

4.3.4.1 Take-off alternate aerodrome
4.3.4.1.1
A take-off alternate aerodrome shall be selected and specified in the operational flight plan if either the meteorological conditions at the aerodrome of departure are below the operator's established aerodrome landing minima for that operation or if it would not be possible to return to the aerodrome of departure for other reasons.
4.3.4.1.2
The take-off alternate aerodrome shall be located within the following flight time from the aerodrome of departure: a) for aeroplanes with two engines, one hour of flight time at a one-engine-inoperative cruise speed determined from the aircraft operating manual, calculated in ISA and still-air conditions using the actual take-off mass; or b) for aeroplanes with three or more engines, two hours of flight time at an all-engine operating cruising speed, determined from the aircraft operating manual, calculated in ISA and still-air conditions using the actual take-off mass; or c) for aeroplanes engaged in extended diversion time operations (EDTO) where an alternate aerodrome meeting the distance criteria of a) or b) is not available, the first available alternate aerodrome located within the distance of the operator's approved maximum diversion time considering the actual take-off mass.
4.3.4.1.3
For an aerodrome to be selected as a take-off alternate the available information shall indicate that, at the estimated time of use, the conditions will be at or above the operator's established aerodrome operating minima for that operation.
4.3.4.2 En-route alternate aerodromes
En-route alternate aerodromes, required by 4.7 for extended diversion time operations by aeroplanes with two turbine power-units, shall be selected and specified in the operational and air traffic services (ATS) flight plans.
4.3.4.3 Destination alternate aerodromes
4.3.4.3.1
For a flight to be conducted in accordance with the instrument flight rules, at least one destination alternate aerodrome shall be selected and specified in the operational and ATS flight plans, unless: a) the duration of the flight from the departure aerodrome, or from the point of in-flight re-planning to the destination aerodrome is such that, taking into account all meteorological conditions and operational information relevant to the flight, at the estimated time of use, a reasonable certainty exists that: 1) the approach and landing may be made under visual meteorological conditions; and 2) separate runways are usable at the estimated time of use of the destination aerodrome with at least one runway having an operational instrument approach procedure; or b) the aerodrome is isolated. Operations into isolated aerodromes do not require the selection of a destination alternate aerodrome(s) and shall be planned in accordance with 4.3.6.3 d) 4); 1) for each flight into an isolated aerodrome a point of no return shall be determined; and

2) a flight to be conducted to an isolated aerodrome shall not be continued past the point of no return unless a current assessment of meteorological conditions, traffic, and other operational conditions indicate that a safe landing can be made at the estimated time of use.

Note 1.— Separate runways are two or more runways at the same aerodrome configured such that if one runway is closed, operations to the other runway(s) can be conducted.

Note 2.— Guidance on planning operations to isolated aerodromes is contained in the Flight

Planning and Fuel Management Manual (Doc 9976).

4.3.4.3.2

Two destination alternate aerodromes shall be selected and specified in the operational and ATS flight plans when, for the destination aerodrome:

- a) meteorological conditions at the estimated time of use will be below the operator's established aerodrome operating minima for that operation; or
- b) meteorological information is not available.

4.3.4.4

Notwithstanding the provisions in 4.3.4.1, 4.3.4.2, and 4.3.4.3; 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 operational variations to alternate aerodrome selection criteria. The specific safety risk assessment shall include at least the:

- a) capabilities of the operator;
- b) overall capability of the aeroplane and its systems;
- c) available aerodrome technologies, capabilities and infrastructure;
- d) quality and reliability of meteorological information;
- e) identified hazards and safety risks associated with each alternate aerodrome variation; and
- f) specific mitigation measures.

Note.— Guidance on performing a safety risk assessment and on determining variations, including examples of variations, are contained in the Flight Planning and Fuel Management Manual (Doc 9976)

and the Safety Management Manual (SMM) (Doc 9859).

4.3.5 Meteorological conditions
4.3.5.1
A flight to be conducted in accordance with the visual flight rules shall not be commenced unless current meteorological reports or a combination of current reports and forecasts indicate that the meteorological conditions along the route or that part of the route to be flown under the visual flight rules will, at the appropriate time, be such as to render compliance with these rules possible.
4.3.5.2
A flight to be conducted in accordance with the instrument flight rules; a) shall not take off from the departure aerodrome unless the meteorological conditions, at the time of use, are at or above the operator's established aerodrome operating minima for that operation; and b) shall not take off or continue beyond the point of in-flight re-planning unless at the aerodrome of intended landing or at each alternate aerodrome to be selected in compliance with 4.3.4, current meteorological reports or a combination of current reports and forecasts indicate that the meteorological conditions will be, at the estimated time of use, at or above the operator's established aerodrome operating minima for that operation.
4.3.5.3
To ensure that an adequate margin of safety is observed in determining whether or not an approach and landing can be safely carried out at each alternate aerodrome, the operator shall specify appropriate incremental values, acceptable to the State of the Operator, for height of cloud base and visibility to be added to the operator's established aerodrome operating minima. <i>Note.— Guidance on the selection of these incremental values is contained in the Flight Planning and Fuel Management Manual (Doc 9976).</i>
4.3.5.4
The State of the Operator shall approve a margin of time established by the operator for the estimated time of use of an aerodrome. <i>Note.— Guidance on establishing an appropriate margin of time for the estimated time of use of an aerodrome is contained in the Flight Planning and Fuel Management Manual (Doc 9976).</i>

4.3.6 Fuel requirements

4.3.6.1

An aeroplane shall carry a sufficient amount of usable fuel, to complete the planned flight safely and to allow for deviations from the planned operation.

