Extended Diversion Time Operations Workshop

Module 5

Flight Operations Considerations

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Course Structure

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Module 5
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Module 8
Implementing EDTO Regulations

Module 9
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Module 10 – Wrap Up

Objectives

At the end of this module, participants will understand the flight operations requirements and dispatch planning considerations supporting EDTO operations.

EDTOM References

Doc 10085: Extended Diversion Time Operations (EDTO) Manual

EDTOM

Chapter 3: EDTO flight operations requirements

- 3.1 General
- 3.2 Conversion of threshold and maximum diversion time into distance
- 3.3 Operations beyond 60 minutes
- 3.4 Operations beyond EDTO threshold time
- 3.5 Flight preparation considerations
- 3.6 In-flight considerations
- 3.7 Aeroplane performance data
- 3.8 EDTO flight operations manual (EFOM)
- 3.9 EDTO training programme

Module 5 - Outline

Part I — Defining the EDTO Area of Operations

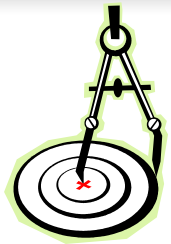
Part II — Performing EDTO Flight Planning

Part III — Conducting EDTO Flights

Part IV — Documentation and Training

Part V — Practical Exercise

Area of Operation Determination



Objective:

- To establish a geographic region for conducting EDTO flight operations, or to demonstrate that an operation does not require EDTO capability. The area of operations assessment establishes applicability of the standards set forth in Annex 6, Part 1 and associated State regulations.
  - Does the operation require a diversion time in excess of 60 minutes? (If so, Section 4.7.1 applies)
  - Does the operation require a diversion time in excess of the state established threshold time? (If so, Section 4.7.2 and Specific EDTO Approval applies)
  - If EDTO, what is the maximum diversion time (MDT) required?

Area of Operation Applicability

Annex 6, Part 1 (4.7.2.1):

- EDTO specific approval is required to operate on routes where the diversion time to an *enroute alternate aerodrome* exceeds a *threshold time* established by the State.
  - **One engine inoperative (OEI) speed** for two engine aeroplanes
  - **All engines operating (AEO) speed** for aeroplanes with more than two engines
  - Standard day (ISA), still air conditions
- Diversion time must be converted to distance to establish geographic applicability (ref Attachment C, and Chapter 3 of the EDTOM).

Area of Operation Dependencies

- The primary factors affecting the EDTO Area of Operation determination include the selection of:
  - Enroute alternate aerodromes
  - Maximum Diversion Time (MDT)
  - Assumed Diversion Speed (OEI or AEO)
  - Assumed Diversion Weight (Reference Weight)

} To Establish Diversion Distance

- These same considerations apply to area of operations determination for:
  - 60-minute operations
  - Operations within the EDTO threshold time

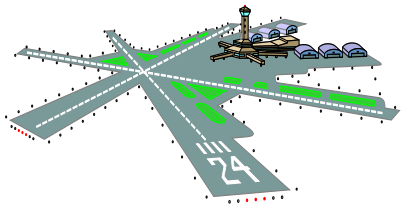
Definitions

- **Enroute Alternate Aerodrome (Annex 6, Part 1 Definitions)**

Alternate Aerodrome: An aerodrome to which an aircraft may proceed when it becomes either impossible or inadvisable to proceed to or to land at the aerodrome of intended landing where the necessary services and facilities are available, where aircraft performance requirements can be met and which is operational at the expected time of use.

En-route alternate: An alternate aerodrome at which an aircraft would be able to land in the event that a diversion becomes necessary while en route *(may also be the takeoff and/or destination aerodromes).*

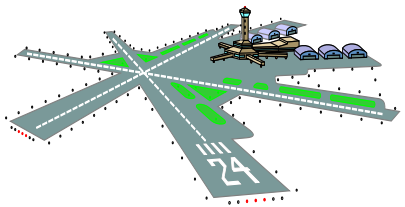
Note: An **EDTO Alternate Aerodrome** is an en-route alternate aerodrome which has been nominated for an EDTO flight



EDTO Area of Operation

En-route Alternate Aerodrome Considerations

- **Availability** *(e.g. hours of operation or ability to respond to a diversion)*
- **Performance requirements** for the expected landing weight *(e.g. runway length, width)*
- **Runway strength** *(with allowance for ICAO and State overload guidance*)*
- **Ground operational services** *(ATS, lighting, communications, weather reporting)*
- At least one let down navigation aid and **approach procedure**
- **Emergency services** *(Minimum RFFS Category 4)*
- **Other criteria**: Maintenance facilities, passenger accommodations…

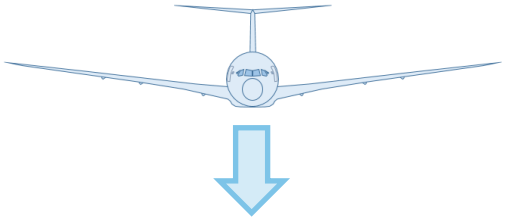


* ICAO Doc 9157 - Aerodrome Design Manual, Part 3 - Pavements, Chapter 2

EDTO Area of Operation

Assumed weight at diversion (Reference Weight)

- Not specifically defined in the ICAO Standards, but intended to be a representative weight for the planned EDTO operation.
- Potential approachs:
  - Weight at xx minutes (EDTO threshold time) into a typical mission
  - Heaviest expected weight at EDTO Entry Point (EEP)
  - Heaviest expected weight at Equal Time Points (ETPs) between EDTO diversion aerodromes.



Approved one engine inoperative (OEI) speed

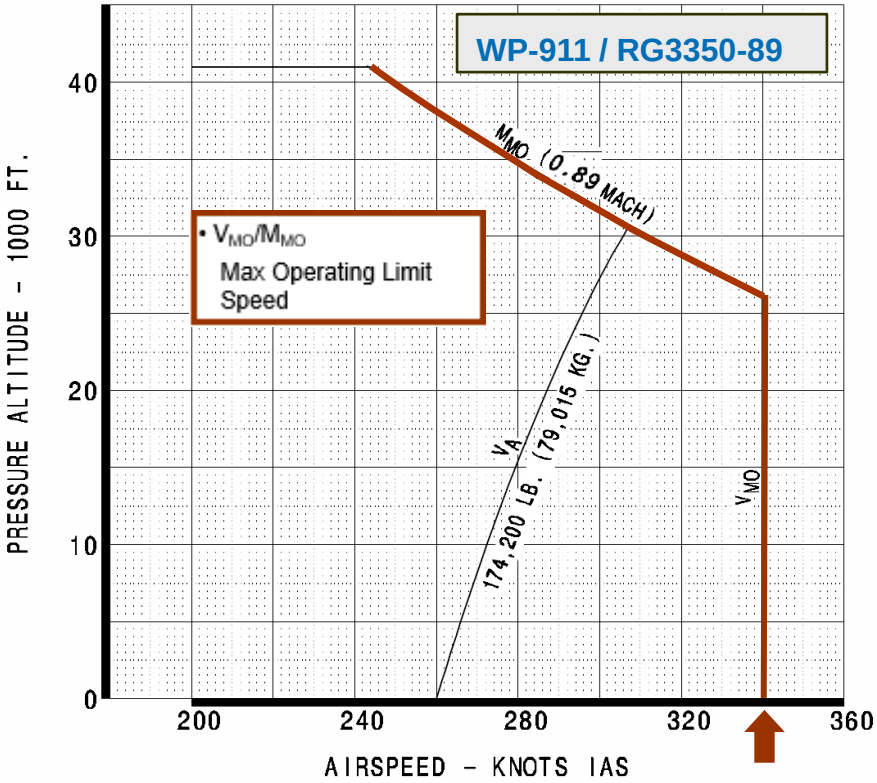
- Typically a Mach/Indicated Airspeed (IAS) combination, which must be within the certified operating limits of the aeroplane
- Basis for both the EDTO area of operation diversion distance and engine inoperative diversion fuel requirements
- Normally a high speed approaching M_{MO}/V_{MO} is selected, but this may be reduced if diversion fuel limitations or altitude capability considerations are a factor
- The diversion distance calculation assumes Maximum Continuous Thrust (MCT) on the operating engine and includes a driftdown profile from the initial all engine cruise altitude

EDTO Area of Operation
Two Engine Aeroplanes

Example Operational Flight Envelope

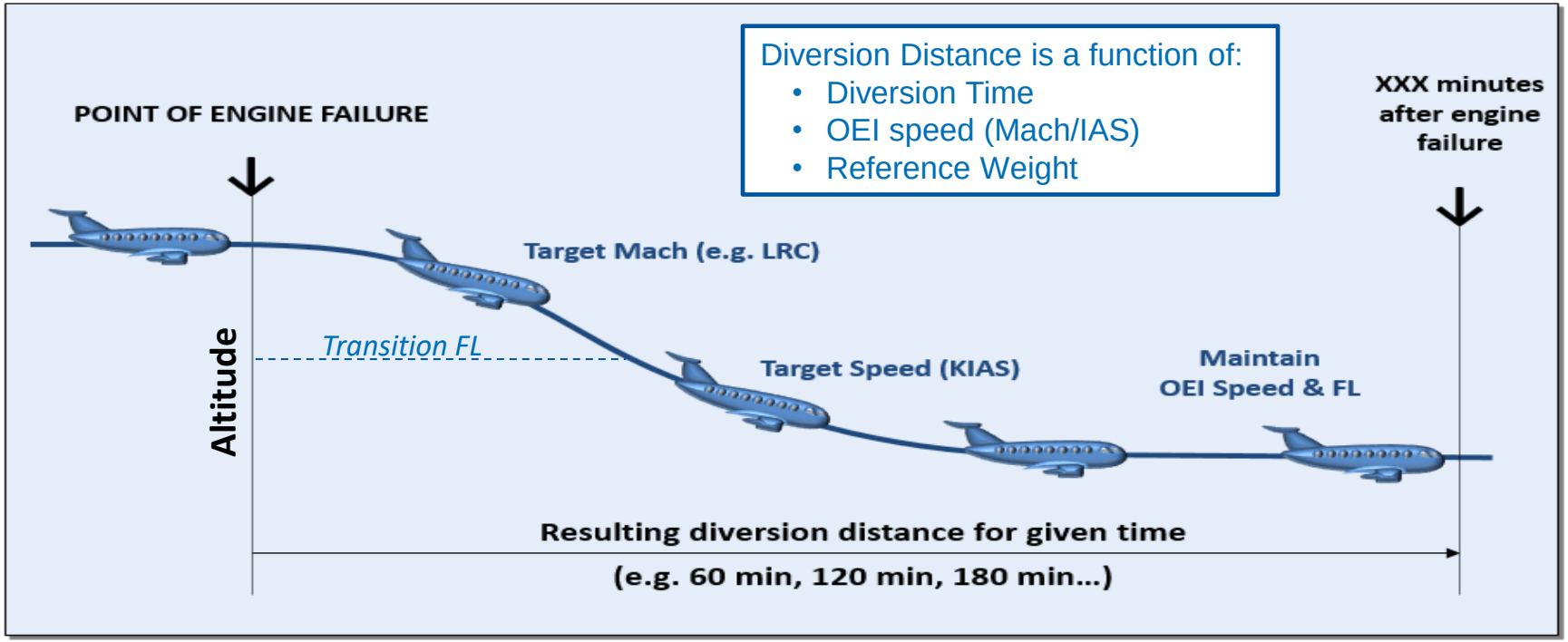
- Based on upset protection to maximum dive speeds (M_D, V_D)
- Some margin is typically included in overspeed warning systems (e.g. V_{MO}-5 KIAS)
- Speeds for best fuel burn are typically well below max operating speeds (e.g. WP-911 LRC ~ 0.84 Mach)

Example



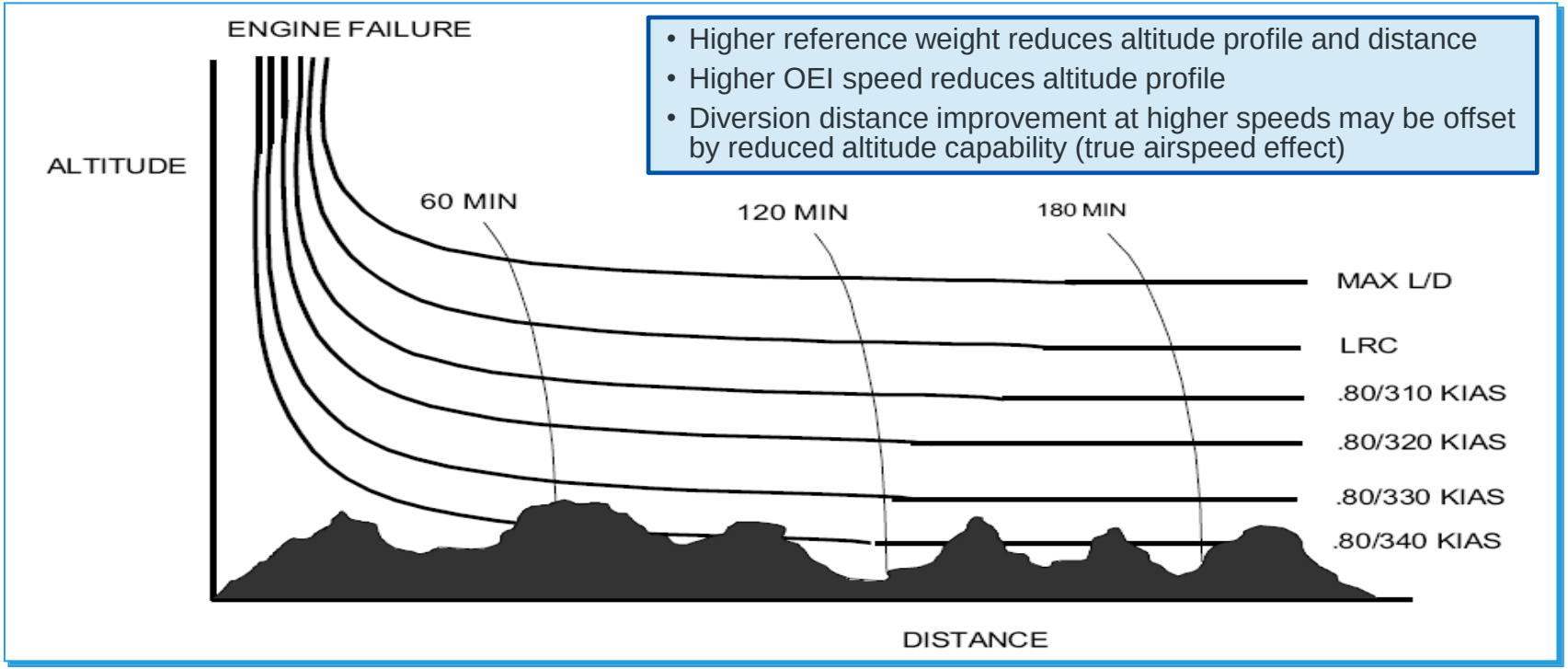
EDTO Area of Operation
Two Engine Aeroplanes

- Driftdown Profile Example (Still Air, ISA):



