APPROVAL OF EXTENDED RANGE TWIN-ENGINE OPERATIONS (ETOPS)

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Air Operators Certification and Surveillance Directorate

1. ACKNOWLEDGEMENT

A. This Advisory circular has been developed based on similar documents issued by other CAAs like the FAA, TCA and JAA. Some paragraphs or statements contained in this document may be copied in whole or in part from documents such as the TCA P6327, the FAA Advisory Circular 120-42A and the JAA Information Leaflet No. 20. The information was copied, in some cases in order to avoid perceived contradiction between documents, and in other cases, in an effort to harmonize our requirements with those of other Authorities. Since specific reference to the source document would have served no purpose and would have likely caused clutter in the text, it was left out and replaced by this acknowledgement.

2. PURPOSE

A. This Advisory Circular states an acceptable means, but not the only means, for obtaining approval under ECARAS for two engine aeroplanes to operate over a route that contains a point further than one hour flying time at the normal one engine inoperative cruise speed (in still air) from an adequate aerodrome. Specific criteria are included for deviation of 75 minutes, 120 minutes or 180 minutes from an adequate aerodrome.

3. REFERENCES

DEFINITIONS

A. **Aerodrome**

1) **Adequate.** For the purpose of this AC, an adequate aerodrome is an aerodrome, which the air operator and the Authority consider to be adequate, having regard to the performance requirements applicable at the expected landing weight. In particular, it should be anticipated that at the expected time of use:

(a) the aerodrome will be available, and equipped with the necessary ancillary services, such as ATS, sufficient lighting,

communications, weather reporting, navaids and emergency services; and

(b) at least one approach aid will be available for an instrument approach.

(2) **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 operating minima, as specified in the operation specifications, and the field condition reports indicate that a safe landing can be accomplished at the time of the intended operation.

B. **Auxiliary Power Units (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. **Benign Area of Operations** – An area that provides numerous adequate aerodromes, a high level of reliability and availability of communication, navigation and ATC services and facilities, and where prevailing weather conditions are stable and generally do not approach extremes in temperature, wind, ceiling, and visibility.

D. **Critical Point (CP).** A “critical point” is the point along a route which is most critical from a fuel requirement point of view, from which an aircraft can proceed toward the destination or initiate a diversion to another aerodrome. (The CP is usually, but not always, the last ETP).

E. **Demanding Area of Operation.** An area that has one or more of the following characteristics:

(1) Prevailing weather conditions can approach extremes in winds, temperature, ceiling, and visibility for prolonged period of time;

(2) few alternate aerodromes;

(3) due to remote or overwater area, a high level of reliability and availability of communications, navigation, and ATC services may not exist.

F. **Dispatch Release.** The Dispatch Release of a flight occurs when the flight dispatcher approves the Operational Flight Plan, after which it is submitted to the pilot-in-command for acceptance. The dispatch release may be in the form of an Operational Flight Plan or a separate document, signed by the flight dispatcher and issued in accordance with the company operations manual.

G. **ETOPS Configuration Maintenance and Procedures (CMP) Standard.**

A document containing the minimum requirements for the aircraft configuration including any special inspections, maintenance tasks, hardware life limits and Master Minimum Equipment List (MMEL) constraints necessary to establish and maintain the suitability of an airframe- engine combination for extended range operations.

H. **Engine.** The basic engine assembly plus its essential accessories as supplied by the engine manufacturer

I. Equal Time Point (ETP) - An Equal Time Point is a point along the route which is located at the same flight time from two aerodromes.

J. **Extended Range (or ETOPS) Area of Operation.** The area in which an air operator is authorized to conduct a flight under ETOPS regulations. It is defined by circles centered on the adequate aerodromes, the radius of which is the allowed maximum diversion

distance. In computing the area of operation advantage may be taken from driftdown

K. **Extended Range or ETOPS Operations.** For the purpose of this AC, extended range operations are those flights conducted over a route that contain 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.

L. **Extended Range Entry Point (EEP).** The extended range entry point is the point on the aircraft's outbound route which is one-hour flying time at the approved single engine inoperative cruise speed (under standard conditions in still air) from an adequate aerodrome.

M. **Extended Range Exit Point (EXP).** The EXP (Exit Point) is the first point on the aircraft's inbound route where the aircraft is continuously within 60 minutes flying time at the approved one-engine-inoperative cruise speed (under standard conditions in still air) from an adequate aerodrome.

N. **Extended Range segment.** The extended range segment starts at the EEP and ends at the EXP.

O. **Extended Range Sensitive Event.** An Extended Range sensitive event is any occurrence that could be detrimental to Extended Range operations. This includes, but is not limited to, in-flight shutdowns; diversions or turn-backs; un-commanded power changes or surges; inability to control the engine or obtain desired power; and problems with systems critical to ETOPS operation.

P. **Failsafe.** Is the design methodology upon which airworthiness standards for Transport Category Aeroplanes are based? It requires

the effect of failures and combination of failures to be considered in defining a safe design

Q. **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 (that is, 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, etc.).

R. **Approved One Engine Cruise Speed**

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

(2) The air operator shall use this speed in:

(a) establishing the area of extended range operations and any dispatch limitations;

(b) Calculation of one-engine-inoperative fuel requirements under paragraph 10.d.(4) Fuel and Oil Supply of this AC; and

(c) Establishing the level off altitude (net performance) data. This level off altitude (net performance) must clear any obstacles en route by margins as specified in applicable operating rules.

(3) As permitted under section 10.f. (3) of this AC, based on evaluation of the actual situation, the pilot in command has the authority to deviate from the planned one- engine-inoperative cruise speed.

S. **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.

(1) Airframe System. Any system on the eroplane that is not a part of the propulsion system.

(2) 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.

5. DISCUSSION

To be eligible for extended range operations, the specified airframe-engine combination should have been certificated to the airworthiness standards of transport category aeroplanes and should be evaluated considering the concepts in Paragraph 7, evaluated considering the type design considerations in Paragraph 8, evaluated considering in-service experience discussed in Paragraph 9, and evaluated considering the continuing airworthiness and operational concepts outlined in Paragraph 10.

6. APPLICABILITY

This circular provides guidance for obtaining acceptance type design, continued airworthiness and operations approval for those two engine transport category aeroplanes intended for use in extended range operations. Although many of the criteria in this AC may be currently incorporated into an operator's approved program for other aeroplanes or route structures, the unique nature of extended range operations with two engine aeroplanes necessitates an evaluation of these operations to ensure that the approved programs are effective. To the extent that changes in the aeroplane's type design, continued airworthiness, or the operations

program are involved as a result of this evaluation, they are approved through the normal approval processes.