4.3.6.2

The amount of usable fuel to be carried shall, as a minimum, be based on:

a) the following data:

- 1) current aeroplane-specific data derived from a fuel consumption monitoring system, if available; or
- 2) if current aeroplane-specific data is not available, data provided by the aeroplane manufacturer; and

b) the operating conditions for the planned flight including:

- 1) anticipated aeroplane mass;
- 2) Notices to Airmen;
- 3) current meteorological reports or a combination of current reports and forecasts;
- 4) air traffic services procedures, restrictions and anticipated delays; and
- 5) the effects of deferred maintenance items and/or configuration deviations.

4.3.6.3

The pre-flight calculation of usable fuel required shall include:

a) *taxi fuel*, which shall be the amount of fuel expected to be consumed before take-off;

b) *trip fuel*, which shall be the amount of fuel required to enable the aeroplane to fly from take-off or the point of in-flight re-planning until landing at the destination aerodrome taking into account

the operating conditions of 4.3.6.2 b);

c) *contingency fuel*, which shall be the amount of fuel required to compensate for unforeseen

factors. It shall be 5 per cent of the planned trip fuel or of the fuel required from the point of in

flight re-planning based on the consumption rate used to plan the trip fuel but in any case shall

not be lower than the amount required to fly for five minutes at holding speed at 450 m (1 500 ft)

above the destination aerodrome in standard conditions;

Note.— Unforeseen factors are those which could have an influence on the fuel consumption to

the destination aerodrome, such as deviations of an individual aeroplane from the expected fuel

consumption data, deviations from forecast meteorological conditions, extended taxi times before

take-off, and deviations from planned routings and/or cruising levels.

d) *destination alternate fuel*, which shall be:

- 1) where a destination alternate aerodrome is required, the amount of fuel required to enable the aeroplane to:

- i) perform a missed approach at the destination aerodrome;

ii) climb to the expected cruising altitude;
iii) fly the expected routing;
iv) descend to the point where the expected approach is initiated; and
v) conduct the approach and landing at the destination alternate aerodrome;
or
2) where two destination alternate aerodromes are required, the amount of fuel, as calculated in 4.3.6.3 d) 1), required to enable the aeroplane to proceed to the destination alternate aerodrome which requires the greater amount of alternate fuel; or
3) where a flight is operated without a destination alternate aerodrome, the amount of fuel required to enable the aeroplane to fly for 15 minutes at holding speed at 450 m (1 500 ft) above destination aerodrome elevation in standard conditions; or
4) where the aerodrome of intended landing is an isolated aerodrome:
i) for a reciprocating engine aeroplane, the amount of fuel required to fly for 45 minutes plus 15 per cent of the flight time planned to be spent at cruising level, including final reserve fuel, or two hours, whichever is less; or
ii) for a turbine engine aeroplane, the amount of fuel required to fly for two hours at normal cruise consumption above the destination aerodrome, including final reserve fuel;
e) *final reserve fuel*, which shall be the amount of fuel calculated using the estimated mass on arrival at the destination alternate aerodrome or the destination aerodrome, when no destination alternate aerodrome is required:
1) for a reciprocating engine aeroplane, the amount of fuel required to fly for 45 minutes, under speed and altitude conditions specified by the State of the Operator; or
2) for a turbine engine aeroplane, the amount of fuel required to fly for 30 minutes at holding speed at 450 m (1 500 ft) above aerodrome elevation in standard conditions;
f) *additional fuel*, which shall be the supplementary amount of fuel required if the minimum fuel calculated in accordance with 4.3.6.3 b), c), d) and e) is not sufficient to:
1) allow the aeroplane to descend as necessary and proceed to an alternate aerodrome in the event of engine failure or loss of pressurization, whichever requires the greater amount of fuel based on the assumption that such a failure occurs at the most critical point along the route;
i) fly for 15 minutes at holding speed at 450 m (1 500 ft) above aerodrome elevation in standard conditions; and
ii) make an approach and landing;
2) allow an aeroplane engaged in EDTO to comply with the EDTO critical