EDTO Area of Operation
Two Engine Aeroplanes

- Effect of Diversion Weight and Speed



EDTO Area of Operation
Two Engine Aeroplanes

- Example Diversion Distance Information

WP-911 / RG3350-89

DIVERSION DISTANCE (NM)							
DIVERSION SPEED (M/KIAS)	WEIGHT AT DIVERSION (1000 KG)	LEVEL OFF FLIGHT LEVEL (100 FT)	DIVERSION TIME (MIN)				
			60	120	180	240	300
.84/330	170	190	439	866	1294	1720	2100
	190	180	436	860	1285	1703	2100
	210	170	434	853	1272	1685	2095
	230	160	430	840	1250	1660	2070
	250	150	427	834	1235	1642	2052
.84/310	170	220	424	837	1249	1680	2090
	190	220	424	836	1249	1663	2073
	210	220	419	827	1238	1645	2055
	230	210	415	818	1224	1620	2030
	250	190	412	806	1200	1602	2012

- Engine Inoperative
- Max Continuous Thrust
- Zero Wind

Example

EDTO Area of Operation
Two Engine Aeroplanes

Example Operational Diversion Distance Solution

WP-911 / RG3350-89

Assumptions:

- EDTO Threshold Time: **60 Minutes**
- EDTO Threshold Weight: **230,000 KG**
- Maximum Diversion Time: **240 Minutes**
- One Engine Inop (OEI) Speed: **.84 Mach / 330 KIAS**

Example

EDTO Area of Operation
Two Engine Aeroplanes

- Example Diversion Distance Information

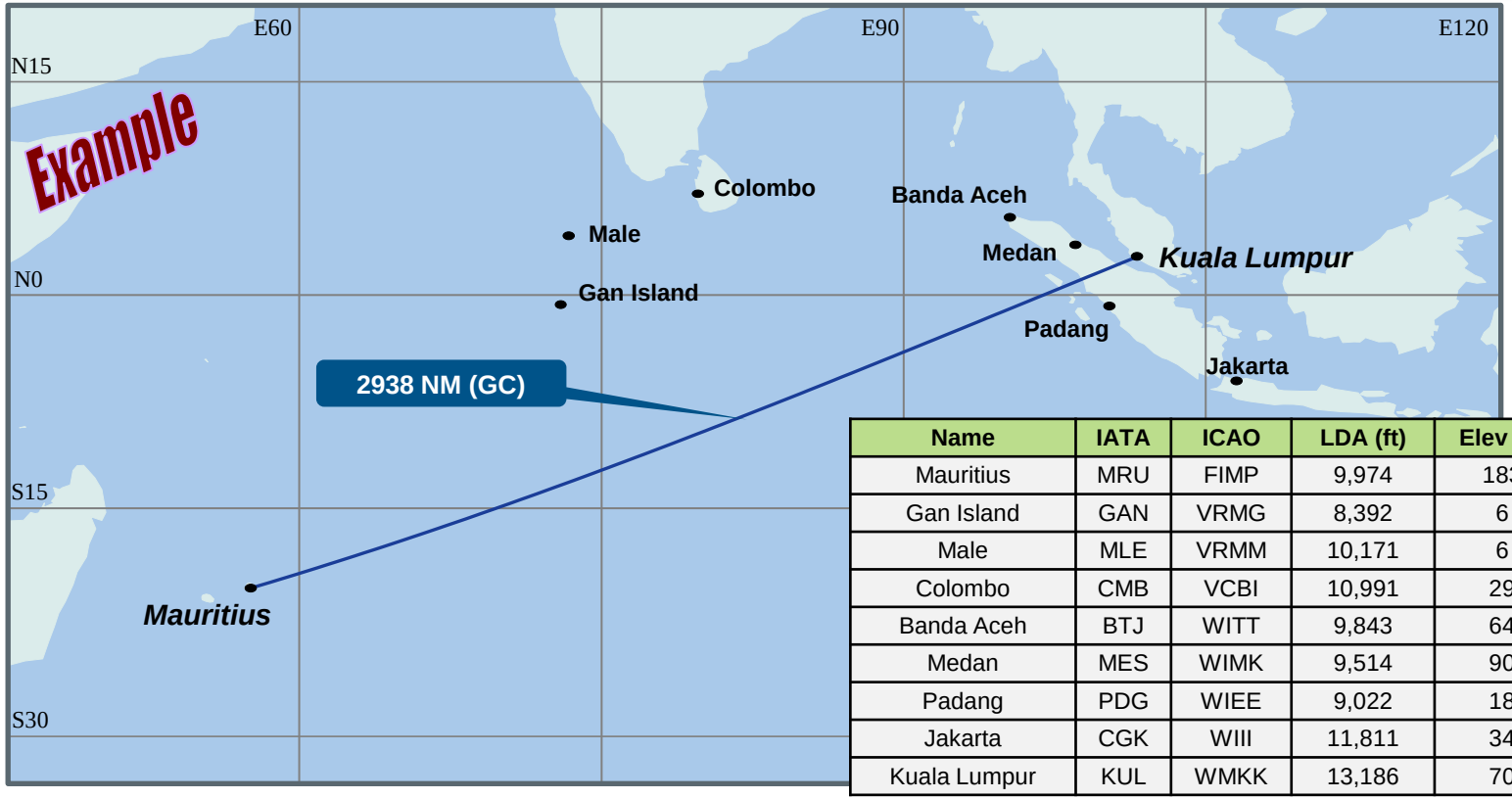
WP-911 / RG3350-89

DIVERSION DISTANCE (NM)							
DIVERSION SPEED (M/KIAS)	WEIGHT AT DIVERSION (1000 KG)	LEVEL OFF FLIGHT LEVEL (100 FT)	DIVERSION TIME (MIN)				
			60	120	180	240	300
.84/330	170	190	439	866	1294	1720	2100
	190	180	436	860	1285	1703	2100
	210	170	434	853	1272	1685	2095
	230	160	430	840	1250	1660	2070
	250	150	427	834	1235	1642	2052
.84/310	170	220	424	837	1249	1680	2090
	190	220	424	836	1249	1663	2073
	210	220	419	827	1238	1645	2055
	230	210	415	818	1224	1620	2030
	250	190	412	806	1200	1602	2012

- Engine Inoperative
- Max Continuous Thrust
- Zero Wind

Example

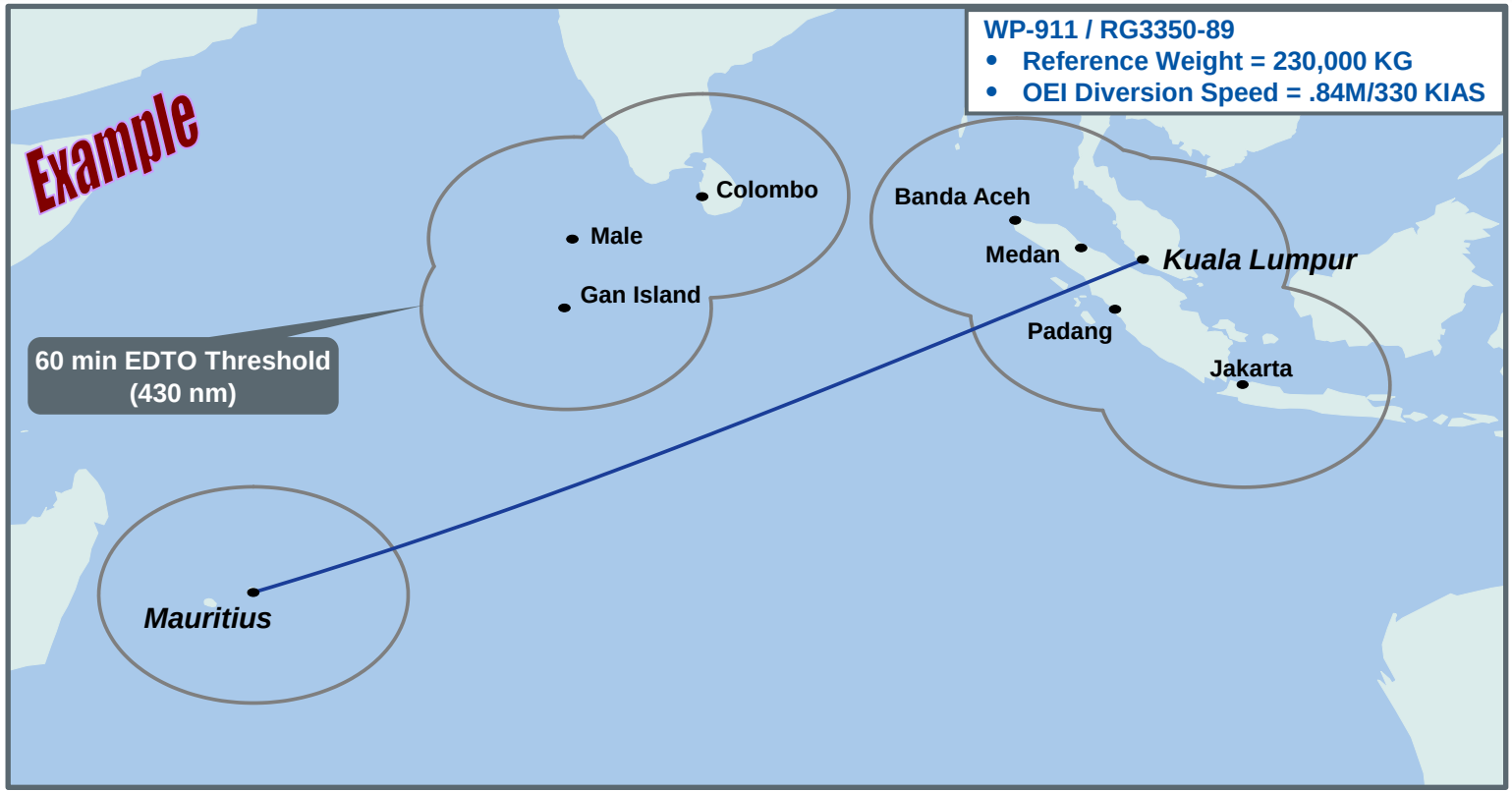
EDTO Area of Operation Example
MRU-KUL



Name	IATA	ICAO	LDA (ft)	Elev (ft)	PCN	RFFS
Mauritius	MRU	FIMP	9,974	183	98	9
Gan Island	GAN	VRMG	8,392	6	48	7
Male	MLE	VRMM	10,171	6	64	9
Colombo	CMB	VCBI	10,991	29	85	9
Banda Aceh	BTJ	WITT	9,843	64	88	7
Medan	MES	WIMK	9,514	90	71	8
Padang	PDG	WIEE	9,022	18	83	9
Jakarta	CGK	WIII	11,811	34	114	9
Kuala Lumpur	KUL	WMKK	13,186	70	90	10

EDTO Area of Operation Example

Two engine aeroplane

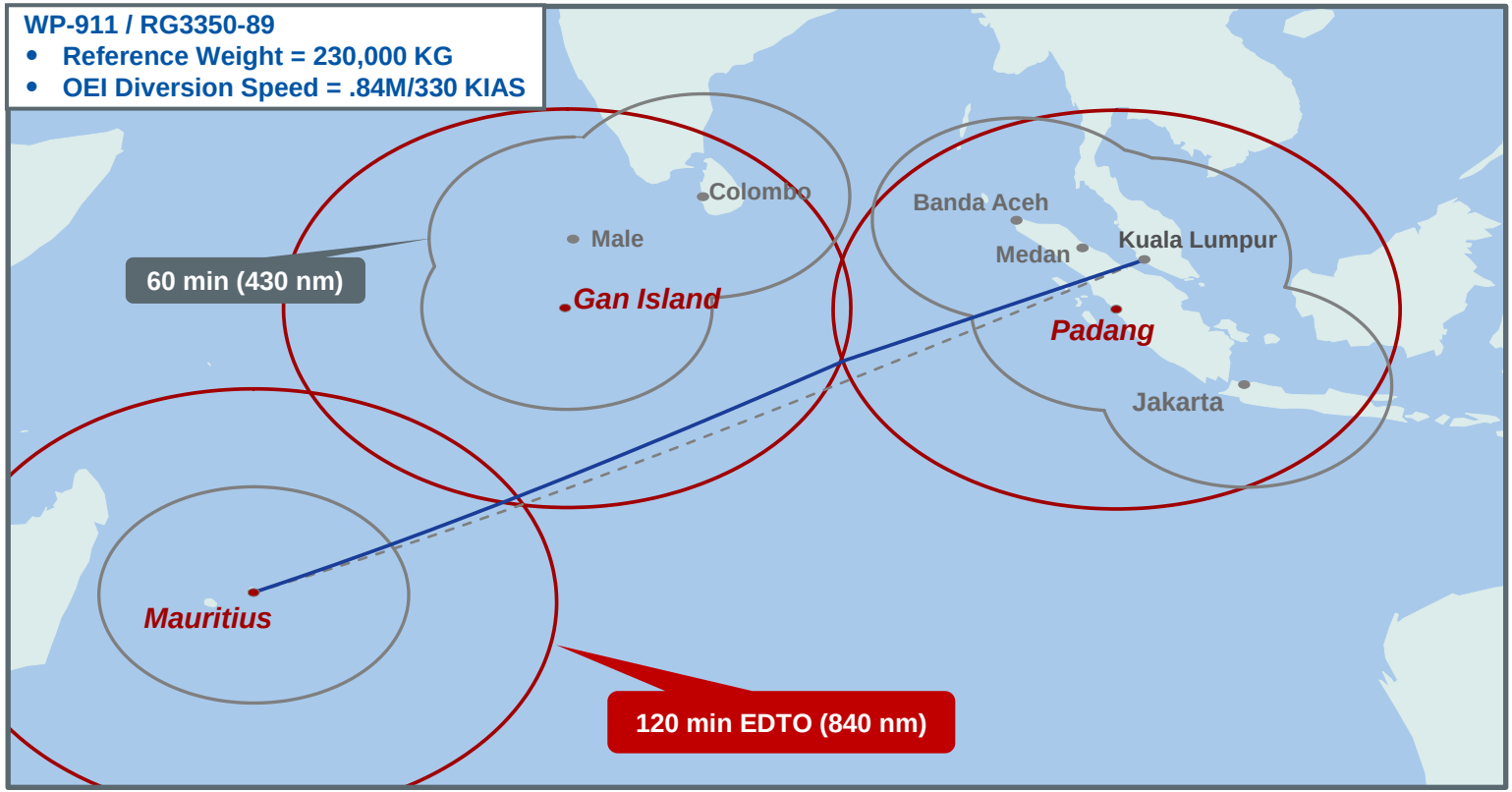


Beyond 60 Minute Operation?

EDTO Operation?

Maximum Diversion Time Required?

