CIVIL AVIATION PUBLICATION

CAP 04

ETOPS

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1. INTRODUCTION

1.1 General

This CAP describes the processes and requirements for obtaining approval for two-engine aeroplanes to operate 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.

1.2 Diversion Times

Diversion times may be influenced by operator experience, propulsion system reliability and operational requirements and the content of this CAP is related to diversion time as follows:

(a) greater than 60 but less than or equal to 90 minutes;

(b) greater than 90 minutes but less than or equal to 120 minutes; and

(c) greater than 120 minutes up to a maximum of 180 minutes.

2. REFERENCES

(a) EASA AMC 20-6 (ETOPs)

(b) Certification Specifications (CS 25.901, 25.903, 25.1309, 25.1351 d, CS 25 Subpart J, CS-E 510, CS-E 515, CS-E 520;

(c) ANTR-OPS 1.245 & 1.246

3. DEFINITIONS

(a) Aerodrome

(1) Adequate. For the purpose of this CAP, an adequate aerodrome is an aerodrome, which the operator and the Authority consider 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 ICAO category 4 (for RFFS not located on the aerodrome; capable of meeting the aeroplane with 30 minutes notice) or the relevant aeroplane category if lower, is acceptable for planning purposes only, when being considered as an ETOPS en-route alternate; and

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

(2) Suitable. For the purpose of this CAP 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 operating minima and the field condition reports indicate that a safe landing can be accomplished at the time of the intended operation.

(b) 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.

(c) 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 by the Authority to establish the suitability of an airframe-engine combination for extended range operation.

(d) Engine

The basic engine assembly as supplied by the engine manufacturer.

(e) Extended Range Operations

For the purpose of this CAP, 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.

(f) 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.

(g) Maintenance Personnel

Mechanics, Licensed Ground Engineers, Maintenance Support Personnel.

(h) 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).

(i) ETOPS significant system

(1) 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.

(2) 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.

(3) 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.

(4) 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.

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 units; and components that affect the safe operation of the major propulsion units.

(j) Approved One-Engine Inoperative Cruise Speed

(1) The approved one-engine-inoperative cruise speed for the intended area of operation shall be a speed, within the certificated limits of the aeroplane, selected by the operator and approved by the regulatory authority.

(2) The operator shall use this speed for;

(i) establishing the outer limit of the area of operation and any dispatch limitation

(ii) calculation of single engine fuel requirements; and

(iii) establishing the level off altitude (net performance) data. This level off altitude (net performance) must clear any obstacle en route by margins as specified in ANTR-OPS 1.

4. GENERAL CONSIDERATIONS

4.1 General

Although it is self-evident that the overall safety of an extended range operation cannot be better than that provided by the reliability of the propulsion systems, some of the factors related to extended range operation are not necessarily obvious. For example, cargo compartment fire suppression/containment capability could be a significant factor, or operational/maintenance practices may invalidate certain determinations made during the aeroplane type design certification or the probability of system failures could be a more significant problem than the probability of propulsion system failures. Although propulsion system reliability is a critical factor, it is not the only factor which should be seriously considered in evaluating extended range operation. Any decision relating to extended range operation with two-engine aeroplanes should also consider the probability of occurrence of any conditions which would reduce the capability of the aeroplane or the ability of the crew to cope with adverse operating conditions.

4.2 SMS and Quality Involvement

The operator’s Safety Management System would normally conduct the initial feasibility studies and, once approved for ETOPs, conduct continuing operational and maintenance assessments. The operator’s Quality System must be involved in the application process and on-going assessment of ETOPs operations and maintenance.

4.3 In-service experience

Each operator requesting approval will be required to have appropriate experience. A summary shall be provided to the Authority, indicating the operator's capability to maintain and operate the specific airframe-engine combination for the intended extended range operation. This summary should 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. Approval would be based on a review of this information. Consideration may be given by the CAA to the approval of extended range operations up to 90-minutes only for operators with minimal or no in-service experience with the airframe-engine combination. This determination considers such factors as the proposed area of operations, the operator's demonstrated ability to successfully introduce aeroplanes into operations, the quality of the proposed maintenance and operations programs.

4.4 Human Factors

Operators should be aware of the human factor issues regarding maintenance and operations generally and must apply human factor principles specifically for ETOP’s maintenance, dispatch and operations. System failures or malfunctions occurring during extended range operation could affect flight crew workload and procedures.

