GHANA
CIVIL AVIATION AUTHORITY

ADVISORY CIRCULAR
AC 09-008

PROCESS & APPLICATION: EDTO CERTIFICATION

SECTION 1 POLICY & GENERAL INFORMATION

1.1 PURPOSE

This Advisory Circular (AC) provides Ghana aircraft owners and operators with comprehensive information on a means of gaining the approval of the GCAA to undertake "Extended Diversion Time Operation" (EDTO) in transport category aircraft.

EDTO approval allows the operation of two engine aircraft over routes where the aircraft will be more than 60 minutes flying time from an acceptable alternate aerodrome.

1.2 APPLICABILITY

A. This AC is for use by Ghana operators, those who own/operate either Ghana or foreign registered aircraft, and their flight crews. Those operators wishing to engage in EDTO operations anywhere in the world must obtain certification from GCAA for those operations.

B. This AC applies to all twin-engine aeroplanes with a MCTOW of more than 8618 kilograms (19,000 pounds) for which the type certificate has been issued authorizing the transport of 20 or more passengers (whether or not the individual aircraft is configured for 20 or more passengers) operated by a Ghana air operator in a commercial air transport.

EDTO does not apply to flights conducted wholly within Ghana domestic airspace.

1.3 STATUS OF THIS AC

This AC is an original issuance.

1.4 BACKGROUND

A. This AC provides the policy, procedures and guidelines for obtaining Type Design and/or Operational Approval for two-engine transport category aeroplanes to operate over a specified route containing a point farther than 60 minutes flying time at the approved one-engine-inoperative cruise speed (under standard conditions in still air) from an adequate aerodrome regardless of terrain.

B. The 60-minute threshold is a point beyond which the provisions of this publication will apply. Previously issued approvals for EDTO/EROPS programs will continue to be valid; requests for new EDTO authorizations or changes to existing programs will be assessed under the

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

criteria outlined in this document. Specific criteria are included for deviation of 75, 90, 120, 138 and 180 minutes.

C. An *EDTO Certification* (or equivalent approval/qualification from another State) is not mandatory in order to gain access to Ghana airspace.

1.5 RELATED PUBLICATIONS

For further information on this topic, operators may wish to review the following publications/ regulatory requirements.

1) Federal Aviation Administration (FAA). Website: www.faa.gov

- AC 120-42A

2) Joint Aviation Authorities (JAA)

- JAA Information Leaflet 20

1.6 DEFINITIONS

- This list of definitions is applicable in the context of this manual only.
- Words, such as "aerodrome" may be found in other publications with a different definition.

A. **Aircraft Flight Manual**. In this publication, the term Aircraft Flight Manual will be used in lieu of the terms "Aeroplane Flight Manual" and/or "Approved Flight Manual".

B. **Aerodrome**.

1) **Adequate**. For the purpose of this AC, an adequate aerodrome is an aerodrome, which the air operator and the GCAA 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.

C. **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.

D. **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.

E. **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.

F. **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).

G. **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.

H. **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.

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

J. **Engineering Judgment.** A subjective decision required due to the complexity of an issue based upon a qualitative analysis of relevant data.

K. **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.

L. **Extended Range (ER) or EDTO Operations.** For the purpose of this document, extended range operations are those operations conducted over a specified route that contain a point further than 60 minutes flying time at the approved one-engine-inoperative cruise speed (under standard conditions in still air) from an adequate aerodrome.

M. **ER (or EDTO) Area of Operation** The area in which an air operator is authorized to conduct a flight under EDTO regulations. It is defined by circles centered on the adequate aerodromes, the radius of which is the allowed maximum diversion distance (maximum diversion distance equals approved maximum diversion time multiplied by the approved one-engine-inoperative cruise speed).

N. **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.

O. **ER Exit Point (EXP)** The EXP 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.

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

Q. **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 EDTO operation.

R. **Fail-safe.** 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.

S. **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.).

T. **Power Plant.** A system consisting of an engine and all ancillary components installed on the engine prior to installation on the aeroplane to provide and control power/thrust and for the extraction of energy.

U. **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 aeroplane 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.

V. **Single Engine Cruise Speed** (or One Engine-Inoperative Cruise Speed)

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

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; and

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

3) Based on evaluation of the actual situation, the pilot in command has the authority to deviate from the planned one-engine-inoperative cruise speed.

W. **Unacceptable Thrust-Loss.** Total thrust-loss or loss of thrust to an extent that would preclude continued controlled flight with the affected engine to an adequate aerodrome, should the other engine fail.

1.7 ABBREVIATIONS

- ACARS Airborne Communication And Reporting System
- AFM Aircraft Flight Manual
- APU Auxiliary Power Unit
- ATC Air Traffic Control
- BECMG Becoming (Weather)
- CDL Configuration Deviation List
- CMP Configuration, Maintenance and Procedures Manual
- CP Critical Point
- EEP Extended Range Entry Point
- ER Extended Range

- ETP Equal Time Point
- EXP Extended Range Exit Point
- HAT Height Above Threshold
- HAA Height Above aerodrome
- IFSD In Flight Shut Down
- IPC Illustrated Parts Catalogue
- MCTOW Maximum Certified Take-off Weight
- MEL Minimum Equipment List
- MMEL Master Minimum Equipment List
- PMI Principal Maintenance Inspector
- POI Principal Operations Inspector
- PROB Probability (Weather)
- RAT Ram Air Turbine
- STC Supplemental Type Certificate
- TC Type Certificate
- TEMPO Temporary (Weather)
- PSRA Propulsion System Reliability Assessment

SECTION 2 OPERATIONAL AUTHORIZATION

There is a general process that the GCAA uses to determine the readiness of an air operator for an EDTO operational authorization.

2.1 APPLICANT PREPARATION

A. An air operator planning to qualify for EDTO operations should file a Pre-Application Statement of Intent (PASI) outlining the approvals that will be requested with the formal application.

B. It would be helpful if the air operator would submit a Schedule of Events (SOE) outlining the key milestones that are planned. This provides a basis for discussion of the realities of the schedule.

C. Because of the general nature of the EDTO processing, the air operator's personnel should be coordinating with the assigned inspectors from the GCAA so that there is an awareness of the continuing status of the preparation.

2.2 INITIAL APPLICATION REVIEW

A. Air operators requesting approval for EDTO shall submit their requests, with the required supporting documentation, to the GCAA at least 90 days prior to the proposed start of extended range operations.

B. The data provided with the request shall substantiate the air operator's ability to safely conduct and support these operations and shall include the means used to satisfy the criteria outlined in this circular. The request should include all documentation listed in this advisory circular.

C. The GCAA is expecting that the package will address all requirements listed in this advisory circular. The package must be complete or the GCAA will not continue the processing of the package.

D. In considering an application from an air operator to conduct EDTO operations, an assessment shall be made of the air operator's overall safety record, past performance, flight crew training, maintenance training and maintenance reliability programs.

2.3 DOCUMENT EVALUATION

A. The GCAA will evaluate the application package to verify that all requirements listed in this advisory circular are in compliance with the relevant safety practices for EDTO operations.

B. Those documents determined to be satisfactory will be formally accepted (or approved, if appropriate).

2.4 AIRCRAFT TYPE DESIGN CONFORMITY

A. A Type Certificate acceptance process will be accomplished by the GCAA.

B. An aeroplane type design conformity review will be accomplished to ensure the requirements for EDTO design features and criteria.

2.5 APPLICANT IMPLEMENTATION

A. Applicant will implement all programmes and training of personnel.

B. Applicant will ensure that all systems and facilities are ready for inspection

2.6 INSPECTIONS & DEMONSTRATIONS

A. The GCAA will conduct inspections to ensure that all facilities, systems, programs and records are functional for acquiring qualifying experience.

B. The air operator will demonstrate to the GCAA that its training and systems are functioning as necessary to conduct EDTO operations. The demonstrations will include, but not be limited to:

- EDTO flight crew evaluation in simulator, both a normal operation and an operation requiring a diversion.
- Validation flight(s), with all participating maintenance and operations aspects being evaluated.