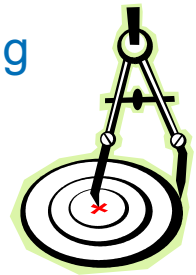
Example EDTO Dispatch Solution
120 Minutes



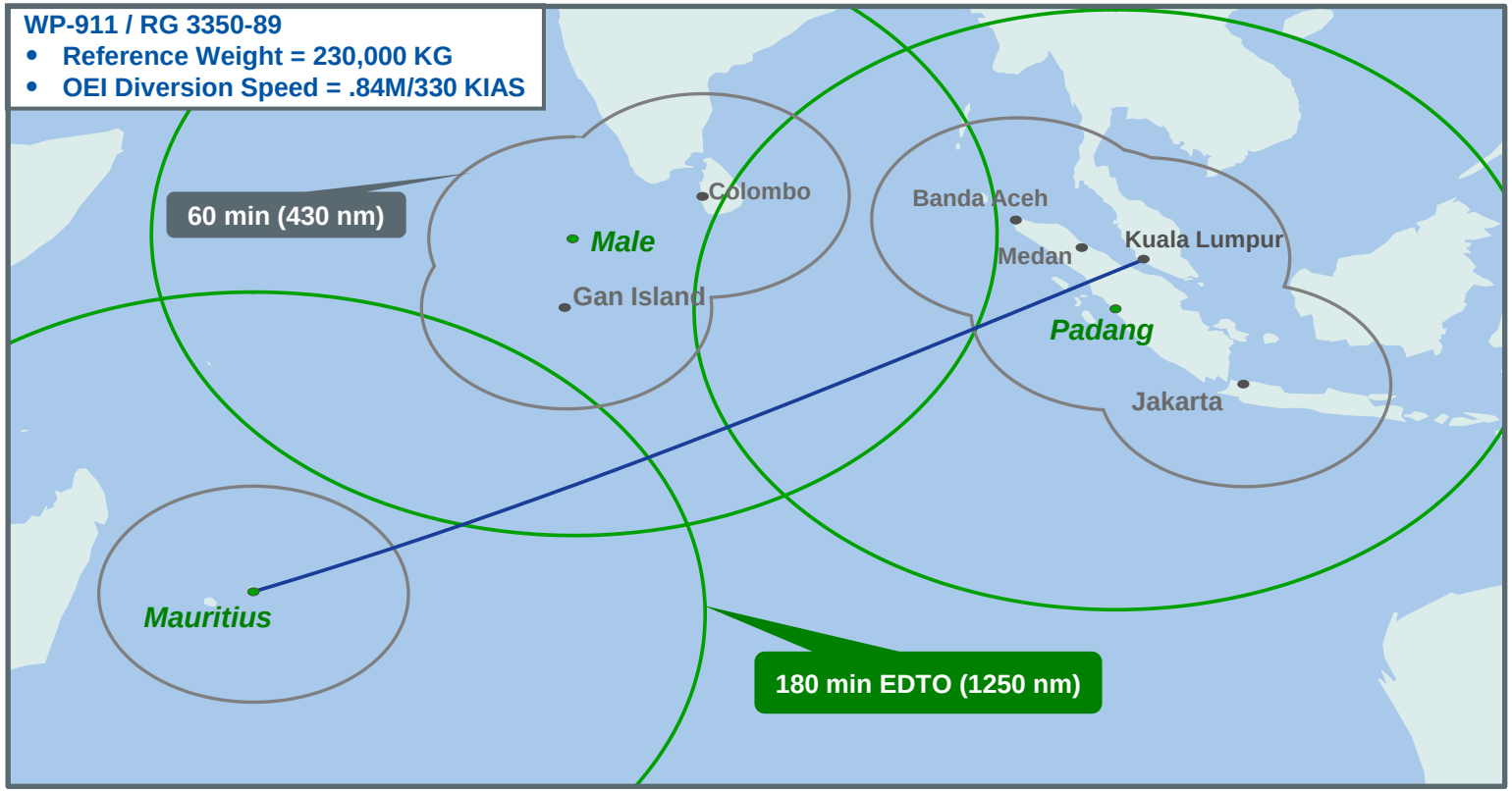
EDTO Area of Operation

Considerations for a higher Maximum Diversion Time (MDT)

- Aeroplane must be configured to a higher airworthiness standard
  - CMP, MEL Compliance
- Fewer EDTO alternates required for dispatch, but more enroute alternate aerodromes within the EDTO area of operations
- Increased flexibility for weather avoidance and other operational factors
- Improved route optimization and less potential for indirect ‘dog leg’ routing
  - Reduced route time reduces potential for problems
  - Reduced over water exposure mitigates operational risk
  - Enhanced operating efficiency *and* safety



Example EDTO Dispatch Solution
180 Minutes



All engines operating (AEO) speed

- Typically a fixed Mach number or Indicated Airspeed (IAS), which must be within the certified operating limits of the aeroplane
- Basis for the EDTO area of operation diversion distance, but no relationship to EDTO diversion fuel planning
- Normally a high speed approaching MMO/VMO is selected to maximize EDTO time limited system capability
- The diversion distance calculation is based on a fixed true airspeed (no driftdown), at an assumed all engine cruise altitude

EDTO Area of Operation

Aeroplanes with more than two engines

Example Operational Diversion Distance Solution

WP-3 / MT2021

Assumptions:

- EDTO Threshold Time: **120 Minutes = *964 NM*** [2]
- EDTO Threshold Weight: **220,000 KG**
- Optimum Altitude: **FL 380**
- All Engines Operating (AEO) Speed: **.84 Mach = *482 KTAS*** [1]

[1] $TAS = 661.4786 * M \sqrt{\theta}$

[2] $Dist = (TAS * Time) \div 60$

Example

EDTO Area of Operation

Aeroplanes with more than two engines

- Example All Engine Cruise Information*

WP-3 / MT2021

PRESS ALT (1000 FT)	KIAS STD TAT KTAS		WEIGHT (1000 KG) 260	250	240	230	220	210	200	190	180	170
43	239	%N1									85.2	84.1
	-26	MAX TAT										
	482	FF/ENG									2663	2534
42	244	%N1								85.3	84.2	83.3
	-26	MAX TAT										
	482	FF/ENG								2802	2667	2565
41	250	%N1							85.3	84.2	83.3	82.5
	-26	MAX TAT										
	482	FF/ENG							2940	2801	2696	2606
40	256	%N1						85.2	84.2	83.3	82.5	81.8
	-26	MAX TAT										
	482	FF/ENG						3071	2930	2824	2733	2657
39	262	%N1				86.4	85.1	84.1	83.3	82.5	81.8	81.1
	-26	MAX TAT										
	482	FF/ENG				3381	3198	3058	2951	2859	2781	2717
38	268	%N1			86.2	84.9	84.0	83.2	82.5	81.8	81.1	80.5
	-26	MAX TAT										
	482	FF/ENG			3503	3323	3185	3080	2987	2909	2844	2781
37	274	%N1	87.2	85.9	84.7	83.8	83.0	82.4	81.7	81.0	80.4	79.9
	-26	MAX TAT										
	482	FF/ENG	3824	3620	3446	3313	3209	3117	3039	2974	2910	2850
36	281	%N1	85.5	84.5	83.6	82.9	82.3	81.6	81.0	80.4	79.9	79.5
	-26	MAX TAT										
	482	FF/ENG	3738	3572	3445	3342	3252	3174	3108	3045	2984	2927
35	287	%N1	84.6	83.8	83.1	82.5	81.8	81.3	80.7	80.3	79.8	79.4
	-23	MAX TAT										
	484	FF/ENG	3720	3599	3497	3408	3331	3265	3201	3139	3081	3028

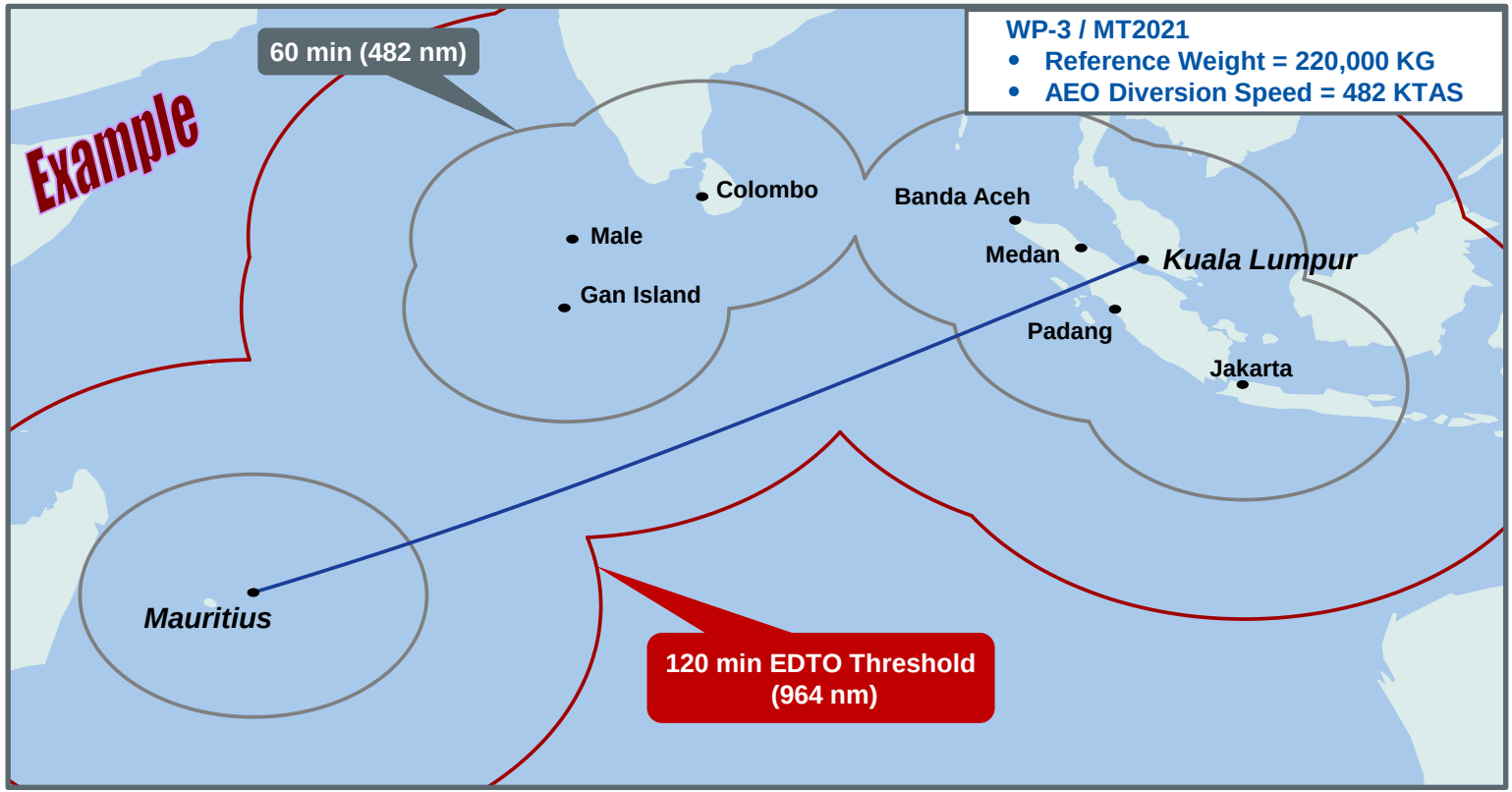
* Shaded area approximates Optimum Altitude

- All Engines Operating
- .84 Mach

Example

EDTO Area of Operation Example

Aeroplanes with more than two engines



Beyond 60 Minute Operation?

EDTO Operation?

Review Question

Q5.1 Chose the most appropriate definition of the term ‘MDT’

- Maintenance Data Terminal
- Mean Down Time
- Maximum Diversion Time
- Mission Design Team

Review Question

Q5.2 Which of the following has no impact on the EDTO diversion distance calculation

- Diversion time
- OEI or AEO speed
- Assumed diversion weight
- Enroute alternate aerodromes

Module 5 - Outline

Part I — Defining the EDTO Area of Operations

Part II — **Performing EDTO Flight Planning**

Part III — Conducting EDTO Flights

Part IV — Documentation and Training

Part V — Practical Exercise

Performing EDTO Flight Planning

Planning for EDTO routes typically involves two phases:

- EDTO Approval Planning
  - The EDTO Route Authorization or initial conceptual planning phase which precedes EDTO Operational Approval
- EDTO Dispatch Planning
  - The day-to-day EDTO operational flight planning prior to each EDTO flight

Note: The decisions made in the initial approval planning phase will establish the basis for day-to-day EDTO dispatch planning

Performing EDTO Flight Planning

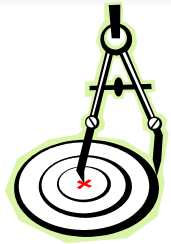
EDTO Approval Planning
(Still air planning exercise)

- Determine approved diversion speed and Maximum Diversion Time (MDT)
- Evaluate enroute alternate aerodromes
- Establish approved EDTO area of operation
- Implement EDTO flight planning system

EDTO Dispatch Planning
(Considers forecast weather conditions)

- MDT is a dispatch limitation. Check diversion fuel considering forecast wind and temperature.
- Select EDTO alternate aerodromes
- Establish dispatch EDTO area of operation
- Execute EDTO flight planning system

EDTO Flight Planning Definitions



- **EDTO Entry Point (EEP):**

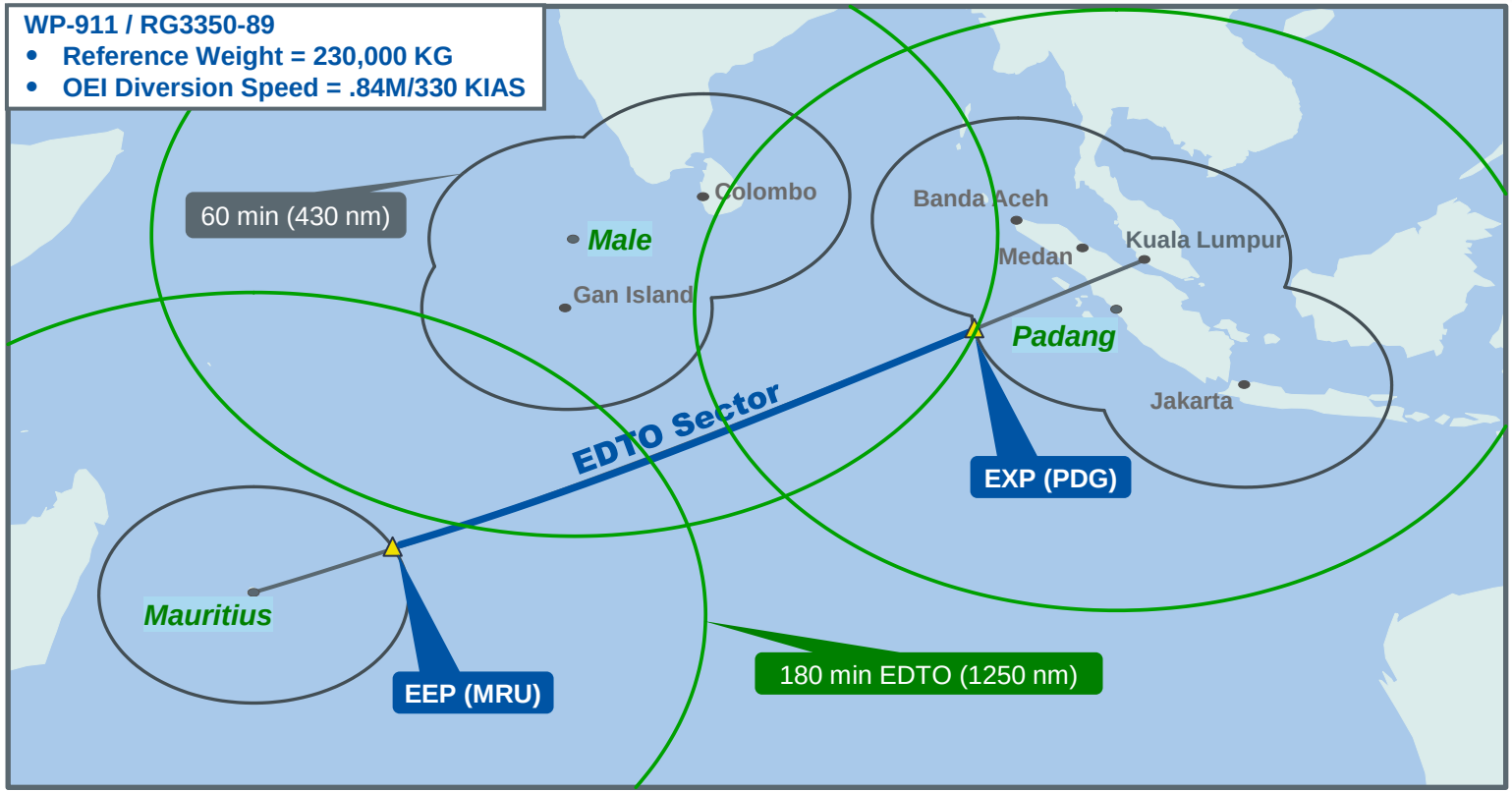
  The first point on an EDTO flight, under standard conditions in still air, that is beyond the state established threshold time from an enroute alternate aerodrome

