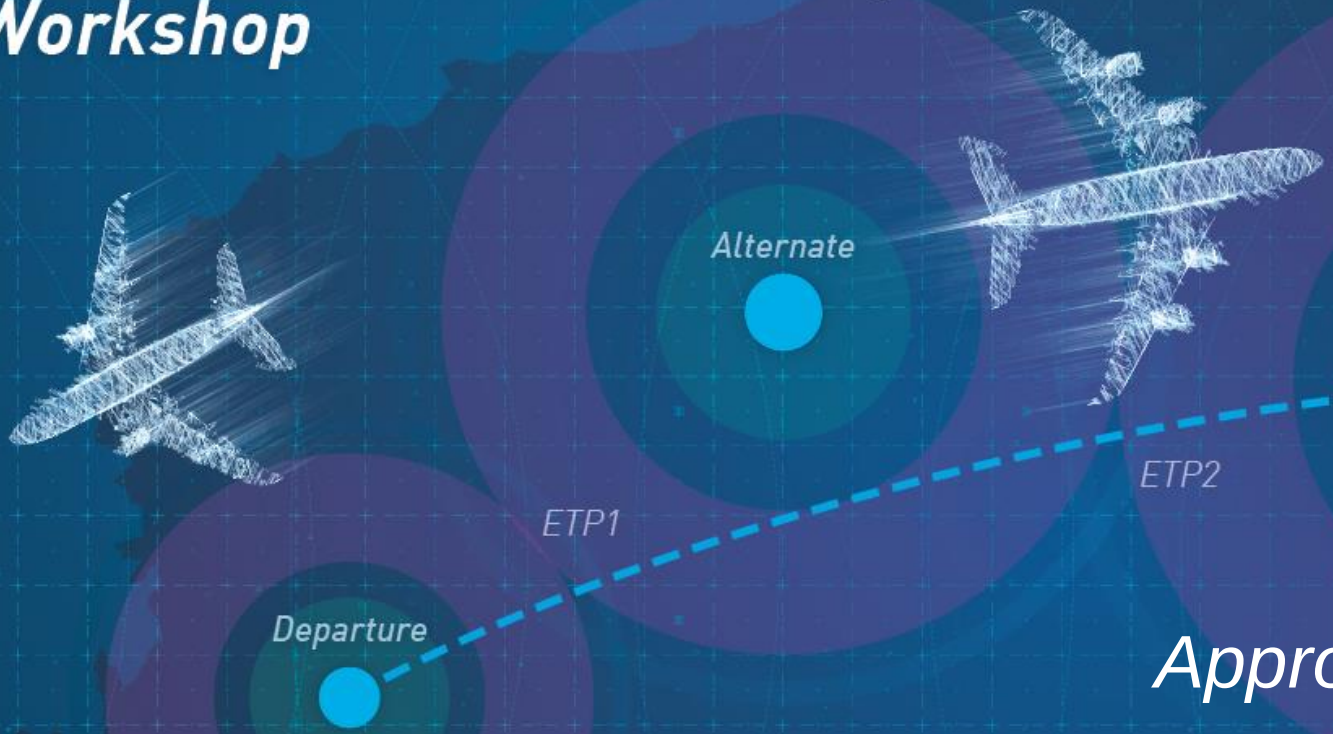
Extended Diversion Time Operations Workshop



Module 3
Approval Process

ICAO Proudly in partnership with AIRBUS BOEING

Course Structure

Module 1
Course Introduction

Module 2
EDTO Foundation

Module 3
Approval Process

Module 4
Type Design & Reliability Considerations

Module 5
Flight Operations Considerations

Module 6
Maintenance Considerations

Module 7
Continued Surveillance

Module 8
Implementing EDTO Regulations

Module 9
Assessment

Module 10 – Wrap Up

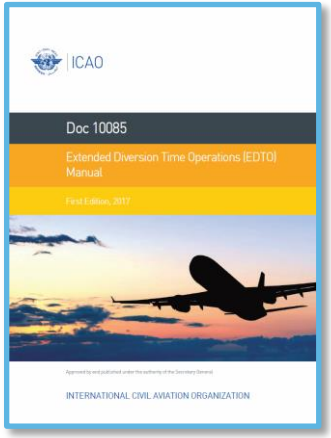
Objectives

At the end of this module, participants will be able to understand the major elements of the EDTO approval process and related requirements.

