC Operations Specifications will be sent to the operator as approval for the requested variation(s) to the ETOPS operational approval.

– END –

Appendix A Propulsion System Reliability Assessment

A.1 General

A.1.1 To establish whether a particular airframe-engine combination has satisfied the propulsion systems reliability requirements for extended range operation, an assessment will be made by AACM using all pertinent propulsion system data. To accomplish the assessment, AACM will need world fleet data, and data from various sources (the operator, the engine manufacturer and the aeroplane manufacturer) which should be extensive enough and of sufficient maturity to enable AACM to access with a high level of confidence, using engineering and operational judgment and standard statistical methods where appropriate, that the risk of total power loss from independent causes is sufficiently low. AACM will state whether or not the current propulsion system reliability of a particular airframe-engine combination satisfies the relevant criteria.

A.1.2 If an approved engine CMP is maintained by the responsible engine Authority and is duly referenced on the engine Type Certificate Data Sheet, then this shall be made available to AACM.

A.2 Service Experience

A.2.1 When considering the acceptability of a propulsion system for extended range operation, maturity should be assessed not only in terms of total fleet hours and fleet leader time over a calendar time, but also on the extent to which test data and design experience can be used as an alternative.

A.2.2 There are two extremes in the ETOPS process with respect to maturity; one is the demonstration of stable reliability by the accumulation of service experience and the other is by an agreed design and test program between the manufacturers and authorities. The extent to which a propulsion system is a derivative of previous ETOPS-rated systems is also a factor of the level of maturity.

A.2.3 There is justification for the view that modern propulsion systems achieve a stable reliability level by 100,000 hours for new types and 50,000 hours for derivatives. 3,000 to 4,000 hours is considered to be the necessary time in service for a specific unit to indicate problem areas. Normally, the service experience will be:

(a) For new propulsion systems: 100,000 hours and 12 months service. Where experience on another aeroplane is applicable, a significant portion of the 100,000 hours should normally be obtained on the candidate aeroplane.

(b) For derivative propulsion systems: 50,000 hours and 12 months service. These values may vary according to the degree of commonality. To this end in determining the derivative status of a propulsion system, consideration should be given to technical criteria referring to the commonality with previous ETOPS-rated engines. Prime areas of concern include:

(i) Turbomachinery
(ii) Controls and accessories and control logic
(iii) Configuration hardware (e.g., piping, cables etc.)
(iv) Aircraft to engine interfaces and interaction (e.g., fire, thrust reversers, and avionics etc.)

A.2.4 The extent to which the in-service experience might be reduced would depend upon the degree of commonality with previous ETOPS-rated engines using the above criteria, and would be decided on a case-by-case basis. Also on a case-by-case basis, relevant test and design experience and maximum diversion time requested could be taken into account when arriving at the in-service experience required.

A.2.5 Thus the required experience to demonstrate propulsion system reliability should be determined by:

(a) The extent to which previous service experience of common ETOPS-rated propulsion systems can be considered;

(b) To what extent compensating factors such as design similarity and test evidence can be used; and

(c) The two preceding considerations would then determine the amount of service experience needed for a particular propulsion system proposed for ETOPS.

A.2.6 These considerations would be made on a case-by-case basis and would need to provide a demonstrated level of propulsion system reliability in terms of IFSD rate of the order 0.05 per 1,000 hours, as is necessary also for new propulsion systems.

A.3 Data Required for Assessment

(a) A list of all engine shutdown events, both ground and in-flight, for all causes (excluding normal training events) including flameout. The list shall provide the following for each event:

(i) Date;

(ii) Airline;

(iii) Aeroplane and engine identification (model and serial number);

(iv) Engine configuration and modification history;

(v) Engine position;

(vi) Symptoms leading up to the event, phase of flight or ground operation;

(vii) Weather/environmental conditions and reasons for shutdown and any comment regarding engine re-start potential.

(b) All occurrences where the intended thrust level was not achieved, or where crew action was taken to reduce thrust below the normal level, for whatever reason;

(c) Unscheduled engine removals/shop visit rates;

(d) Total engine hours and aeroplane cycles;

(e) All events should be considered to determine their effects on ETOPS operation; and

(f) Additional data as required.