7. CONCEPTS

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 operations 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 engine reliability is a critical factor, it is not the only factor which should be seriously considered in evaluating extended range operations. Any decision relating to extended range operation with two engine aeroplanes should also consider the probability of occurrence of any condition which would reduce the capability of the aeroplane or the ability of the crew to cope with adverse operating conditions. The following is provided to define the concepts for evaluating extended range operations with two engine aeroplanes.

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

B. **Propulsion System.** 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.

C. **Maintenance Reliability Program Definition.** Since the quality of maintenance and reliability programs 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 program's ability to maintain a satisfactory level of aeroplane systems reliability for the particular airframe-engine combination.

D. **Maintenance and Reliability Program Implementation.** Following a determination that the airframe systems and propulsion systems are designed to be suitable for extended range operations, an in-depth review of the applicant's training programs, operations, and maintenance and reliability programs should be accomplished to show ability to achieve and maintain an acceptable level of systems reliability to safely conduct these operations.

E. **Human Factors.** System failures or malfunctions occurring during extended range operations could affect flight crew workload and procedures. Since the demands on the flight crew may increase, an assessment should be made to ensure that exceptional piloting skills or crew coordination are not required.

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

(1) **Type Design ETOPS Approval.**

(a) The process which will normally lead to the type design ETOPS approval can be divided into two steps:

(i) **Eligibility for ETOPS:** The applicant should show that the design features of the particular airframe-engine combination are suitable for the intended operations (see paragraph 8).

(ii) **Capability for ETOPS:** The applicant should show that the particular airframe-engine combination, having been recognised eligible for ETOPS, can achieve a sufficiently high level of reliability in service so that safe extended range operation may be conducted.

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

(2) **In-service Experience.** It is also necessary for each operator desiring approval for extended range operations to show that it has obtained sufficient maintenance and operations experience with that particular airframe-engine combination to safely conduct these operations. (See Paragraph 9.b)

(3) **Operations Approval.** The type design or acceptance type design approval does not reflect a continuing airworthiness or operational approval to conduct extended range operations. Therefore, before approval, each operator should demonstrate the ability to maintain and operate the aeroplane so as to achieve the necessary reliability and to train its personnel to achieve competence in extended range operations.The operational approval to conduct extended range operations is made by amendment to the operator's operations specifications (see Paragraph 10) which includes requisite items provided in the AFM.

(4) **Continuing Airworthiness.** From time to time, the State of Design Authority may require that the type design CMP standard be revised to correct subsequent problems that impede the achievement of the required level of reliability. As a result a revision to existing CMP standard

may be required to achieve and maintain desired level of reliability and, therefore, safety of the extended range operation. In such cases CMP standards in effect prior to revision will no longer be considered suitable for continued extended range operation. The CMP standard and its revisions may require priority actions to be implemented before the next ETOPS flight and other actions to be implemented according to a schedule accepted by the Authority.

8. TYPE DESIGN APPROVAL CONSIDERATION

A. ECARAS states that “The Authority will not issue type certificates, production certificates or other related approvals for aircraft or aeronautical products until such time an application is made and the Authority provides suitable regulations or provisions for the issuance of an airworthiness certificate, or airworthiness document as appropriate for the product concerned.”. Same rule further states in paragraph b) that “An applicant intending to import a first of type aircraft or aeronautical product Ethiopia shall apply to the Authority for the issuance of an Acceptance Type Certificate, in a form and manner prescribed by the Authority”. Therefore, each applicant for extended range operations approval shall apply for an Acceptance Type Certificate for the particular airframe-engine combination based on the original Type Design Certification as required ECARAS. The fact that an Acceptance Type Certificate for the particular airframe-engine combination may have been previously issued by the Authority shall not to be interpreted as an automatic approval to conduct extended range operations. In all cases, the applicant shall submit its request for approval showing evidence that the individual aircraft is eligible and capable for extended range operations approval. The issuance of acceptance type design approval will be based on the approval issued by the State of Design Authority in the approved AFM or supplement, and Type Certification Data Sheet or Supplemental Type Certificate which contain directly or by reference the following pertinent information, as applicable:

(1) Special limitations (if necessary), including any limitations associated with a maximum diversion time established in accordance with Paragraph 8c (1).

(2) Markings or placards (if required);

(3) Revision to the performance section in accordance with paragraph 10d (6);

(4) The airborne equipment, installation, and flight crew procedures required for extended range operations;

(5) Description or reference to a document containing the approved airplane configuration CMP standard

(6) A statement to the effect that: (sample)

B. "The type design reliability and performance of this airframe-engine combination has been evaluated in accordance with the applicable requirements (e.g. AC 120-42A, JAA IL No20), and found suitable for (state maximum diversion time) extended range operations with the incorporation of the approved airplane configuration CMP standard. This finding does not constitute approval to conduct extended range operations."

Note: *Refer to the applicable code of regulations when conducting the aircraft conformity inspection.*

9. IN-SERVICE EXPERIENCE

In establishing the suitability of a type design in accordance with Paragraph 8 of this AC and as a prerequisite to obtaining any operational approval, in accordance with the criteria of Paragraph 10 of this AC, it should be shown that an acceptable level of propulsion system reliability has been achieved in service by the world fleet for that particular airframe-engine combination. Although the Authority is not assessing directly the suitability of a type design (this is done by the State of Design Authority) this conclusion is endorsed by the Authority through the issuance of an Acceptance Type Certificate based on the original Type Certificate

and corresponding Data Sheet. The candidate operator needs also to obtain sufficient maintenance and operation familiarity with the particular airframe-engine combination in question.

A. Prior to the type design approval, Paragraph 8, it should be shown that the world fleet of the particular airframe-engine combination for which approval is sought can or has achieved, an acceptable and reasonably stable level of single propulsion system in-flight shutdown (IFSD) rate and airframe system reliability

B. Each operator requesting approval to conduct extended range operations should have operational in-service experience appropriate to the operation in service-subparagraphs 9b. (1), (2), (3) contain guidelines for requisite in-service experience. These guidelines may be reduced or increased following review and concurrence on a case-by-case basis by the Authority. Any reduction or increase in in-service experience guidelines will be based on an evaluation of the operator's ability and competence to achieve the necessary reliability for the particular airframe-engine combination in extended range operations. For example, a reduction in in-service experience may be considered for an operator who can show extensive in-service experience with a related engine on another aeroplane, which has achieved acceptable reliability. In contrast, an increase in in-service experience may be considered for those cases where heavy maintenance has yet to occur and/or abnormally low number of takeoffs has occurred.

(1) **75-Minute Operation.** Consideration may be given to the approval of 75-minute extended range operations 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, and the quality of the proposed maintenance and operations programs.

(2) **120-Minute Operation.** Each operator requesting approval to conduct extended range operations with a maximum diversion time of 120 minutes (in

still air) should have 12 consecutive months of operational in-service experience with the specified airframe- engine combination. In-service experience guidelines may be increased or decreased by the Authority, as noted in Paragraph 9b.