EDTOM References

Doc 10085: Extended Diversion Time Operations (EDTO) Manual

Definitions
1.4 – Authorization Procedures
1.5 – Continuity of EDTO Certification
1.6 – Continuity of EDTO Authorization



The following symbol indicates a reference to the EDTO Manual throughout this module:

EDTOM

Other ICAO References

Annex 6, Part 1: Operation of Aircraft
Chapter 1: Definitions

Section 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)

Annex 8: Airworthiness of Aircraft, Part 1. Definitions

Doc 7300: Convention on International Civil Aviation (Chicago Convention)

Doc 8335: Procedures for Operations Inspection, Certification and Continued Surveillance

Doc 9734: Safety Oversight Manual, Part A

Doc 9760: Airworthiness Manual, Part III and V

Doc 10059: Manual on the implementation of Article 83 *bis* of the Chicago Convention

Module 3 - Outline

Part I — EDTO Approval Major Elements

Part II — Responsibilities of Contracting States

Part III — EDTO Type Design Approval Process

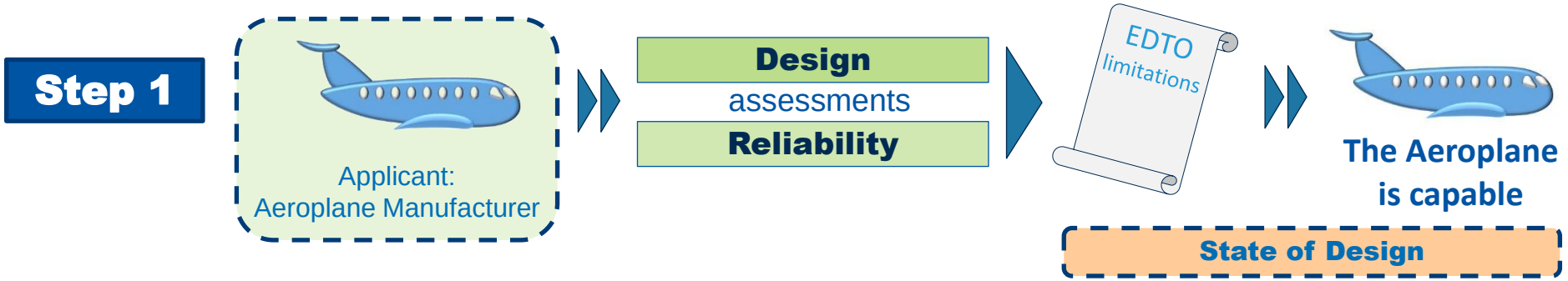
Part IV — EDTO Operational Approval Process

Part V — Review Questions

Part VI — Practical Exercise

EDTO Approval Elements

EDTO Approval is a Two Step Process



- Aeroplane manufacturers must perform a **Type Design & Reliability Assessment** of the aeroplane/engine combination for approval or validation by the Type Design Authority.

The Aeroplane is Capable

- This step is referred to as '**EDTO Type Design Approval**' in this module and throughout the EDTO workshop to describe aeroplanes **certified** for EDTO capability

EDTO Approval Elements

EDTO Approval is a Two Step Process

- Airline operators must apply for authorization from their local authority in order to fly EDTO routes with an **EDTO capable aeroplane/engine combination (AEC)**.

The Airline is Ready

- This authorization constitutes a **Specific Approval** which is referred to as '**EDTO Operational Approval**' in this module and throughout the EDTO workshop.

