



交通部民用航空局 核定採用國際飛航標準

主旨：雙或二具以上渦輪發動機飛機實施延展轉降時限作業
(Extended Diversion Time Operations, EDTO)

發行日期： 2021.12.01	依據： 民用航空法第 41 條之 1 第 2 項； 航空器飛航作業管理規則第 76 條第 2 項及第 227 條之 1	編號： NO.5
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一、適用對象

民用航空運輸業及普通航空業以雙或二具以上渦輪發動機飛機從事延展轉降時限作業之航空器使用人。

二、說明

交通部民用航空局核定採用 ICAO Annex 6 Part I 4.7 及 Attachment C 有關雙或二具以上渦輪發動機飛機實施延展轉降時限作業規定。

三、符合性

民用航空運輸業及普通航空業雙或二具以上渦輪發動機飛機實施延展轉降作業時限應符合本文件第四節之規定。

四、作業標準

- (一) 民用航空運輸業及普通航空業以雙或二具以上渦輪發動機飛機實施延展轉降時限作業之定義及附加要求，採用 ICAO Annex 6 Part I (第 11 版第 46 次修訂) Chapter 4.7 Additional requirements for operations by aeroplanes with turbine engines beyond 60 minutes to an en-route alternate aerodrome including extended diversion time operations (EDTO)，如附件一。

(二) 民用航空運輸業及普通航空業以雙或二具以上渦輪發動機飛機實施延展轉降時限作業規定，採用 ICAO Annex 6 Part I (第 11 版第 46 次修訂) Attachment C. Guidance for operations by turbine-engined aeroplanes beyond 60 minutes to an en-route alternate aerodrome including extended diversion time operations (EDTO)，如附件二。

五、取代資訊

無。

附件一 Annex 6, Operation of Aircraft Part I— International

Commercial Air Transport — Aeroplane, Chapter 4.7

DEFINITIONS

EDTO critical fuel. The fuel quantity necessary to fly to an en-route alternate aerodrome considering, at the most critical point on the route, the most limiting system failure.

Note.— Attachment C contains guidance on EDTO critical fuel scenarios.

EDTO significant system. An aeroplane system whose failure or degradation could adversely affect the safety particular to an EDTO flight, or whose continued functioning is specifically important to the safe flight and landing of an aeroplane during an EDTO diversion.

Extended diversion time operations (EDTO). Any operation by an aeroplane with two or more turbine engines where the diversion time to an en-route alternate aerodrome is greater than the threshold time established by the State of the Operator.

Threshold time. The range, expressed in time, established by the State of the Operator, to an en-route alternate aerodrome, whereby any time beyond requires a specific approval for EDTO from the State of the Operator.

4.7 ADDITIONAL REQUIREMENTS FOR OPERATIONS BY AEROPLANES WITH TURBINE ENGINES BEYOND 60 MINUTES TO AN EN-ROUTE ALTERNATE AERODROME INCLUDING EXTENDED DIVERSION TIME OPERATIONS (EDTO)

4.7.1 Requirements for operations beyond 60 minutes to an en-route alternate aerodrome

4.7.1.1 Operators conducting operations beyond 60 minutes from a point on a route to an en-route alternate aerodrome shall ensure that:

a) for all aeroplanes:

- 1) en-route alternate aerodromes are identified; and
- 2) the most up-to-date information is provided to the flight crew on identified en-route alternate aerodromes, including operational status and meteorological conditions;

b) for aeroplanes with two turbine engines, the most up-to-date information provided to the flight crew indicates that conditions at identified en-route alternate aerodromes will be at or

above the operator's established aerodrome operating minima for the operation at the estimated time of use.

Note.— Guidance on compliance with the requirements of these provisions is contained in Attachment C.

4.7.1.2 In addition to the requirements in 4.7.1.1, all operators shall ensure that the following are taken into account and provide the overall level of safety intended by the provisions of Annex 6, Part I:

- a) operational control and flight dispatch procedures;
- b) operating procedures; and
- c) training programmes.

4.7.2 Requirements for extended diversion time operations (EDTO)

4.7.2.1 Unless the State of the Operator has issued a specific approval for EDTO, an aeroplane with two or more turbine engines shall not be operated on a route where the diversion time to an en-route alternate aerodrome from any point on the route, calculated in ISA and still-air conditions at the one-engine-inoperative cruise speed for aeroplanes with two turbine engines and at the all engines operating cruise speed for aeroplanes with more than two turbine engines, exceeds a threshold time established for such operations by that State. The specific approval shall identify the applicable threshold time established for each particular aeroplane and engine combination.

Note 1.— When the diversion time exceeds the threshold time, the operation is considered to be an extended diversion time operation (EDTO).

Note 2.— Guidance on the establishment of an appropriate threshold time and on specific approval of extended diversion time operations is contained in Attachment C and in the Extended Diversion Time Operations (EDTO) Manual (Doc 10085).

Note 3.— For the purpose of EDTO, the take-off and/or destination aerodromes may be considered en-route alternate aerodromes.

4.7.2.2 On issuing the specific approval for extended diversion time operations, the State of the Operator shall specify the maximum diversion time granted to the operator for each particular aeroplane and engine combination.

Note.— Guidance on the conditions to be used when converting diversion times to distances is contained in Attachment C and in the Extended Diversion Time Operations (EDTO) Manual (Doc 10085).

4.7.2.3 When specifying the appropriate maximum diversion time for the operator of a particular aeroplane type engaged in extended diversion time operations, the State of the Operator shall ensure that:

- a) for all aeroplanes: the most limiting EDTO significant system time limitation, if any, indicated in the aeroplane flight manual (directly or by reference) and relevant to that particular operation is not exceeded; and
- b) for aeroplanes with two turbine engines: the aeroplane is EDTO certified.

Note 1.— EDTO may be referred to as ETOPS in some documents.

Note 2.— Guidance on compliance with the requirements of this provision is contained in Attachment C.

4.7.2.3.1 Notwithstanding the provisions in 4.7.2.3 a), the State of the Operator may, based on the results of a specific safety risk assessment conducted by the operator which demonstrates how an equivalent level of safety will be maintained, approve operations beyond the time limits of the most time-limited system. The specific safety risk assessment shall include at least the:

- a) capabilities of the operator;
- b) overall reliability of the aeroplane;
- c) reliability of each time-limited system;
- d) relevant information from the aeroplane manufacturer; and
- e) specific mitigation measures.

Note.— Guidance on the specific safety risk assessment is contained in Attachment C and in the Extended Diversion Time Operations (EDTO) Manual (Doc 10085).

4.7.2.4 For aeroplanes engaged in EDTO, the additional fuel required by 4.3.6.3 f) 2) shall include the fuel necessary to comply with the EDTO critical fuel scenario as established by the State of the Operator.

Note.— Guidance on compliance with the requirements of this provision is in Attachment C and in the Extended Diversion Time Operations (EDTO) Manual (Doc 10085).

4.7.2.5 A flight shall not proceed beyond the threshold time in accordance with 4.7.2.1 unless the identified en-route alternate aerodromes have been re-evaluated for availability and the most up-to-date information indicates that, during the estimated time of use, conditions at those aerodromes will be at or above the operator's established aerodrome operating minima for the operation. If any conditions are identified that would preclude a safe approach and landing at that aerodrome during the estimated time of use, an alternative course of action shall be determined.

4.7.2.6 The State of the Operator shall, when specifying maximum diversion times for aeroplanes with two turbine engines, ensure that the following are taken into account in providing the overall level of safety intended by the provisions of Annex 8:

- a) reliability of the propulsion system;
- b) airworthiness certification for EDTO of the aeroplane type; and
- c) EDTO maintenance programme.

Note 1.— EDTO may be referred to as ETOPS in some documents.

Note 2.— The Airworthiness Manual (Doc 9760) contains guidance on the level of performance and reliability of aeroplane systems intended by 4.7.2.6, as well as guidance on continuing airworthiness aspects of the requirements of 4.7.2.6.