2.7 APPLICANT IN-SERVICE EXPERIENCE

A. The air operator will now acquire the operating experience required for the requested diversion time.

B. The GCAA will continue to conduct inspections and validation during this period to ensure that the air operator’s EDTO program is functioning within the targets and criteria to hold the EDTO authorization level requested.

2.8 OPERATIONS SPECIFICATIONS

A. Initially, the air operator will not be qualified for EDTO operations. No revision to the AOC holder’s operations specifications will be made as the qualifying experience process is begun.

B. At each point during the operating experience process, the air operator's operations specifications will be amended as the qualifications are met for a higher EDTO authorization level.

2.9 CONTINUING SURVEILLANCE

A. After the air operator has reached the EDTO authorization level that it desires, the authorization process will completed. Now the air operator is subject to continued inspections and surveillance of its systems, programs, training and records.

B. The fleet average IFSD rate for the specified airframe-engine combination will continue to be monitored in accordance with Appendix A.

C. As with all other operations, the GCAA 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 as provided in Appendix A, and that the operation continues to be conducted safely.

D. 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 EDTO operation, the GCAA 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.

SECTION 3 AIRCRAFT EDTO ELIGIBILITY

3.1 TYPE DESIGN APPROVAL CONSIDERATION

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

1) **Eligibility for EDTO:** The applicant should show that the design features of the particular airframe-engine combination are suitable for the intended operations.

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

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

3.2 TYPE DESIGN ACCEPTANCE

3.2.1 ACCEPTANCE TYPE CERTIFICATE

A. Due to the small size and structure of the aviation environment in Ghana, the GCAA does not issue Type Certificates for aircraft or aeronautical products.

B. Applicants intending to import a first of type aircraft or aeronautical product to Ghana shall apply to the GCAA for the issuance of an Acceptance Type Certificate, in a form and manner as prescribed by the GCAA.

C. Each applicant for EDTO approval shall apply for an Acceptance Type Certificate for the particular airframe-engine combination based on the original Type Design Certification as required by the GCAA.

3.2.2 REQUIRED FOR EACH INDIVIDUAL AIRCRAFT

A. The fact that an Acceptance Type Certificate for the particular airframe-engine combination may have been previously issued by the GCAA shall not to be interpreted as an automatic approval to conduct extended range operations.

B. 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.

3.2.3 CRITERIA FOR ACCEPTANCE TYPE 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:

- A statement of evaluation (see Note)
- Special limitations (if necessary), including any limitations associated with a maximum diversion time.
- Markings or placards (if required);
- Revision to the performance section;
- The airborne equipment, installation, and flight crew procedures required for extended range operations;
- Description or reference to a document containing the approved aeroplane configuration CMP standard;

Sample Text: "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 aeroplane configuration CMP standard. This finding does not constitute approval to conduct extended range operations."

3.3 IN-SERVICE EXPERIENCE

3.3.1 WORLD-WIDE EXPERIENCE WITH TYPE DESIGN

A. In establishing the suitability of a type design and as a prerequisite to obtaining any operational approval, 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.

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

B. Although the GCAA 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 GCAA through the issuance of an Acceptance Type Certificate based on the original Type Certificate and corresponding Data Sheet.

3.3.2 AIR OPERATOR MAINTENANCE & OPERATIONS EXPERIENCE

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

1) Prior to the type design acceptance approval, 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.

2) Each operator requesting approval to conduct extended range operations should have operational in-service experience appropriate to the operation proposed.

3.3.3 CONSIDERATION OF AIR OPERATOR OPERATING EXPERIENCE

3.3.3.1 General Guidelines

A. These guidelines in this section may be reduced or increased following review and concurrence on a case-by-case basis by the GCAA.

B. 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.

C. 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 an abnormally low number of takeoffs has occurred.

D. The GCAA may require an increase in prerequisite in-service experience in cases where an abnormally low number of flights and/or ER segments have occurred.

E. Where an air operator ceases EDTO operations for a period exceeding 13 months, application for reinstatement must be submitted.

3.3.3.2 Acceptable Performance Required

A. All in-service experience requirements assume acceptable performance. Air operator EDTO program difficulties may require additional in-service experience and/or removal of the eligibility.

B. The initial in-service experience may be reduced in situations where an air operator can successfully demonstrate its ability and competence to achieve the necessary reliability required for EDTO operations (see Appendix C).

3.3.3.3 75-Minute Approval

A. 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.

B. 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.

3.3.3.4 90-Minute Approval

Six months of operating experience will normally be required.

3.3.3.5 120-Minute Approval

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.

3.3.3.6 138-Minute Approval

Three (3) months of 120 minute EDTO operating experience. EDTO type design approval configuration may be to the 120 minute criteria, but any specific limitations may not be exceeded.

3.3.3.7 180-Minute Approval

Twelve (12) consecutive months of operational in-service experience with the specified airframe-engine combination in conducting 120-minute extended range operations.

3.4 ACCELERATED PROGRAM

A. The accelerated EDTO Approval concept is based on a structured program of compensating factors and a step-by-step approach as outlined in Appendix C of this document. This is the same philosophy as the technical transfer analysis used to accelerate the aircraft EDTO Type Design Approval. The content of the appendix is applicable only in consideration of granting an Operational Approval for an air operator intending to operate an airframe/engine combination which has been awarded Type Design Approval including EDTO.

B. The Accelerated EDTO Operational Approval allows for a reduction of in-service experience, based on the degree of compliance with the existing air operator's EDTO program, which can be validated with supporting documentation. EDTO Maintenance & Reliability Requirements

SECTION 4 MAINTENANCE & RELIABILITY REQUIREMENTS

4.1 GENERAL

A. Maintenance personnel and other personnel involved should be made aware of the special nature of EDTO and have the knowledge, skills and ability to accomplish the requirements of the program.

B. Configuration Maintenance Program must be in place before the formal submission of the application.

4.2 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.

4.3 MAINTENANCE PROGRAM

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

B. This program must be reviewed by the PMI to ensure that it provides an adequate basis for development of a supplemental EDTO maintenance program as defined in the CMP document for the airframe/ engine combination.

EDTO maintenance requirements will be expressed in, and approved as, supplemental requirements.

C. This review must include maintenance procedures to preclude identical action being applied to multiple similar elements in any EDTO significant system (for example, fuel control change on both engines).

1) EDTO related tasks must be identified on the operator's routine work forms and related instructions.

2) EDTO related procedures, such as involvement of centralized maintenance control, must be clearly defined in the operators program.

3) An EDTO service check must be developed to verify that the status of the aeroplane and certain critical items are acceptable.

NOTE: The service check may not be required for the return leg of a 75-minute EDTO flight in a benign area of operation.

- This check must be accomplished and signed off by an EDTO qualified maintenance person immediately prior to an EDTO flight.
- Such a person may be a member of the flight crew.

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

4.4 EDTO MANUAL

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

B. All EDTO requirements, including supportive programs, procedures, duties, and responsibilities, must be identified and subject to revision control.

C. This manual should be submitted to the PMI at least 90 days before scheduled commencement of EDTO flights of the particular aircraft (airframe/engine combination).

4.5 OIL CONSUMPTION PROGRAM

A. 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 EDTO stations with reference to the running average consumption; that is, the monitoring must be continuous up to, and including, oil added at the EDTO departure station.

B. If oil analysis is meaningful to this make and model, it should be included in the program.

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

4.6 ENGINE CONDITION MONITORING

A. This program will describe the parameters to be monitored, method of data collection and corrective action process. The program should reflect manufacturer's instructions and industry practice.

B. This monitoring will be used to detect deterioration at an early stage to allow for corrective action before safe operation is affected.

C. The program must ensure that engine limit margins are maintained so that a prolonged single engine diversion may be conducted without exceeding approved engine limits (that is, rotor speeds, exhaust gas temperatures) at all approved power levels and expected environmental conditions.