Aeroplane/Engine Combination (AEC)

- A combination of aeroplane model and engine model which has been identified for the purpose of EDTO certification (also called type design and reliability approval) or authorized for EDTO…
  - Substantially common minor model variants may be grouped into a single EDTO authorization or approval

EDTOM

Definitions

Preclude and Protect Philosophy

Two-step approval process supports EDTO philosophy

PRECLUDE : Avoid the diversion

Enhanced
aeroplane/engine reliability standards
(e.g. IFSD rate)

Enhanced
airline maintenance practices
(e.g. Dual Maintenance Limitations)

PROTECT : Ensure that the diversion is safe

Enhanced
aeroplane/engine design standards
(e.g. independent electrical sources)

Enhanced
Dispatch Planning
(e.g. EDTO Fuel Reserves, Weather)
and **Flight Crew training and awareness**

EDTO Approval Elements

To operate beyond EDTO Threshold, two conditions must be met:

EDTO Type Design (AEC) Evaluation

(Certification required for Twins only)

Applicant:

MANUFACTURER

Annex 8 + EDTO Manual

CS 25 + AMC 20-6

FAR 25/33 + AC25xx (TBC)

Prime Certification Authority

+

Validation Authorities

EDTO Operational Evaluation

Applicant:

OPERATOR

Annex 6 + EDTO Manual

AIR OPS + AMC 20-6

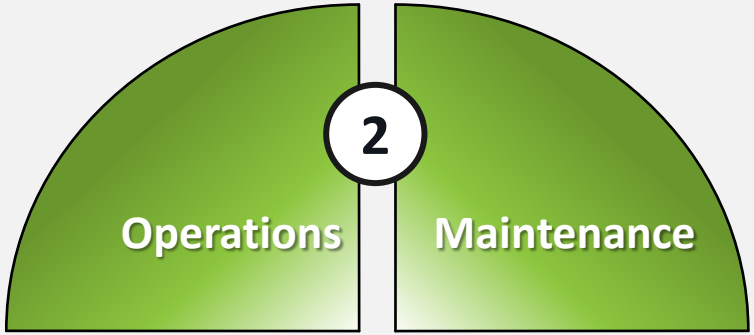
FAR121/135 +AC120-42B

NAA Rules

National Aviation Authority

EDTO Type Design Evaluation must be completed **before** granting of operational approval of Operator for EDTO

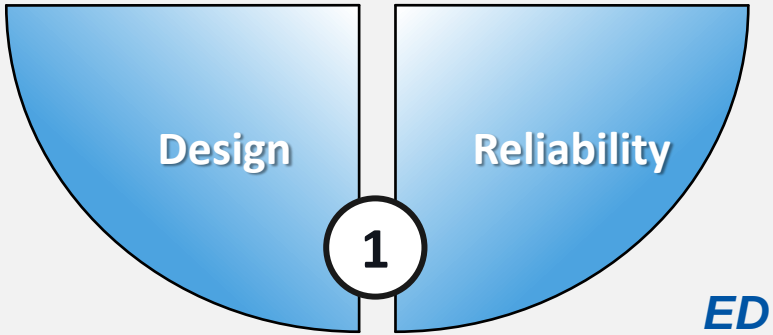
Elements of EDTO Assessment



Compliance demonstration:

Responsibility of the Operator

EDTO Operational Capability Assessment



Compliance demonstration:

Responsibility of the Manufacturer

EDTO Type Design & Reliability Assessment

Applicability of EDTO Regulations

- Operational Approval
  - State regulations and guidance materials for EDTO operational approval are applicable at **time of operations**
  - EDTO operators must comply with the latest (current) issue of applicable regulatory material for EDTO operations

Current

Current

- Type Design Approval
  - State regulations and guidance materials for EDTO type design and reliability approval are applicable at **time of application**
  - Follow-on derivative aeroplanes and/or increases in EDTO capability may be subject to later standards

Before 2011

Before 2007

Module 3 - Outline

Part I — EDTO Approval Major Elements

Part II — **Responsibilities of Contracting States**

Part III — EDTO Type Design Approval Process

Part IV — EDTO Operational Approval Process

Part V — Review Questions

Part VI — Practical Exercise

Foreword

This section provides a review of ICAO contracting State responsibilities which is not unique to EDTO, but applies equally to EDTO as with all areas of the Standards related to airworthiness determination and operational authorization.

Contracting State Definitions

Annex 6, Part 1 and Annex 8 Definitions:

State of Design: The State with jurisdiction over the organization responsible for the type design.

