



GOVERNMENT OF INDIA
OFFICE OF THE DIRECTOR GENERAL OF CIVIL AVIATION
TECHNICAL CENTRE, OPP SAFDURJUNG AIRPORT, NEW DELHI

CIVIL AVIATION REQUIREMENTS
SECTION 2 - AIRWORTHINESS
SERIES 'O' PART VIII
ISSUE I, DATED 11TH AUGUST, 1999

EFFECTIVE: FORTHWITH

SUBJECT: **AIRWORTHINESS, MAINTENANCE AND OPERATIONAL REQUIREMENTS
FOR EXTENDED RANGE OPERATIONS WITH TWIN ENGINE AEROPLANES
FOR COMMERCIAL AIR TRANSPORT OPERATIONS.**

1. INTRODUCTION:

This Civil Aviation Requirements provides requirements for obtaining DGCA approval for twin engine aeroplanes to operate over a route that contains a point farther than one hour flying time at the normal one-engine inoperative cruise speed (in still air) from an adequate airport. Extended Twin Engine Operations (ETOPS) requirements are applicable to routes over water as well as remote areas over land. The purpose of ETOPS is to provide very high level of safety while facilitating the use of twin engines on routes, which were previously restricted to three or four engine aircraft. ETOPS operation also permits more effective use of an airline resource.

This part of the CAR is being issued under the provision of rule 133A of the Aircraft Rules 1937 and lays down the procedures and the requirement for ETOPS approval which is complimentary to the requirements of FAA Advisory Circular No. AC120-42A and JAR information leaflet No. 20 for such operations.

2. APPLICABILITY:

This CAR lays down the minimum requirements for turbo propeller, turbojet and turbofan aeroplanes transiting oceanic areas or routes entirely over land, registered in India, and **engaged in Commercial Air Transport Operations**. Operators cannot operate a twin engine aircraft of AUW more than 5700 kg beyond 60 minutes on single engine inoperative cruise speed unless approved by DGCA for ETOPS. The segment of operation beyond 60 minutes will be termed as Extended Twin Engine Operation (ETOP) and this will require prior approval of DGCA. This is identical to Extended Range operations (EROPS)

To be eligible for extended range operations the specified airframe/engine combination should have been certificated to the Airworthiness Standards of Transport Category aeroplanes by FAA of USA or JAA or by any other regulatory authority acceptable to DGCA

3. DEFINITIONS:

3.1 Adequate airport:

Adequate airport is an airport meeting the safety requirements for takeoff and landing for commercial and non-commercial operations. It should be anticipated that at the expected time of use:

- (a) The aerodrome will be compatible with the performance requirements for the expected landing weight and will be available and equipped with necessary ancillary services such as ATC, sufficient lighting, communications, weather reporting, navigation aids, refueling and emergency services and
- (b) at least one let down aid (ground radar would so qualify) will be available for an Instrument approach.

3.2 Suitable airport

Suitable airport is an adequate airport with weather reports or forecast or any combination thereof indicating that the weather conditions are at or above operating minima as specified in the operations specification and the field condition report indicates that a safe landing can be accomplished at the time of the intended operations.

3.3 Diversion/ Enroute alternate airport

Diversion/ Enroute alternate airport means an airport at which an aircraft may land if a landing at the intended airport is inadvisable. The aerodrome will be available and equipped with necessary ancillary services such as ATC, sufficient lighting, communications, weather reporting, navigation aids, emergency services etc.

3.4 Auxiliary Power Unit (APU):

A gas turbine engine intended for use as a power source for driving generators, hydraulic pumps and other aeroplane accessories, equipment and/or to provide compressed air for aeroplane pneumatic system.

3.5 Extended Range Operation:

Extended Range Operations are those flights conducted over a route that contains a point farther than one hour flying time at the approved one engine inoperative cruise speed (under standard conditions in still air) from an adequate airport.

3.6 Extended Range entry Point:

The extended range entry point is the point on the aeroplanes out bound route which is one-hour flying time at the approved single engine inoperative cruise speed (under standard conditions in still air) from an adequate airport.

3.7 ETOPS Segment:

ETOPS segment starts at the ETOPS entry point and finishes when the flight path is back and remains within 60-minute area from an adequate airport.

3.8 In - Flight Shutdown (IFSD):

When an engine ceases to function in flight and is shutdown, whether self-induced, crew initiated or caused by some other external influence (i.e. IFSD for all cases; for example due to flameout, internal failure, crew initiated shutoff, foreign object ingestion, icing, inability to obtain and/or control desired thrust etc.).