4.7.2.7 Recommendation.— The State of the Operator of an aeroplane type with two turbine engines which, prior to 25 March 1986, was authorized and operating on a route where the flight time at one-engine-inoperative cruise speed to an en-route alternate aerodrome exceeded the threshold time established for such operations in accordance with 4.7.2.1 should give consideration to permitting such an operation to continue on that route after that date.

附件二 Annex 6, Operation of Aircraft Part I— International Commercial Air Transport — Aeroplane, Attachment C

ATTACHMENTS

ATTACHMENT C. GUIDANCE FOR OPERATIONS BY TURBINE-ENGINEED AEROPLANES BEYOND 60 MINUTES TO AN EN-ROUTE ALTERNATE AERODROME INCLUDING EXTENDED DIVERSION TIME OPERATIONS (EDTO)

(Supplementary to Chapter 4, 4.7)

1. INTRODUCTION

1.1 The purpose of this Attachment is to provide guidance on the general provisions relating to operations by turbine engined aeroplanes beyond 60 minutes' flying time to an en-route alternate aerodrome and extended diversion time operations contained in Annex 6 Part I Chapter 4, 4.7. The guidance will also assist States in establishing a threshold time and approving the maximum diversion time for a given operator with a specific aeroplane type. The provisions in Annex 6 Part I Chapter 4, 4.7, are divided into:

- a) the basic provisions that apply to all aeroplanes operating beyond 60 minutes to an en-route alternate aerodrome; and
- b) provisions to fly beyond a threshold time, and up to a maximum diversion time, approved by the State of the Operator, that may be different for each operator/aeroplane type combination.

This Attachment provides guidance on the means of achieving the required level of safety envisaged.

1.2 Similar to the threshold time, the maximum diversion time is the range (expressed in time) from a point on a route to an en-route alternate aerodrome up to which the State of the Operator will grant approval. When approving the operator's maximum diversion time, States will need to consider not only the capable range of the aircraft, taking into consideration any limitation of the aeroplane's type certificate, but also the operator's previous experience on similar aircraft types and routes.

1.3 The material in this Attachment is organized to address guidance on operations beyond 60 minutes to an en-route alternate aerodrome for all aeroplanes with turbine engines (Section 2) and guidance for extended diversion time operations (Section 3). The EDTO section is further divided into general provisions (Section 3.1), provisions that apply to aeroplanes with more than two

engines (Section 3.2) and provisions that apply to aeroplanes with two engines (Section 3.3). The sections on aeroplanes with two engines and more than two engines are organized in exactly the same way. It should be noted that these sections may appear to be similar and thus repetitive; however there are requirement differences based on the aeroplane type. The reader should see Sections 2 and 3.1 and then either 3.2 for aeroplanes with more than two engines or 3.3 for aeroplanes with two engines.

2. OPERATIONS BY AEROPLANES WITH TURBINE ENGINES BEYOND 60 MINUTES TO AN EN-ROUTE ALTERNATE AERODROME

2.1 General

2.1.1 All provisions for operations by aeroplanes with turbine engines beyond 60 minutes to an en-route alternate aerodrome also apply to extended diversion time operations (EDTO). Figure C-1 illustrates generically the integration of operations beyond 60 minutes to an en-route alternate aerodrome and EDTO.

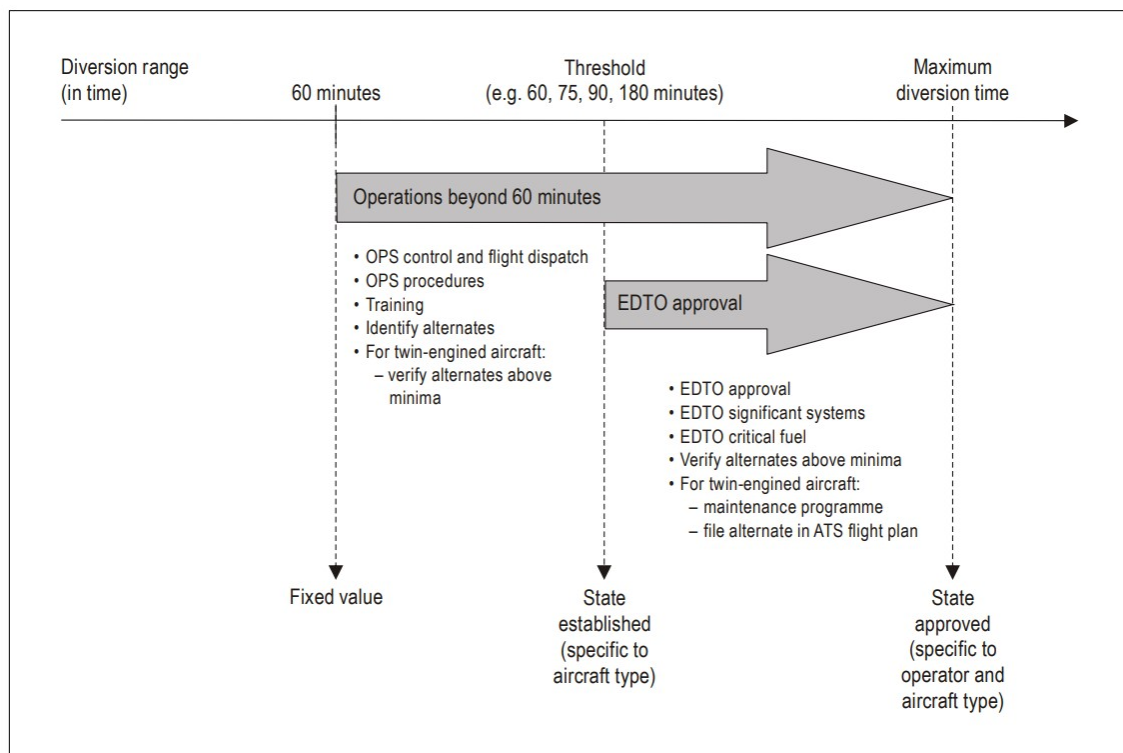


Figure C-1. Generic EDTO graphical representation

2.1.2 In applying the requirements for aeroplanes with turbine engines in Annex 6 Part I Chapter 4, 4.7, it should be understood that:

- operational control refers to the exercise, by the operator, of responsibility for the initiation, continuation, termination or diversion of a flight;

- b) flight dispatch procedures refer to the method of control and supervision of flight operations. This does not imply a specific requirement for licensed flight dispatchers or a full flight following system;
- c) operating procedures refer to the specification of organization and methods established to exercise operational control and flight dispatch procedures in the appropriate manual(s) and should cover at least a description of responsibilities concerning the initiation, continuation, termination or diversion of each flight as well as the method of control and supervision of flight operations; and
- d) training programme refers to the training for pilots and flight operations officers/flight dispatchers in operations covered by this and following sections.

2.1.3 Aeroplanes with turbine engines operating beyond 60 minutes to an en-route alternate aerodrome are not required to have specific additional approval by the State of the Operator except if they engage in extended diversion time operations.

2.2 Conditions to be used when converting diversion times to distances

2.2.1 For the purpose of this guidance, an approved one-engine-inoperative (OEI) speed or approved all-engines operative (AEO) speed is any speed within the certified flight envelope of the aeroplane.

2.2.2 Determination of the 60-minute distance — aeroplanes with two turbine engines

2.2.2.1 For determining whether a point on the route is beyond 60 minutes to an en-route alternate, the operator should select an approved OEI speed. The distance is calculated from the point of the diversion followed by cruise for 60 minutes, in ISA and still-air conditions, as shown in Figure C-2. For the purposes of computing distances, credit for driftdown may be taken.