State of Manufacture: The State with jurisdiction over the organization responsible for the final assembly of the aircraft.

State of the Operator: The State where the operator's principle place of business is located or, where the operator's permanent residence is.

State of Registry: The State on whose register the aircraft is entered.

Attendee Poll

Q3.1 Which ICAO State categories apply to your State?

- State of Design
- State of Registry
- State of Operator
- State of Registry & State of Operator
- All of the above

Contracting State Responsibilities

State of Design ➔ Primary Responsibility for EDTO Type Design Approval and Reliability Assessment (TCDS)

***State of Operator** ➔ Primary Responsibility for EDTO Operational Approval and Oversight (OpSpec)

***State of Registry** ➔ Primary Responsibility for EDTO Continued Airworthiness Program Approval and Oversight and acceptance/validation of EDTO Type Design (C of A)

* Note: When the State of Registry and State of the Operator are different, shared safety oversight responsibilities may be established and filed through an **Article 83 *bis* agreement**

Contracting State Responsibilities

Article 83 *bis* - Transfer of certain functions and duties

… when an aircraft registered in a contracting state is operated pursuant to an agreement for the lease, charter or interchange of the aircraft … by an operator who has his principle place of business… in another contracting State, the State of registry may, by agreement with such other state, transfer to it all or part of its functions and duties as State of Registry…

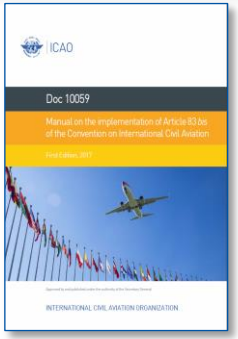
The State of Registry shall be relieved of responsibility in respect of the functions and duties transferred.

The transfer shall not have effect in respect of other contracting States before either the agreement… has been registered with the Council… or the existence and scope of the agreement have been directly communicated to the authorities of the other contracting State or States concerned

Doc 7300
Chicago Convention

Article 83 *bis* Implementation

Doc 10059, Manual on the implementation of Article 83 *bis* of the Convention on International Civil Aviation.



Doc 10059
First Edition, 2017

Article 83 *bis* Implementation

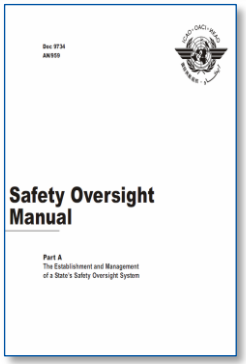
Doc 10059, Appendix C. Example of record of Sate of Registry and State of the Operator Duties and Functions…

ICAO Annex Reference	Subject	Primary responsibility (SoR or SoO)	State of Registry (SoR) duties and functions	State of the Operator (SoO) duties and functions	Liaison scope	Liaison frequency
Annex 6, Part I, Attachment D para, 2.4	Special operations approvals	SoO	Evaluate aircraft equipment suitability, reliability and maintenance and inform SoO.	Evaluate operational procedures, qualifications and training and issue special operations approvals following verification with SoR that applicable airworthiness certification standards have been incorporated.	Coordinated evaluation between SoR airworthiness inspectors/SoO flight operations inspectors.	To be agreed between the two States.
Annex 6, Part I, para. 4.7.2.6	Extended diversion time operations (EDTO) maintenance	SoR	Issue airworthiness certification of EDTO. Approve the EDTO maintenance programme requirements.	Issue operational approval of EDTO. Inform SoR of propulsion system reliability.	Liaison between SoR airworthiness inspectors/SoO flight operations inspectors.	To be agreed between the two States. To include a review of the maintenance programme and reliability reports.