  Determined using an OEI speed for two engine aeroplanes and an AEO speed for aeroplanes with more than two engines

- **EDTO Exit Point (EXP):**

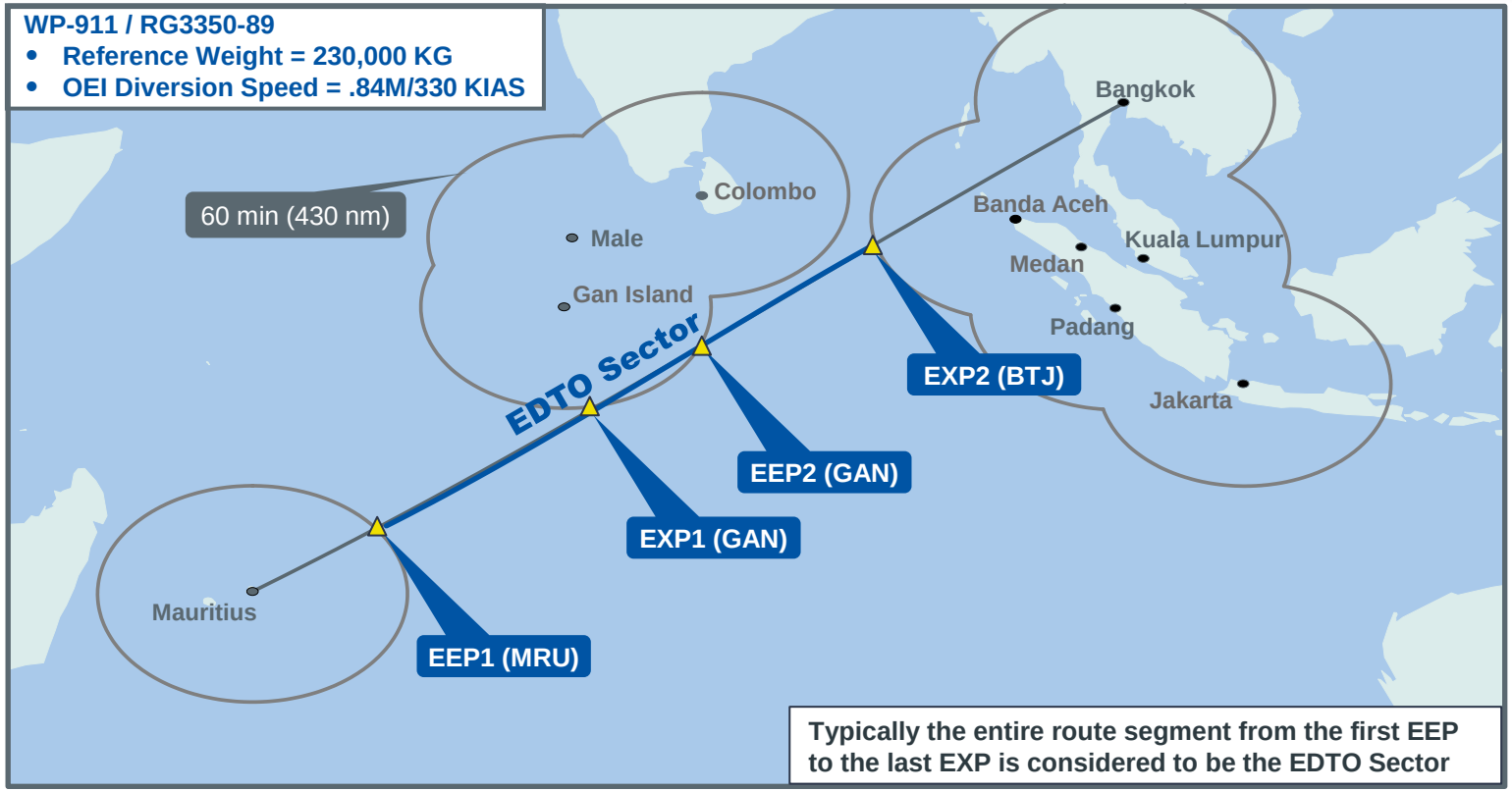
  The last point on an EDTO flight, under standard conditions in still air, that is beyond the state established threshold time from an enroute alternate aerodrome

Example - EDTO Entry/Exit Points
MRU to KUL

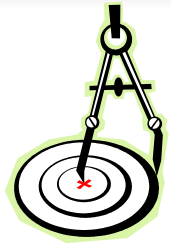


Example - Multiple EDTO Sectors?

MRU to BKK



EDTO Flight Planning Definitions



- **EDTO Equal Time Point (ETP):**

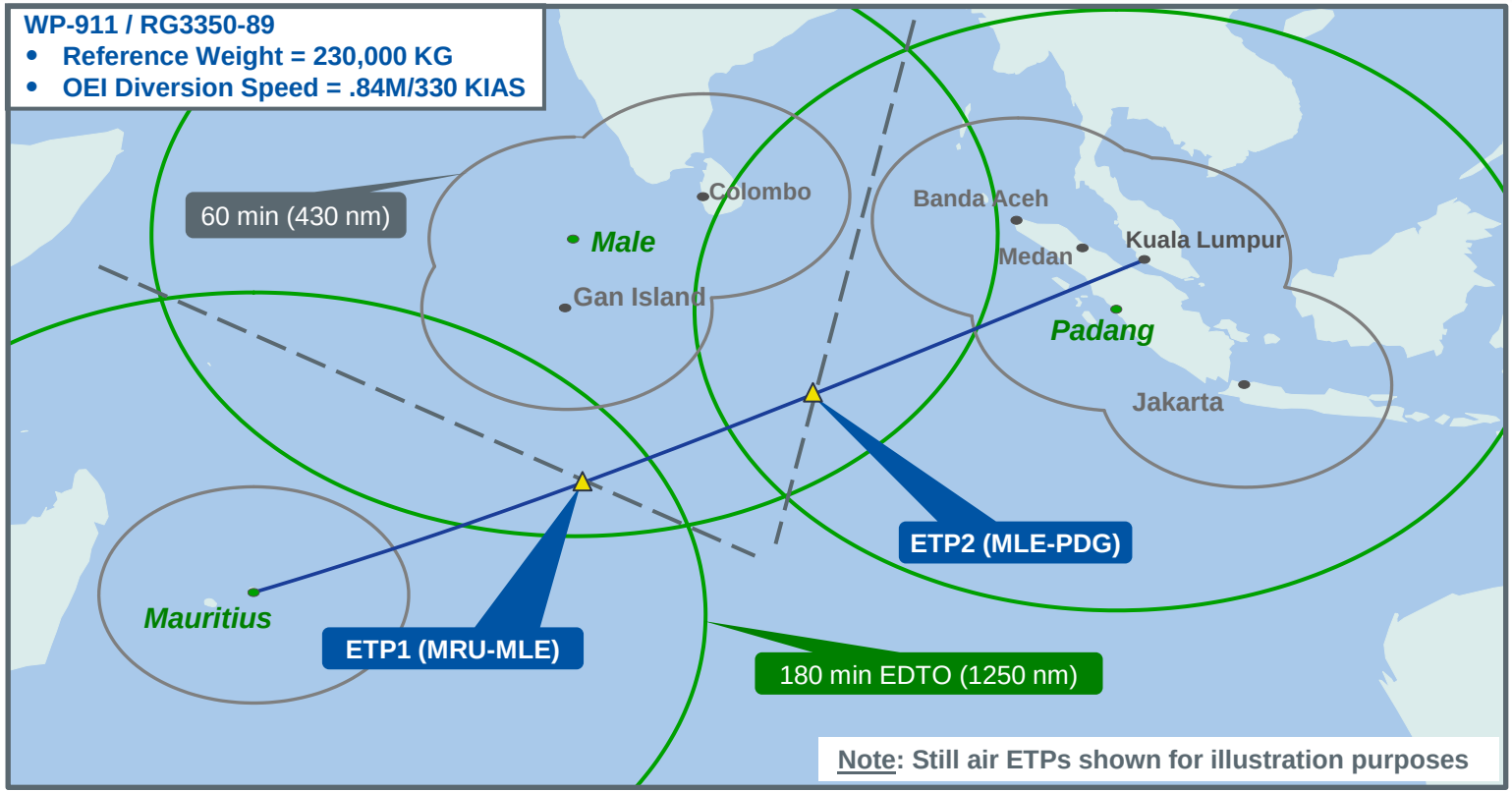
  A point of equal diversion time between EDTO alternate aerodromes, considering forecast wind and temperature conditions at the applicable diversion flight level

- **Critical Point (CP):**

  The EDTO ETP at which the EDTO diversion fuel required exceeds or is closest to the normal planned fuel load

  Typically the last ETP on an EDTO flight

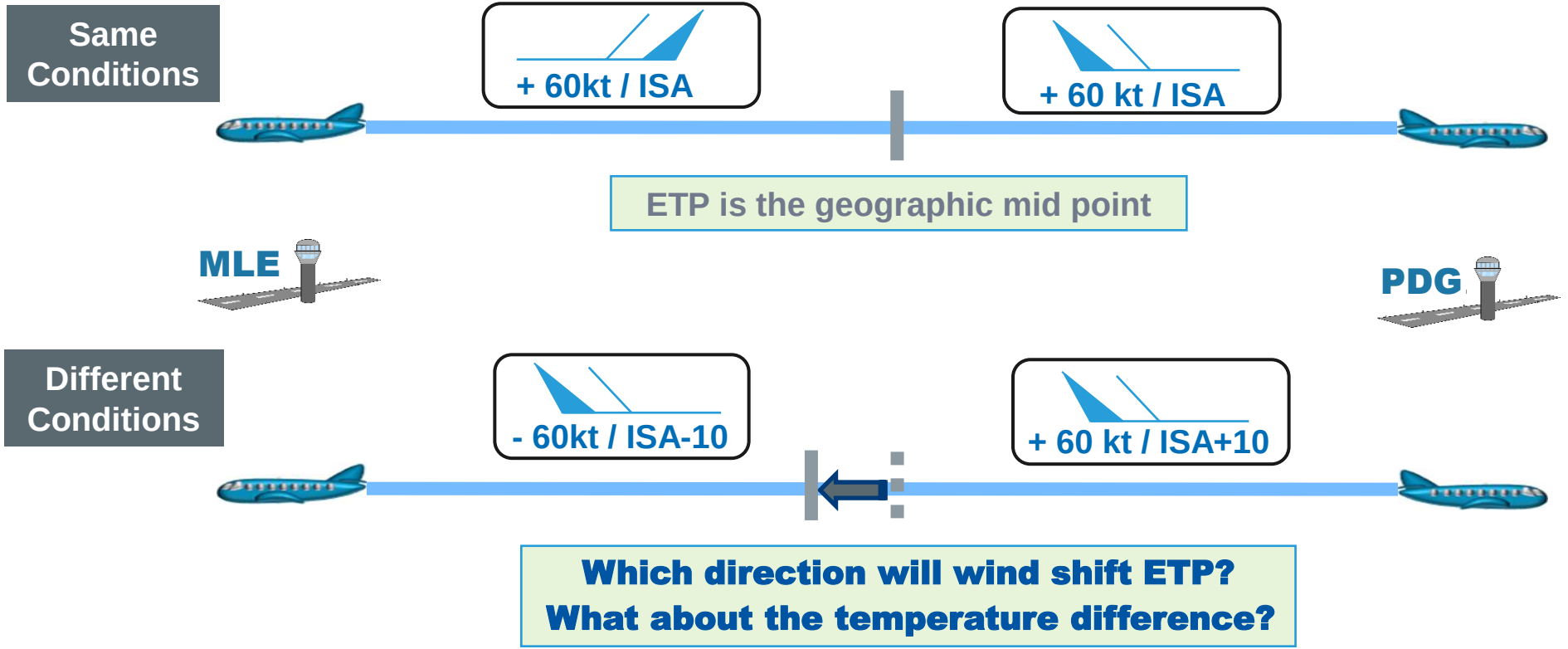
Example - EDTO Equal Time Points
MRU to KUL



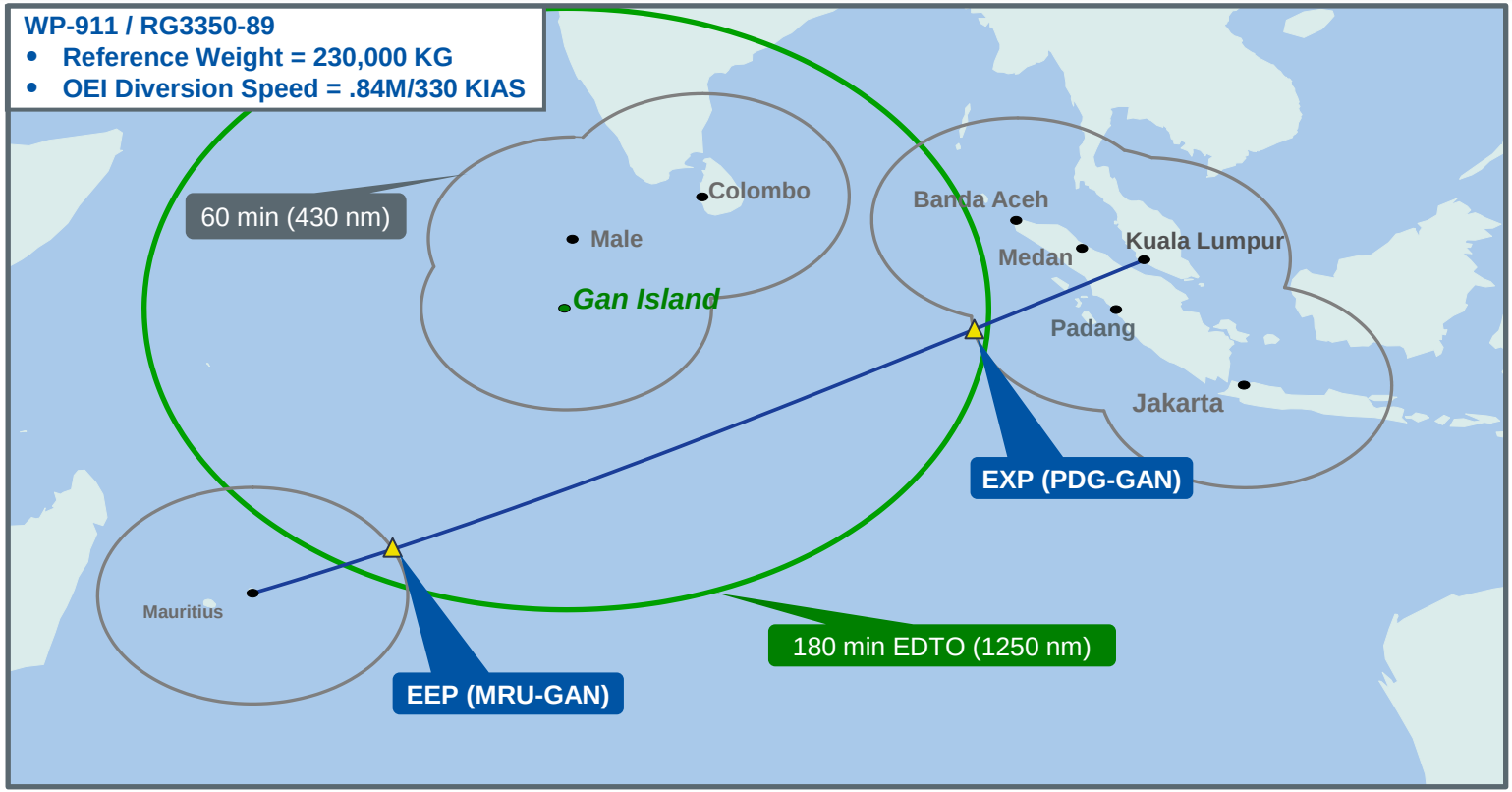
Which ETP is the Critical Point (CP)?