(3) **180-Minute Operation.** Each operator requesting approval to conduct extended range operations with a maximum diversion time of 180 minutes (in still air) should have previously gained 12 consecutive months of operational in-service experience with the specified airframe-engine combination in conducting 120-minute extended range operations. In-service experience guidelines may be reduced or increased by the Authority, as noted in Paragraph 9b. Likewise, the substitution of in-service experience, which is equivalent to the actual conduct of 120-minute ETOPS operations, will also be established by the Authority, on a case-by-case basis.

10. OPERATIONAL APPROVAL CONSIDERATIONS

Paragraphs 10.a. through 10.h. detail the criteria for operational approval of extended range operations with a maximum diversion time of 120 minutes to an en-route alternate (at single engine inoperative cruise speed in still air). Appendices 2 and 3 serve two functions; first, they provide expanded explanation of the elements contained in this advisory circular and second, they serve to differentiate the criteria for approval of operations less than 120 minutes (75 minutes) and beyond 120 minutes (180 minutes). For approval of 75-minute operations, only certain requirements of this AC apply. (See Appendix 3)

A. **Requesting Approval.** Any operator requesting approval under ECARAS for extended range operations with two engine aeroplanes (after providing an acceptable evaluation of the considerations in Paragraphs 8 and 9) should submit the requests with the required supporting data, to the Authority at least 90 days prior to the proposed start of extended range operation with the specific airframe-engine combination. In considering an application from an operator to conduct extended range operations, an assessment should be

made of the operator's overall safety record, past performance, flight crew training, and maintenance programs. 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. (Any reliability assessment obtained, either through analysis or service experience, should be used as guidance in support of operational judgments regarding the suitability of the intended operation.)

B. **Assessment of the Operator's Propulsion System Reliability.** When reviewing an operator request for approval of extended range operations, an assessment should be made of the applicant's ability to achieve and maintain the required level of propulsion system reliability. This assessment should 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 power units should 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.

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

C. **Engineering Modifications and Maintenance Program Considerations.** Although these considerations are normally part of the operator's continuing airworthiness program, the maintenance and reliability program may need to be supplemented in consideration of the special requirements of extended range operation (Appendix 2). The following items, as part of the operator's program, will be reviewed to ensure that they are adequate for extended range operations:

(1) **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.

(2) **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 90 days before such changes may be adopted.

(3) **Reliability Reporting.** The reliability reporting program 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 Authority and to the relevant airframe and engine manufacturers. Appendix 2 contains additional information concerning propulsion and airframe system reliability monitoring and reporting.

(4) **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 revised CMP standards, should be promptly implemented. 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 (see paragraph 7.f. (4)).

(5) **Control Process.** Procedures and centralized control process should 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) **Programmes.** The maintenance program used to ensure that the airborne equipment will continue to be maintained at the level of performance and reliability necessary for extended range operations, including such programmes as engine condition monitoring program and oil consumption monitoring.

D. **Flight Release Considerations**

(1) **General.** The flight release considerations specified in this section are in addition to, or amplify; the requirements contained in ECARAS Part 8 and 9 and specifically apply to extended range operations. Although many of the considerations in this AC are currently incorporated into approved programs 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 programs are adequate for this purpose.

(2) **Minimum Equipment List (MEL)**. System redundancy levels appropriate to extended range operations should be reflected in the MEL. 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 units;
(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.

(3) **Communication and Navigation Facilities.** An aeroplane should not be released on an extended range operation unless:

(a) Communications facilities are available to provide under normal conditions, of propagation at the normal 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 an engine shutdown; and

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

(4) **Fuel and Oil Supply.**

(a) **General**. An aeroplane should not be released on an extended range operation unless it carries sufficient fuel and oil to meet the regulatory requirements and any additional fuel that may be determined in accordance with subparagraph 10.d. (4)(ii). 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 10,000 feet 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 units;

(iv) Loss of aeroplane pressurization and air conditioning; consideration should 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 should also be considered as necessary.

(b) **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 subparagraph 10.d. (4)(iii) - 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 the 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 subparagraph 10.d.(4)(i), the critical fuel scenario should allow for: a contingency figure of 5 percent added to the calculated fuel burn from the critical point to allow for errors in wind forecasts, a 5 percent penalty in 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.

(** or operator's demonstrated value for in-service deterioration in cruise fuel mileage)

(c) **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 in determining the critical fuel reserve necessary is operationally the most critical considering both engine at 10,000 feet, non-standard aeroplane configuration not shown to be time and aeroplane configuration (for example, 2 engine versus 1 engine at 10,000 feet, non-standard aeroplane configuration not shown to be Extremely Improbable, paragraph 8.c. (2) (ii) (D)).

(i) At the critical point, consider simultaneous failure of an engine 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 10,000 feet at the approved one engine inoperative cruise speed or continued cruise above 10,000 feet if the aeroplane is equipped with sufficient supplemental oxygen in accordance with the applicable rule requirements.

(iii) Upon approaching destination, descent to 1,500 feet above destination, hold for 15 minutes, initiation of an approach followed by a missed approach and then execution of a normal approach and landing.

(5) **Alternate Aerodromes.** An aeroplane should not be released on an extended range operation unless the required takeoff, destination and alternate aerodromes, including suitable en-route alternate aerodromes are listed in the cockpit documentation (for example, computerized flight plan). Suitable en-route alternates should also be identified and listed in the dispatch release 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:

(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 ECARAS PART 8.

(b) The aerodrome services and facilities are adequate for the applicant operator's approved approach procedures) and operating minima for the runway expected to be used while complying with the applicable aerodrome operating minima;

(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 weather minima for en-route alternate aerodromes in Appendix 1. In addition, for the 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, the forecast crosswind component, including gusts, for the landing runway expected to be used should not exceed the maximum permitted crosswind for landing taking into account the runway condition (dry, wet or contaminated).

(d) During the course of the flight, the flight crew should be informed of any significant changes in conditions at designated en-route alternates (e.g.: NOTAMs). Prior to a120-minute extended range flight proceeding beyond the extended range entry point, the forecast weather for the time periods established in subparagraph10.d.(5)(iii), 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 be notified and an acceptable alternates) selected, where safe approach and landing can be made.

(e) In addition, the operator's programme should provide flight crews with information adequate aerodromes appropriate to the route to be

flown which are not forecast to meet Appendix 1 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.*

(6) **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 (see Paragraph 8.d. (3)) information provided or referenced in the Aeroplane Flight Manual.

(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) Driftdown (includes net performance);

(ii) Cruise altitude coverage including 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 10,000 feet); and (ii) Holding.