Doc 10059
First Edition, 2017

Contracting State Responsibilities
Type Certification

Overview of States Safety Oversight Obligations (ICAO Doc 9734 – Safety Oversight Manual, Part A):



Doc 9734, Part A

2.3.3.1 **State of Design** Obligations

a) It issues a **type certificate** which defines the design of an aircraft type and certifies that this design meets the appropriate airworthiness requirements of that state.

b) It transmits any generally applicable information necessary for the continuing airworthiness and safe operation of the aircraft to:

- every Contracting State which has advised the State of Design that it has entered the aircraft on it's register; and
- any other Contracting State upon request…

Contracting State Responsibilities
Type Certification

Type Certification Activities: **State of Design** (ICAO Doc 9760 – Airworthiness Manual, Part V)

2.3.1.2 There are five key activities associated with a type certification process, namely:

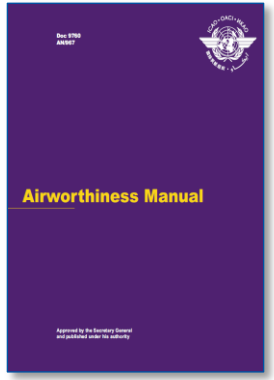
a) establishing the certification basis;

b) establishing the means or methods of compliance;

c) demonstration and findings of compliance;

d) certifying the type design; and

e) post certification activities.



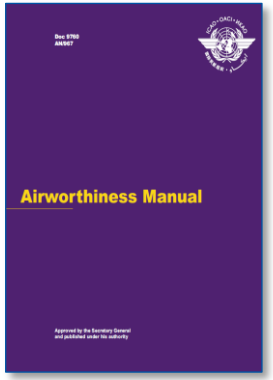
Doc 9760, Part V

Contracting State Responsibilities
Type Validation/Acceptance

Type Certification Activities: **States other than the State of Design**
(ICAO Doc 9760 – Airworthiness Manual, Part V):

2.4: Annex 8, Part II, Chapter 3 states that the issuance, or rendering valid, a Certificate of Airworthiness, must be based on satisfactory evidence that the aeroplane complies with the design aspects of the appropriate airworthiness requirements of the **State of Registry**…

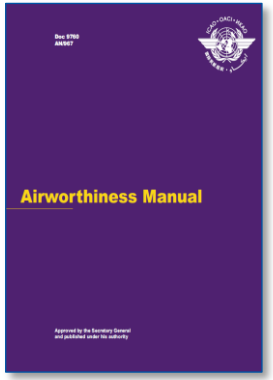
The satisfactory evidence used by the majority of Contracting States is the Aircraft Type Certificate



Doc 9760, Part V

Contracting State Responsibilities
Type Validation/Acceptance

Type Certification, Validation and Acceptance (ICAO Doc 9760 – Airworthiness Manual, Part III, Chapter 4)



Doc 9760, Part III

A Certificate of Airworthiness shall be issued by a Contracting State on the basis of satisfactory evidence that the aircraft complies with the design aspects of the appropriate airworthiness requirements.

In order to meet these requirements the **State of Registry** has to have satisfactory evidence that the design of the aircraft meets its airworthiness requirements. This can be achieved in three ways:

a) Type certification;

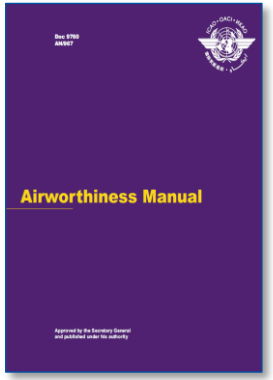
b) Type validation; or

c) Type acceptance

Contracting State Responsibilities
Type Validation/Acceptance

Type Certification Activities: **States other than the State of Design**
(ICAO Doc 9760 – Airworthiness Manual, Part V)

2.4 (cont'd): *It is not expected nor encouraged that States of Registry perform the same in-depth determinations of compliance that the State of Design has already done*. Instead, States are encouraged, through regulations, bilateral agreements or policy, to give maximum credit to the type certification work already done by the State of Design and, minimize duplicate or redundant testing that adds little or no value to the overall airworthiness of the aeronautical product.



Doc 9760, Part V

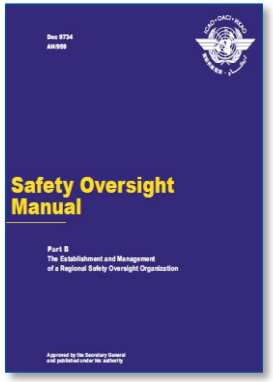
Attendee Poll

Q3.2: Which approach is used by your State for the import of new aeroplane types?