A.4 Risk Management and Risk Model

A.4.1 Propulsion systems approved for extended range operation must be sufficiently reliable to assure that defined safety targets are achieved.

A.4.2 A review of information for modern fixed wing jet powered aircraft shows that the rate of fatal accidents for all causes is in the order of 0.3×10^{-6} per flying hour. The reliability of aeroplane types approved for extended range operation should be such that they achieve at least as good an accident record as equivalent technology equipment. The overall target of 0.3×10^{-6} per flying hour has therefore been chosen as the all-causes safety target.

A.4.3 When considering safety targets, an accepted practice is to allocate appropriate portions of the total to the carious potential contributing factors. By applying this practice to the overall target of 0.3×10^{-6} per flying hour, in the proportions previously considered

appropriate, the probability of a catastrophic accident due to complete loss of thrust from independent causes must be no worse than 0.3×10^{-8} per flying hour.

A.4.4 Propulsion system related accidents may result from independent cause events but, based on historical evidence, result primarily from events such as uncontained engine failure events, common cause events, engine failure plus crew error events, human error related events and other. The majority of these factors are not specifically exclusive to ETOPS.

A.4.5 Using an expression developed by ICAO (ref. AN-WP/5593 dated 15/2/84) for the calculation of engine in-flight shutdown rate, together with the above safety objective and accident statistics, a relationship between target engine in-flight shutdown rate for all independent causes and maximum diversion time has been derived. This is shown in Figure 1.

A.4.6 In order than type design approval may be granted for extended range operation, it will be necessary to satisfy AACM that after application of the corrective actions identified during the engineering assessment (see paragraph A.5), the target engine in-flight shutdown rates will be achieved. This will provide assurance that the probability objective for loss of all thrust due to independent causes will be met.

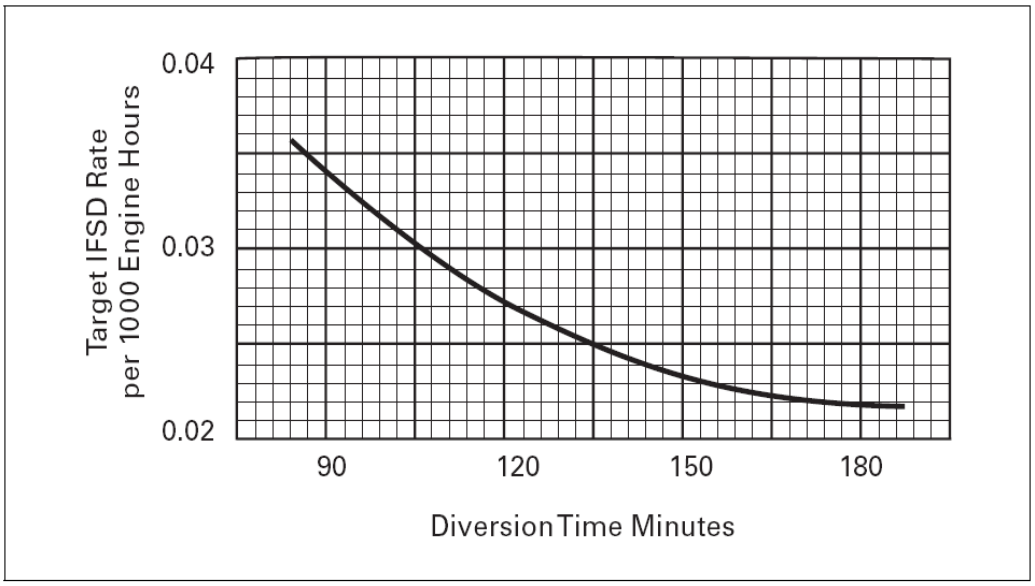

Figure 1. Target IFSD Rate versus Diversion Time

A.5 Engineering Assessment

A.5.1 There are maintenance programmes, engine on-wing health monitoring programmes, and the promptness and completeness in incorporating engine service bulletins, etc., that influence an operator's ability to maintain a level of reliability. The data and information required will form a basis from which a world-fleet engine shutdown rate will be established for use in determining whether a particular airframe-engine combination complies with criteria for extended range operation.