D. Engine margins preserved through this program must also 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.

4.7 VERIFICATION PROGRAM AFTER MAINTENANCE

A. The operator will develop a verification program that includes procedures to ensure the appropriate corrective action following an engine shutdown, primary system failure, adverse trend(s) or any prescribed event(s) which require verification flight or other action. This program must also establish means to ensure the accomplishment of the appropriate flight or action.

B. A clear description of who must initiate verification actions and the section or group responsible for the determination of what action is necessary must be identified in the program.

C. Primary systems, like APU, or conditions requiring verification actions must be described in the air operator's EDTO manual.

4.8 RELIABILITY PROGRAM

A. An EDTO reliability program will be developed or the existing reliability program supplemented, as applicable. This program should be designed with early identification and prevention of EDTO related problems as the primary goal as well as ensuring that the minimum EDTO reliability levels are maintained.

B. The program should be event-orientated and incorporate reporting procedures for significant events detrimental to EDTO flights.

C. This information should be readily available for use by the air operator and GCAA to help establish that the reliability level is adequate, and to assess the operator's competence and capability to safely continue EDTO operations.

D. The GCAA should be notified within 72 hours of events reportable through this program.

4.8.1 POSSIBLE ROLLBACK OF MAXIMUM DIVERSION TIME

A. The air operator must also ensure that procedures are established and implemented that will roll back the approved EDTO diversion time should the engine in flight shutdown rate exceed the limits specified in Appendix A of this document.

B. The air operator's "person responsible for the maintenance control system" (PRM) must have the authority to initiate roll back of the approved EDTO diversion time.

C. Where reliability data indicate that the "target criteria" per Appendix A of this document is no longer being met, the air operator must notify their PMI of the corrective measures taken.

D. Where the "minimum criteria" are no longer being met, the air operator must roll back the EDTO diversion time to that specified in Appendix A for the particular IFSD rate noted.

E. Failure of an air operator to roll back the maximum diversion time when required will constitute grounds for removal of EDTO authority.

4.8.2 ADDITIONAL REPORTING REQUIREMENTS

In addition to the maintenance events routinely required by regulation to be reported to the GCAA, 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 EDTO (engine bleed air, pressurization, electrical power, etc.);

6) Any other event detrimental to EDTO.

4.8.3 REPORT CONTENTS

The report will also identify the following:

1) Aircraft identification (type and registration number);
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; and
6) Corrective action.

4.8.4 ASSESSMENT OF THE OPERATOR'S PROPULSION SYSTEM RELIABILITY.

A. 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.

B. 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

C. The operator's past record of propulsion system reliability with related types of power units should also be reviewed.

4.9 CONTRACTED MAINTENANCE & RELIABILITY

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

4.10 PROPULSION SYSTEM MONITORING

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

B. The assessment should include, on a 12-month moving average basis:

1) Engine hours flown in the period;
2) In-flight shutdown rate for all causes; and
3) Engine removal rate.

C. 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 4.7 of this Chapter must still be observed for the EDTO fleet.

D. Any adverse sustained trend would require an immediate evaluation to be accomplished by the operator in consultation with the GCAA.

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.

E. An immediate evaluation must be accomplished by the air operator and the GCAA 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.

- This evaluation may involve coordination with the Type Certificate holder and issuing Authority.
- The evaluation may result in corrective action or operational restrictions being applied.

4.11 MAINTENANCE TRAINING

A. The maintenance training program will focus on the special nature of EDTO. This program should be included in the normal maintenance training program.

B. The goal of this program is to ensure that all personnel involved in EDTO are provided the necessary training so that the EDTO programs are properly accomplished and to emphasize the special nature of EDTO maintenance requirements.

C. “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 air operator’s approved procedures for Personnel Authorization.

4.12 EDTO PARTS CONTROL

A. The operator will develop a parts control program with support from the manufacturer, that ensures the proper parts and configuration are maintained for EDTO.

B. The program includes verification that parts placed on EDTO aircraft during parts borrowing or pooling arrangements, as well as those parts used after repair or overhaul, maintain the necessary EDTO configuration for that aeroplane.

4.13 ENGINEERING MODIFICATIONS

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

B. 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.

C. 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.

D. The EDTO operational approval of each EDTO operator will require it to keep its EDTO fleets in conformity with the current CMP standards, taking into account implementation delays

SECTION 5 EDTO FLIGHT OPERATIONS CONSIDERATIONS

5.1 GENERAL

A. The flight release considerations specified in this section are in addition to, or amplify, the requirements contained in applicable directives and specifically apply to extended range operations.

B. Although many of the considerations in this AC are currently incorporated into approved programs for other aeroplanes or route structures, the unique nature of EDTO necessitates

that compliance with the more restrictive requirements be re-examined to ensure that the approved programs are adequate for this purpose.

5.1.1 MINIMUM EQUIPMENT LIST (MEL)

A. System redundancy levels appropriate to the intended Extended Range Operations are to be reflected in the MEL.

1) For EDTO operations, the air operator's MEL shall be based on the information contained within the aircraft MMEL, the CMP document, and/or the TC Supplement as applicable.

2) An air operator's MEL will be more restrictive than the MMEL considering the kind of Extended Range operation proposed and equipment and service problems unique to the air operator.

The EDTO MEL criteria need not be applied for EDTO operational approval in Benign Area of Operation (75 minutes).

3) For aeroplanes already in operational service, the existing MEL shall be re-evaluated and adjusted to reflect system redundancy level requirements for EDTO.

B. Systems considered to have a fundamental influence on flight safety may include, but are not limited to the following:

Automated aeroplane system status monitoring should be provided to enhance the flight crew's ability to make timely diversion decisions.

- Electrical, including battery;
- Hydraulic;
- Pneumatic;
- Flight instrumentation;
- Fuel;
- Flight control;
- Ice protection;
- Engine start and ignition;
- Propulsion system instruments;
- Navigation and communications;
- Auxiliary power units;
- Air conditioning and pressurization;
- Cargo fire suppression;
- Engine fire protection;
- Emergency equipment; and
- Any other equipment necessary for extended range operations.

5.2 EDTO-SENSITIVE FAILURE ACTIONS

A. The air operator shall develop a list of items that are considered EDTO-sensitive during flight.

B. This list shall:

1) Be published in an appropriate document (e.g. Quick Reference Handbook) readily accessible to the flight crew;

2) Contain applicable CMP standards, limitations and procedures in addition to information stating requirements prior to entering the EDTO segment of the flight; and

3) Contain direction to the flight crew for their action if any of the specified items fail during any phase of flight.

C. This document shall give specific direction for action required for both EDTO and non-EDTO phases of flight, and shall include, but is not limited to:

- The identified items and relevant procedures shall be acceptable to the GCAA.
- A statement will be included to ensure that the Pilot in Command has the final authority in all phases of flight.

- electrics;
- hydraulics;
- pneumatics;
- auto pilot;
- fuel;
- ice protection;
- navigation and communications;
- auxiliary power unit;
- air conditioning and pressurization;
- fire protection; and
- enroute alternate weather limits.

5.3 COMMUNICATION & NAVIGATION FACILITIES

An aeroplane should not be released on an EDTO operation unless:

1) 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;

Operators should consider VHF/Satellite data link enhancements to their operational control system as soon as they become feasible.

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

It shall be shown that current weather information, adequate status monitoring information and crew procedures for all aircraft and ground facilities' critical systems are available to enable the flight crews to make go/no go and diversion decisions.

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

5.4 DISPATCH WEATHER ACQUISITION & DISTRIBUTION

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

B. Such factors as staffing, dispatcher training, sources of weather reports and forecasts, and when possible, a record of forecast reliability should be evaluated.

5.5 OPERATIONAL CONTROL PRACTICES & PROCEDURES

A. During the course of the flight, the flight crew should be informed of any significant changes in conditions at designated enroute alternates.