- Type Certification
- Type Validation
- Type Acceptance
- Not Sure

Contracting State Responsibilities
Operational Approval and Oversight

Doc 9734: Safety Oversight Manual
Part 1, Chapter 3: 8 Critical Elements (CEs) of a Safety Oversight System

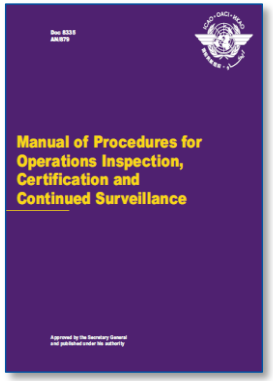


Doc 9734

Contracting State Responsibilities
Operational Approval

Doc 8335: Manual of Procedures for Operations Inspection, Certification and Continued Surveillance

Operations Specifications: *The authorizations, conditions and limitations associated with the AOC and subject to the conditions in the operations manual…*



Doc 8335

Part III. The AOC - Application, Evaluation and Certification (5 Phase Process)

	Chapter 1.	General
1	Chapter 2.	Pre-application phase
2	Chapter 3.	Formal application phase
3	Chapter 4.	Document evaluation phase
4	Chapter 5.	Operational demonstration and inspection phase
	Chapter 6.	Maintenance control demonstration and inspection phase
5	Chapter 7.	Certification phase

Module 3 - Outline

Part I — EDTO Approval Major Elements

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Part VI — Practical Exercise

EDTO Type Design Requirements
Comparison

ICAO Annex 6, Part 1, Section 4.7.2
Requirements for Extended Diversion Time Operations (EDTO)

- Two engine aeroplanes
  - Paragraph 4.7.2.3(b) requires that a two engine aeroplane be '**EDTO certified**' (EDTO Type Design Approved) to conduct EDTO operations.

- Aeroplanes with more than two engines
  - While some States (e.g. FAA) have elected to establish EDTO type design requirements, there are no provisions under the ICAO standards.

- All aeroplanes
  - Paragraph 4.7.2.3(a) requires identification of the most limiting EDTO significant system time in the aeroplane flight manual.
  - This necessitates an aeroplane capability **assessment** for EDTO