EDTO Equal Time Points

Effect of forecast wind and temperature



Special Case - Single EDTO Alternate
MRU to KUL



Diversion to GAN should be protected from EEP to EXP

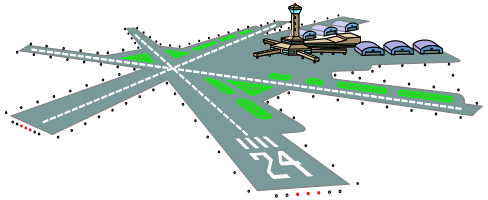
EDTO Flight Planning Definitions

EDTO Alternate Aerodrome (EDTOM Definitions)

An en-route alternate aerodrome that is designated in a dispatch or flight release for use in the event of a diversion during an EDTO flight, and which meets the applicable dispatch minima (weather and field conditions)

This definition applies to flight planning and does not in any way limit the authority of the pilot in command during flight

Note: EDTO alternate aerodromes may also be the takeoff and/or destination aerodromes



EDTO Alternate Considerations

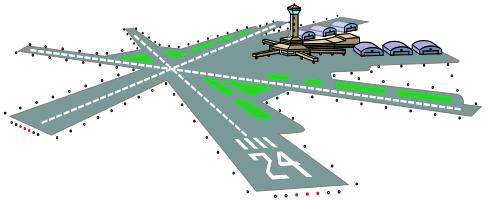
EDTO Dispatch Planning Weather Minimums

- Ceiling and visibility requirements for EDTO dispatch planning which are more conservative than the normal operating minimums required to conduct an approach
- Intended to account for potential deteriorating weather conditions over a ‘period of validity’ during the EDTO flight
- Published NOTAMs and MEL constraints may impact available approach procedures and required minimums for dispatch
- Specific requirements may vary from State to State (e.g. relief for conditional forecast elements)
- Applicable to dispatch only, normal operating minimums apply once enroute

EDTO Alternate Considerations

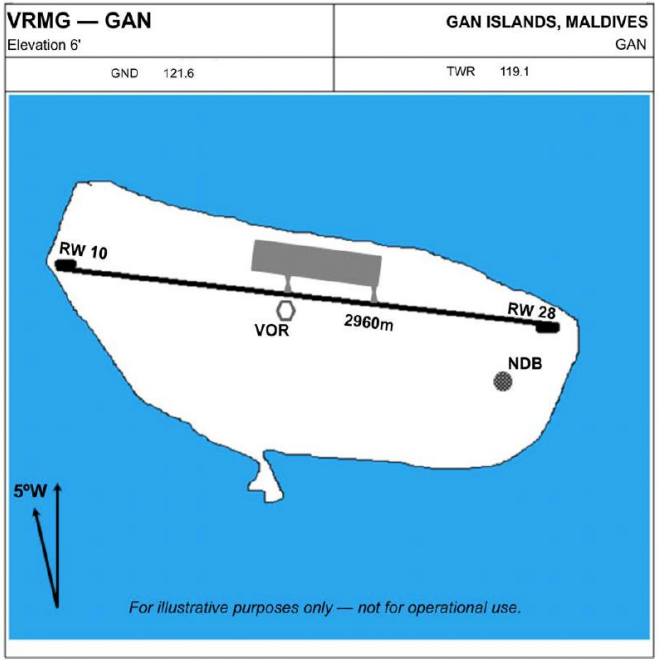
Example EDTO Dispatch Planning Minimums
(May vary from State to State)

Approach Facility	Ceiling	Visibility
Precision approach	Authorized DH/DA plus an increment of 60 m (200 ft)	Authorized visibility plus an increment of 800 m
Non-precision approach or circling approach	Authorized MDH/MDA plus an increment of 120 m (400 ft)	Authorized visibility plus an increment of 1500 m



EDTO Alternate Considerations

Example Aerodrome Approach Minimums (Gan Island)



RWY 28	MDA	RVR	Circling
A	360 ft	1 200 m	**400 ft** (1 600 m)
B			**500 ft** (1 600 m)
C			**600 ft** (2 400 m)
D	360 ft	2 000 m	**700 ft** (3 600 m)

Review Question

RWY 28	MDA	RVR	Circling
A	360 ft	1 200 m	**400 ft** (1 600 m)
B			**500 ft** (1 600 m)
C			**600 ft** (2 400 m)
D	360 ft	2 000 m	**700 ft** (3 600 m)

Approach Facility	Ceiling	Visibility
Precision approach	Authorized DH/DA plus an increment of 60 m (200 ft)	Authorized visibility plus an increment of 800 m
Non-precision approach or circling approach	Authorized MDH/MDA plus an increment of 120 m (400 ft)	Authorized visibility plus an increment of 1500 m

Based on this example, what are the EDTO dispatch planning minimums for a Cat D straight-in approach to Rwy 28?

Review Question

Q5.3 EDTO Dispatch Planning Minimums (GAN, RWY 28)

- 360 ft ceiling and 2000 m visibility
- 760 ft ceiling and 3500 m visibility
- 400 ft ceiling and 1500 m visibility
- 700 ft ceiling and 3600 m visibility

EDTO Alternate Considerations

Based on this example, what are the EDTO dispatch planning minimums for a Cat D straight-in approach to GAN RWY 28?

RWY 28	MDA	RVR	Circling
A	360 ft	1 200 m	**400 ft** (1 600 m)
B			**500 ft** (1 600 m)
C			**600 ft** (2 400 m)
D	360 ft	2 000 m	**700 ft** (3 600 m)

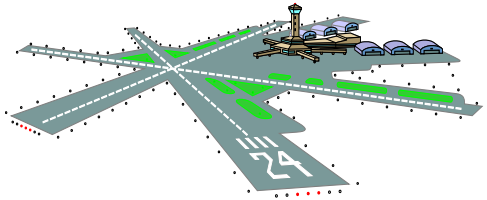
Approach Facility	Ceiling	Visibility
Precision approach	Authorized DH/DA plus an increment of 60 m (200 ft)	Authorized visibility plus an increment of 800 m
Non-precision approach or circling approach	Authorized MDH/MDA plus an increment of 120 m (400 ft)	Authorized visibility plus an increment of 1500 m

760 ft ceiling (360 + 400) and 3500 m visibility (2000 + 1500)

EDTO Alternate Considerations

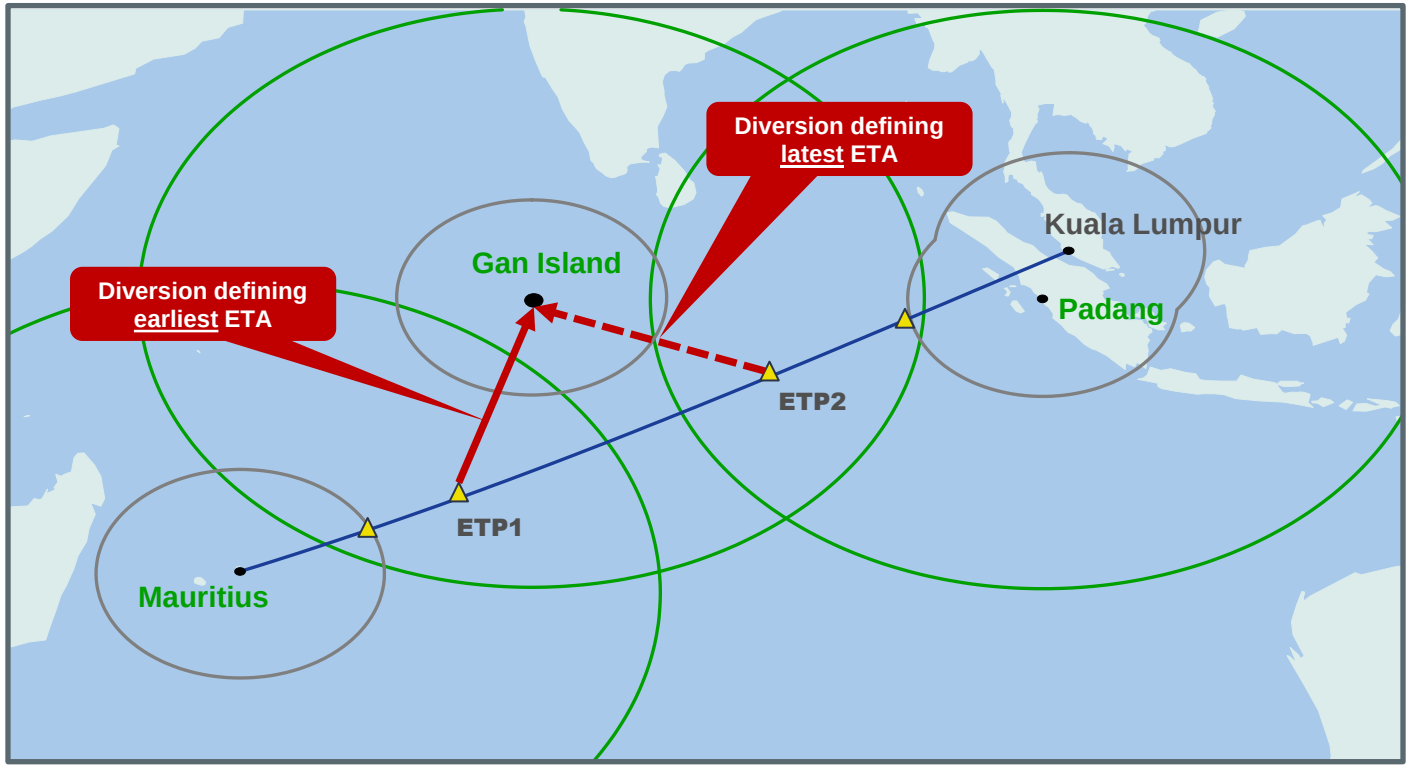
Period of Validity (EDTOM Section 3.5.2.3)

- The ‘time window’ over which the forecast weather conditions should meet or exceed the EDTO dispatch planning minima at a particular EDTO Alternate Aerodrome
- Considers the earliest to latest expected arrival times at the EDTO alternate in the event of an enroute diversion
    - Some States have applied additional margins (e.g. 1 hour) to these times



EDTO Alternate Considerations

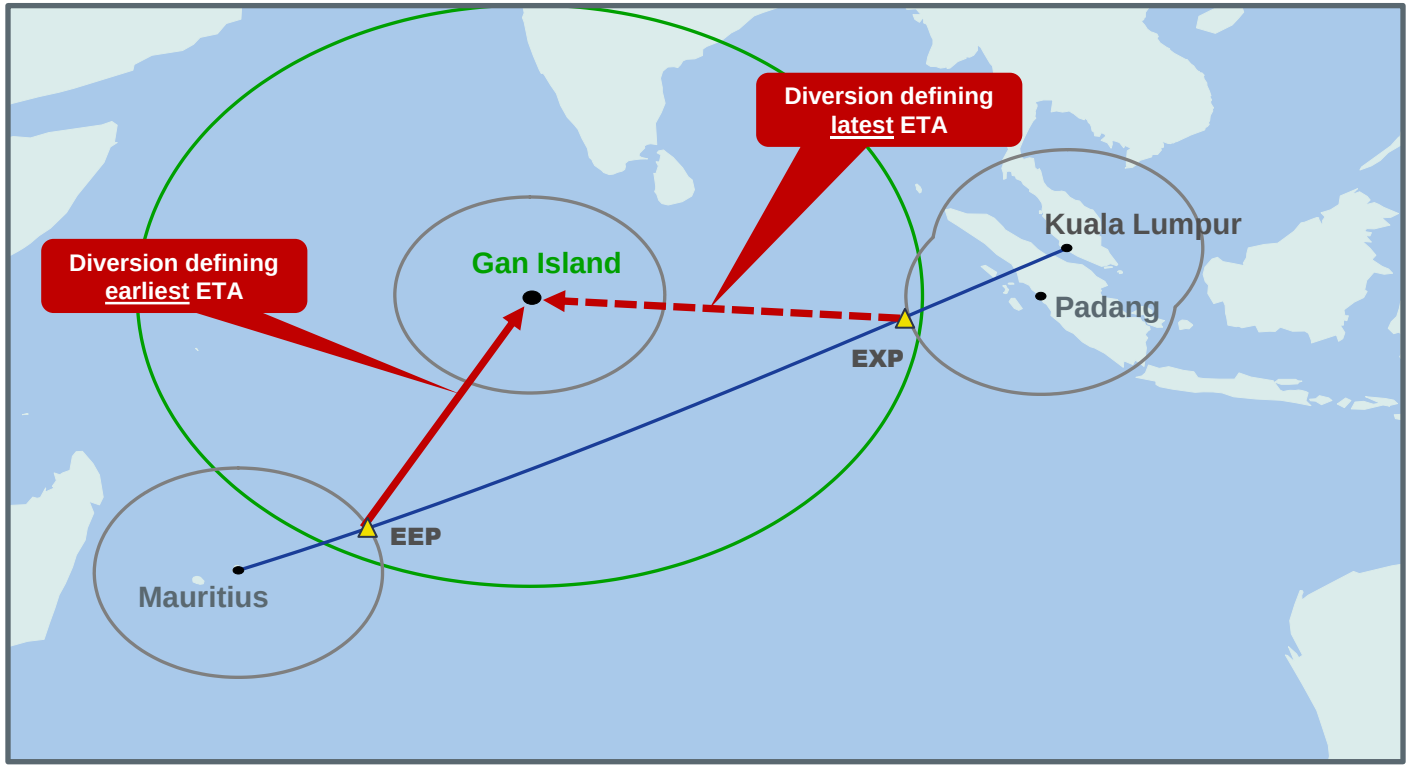
Period of Validity Example (GAN)