B. Prior to a 180-minute EDTO flight proceeding beyond the extended range entry point, the forecast weather for the time periods, landing distances, and aerodrome services and facilities (e.g.: NOTAMs) at designated enroute alternates should be evaluated.

C. 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.

D. 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).

5.6 FUEL & OIL SUPPLY

5.6.1 GENERAL

A. An aeroplane shall not be dispatched on an EDTO flight unless it carries sufficient fuel and oil to meet the regulatory requirements for all flights, including additional contingency fuel reserves that may be determined in accordance with paragraph 5.6.2 of this AC.

B. Prior to dispatching an aircraft on an EDTO flight, the air operator shall determine, for the planned route, both a standard and EDTO fuel requirement. The fuel quantity required for dispatch is the greater of the two resulting fuel requirements.

EDTO fuel planning must consider the expected meteorological conditions along the planned route.

C. In computing fuel and oil requirements, at least the following shall be considered:

1) Current forecast winds and meteorological conditions along the expected flight path at one engine inoperative cruising altitude and throughout the approach and landing;

2) any requirement for operation of ice protection systems and performance loss due to ice accretion on the unprotected surfaces of the aeroplane;

3) any required operation of auxiliary power unit (APU);

Icing encounters shall be conservatively factored to account for the likelihood of an encounter, threat severity, encounter duration and anticipated flight crew action.

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

5) an approach followed by a missed approach and a subsequent approach and landing;

6) navigational accuracy required; and

APU oil consumption and servicing shall be considered in accordance with CMP document requirements.

7) any known Air Traffic Control (ATC) constraints.

5.6.2 CRITICAL FUEL RESERVES

A. 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 paragraph 5.6.3 of this AC (Critical Fuel Scenario).

B. These critical fuel reserves should be compared to the fuel that will be on board at the most critical point based on a departure with the normal fuel required by regulations for the proposed trip.

C. If it is determined by this comparison that the fuel that would be on board at the most critical point is less than the critical fuel reserves, then additional fuel shall be loaded to ensure that the fuel on board at the most critical point is equal to or greater than the critical fuel reserves.

D. In consideration of the items listed in paragraph 5.6.1 of this AC, the critical fuel scenario should allow for:

1) A contingency figure of 5 percent added to the calculated fuel burn from the critical point to a suitable alternate, to allow for errors in wind forecasts and fuel mileage;

2) Any Configuration Deviation List and/or Minimum Equipment List items;

3) Both airframe and engine anti-icing;

4) Ice accumulation on unprotected surfaces if icing conditions are likely to be encountered during the diversion; and

5) Any required operation of an auxiliary power unit and/or Ram Air Turbine (RAT).

5.6.3 CRITICAL FUEL SCENARIO

A. Calculation of the critical fuel reserve requires the air operator to determine the failure scenario that is the most operationally critical, considering time and aircraft configuration. Any failure or combination of failures not shown to be extremely improbable must be considered.

- Simultaneous failure of an engine and the pressurization system will usually be the most restrictive.
- This will involve an immediate descent and continued cruise at 10,000 MSL at the approved one engine inoperative cruise speed.

B. The critical fuel reserve is the fuel required, taking into account the items listed in paragraph 5.6.2 of this AC necessary:

1) To proceed from the most critical point to a suitable alternate following the occurrence of the most operationally critical event(s); plus,

2) upon reaching the suitable alternate, to descend to 1,500 feet above the aerodrome, hold for 15 minutes, initiate an approach followed by a missed approach and then execute an approach and landing.

C. For example, if the critical scenario was determined to be the simultaneous failure of one propulsion system and the pressurization system, then the critical fuel reserves would be the fuel required to:

1) At the most critical point, immediate descent to and continued cruise at 10,000 feet at the approved one-engine-inoperative cruise speed (fuel consumption may be based on continued cruise above 10,000 feet if the aircraft has sufficient supplemental oxygen in accordance with applicable directives); and,

2) upon reaching the suitable alternate, to descend to 1,500 feet above destination, hold for 15 minutes, initiate an approach followed by a missed approach and then execute an approach and landing.

5.7 ALTERNATE AERODROMES

A. A list of enroute alternates and the enroute alternate weather limits will be published in the air operator's Operations Manual.

B. An aeroplane shall not be released on an extended range operation unless the required take-off, destination and alternate aerodromes, including enroute alternate aerodromes to be used in the event of a system failure which requires a diversion, are listed in the operational flight plan, (e.g. on board copy of computer flight plan).

C. Suitable enroute alternates are also required to be identified, listed and provided to the crew with the most up to date information (e.g. aerodrome data, facilities, weather, etc.) as part of the dispatch release for all cases where the planned route of flight contains a point more than 60 minutes flying time at the approved one-engine-inoperative cruise speed from an adequate aerodrome.

D. Since these enroute alternates serve a different purpose than the destination aerodrome and would normally be used only in the event of an engine failure or the loss of a primary airframe system, an aerodrome may not be listed as a suitable e route alternate unless:

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

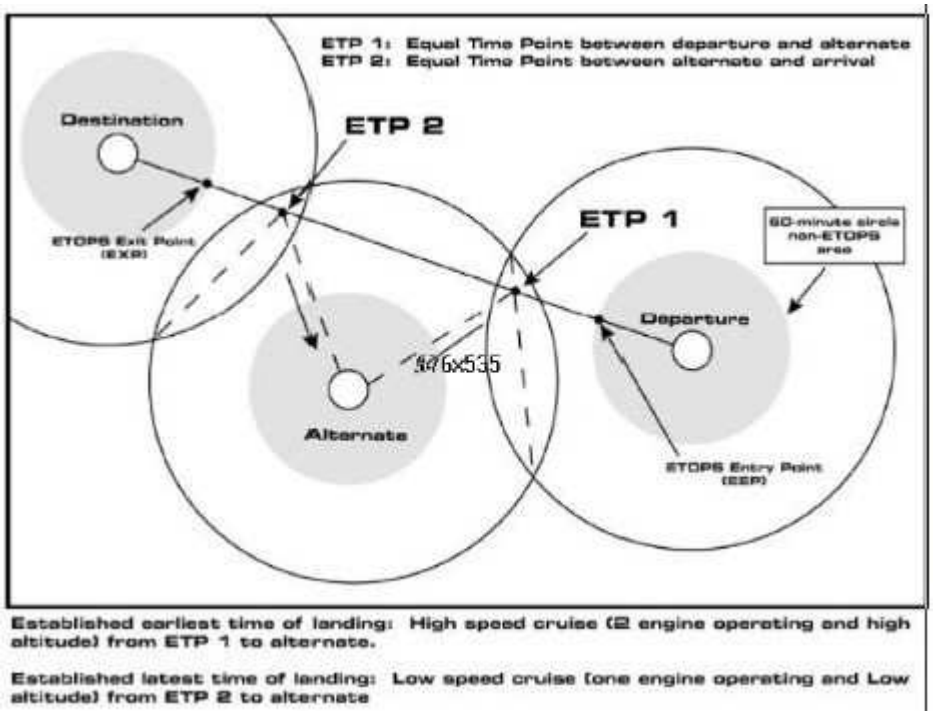
2) The aerodrome services and facilities are available and adequate for the air operator's approved approach procedure(s) and operating minima for the runway expected to be used;

3) The latest available forecast weather conditions for a period commencing one hour before the established earliest time of landing and ending one hour after the established latest time of landing at that aerodrome, are equal to or exceed the authorized weather minima for enroute alternate aerodromes in Appendix B;

4) For the same period, the forecast cross wind component for the intended landing runway, including gusts, is less than the maximum permitted cross wind for a single engine landing. Where no single engine demonstrated cross wind value exists, 80% of the all engine demonstrated value will be used; and,

5) During the course of the flight, the flight crews remain informed of any significant changes at enroute alternates. Prior to proceeding beyond the ER Entry Point, the

forecast weather for the time periods, aeroplane status, fuel remaining, runway surface conditions, landing distances, aerodrome services and facilities shall be evaluated.