<p>fuel scenario as established by the State of the Operator;</p> <p>3) meet additional requirements not covered above;</p> <p><i>Note 1.— Fuel planning for a failure that occurs at the most critical point along a route (4.3.6.3 f) 1)) may place the aeroplane in a fuel emergency situation based on 4.3.7.2.</i></p> <p><i>Note 2.—Guidance on EDTO critical fuel scenarios are contained in Attachment D;</i></p> <p>g) <i>discretionary fuel</i>, which shall be the extra amount of fuel to be carried at the discretion of the pilot-in-command.</p>
4.3.6.4
Recommendation. — <i>Operators should determine one final reserve fuel value for each aeroplane type and variant in their fleet rounded up to an easily recalled figure.</i>
4.3.6.5
4.3.6.5 An aeroplane shall not take off or continue from the point of in-flight re-planning unless the usable fuel on board meets the requirements in 4.3.6.3 b), d), e) and f) if required.
4.3.6.6
<p>Notwithstanding the provisions in 4.3.6.3 a), b), c), d), and f); 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 variations to the pre-flight fuel calculation of taxi fuel, trip fuel, contingency fuel, destination alternate fuel, and additional fuel. The specific safety risk assessment shall include at least the:</p> <p>a) flight fuel calculations;</p> <p>b) capabilities of the operator to include:</p> <p>i) a data-driven method that includes a fuel consumption monitoring programme; and/or</p> <p>ii) the advanced use of alternate aerodromes; and</p> <p>c) specific mitigation measures.</p> <p><i>Note.— Guidance for the specific safety risk assessment, fuel consumption monitoring programmes and the advanced use of alternate aerodromes is contained in the Flight Planning and Fuel Management Manual (Doc 9976).</i></p>
4.3.7 In-flight fuel management
4.3.7.1
An operator shall establish policies and procedures, approved by the State of the Operator, to ensure that in-flight fuel checks and fuel management are performed.
4.3.7.2
The pilot-in-command shall continually ensure that the amount of usable fuel remaining on board is not less than the fuel required to proceed to an aerodrome where a safe landing can be made with the planned final reserve fuel remaining upon landing.
4.3.7.2.1
The pilot-in-command shall request delay information from ATC when unanticipated circumstances may result in landing at the destination

aerodrome with less than the final reserve fuel plus any fuel required to proceed to an alternate aerodrome or the fuel required to operate to an isolated aerodrome.

4.3.7.2.2

The pilot-in-command shall advise ATC of a minimum fuel state by declaring MINIMUM FUEL when, having committed to land at a specific aerodrome, the pilot calculates that any change to the existing clearance to that aerodrome may result in landing with less than planned final reserve fuel.

Note 1.— The declaration of MINIMUM FUEL informs ATC that all planned aerodrome options have been reduced to a specific aerodrome of intended landing and any change to the existing clearance may result in landing with less than planned final reserve fuel. This is not an emergency situation but an indication that an emergency situation is possible should any additional delay occur.

Note 2.— Guidance on declaring minimum fuel is contained in the Flight Planning and Fuel Management Manual (Doc 9976).

4.3.7.2.3

4.3.7.2.3 The pilot-in-command shall declare a situation of fuel emergency by broadcasting MAYDAY MAYDAY MAYDAY FUEL, when the calculated usable fuel predicted to be available upon landing at the nearest aerodrome where a safe landing can be made is less than the planned final reserve fuel.

Note 1.— The planned final reserve fuel refers to the value calculated in 4.3.6.3 e) 1) or 2) and is the minimum amount of fuel required upon landing at any aerodrome.

Note 2.— The words “MAYDAY FUEL” describe the nature of the distress conditions as required in Annex 10, Volume II, 5.3.2.1, b) 3.

Note 3.— Guidance on procedures for in-flight fuel management are contained in the Flight Planning and Fuel Management Manual (Doc 9976).

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
<p>Operators conducting operations beyond 60 minutes, from a point on a route to an en-route alternate aerodrome shall ensure that:</p> <p>a) for all aeroplanes:</p> <ol style="list-style-type: none"> 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; <p>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.</p> <p><i>Note.— Guidance on compliance with the requirements of these provisions is contained in Attachment D.</i></p>
4.7.1.2
<p>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:</p> <ol style="list-style-type: none"> 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
<p>Unless the operation has been specifically approved by the State of the Operator, an aeroplane with two or more turbine engines shall not be operated on a route where the diversion time 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-engine operating cruise speed for aeroplanes with more than two turbine engines, to an en-route alternate aerodrome exceeds a threshold time established for such operations by that State.</p> <p><i>Note 1.— When the diversion time exceeds the threshold time, the operation is considered to be an extended diversion time operation (EDTO).</i></p> <p><i>Note 2.— Guidance on the establishment of an appropriate threshold time and on approval of extended diversion time operations are contained in Attachment D.</i></p> <p><i>Note 3.— For the purpose of EDTO, the take-off and/or destination aerodromes may be considered en-route alternate aerodromes.</i></p>
4.7.2.2
<p>The maximum diversion time, for an operator of a particular aeroplane type engaged in extended diversion time operations shall be approved by the State of the Operator.</p> <p><i>Note.— Guidance on the conditions to be used when converting diversion</i></p>

times to distances are contained in Attachment D.

4.7.2.3

When approving the appropriate maximum diversion time for an operator for 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 D.

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 for the specific safety risk assessment is contained in Attachment D.

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 D.

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 approving 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.

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.*