AC 98-8-1(Rev 0)
17 September 2018

Civil Aviation Authority of Singapore

Advisory Circular

EXTENDED DIVERSION TIME OPERATIONS (EDTO)

GENERAL
Advisory Circulars (ACs) are issued by the Director-General of Civil Aviation (DGCA) from time to time to provide practical guidance or certainty in respect of the statutory requirements for aviation safety. ACs contain information about standards, practices and procedures acceptable to CAAS. An AC may be used, in accordance with section 3C of the Air Navigation Act (Cap. 6) (ANA), to demonstrate compliance with a statutory requirement. The revision number of the AC is indicated in parenthesis in the suffix of the AC number.

PURPOSE
This AC provides guidance to demonstrate compliance with the requirements regarding, and information related to an application for, an approval for EDTO in accordance with ANR-98.

APPLICABILITY
This AC is applicable to the operator seeking an approval to conduct EDTO.

RELATED REGULATIONS
This AC relates specifically to Division 8 in Part 2, and the Third Schedule, of ANR-98.

RELATED ADVISORY CIRCULARS
- AC 98-1-1 Application for an Approval to Conduct a Special Operation

CANCELLATION
This is the first AC issued on this subject.

EFFECTIVE DATE
This AC is effective from 1 October 2018.

OTHER REFERENCES

- ICAO Annex 6 Part I Attachment C Guidance for operations by turbine-engined aeroplanes beyond 60 minutes to an en-route alternate aerodrome including extended diversion time operations (ETDO)
- FAA AC 120-42B Extended Operations (ETOPS and Polar Operations)
- EASA AMC 20-6 Extended range operation with two-engine Aeroplanes ETOPS certification and operation

DEFINITIONS

Where the following terms are used in this AC, they have the meaning indicated:

Aeroplane system - An aeroplane 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 related aeroplane equipment such as that required to supply power for the equipment operation. As used herein the power-unit is not considered to be an aeroplane system.

ETOPS (or extended range twin-engine operations) – an alternative term to EDTO when used in the context of twin-engine aeroplanes in this AC and some documents.

Propulsion system - A system consisting of an engine and all other equipment utilised to provide those functions necessary to sustain, monitor and control the power/thrust output of any one engine following installation on the airframe.

1 BASIC CONCEPT

1.1 Threshold Time

The threshold time is not an aircraft operating limit but one of the criteria to safeguard overall level of safety for turbine-powered commercial air transport aeroplanes flying long distances away from adequate en-route alternate aerodromes. An operation where the aeroplane flies beyond this threshold time is referred to as EDTO operation and will need to be approved. As specified in ANR-121, the threshold time is –

(a) in respect of an aeroplane with 2 turbine engines, 60 minutes; or

(b) in respect of an aeroplane with more than 2 turbine engines, 180 minutes.

1.2 Maximum Diversion Time

As defined in ANR-121, maximum diversion time is the maximum allowable range specified in an EDTO operational approval, expressed in time, from a point on a route to an en-route alternate aerodrome.

2 OPERATIONAL APPROVAL

2.1 Notification of plan for EDTO

2.1.1 In view of the complexity of this subject which requires heavy investment in manpower resources, operators plans to operate in EDTO environment are advised to notify CAAS as soon as possible.

2.1.2 Subject to completeness and timeliness of the application, the evaluation of a standard EDTO application requires at least three months while that of an Accelerated/Early or EIS EDTO may take six months or more.

2.2 In evaluating an application for EDTO (or a variation to increase an approved maximum diversion time), besides the requirements in Division 8 of ANR-98 and set forth in this AC, CAAS would also take the following into consideration:

(a) the operator's past experience and compliance record is satisfactory;

(b) the operator has demonstrated that the flight can continue to a safe landing under the anticipated degraded operating conditions which would arise from situations such as:

(i) total loss of thrust from a critical engine; or

(ii) total loss of engine generated electric power; and

(iii) any other condition which CAAS considers to be equivalent in airworthiness and performance risk; and

(c) specific mitigation measures that the operator may take, following the safety risk assessment (required under Regulation 5(2)(a)(ii) of ANR-98).

2.3 Eligibility and eligibility progression for EDTO for an aeroplane with 2 turbine engines (ETOPS)

2.3.1 CAAS would consider an application for ETOPS operational approval with following maximum diversion times after the operator has acquired the respective operating experience:

(a) ETOPS with 120 minutes maximum diversion time (120-minute ETOPS) – after 12 months of operating experience on the same airframe/engine combination at 60 minutes diversion time.

(b) ETOPS with 180 minutes maximum diversion time – after 12 months of operating experience on the same airframe/engine combination under a 120-minute ETOPS operation approval.

2.3.2 For 120-minute ETOPS, CAAS may grant, subject to special considerations, extension to the maximum diversion time of up to 138 minutes (additional 15% of 120 minutes).

2.3.3 CAAS may consider granting ETOPS Operational Approval of up to 207 minutes (additional 15% of 180 minutes) maximum diversion time on a case-by-case basis provided that the operator complies with the 207 minute requirements promulgated in Appendix 2 of FAA AC 120-42B.

2.4 Accelerated/Early and EIS (entry into service) EDTO

2.4.1 "Accelerated EDTO" and "Early EDTO" are terms for EDTO eligibility without going through the qualifying time progression as promulgated in paragraph 2.3, while "EIS EDTO" is EDTO eligibility at launch of the airframe/engine type

2.4.2 A matured operator with proven good track record and sound infra-structural supports for EDTO operation may apply to CAAS for Accelerated/Early or EIS EDTO citing such supports as international best practices satisfactory risk assessment including assessment of human performance limitations.