(c) Details of any other conditions relevant to extended range operations 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 ECARAS Part 8.

E. Flight Crew Training, Evaluation, and Operating Manuals.

(1) **Adequacy of Flight Crew Training and Operating Manuals.** The Authority will review in-service experience of critical and essential aeroplane systems. The review will include system reliability levels and individual event circumstances, including crew actions taken in response to equipment failures or unavailability. The purpose of the review will be to verify the adequacy of information provided in training programs and operating manuals. The aviation industry should provide information for and participate in these reviews. The Authority will use the information resulting from these reviews to modify or update flight crew training programs, operating manuals, and checklists, as necessary.

(2) **Flight Crew Training and Evaluation Program.** The operator's training program in respect to extended range operations should provide training for flight crewmembers followed by subsequent evaluations and proficiency checks in the following areas:

(a) Introduction to ETOPS regulations;

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

(c) Performance.

(i) Flight planning, including all contingencies.

(ii) Flight performance progress monitoring.

(d) 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, including appropriate flight management devices.

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

- 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.

- Operational restrictions associated with these failures including any applicable MEL considerations.
- Procedures for air start of the propulsion systems, including the APU, if required.
- 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 or fuel remaining.

(3) **ETOPS Check Airman.** The operator should designate specific ETOPS check airman. The objective of the ETOPS check airman program should be to ensure standardized flight crew practices and procedures and also to emphasize the special

nature of ETOPS operations. Only airmen with a demonstrated understanding of the unique requirements of ETOPS should be designated as a check airman.

F. Operational Limitations

(1) **Area of operation**

(a) An operator may be authorized 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 75, 120 or 180 minutes at the approved one engine cruise speed (under standard conditions in still air). Appendices 2 and 3 provide criteria for operation at the different diversion times.

(b) The area which meets the considerations in Paragraph 9.f.(1)(i) may be approved for extended range operations with two engine aeroplanes and should be specified in the operations specifications as the authorized area of operations.

(2) **Flight Release Limitation.** The flight release limitation should specify the maximum diversion time from a suitable aerodrome an operator can conduct a particular extended range operation. The maximum diversion time at the approved one engine inoperative cruise speed (under standard conditions in still air) should not be any greater than the value established by subparagraph 10.f.(1)(i).

(a) **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.

Operators should provide for:

(i) Compliance with ECARAS PART 8 where, 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 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.

(b) **Criteria for Maximum Diversion Times**. The criteria for different maximum diversion times are detailed in Appendices 2 and 3.

(3) 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.

G. Operations Specifications.

(1) An operator's two engine aeroplane should not be operated on an extended range flight unless authorized by operations specifications approval (both maintenance and operations).

(2) Operations specifications for extended range operations should specifically include provisions covering at least the following:

(a) Part D should define the particular airframe-engine combinations, including the current approved CMP standard

required for extended range operation as normally identified in the AFM (paragraph 8.f.).

(b) Authorized area of operation.

(c) Minimum altitudes to be flown along planned and diversionary routes.

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

(e) Aerodromes authorized for use, including alternates, and associated instrument approaches and operating minima.

(f) The approved maintenance and reliability program (reference Appendix2) for extended range operations including those items specified in the type design approved CMP standard.

(g) Identification of those aeroplanes designated for extended range operation by make and model as well as serial and registration numbers.

H. **Operational Validation Flight.** The operator should demonstrate, by means of an Authority witnessed validation flight using the specified airframe-engine combination that it has the competence and capability to safely conduct and adequately support the intended operation. The Authority, will determine the conditions for each operator's validation flight using the specified airframe-engine combination that it has the competence and capability to safely conduct and adequately support the intended operation. The Authority, will determine the conditions for each operator's validation flight following a review on a case-by-case basis of the operator's experience and the proposed operation. The

following emergency conditions should be demonstrated during the validation flight unless successful demonstration of these conditions has been witnessed by the Authority in an acceptable simulation prior to the validation flight:

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

(2) Total loss of normal generated electrical power;

(3) Any other condition considered to be more critical in terms of airworthiness, crew workload, or performance risk.

(l) **Extended range operations.** type design approval for extended range operations in accordance with paragraph 8 and satisfactory application of the criteria in paragraphs 9 and 10 and prior to the issuance of operations specifications, the operator's application, as well as the principal inspectors' (Principal Maintenance Inspector, Principal Avionics Inspector, Principal Operations Inspector) recommendations and supporting data should be forwarded to the Director, Flight Standards Service, for review and concurrence. Following the review and concurrence by the Director, the operational validation flight should be conducted in accordance with any additional guidance specified in the review and concurrence. When the operational validation flight has been evaluated and found acceptable, an applicant may be authorized to conduct extended range operations with the specified airframe-engine combination. Approval to conduct ETOPS is made by the issuance of operations specifications containing appropriate limitations.

11. CONTINUING SURVEILLANCE

The fleet average IFSD rate for the specified airframe-engine combination will continue to be monitored in accordance with Appendix 2. As with all other operations, the Authority should also monitor all aspects of the extended range operations it has authorized to ensure that the levels of reliability achieved in extended range operations remain at the necessary levels, and that the operation continues to be conducted safely. In the event that an acceptable level of reliability is not maintained, significant adverse trends exist, or if significant deficiencies are detected in the type design or the conduct of the ETOPS operation, the Authority should initiate a special evaluation, impose operational restriction, if necessary, and stipulate corrective action for the operator to adopt to resolve the problems in a timely manner.

Wosenyelesh Hunegnaw /Colonel/
ECAA DG

APPENDIX 1. SUITABLE ENROUTE ALTERNATE AERODROMES

1. GENERAL

A. 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 (for example, cargo fire suppressant), or by the approved maximum diversion time for that route.

B. It is, therefore, important that any aerodrome designated as an en-route alternate has 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 descent altitude (MDA), and that the surface conditions are within acceptable limits to permit the approach and landing to be safely completed with an engine and/or systems inoperative.

2. **ADEQUATE AIRPORT**

As with all other operations, an operator desiring any route approval should show that it is able to satisfactorily conduct scheduled operations between each required airport other than that route or route segment. Operators should show that the facilities and services specified in ECARAS 9.2.4.1 are available and adequate for the proposed operation.

3. **SUITABLE AERODROME**

For an aerodrome to be suitable for the purpose of this advisory circular, it should have the capabilities, services, a minimum of ICAO category 4, or the relevant aeroplane category if lower, Rescue and Fire Fighting Services (RFFS) and facilities necessary to designate it as an adequate aerodrome, and have weather and field conditions at the time of the particular operation which provide a high assurance that an approach and landing can be safely completed with an engine and/or systems inoperative in the event that a diversion to the en-route alternate becomes necessary. 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 dispatch purposes are generally higher than the weather minima necessary to initiate an instrument approach. This is necessary to assure that the instrument approach can be conducted safely if the flight has to divert to the alternate aerodrome. Additionally, since the visual reference necessary 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 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 higher than for precision approaches.