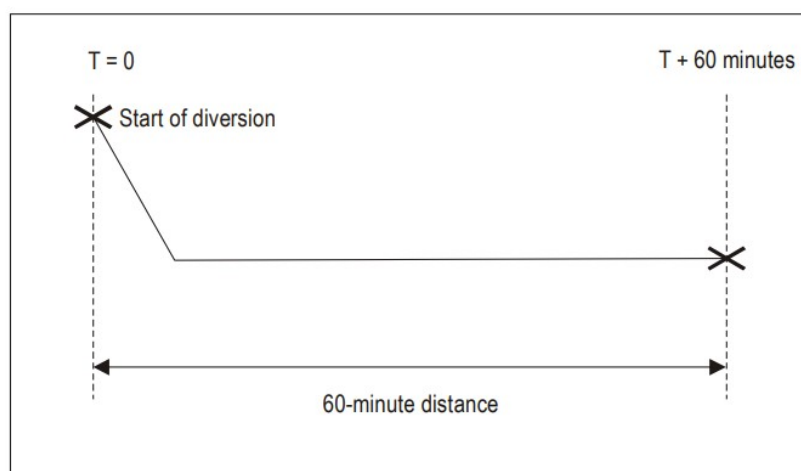


Figure C-2. Sixty-minute distance — aeroplanes with two turbine engines

2.2.3 Determination of the 60-minute distance — aeroplanes with more than two turbine engines

2.2.3.1 For determining whether a point on the route is beyond 60 minutes to an en-route alternate, the operator should select an approved AEO speed. The distance is calculated from the point of the diversion followed by cruise for 60 minutes, in ISA and still-air conditions, as shown in Figure C-3.

2.3 Training

2.3.1 Training programmes should ensure that the requirements of Annex 6 Part I Chapter 9, 9.4.3.2, are complied with such as, but not limited to, route qualification, flight preparation, concept of extended diversion time operations and criteria for diversions.

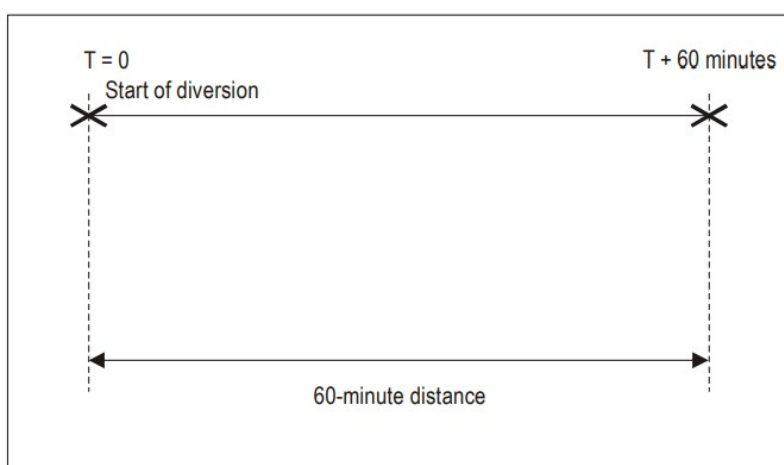


Figure C-3. Sixty-minute distance — aeroplanes with more than two turbine engines

2.4 Flight dispatch and operational requirements

2.4.1 In applying the general flight dispatch requirements of Annex 6 Part I Chapter 4 particular attention should be paid to the conditions which might prevail any time that the operation is beyond 60 minutes to an en-route alternate aerodrome, e.g. systems degradation and reduced flight altitude. For compliance with the requirement of Annex 6 Part I Chapter 4, 4.7, at least the following aspects should be considered:

- a) identify en-route alternate aerodromes;
- b) ensure that, prior to departure, the flight crew is provided with the most up-to-date information on the identified en route alternate aerodromes, including operational status and meteorological conditions and, in flight, make available means for the flight crew to obtain the most up-to-date weather information;
- c) methods to enable two-way communications between the aeroplane and the operator's operational control centre;

- d) ensure that the operator has a means to monitor conditions along the planned route including the identified alternate aerodromes and ensure that procedures are in place so that the flight crew are advised of any situation that may affect the safety of flight;
- e) ensure that the intended route does not exceed the established aeroplane threshold time unless the operator is approved for EDTO operations;
- f) pre-flight system serviceability including the status of items in the minimum equipment list;
- g) communication and navigation facilities and capabilities;
- h) fuel requirements; and
- i) availability of relevant performance information for the identified en-route alternate aerodrome(s).

2.4.2 In addition, operations conducted by aeroplanes with two turbine engines require that, prior to departure and in flight, the meteorological conditions at identified en-route alternate aerodromes will be at or above the aerodrome operating minima required for the operation during the estimated time of use.

2.5 En-route alternate aerodromes

2.5.1 Aerodrome(s) to which an aircraft may proceed in the event that a diversion becomes necessary while en route, where the necessary services and facilities are available, where aircraft performance requirements can be met, and which are expected to be operational if required, need to be identified any time that the operation is beyond 60 minutes to an en-route alternate aerodrome.

Note.— En-route alternate aerodromes may also be the take-off and/or destination aerodromes.

3. EXTENDED DIVERSION TIME OPERATIONS (EDTO) REQUIREMENTS

3.1 Basic concept

3.1.1 In addition to the provisions in Section 2, this section addresses the provisions that apply to operations by aeroplanes with two or more turbine engines where the diversion time to an en-route alternate aerodrome is greater than the threshold time established by the State of the Operator (extended diversion time operations).

3.1.2 EDTO significant systems

3.1.2.1 EDTO significant systems may be the aeroplane propulsion system and any other aeroplane systems whose failure or malfunctioning could adversely affect safety particular to an EDTO flight, or whose functioning is specifically important to continued safe flight and landing

during an aeroplane EDTO diversion.

3.1.2.2 Many of the aeroplane systems that are essential for non-extended diversion time operations may need to be reconsidered to ensure that the redundancy level and/or reliability will be adequate to support the conduct of safe extended diversion time operations.

3.1.2.3 The maximum diversion time should not exceed the value of the EDTO significant system limitation(s), if any, for extended diversion time operations identified in the aeroplane flight manual, directly or by reference, reduced by an operational safety margin, commonly 15 minutes, specified by the State of the Operator.

3.1.2.4 The specific safety risk assessment to approve operations beyond the time limits of an EDTO significant time limited system per the provisions in Annex 6 Part I Chapter 4, 4.7.2.3.1, should be based on the safety risk management guidance contained in the Safety Management Manual (SMM) (Doc 9859). Hazards should be identified and safety risks assessed according to predicted probability and the severity of the consequences based on the worst foreseeable situation. When addressing the following components of the specific safety risk assessment it should be understood that:

- a) capabilities of the operator refer to the operator's quantifiable in-service experience, compliance record, aeroplane capability and overall operational reliability that:
 - 1) are sufficient to support operations beyond the time limits of an EDTO significant time-limited system;
 - 2) demonstrate the ability of the operator to monitor and respond to changes in a timely manner; and
 - 3) there is an expectation that the operator's established processes, necessary for successful and reliable extended diversion time operations, can be successfully applied to such operations;
- b) overall reliability of the aeroplane refers to:
 - 1) quantifiable standards of reliability taking into account the number of engines, aircraft EDTO significant systems and any other factors that may affect operations beyond the time limits of a particular EDTO significant time-limited system; and
 - 2) relevant data from the aeroplane manufacturer and data from the operator reliability programme used as a basis to determine overall reliability of the aeroplane and its EDTO significant systems;
- c) reliability of each time-limited system refers to quantifiable standards of design, testing and monitoring that ensure the reliability of each particular EDTO significant time-limited system;

- d) relevant information from the aeroplane manufacturer refers to technical data and characteristics of the aeroplane and worldwide fleet operational data provided by the manufacturer and used as a basis to determine overall reliability of the aeroplane and its EDTO significant systems; and
- e) specific mitigation measures refer to the safety risk management mitigation strategies, which have manufacturer concurrence, that ensure an equivalent level of safety is maintained. These specific mitigations shall be based on:
 - 1) technical expertise (e.g. data, evidence) proving the operator's eligibility for an approval of operations beyond the time limit of the relevant EDTO significant system; and
 - 2) an assessment of relevant hazards, their probability and the severity of the consequences that may adversely impact the safety of the operation of an aeroplane operated beyond the limit of a particular EDTO significant time-limited system.

3.1.3 Threshold time

3.1.3.1 It should be understood that the threshold time established in accordance with Annex 6 Part I Chapter 4, 4.7, is not an operating limit. It is a flight time to an en-route alternate aerodrome, which is established by the State of the Operator as being the EDTO threshold beyond which particular consideration should be given to the aeroplane capability as well as the operator's relevant operational experience, before granting an EDTO approval.