3.9 Propulsion System:

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

3.10 ETOPS Configuration, Maintenance and Procedures (CMP) Standard:

The particular aeroplane configuration minimum requirements including any special inspection, hardware life limits, master minimum equipment list constraints and maintenance practices found necessary to establish the suitability of an airframe engine combination for an extended range operation.

3.11 Maximum Diversion time:

The maximum diversion time is the maximum flying time authorised from any point of the route to the nearest adequate airport for landing.

4. ETOPS RANGE CATEGORIES AND REQUIREMENTS:

The Extended Range Operations are covered under categories viz. 75 minutes, 120 minutes and 180-minutes diversion time (the approval to operate may be extended in steps of 15 minutes), as explained below:

a) 75 minute operation:

Approval to carry out extended range operation with 75 minutes diversion time may be granted by DGCA to an operator with minimal or no in-service experience with particular airframe engine combination. This approval will be based on such factors as the proposed areas of operation, the operators demonstrated ability to successfully introduce aircraft into operation, and the quality of the proposed maintenance and operation program. Special case by case operational approval may be granted beyond 75 minutes diversion time (in steps of 15 minutes) with limited evaluation of service experience at the time of the application. For this approval, the service experience of Airframe –engine combination may be less than 2,50,000 hours in the world fleet.

b) Up to 120-minute operation:

Each operator requesting approval to conduct extended range operations with a maximum diversion time of 120 minutes (in still air) should have minimum of 12 consecutive months of operational in service experience with the specified airframe engine combination.

Normally the accumulation of at least 2,50,000 engine hours in the world fleet (not necessarily on a particular airframe) will be necessary before the proposal is considered. Where the engine experience on another type of aeroplane is applicable to the candidate aeroplane, the candidate aeroplane should normally obtain a significant portion of the 2,50,000-engine hrs experience. This number of engine hours maybe reduced if sufficient data is available to prove reliability of the engine. In the event that a particular engine is derived from an existing engine the required operational experience is subject to establishing the degree of hardware commonalties and operating similarities.

c) Above 120 minute and upto 180 minutes operation:

Each operator requesting approval for maximum diversion time of 180 minutes (in still air) should have held current approval for 120 minutes ETOPS for a minimum period of 12 months with a corresponding high level of demonstrated propulsion system reliability.

5. PROPULSION SYSTEM MONITORING

The operator should establish firm criteria as to what action has to be taken when adverse trend in propulsion system conditions are detected. When the propulsion system IFSD (computed on 12 month rolling average) exceeds 0.05/1000 engine hours for a 120 minute operation or exceeds 0.02/1000 engine hours for a 180 minutes operation, an immediate evaluation should be accomplished and a report on problems identified and corrective action taken must be forwarded to DGCA to consider additional corrective action or operational restriction. Further the operator should compile necessary data on propulsion system reliability which should include

- a) A list of all engine shutdown events both on ground and in flight (excluding normal training events) for all causes including flame out.
- b) Unscheduled engine removal rate and summary
- c) Total engine hours and cycles.
- d) Mean time between failures of propulsion system components that affect reliability.
- e) IFSD rate based on 6 and 12 months rolling average.
- f) Any other relevant data.

6 ETOPS APPROVAL:

6.1 Procedure for seeking approval for ETOPS

Any operator requesting approval for extended range operations with twin engine aeroplanes should submit the request with the supporting data to the Regional Airworthiness office of DGCA at least three months prior to the proposed start of extended range operation with the specific airframe/engine combination. Each operator requesting approval to conduct extended range operations should have operational in service experience as given in para 4 appropriate to the operation proposed. This data shall include the details of compliance of modifications, additions and changes in the maintenance practices, which were made to qualify the aeroplane system for ETOPS operations. It should also 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. The operator must obtain sufficient maintenance and operations

familiarity with the particular airframe engine combination in question before seeking approval.

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

Extended Range Operations approval of an aeroplane by the manufacturer/Regulatory Authority of the country of manufacture is normally reflected by a statement in the approved Aeroplane Flight Manual (AFM) / Type Certificate Data Sheet (TDS) or Supplemental Type Certificate (STC), which specifies the Configuration, Maintenance and Procedures (CMP) Standard requirements for suitability. The CMP standards shall be of latest revision. The standards and its revisions may require priority actions to be implemented before the next ETOP flight and other actions to be implemented according to a schedule acceptable to DGCA.