6) If any conditions are identified which would preclude safe approach and landing, then the pilot shall be notified and an acceptable alternate(s) selected where safe approach and landing can be made.

E. Once the flight has entered the extended range segment, if the forecast for the enroute alternate is revised to below the landing limits, the flight may continue at the Captain's discretion.

F. In addition, the air operator's program should provide flight crews with information on adequate aerodromes appropriate to the route to be flown which are not forecast to meet Appendix B enroute 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.

The alternate aerodromes should be chosen in order to make it possible for the aeroplane to reach the alternate, especially with regard to performance (flight over obstacles) and/or oxygen requirements.

5.8 AEROPLANE PERFORMANCE DATA

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

B. The following data shall be based on information provided or referenced in the AFM:

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

(a) Drift down (includes net performance);

(b) Cruise altitude coverage including 10,000 feet;

(c) Holding;

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

(e) Missed approach.

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

(a) Cruise (altitude coverage including 10,000 feet); and

(b) Holding.

3) 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 aeroplanes, RAT, thrust reverser deployment, etc.; and

4) The altitudes, airspeeds, thrust settings, and fuel flow used in establishing the ER area of operations for each airframe/engine combination must be used in showing the corresponding terrain and obstruction clearances in accordance with applicable directives.

5.9 OPERATIONS MANUAL

An air operator's Company Operations Manual or training manuals shall outline the training and standard operating procedures applicable to EDTO operations in addition to, but not limited to, the following:

1) Minimum altitudes to be flown along planned and diversionary routes as applicable;

2) Aerodromes authorized for use, including alternates and associated instrument approaches and operating minima; and

3) The information used in determining the critical fuel scenario.

5.10 FLIGHT CREW TRAINING & EVALUATION PROGRAM

5.10.1 GENERAL TRAINING

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

1) Introduction to EDTO regulations;

2) Routes and aerodromes intended to be used in EDTO area of operations;

3) Performance.

- Driftdown (includes net performance);
- Cruise altitude coverage including 10,000 feet;
- Holding;
- Altitude capability (includes net performance);
- Missed approach.
- Cruise (altitude coverage including 10,000 feet); and
- Holding.

4) Flight planning, including all contingencies.

5) Flight performance progress monitoring.

6) Procedures.

(a) 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.

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

5.10.2 INITIAL & RECURRENT PROCEDURES TRAINING

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:

1) 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.

2) Operational restrictions associated with these failures including any applicable MEL considerations.

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

4) Crew incapacitation.

5) Use of emergency equipment including protective breathing and ditching equipment.

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

7) Procedures to be followed in the event that there is a change in conditions at designated enroute alternates which would preclude safe approach and landing.

8) Understanding and effective use of approved additional or modified equipment required for EDTO.

9) Fuel requirements and management. Flight crews shall be trained on the fuel management procedures to be followed during the enroute portion of the flight. These procedures should provide for an independent cross-check of fuel quantity indicators. For example, fuel flows could be used to calculate fuel burned and compared to indicated fuel remaining.

10) Dispatch considerations (MEL, CDL, weather minima, and flight crew performed maintenance service checks; and

11) Flight crew documentation.

5.10.3 EDTO CHECK PILOT PROGRAM

A. The air operator shall provide sufficient qualified EDTO check pilots. The objective of the EDTO check pilot program will be to ensure standardized flight crew practices and procedures. They must emphasize the special nature of EDTO operations.

B. Only pilots with a demonstrated understanding of the unique and critical requirements of EDTO will be designated as instructors and/or check pilots for EDTO operations.

5.11 OPERATIONAL LIMITATIONS

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, 138 or 180 minutes at the approved one engine cruise speed (under standard conditions in still air).

5.11.1 AREAS OF OPERATION

A. Following satisfactory compliance with these criteria, an air operator may be authorized to conduct EDTO with a particular airframe-engine combination within a particular area of operation.

B. The area of operation will be limited by the maximum approved diversion time to an adequate aerodrome at the approved one-engine-inoperative cruise speed (under standard conditions in still air) from any point along the proposed route of flight.

C. The area of operation approved shall be specified in an Operations Specification.

5.11.2 FLIGHT RELEASE LIMITATION

A. Flight release limitation shall specify the maximum diversion time from a suitable aerodrome for which an air operator can conduct a particular EDTO operation.

B. The maximum diversion time at the approved one-engine-inoperative cruise speed shall not be any greater than the value specified in the Operations Specification.

5.12 USE OF STANDARD MAXIMUM DIVERSION TIME

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

B. Air operators shall ensure that:

1) Company procedures require that upon occurrence of an in-flight shutdown of an engine, the pilot shall, subject to the PIC's authority, promptly initiate a diversion and fly to and land at the nearest aerodrome, in point of time determined to be acceptable by the flight crew; and,

2) A procedure shall be established such that in the event of a single or multiple critical system failure, the pilot shall, subject to the PIC's authority, promptly initiate a diversion procedure and fly to and land at the nearest aerodrome, in point of time determined to be acceptable by the flight crew, unless it can be established that no substantial degradation of safety results from continuation of the planned flight.

C. For aeroplanes for which EDTO approval is required, the flight path, range performance and fuel flow shall be determined at each weight, altitude and temperature within the operating limits established for the aeroplane.

D. The flight path and range performance shall be determined for each selected configuration with:

1) The most unfavorable center of gravity;

2) The critical engine inoperative;

3) The remaining engine at the available maximum continuous power or thrust;

4) The means for controlling the engine supplied air-conditioned air to ensure a reasonable cabin temperature; and

5) Consideration of the effects of icing on single engine performance.

5.12.1 PILOT-IN-COMMAND AUTHORITY

Contingency procedures or plans should not be interpreted in any way which prejudice the final authority and responsibility of the Pilot-In-Command for safe operation of the aeroplane

5.13 OPERATIONAL VALIDATION FLIGHT

A. The operator should demonstrate, by means of an GCAA 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.

B. The GCAA, 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.

C. The following emergency conditions should be demonstrated during the validation flight unless successful demonstration of these conditions has been witnessed by the GCAA 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.

D. 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.

E. 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.

5.14 OPERATIONS SPECIFICATIONS

A. Approval to conduct EDTO is made by the issuance of operations specifications containing appropriate limitations.

B. 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).

C. Operations specifications for extended range operations should specifically include provisions covering at least the following:

1) The Ops Specs should define the particular airframe-engine combinations, including the current approved CMP standard required for extended range operation as normally identified in the AFM.

2) Authorized area of operation.

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

4) 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.

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

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

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

8) Aeroplane Performance Reference.

9) Criteria for Maximum Diversion Times.

D. 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.

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APPENDIX A
Propulsion System Reliability Program

1. General

2. Type Design Approval

A. To establish if a particular airframe-engine combination has satisfied the propulsion system reliability criteria for EDTO, a thorough assessment shall be conducted by specialists of the responsible airworthiness authority for airframe-propulsion system design utilizing all the pertinent engine and airframe-propulsion system data and information available (includes the APU, if required).

B. The GCAA will review these findings as part of the aircraft type design approval activity.

3. Operational Approval

The intent of the operational approval is to establish if an air operator has demonstrated the capability of ensuring propulsion system reliability targets have been met and will continue to be met.

CONCEPTS AND CRITERIA

A. No single parameter by itself, without other data/information, can adequately qualify reliability. There are a number of variables, maintenance and operating statistics and general information about the operational experience of a particular power unit, which characterize propulsion system reliability.

B. Engineering judgment must then be utilized to determine the adequacy and applicability of this data and information to EDTO and to determine the suitability of the aeroplane for EDTO.

C. As an aid in making this judgment, statistical analysis will be used to help determine that the desired level of reliability is obtained.

D. The evidence must be such that it can be shown with high confidence that the risk of total thrust loss or loss to an extent that precludes continued safe flight, is acceptably low, i.e., at an appropriate level less than between 10-8 and 10-9 per hour during the relevant portion of the cruise.