3.1.4 Maximum diversion time

3.1.4.1 It should be understood that the maximum diversion time approved in accordance with Annex 6 Part I Chapter 4, 4.7, should take into consideration the most limiting EDTO significant system time limitation, if any, indicated in the aeroplane flight manual (directly or by reference) for a particular aeroplane type and the operator's operational and EDTO experience, if any, with the aeroplane type or, if relevant, with another aeroplane type or model.

3.2 EDTO for aeroplanes with more than two turbine engines

3.2.1 General

3.2.1.1 In addition to the provisions in Sections 2 and 3.1 of this Attachment, this section addresses the provisions that apply in particular to aeroplanes with more than two turbine engines (see Figure C-4).

Note.— EDTO may be referred to as ETOPS in some documents.

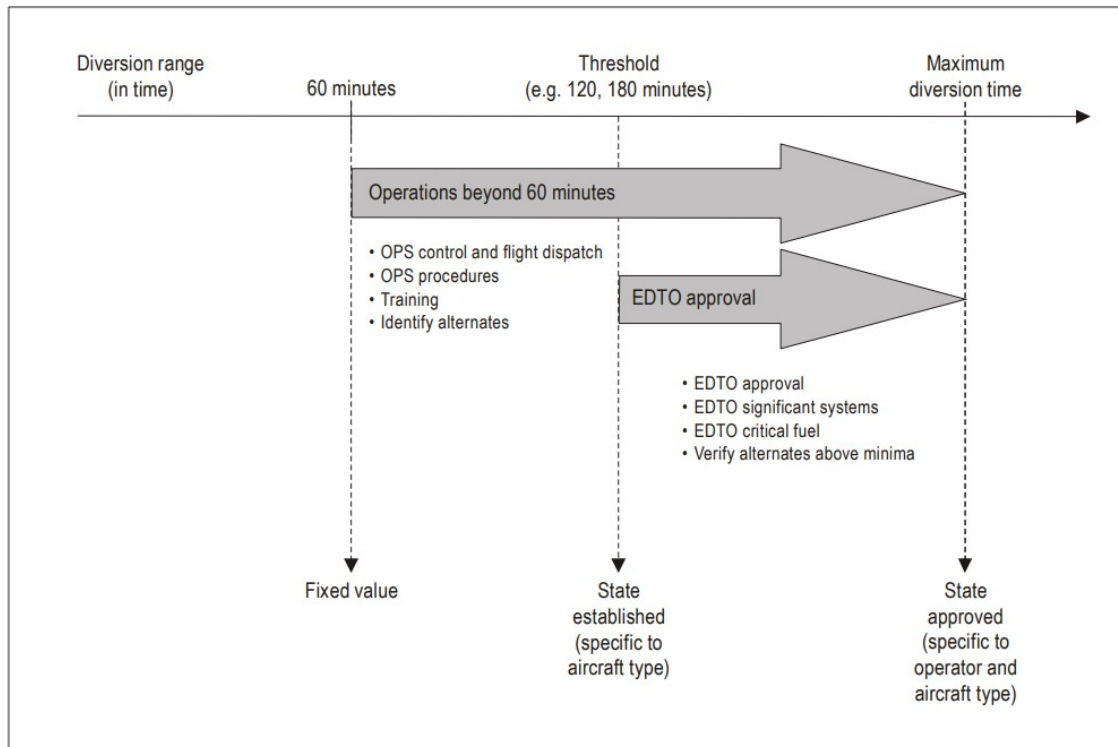


Figure C-4. Generic EDTO graphical representation for aeroplanes with more than two turbine engines

3.2.2 Operational and diversion planning principles

3.2.2.1 When planning or conducting extended diversion time operations, the operator and pilot-in-command should ensure that:

- a) the minimum equipment list, the communications and navigation facilities, fuel and oil supply, en-route alternate aerodromes and aeroplane performance are appropriately considered;
- b) if no more than one engine is shut down, the pilot-in-command may elect to continue beyond the nearest en-route alternate aerodrome (in terms of time) if the pilot-in-command determines that it is safe to do so. In making this decision the pilot-in-command should consider all relevant factors; and
- c) in the event of a single or multiple failure of an EDTO significant system or systems (excluding engine failure), the aircraft can proceed to and land at the nearest available en-route alternate aerodrome where a safe landing can be made unless it has been determined that no substantial degradation of safety will result from any decision made to continue the planned flight.

3.2.2.2 EDTO critical fuel

3.2.2.2.1 An aeroplane with more than two engines engaged in EDTO operations should carry enough fuel to fly to an en-route alternate aerodrome as described in 3.2.6. This EDTO critical fuel corresponds to the additional fuel that may be required to comply with Annex 6 Part I Chapter 4, 4.3.6.3 f) 2).

3.2.2.2.2 The following should be considered, using the anticipated mass of the aeroplane, in determining the corresponding EDTO critical fuel:

- a) fuel sufficient to fly to an en-route alternate aerodrome, considering at the most critical point of the route, simultaneous engine failure and depressurization or depressurization alone, whichever is more limiting;
 - 1) the speed selected for the diversions (i.e. depressurization, combined or not with an engine failure) may be different from the approved AEO speed used to determine the EDTO threshold and maximum diversion distance (see 3.2.8);
- b) fuel to account for icing;
- c) fuel to account for errors in wind forecasting;
- d) fuel to account for holding an instrument approach and landing at the en-route alternate aerodrome;
- e) fuel to account for deterioration in cruise fuel-burn performance; and
- f) fuel to account for APU use (if required).

Note.— Guidance on EDTO critical fuel planning can be found in the Flight Planning and Fuel Management Manual(Doc 9976).

3.2.2.3 The following factors may be considered in determining if a landing at a given aerodrome is the more appropriate course of action:

- a) aeroplane configuration, mass, systems status and fuel remaining;
- b) wind and weather conditions en route at the diversion altitude, minimum altitudes en route and fuel consumption to the en-route alternate aerodrome;
- c) runways available, runway surface condition and weather, wind and terrain in the proximity of the en-route alternate aerodrome;
- d) instrument approaches and approach/runway lighting available and rescue and fire fighting services (RFFS) at the en-route alternate aerodrome;
- e) the pilot's familiarity with that aerodrome and information about that aerodrome provided to the pilot by the operator; and

f) facilities for passenger and crew disembarkation and accommodation.

3.2.3 Threshold time

3.2.3.1 In establishing the appropriate threshold time and to maintain the required level of safety, it is necessary for States to consider that:

- a) the airworthiness certification of the aeroplane type does not restrict operations beyond the threshold time, taking into account the aeroplane system design and reliability aspects;
- b) specific flight dispatch requirements are met;
- c) necessary in-flight operational procedures are established; and
- d) the operator's previous experience on similar aircraft types and routes is satisfactory.

3.2.3.2 For determining whether a point on a route is beyond the EDTO threshold to an en-route alternate aerodrome, the operator should use the approved speed as described in 3.2.8.

3.2.4 Maximum diversion time

3.2.4.1 In approving the maximum diversion time, the State of the Operator should take into consideration the aeroplane's EDTO significant systems (e.g. limiting time limitation, if any, and relevant to that particular operation) for a particular aeroplane type and the operator's operational and EDTO experience with the aeroplane type or, if relevant, with another aeroplane type or model.

3.2.4.2 For determining the maximum diversion distance to an en-route alternate, the operator should use the approved speed as described in 3.2.8.

3.2.4.3 The operator's approved maximum diversion time should not exceed the most limiting EDTO significant system time limitation identified in the aeroplane flight manual, reduced by an operational safety margin, commonly 15 minutes, specified by the State of the Operator.

3.2.5 EDTO significant systems

3.2.5.1 In addition to the provisions in 3.1.1, this section addresses particular provisions for aeroplanes with more than two turbine engines.