4. **STANDARD ENROUTE ALTERNATE AERODROME WEATHER MINIMA**

The following are established for flight planning and release purposes with two engine aeroplanes in extended range operations. These weather minima recognize the benefits of precision approaches, as well as the increased assurance of safely completing an instrument approach at airports which are equipped with precision approaches to at least two separate runways, (two separate landing surfaces). A particular aerodrome may be considered to be a suitable aerodrome for flight planning and release purposes for extended range operations if it meets the criteria of Paragraph 3 of this Appendix and has one of the following combinations of instrument approach capabilities and en-route alternate aerodrome weather minima ECARAS Part8 § 8.6.2.9. See Table 1 below:

Table 1 - Planning minima – ETOPS

Note: *The forecast weather criteria used in the selection of alternate aerodromes for IFR flight will also be used for the selection of ETOPS alternates.*

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 *(See note 1)*	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	Precision Approach Cat I (ILS,	Non-Precision Approach Minima		

(ILS, MLS)	MLS)	
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	

Note 1: *Runways on the same aerodrome are considered to be separate runways when they are separate landing surfaces which may overlay or cross such that if one of the runways is blocked, it will not prevent the planned type of operations on the other runway and each of the landing surfaces has a separate approach based on a separate aid.*

5. LOWER THAN STANDARD ENROUTE ALTERNATE AERODROME WEATHER MINIMA

Lower than standard en-route alternate aerodrome weather minima may be considered for approval for certain operators on a case-by-case basis by the Authority, at suitably equipped aerodromes for certain aeroplanes which have the certificated capability to safely conduct Category II and/or Category III approach and landing operations after encountering any failure condition in the airframe and/or propulsion systems which would result in a diversion to an en-route alternate aerodrome. Subsequent failures during the diversion, which would result in the loss of the capability to safely conduct and complete Category II and/or Category III approach

and landing operations, should be shown to be improbable. The certificated capability of the aeroplane should be evaluated considering the approved maximum diversion time. Lower than standard en-route alternate weather minima may be considered at suitably equipped aerodromes, if appropriate, for those aeroplanes which have these approved capabilities considering the established maximum diversion time.

6. **ENROUTE ALTERNATE SUITABILITY IN FLIGHT**

The suitability of an en-route alternate aerodrome for an aeroplane which encounters a situation in-flight which necessitates a diversion, including the provisions of ECARAS § 8.6.2.12 while en-route on an extended range operation is based on a determination that the aerodrome is still suitable for the circumstances, and the weather and field conditions at that aerodrome will permit an instrument approach to be initiated and a landing completed.

APPENDIX 2. 75, 120, and 180-MINUTE ETOPS MAINTENANCE REQUIREMENTS

1. **GENERAL**

The maintenance program for aeroplanes used in 75, 120, and 180-minute ETOPS 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 program.

2. **MAINTEANCE PROGRAM**

The basic maintenance program for the aeroplane being considered for ETOPS is the continuous airworthiness maintenance program currently approved for that operator, for the make and model airframe-engine

combination. This program should be reviewed by the PMI to ensure that it provides an adequate basis for development of a supplemental ETOPS maintenance program. ETOPS maintenance requirements will be expressed in, and approved as, supplemental requirements. This should include maintenance procedures to preclude identical action being applied to multiple similar elements in any ETOPS significant system (for example, 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 centralized maintenance control, should be clearly defined in the operators program.

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 and signed off by an ETOPS qualified maintenance person immediately prior to an ETOPS flight. Such a person may be a member of the flight crew.

NOTE: *The service check may not be required for the return leg of a 75-minute ETOPS flight in a benign area of operation (defined in Appendix 3).*

D. Logbooks should be reviewed and documented as appropriate to ensure proper MEL procedures, deferred items, maintenance checks and that system verification procedures have been properly performed.

3. **ETOPS Manual.** The operator should develop a manual for use by personnel involved in ETOPS. This manual need not include but should at least reference the maintenance programs 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 programs, procedures, duties, and responsibilities, should be identified and subject to revision control. This manual should be submitted to the Authority at least 90 days before implementation of ETOPS flights.

4. **Oil Consumption Program.** The operator's oil consumption program should reflect the manufacturer's recommendations and be sensitive to oil consumption trends. It should consider the amount of oil added at the departing ETOPS stations with reference to the running average consumption; that is, 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 program. If the APU is required for ETOPS operation, it should be added to the oil consumption program.

5. **Engine Condition Monitoring.** This program should describe the parameters to be monitored, method of data collection and corrective action process. The program should reflect manufacturer's instructions and industry practice. This monitoring will be used to detect deterioration at an early stage to allow for corrective action before safe operation is affected The program should ensure that engine limit margins are maintained so that a prolonged single engine diversion may be conducted without exceeding approved engine limits (that is, rotor speeds, exhaust gas temperatures) at all approved power levels and expected environmental conditions. Engine margins preserved through this program should account for the effects of additional engine loading demands (for example, anti-ice, electrical, etc.) which may be required during the single engine flight phase associated with the diversion.

6. **Verification Program after Maintenance.** The operator should develop a verification program or procedures should 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 should be identified in the program.

Primary systems, like APU, or conditions requiring verification actions should be described in the operators ETOPS manual.

7. **Reliability Program.** An ETOPS reliability program should be developed or the existing reliability program supplemented. This program should be designed with early identification and prevention of ETOPS related problems as the primary goal. The program 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 72 hours of events reportable through this program.

A. In addition to the items required to be reported by ECARAS § 5.51.4, the following items should also be included:

(1) In-flight shutdowns.

(2) Diversion or turnback.

(3) Uncommanded power changes or surges.

(4) Inability to control the engine or obtain desired power.

(5) Problems with systems critical to ETOPS.

(6) Any other event detrimental to ETOPS.

B. The report should identify the following.

(1) Aeroplane identification.

(2) Engine identification (make and serial number).

(3) Total time, cycles, and time since last shop visit.

(4) For systems, time since overhaul or last inspection of the defective unit.

(5) Phase of flight.

(6) 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 shutdown 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. When the propulsion system IFSD (computed on a 12-month rolling average) exceeds 0.05/1000 engine hours for a 120-minute operation, or exceeds 0.03/1000 engine hours for a 180-minute operation, an immediate evaluation should be accomplished by the operator and the Authority, which may involve coordination with the Type Certificate holder and issuing 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 program should focus on the special nature of ETOPS. This program should be included in the normal maintenance training program. The goal of this program is to ensure that all personnel involved in ETOPS are provided the necessary training so that the ETOPS programs are properly accomplished and to emphasize the special nature of ETOPS maintenance requirements. Qualified maintenance personnel are those that have completed the operator's extended range training program and have satisfactorily performed extended range tasks under supervision, within the framework of the operator’s approved procedures for personnel authorisation.