Since the demands on the flight crew may increase, an assessment should be made to ensure that more than average piloting skills or crew co-ordination are not required.

5. MAINTENANCE CONSIDERATIONS

5.1 Airframe Systems

A number of airframe systems have an effect on the safety of extended range operation; therefore, the type design certification of the aeroplane should be reviewed to ensure that the design of these systems are acceptable for the safe conduct of the intended operation.

5.2 Propulsion Systems

In order to maintain a level of safety consistent with the overall safety level achieved by modern aeroplanes, it is necessary for two-engine aeroplanes used in extended range operation to have an acceptably low risk of significant loss of power/thrust for all design and operation related causes.

The target IFSD rate versus diversion time used by the CAA is in Figure 1.

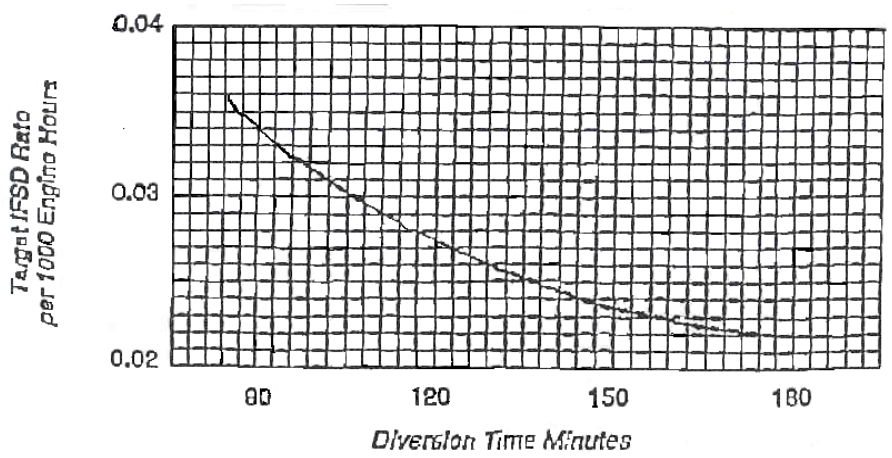

Figure 1: Target IFSD Rate versus Diversion Time

5.3 Maintenance and Reliability Programme Definition

Since the quality of maintenance and reliability programmes can have an appreciable effect on the reliability of the propulsion system and the airframe systems required for extended range operation, an assessment should be made of the proposed maintenance and reliability programme's ability to maintain a satisfactory level of propulsion and airframe system reliability for the particular airframe-engine combination.

Although these considerations are normally part of the operator's continuing airworthiness programme, the maintenance and reliability programme may need to be supplemented in consideration of the special requirements of extended range operation (Appendix 1). The following items, as part of the operator's programme must be reviewed to ensure that they are adequate for extended range operations:

(a) Engineering Modifications

The operator should provide to the Authority 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.

(b) Maintenance Procedures

Following Approval of the changes in the maintenance and training procedures, substantial changes to maintenance and training procedures, practices, or limitations established to qualify for extended range operations should be submitted to the Authority at least two months before such changes may be adopted.

(c) Reliability Reporting

The reliability reporting programme as supplemented and approved, should 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 provided regularly to the Authority and to the relevant airframe and engine manufacturers.

Appendix 1 contains additional information concerning propulsion and airframe system reliability monitoring and reporting.

(d) Implementation

Approved modifications and inspections which would maintain the reliability objective for the propulsion and airframe systems as a consequence of Airworthiness Directive (AD) actions and/or revised CMP standards should be promptly implemented.

Note: In principle, the CMP does not repeat Airworthiness Directives. An operator thus needs to ensure compliance with both the applicable ADs and the CMP standards when operating ETOPS.

Other recommendations made by the engine and airframe manufacturers should also be considered for prompt implementation. This would apply to both installed and spare parts. The ETOPS operational approval of each ETOPS operator will require it to keep its ETOPS fleets in conformity with the current CMP standards, taking into account implementation delays.

(e) Control Process

Procedures and a centralised control process should be established which would preclude an aeroplane being released 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 being released on an extended range operation.

(f) Programmes

The maintenance programme used, will ensure that the airframe and propulsion systems will continue to be maintained at the level of performance and reliability necessary for extended range operation, including such programmes as engine condition monitoring and engine oil consumption monitoring.