3 EDTO OPERATIONAL CONSIDERATIONS

3.1 To maintain the required level of safety for EDTO operations, it is necessary that:

(a) the airworthiness certification of the aeroplane type, taking into account the aeroplane system design and reliability aspects, specifically permits operations beyond the threshold time;

(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; and

(e) necessary in-flight operational procedures are established.

4 AIRWORTHINESS CERTIFICATION

4.1 The operator must show that the design features of the particular airframe/engine combination are suitable for the intended EDTO operations. Evidence that the type design of an aeroplane with two turbine engines is approved for EDTO is normally reflected in the Aircraft Flight Manual (AFM) and Type Certificate Data Sheet (TCDS) or Supplement Type Certificate (STC), which contains directly or by reference the following information as applicable:

(a) special limitations (if necessary), including any limitations associated with a maximum diversion time and time limited systems (e.g. the endurance of cargo fire suppression system);

(b) additional markings or placards (if required);

(c) reference to the performance section;

(d) specific airborne equipment, installation and flight crew procedures required for EDTO operations;

(e) description or reference to a document containing the approved aeroplane configuration, maintenance and procedures (CMP) standards.

4.2 Although EDTO certification is not required for aeroplane with more than two engines, a review of the time capabilities of the relevant EDTO time limited systems should be performed to adequately consider the relevant time capabilities during EDTO operations. On most aeroplanes with more than two engines, the only relevant time limited system is the cargo fire suppression system.

5 AIRWORTHINESS REQUIREMENTS

5.1 The operator should pay special attention to ensuring 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 essential systems.

5.2 Information or procedures specifically related to EDTO operations should be incorporated into the aeroplane flight manual, maintenance manual or other appropriate document.

5.3 For ETOPS, the maintenance programme required in the Third Schedule of ANR-98 may be the continuing airworthiness maintenance schedule approved by the DGCA. The operator should review the schedule to ensure that it provides an adequate basis for development of ETOPS maintenance requirements.

5.4 The operator is required to implement procedures to prevent identical action being applied to multiple similar elements. This may be achieved, if other procedural measures are not possible, by having the identical action being performed by different maintenance personnel or teams.

5.5 As part of an APU in-flight start programme, where required by paragraph 6 of the Third Schedule of ANR-98, the operator should perform an APU in-flight start once every three months for each aircraft of its EDTO fleet. The result of the in-flight start shall be annotated in the Technical Log of the aircraft.

6 PROPULSION SYSTEM MATURITY AND RELIABILITY

6.1 The basic elements for EDTO operational approval are the maturity and reliability of the propulsion system. These should be such that the risk of complete loss of power from independent causes is extremely remote.

6.2 The only way to assess the maturity of the propulsion system and its reliability in service is to exercise engineering judgement, taking account of the worldwide experience with the engine.

6.3 For a propulsion system whose reliability has already been assessed, CAAS will evaluate the ability of the operator to maintain that level of reliability, taking into account the operator's record of reliability vis-à-vis engines of closely related types.

6.4 The engine/APU oil consumption monitoring programme (required in the Third Schedule of ANR-98) is part of the overall need to monitor engine reliability. For the purpose of monitoring the oil consumption, the operator should account for the amount of oil added at the departing ETOPS stations with reference to the running average consumption, i.e. monitoring should be continuous up to and including oil added at the ETOPS departure station. If appropriate, oil analysis should be included in the programme.

6.5 For purpose of monitoring the engine condition (required in the Third Schedule of ANR-98), the assessment of IFSD rate should include monitoring the following matters on a 12-month moving average basis –

(a) engine hours flown in the period;
(b) all causes for IFSD; and
(c) engine removal.

6.6 When the IFSD rate exceeds the limits in paragraph 6.7, the operator should –

(a) notify CAAS as soon as possible; and
(b) conduct an immediate evaluation to ascertain the causes of the IFSD rate; and
(c) take such corrective action or restrict its operations as CAAS may advise.

6.7 Unless otherwise specified by CAAS as part of the approval, the relevant IFSD rate is —

(a) 0.05 per 1000 engine hours for 120-minute ETOPS;
(b) 0.03 per 1000 engine hours for ETOPS maximum diversion time of more than 120 minutes but up to 180 minutes; or
(c) 0.02 per 1000 engine hours for ETOPS maximum diversion time of more than 180 minutes.

7 FLIGHT DISPATCH REQUIREMENTS

7.1 In applying the general flight dispatch requirements, particular attention should be paid to the conditions which might prevail during EDTO operations, e.g. extended flight with one engine inoperative, major systems degradation, reduced flight altitude, etc. For compliance with the requirements, the operator must ensure that at least the following aspects are satisfied during flight dispatch:

(a) required en-route alternate aerodromes are identified;

(b) prior to departure, the flight crew has been 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 have been established to enable two-way communications between the aeroplane and the operator's operational control centre;

(d) a means has been established to monitor conditions along the planned route including the identified alternate aerodromes and that procedures are in place for the flight crew to be advised of any situation that may affect safety of flight;

(e) the intended route does not exceed the approved maximum diversion time;

(f) aircraft systems, including the relevant items in the minimum equipment list, are serviceable pre-flight;

(g) communication (such as SATCOM), and navigation facilities and capabilities, are available;

(h) fuel requirements are met; and

(i) relevant performance information for the identified en-route alternate aerodrome(s) are available.

8 OPERATIONAL AND DIVERSION PLANNING PRINCIPLES

8.1 When planning or conducting EDTO, 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 or aeroplane performance are appropriately considered.

(b) In the event of an aeroplane engine shutdown, the aeroplane 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

(c) In the event of a single or multiple failure of an EDTO significant system or systems (excluding engine failure), the aeroplane 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.