3.2.5.2 Consideration of time limitations

3.2.5.2.1 For all operations beyond the EDTO threshold as determined by the State of the Operator, the operator should consider, at time of dispatch and as outlined below, the most limiting EDTO significant system time limitation, if any, indicated in the aeroplane flight manual (directly or by reference) and relevant to that particular operation.

3.2.5.2.2 The operator should check that from any point on the route, the maximum diversion

time does not exceed the most limiting EDTO significant system time limitation, reduced by an operational safety margin, commonly 15 minutes, specified by the State of the Operator.

3.2.5.2.3 The maximum diversion time subject to cargo fire suppression time limitations are considered part of the most limiting EDTO significant time limitations in 3.3.5.2.2.

3.2.5.2.4 For that purpose, the operator should consider the approved speed as described in 3.2.8.2 or consider adjusting that speed with forecast wind and temperature conditions for operations with longer threshold times (e.g. beyond 180 minutes) as determined by the State of the Operator.

3.2.6 En-route alternate aerodromes

3.2.6.1 In addition to the en-route alternate aerodrome provisions described in 2.5 the following apply:

- a) for route planning purposes, identified en-route alternate aerodromes, which could be used if necessary, need to be located at a distance within the maximum diversion time from the route; and
- b) in extended diversion time operations, before an aeroplane crosses its threshold time during flight, there should always be an en-route alternate aerodrome within the approved maximum diversion time whose conditions will be at or above the operator's established aerodrome operating minima for the operation during the estimated time of use.

If any conditions, such as weather below landing minima, are identified that would preclude a safe approach and landing at that aerodrome during the estimated time of use, an alternative course of action should be determined such as selecting another en-route alternate aerodrome within the operator's approved maximum diversion time.

Note.— En route alternate aerodromes may also be the take-off and/or destination aerodromes.

3.2.7 Operational approval procedure

3.2.7.1 In approving the operator with a particular aeroplane type for extended diversion time operations, the State of the Operator should establish an appropriate threshold time and maximum diversion time and, in addition to the requirements previously set forth in this Attachment, ensure that:

- a) specific operational approval is granted (by the State of the Operator);
- b) the operator's past experience and compliance record is satisfactory and the operator has established the processes necessary for successful and reliable extended diversion time operations and shown that such processes can be successfully applied throughout such operations;

- c) the operator's procedures are acceptable based on certified aeroplane capability and adequate to address continued safe operation in the event of degraded aeroplane systems;
- d) the operator's crew training programme is adequate for the proposed operation;
- e) documentation accompanying the authorization covers all relevant aspects; and
- f) it has been shown (e.g. during the EDTO certification of the aeroplane) that the flight can continue to a safe landing under the anticipated degraded operating conditions which would arise from:
 - 1) the most limiting EDTO significant system time limitation, if any, for extended diversion time operations identified in the aeroplane flight manual, directly or by reference; or
 - 2) any other condition which the State of the Operator considers to be equivalent in airworthiness and performance risk.

3.2.8 Conditions to be used when converting diversion times to distances for the determination of the geographical area beyond threshold and within maximum diversion distances

3.2.8.1 For the purpose of this guidance, an approved AEO speed is any all-engines-operative speed within the certified flight envelope of the aeroplane

Note.— See 3.2.5.2.2 for operational considerations.

3.2.8.2 When applying for EDTO the operator should identify, and the State of the Operator should approve, the AEO speed(s), considering ISA and still-air conditions, that will be used to calculate the threshold and maximum diversion distances. The speed that will be used to calculate the maximum diversion distance may be different from the speed used to determine the 60-minute and EDTO thresholds.

3.2.8.3 Determination of the EDTO threshold

3.2.8.3.1 For determining whether a point on the route is beyond the EDTO threshold to an en-route alternate, the operator should use the approved speed (see 3.2.8.1 and 3.2.8.2). The distance is calculated from the point of the diversion followed by cruise for the threshold time as determined by the State of the Operator and shown in Figure C-5.

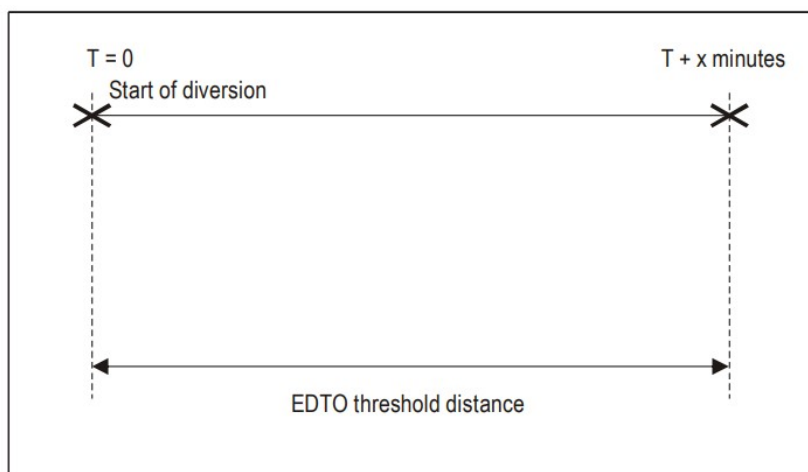


Figure C-5. Threshold distance — aeroplanes with more than two turbine engines

3.2.8.4 Determination of the maximum diversion time distance

3.2.8.4.1 For determining the maximum diversion time distance to an en-route alternate, the operator should use the approved speed (see 3.2.8.1 and 3.2.8.2). The distance is calculated from the point of the diversion followed by cruise for the maximum diversion time as approved by the State of the Operator and shown in Figure C-6.

3.2.9 Airworthiness certification requirements for extended diversion time operations beyond the threshold time

3.2.9.1 There are no additional EDTO airworthiness certification requirements for aeroplanes with more than two engines.

3.2.10 Maintaining operational approval

3.2.10.1 In order to maintain the required level of safety on routes where these aeroplanes are permitted to operate beyond the established threshold time, it is necessary that:

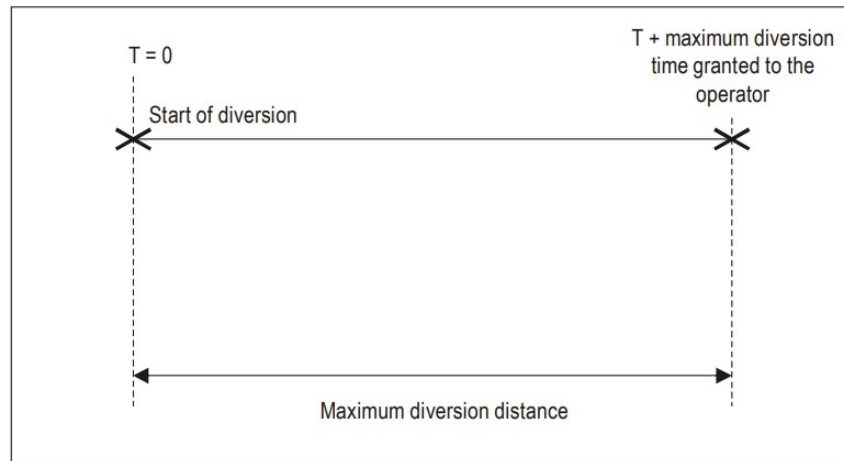


Figure C-6. Maximum diversion distance — aeroplanes with more than two turbine engines

- a) specific flight dispatch requirements are met;
- b) the necessary in-flight operational procedures are established; and
- c) specific operational approval is granted by the State of the Operator.

3.2.11 Airworthiness modifications and maintenance programme requirements

3.2.11.1 There are no additional EDTO airworthiness or maintenance requirements for aeroplanes with more than two engines.