5.4 Maintenance and Reliability Programme Implementation

Following a determination that the airframe systems and propulsion systems are designed to be suitable for extended range operation, an in-depth review of the applicant's training programmes, operations and maintenance and reliability programmes should be accomplished to show ability to achieve and maintain an acceptable level of systems reliability to safely conduct these operations. Additional modifications or maintenance actions generated by an operator or manufacturer to enhance or maintain the continued airworthiness of the aeroplane must be made through the normal approval process. The operator should thoroughly evaluate such changes to ensure that they do not adversely affect reliability or conflict with requirements for ETOPs approval.

5.5 Approval Basis

Each applicant for extended range approval should show that the particular airframe-engine combination is sufficiently reliable. Systems required for extended range operation should be shown by the manufacturer to be designed to a fail-safe criteria and should be shown by the operator to be continuously maintained and operated at levels of reliability appropriate for the intended operation.

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

The CAA will only accept an application if the ETOPs approval basis is reflected in the AFM or supplement, and Type Certification Data Sheet or Supplemental Type Certificate.

5.6 Minimum Equipment List (MEL)

System redundancy levels appropriate to extended range operations should be reflected in the Master Minimum Equipment List (MMEL). An operator's MEL may be more restrictive than the MMEL considering the kind of extended range operation proposed and equipment and service problems unique to the operator. Systems considered to have a fundamental influence on flight safety may 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 pressurisation;

(m) cargo fire suppression;

(n) engine fire protection;

(o) emergency equipment; and

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

6. OPERATIONAL CONSIDERATIONS

6.1 Flight Preparation and In-flight Considerations

(a) General

The flight release considerations specified in this section are in addition to, or amplify, the requirements contained in ANTR-OPS 1 and specifically apply to extended range operations. Although many of the considerations in this CAP 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.

(b) Communication and Navigation Facilities

An aeroplane should not be released on an extended range operation unless:

(1) 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.

(2) 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 an engine shutdown; and

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

(c) Fuel and Oil Supply

(1) General

An aeroplane should not be released on an extended range operation unless it carries sufficient fuel and oil to meet the requirements of ANTR-OPS 1 and any additional fuel that may be determined in accordance with sub-paragraph (2) below – Critical Fuel Reserves. In computing fuel requirements, at least the following should 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 pressurisation and air conditioning; consideration should be given to flying at an altitude meeting oxygen requirements in the event of loss of pressurisation;

(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 should also be considered as necessary.

(2) Critical Fuel Reserves

In establishing the critical fuel reserves, the applicant is to determine the fuel necessary to fly to the most critical point and execute a diversion to a suitable

alternate under the conditions outlined in sub-paragraph (3) below the 'Critical Fuel Scenario'. These critical fuel reserves should be compared to the normal applicable operational rule requirements for the flight. If it is determined by this comparison that the fuel to complete the critical fuel scenario exceeds the fuel that would be on board at the most critical point, as determined by applicable operational rule requirements, additional fuel should be included to the extent necessary to safely complete the critical fuel scenario. In consideration of the items listed in sub-paragraph (1) above, the critical fuel scenario should allow for a contingency figure of 5% added to the calculated fuel burn from the critical point to allow for errors in wind forecasts, a 5% penalty in fuel mileage (or operator's demonstrated value for in-service deterioration in cruise fuel mileage), any Configuration Deviation List items, both airframe and engine anti-icing; and account for ice accumulation on unprotected surfaces if icing conditions are likely to be encountered during the diversion. If the APU is a required power source, then its fuel consumption should be accounted for during the appropriate phase(s) of flight.

(3) Critical Fuel Scenario

The following describes a scenario for a diversion at the most critical point. The applicant should confirm 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 (e.g., two-engine versus one-engine at 10,000 feet non-standard aeroplane configuration):

(i) At the critical point, consider simultaneous failure of one propulsion system and the pressurisation 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 10 000 feet at the relevant one-engine-inoperative cruise speed or continued cruise above 10 000 feet if the aeroplane is equipped with sufficient supplemental oxygen in accordance with ANTR-OPS 1.

(iii) Upon approaching the ETOPS en-route alternate, descent to 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.

(d) Alternate Aerodromes

An aeroplane should not depart 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. computerised flight plan). Suitable en-route alternates should also be identified and listed in operational flight plan 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 should not be listed as a suitable en-route alternate unless:

(1) 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 ANTR-OPS 1.