10. **ETOPS Parts Control.** The operator should develop a parts control program with support from the manufacturer, that ensures the proper parts and configuration are maintained for ETOPS. The program includes verification that parts placed on ETOPS aeroplanes 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 3 ETOPS OPERATIONAL PROGRAM CRITERIA

1. **GENERAL.** Paragraphs 10.a. through 10.h. of this AC detail the criteria for operational approval of extended range operations with a maximum diversion time of 120 minutes to an en-route alternate (at approved single engine inoperative cruise speed). This appendix serves the function of differentiating the criteria for approval of operations less than 120 minutes (75 minutes) and beyond 120 minutes (180 minutes). For approval of 75-minute operations, not all of the requirements of the basic AC need necessarily be met. For approval of 180-minute operations, all of the requirements of the basic AC must be met along with the requirements identified in the Appendix as necessary for 180-minute operations.

2. **75-MINUTE OPERATION.** The criteria detailed below are the basis for evaluating different areas of operation and requirement for approving 75-minute operation.

A. **Benign Area of Operation.** To be defined as a benign area of operation, the following considerations should apply:

(1) Numerous adequate aerodromes.

(2) A high level of reliability and availability are required of communications, navigation, and ATC services and facilities.

(3) Prevailing weather conditions are stable and generally do not approach extremes in temperature, wind, ceiling, and visibility.

B. Criteria for Approval to Operate in a Benign Area of Operation.

(1) Type Design. The airframe-engine combination should be reviewed to determine if there are any factors which would affect safe conduct of operations. Type design ETOP approval criteria are not necessarily required.

(2) Maintenance programs should follow the guidance in Appendix 4 for 75-minute programs.

(3) Operational Programs.

(a) **Minimum Equipment List.** Provisions of the MMEL, excluding "Extended Range" provisos, apply.

(b) **Dispatch limitations.** Flight should be operated at a weight that permits the flight, at approved one engine inoperative cruise speed and power setting, to maintain flight altitude at or above the Minimum En-route Altitude.

C. **Demanding Area of Operation.** A demanding area of operations for the purpose of 75-minute approval has one or more of the following characteristics:

(1) **Weather.** Prevailing weather conditions can approach extremes in winds, temperature, ceiling, and visibility for protracted periods of time.

(2) **Alternates.** Adequate aerodromes are not numerous.

(3) Due to remote or overwater area, a high level of reliability and availability of communications, navigation, and ATC facilities services may not exist.

D. Criteria for Approval to Operate in a Demanding Area of Operation.

(1) Type Design. The airframe-engine combination should be reviewed to determine any factors which could effect safe operations in the demanding area of operations. Type design ETOPS approval criteria are not necessarily required.

(2) Maintenance programs should be instituted which follow the guidance in Appendix 4 for 120-minute operation.

(3) Operation programs should be instituted which follow the guidance contained in this AC for 120-minute programs.

3. **180-MINUTE OPERATION.** 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. The substitution of in-service experience which is equivalent to the actual conduct of 120-minute operations will be established by the Authority, on a case-by-case basis. Prior to approval, the operator's capability to conduct operations and implement effective ETOPS programs in accordance with the criteria detailed in Paragraph 10 of this advisory circular will be examined. Only operators who have demonstrated capability to conduct a 120-minute program successfully will be considered for approval beyond 120 minutes. These operators should also demonstrate additional capabilities discussed in this paragraph. 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 dispatch limitation will be a maximum diversion time of 180 minutes to a suitable aerodrome at approved single engine inoperative speed (under standard conditions in still air).

A. Dispatch Considerations.

(1) **MEL.** The MEL should reflect adequate levels of primary system redundancy to support 180-minute (still air) operations. The systems listed in Paragraph 10.d.(2)(i) through (xvi) should be considered.

(2) **Weather.** An operator should 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 operation. Such factors as staffing, dispatcher training, sources of weather reports and forecasts, and when possible, a record of forecast reliability should be evaluated.

(3) **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 in accordance with regulatory requirements.

(4) **Operational Control Practices and Procedures.** During the course of the flight, the flight crew should be informed of any significant changes in conditions at designated en-route alternates. Prior to a 180-minute ETOPS flight proceeding beyond the extended range entry point, the forecast weather for the time periods established in paragraph 10.d(5)(iii), landing distances, and aerodrome services and facilities (e.g.: NOTAMs) 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, the pilot should be notified and an acceptable alternate selected where safe approach and landing can be made. The maximum diversion time to the newly selected alternate should not exceed 180 minutes at the approved single engine inoperative cruise speeds (under standard conditions in still air.

(5) **Flight Planning.** Operators should provide for compliance with ECARAS § 8.6.2. The effects of wind and temperature at single engine inoperative cruise altitude should be accounted for. In addition, the operator's program should provide flight crews with information on suitable aerodromes appropriate to the route to be flown which are not forecast to meet Appendix 1 en-route alternate weather minima. Aerodrome facility information, and other appropriate planning data concerning these aerodromes should be provided to flight crews for use in complying with ECARAS 8.6.2. when executing a diversion.

B. Crew Training and Evaluation.

(1) 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.

(2) **Contingency Procedures**. Flight crews should be provided detailed initial and recurrent training which emphasizes established

contingency procedures for each area of operation intended to be used.

(3) **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.

(4) **ETOPS Service Check**. If a member of the flight crew is authorised to perform the service check referred to in Appendix 2, Par. 2, iii) such a person should be provided initial and recurrent training covering the verification of the status of the aeroplane and certain critical items prior to an ETOPS flight.

C. Equipment.

(1) **VHF/Satellite Data Link.** Operators should consider enhancements to their operational control system as soon as they become feasible.

(2) **Automated System Monitoring.** Automated aeroplane system status monitoring should be provided to enhance the flight crew's ability to make timely diversion decisions.

4. **VALIDATION FLIGHT OR FLIGHTS.** The operator should demonstrate by means of an Authority witnessed validation flight that it has the capability to safely conduct 180-minute operations with the specified airframe-engine combination. The guidance for validation flights contained in Paragraph 10.h. of this TC should be followed.

APPENDIX 4 REDUCTION OF OPERATOR'S INSERVICE EXPERIENCE REQUIREMENT PRIOR TO THE GRANTING OF ETOPS OPERATIONAL APPROVAL (ACCELERATED ETOPS OPERATIONAL APPROVAL).

1. GENERAL

A. Paragraph 9(b) of this TC states the following:

(1) (In-service experience) guidelines may be reduced or increased following review and concurrence on a case-by-case basis by the Authority.