A.5.2 An analysis will be made on a case-by-case basis, of all significant failures, defects and malfunctions experienced in service (or during testing) for the particular airframe-engine combination. Significant failures are principally those causing or resulting in in-flight shutdown or flameout of the engine(s), but may also include unusual ground failures and/or unscheduled removal of engines. In making the assessment, consideration will be given to the following:

(a) The type of propulsion system, previous experience, whether the engine is new or a derivate of an existing model, and the operating thrust level to be used after one engine shutdown;

(b) The trends in the cumulative twelve month rolling average, updated quarterly, of in-flight shutdown rates versus propulsion system flight hours and cycles;

(c) The demonstrated effect of corrective modifications, maintenance, etc. on the possible future reliability of the propulsion system;

(d) Maintenance actions recommended and performance and their effect on propulsion system and APU failure rates;

(e) The accumulation of operational experience which covers the range of environmental conditions likely to be encountered; and

(f) Intended maximum flight duration and maximum diversion in the ETOPS segment, used in the extended range operation under consideration.

A.5.3 Engineering judgment will be used in the analysis of paragraph A.5.2 such that the potential improvement in reliability, following the introduction of corrective actions identified during the analysis, can be quantified.

A.5.4 The resultant predicted reliability level and the criteria developed in accordance with paragraph A.4 will together be used to determine the maximum diversion time for which the particular airframe-engine combination qualifies.

A.5.5 The type design standard for type approval of the engine-airframe combination for extended range operations will include all modifications and maintenance actions for which full or partial credit is taken in paragraph A.5.3 and other such actions required by AACM to enhance reliability. The schedule for incorporation of type design standard items should normally be established in the Configuration Maintenance Procedures (CMP) for example in terms of calendar time, hours or cycles.

Appendix B Suitable En-route Alternate Aerodromes

B.1 General

B.1.1 One of the distinguishing features of two-engine extended range operations is the concept of a suitable en-route alternate aerodrome being available to which an aeroplane can divert after a single failure or failure combinations which require a diversion. Whereas most two-engine aeroplanes operate in an environment where there is usually a choice of diversion aerodromes available, the extended range aeroplane may have only one alternate within a range dictated by the endurance of a particular airframe system (e.g., cargo fire suppressant), or by the approved maximum diversion time for that route.

B.1.2 It is, therefore, important that any aerodromes designated as en-route alternates shall have the capabilities, services and facilities to safely support that particular aeroplane, and that the weather conditions at the time of arrival provide a high assurance that adequate visual references are available upon arrival at decision height (DH) or minimum decision altitude (MDA), and that the surface conditions are within acceptable limits to permit the approach and landing to be safely completed with one propulsion system and/or airframe systems inoperative.

B.2 Suitable Aerodrome Selection

B.2.1 For the purpose of this AC, a suitable aerodrome shall have the capabilities, services, a minimum of ICAO category 4, or the relevant aeroplane category if lower, Rescue and Fire Fight Service (RFFS) and facilities necessary to designate it as an adequate aerodrome, (for RFFS not located on the aerodrome; capability of meeting the aeroplane within 30 minutes notice) and have weather and field conditions at the time of that particular operation which provide a high assurance that an approach and landing can be safely completed with one propulsion system and/or airframe systems inoperative, in the event that a diversion to the en-route alternate becomes necessary.

B.2.2 Due to the natural variability of weather conditions with time, as well as the need to determine the suitability of a particular en-route aerodrome prior to departure, the en-route alternate weather minima for planning purposes shall be higher than the weather minima required to initiate an instrument approach. This is necessary to assure that the instrument approach and landing can be conducted safely if the flight has to divert to the alternate aerodrome. Additionally, since the visual reference required to safely complete an approach and landing is determined, among other things, by the accuracy with which the aeroplane can be controlled along the approach path by reference to instrument aids, as well as by the tasks the pilot is required to accomplish to manoeuvre the aeroplane so

as to complete the landing, the weather minima for non-precision approaches are generally high than for precision approaches.