ASSESSMENT

To assess adequately the propulsion system reliability for EDTO type design and operational approval, certain world fleet data and information are required. The GCAA will maximize the use of existing sources and kinds of data generally available but additional data may be required in certain cases.

4. Data Requirements

TYPE DESIGN APPROVAL

A. World fleet data and information are necessary to adequately assess propulsion system reliability for EDTO. This data shall include:

1) A list of all engine shutdown events both ground and in-flight for all causes (excluding normal training events) including flameout. The list shall provide the following for each event:
   (a) data,
   (b) airline,
   (c) aeroplane and engine identification (model and serial number),
   (d) power unit configuration and modification history,
   (e) engine position,
   (f) symptoms leading up to the event,
   (g) phase of flight or ground operation,
   (h) weather/environmental conditions and
   (i) reason for shutdown.
2) A list of all occurrences where achieved thrust was below the intended level, for whatever reason: The list shall provide the above detailed information.
3) Data concerning total engine hours and aeroplane cycles (if known, include engine hour distribution, e.g., percent of world fleet of engines at 1,000 hours, 2,000 hours, etc.).
4) Data listing mean time between failure of the propulsion system and associated components that affect reliability (unscheduled removals).
5) The amount and frequency of using reduced/de-rated thrust (if detailed data is not available, a representative sampling may be sufficient); and
6) Additional data as specified by the specialist group.

OPERATIONAL APPROVAL

Data requirements for EDTO Type Design Approval is limited to air operator fleet experience and any experience claimed as compensatory experience.

5. Experience

TYPE DESIGN

A. In support of applications for EDTO type approval, data shall be provided from various sources to ensure completeness, i.e., engine manufacturer, air operator and aeroplane manufacturer.

B. To provide a reasonable indication of reliability trends and significant problem areas, an accumulation of at least 150,000 engine hours is normally required in the world fleet before the assessment process can produce meaningful results. This number of hours may be reduced if

adequate compensating factors are established which give a reasonable equivalent data base.

C. Once an assessment has been completed and the specialist groups have documented their findings, the GCAA will declare whether or not the current propulsion system reliability of a particular airframe-engine combination satisfies the relevant criteria of this document.

D. The GCAA will specify items required to qualify the propulsion system suitable for EDTO, such as the recommended propulsion system type design configuration, operating conditions, maintenance requirements and limitations.

AIR OPERATOR

A. Operational experience is required to ensure the air operator can and will continue to maintain and operate the particular aircraft-engine combination at an acceptable level of reliability.

B. The assessment of an air operator's suitability to be granted an EDTO approval is routinely made after a minimum amount of operating experience.

C. Operational experience requirements may be reduced if adequate compensatory experience factors exist.

ENGINEERING ASSESSMENT

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

1) The type of power unit, previous experience, whether the power unit is new or a derivative of an existing model and the engine operating rating limit to be used with one-engine shutdown;

2) The trends in cumulative and six and twelve months rolling average, updated quarterly, of in-flight shutdown rates versus propulsion system flight hours and cycles;

3) The effect of corrective modifications, maintenance, etc., on future reliability of the propulsion system;

4) Maintenance actions recommended and performed and its effect on engine and APU failure rates;

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

6) Intended maximum flight duration, maximum diversion and mean diversion time used in EDTO.

TYPE DESIGN

A. An assessment of the corrective actions planned or taken for each problem identified with the objective of verifying that the action is sufficient to correct the deficiency.

B. When each identified significant deficiency has a corresponding corrective action acceptable to the GCAA and when all corrective actions are satisfactorily incorporated and verified, The GCAA determines that an acceptable level of reliability can be achieved. Statistical corroboration will also be utilized.

C. Any certification inspections and tests that may be necessary to approve these corrective actions will be the responsibility of the appropriate Design Approval Authority. The required

corrective action and modifications will be included in the type design standard necessary for final type approval of the aeroplane for EDTO.

OPERATIONS

A. The GCAA recognizes that a number of potential countable events (e.g. IFSDs, flameouts, uncommanded thrust reductions, etc.) are not EDTO relevant or action has been taken to preclude further occurrences.

B. An air operator may request, through the PMI to that such an event be discounted so that the propulsion system reliability objective is not affected.

C. Any configuration, maintenance or procedural change to satisfy the event discounting must become part of the air operators EDTO CMP criteria. (Credit for optional equipment, e.g. ACARS, must be reviewed against MEL criteria).

6. Propulsion System Reliability Objective

TYPE DESIGN

A determination will be made that the type design of the propulsion system achieves the desired level of reliability. PMI will determine if the probability of total/unacceptable thrust loss due to design related and/or independent causes meet the criteria of this section.

OPERATIONS

A. A determination will be made of the propulsion system's ability to achieve the desired level of operational reliability in EDTO. PMI will determine if the probability of total/unacceptable thrust loss for all independent causes meets the criteria of this section.

B. The propulsion system reliability objective will ensure that the propulsion system achieves at least the minimum reliability criteria required of other critical aircraft systems, i.e., navigation, flight control, communications, etc.

C. Considering the complexity of the entire powerplant system, the approach to determine the reliability has been to use in-service data. This data therefore, not only considers design related failures, but also includes maintenance and operational effects on the failure rates.

D. The events to be considered are to include those occurring from the beginning of the take-off roll to the end of the landing phase, though items confirmed as not EDTO significant will be discounted. Failures considered are, engine in-flight shutdowns (IFSD), any other significant

power loss or loss of engine control. The reliability objective used by the GCAA relates diversion time to the probability of a loss of thrust which precludes continued safe flight.

FIGURE 1 - PROPULSION SYSTEM RELIABILITY OBJECTIVE (GRAPH)

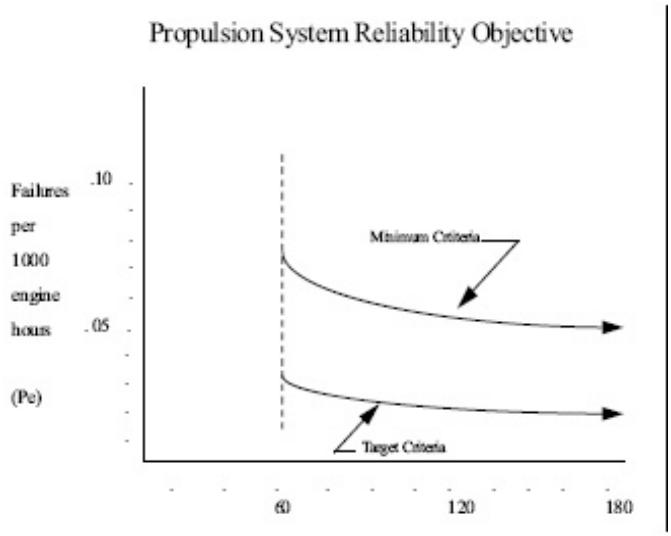

FIGURE 2 - PROPULSION SYSTEM RELIABILITY OBJECTIVE (TABBED)

Diversion Time (minutes)(t)		
Reliability Table (Engine Failures per 1000 hours)		
Diversion Time	Target Criteria	Minimum Criteria
60 minutes	.032	.063
75 minutes	.028	.056
90 minutes	.026	.052
120 minutes	.022	.044
138 minutes	.021	.042
180 minutes	.018	.036

End of Appendix A

APPENDIX B
Suitable Aerodromes

1. General

A. One of the distinguishing features of two engine extended range operations is the concept of a suitable enroute 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 enroute 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 aerodrome

A. As with all other operations, an operator desiring any route approval is required to show that it is able to satisfactorily conduct operations between each required aerodrome over that route or route segment.

B. Air operators are required to show that the facilities and services specified are available and adequate for the proposed operation.

C. For the purposes of this advisory circular, in addition to meeting this criteria, those aerodromes which meet GCAA standards or ICAO Annex 14 and are determined to be usable by the particular aeroplane, will be accepted as adequate aerodromes.