3.2.12 Examples

3.2.12.1 In establishing the appropriate threshold and approved maximum diversion time for the operator with a particular aeroplane type, the State of the Operator should consider, but not be limited to, the following: the airworthiness certification of the aeroplane, the operator's experience in conducting operations beyond the 60-minute threshold, flight deck crew experience in conducting such operations, the maturity of that operator's flight dispatch system, the communication capability with the operator's operational control centre (ACARS, SATCOM, HF, etc.), the robustness of both the operator's standard operating procedures and the familiarity of the crews with those procedures, the maturity of the operator's safety management system, the crew training programme and the reliability of the propulsion system. The following examples are based on these considerations and are taken from actual State requirements:

- a) State A: State A has established the threshold time at 180 minutes based on the capability of the operator and the aeroplane type for an aeroplane with more than two engines and has approved a maximum diversion time of 240 minutes. That operator will need to have specific approval to be further than 180 minutes to an en-route alternate aerodrome (AEO

speed in ISA and still-air conditions), remain within 240 minutes to an en-route alternate aerodrome and meet the requirements in Annex 6 Part I Chapter 4, 4.7.1 to 4.7.2.4.

If that operator, with the particular aeroplane type, plans a route within the threshold time established by the State of the Operator (in the above example this is 180 minutes) to an en-route alternate aerodrome, that operator would not require any additional approval from the State of the Operator and would only need to comply with the requirements in Annex 6 Part I Chapter 4, 4.7.1, if the operation is conducted beyond 60 minutes from an en-route alternate aerodrome.

b) State B: The CAA is approached by the operator who is in the process of expansion, having acquired aeroplanes with more than two engines capable of EDTO. The operator submits an application to amend its AOC to include this new aeroplane type on newly granted routes. These routes take the flight beyond 60 minutes to an en-route alternate, thus requiring the establishment of a threshold time and approval of a maximum diversion time. Taking into account:

- 1) that the operator has not had previous experience with the routes and area of operation;
- 2) the new aeroplane type;
- 3) the inexperience of the company and its flight operations/operations control department at planning and dispatching such flights; and
- 4) the new operating procedures to be established,

State B determines that the threshold time for the operator should be limited to 120 minutes and approves a maximum diversion time of 180 minutes.

As the operator gains experience with the operation and the procedures over time, the State may amend the initially established threshold time and approved maximum diversion time.

3.3 EDTO for aeroplanes with two turbine engines

3.3.1 General

3.3.1.1 In addition to the provisions in Sections 2 and 3.1, this section addresses the provisions that apply in particular to aeroplanes with two turbine engines (see Figure C-7).

3.3.1.2 EDTO provisions for aeroplanes with two turbine engines do not differ from the previous provisions for extended range operations by aeroplanes with two turbine engines (ETOPS). Therefore, EDTO may be referred to as ETOPS in some documents.

3.3.2 Operational and diversion planning principles

3.3.2.1 When planning or conducting extended diversion time operations, the operator and

pilot-in-command should normally ensure that:

- a) the minimum equipment list, the communications and navigation facilities, fuel and oil supply, en-route alternate aerodromes or aeroplane performance are appropriately considered;
- b) in the event of an aeroplane engine shutdown, the aircraft can proceed to and land at the nearest (in terms of the least flying time) en-route alternate aerodrome where a safe landing can be made; and

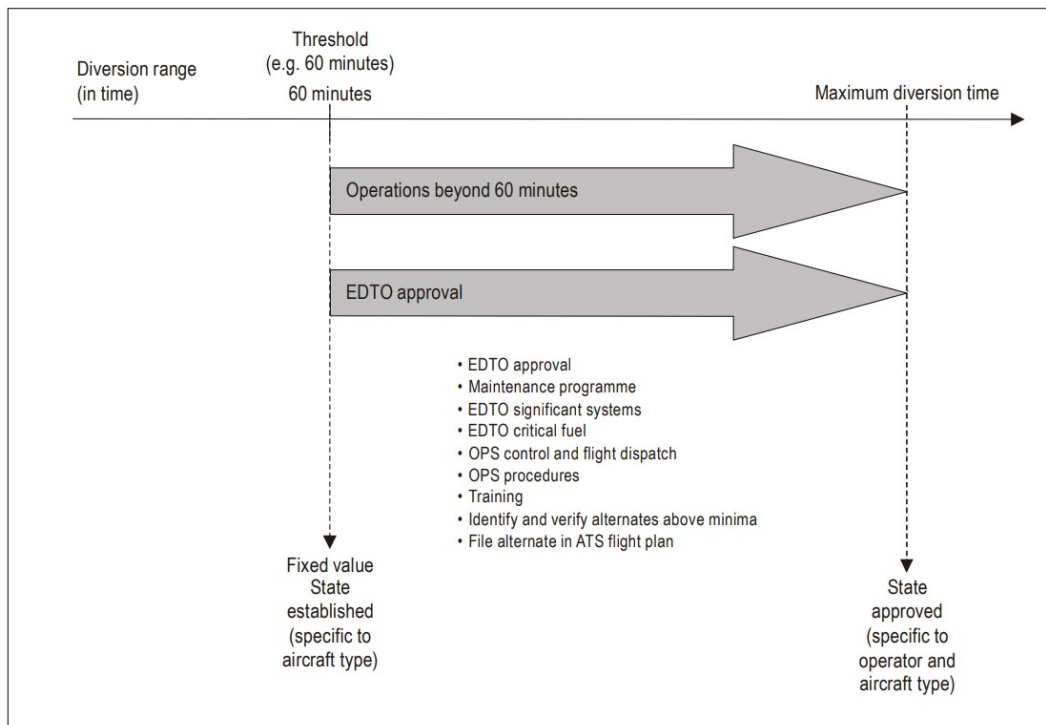


Figure C-7. Generic EDTO graphical representation for aeroplanes with two turbine engines

- c) in the event of a single or multiple failure of an EDTO significant system or systems (excluding engine failure), the aircraft can proceed to and land at the nearest available en-route alternate aerodrome where a safe landing can be made unless it has been determined that no substantial degradation of safety will result from any decision made to continue the planned flight.

3.3.2.2 EDTO critical fuel

3.3.2.2.1 An aeroplane with two engines engaged in EDTO operations should carry enough fuel to fly to an en-route alternate aerodrome as described in 3.3.6. This EDTO critical fuel corresponds to the additional fuel that may be required to comply with Annex 6 Part I Chapter 4,

4.3.6.3 f) 2).

3.3.2.2.2 The following should be considered, using the anticipated mass of the aeroplane, in determining the corresponding EDTO critical fuel:

- a) fuel sufficient to fly to an en-route alternate aerodrome, considering at the most critical point of the route, failure of one engine or simultaneous engine failure and depressurization or depressurization alone, whichever is more limiting;
 - 1) the speed selected for the all-engines-operative diversion (i.e. depressurization alone) may be different from the approved OEI speed used to determine the EDTO threshold and maximum diversion distance (see 3.3.8);
 - 2) the speed selected for the OEI diversions (i.e. engine failure alone and combined engine failure and depressurization) should be the approved OEI speed used to determine the EDTO threshold and maximum diversion distance (see 3.3.8);
- b) fuel to account for icing;
- c) fuel to account for errors in wind forecasting;
- d) fuel to account for holding an instrument approach and landing at the en-route alternate aerodrome;
- e) fuel to account for deterioration in cruise fuel-burn performance; and
- f) fuel to account for APU use (if required).

Note.— Guidance on EDTO critical fuel planning can be found in the Flight Planning and Fuel Management Manual (Doc 9976).

3.3.2.3 The following factors may be considered in determining if a landing at a given aerodrome is the more appropriate course of action:

- a) aeroplane configuration, mass, systems status and fuel remaining;
- b) wind and weather conditions en route at the diversion altitude, minimum altitudes en route and fuel consumption to the en-route alternate aerodrome;
- c) runways available, runway surface condition and weather, wind and terrain in the proximity of the en-route alternate aerodrome;
- d) instrument approaches and approach/runway lighting available and rescue and fire fighting services (RFFS) at the en-route alternate aerodrome;
- e) the pilot's familiarity with that aerodrome and information about that aerodrome provided to the pilot by the operator; and
- f) facilities for passenger and crew disembarkation and accommodation.