Operators inservice experience may be reduced or increased based on evaluation of the operator's ability and competence to achieve the necessary reliability for the particular airframe engine combination for extended range operations. For example, a reduction in inservice experience may be considered for an operator who can show extensive inservice experience with a related engine on another aeroplane, which has achieved acceptable reliability. In contrast an increase in inservice experience may be considered for those cases where heavy maintenance is yet to occur and/or abnormally low number of takeoffs have occurred.

6.2 Application for approval:

An applicant seeking approval for ETOPS shall submit the proposal on the prescribed application given in Annexure 'A'.

The operator should further furnish details of the procedure/instructions and methodology for continued capability to adhere to conditions laid down at the time of grant of approval in a separate ETOPS Manual for use by personnel involved in ETOPS, which may form part of the Quality Control Manual. Any amendment to the ETOPS manual requires DGCA approval.

6.3 Contents of the ETOPS manual:

ETOPS Manual should include procedures and guidelines for the maintenance program and other requirements for extended range operations. In addition, all ETOPS requirements, including supportive programs, procedures, duties and responsibilities including actions to be taken in case of adverse trend, including IFSD rate, reliability level etc. should be identified and documented. This manual should be submitted two months in advance to the Regional Airworthiness office before seeking approval of ETOPS flight.

The operator should lay special emphasis on the following program: -

- (i) Oil Consumption program: The operators oil consumption program should reflect manufacturer recommendations and be sensitive to oil consumption trends. It should consider the amount of oil added at the departing ETOPS stations with reference to the

running average consumption i.e the monitoring must be continuous upto and including oil added at the ETOPS departure stations. Routine quality control checks and SOAP check where applicable to this make and model should be included in the program. If the APU is required for ETOPS operation it should be added to the oil consumption program

- (ii) Engine Condition Monitoring: This program should describe the parameters to be monitored, method of data collection and corrective action process. This monitoring shall be used to detect deterioration at an early stage to allow for corrective action before safe operation is affected. This program should ensure that engine limit margins are maintained so that a prolonged single engine diversion may be conducted without exceeding approved engine limits at all approved power levels and expected environmental conditions.
- (iii) Reliability Program: An ETOPS reliability program shall be developed by the operator or the existing reliability program supplemented. This program should be designed for early identification and prevention of ETOPS related problems as the primary goal. This program should be event oriented and incorporate reporting and rectification procedures for significant events detrimental to ETOPS flight. This information should be readily available for use by the operator and DGCA to help establish that the reliability level is adequate and to assess the operators competence and capability to safely continue ETOPS. The operator shall intimate the office of DGCA within 48 hours the following reportable events :-
 - a) In flight shut downs.
 - b) Diversion or turn back.
 - c) Uncommented power changes or surges.
 - d) Inability to control the engine or obtain desired power.
 - e) Problems with systems critical to ETOPS.
 - f) Any other event detrimental to ETOPS.

The report should identify the following :-

- a) The aircraft identification including make and serial number.
 - b) Engine identification make and serial number.
 - c) Total time, cycles and time since last shop visit.
 - d) For systems, time since overhaul or last inspection of the defective unit.
 - e) Phase of flight
 - f) Corrective action
- (iv) The APU installation, if required, for extended range operations, should meet all the requirements necessary to demonstrate its ability to perform the intended functions and if certain extended range operation necessitate in flight start and run of the APU after prolonged cold soaking, it must be substantiated that the APU has adequate reliability for that operation.
- (v) Propulsion System Monitoring: The operator shall lay down actions to be taken when adverse trends in propulsion system conditions are detected. When the IFSD exceeds

0.05/1000 engine hours for 120-min operation or exceeds 0.02/1000 engine hours for a 180-minute operation, an immediate evaluation shall be accomplished with the problem identified and corrective action taken. Regional Airworthiness Office of DGCA shall be provided with information in this regard.

- (vi) Maintenance Training: The operator should evolve a maintenance-training program for all the maintenance engineers engaged in the maintenance of aircraft approved for ETOPS focussing on the special nature of ETOPS. This program shall be included in the normal maintenance-training program. The object of this program is to ensure that all personnel involved in ETOPS are provided with the necessary training on the special nature of ETOPS maintenance requirements.
- (vii) ETOPS Parts Control Program: The operator shall evolve a program that ensures that proper parts and configuration are maintained for satisfactory ETOPS operation while borrowing / procuring/ pooling parts. The programme. should also cover those parts used during repair or overhaul to maintain the necessary ETOPS configuration
- (viii) Aircraft Performance Monitoring: The continued airworthiness Program mentioned in para 7 should cover Aircraft Performance Monitoring to assess any degradation in the aircraft performance. This monitoring programme should form part of ETOPS manual.
- (ix) Sub-Contract Maintenance:- When maintenance is sub-contracted, the operator must ensure that
 - a) The maintenance personnel of the sub-contractor involved are qualified for ETOPS.
 - b) All airworthiness flight dispatch procedures and additional maintenance requirements as identified in the operators maintenance system manual is complied with.