(2) Any reduction will be based on evaluation of the operator's ability and competence to achieve the necessary reliability for the particular airframe-engine combination in extended range operations.

(3) For example, a reduction in in-service experience may be considered for an operator who can show extensive in-service experience with a related engine on another airplane which has achieved acceptable reliability.

(4) The substitution of in-service experience which is equivalent to the actual conduct of 120-minute ETOPS operations will also be established by the Authority, on a case-by-case basis.

B. The purpose of this Appendix is to establish the factors which the Authority, may consider in exercising the authority to allow reduction or substitution of operators in service experience requirement in granting ETOPS Operational Approval.

C. The excellent propulsion related safety record of two-engine airplanes has not only been maintained, but potentially enhanced, by the process related provisions associated with ETOPS Type Design and Operational Approvals. Further, currently available data shows that these process related benefits are achievable without extensive in-service experience. Therefore, reduction or elimination of in-service experience requirements may be possible when the operator shows to the Authority that adequate and validated ETOPS processes are in place.

D. The Accelerated ETOPS Operational Approval Program with reduced in-service experience does not imply that any reduction of existing levels of safety should be tolerated but rather acknowledges that an operator may be able to satisfy the objectives of this TC by a variety of means of demonstrating that operator's capability.

E. This Appendix describes the means by which an operator may initiate ETOPS operations when the operator establishes the processes necessary for successful and reliable ETOPS operations are in place and are considered to

be reliable. This may be achieved by thorough documentation of processes, demonstration on another airplane/validation (as described in paragraph 7 of this Appendix) or a combination of these processes.

2. BACKGROUND

A. When ETOPS requirements were first released in 1985, ETOPS was a new concept, and requiring extensive in-service verification of capability to assure the concept was a logical approach. At that time, the Authorities recognized that reduction in the in-service experience requirements or substitution of in-service experience, on another airplane, would be possible.

B. The ETOPS concept has been successfully applied for more than a decade; ETOPS is now widely employed and is well established. The number of ETOPS operators has increased dramatically; and in the North Atlantic, U.S. airlines have more twin operations than the number of operations accomplished by three- and four-engine airplanes.

C. Under this AC an operator is generally required to operate an airframe-engine combination for one (1) year, before being eligible for 120-minute ETOPS; and another one (1) year, at 120-minute ETOPS, before being granted 180-minute ETOPS approval. For example, an operator who currently has 180-minute ETOPS approval on one type of airframe-engine or who is currently operating that route with an older generation three- or four-engine airplane could be required to wait for up to two (2) years for such an approval. Such a requirement could create undue economic and operational burdens on operators. On the other hand, experience data indicates that compliance with the alternative processes of this Appendix will provide for successful ETOPS operation at earlier than the standard time established in the basic AC.

D. ETOPS operational data indicates that twin-engine airplanes have maintained a high degree of reliability due to implementation of specific maintenance, engineering, and flight operation process-related requirements. Compliance with ETOPS processes is crucial in assuring high levels of reliability of twin-engine airplanes. Data also indicates that previous experience with an

airframe-engine combination prior to operating ETOPS, does not necessarily make a significant difference in the safety of such operations. Commitment to establishment of reliable ETOPS processes has been found to be a much more significant factor. Such commitment, by operators, has, from the outset, resulted in operation of twin-engine airplanes at a mature level of reliability.

E. ETOPS experience of the past decade clearly demonstrates that a firm commitment by the operator to establish proven ETOPS processes prior to the start of actual ETOPS and dedication to that commitment throughout the life of the program is paramount to safe and reliable ETOPS operations.

3. DEFINITIONS

A. **Process**. A process is a series of steps or activities that are accomplished, in a consistent manner, to assure that a desired result is attained on an ongoing basis. Paragraph 4 documents ETOPS processes that should be in place to ensure a successful Accelerated ETOPS program.

B. **Proven Process**. A process is considered to be proven when the following elements are developed and implemented:

(1) Definition and documentation of process elements.

(2) Definition of process related roles and responsibilities.

(3) Procedure for validation of process or process elements.

(a) Indications of process stability/reliability.

(b) Parameters to validate process and monitor (measure) success.

(c) Duration of necessary evaluation to validate process.

(4) Procedure for follow-up in-service monitoring to assure process remains reliable/stable.

Methods of process validation are provided in paragraph 7.

4. ETOPS PROCESSES

A. The two-engine airframe/engine combination for which the operator is seeking Accelerated ETOPS Operational Approval must be ETOPS Type Design approved (and have been issued an Acceptance Type Certificate by the

Authority) prior to commencing ETOPS. The operator seeking Accelerated ETOPS Operational Approval must demonstrate to the Authority that it has an ETOPS program in place that addresses the process elements identified in this section.

B. The following are the ETOPS process elements:

(1) Airplane/engine compliance to Type Design Build Standard (CMP).

(2) Compliance with the Maintenance Requirements as defined in paragraph 10 and paragraph 4 of this AC:

(a) Fully developed Maintenance Program. (Appendix 2, paragraph 2 which includes a tracking and control program.)

(b) ETOPS manual (Appendix 2, paragraph 3 in place).

(c) A proven Oil Consumption Monitoring Program. (Appendix 2, paragraph 4)

(d) A proven Engine Condition Monitoring and Reporting system. (Appendix 2, paragraph. 5)

(e) A proven Verification Program after Maintenance. (Appendix 2, paragraph 6)

(f) A proven ETOPS Reliability Program. (Appendix 2, paragraph 7.)

(g) Propulsion system monitoring program (Appendix 2, paragraph 8) in place. The operator should establish a program that results in a high degree of confidence that the propulsion system reliability appropriate to the ETOPS diversion time would be maintained.

(h) Training and qualifications program in place for ETOPS maintenance personnel. (Appendix 2, paragraph 9)

(i) Established ETOPS parts control program. (Appendix 2, paragraph 10.)

(3) Compliance with the Flight Operations Program as defined in paragraph 10 and Appendix 3 of this AC:

(a) Proven flight planning and dispatch programs appropriate to ETOPS.

(b) Availability of meteorological information and MEL appropriate to ETOPS.

(c) Initial and recurrent training and checking program in place for ETOPS flight operations personnel.

(d) Flight crew and dispatch personnel familiarity assured with the ETOPS routes to be flown; in particular the requirements for, and selection of, en-route alternates.

(4) Documentation of the following elements:

(a) Technology new to the operator and significant difference in primary & secondary power (engines, electrical, hydraulic and pneumatic) systems between the airplanes currently operated and the two-engine airplane for which the operator is seeking Accelerated ETOPS Operational Approval.

(b) The plan to train the flight and maintenance personnel to the differences identified in subparagraph (i) above.