(2) The aerodrome services and facilities are adequate to permit the conduct of an instrument approach procedure to the runway expected to be used while complying with the applicable aerodrome operating minima.

(3) 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 authorised weather minima for en-route alternate aerodromes in Appendix 3. In addition, for the same period, the forecast crosswind component, including gusts, for the landing runway expected to be used should not exceed the maximum permitted crosswind for single engine landing taking into account the runway condition (dry, wet or contaminated).

(4) During the course of the flight, the flight crew 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 required time periods, aeroplane status, fuel remaining, runway surface conditions, landing distances and aerodrome services and facilities at designated en-route alternates should be evaluated. If any conditions are identified (such as weather forecast below landing minima) which would preclude safe approach and landing, then the pilot should take an appropriate course of action.

(5) In addition, the operator's programme should provide flight crews with information on adequate aerodromes appropriate to the route to be flown which are not forecast to meet ANTR-OPS 1, Subpart D en-route alternate weather minima. Aerodrome facility information and other appropriate planning data concerning these aerodromes should be provided to flight crews for use when executing a diversion.

Note: The alternate aerodromes should 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.

(e) Aeroplane Performance Data

No aeroplane should be released 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. The following data should be based on Authority approved information or referenced in the Aeroplane Flight Manual (AFM).

(1) 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 10 000 feet;

(iii) holding;

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

(v) missed approach.

(2) 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 10 000 feet); and

(ii) Holding.

(3) 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.

(4) 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 ANTR-OPS 1.

6.2 Flight Crew Training, Evaluation, and Operating Manuals

(a) Adequacy of Flight Crew Training and Operating Manuals

The Authority will review in-service experience of significant aeroplane systems. The review will include system reliability levels and individual event circumstances, including crew actions taken in response to equipment failures or unavailabilities. The Authority will use the information resulting from these reviews to modify or update flight crew training programmes, operating manuals and checklists, as necessary.

Note: Refer to Appendix 3 for ETOPs Operations Manual Guide

(b) Flight Crew Training and Evaluation Programme

The operator's training programme in respect to extended range operations should provide training for flight crew members followed by subsequent evaluations and proficiency checks as well as refresher training in the following areas:

(1) Introduction to ETOPS regulations

(2) Routes and aerodromes intended to be used in the ETOPS area of operations

(3) Performance:

(i) Flight planning, including all contingencies.

(ii) Flight performance progress monitoring.

(4) Procedures:

(i) Diversion Procedures and Diversion 'Decision making'. Special initial and recurrent training to prepare flight crews to evaluate probable propulsion and airframe systems failures should be conducted. The goal of this training should be to establish crew competency in dealing with the most probable operating contingencies.

(ii) Use of appropriate navigation and communication systems, appropriate flight management devices.

(iii) The flight crew should be provided with detailed initial and recurrent training which emphasises abnormal and emergency procedures to be followed in the event of foreseeable failures for each area of operation, 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 should be conducted during initial and recurrent training.

(B) Operational restrictions associated with these failures including any applicable Minimum Equipment List (MEL) considerations.

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

(D) Crew incapacitation

(iv) Use of emergency equipment including protective breathing and ditching equipment.

(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

Flight crew should be trained on the fuel management procedures to be followed during the en-route portion of the flight. These procedures should provide for an independent cross-check of fuel quantity indicators. For example fuel flows could be used to calculate fuel burned and compared to indicated fuel remaining.

(viii) Operators should develop and incorporate annual ETOPS refresher training programmes for flight crew qualified for ETOPS operations.

(c) ETOPS Check Programme

The objective of the ETOPS check programme should be to ensure standardised flight crew practices and procedures and also to emphasis the special nature of ETOPS operations. Only pilots with a demonstrated understanding of the unique requirements of ETOPS should be designated as check pilots for ETOPS.

6.3 Operational Limitations

(a) Area of Operation

(1) An operator may be authorised to conduct extended range operations within an area where the diversion time, at any point along the proposed route of flight to an adequate aerodrome, is up to a maximum of 180 minutes in still air at the approved one-engine-inoperative cruise speed. Appendices 1 and 4 provide criteria for such operations.

(2) In the case of operations cleared up to 120 minutes maximum diversion time, small increases in the diversion time for specific routes may be approved as needed, if it can be shown that the resulting routing will provide an enhancement of overall safety.