B.3 Standard En-route Alternate Aerodrome Pre-departure Weather Minima

B.3.1 The following standard en-route alternate planning weather minima are established for flight planning and dispatch purposes with two-engine aeroplanes in extended range operations. A particular aerodrome may be considered to be a suitable aerodrome if it meets the criteria of this Appendix and has one of the following combinations of instrument approach capabilities and en-route alternate aerodrome weather minima at the time of the particular operation.

Table 1 Planning minima - ETOPS

Approach Facility Configuration	Alternate Airfield Ceiling	Weather Minima Visibility/RVR
For aerodromes with at least one operational navigation facility, providing a precision or non-precision runway approach procedure or a circling manoeuvre from an instrument approach procedure	A ceiling derived by adding 122 m (400 feet) to the authorised DH, MDH (DA/MDA) or circling minima	A visibility derived by adding 1 500 meters to the authorised landing minima.
The weather minima below apply at aerodromes which are equipped with precision or non-precision approaches on at least two separate runways (two separate landing surfaces)		
For aerodromes with at least two operational navigation facilities providing a precision or non-precision runway approach procedure to separate suitable runways	A ceiling derived by adding 61 m (200 feet) to the higher of the authorised DH/MDH (DA/MDA) for the approaches	A visibility derived by adding 800 meters to the higher of the two authorised landing minima

Table 2 Planning minima – ETOPS

Type of Approach	Planning Minima (RVR visibility required & ceiling if applicable)			
	Aerodrome with			
	at least 2 separate approach procedures based on 2 separate aids serving 2 separate runways	at least 2 separate approach procedures based on 2 separate aids serving 1 runway	or	at least 1 approach procedure based on 1 aid serving 1 runway
Precision Approach Cat II, III (ILS, MLS)	Precision Approach Cat I Minima	Non-Precision Approach Minima		
Precision Approach Cat I (ILS, MLS)	Non-Precision Approach Minima	Circling minima or, if not available, non-precision approach minima plus 200 ft / 1 000 m		
Non-Precision Approach	The lower of non-precision approach minima plus 200 ft / 1 000 m or circling minima	The higher of circling minima or non-precision approach minima plus 200 ft / 1 000 m		
Circling Approach	Circling minima			

B.3.2 An operator shall include either Table 1 or Table 2 above in its Operations Manual, but not a combination of both, for use in determining the operating minima at the planned en-route alternate aerodrome.

B.3.3 The appropriate planning minima may only be used if the expected wind and surface conditions would permit an engine-out landing on the runway(s) served by the aid(s). For planning purposes the expected cross-winds, including gusts, for a period commencing one hour before the established earliest time of landing and ending one hour after the established latest time of landing at that aerodrome, shall not exceed the maximum permitted cross-wind for landing unless otherwise agreed with AACM. In all cases, AACM directs that higher planning minima shall apply. However, AACM may approve lower aerodrome planning minima for a specific en-route alternate aerodrome on the basis of favourable special meteorological, terrain and operational studies produced by an operator or group of operators.

Appendix C ETOPS Maintenance Requirements

C.1 General

C.1.1 The maintenance programme shall contain the standards, guidance and direction necessary to support the intended operations. Maintenance personnel involved shall be made aware of the special nature of ETOPS and have the knowledge, skills and ability to accomplish the requirements of the programme.

C.2 ETOPS Maintenance Programme

C.2.1 The basic maintenance programme for the aeroplane being considered for ETOPS is the continuing airworthiness maintenance programme currently approved for that operator, for the make and model airframe-engine combination. This programme shall be reviewed to ensure that it provides an adequate basis for development of ETOPS maintenance requirements. These shall include maintenance procedures to preclude identical action being applied to multiple similar elements in any ETOPS significant system (e.g. fuel control change on both engines).

(a) ETOPS-related tasks shall be identified on the operator's routine work forms and related instructions.

(b) ETOPS-related procedures, such as involvement of centralized maintenance control, shall be clearly defined in the operator's programme.