7 Continued Airworthiness Program

- 7.1 Operators intending to carry out extended range operations should have the ability to maintain aeroplane in a continuous state of airworthiness and adhere to the well-defined programmes and procedures.
- 7.2 The basic maintenance program for the aeroplane being considered for ETOPS is the continuous airworthiness maintenance program currently approved for that operator. This will cover the particular model airframe engine combination.
- 7.3 The Continued Airworthiness program should contain the standards, guidance and direction necessary to support the intended operations. The maintenance personnel involved in effecting this program should be made aware of the special nature of ETOPS and have the knowledge, skills and ability to accomplish the requirement of the program. ETOPS maintenance requirements will be approved as supplemental requirements. The operator should adhere to a policy of avoiding maintenance by the same maintenance staff on both units of a dual system or on similar system which are critical to ETOPS operation, such as engines during a single maintenance visit. (e.g. fuel control change on both engines.)

However at outstations a single maintenance crew action may be verified by suitable ground tests including BITE tests , functional checks or operational checks etc

- 7.4 ETOPS related tasks should be identified on the operators routine work procedures and related instructions.
- 7.5 The operator should develop ETOPS maintenance checks to ensure that the status of the aeroplane and critical items related to ETOPS operations are acceptable. This check should be accomplished and certified by an ETOPS qualified maintenance person prior to an ETOPS flight.
- 7.6 The operator shall develop a program for prompt implementation of modifications and inspections, which could affect propulsion system reliability.
- 7.7 Minimum Equipment List (MEL): The operators should develop MEL exclusively for ETOPS operations which may be more restrictive than MMEL considering the nature of operation proposed and service problems that may be encountered and unique to the operator.
- 7.8 Flight Report Books should be reviewed and documented as appropriate to ensure proper MEL procedures deferred items, maintenance checks and that system verification procedure has been properly performed.
- 7.9 A separate defect report should be submitted to the DGCA on all defects experienced on ETOPS sectors.
- 7.10 Procedure to be established to ensure that the airborne equipment will continue to be maintained at the level of performance and reliability required for extended range operations.

8 OPERATIONS SPECIFICATIONS:

An operator's twin engine aircraft should not be operated on an extended range flight unless approved by DGCA for both maintenance and operations and endorsed on the Air Operators Certificate /operating permit or an equivalent document as part of the operations specifications. The operators shall, therefore, evolve an Operations Specification for Extended Range operations, which should cover at least the following before seeking approval: -

- a) Should define particular airframe-engine combination including the current approved CMP standard required for extended range operations.
- b) Authorised area of operation and minimum altitude to be flown along the planned and diversionary route.
- c) Maximum diversion time at the approved one engine cruise speed.
- d) Airports authorised for use including alternates and associated instrument approaches and operating minima.

- e) Procedure to preclude an aeroplane being dispatched for Extended Range operation after propulsion system shut down, engine/major engine module change or primary airframe system failure etc on a previous flight without appropriate corrective action having been taken. The operator shall develop verification program or procedure to ensure corrective action following an engine shut down, primary system failure, or any prescribed events, which require a verification flight or other action. Such a case requires aircraft to undergo verification flight of either non-revenue or revenue but non-ETOP flight before releasing for extended range operations. This verification flight can be combined with regular ETOP revenue flight provided verification phase is documented as satisfactorily completed upon reaching the ETOP entry point.

9 CREW TRAINING AND EVALUATION

- 9.1** Operator shall evolve a training program for the flight crew covering initial and recurrent training. This training should cover various aspects including standby generator as the sole power source. Established contingency procedures should be emphasised for each area of operation intended to be used. In addition, special, initial and recurrent training should be given to prepare flight crews to evaluate probable engine and airframe system failures. The object of this training should be to establish crew competency in dealing with most probable operating contingency (diversion decision making).
- 9.2** The training should also cover proficiency check in performance like flight planning, procedure on diversion, abnormal and emergency procedures, air start of propulsion system, crew incapacitation etc.
- 9.3** The flight crew-training programme shall be submitted to the Flight Inspection Directorate (FID) of DGCA for approval. The training and checks of the crew shall be carried out as approved by the FID.