Such increases:

(i) will require the Authority to assess overall type design including time limited systems, demonstrated reliability; and

(ii) to establish an appropriate MEL related to the diversion time required; and

(iii) will not be more than 15 per cent of the original maximum diversion time approved in accordance with paragraph 10.f.

(b) Flight Release Limitation

The flight release limitation should specify the maximum diversion time from a suitable aerodrome for which an operator can conduct a particular extended range operation.

(1) Use of Maximum Diversion Time

The procedures established by the operator should ensure that extended range operation is limited to flight plan routes where the approved maximum diversion time to suitable aerodromes can be met under standard conditions in still air. Operators should provide for:

(i) Company procedures to state that upon occurrence of an in-flight shutdown of an engine, the pilot should promptly initiate diversion to fly to and land at the nearest aerodrome, in terms of time, determined to be suitable by the flight crew.

(ii) A practice to be established such that in the event of a single or multiple primary system failure, the pilot will initiate the diversion procedure to fly to and land at the nearest aerodrome in terms of time, determined to be suitable by the flight crew, unless it has been justified that no substantial degradation of safety results from continuation of the planned flight.

(c) Contingency procedures should 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.

7. ADDITIONAL CONSIDERATIONS FOR 120 - 180 MINUTE OPERATIONS

7.1 General

Each operator requesting approval to conduct extended range operations beyond 120 minutes should have approximately 12 consecutive months of operational in-service experience with the specified ETOPS configured airframe-engine combination in the conduct of 120 minute operations. Approval will be given on a case by case basis for an increase to their area of operation beyond 120 minutes. The area of operation will be defined by a maximum diversion time of 180 minutes to an adequate aerodrome at approved one-engine-inoperative cruise speed (under standard conditions in still air). The release limitation will be a maximum diversion time of 180 minutes to a suitable aerodrome at the approved one-engine-inoperative speed (under standard conditions in still air).

7.2 Release Considerations

(a) Minimum Equipment List (MEL)

The MEL should reflect adequate levels of primary system redundancy to support 180 minutes (still air) operations.

(b) Weather

An operator should substantiate that the weather information system which it utilises can be relied upon to forecast terminal and en-route weather with a reasonable degree of accuracy and reliability in the proposed area of operation.

(c) Fuel

The critical fuel scenario should also consider fuel required for all-engine-operations at 10 000 feet or above 10 000 feet if the aeroplane is equipped with sufficient supplemental oxygen.

7.3 Flight Planning

The effects of wind and temperature at the one-engine-inoperative cruise altitude should be accounted for in the calculation of equal-time point. In addition, the operator's programme should provide flight crews with information on adequate aerodromes appropriate to the route to be flown which are not forecast to meet Appendix 3 en-route alternate weather minima. Aerodrome facility information and other appropriate planning data concerning these aerodromes should be provided to flight crews for use when executing a diversion.

(a) Crew Training and Evaluation

If standby sources of electrical power significantly degrade cockpit instrumentation to the pilots, then approved training, that simulates an instrument approach with the standby generator as the sole power source, should be conducted during initial and recurrent training.

(b) Contingency Procedures

Flight crews should be provided with detailed initial and recurrent training that emphasises established contingency procedures, for each area of operation intended to be used.

(c) Diversion Decision Making

Special initial and recurrent training to prepare flight crews to evaluate probable propulsion and airframe systems failures should be conducted. The goal of this training should be to establish crew competency in dealing with the most probable operating contingencies.

Note: Although already required for maximum diversion time between 60 and 120 minutes under standard conditions in still air, the requirements are emphasised for maximum diversion time beyond 120 minutes.

(d) Specific instruction should be included in the company operational procedures with the additional proviso that an alternate should be selected that is within 180 minutes maximum diversion time, at the approved one-engine-inoperative speed (under standard conditions in still air).

7.4 Equipment

(a) VHF/HF, Data Link where available

Operators should consider enhancements to their 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.

8. APPLICATION & APPROVAL PROCESS

8.1 Application

Any operator requesting approval for extended range operations with two engine aeroplanes should submit the application (See Appendix 2), with the required supporting data, to the Authority at least 3 months prior to the proposed start of extended range operation with the specific airframe-engine combination.

The CAA will require an operator to be able to demonstrate the ability to maintain and operate the aeroplane so as to achieve the necessary reliability and to train its personnel to achieve the competence in ETOPs operations.