Typical case with ETP before and after EDTO alternate

EDTO Alternate Considerations

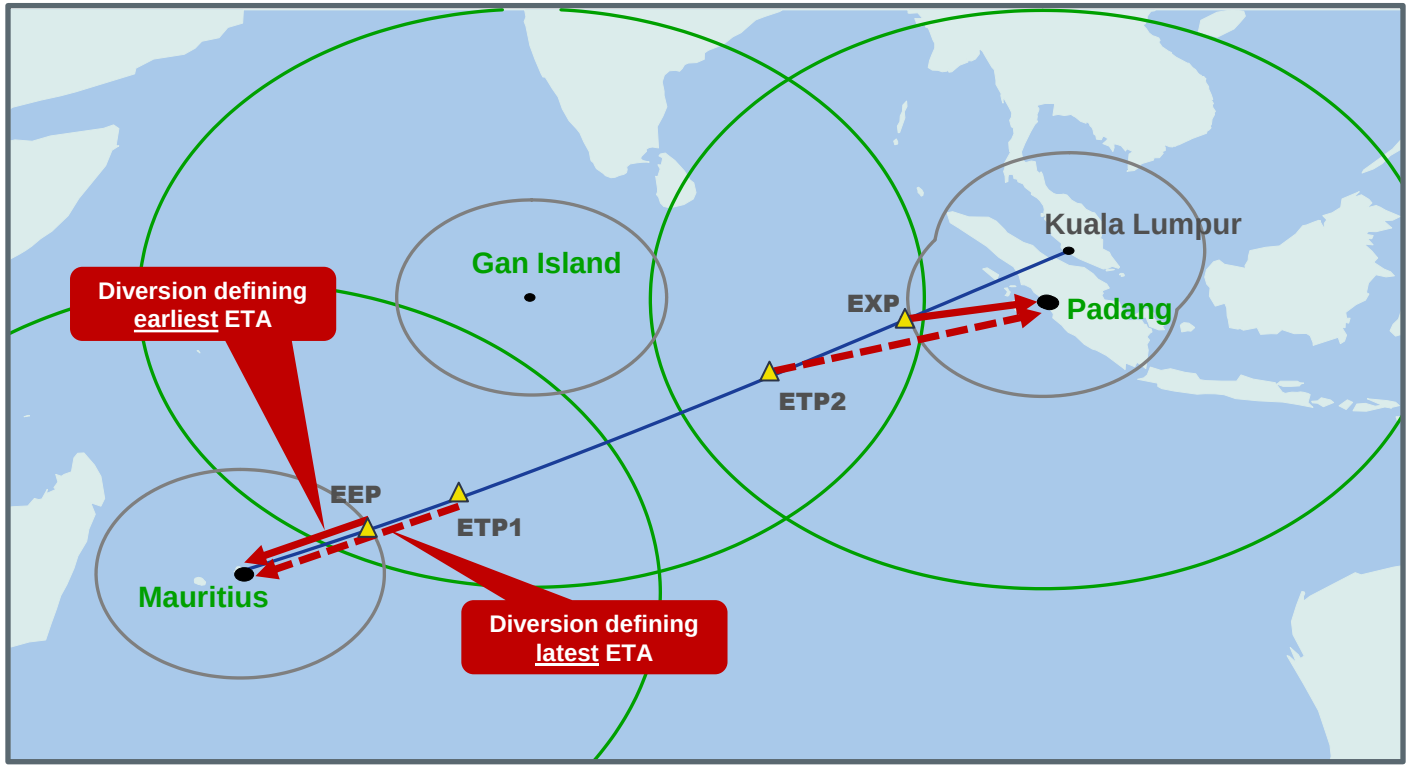
Period of Validity Example (GAN)



Special case for single EDTO alternate

EDTO Alternate Considerations

Period of Validity Example (MRU, PDG)

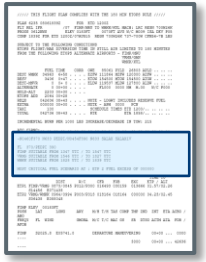


Typical case for first and last EDTO alternates

EDTO Period of Validity
Operational Application

Typical EDTO Flight Plan Presentation

```
FIMP VALIDITY PERIOD FROM 1347 UTC / TO 1547 UTC
VRMG VALIDITY PERIOD FROM 1546 UTC / TO 1827 UTC
WIEE VALIDITY PERIOD FROM 1828 UTC / TO 1839 UTC
```



Typical EDTO Flight Plan

The last EDTO alternate typically has the shortest period of validity (additional time margin may be appropriate)

How is the flight plan validity period confirmed?

EDTO Alternate Considerations

Rescue and Fire Fighting Service (RFFS)

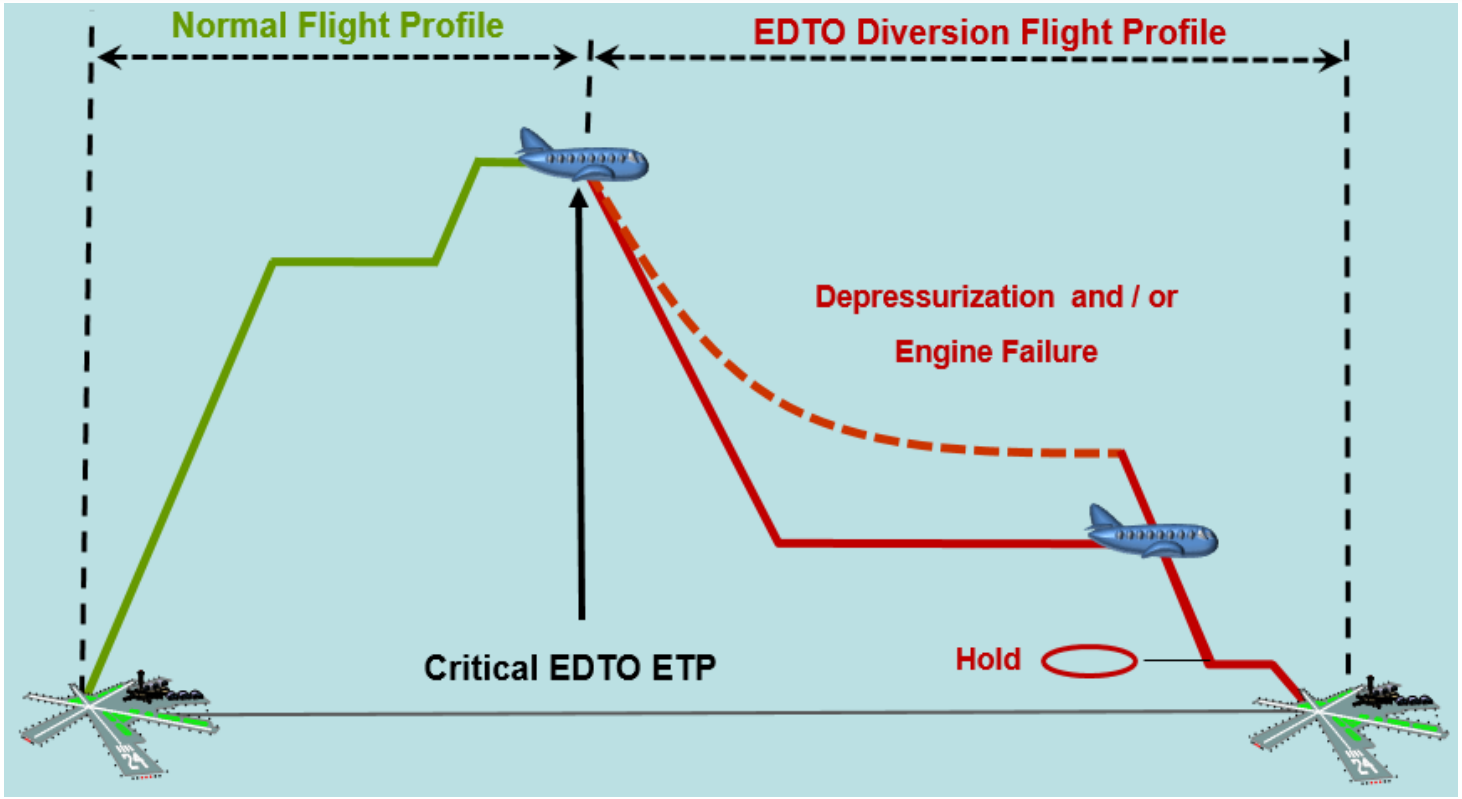
- The minimum RFFS level for an EDTO alternate aerodrome is Category 4 independent of the aeroplane RFFS category
  - Any modification by NOTAM should be considered
- Some States have adopted additional requirements (e.g. RFFS 7) for EDTO beyond 180 minutes
- State regulations may also include allowance for fire fighting resources outside of the aerodrome environment (with sufficient response time)
- Additional guidance on RFFS levels for all aerodromes is provided in Attachment I to Annex 6, Part I

EDTO Critical Fuel Scenario

- A check against the normal planned fuel load to ensure diversion fuel protection for EDTO (adjust fuel load if required)
- EDTO fuel protection considers three ‘scenarios’ from the most critical point (CP) on an EDTO route to a designated EDTO alternate aerodrome:
  - **Engine Failure (Two Engine Aeroplanes only)**
  - **Decompression**
  - **Simultaneous Engine Failure and Decompression**

EDTO Critical Fuel Scenario

EDTOM Section 3.5.3



Fuel Allowances:

- Icing/anti-ice
- Performance degradation
- Wind forecast errors
- Holding and approach
- APU (if required)

EDTO Critical Fuel Scenario
Diversion Speed Modes

	60 Min/EDTO Threshold Distance	EDTO Max Diversion Distance	Critical Fuel – All engine depressurization	Critical Fuel – Engine inop depressurization	Critical fuel – Engine failure only
Two engine aeroplanes	Any selected OEI Speed	Approved OEI speed	Any selected AEO speed	Approved OEI speed	Approved OEI speed
Aeroplanes with more than two engines	Any selected AEO speed	Approved AEO speed	Any selected AEO speed	Any selected OEI speed	Not Applicable

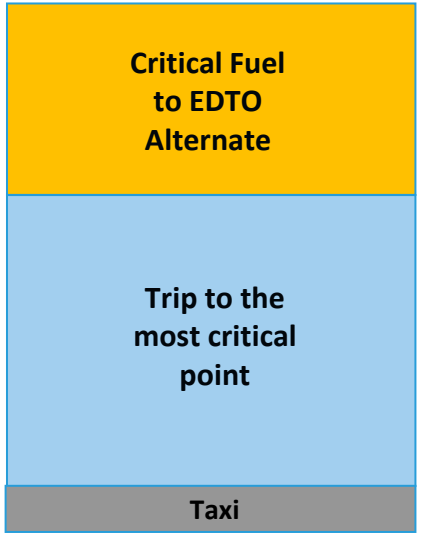
May also apply to EDTO threshold distance, if EDTO is required

- For two engine aeroplanes, the assumed speed for the engine failure critical fuel scenarios is the approved OEI speed used to define the EDTO maximum diversion distance

EDTO Critical Fuel Check

Example: No Additional EDTO Fuel Required

Standard fuel calculation



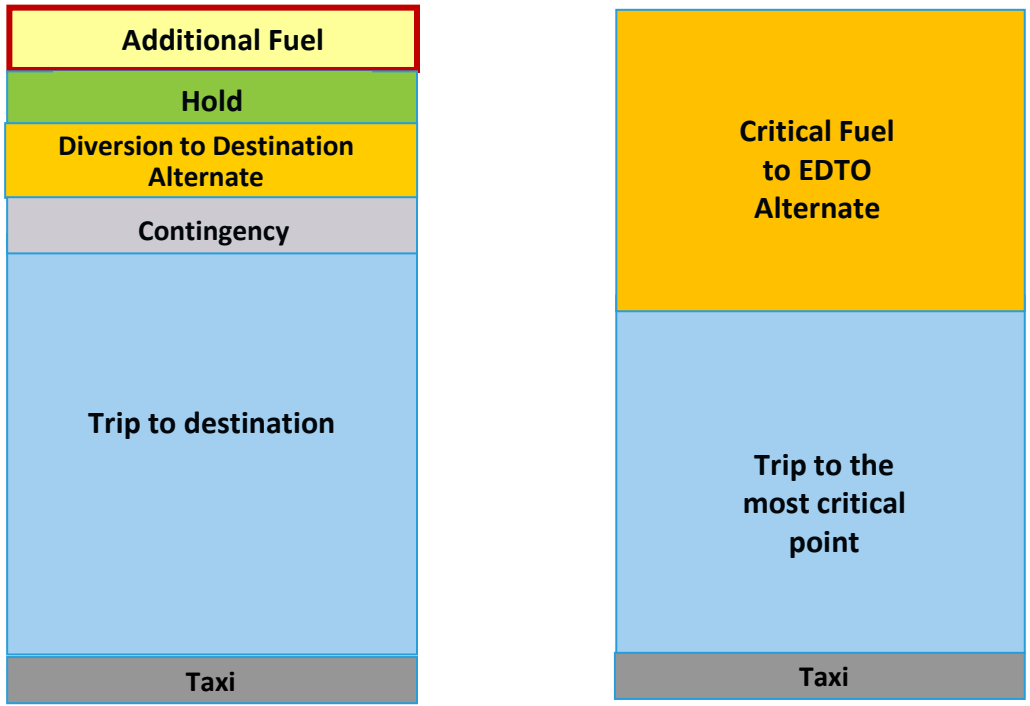
EDTO fuel calculation

No additional EDTO fuel required

EDTO Critical Fuel Check

Example: Additional EDTO Fuel Required

Additional EDTO fuel required



Standard fuel calculation

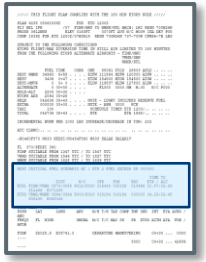
EDTO fuel calculation

EDTO Critical Fuel Scenario
Operational Application

Example - No Additional EDTO Fuel Required*

CRITICAL POINT AT : ETP2 FUEL EXCESS OF 01405

		DIST	W/C	CFR	FOB	EXC	TIME TO ETP / ALT
ETP1	FIMP/VRMG	0873/0845	P012/P000	16493	30159	13666	01.57/02.26
	S14456 E071438						
ETP2	VRMG/WIEE	0964/0994	P003/P013	18164	19569	01405	04.23/03.05
	S06438 E088048						



Typical EDTO Flight Plan

Critical Fuel Required

Normal Fuel at ETP

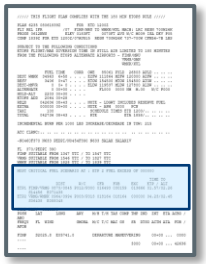
** Normal fuel on board (FOB) exceeds critical fuel requirement (CFR) at each ETP*

EDTO Critical Fuel Scenario
Operational Application

Example - Additional EDTO Fuel Required*

CRITICAL POINT AT : ETP2 FUEL EXCESS OF 00000

		DIST	W/C	CFR	FOB	EXC	TIME TO ETP / ALT
ETP1	FIMP/VRMG	0873/0845	P012/P000	16493	30159	13666	01.57/02.26
	S14456 E071438						
ETP2	VRMG/WIEE	0964/0994	P003/P013	18164	18164	00000	04.23/03.05
	S06438 E088048						



Typical EDTO Flight Plan

Critical Fuel Required

Adjusted Fuel at ETP

** Normal fuel on board (FOB) adjusted for critical fuel requirement (CFR) at ETP2*

EDTO Critical Fuel Scenario
Operational Application

Example - Additional EDTO Fuel Required*

EDTO FLIGHT/MAX DIVERSION TIME IN STILL AIR LIMITED TO 180 MINUTES
FROM THE FOLLOWING EDTO ALTERNATE AERODROMES -
FIMP/MRU,VRMG/GAN,WIEE/PDG

	FUEL	TIME					
	FUEL	TIME		OWE	85061	PYLD	26803
DEST WMKK	34963	6+58	. . . .	AZFW	111864	MZFW	120300
RESV	1049		. . . .	ATOW	154500	MTOW	154500
DEST-MNVR	0		. . . .	ALDW	119537	MLDW	127800
ALTERNATE	2357						
HOLD-ALT	2203	0+30					
EDTO ADD	2064						
REQD	42636	7+28					
EXTRA	00000						
TAXI	100						
TOTAL	42736	7+28					

Trip to Destination

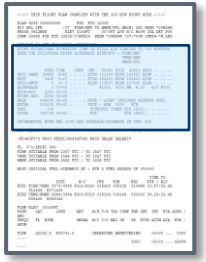
Contingency

Destination Alternate

Holding

Taxi

Additional EDTO Fuel Uplift



Typical EDTO Flight Plan

EDTO Time Limited Systems (TLS)

- **Consideration of Time Limitations:**
  Annex 6 Part 1, Attachment C (3.2.5.2 and 3.3.5.2)

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

  - **All aeroplanes**: The time capability of the cargo fire suppression system minus a state established operational margin (e.g. 15 minutes)
  - **Two engine aeroplanes**: An additional system time limitation (other than cargo fire suppression) may be identified

EDTO Time Limited Systems (TLS)

EDTO Up to 180 Minutes *(Including 15% Operational Extension)*

- Time limited system planning based on still air, standard day conditions
- Does not vary from flight to flight unless aeroplane TLS configuration is impacted by MEL constraints

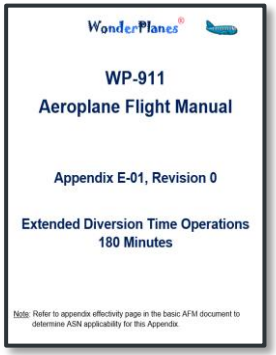
EDTO beyond 180 Minutes

- Time limited system planning based on forecast wind and temperature (planning varies from flight to flight)
- All engines operating (AEO) speed for cargo fire suppression
- One engine inoperative (OEI) speed for any two engine aeroplane time limited systems other than cargo fire suppression

EDTO Time Limited Systems (TLS)

EDTO up to 180 Minutes Example

Example AFM Statement - 180 Minute EDTO: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WP-911

Aeroplane Flight Manual

Appendix E-01, Revision 0

Extended Diversion Time Operations
180 Minutes

Note: Refer to appendix effectivity page in the basic AFM document to determine ASN applicability for this Appendix.