3. Suitable Aerodrome

A. 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.

B. At the time of the particular operations, it should have weather and field conditions 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 enroute alternate becomes necessary.

C. The enroute alternate weather minima for dispatch purposes are generally higher than the weather minima necessary to initiate an instrument approach to factor for the natural variability of weather conditions with time as well as the need to determine the suitability of a particular enroute aerodrome prior to departure, This requirement is necessary to assure that the instrument approach can be conducted safely if the flight has to divert to the alternate aerodrome.

D. 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

A. The alternate aerodrome weather planning minimum requirements contained in this section are established for flight planning and release purposes in EDTO.

B. These weather minima recognize the benefits of precision approaches, as well as the increased assurance of safely completing an instrument approach at aerodromes which are equipped with precision approaches to at least two separate runways, (two separate landing surfaces).

C. 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 this Appendix and has one of the combinations of instrument approaches capabilities and enroute alternate aerodrome weather minima at the time of the particular operation.

TABLE 1 - PLANNING MINIMA – EDTO

Note: The forecast weather criteria used in the selection of alternate aerodromes for IFR flight will also be used for the selection of EDTO 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 (ILS, MLS)	Precision Approach Cat I Minima	Non-Precision Approach Minima		
Precision Approach Cat I (ILS, MLS)	Non-Precision Approach Minima	Circling minima or, if not available, non-precision approach minima plus 200 ft / 1 000 m		
Non-Precision Approach	The lower of non-precision approach minima plus 200 ft / 1 000 m or circling minima	The higher of circling minima or non-precision approach minima plus 200 ft / 1 000 m		
Circling Approach	Circling minima			

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. Use of Weather Forecasts

Weather forecasts that contain the term BECMG, TEMPO or PROB may be used to determine the weather suitability of an aerodrome as an alternate provided that:

1) Where the conditions are forecast to improve, the forecast BECMG condition shall be considered to be applicable as of the end of the BECMG time period, and these conditions shall not be below the published alternate minima requirements for that aerodrome; and,
2) Where the conditions are forecast to deteriorate, the forecast BECMG condition shall be considered to be applicable as of the start of the BECMG time period, and these conditions shall not be below the published alternate minima requirements for that aerodrome; and,
3) The forecast TEMPO condition shall not be below the published alternate minima requirements for that aerodrome; and,
4) The forecast PROB condition shall not be below the appropriate landing minima for that aerodrome. Where a condition is forecast as "PROB", provided the probability per cent factor is less than 40 per cent, it is not limiting. However the Pilot-In-Command will exercise good aviation judgment in assessing the overall "PROB" conditions.

6. Lower Than Standard Enroute Alternate Aerodrome Weather Minima

A. Lower than standard enroute alternate aerodrome weather minima for Category II or III instrument approaches may be considered for approval for certain operators on a case-by-case basis by the GCAA. To receive this consideration, the:
   1) The air operator must be specifically approved for these operations in the particular aeroplane type;
   2) The aircraft must be dispatched with operational readiness for these operations;
   3) The flight crews must be current and qualified for such operations;
   4) The aerodromes shall have the certificated capability for Category II and/or Category III approach and landing operations; and
   5) 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.

B. The certificated capability of the aeroplane should be evaluated considering the approved maximum diversion time. Lower than standard enroute 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.

7. Enroute Alternate Suitability Decision In-Flight

After encountering a situation in-flight which necessitates at diversion, the pilot-in-command must make a suitability decision regarding the alternate aerodrome. That decision, while enroute on an extended range operation, is based on a determination that the aerodrome is still suitable for the circumstances and that the weather and field conditions will permit an instrument approach to be initiated and a landing completed.

End of Appendix B

APPENDIX C
Accelerated EDTO Approval

1. General

A. The following general guidelines apply to a decision for accelerated EDTO operational approval:

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

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 aeroplane which has achieved acceptable reliability.

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

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

C. The excellent propulsion related safety record of two-engine aeroplanes has not only been maintained, but potentially enhanced, by the process related provisions associated with EDTO Type Design and Operational Approvals.

1) Currently available data shows that these process related benefits are achievable without extensive in-service experience.

2) Reduction or elimination of in-service experience requirements may be possible when the operator shows to the GCAA that adequate and validated EDTO processes are in place.

D. The Accelerated EDTO 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 AC by a variety of means of demonstrating that operator's capability.

E. This Appendix describes the means by which an operator may initiate EDTO operations when the operator establishes the processes necessary for successful and reliable EDTO operations are in place and are considered to be reliable. This may be achieved by thorough documentation of processes, demonstration on another aeroplane/validation (as described in paragraph 7 of this Appendix) or a combination of these processes.

2. Background

A. When EDTO requirements were was first released in 1985, EDTO was a new concept, 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 aeroplane would be possible.

B. The EDTO concept has been successfully applied for more than a decade; EDTO is now widely employed and is well established. The number of EDTO 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 aeroplanes.

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 EDTO; and another one (1) year, at 120-minute EDTO, before being granted 180-minute EDTO approval. For example, an operator who currently has 180-minute EDTO approval on one type of airframe-engine or who is currently operating that route with an older generation three- or four-engine aeroplane 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 EDTO operation at earlier than the standard time established in the basic AC.

D. EDTO operational data indicates that twin-engine aeroplanes have maintained a high degree of reliability due to implementation of specific maintenance, engineering, and flight operation process-related requirements. Compliance with EDTO processes is crucial in assuring high levels of reliability of twin-engine aeroplanes. Data also indicates that previous experience with an airframe-engine combination prior to operating EDTO, does not necessarily make a significant difference in the safety of such operations. Commitment to establishment of reliable EDTO 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 aeroplanes at a mature level of reliability.

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

3. Definitions

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 EDTO processes that should be in place to ensure a successful Accelerated EDTO program.

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.

4. EDTO Processes

A. The two-engine airframe/engine combination for which the operator is seeking Accelerated EDTO Operational Approval must be EDTO Type Design approved (and have been issued an Acceptance Type Certificate by the GCAA) prior to commencing EDTO. The operator seeking Accelerated EDTO Operational Approval must demonstrate to the GCAA that it has an EDTO program in place that addresses the process elements identified in this section.

B. The following are the EDTO process elements:

1) Aeroplane/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.which includes a tracking and control program.)

(b) EDTO manual in place.

(c) A proven Oil Consumption Monitoring Program.

(d) A proven Engine Condition Monitoring and Reporting system.

(e) A proven Verification Program after Maintenance.

(f) A proven EDTO Reliability Program.)

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

(h) Training and qualifications program in place for EDTO maintenance personnel.

(i) Established EDTO parts control program.

3) Compliance with the Flight Operations Program as defined in Section 5 of this AC:

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

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

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

(d) Flight crew and dispatch personnel familiarity assured with the EDTO routes to be flown; in particular the requirements for, and selection of, enroute 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 aeroplanes currently operated and the two-engine aeroplane for which the operator is seeking Accelerated EDTO Operational Approval.

(b) The plan to train the flight and maintenance personnel to the identified differences.

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

(f) Details of any EDTO 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. Normally, the operator should submit an Accelerated EDTO Operational Approval Plan to the GCAA six (6) months before the proposed start of 180 minutes operations.

B. This time will permit the GCAA to review the documented plans and assure adequate EDTO processes are in place.

C. The operators application for Accelerated EDTO should:

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

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

(a) 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 GCAA visibility is required or the GCAA approval is sought should be included in the Review Gates.

(b) 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 GCAA at approval of the Accelerated EDTO Operational Approval Plan. When an operator wishes to add new areas to the approved list, GCAA concurrence is required.

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

7. Process Validation

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

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 aeroplane 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 aeroplane 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 GCAA to be inadequate or the plan does not produce acceptable results, validation of the process in an aeroplane will be required.