(c) An ETOPS service check shall be developed to verify that the status of the aeroplane and certain critical items are acceptable. This check shall be accomplished and signed off by an ETOPS qualified maintenance person immediately prior to an ETOPS flight.

(d) Logbooks shall be reviewed and documented as appropriate to ensure proper MEL procedures, deferred items and maintenance checks, and that system verification procedures have been performed.

C.3 ETOPS Manual

C.3.1 The operator shall develop a manual for use by personnel involved in ETOPS. This manual need not include, but shall at least refer to, the maintenance programme and other requirements described by this Appendix and clearly indicate where they are located in the operator's manual system. All ETOPS requirements, including supportive programme procedures, duties and responsibilities, shall be identified and be subject to revision control. Alternatively the operator may include this information in existing manuals used by personnel involved in ETOPS.

C.4 Oil Consumption Programme

C.4.1 The operator's oil consumption programme shall reflect the manufacturer's recommendations and be sensitive to oil consumption trends. It shall 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 meaningful to this make and model, it shall be included in the programme. If the auxiliary power-unit (APU) is required for ETOPS operation, it shall be added to the oil consumption programme.

C.5 Engine Condition Monitoring

C.5.1 This programme shall describe the parameters to be monitored, method of data collection and corrective action process. The programme shall reflect manufacturer's instructions and industry practice. This monitoring shall be used to detect deterioration at an early stage to allow for corrective action before safe operation is affected. The programme shall 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 programme shall 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 a diversion.

C.6 Rectification of Aeroplane Defects

C.6.1 The operator shall develop a verification programme, or procedures shall be established, to ensure corrective action following an engine shutdown, primary system failure, adverse trends or any prescribed events which require 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 shall be identified in the programme. Primary systems or conditions requiring verification actions shall be described in the operator' ETOPS manual.

C.7 Reliability Programme

C.7.1 An ETOPS reliability programme shall be developed or the existing reliability programme supplemented. This programme shall be designed with early identification and prevention of ETOPS-related problems as the primary goal. The programme shall be event-orientated and incorporate reporting procedures for significant events detrimental to ETOPS flights. This information shall be readily available for use by the operator and AACM to help establish that the reliability level is adequate and to assess the operator's competence and capability to safely continue ETOPS. AACM shall be notified with 72 hours of events reportable through this programme, of which items required to be reported shall include the following:

(a) In-flight shut-downs;

(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; and

(f) Any other event detrimental to ETOPS.

C.7.2 In addition, the report shall also identify the following:

(a) Aeroplane identification (make and serial number);

(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.

C.8 Propulsion System Monitoring

C.8.1 The operator's assessment of propulsion systems reliability for the extended range fleet shall be made available to AACM (with the supporting data) on at least a monthly basis, to ensure that the approved maintenance programme continues to maintain a level of reliability necessary for extended range operations.

C.8.2 The assessment shall include, as a minimum, engine hours flown in the period, in-flight shut-down rate for all causes and engine removal rate computed on a twelve-month rolling average basis. Any adverse sustained trend would require an immediate evaluation to be accomplished by the operator in consultation with AACM. The evaluation may result in corrective action or operational restrictions being applied.

C.9 Maintenance Training

C.9.1 The maintenance training shall focus on the special nature of ETOPS. This programme shall be included in normal maintenance training. The goal of this programme is to ensure that all personnel involved in ETOPs are provided with the necessary training so that the ETOPS maintenance tasks are properly accomplished and to emphasize the special nature of ETOPS maintenance requirements. Qualified maintenance personnel are those that have completed the operator's ETOPS training programme and have satisfactorily performed ETOPS tasks under supervision, within the framework of the operator's approved procedures for Personnel Authorization.

C.10 ETOPS Parts Control

C.10.1 The operator shall develop a part control programme that ensures the proper parts and configuration are maintained for ETOPS. The programme includes verification that parts placed on ETOPS aeroplane during parts borrowing or pooling arrangements, as well as those parts used after repair or overhaul, maintain the necessary ETOPS configuration for that aeroplane.