(c) The plan to use proven manufacturer-validated Training and Maintenance and Operations Manual procedures relevant to ETOPS for the two-engine airplane for which the operator is seeking Accelerated ETOPS Operational Approval.

(d) Changes to any previously proven validated Training, Maintenance or Operations Manual procedures described above. Depending on the nature and extent of any changes, the operator may be required to provide a plan for validating such changes.

(e) The validation plan for any additional operator unique training and procedures relevant to ETOPS.

(f) Details of any ETOPS program support from the airframe manufacturer, engine manufacturer, other operators or any other outside person.

(g) The control procedures when maintenance or flight dispatch support is provided by an outside person as described above.

5. APPLICATION

A. Paragraph 10(a) of this AC requires that requests for extended range operations be submitted at least ninety (90) days prior to the start of extended range operations. Normally, the operator should submit an Accelerated ETOPS Operational Approval Plan to the Authority six (6) months before the proposed start of extended range operations. This time will permit the Authority to review the documented plans and assure adequate ETOPS processes are in place. The operator's application for Accelerated ETOPS should:

(1) Define proposed routes and the ETOPS diversion time necessary to support these routes.

(2) Define processes and related resources being allocated to initiate and sustain ETOPS operations in a manner that demonstrates commitment by management and all personnel involved in ETOPS maintenance and operational support.

(3) Identify, where required, the plan for establishing compliance with the build standard required for Type Design Approval; e.g., CMP (Configuration, Maintenance and Procedures Document) compliance.

(4) Document plan for compliance with requirements in paragraph 4.

(5) Define Review Gates. A Review Gate is a milestone tracking plan to allow for the orderly tracking and documentation of specific requirements of this Appendix. Each Review Gate should be defined in terms of the tasks to be satisfactorily accomplished in order for it to be successfully passed. Items for which the Authority visibility is required or the Authority approval is sought should be included in the Review Gates. Normally, the Review Gate process will start six (6) months before the proposed start of extended range operations and should continue at least until six (6) months after the start of extended range operations. Assure that the proven processes comply with the provisions of paragraph 3 of this Appendix.

6. OPERATIONAL APPROVALS

A. Operational approvals that are granted with reduced in-service experience will be limited to those areas agreed on by the Authority at approval of the Accelerated ETOPS Operational Approval Plan. When an operator wishes to add new areas to the approved list, Authority concurrence is required.

B. Operators will be eligible for ETOPS Operational Approval up to the Type Design Approval limit, provided the operator complies with all the requirements in paragraph 4.

7. PROCESS VALIDATION

A. Paragraph 4 identifies those process elements that need to be proven prior to start of Accelerated ETOPS.

B. For a process to be considered proven, the process must first be defined. Typically, this will include a flow chart showing the various elements of the process. Roles and responsibilities of the personnel who will be managing this process should be defined including any training requirement. The operator should demonstrate that the process is in place and functions as intended. The operator may accomplish this by thorough documentation and analysis, or by demonstrating on an airplane that the process works and consistently provides the intended results. The operator should also show that a feedback loop exists to illustrate need for revision of the process, if required, based on in-service experience.

C. Normally the choice to use, or not use, demonstration on an airplane as a means of validating the process should be left up to the operator. With sufficient preparation and dedication of resources such validation may not be necessary to assure processes produce acceptable results. However, in any case where the proposed plan to prove the processes is determined by the Authority to be inadequate or the plan does not produce acceptable results, validation of the process in an airplane will be required.

D. If an operator is currently operating ETOPS with a different airframe and/or engine combination it may be able to document that it has proven ETOPS processes in place and only minimal further validation may be necessary. It will, however, be necessary to demonstrate that means are in place to assure equivalent results will occur on the airplane being proposed for Accelerated ETOPS Operational Approval. The following elements which while not required, may be useful or beneficial in justifying a reduction in the validation requirements of ETOPS processes:

(1) Experience with other airframes and/or engines.

(2) Previous ETOPS experience.

(3) Experience with long range, overwater operations with two-, three-, or four-engine airplanes.

(4) Experience gained by flight crews, maintenance personnel, and flight dispatch personnel while working with other ETOPS-approved operators.

E. Process validation may be done in the airframe-engine combination that will be used in Accelerated ETOPS operation or in a different type airplane than that for which approval is being sought, including those with three- or four-engines.

F. A process may be validated by first demonstrating the process produces acceptable results on a different airplane type or airframe-engine combination. It should then be necessary to demonstrate that means are in place to assure equivalent results should occur on the airplane being proposed for Accelerated ETOPS Operational Approval.

G. Any validation program should address the following:

(1) The operator should show that it has considered the impact of the ETOPS validation program with regard to safety of flight operations. The operator should state in its application any policy guidance to personnel involved in the ETOPS process validation program. Such guidance should clearly state that ETOPS process validation exercises

should not be allowed to adversely impact the safety of operations especially during periods of abnormal, emergency, or high cockpit workload operations. It should emphasize that during periods of abnormal or emergency operation or high cockpit workload ETOPS process validation exercises may be terminated.

(2) The validation scenario should be of sufficient frequency and operational exposure to validate maintenance and operational support systems not validated by other means.

(3) A means must be established to monitor and report performance with respect to accomplishment of tasks associated with ETOPS process elements. Any recommended changes to ETOPS maintenance and operational process elements should be defined.

(4) Prior to the start of the process validation program, the following information should be submitted to the Authority:

(a) Validation periods, including start dates and proposed completion dates.

(b) Definition of airplane to be used in the validation. List should include registration numbers, manufacturer and serial number and model of the airframes and engines.

(c) Description of the areas of operation (if relevant to validation objectives) proposed for validation and actual extended range operations.

(d) Definition of designated ETOPS validation routes. The routes should be of duration necessary to ensure process validation occurs.

(5) Process validation reporting. The operator should compile results of ETOPS process validation. The operator should:

(a) Document how each element of the ETOPS process was utilized during the validation.

(b) Document any shortcomings with the process elements and measures in place to correct such shortcomings.

(c) Document any changes to ETOPS processes that were required after an inflight shutdown (IFSD), unscheduled engine removals, or any other significant operational events.

(d) Provide periodic Process Validation reports to the Authority. This may be addressed during the Review Gates.

(d) Flight crew and dispatch personnel familiarity assured with the ETOPS routes to be flown; in particular the requirements for, and selection of, en-route alternates.

(4) Documentation of the following elements:

(a) Technology new to the operator and significant difference in primary & secondary power (engines, electrical, hydraulic and pneumatic) systems between the airplanes currently operated and the two-engine airplane for which the operator is seeking Accelerated ETOPS Operational Approval.

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E. Process validation may be done in the airframe-engine combination that will be used in Accelerated ETOPS operation or in a different type airplane than that for which approval is being sought, including those with three- or four-engines.

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