D. If an operator is currently operating EDTO with a different airframe and/or engine combination it may be able to document that it has proven EDTO 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 aeroplane being proposed for Accelerated EDTO Operational Approval. The following elements which while not required, may be useful or beneficial in justifying a reduction in the validation requirements of EDTO processes:

1) Experience with other airframes and/or engines.

2) Previous EDTO experience.

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

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

E. Process validation may be done in the airframe-engine combination that will be used in Accelerated EDTO operation or in a different type aeroplane 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 aeroplane 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 aeroplane being proposed for Accelerated EDTO Operational Approval.

G. Any validation program should address the following:

1) The operator should show that it has considered the impact of the EDTO validation program with regard to safety of flight operations. The operator should state in its application any policy guidance to personnel involved in the EDTO process validation program. Such guidance should clearly state that EDTO 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 EDTO 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 EDTO process elements. Any recommended changes to EDTO 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 GCAA:

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

(b) Definition of aeroplane 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 EDTO validation routes. The routes should be of duration necessary to ensure process validation occurs.

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

(a) Document how each element of the EDTO 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 EDTO processes that were required after an in-flight shutdown (IFSD), unscheduled engine removals, or any other significant operational events.

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

End of Appendix C

APPENDIX D
EDTO Type Design Features

A. This Appendix is included to provide the applicant with information concerning the design features that were considered in obtain a Type Certificate which included EDTO eligibility.

B. A determination shall be made that the design features for a new transport category type design aeroplane intended to be used in EDTO are suitable for such operations. In the event that an existing aeroplane's operation is expanded to include ER operations, a re-evaluation of some design features may be necessary.

C. Modifications to some systems may be required to achieve the desired reliability. In both cases essential systems and propulsion systems for the particular airframe-engine combination will be shown to be designed to fail-safe criteria and to have achieved a level of reliability suitable for the intended operation of the aeroplane.

1. Type Design

Upon satisfactory completion of an engineering type design review and test program, which may include a Certification Flight Test evaluation, an EDTO type design approval will be issued. The Aircraft Flight Manual (AFM) or Supplement and Type Certificate (TC) or Supplemental Type Certificate (STC) shall reference the CMP standard requirements for extended range operations and shall contain the following pertinent information, as applicable:

1) General limitations;

2) Required aeroplane limitations;

3) Revision to the performance section including fuel consumption rates;

4) Flight crew procedures;

5) Markings or placards

6) A statement to the effect that "the aeroplane has been found to meet the type design reliability and performance criteria for EDTO operations in accordance with this document. Compliance with these type design criteria alone does not constitute approval to conduct EDTO operations"; and

7) The Aircraft Type Certificate (TC) or STC should also document the design criteria used to establish compliance, including the effective date of the material.

2. Criteria

A. The evaluation of failures and failure combinations shall be based on engineering judgment and acceptable fail-safe methodology.

B. The analysis should consider effects of operations with one engine inoperative, including allowance for damage that could result from failure of the first engine.

C. Unless it can be shown that equivalent safety levels are provided or the effects of failure are minor, failure and reliability analysis should be used as guidance in verifying that the proper level of fail-safe design has been provided.

AIRFRAME SYSTEMS (GENERAL)

A. Extended duration of single engine operations shall not require exceptional piloting skills and/ or crew coordination. Considering the resulting degradation of the performance of the aeroplane type with an engine inoperative, the increased flight crew workload and the

malfunction of remaining systems and equipment, the impact on flight crew procedures shall be minimized.

B. Consideration shall also be given to the effects of continued flight with an engine and/or airframe systems inoperative on the flight crew's and/or passengers' physiological needs.

PROPULSION SYSTEMS

A. In order to maintain a level of safety, consistent with other aircraft systems, it is necessary to have an acceptably low risk of double propulsion system failure for all design and operational related causes. This implies a relationship between propulsion system reliability and maximum approved diversion time.

B. It shall be shown that the propulsion system reliability has reached an acceptable level for EDTO as determined in accordance with Appendix A of this document.

AUXILIARY POWER UNIT

If an APU is required to satisfy the type design criteria for EDTO, the installation shall meet any additional requirements necessary to demonstrate its ability to perform the intended function, i.e. start reliability, altitude, bleed air capability etc.

COMMUNICATION, NAVIGATION AND BASIC FLIGHT INSTRUMENTS

It shall be shown that, under all combinations of propulsion and/or airframe system failures which are not extremely improbable, reliable communication, sufficiently accurate navigation, and basic flight instruments needed to comply with contingency procedures for EDTO will be available.

CABIN PRESSURIZATION

A. A review of fail-safe redundancy features shall show that the loss of cabin pressure is improbable under single engine conditions.

B. Aeroplane performance data shall be provided to verify the ability for continued safe flight and landing after loss of cabin pressure and subsequent operation at a lower altitude.

C. Unless it can be shown that cabin pressure can be maintained during single engine operation at the altitude required for continued flight to a suitable aerodrome, oxygen shall be available to sustain the passengers and crew for the maximum diversion time.

CABIN HEATING/COOLING

The air conditioning system must be capable of providing a reasonable cabin temperature in the event of any single or combination of failures not shown to be extremely improbable.

EQUIPMENT COOLING

The data shall establish that the required electronic equipment for EDTO has the ability to operate acceptably with an engine shut down. Additionally, adequate indication of the proper functioning of the cooling system shall be verifiable if required, to assure system operation prior to dispatch.

CARGO COMPARTMENT

The cargo compartment design and fire protection system capability (if required) shall be consistent with the following:

1) Design - The cargo compartment fire protection system integrity and reliability shall be suitable for the intended operations considering fire detection sensors, liner materials, etc.;

2) Fire Protection - An analysis or test shall be conducted to show, considering approved maximum diversion time (under standard conditions in still air), (including an allowance for 15 minutes holding and/or an approach and landing), that the ability of the system to

suppress or extinguish fires is adequate to ensure safe flight and landing at a suitable aerodrome.

3) Main deck Class B cargo compartments with volumes in excess of 200 cubic feet, are to be modified to a Class C configuration or equivalent; and,

4) Class D cargo compartments, with volumes in excess of 200 cubic feet, are precluded from use in EDTO.

ICE PROTECTION

Airframe and engine ice protection systems shall be shown to provide adequate protection capability (aircraft controllability, etc.) for the intended operation. This shall account for prolonged exposure to lower altitudes associated with one-engine-inoperative diversion, cruise, holding, approach, missed approach and landing.

ELECTRICAL POWER

A. Three or more reliable and independent electrical power sources shall be available, each capable of powering essential systems independently. If one or more of the required electrical power sources are powered by an APU, hydraulic system, or ram air turbine, the following criteria apply as appropriate:

B. The hydraulic power source must be reliable. To achieve this reliability, it may be necessary to provide two or more independent energy sources (e.g. bleed air from two or more pneumatic sources).

C. Ram air turbine deployment shall be demonstrated to be sufficiently reliable and not require main electrical or engine dependent power for deployment.

D. In the event of any single failure or combination of failures not shown to be extremely improbable, it shall be shown that electrical power is provided for:

1) Essential flight instruments, avionics, communications, navigation, supportive systems and any other equipment deemed necessary for extended range operations for continued safe flight and landing;

2) Crew cockpit information of sufficient accuracy for the intended operation; and

3) Instruments and equipment needed to allow the flight crew to cope effectively with adverse conditions.

HYDRAULIC POWER AND FLIGHT CONTROLS

A. Consideration of these systems may be combined, since many commercial aeroplanes have full hydraulically powered or "fly-by-wire" controls. For aeroplanes with these types of flight controls, evaluation of system redundancy shall show that single failures or failure combinations not shown to be extremely improbable do not preclude continued safe flight and landing.

B. As part of this evaluation, the loss of any two hydraulic systems and any engine should be assumed to occur unless it is established during failure evaluation that there are no sources of damage or the location of the damage sources are such that this failure condition will not occur (engine rotor burst need not be considered in this regard).

End of Appendix D