3.3.3 Threshold time

3.3.3.1 In establishing the appropriate threshold time and to maintain the required level of safety, it is necessary for States to consider that:

- a) the airworthiness certification of the aeroplane type specifically permits operations beyond the threshold time, taking into account the aeroplane system design and reliability aspects;
- b) the reliability of the propulsion system is such that the risk of double engine failure from independent causes is extremely remote;
- c) any necessary special maintenance requirements are fulfilled;
- d) specific flight dispatch requirements are met;
- e) necessary in-flight operational procedures are established; and
- f) the operator's previous experience on similar aircraft types and routes is satisfactory.

3.3.3.2 For determining whether a point on a route is beyond the EDTO threshold to an en-route alternate aerodrome, the operator should use the approved speed as described in 3.3.8.

3.3.4 Maximum diversion time

3.3.4.1 In approving the maximum diversion time, the State of the Operator should take into consideration the EDTO certified capability of the aeroplane, the aeroplane's EDTO significant systems (e.g. limiting time limitation, if any, and relevant to that particular operation) for a particular aeroplane type and the operator's operational and EDTO experience with the aeroplane type or, if relevant, with another aeroplane type or model.

3.3.4.2 For determining the maximum diversion distance to an en-route alternate, the operator should use the approved speed as described in 3.3.8.

3.3.4.3 The operator's approved maximum diversion time should not exceed the EDTO certified capability of the aeroplane or the most limiting EDTO significant system time limitation identified in the aeroplane flight manual, reduced by an operational safety margin, commonly 15 minutes, specified by the State of the Operator.

3.3.5 EDTO significant systems

3.3.5.1 In addition to the provisions in 3.1.1, this section addresses particular provisions for aeroplanes with two turbine engines.

3.3.5.1.1 The reliability of the propulsion system for the aeroplane/engine combination being certified is such that the risk of double engine failure from independent causes is assessed as provided for in the Airworthiness Manual (Doc 9760) and found acceptable to support the diversion time being approved.

Note.— EDTO may be referred to as ETOPS in some documents.

3.3.5.2 Consideration of time limitations

3.3.5.2.1 For all operations beyond the EDTO threshold, as determined by the State of the Operator, the operator should consider, at time of dispatch and as outlined below, the EDTO certified capability of the aeroplane and the most limiting EDTO significant system time limitation, if any, indicated in the aeroplane flight manual (directly or by reference) and relevant to that particular operation.

3.3.5.2.2 The operator should check that from any point on the route, the maximum diversion time at the approved speed as described in 3.3.8.2 does not exceed the most limiting EDTO significant system time limitation, other than the cargo fire suppression system, reduced by an operational safety margin, commonly 15 minutes, specified by the State of the Operator.

3.3.5.2.3 The operator should check that from any point on the route, the maximum diversion time at all-engines operating cruise speed, considering ISA and still-air conditions, does not exceed the cargo fire suppression system time limitation, reduced by an operational safety margin, commonly 15 minutes, specified by the State of the Operator.

3.3.5.2.4 The operator should consider the approved speed as described in 3.3.5.2.2 and 3.3.5.2.3 or consider adjusting that speed with forecast wind and temperature conditions for operations with longer threshold times (e.g. beyond 180 minutes) as determined by the State of the Operator.

3.3.6 En-route alternate aerodromes

3.3.6.1 In addition to the en-route alternate aerodrome provisions described in 2.5, the following apply:

- a) for route planning purposes, identified en-route alternate aerodromes, which could be used if necessary, need to be located at a distance within the maximum diversion time from the route; and
- b) in extended diversion time operations, before an aeroplane crosses its threshold time during flight, there should always be an en-route alternate aerodrome within the approved maximum diversion time whose conditions will be at or above the operator's established aerodrome operating minima for the operation during the estimated time of use.

If any conditions, such as weather below landing minima, are identified that would preclude a safe approach and landing at that aerodrome during the estimated time of use, an alternative course of action should be determined such as selecting another en-route alternate aerodrome within the operator's approved maximum diversion time.

3.3.6.2 During flight preparation and throughout the flight the most up-to-date information on

the identified en-route alternate aerodromes, including operational status and meteorological conditions, should be provided to the flight crew.

Note.— En route alternate aerodromes may also be the take-off and/or destination aerodromes.

3.3.7 Operational approval procedure

3.3.7.1 In approving the operator with a particular aeroplane type for extended diversion time operations, the State of the Operator should establish an appropriate threshold time and approve a maximum diversion time and, in addition to the requirements previously set forth in this Attachment, ensure that:

- a) specific operational approval is granted (by the State of the Operator);
- b) the operator's past experience and compliance record is satisfactory and the operator has established the processes necessary for successful and reliable extended diversion time operations and shown that such processes can be successfully applied throughout such operations;
- c) the operator's procedures are acceptable based on certified aeroplane capability and adequate to address continued safe operation in the event of degraded aeroplane systems;
- d) the operator's crew training programme is adequate for the proposed operation;
- e) documentation accompanying the authorization covers all relevant aspects; and
- f) it has been shown (e.g. during the EDTO certification of the aeroplane) that the flight can continue to a safe landing under the anticipated degraded operating conditions which would arise from:
 - 1) the most limiting EDTO significant system time limitation, if any, for extended diversion time operations identified in the aeroplane flight manual, directly or by reference; or
 - 2) total loss of engine-generated electric power; or
 - 3) total loss of thrust from one engine; or
 - 4) any other condition which the State of the Operator considers to be equivalent in airworthiness and performance risk.

3.3.8 Conditions to be used when converting diversion times to distances for the determination of the geographical area beyond threshold and within maximum diversion distances

3.3.8.1 For the purpose of this guidance, an approved OEI speed is any one-engine-inoperative speed within the certified flight envelope of the aeroplane.

Note.— See 3.3.5.2.2 for operational considerations.

3.3.8.2 When applying for EDTO the operator should identify, and the State of the Operator should approve, the OEI speed(s), considering ISA and still-air conditions, that will be used to calculate the threshold and maximum diversion distances. The identified speed that will be used to calculate the maximum diversion distance should be the same one used to determine fuel reserves for OEI diversions. This speed may be different from the speed used to determine the 60-minute and EDTO thresholds.

3.3.8.3 Determination of the EDTO threshold

3.3.8.3.1 For determining whether a point on the route is beyond the EDTO threshold to an en-route alternate, the operator should use the approved speed (see 3.3.8.1 and 3.3.8.2). The distance is calculated from the point of the diversion followed by cruise for the threshold time as determined by the State of the Operator and shown in Figure C-8. For the purposes of computing distances, credit for driftdown may be taken.

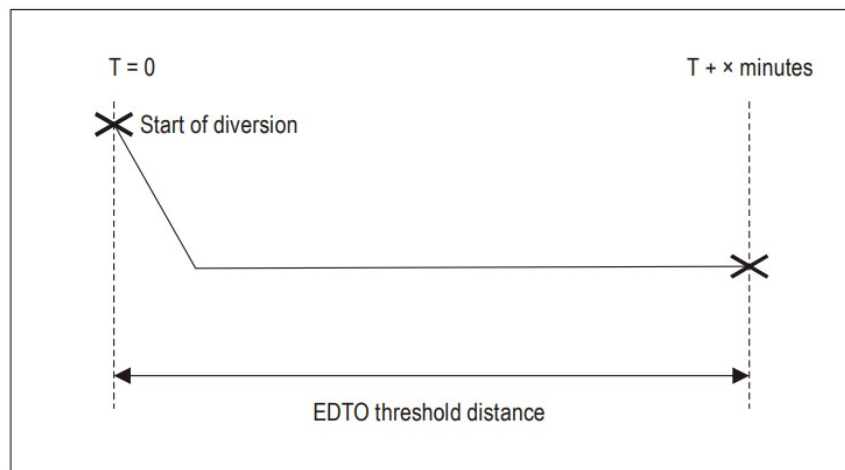


Figure C-8. Threshold distance — aeroplanes with two turbine engines

3.3.8.4 Determination of the maximum diversion time distance

3.3.8.4.1 For determining the maximum diversion time distance to an en-route alternate, the operator should use the approved speed (see 3.3.8.1 and 3.3.8.2). The distance is calculated from the point of the diversion followed by cruise for the maximum diversion time as approved by the State of the Operator and shown in Figure C-9. For the purposes of computing distances, credit for driftdown may be taken.