10 DISPATCH CONSIDERATIONS:

While dispatching the aeroplane for Extended Range operations the following factors apart from airworthiness aspects may be considered:

- a) System redundancy levels appropriate to extended range operations should be as specified in the MEL.
- b) At normal conditions of propagation and normal one engine inoperative cruise altitude, reliable two-way voice communications between aeroplane and appropriate ATC unit over the planned route should be available.
- c) Non visual ground navigation aids should be available for the planned route and alternate flight path. Visual and non-visual aids should be available at the specified and alternate airports for the authorised types of approaches and operations minima.
- d) Should have fuel reserve necessary to fly to the most critical point and execute a diversion to a suitable alternate airport under various operating conditions.

- e) Required take-off destination and alternate airports to be used in the event of engine or other mechanical failure to be identified and reflected in the related documents.
- f) Operations manual should contain sufficient data to support the critical fuel reserves and area of operation and calculations considering the drift down condition and cruise altitude coverage etc.,
- g) Operational limitations like route of operation, maximum diversion time, minimum altitude to be flown ,airports authorised for use etc.,
- h) An operator should substantiate that the weather information system which it utilises can be relied upon to forecast terminal and enroute weather with a reasonable degree of accuracy and reliability in the proposed area of operation.

11 AEROPLANE FLIGHT MANUAL INFORMATION

Operators holding ETOPS approval shall ensure that the applicable flight manual contain at least the following information

- a) The maximum flight time with one power-unit inoperative, for which the systems reliability has been approved in accordance with the airworthiness requirements established for extended range operations;
- b) A list of additional equipment installed to meet the airworthiness requirements for extended range operations.
- c) Additional performance data, including limitations, and flight procedures appropriate to extended range operations; and
- d) Statement to the effect that the aeroplane systems associated with extended range operations meet the required airworthiness and performance criteria but that the meeting of such criteria does not by itself constitute approval to conduct extended range operations.

12 OPERATIONS APPROVAL

The operator shall demonstrate to DGCA using the specified airframe engine combination that the flight can continue to a safe landing under anticipated degraded operating conditions, which could arise from:

- a) total loss of thrust from one engine; or
- b) total loss of engine generated electric power ;or
- c) any other condition which DGCA considers to be equivalent in airworthiness and performance risks.
- d) the operators crew training programme is adequate for the proposed operation and

- e) the documentation accompanying the approval covers all relevant aspects
- f) it has the competence and capability to safely conduct and adequately support the extended range operation.

When the operational validation flight has been evaluated and found acceptable then the operator may be authorised to conduct Extended Range operations with the specified airframe engine combinations. Approval to conduct ETOPS is made by the issuance of operation specification by the DGCA containing appropriate limitations

13. CONTINUING SURVEILLANCE

The fleet average IFSD rate for the specified airframe engine combination shall continue to be monitored in accordance with propulsion system reliability assessment and ETOPS maintenance requirements. As with all other operations the Regional Airworthiness office will also monitor all aspects of the extended range operations. The DGCA is authorised to ensure that the operation continues to be conducted safely. In the event that an acceptable level of reliability is not maintained, significant adverse trend exists or if significant deficiencies are detected in the conduct of ETOPS operation, the Regional Airworthiness Office will initiate a special evaluation, impose operational restriction if necessary, to resolve the problem in a timely manner so as to ensure safe ETOPS operations.

Sd/-
(N Ramesh)
Dy. Director General of Civil Aviation

Annexure 'A'

**GOVERNMENT OF INDIA
OFFICE OF THE DIRECTOR GENERAL OF CIVIL AVIATION**

APPLICATION FOR GRANT OF APPROVAL FOR EXTENDED RANGE OPERATIONS

1. Name of the operator:
2. Aircraft registration number:
3. Type and Serial Number of the Aircraft:
4. Type and model of the Engines fitted:
5. Route of operation, Maximum diversion time, Minimum altitude to be flown:
6. Diversion/ En route alternate airport desired:
7. Copy of the ETOPS Manual:
8. Details of Crew Training:
9. Applicants in service operational experience:
10. Total engine hours of the type in the world fleet:
11. Proof of propulsion system reliability in the world fleet:
12. Propulsion system reliability of the applicant in terms of IFSD:
13. Maximum diversion time certified by the manufacture for the applicants aircraft:
14. Any other additional data as required in the CAR:

Date

Signature of the operator