8.2 Supporting Documentation

The following supporting documentation is required with the application;

(a) Aircraft Flight Manual or Supplement indicating ETOPs

(b) Type Certification Data Sheet or Supplemental Type Certificate

(c) MMEL/MEL

(d) Exposition (amendment) including;

(1) Specific procedures;

(2) Engineer certification requirements;

(3) Oil Consumption Programme

(4) Engine Condition monitoring

(5) Verification Programme after maintenance

(6) Reliability programme

(7) Propulsion system monitoring

(8) Maintenance training

(9) ETOPs parts control

(e) Maintenance Programme (amendment)

(f) Technical Log (if amended)

(g) In-flight Shut down rate for airframe/engine combination (from Manufacturer)

(h) Operations Manual amendments (OMA, OMB, OMC and OMD)

(1) SOPs

(2) Checklists

(3) Area of operations including ETOPs alternates

(4) Training and checking

8.3 Assessment

In considering an application from an operator to conduct extended range operations, an assessment will be made by the CAA of the operator's overall safety record, past performance, flight crew training and experience, and maintenance programme. The data provided with the request should substantiate the operator's ability and competence to safely conduct and support these operations and should include the means used to satisfy the considerations outlined in this paragraph.

Once the CAA is satisfied with the documentation review, training aspects proving flight(s) will be conducted on non-ETOPs revenue flights to confirm dispatch and operational procedures.

8.4 Approval

When the CAA is satisfied the AOC holder’s Operations Specifications will be amended to permit ETOPs operations within a specified area of operations.

9. CONTINUING SURVEILLANCE

9.1 Reliability

The fleet average In Flight Shut Down (IFSD) rate for the specified airframe-engine combination will continue to be monitored in accordance with Appendices 1 and 4. As with all other operations, the CAA will also monitor all aspects of the extended range operations that it has authorised to ensure that the levels of reliability achieved in extended range operations remain at the necessary levels as provided in Appendix 1, 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, then the BCAA may need to initiate a special evaluation, impose operational restrictions, if necessary, and stipulate corrective action for the operator to adopt in order to resolve the problems in a timely manner.

9.2 Operator Responsibilities

It is incumbent upon each operator to take immediate action to rectify the conditions that cause an error, whether it be maintenance, dispatch or operations. The operator should also report the event to the CAA within 72 hours, through the appropriate channels, with initial analysis of causal factors and measures taken to prevent further events. The SMS Manager and Quality Manager must be involved.

9.3 CAA Action

The CAA may consider revoking ETOPs operational approval if IFSD becomes an issue or if the operator response to incidents is not effective or timely. The CAA will also consider the operator's past performance record in determining the action to be taken. If an operator shows a history of operational and/or airworthiness errors, then approval may be revoked until the root causes of these errors are shown to be eliminated and ETOPs programmes and procedures effective.

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APPENDIX 1

ETOPS MAINTENANCE REQUIREMENTS

1 GENERAL

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

2 ETOPS MAINTENANCE PROGRAMME

The basic maintenance programme for the aeroplane being considered for ETOPS is the continuous airworthiness maintenance schedule currently approved for that operator, for the make and model airframe-engine combination. This schedule should be reviewed to ensure that it provides an adequate basis for development of ETOPS maintenance requirements.

These should 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 should be identified on the operator's routine work forms and related instructions.

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

(c) An ETOPS service check should be developed to verify that the status of the aeroplane and certain critical items are acceptable. This check should be accomplished by an authorised and trained person prior to an ETOPS flight. Such a person may be a member of the flight crew.

(d) Log books should 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.

3 EXPOSITION

The operator should amend the Exposition for use by personnel involved in ETOPS. This manual need not include, but should at least reference, the maintenance programme and other requirements described by this Appendix, and clearly indicate where they are located in the operator's document system. All ETOPS requirements, including supportive programmes, procedures, duties, and responsibilities, should be identified and be subject to revision control.

The amendment to the Exposition should be submitted to the Authority at least 30 days before implementation of ETOPS flights.

4 OIL CONSUMPTION PROGRAMME

The operator's oil consumption programme 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 meaningful to this make and model, it should be included in the programme. If the APU is required for ETOPS operation, it should be added to the oil consumption programme.

5 ENGINE CONDITION MONITORING

This programme should describe the parameters to be monitored, method of data collection and corrective action process. The programme 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 programme should 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 should 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.