3.3.9 Airworthiness certification requirements for extended diversion time operations beyond the threshold time

3.3.9.1 During the airworthiness certification procedure for an aeroplane type intended for

extended diversion time operations, special attention should be paid to ensure that the required level of safety will be maintained under conditions which may be encountered during such operations, e.g. flight for extended periods following failure of an engine and/or the aeroplane's EDTO significant systems. Information or procedures specifically related to extended diversion time operations should be incorporated into the aeroplane flight manual, the maintenance manual, the EDTO configuration, maintenance and procedure (CMP) document or other appropriate document.

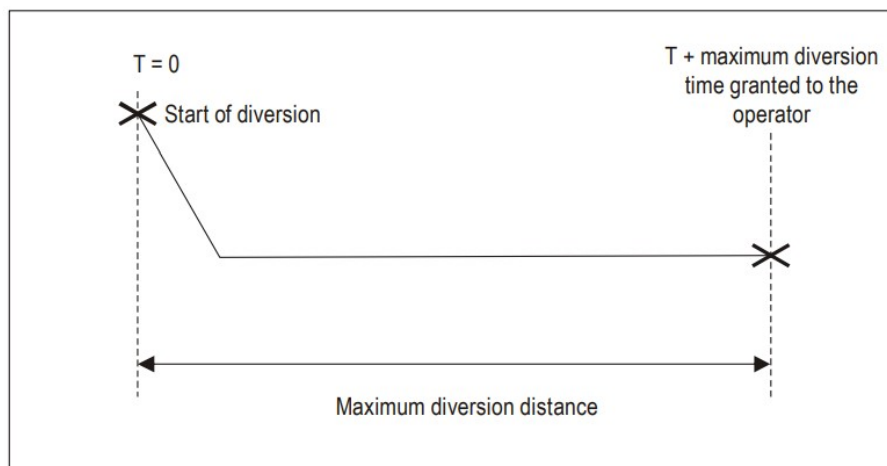


Figure C-9. Maximum diversion distance — aeroplanes with two turbine engines

3.3.9.2 Aeroplane manufacturers should supply data specifying the aeroplane's EDTO significant systems and, where appropriate, any time-limiting factors associated with those systems.

Note 1.— Criteria on aeroplane system performance and reliability for extended diversion time operations are contained in the Airworthiness Manual (Doc 9760).

Note 2.— EDTO may be referred to as ETOPS in some documents.

3.3.10 Maintaining operational approval

3.3.10.1 In order to maintain the required level of safety on routes where these aeroplanes are permitted to operate beyond the established threshold time, it is necessary that:

- a) the airworthiness certification of the aeroplane type specifically permits operations beyond the threshold time, taking into account the aeroplane's system design and reliability aspects;
- b) the reliability of the propulsion system is such that the risk of double engine failure from independent causes is extremely remote, assessed as provided for in the Airworthiness Manual (Doc 9760) and found acceptable to support the diversion time being approved;
- c) any special maintenance requirements are fulfilled;
- d) specific flight dispatch requirements are met;

- e) the necessary in-flight operational procedures are established; and
- f) specific operational approval is granted by the State of the Operator.

Note 1.— The airworthiness considerations applicable to extended diversion time operations are provided in the Airworthiness Manual (Doc 9760), Part IV, Chapter 5.

Note 2.— EDTO may be referred to as ETOPS in some documents.

3.3.11 Airworthiness modifications and maintenance programme requirements

3.3.11.1 Each operator's maintenance programme should ensure that:

- a) the titles and numbers of all airworthiness modifications, additions and changes which were made to qualify aeroplane systems for extended diversion time operations are provided to the State of Registry and, where applicable, to the State of the Operator;
- b) any changes to maintenance and training procedures, practices or limitations established in the qualification for extended diversion time operations are submitted to the State of the Operator and, where applicable, to the State of Registry before such changes are adopted;
- c) a reliability monitoring and reporting programme is developed and implemented prior to approval and continued after approval;
- d) prompt implementation of required modifications and inspections which could affect propulsion system reliability is undertaken;
- e) procedures are established which prevent an aeroplane from being dispatched for an extended diversion time operation after engine shutdown or EDTO significant system failure on a previous flight until the cause of such failure has been positively identified and the necessary corrective action has been completed. Confirmation that such corrective action has been effective may, in some cases, require the successful completion of a subsequent flight prior to dispatch on an extended diversion time operation;
- f) a procedure is established to ensure that the airborne equipment will continue to be maintained at the level of performance and reliability required for extended diversion time operations; and
- g) a procedure is established to minimize scheduled or unscheduled maintenance during the same maintenance visit on more than one parallel or similar EDTO significant system. Minimization can be accomplished by staggering maintenance tasks, performing and/or supervising maintenance by a different technician, or verifying maintenance correction actions prior to the aeroplane entering an EDTO threshold.

Note.— The maintenance considerations applicable to extended diversion time operations are

provided in the Airworthiness Manual (Doc 9760).

3.3.12 Examples

3.3.12.1 In establishing the appropriate threshold and approved maximum diversion time for the operator with a particular aeroplane type, the State of the Operator should consider, but not be limited to, the following: the airworthiness certification of the aeroplane, the operator's experience in conducting operations beyond the 60-minute threshold, flight deck crew experience in conducting such operations, the maturity of that operator's flight dispatch system, the communication capability with the operator's operational control centre (ACARS, SATCOM, HF, etc.), the robustness of both the operator's standard operating procedures and the familiarity of the crews with those procedures, the maturity of the operator's safety management system, the crew training programme and the reliability of the propulsion system. The following examples are based on these considerations and are taken from actual State requirements:

- a) State A: State A has established the threshold time at 60 minutes based on the capability of the operator and the aeroplane type for a twin-engined aeroplane and has approved a maximum diversion time of 180 minutes. That operator will need to have specific approval to be further than 60 minutes to an en-route alternate aerodrome (calculated in ISA and still-air conditions at the one-engine-inoperative cruise speed), remain within 180 minutes to an en-route alternate aerodrome and meet the requirements in Annex 6 Part I Chapter 4, 4.7.1 to 4.7.2.6. If that operator, with the particular aeroplane type, plans a route within the threshold time established by the State of the Operator (in the above example this is 60 minutes) to an en-route alternate aerodrome, that operator, by definition, would not be conducting an extended diversion time operation and thus would not need to meet any of the provisions in Annex 6 Part I Chapter 4, 4.7.
- b) State B: State B has established the threshold time at 90 minutes based on the capability of the operator and the aeroplane type for a twin-engined aeroplane and has approved a maximum diversion time of 180 minutes. That operator will need to have specific approval to be further than 90 minutes to an en-route alternate aerodrome (calculated in ISA and still-air conditions at the one-engine-inoperative cruise speed), remain within 180 minutes to an en-route alternate aerodrome and meet the requirements in Annex 6 Part I Chapter 4, 4.7.1 to 4.7.2.6. If that operator, with the particular aeroplane type, plans a route within the threshold time established by the State of the Operator (in the above example this is 90 minutes) to an en-route alternate aerodrome, that operator would not require any additional approval from the State of the Operator and would need only to comply with the requirements in Annex 6 Part I Chapter 4, 4.7.1, and in particular 4.7.1.1 b).
- c) The same State B: The same State B is approached by the operator who is in the process of expansion, having acquired twin-engined aeroplanes capable of EDTO. The operator

submits an application to amend its AOC to include this new aeroplane type on newly granted routes. These routes take the flight beyond 60 minutes to an en-route alternate, thus requiring the establishment of a threshold time and approval of a maximum diversion time. Taking into account:

- 1) that the operator has not had previous experience with the routes and area of operation;
- 2) the new aeroplane type;
- 3) the inexperience of the company and its flight operations/operations control department at planning and dispatching such flights; and
- 4) the new operating procedures to be established,

State B determines that the threshold time for this operator should be limited to 60 minutes and approves a maximum diversion time of 120 minutes.

As this operator gains experience with the operation and the procedures over time, the State may amend the initially established threshold time and approved maximum diversion time.

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