Aeroplane Flight Manual
180 Minute EDTO - Time Limited System Capability

The time capability of the most limiting EDTO significant system including cargo fire suppression is **195 minutes**

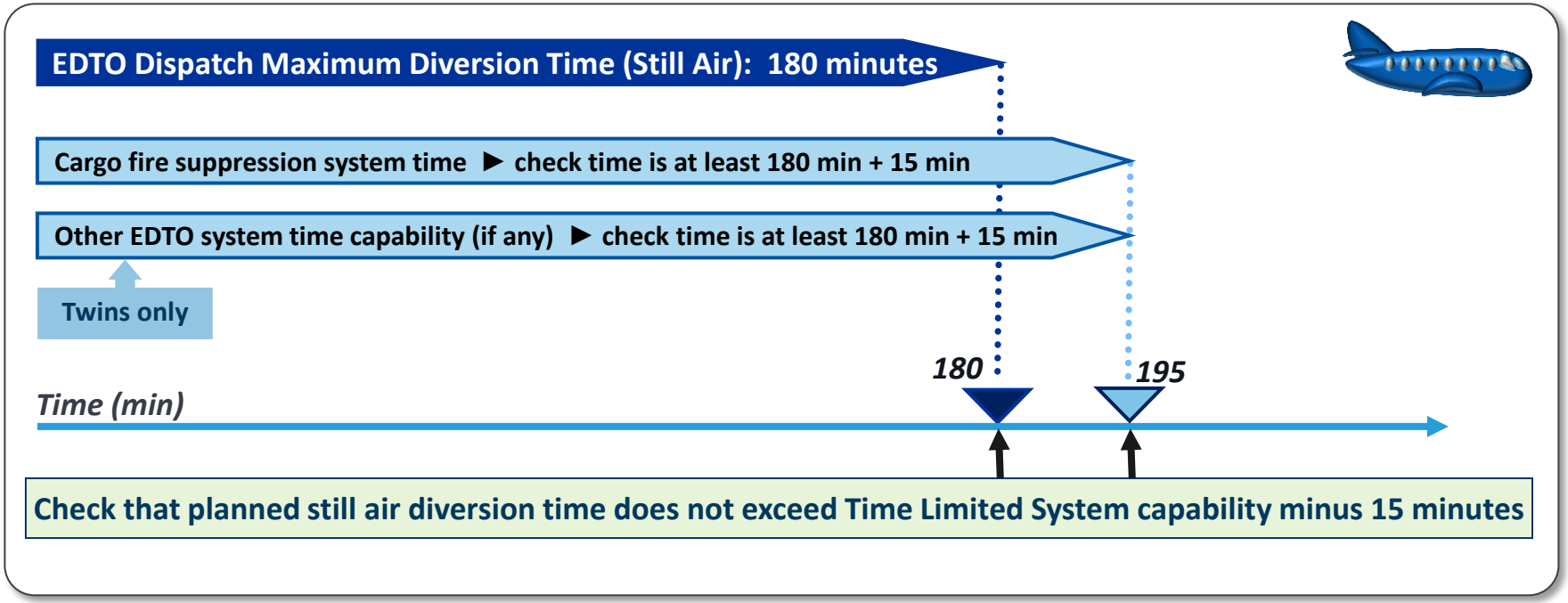
Operational Application:

- Still Air diversion time can not exceed EDTO TLS time minus 15 minutes
- 195 minute system time supports 180 minute EDTO (195 min - 15 min)

EDTO Time Limited Systems (TLS)

EDTO up to 180 Minutes Example

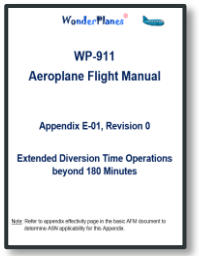
Consideration of Time Limited Systems based on ISA, Still Air Conditions



EDTO Time Limited Systems (TLS)

EDTO beyond 180 Minutes Example

Example AFM Statement - EDTO beyond 180 Minutes:


WonderPlanes

WP-911

Aeroplane Flight Manual

Appendix E-01, Revision 0

Extended Diversion Time Operations beyond 180 Minutes

Note: Refer to appendix effectivity page in the basic AFM document to determine AEM applicability for this Appendix.

Aeroplane Flight Manual

EDTO Beyond 180 Minutes - Time Limited System Capability

The time capability of the cargo fire suppression system is **225 minutes**

The time capability of all other EDTO significant systems is at least **290 minutes**

Operational Application:

- AEO diversion time with forecast winds and temps can not exceed cargo fire suppression time minus 15 minutes
- OEI diversion time with forecast winds and temps can not exceed other EDTO TLS system time minus 15 minutes

EDTO Time Limited Systems (TLS)

240 Minute EDTO Example

Time to distance relationship depends on diversion conditions:

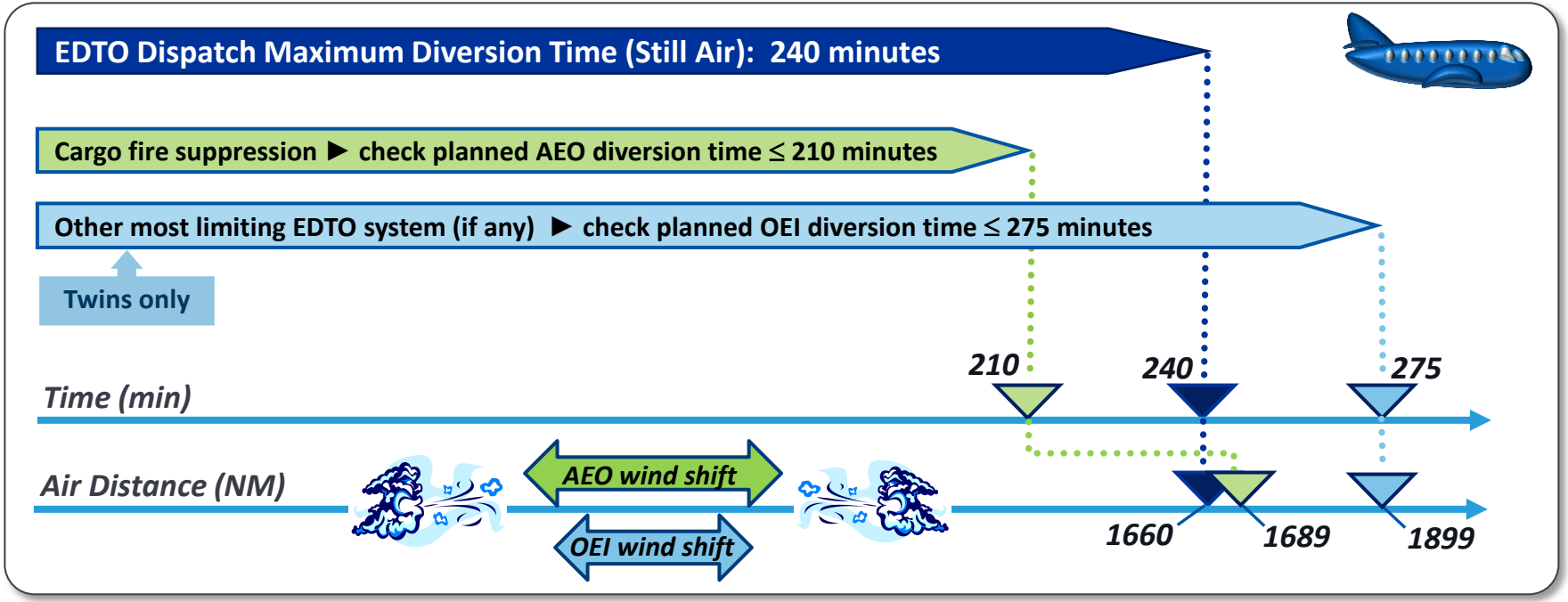
Time Consideration / Diversion Flight Condition	Distance (NM)	
	Air	Ground *
240 Minute EDTO Maximum Diversion Time *(ISA, still air)*: • OEI Driftown at Reference Weight and Approved OEI speed • From Slide 15, WP-911 Diversion Distance assumed conditions:	**1660**	**1660**
225 Minute Cargo Fire Suppression Time *(forecast winds & temps)*: • AEO Cruise at ETP Weight, Typical TAS = 482 knots (.84 Mach) • 482 nm/hr * (225 min - 15 min) ÷ 60	**1687**	**???***
290 Minute Other EDTO System Time *(forecast winds & temps)*: • OEI Driftdown at ETP Weight and Approved OEI speed, • From Slide 18 assumed conditions at 275 (290 - 15) minutes:	**1899**	**???***

**** TLS diversion distance will vary with forecast winds and temperatures***

EDTO Time Limited Systems (TLS)

240 Minute EDTO Example

Consideration of Time Limited Systems based on forecast winds and temperatures



Annex 6, Part 1 Definitions:

- **Master Minimum Equipment List (MMEL):**

  A list established for a particular aircraft type by the organization responsible for the type design with the approval of the State of Design containing items, one or more of which is permitted to be unserviceable at the commencement of a flight. The MMEL may be associated with special operating conditions, limitations or procedures

- **Minimum Equipment List (MEL):**

  A list which provides for the operation of aircraft, subject to specified conditions, with particular equipment inoperative, prepared by an operator in conformity with, or more restrictive than, the MMEL established for the aircraft type

  Chapter 6, 6.1.3 establishes requirement for a MEL. Additional guidance is provided in Attachment E

Minimum Equipment List

EDTO MMEL/MEL restrictions may be related to:

- **The allowable Maximum Diversion Time**

  Some States have established specific requirements for EDTO up to 180 minutes and EDTO beyond 180 minutes (e.g. FAA MMEL Policy Letter 40)

- **The capability of the Time Limited Systems**

  Example: A reduction in the capacity of the cargo fire suppression system

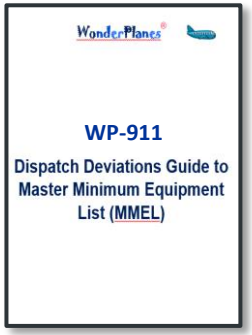
- **Weather minimums or approach capability**

  These items are typically not stated as EDTO restrictions, but may impact the assessment of EDTO alternate aerodromes

  Example: *"May be inoperative provided approach minimums do not require its use"*

Minimum Equipment List

Example of MEL Item based on EDTO restriction:



WonderPlanes® WP-911 Dispatch Deviations Guide (DDG)			
ATA 24, ITEM 24-02: APU Generator System			
Repair Interval	No. Installed	No. Required	Procedure
C	1	0	(O) (M)
Except for EDTO operations, may be inoperative			

What is the allowed maximum diversion time in this example?

Minimum Equipment List

Example of MEL Item based on diversion time restriction:

WonderPlanes®

WP911SP+ Dispatch Deviations Guide (DDG)

ATA 24, ITEM 24-02: APU Generator System

Repair Interval	No. Installed	No. Required	Procedure
C	1	0	(O) (M)

May be inoperative provided:

a. IDGs and Backup Generator operate normally

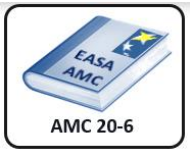
b. Operations beyond 180 minute diversion time are not conducted.

Master Minimum Equipment List

Additional requirements for EDTO beyond 180 minutes:

FAR Part 121, Appendix P

- Fuel Quantity Indicating System (FQIS) *****
- APU, both electrical and pneumatic
- Auto throttle system
- Second communication system (SATCOM Voice) *
- Engine-out auto-land *(if used for planning)*



EASA AMC 20-6

- Fuel Quantity Indicating System (FQIS)
- APU, both electrical and pneumatic
- Automatic engine or propeller control system
- Communication system(s) relied on by the flight crew to comply with communication requirements

EDTO Flight Planning Summary

- Check Aeroplane Configuration / EDTO Status
- Nominate EDTO Alternate Aerodromes
- Establish Area of Operation
- Consider EDTO Fuel Requirements
- Prepare Flight Folder

AIRCRAFT: WP-911	DEP: MRU/FIMP
ENGINES: SOFT THRUST 1500	DEST: KUL/WMKK
EDTO STATUS	
EDTO APPROVED: AEC	Y
EDTO APPROVED: CREW	Y
EDTO APPROVED: ROUTE	Y
MAXIMUM DIVERSION TIME	180 Min
TIME LIMITED SYSTEMS	195 Min
MEL /CDL	None
EDTO ALTERNATE AERODROMES	
WEATHER MINIMUMS	✓
NOTAMS	✓
COMPUTER FLIGHT PLAN (CFP)	
AREA OF OPERATION	✓
EEP, ETP, EXP	✓
PERIOD OF VALIDITY	✓
CRITICAL FUEL CHECK	✓
WEATHER FOLDER	
TAF, METARS, SIGMETS	✓
WINDS AND TEMPS ALOFT	✓
ICING FORECASTS	✓

Review Question

Q5.4 Chose the most appropriate definition of the term ‘ETP’

- Engineering Test Plan
- External Tracking Processor
- Employment Training Panel
- Equal Time Point

Review Question

Q5.5 Which of the following **does not** apply to the assessment of an EDTO alternate aerodrome

- Weather minima
- Landing performance requirements
- Rescue and fire-fighting service (RFFS)
- Business lounge in passenger terminal

Review Question

Q5.6 Which of the following **is not** considered in the EDTO critical fuel scenario

- Engine failure
- Decompression
- Combined engine failure and decompression
- Cargo fire

Module 5 - Outline

Part I — Defining the EDTO Area of Operations

Part II — Performing EDTO Flight Planning

Part III— Conducting EDTO Flights

Part IV— Documentation and Training

Part V — Practical Exercise

EDTO In-flight Considerations

EDTOM Section 3.6

Fundamental Concepts:

"In-flight considerations for EDTO are separate but complimentary to the flight preparation considerations discussed in Section 3.5. The pilot in command is not bound by the EDTO planning assumptions and may exercise discretionary authority to deviate from these assumptions in the event of an in-flight emergency."