6 VERIFICATION PROGRAMME AFTER MAINTENANCE

The operator should develop a verification programme or procedures should be established to ensure corrective action following an engine shutdown, primary system failure or adverse trends or any prescribed events 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 should be identified in the programme. Primary systems or conditions requiring verification actions should be described in the operator's ETOPS section of the Expositionl.

7 RELIABILITY PROGRAMME

An ETOPS reliability programme should be developed or the existing reliability programme supplemented. This programme should be designed with early identification and prevention of ETOPS related problems as the primary goal. The programme should be event orientated and incorporate reporting procedures for significant events detrimental to ETOPS flights. This information should be readily available for use by the operator and Authority to help establish that the reliability level is adequate, and to assess the operator's competence and capability to safely continue ETOPS. The Authority should be notified within 96 hours of events reportable through this programme.

(a) In addition to the items required to be reported by national regulations, the following items should be included:

(i) in-flight shutdowns;

(ii) diversion or turn back;

(iii) un-commanded power changes or surges;

(iv) inability to control the engine or obtain desired power; and

(v) problems with systems critical to ETOPS.

(b) The report should identify the following:

(i) aeroplane identification;

(ii) engine identification (make and serial number);

(iii) total time, cycles and time since last shop visit;

(iv) for systems, time since overhaul or last inspection of the defective unit;

(v) phase of flight; and

(vi) corrective action.

8 PROPULSION SYSTEM MONITORING

The operator's assessment of propulsion systems reliability for the extended range fleet should be made available to the Authority (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 operation. The assessment should 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 airframe-engine combination, data from the operator's total fleet will be acceptable. However, the reporting requirements of paragraph 7 of this Appendix must still be observed for the extended range fleet. 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.

9 MAINTENANCE TRAINING

The Maintenance training should focus on the special nature of ETOPS. This programme should be included in the 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 emphasise the special nature of ETOPS maintenance requirements. Qualified maintenance personnel are those that have completed the operator's extended range training programme and have satisfactorily

performed extended range tasks under supervision, within the framework of the operator's approved procedures for Personnel Authorisation.

10 ETOPS PARTS CONTROL

The operator should develop a parts control programme with support from the manufacturer, that ensures the proper parts and configuration are maintained for ETOPS. The programme includes verification that parts placed on an 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.

APPENDIX 2

APPLICATION FORMAT FOR ETOPS OPERATIONAL APPROVAL

APPLICANTS DETAILS		
Company name		AOC No.
Mailing Address		
E-mail Address		
Contact Tel No.		

AIRCRAFT DETAILS		
Aeroplane Type	Aeroplane Series	Registration Mark

SIGNATURE BLOCK	
Signature	
Name	
Appointment	
Date	

Note 1: The application should be submitted by the Accountable Manager

Note 2: 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 the Civil Aviation Affairs. Original documents should not be sent, photocopies are sufficient.

Note 3: Do not send complete manuals, only the relevant sections/pages will be required until such time a formal amendment should be submitted to the CAA for approval.

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APPENDIX 3

APPLICANT'S ETOPS OPERATIONS MANUAL GUIDE

Operations Manual	Subjects	Requirements	Operator's Operations Manual Reference or Document Reference
Part A **General**	Documents/regulations used in compiling ETOPS Manual/Procedures.	ANTR-OPS	
	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.	

Operations Manual	Subjects	Requirements	Operator's Operations Manual Reference or Document Reference
Part A **General (continued)**	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. Computerised 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.	

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Operations Manual	Subjects	Requirements	Operator's Operations Manual Reference or Document Reference
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: • 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.	

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Operations Manual	Subjects	Requirements	Operator's Operations Manual Reference or Document Reference
Part D **Training (continued)**		Normal procedures: • 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. • Weather monitoring. • In-flight fuel management (to include independent cross-checking of fuel quantity). Non-normal procedures: • 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.	

Operations Manual	Subjects	Requirements	Operator's Operations Manual Reference or Document Reference
Part D **Training (continued)**	ETOPS Simulator Training and Line Flying Under Supervision.	Pilots conversion course. Annual refresher course.	
	Flight Operations Staff and Dispatchers.	Outline of training syllabus to include: • 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 Comments to Support Your Application:

E.G. Risk Assessment documentation conducted under the Operator SMS

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