The additional in-flight considerations for EDTO primarily consist of enhanced awareness of aeroplane system and fuel status, and the monitoring of EDTO alternate aerodrome conditions… Aeroplane operating procedures are typically equally applicable to both EDTO and non-EDTO operations…

EDTO In-flight Considerations

EDTO Flight Planning

- EDTO Alternate dispatch planning minimums
- Determine EDTO waypoints (EEP, ETPs, EXP)
- Critical fuel requirement
- MEL is applicable
- Approved OEI or AEO speed

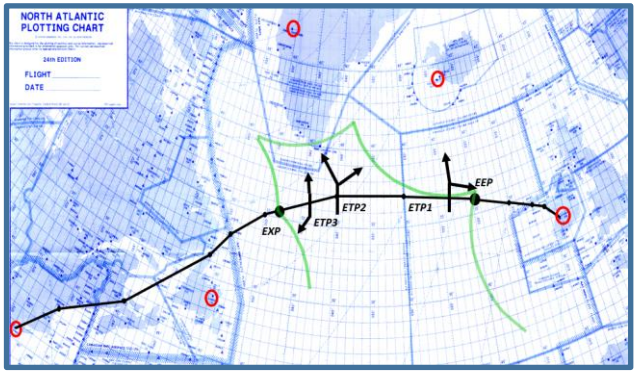
EDTO Enroute Operations

- Enroute Alternate operating minimums
- Monitor flight progress within EDTO Sector
- Operator minimum fuel policy
- QRH is applicable
- Diversion speeds may differ at PIC discretion

Flight Progress Monitoring

Standard long range navigation and communication procedures and equipment requirements apply with increased emphasis on:

- Airplane position relative to EDTO Sector (EEP, ETPs, EXP)
- Fuel progress monitoring
- En-route alternate and aeroplane system status



EDTO Plotting Chart

FMS Navigation

```
FIMP ELEV  00183FT
POSN     LAT      LONG      AWY    M/H T/H TAS COMP TMP ZND   ZNT  ETA ACBO / ABO
FREQY    FL  WIND           GMORA  M/C T/C MAC GS   SR  DTGO ACTM ATA  FOB / AFOB

FIMP     S2025.8  E05741.0          DEPARTURE MANEUVERING      00+00 ...  0000 ....
                                                      3000     00+00 ... 42636 ....


TOC                                 N633   079 060 460 P010 P08 0131 00+22...   4084 ....
         370 327072                 040    088 069     470  04  2869 00+22 ... 38552 ....

OVTIS    S1931.4  E06008.7 N633     079 060 460 P010 P08 0018 00+02 ...  4287 ....
         370 327072         040     088 069 788 470  04  2851 00+24 ... 38349 ....

EEP      S1756.3  E06415.9 N633     079 062 459 P012 P08 0253 00+32 ...  7169 ....
         370 324058         026     086 069 786 471  02  2598 00+56 ... 35467 ....

PADSO    S1738.7  E06500.0 N633     079 062 459 P012 P08 0046 00+06 ...  7694 ....
         370 324058         026     086 069 786 471  02  2552 01+02 ... 34942 ....

PARTI    S1532.4  E07000.0 N633     078 063 458 P007 P08 0314 00+40 ... 11224 ....
         370 324036         026     082 067 785 465  01  2238 01+42 ... 31412 ....

ETP1     S1445.6  E07143.8 N633     076 064 455 M004 P08 0111 00+15 ... 12477 ....
         370 348019         010     078 066 780 451  03  2127 01+57 ... 30159 ....

PEDPI    S1316.6  E07500.0 N633     076 064 455 M004 P08 0210 00+28 ... 14848 ....
         370 348019         010     078 066 780 451  03  1917 02+25 ... 27788 ....

PANDU    S1138.1  E07826.6 N633     073 063 454 M006 P03 0225 00+30 ... 17445 ....
         390 360013         010     074 064 787 448  01  1692 02+55 ... 25191 ....

SAKEG    S0810.3  E08520.1 N633     071 063 453 M010 P03 0457 01+02 ... 22449 ....
         390 026012         010     072 064 785 443  02  1235 03+57 ... 20187 ....

ETP2     S0643.8  E08804.8 N633     066 061 452 M025 P03 0185 00+26 ... 24472 ....
         390 030030         010     067 063 783 427  03  1050 04+23 ... 18164 ....

PIBED    S0520.2  E09044.0 N633     066 061 452 M025 P03 0179 00+25 ... 26430 ....
         390 030030         010     067 063 783 427  03  0871 04+48 ... 16206 ....
```

Flight Plan Nav/Fuel Log

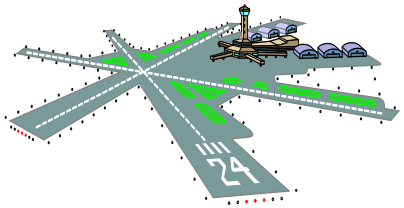
Alternate Aerodrome Status
(Weather Minima)

EDTO Alternate Weather Minima Summary:

- **Prior to Departure**: EDTO dispatch planning minimums applicable
- **Enroute before EEP**: Aerodrome operating minimums applicable
  - If an EDTO alternate falls below minimums: amend flight plan to select another EDTO alternate, continue non-EDTO, divert or turn back
- **After passing EEP**: No specific weather minima requirement

Other Operational Considerations:

- Good practice to monitor EDTO alternate status throughout flight, and update next EDTO alternate weather when passing ETP
- In case of an enroute diversion, the flight crew is not obligated to select a designated EDTO alternate and may chose another suitable aerodrome if determined to be a safer course of action



Procedures to Support EDTO Maintenance Programme

Some EDTO Maintenance Program elements have a Flight Operations interface and may require action by the flight crew:

- APU in-flight start program
- EDTO maintenance verification flights
- EDTO flight release after a non-technical diversion

These interfaces should be addressed in the operators EDTO Flight Operations documentation and training programs.

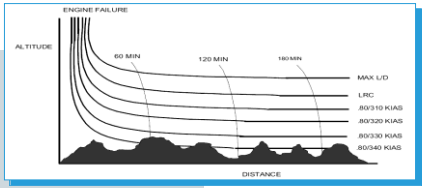
Note: EDTO Maintenance Program considerations for two engine aeroplanes will be discussed further in Module 6.

Diversion Decision Considerations

- QRH non-normal checklists calling for ‘Land ASAP’ or ‘Land at nearest suitable aerodrome’
  - Multiple system failures, engine failure, decompression, smoke or fire…
  - OEM non-normal procedures typically do not distinguish EDTO and are validated for both EDTO and non-EDTO operations
- Required alternates unavailable or unsuitable for use (prior to EDTO entry)
- Excessive fuel consumption, exceeding available fuel reserves
- Any other situation that the flight crew determines to have an adverse effect on safety of flight
  - Most EDTO diversions are due to non-technical causes (weather, passenger medical…)
- Comply with route requirements as for non-EDTO, coordinate/communicate with flight dispatch as required

OEI Diversion Strategies

Diversion speed and thrust selection are at the discretion of the flight crew based on prevailing operational conditions.



‘Obstacle Clearance’ Strategy

- Best altitude profile for terrain clearance
- Optimum driftdown (L/D max) speed

Altitude

‘Fuel’ Strategy

- Optimizes diversion fuel required
- Descent to LRC cruise ceiling and LRC cruise

Fuel

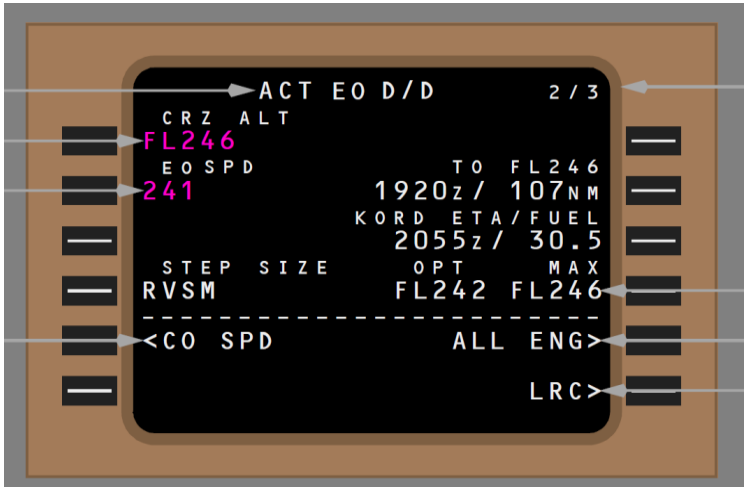
‘Fixed Speed’ (EDTO) Strategy

- Minimum diversion time (at the expense of fuel and altitude)
- Driftdown and cruise at EDTO OEI Speed

Time

OEI Diversion Strategies

Flight crews should have access to relevant aeroplane performance data:



WP 911 FMS Engine Out Page

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF PRESSURE ALTITUDE		
START DRIFT DOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
240	231	266	18400	16900	15500
230	222	261	20100	18500	17100
220	213	256	21400	20100	18700
210	203	250	22700	21500	20300
200	194	245	24100	22900	21700
190	184	239	25400	24300	23100
180	174	232	26700	25800	24600
170	165	226	28000	27500	26300
160	155	220	29500	29200	28100
150	145	213	30900	30800	29900
140	136	206	32300	32200	31800
130	126	199	33700	33700	33600
120	116	192	35300	35300	35200
110	107	185	37000	36900	36800
100	97	178	38800	38700	38600

Example

WP 911 Performance Manual Data

EDTOM Aeroplane Performance Data is addressed in EDTOM Section 3.7

Review Question

Q5.7 Which of the following is the most appropriate guidance for an EDTO enroute system failure

- Minimum Equipment List (MEL)
- EDTO Significant Systems List (SSL)
- Quick Reference Handbook (QRH)
- Aeroplane Flight Manual (AFM)

Module 5 - Outline

Part I — Defining the EDTO Area of Operations

Part II — Performing EDTO Flight Planning

Part III— Conducting EDTO Flights

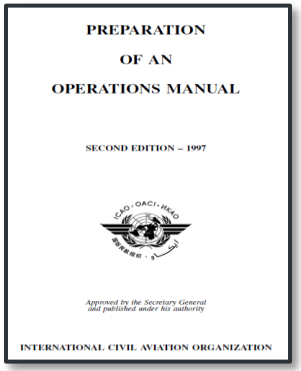
Part IV— Documentation and Training

Part V — Practical Exercise

Typical Operations Manual Format

Annex 6, Part 1 – Appendix 2: Organization and Content of an Operations Manual

- Part A: General
- Part B: Aircraft Operating Information
- Part C: Areas, Routes and Aerodromes
- Part D: Training



Doc 9376
Preparation of an Operations Manual

EDTO provisions may be included in this basic structure or published in a separate stand alone EDTO flight operations manual (EFOM)

EDTO Flight Operations Manual

EDTOM Section 3.8

Purpose:

- To provide involved personnel and EDTO authorized persons with a descriptive means aimed at ensuring safe and efficient EDTO operations…
- Acccordingly all EDTO requirements including supportive programme policies, procedures, duties, responsibilities and limitations should be identified…

Approval and revision control:

- The EFOM or EDTO sections of the basic FOM should be reviewed and approved by the responsible Flight Operations Inspector (FOI) as part of the operational approval application process.
- Major revisions to the EDTO program documentation should also be reviewed and approved prior to operator implementation (minor revisions may be accepted).

EDTO Flight Operations Manual

EDTO Flight Operations Manual Content Elements:

- EDTO definitions and concepts. Information on applicable EDTO rules, operator's EDTO program, flight preparation etc…

- AEC specific information (e.g. Max diversion times and distances, OEI or AEO speeds, EDTO procedures, performance data)

- Authorized operational areas, route specific information, enroute alternate aerodromes, approved weather minimums

- EDTO training and qualification policies and procedures, EDTO training curriculi

Considerations:

- Flight Operations personnel should complete approved training on EDTO prior to an operator receiving EDTO operational approval
  - Flight crews, flight dispatchers, other operations personnel…
- EDTO training programmes should address the specific regulations, authorizations, policies, procedures and documentation related to the particular EDTO program.
  - Flight crew training programs should include the content and duration of academic training, simulated flight demonstrations, line checks and currency requirements
  - Dispatcher training programs should also address academic training considerations as well as practical training on the specific tools and methods used for EDTO flight preparation
- Operators may employ the use of different training media and methods (e.g. CBT, standup instruction, simulation) in their EDTO training programmes

EDTO Training Programme

Typical Academic Training Elements:

- **Familiarity with ICAO EDTO standards and relevant State regulations**
- **EDTO Operational Program Approvals**
  - EDTO Fleet
  - Operational Area
  - EDTO Threshold, Maximum diversion times and speeds
- **EDTO Flight Planning Considerations**
  - EDTO area of operations
  - Alternate aerodromes for EDTO
  - EDTO fuel reserves
- **EDTO Flight Planning Considerations (cont'd)**
  - Time limited system considerations
  - EDTO technical status and MEL considerations
  - EDTO Flight Release and Computer Flight Plan
- **EDTO Enroute Considerations**
  - Standard Operating Procedures
  - Inflight Monitoring
  - Diversion Considerations
  - Non-normal and Contingency Procedures
- **Aeroplane Performance Data**
- **EDTO Flight Operations Manual**

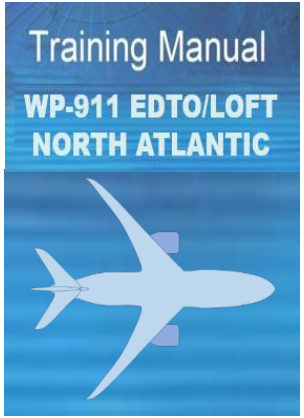
EDTO Training Programme

Typical Practical Training Elements (Flight Crews):

- **Preflight briefing**
- **EDTO flight release**
- **Cockpit preparation**
- **En-route (normal)**
  - Entering EDTO Sector
  - En-route monitoring procedures
  - FMS procedures (as applicable)
  - Navigation and communication
- **En-route (non-normal)**
  - Contingency procedures
  - Select non-normal procedures and checklists
  - Diversion decision making
  - FMS procedures (as applicable)
  - En-route diversion
- **Post-flight procedures**

EDTO Training Programme

Recurrent Training:



- Typically conducted annually, but may vary among operators
  - Frequency, duration and specific currency requirements should be defined in the operator's EDTO training program
- Condensed or shortened refresher academic training is normally adequate for personnel who have maintained an active role in the EDTO program
  - Repeat initial training may be appropriate for personnel who are no longer considered current
- Practical recurrent training (e.g. EDTO LOFT) should consider student exposure to different operational situations instead of repeating the same scenarios
  - Relevent experience from actual in-service events may be considered

EDTO Flight Operations Summary

Approval Planning

- Determine approved diversion speed and Maximum Diversion Time (MDT)
- Evaluate potential enroute alternates
- Establish approved EDTO area of operation
- Implement EDTO flight planning system

Dispatch Planning

- Determine EDTO waypoints (EEP, ETPs, EXP)
- EDTO alternate dispatch planning minimums
- Critical fuel requirement
- MEL is applicable
- Approved OEI or AEO speed

Enroute Operations

- Monitor flight progress within EDTO Sector
- Enroute alternate operating minimums
- Operator minimum fuel policy
- QRH is applicable
- Diversion speeds may differ at PIC discretion

Module 5 - Outline

Part I — Defining the EDTO Area of Operations

Part II — Performing EDTO Flight Planning

Part III— Conducting EDTO Flights

Part IV— Documentation and Training

Part V — Practical Exercise

Questions?

EDTO Workshop

End of Module 5 - Flight Operations Considerations