EDTO Type Design Approval
Two Engine Aeroplanes

ICAO Annex 6

EDTO certification and assessment of EDTO time limited systems

AMC 20-6

Chapter II, Type Design Approval Considerations

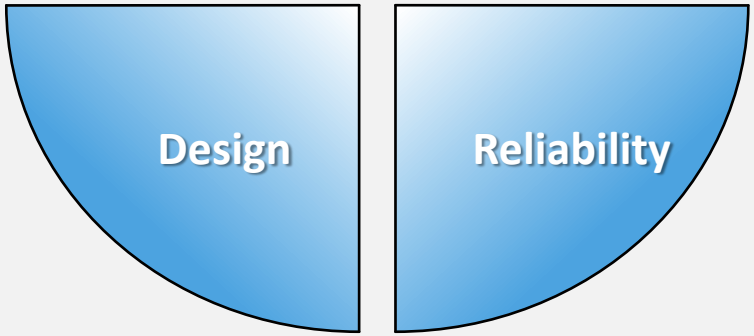
PART 21

PART 25

PART 33

These FAA ETOPS Certification rules have superseded AC 120-42A in 2007

Additional guidance in new AC for Part 25 still pending



<u>Compliance demonstration:</u>

Responsibility of the Manufacturer

EDTO Type Design & Reliability Approval

EDTO Type Design Assessment

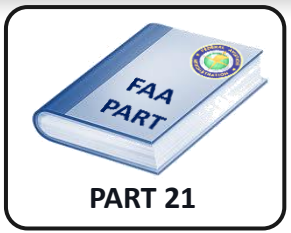
Aeroplanes with More than Two Engines

ICAO Annex 6

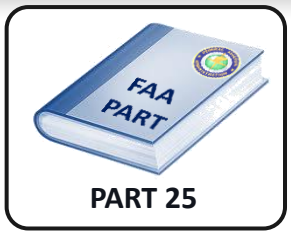
Assessment of EDTO time limited systems

ICAO 20-6

Chapter II, Type Design Approval Considerations



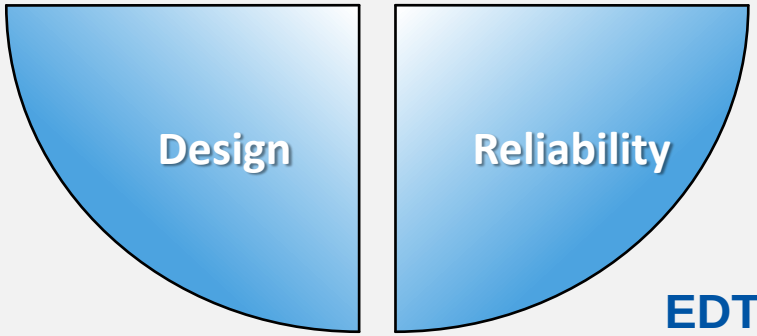
PART 21



PART 25

PART 33

2007 FAA ETOPS Certification rules introduced requirements for passenger aeroplanes manufactured after February, 2015



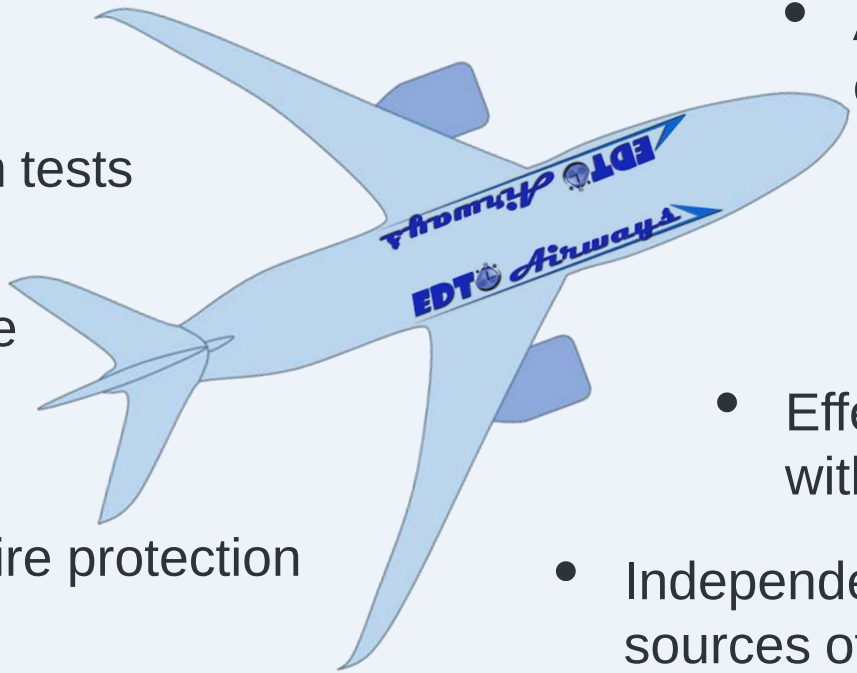
Compliance demonstration:

Responsibility of the Manufacturer

EDTO Type Design & Reliability Assessment

EDTO Type Design Approval
Two Engine Aeroplanes

- Design to fail-safe criteria
- Analysis of failure effects
- Manufacturer demonstration tests
- Equipment cooling
- In-service experience (world fleet)
- Effect of operation with a failed engine
- Cargo fire protection
- Independent sources of AC power
- Fuel management



EDTO Type Design Approval
Two Engine Aeroplanes

Basic concepts:

- EDTO type design approval is a pre-requisite to operational approval
- Each aeroplane/engine combination is approved separately
  - Approvals may be grouped by minor model series
  - Derivative airplanes require additional approval
- EDTO type design approval levels
  - Up to 180 minutes (e.g. 90, 120, 180)
  - Greater than 180 minutes (up to EDTO significant system time capability)

Approval methods:

- Early EDTO Method
  - EDTO type design approval obtained with no or reduced service experience on the candidate aeroplane/engine combination
- Five (5) Early EDTO Process Elements:
  - Design for EDTO
  - Relevant Experience
  - Maintenance and Operations Procedures Validation
  - EDTO Testing (APU, Engine, Aeroplane)
  - Problem Tracking and Resolution

Approval methods (cont'd):

- Service Experience Method
  - A minimum of 100,000 (EASA) or 250,000 (FAA) world fleet in-service engine hours on the candidate aeroplane/engine combination prior to EDTO approval (may be reduced with consideration for compensating factors)

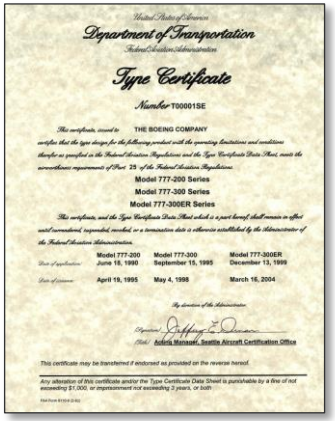
- Combined Service Experience and Early EDTO Method
  - A minimum of 15,000 world fleet in-service engine hours on the candidate aeroplane/engine combination

+

  - Early EDTO requirements (except for some aeroplane demonstration tests)

Substantiation Documents

- EDTO type design approval substantiation is published in three primary certification documents:
  - Aeroplane Flight Manual (AFM)
    - May be a customer option on some aeroplane models
  - Aeroplane and Engine Type Certification Data Sheets (TCDS)
  - EDTO Configuration, Maintenance and Procedures Document (CMP)



Department of Transportation

Federal Aviation Administration

Type Certificate

Number T00001SE

This certificate, issued to THE BOEING COMPANY

certifies that the type design for the following product with the operating limitations and conditions therefor as specified in the Federal Aviation Regulations and the Type Certificate Data Sheet, meets the airworthiness requirements of Part 25 of the Federal Aviation Regulations.

Model 777-200 Series
Model 777-300 Series
Model 777-300ER Series

This certificate, and the Type Certificate Data Sheet which is a part hereof, shall remain in effect until surrendered, suspended, revoked, or a termination date is otherwise established by the Administrator of the Federal Aviation Administration.

	Model 777-200	Model 777-300	Model 777-300ER
Date of Application	June 16, 1990	September 15, 1995	December 13, 1999
Date of Issuance	April 19, 1995	May 4, 1998	March 16, 2004

By direction of the Administrator

Signature Jeffrey E. Duven

Title Aviation Manager, Seattle Aircraft Certification Office

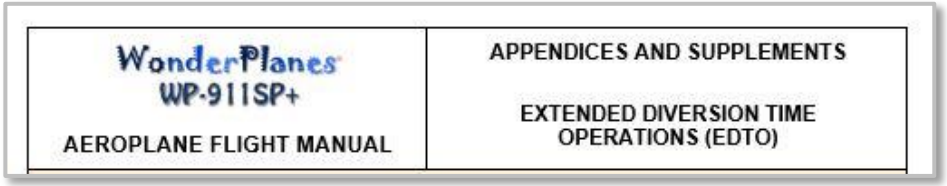
This certificate may be transferred if endorsed as provided on the reverse hereof.

Any alteration of this certificate and/or the Type Certificate Data Sheet is punishable by a fine of not exceeding $1,000, or imprisonment not exceeding 3 years, or both

FAA Form 8100-2 (8-82)

EDTO Type Design Approval
Two Engine Aeroplanes

Typical AFM Language:



WonderPlanes WP-911SP+ AEROPLANE FLIGHT MANUAL	APPENDICES AND SUPPLEMENTS EXTENDED DIVERSION TIME OPERATIONS (EDTO)

The type design reliability and performance of this airplane/engine combination has been evaluated in accordance with 14 CFR 25.1535 and found suitable for **greater than 180 minutes** extended diversion time operations (EDTO) when configured in accordance with WonderPlanes Document WP911001 "MODEL WP-911 EDTO Configuration, Maintenance, and Procedures".

This finding does not constitute approval to conduct extended diversion time operations.

System Time Capabilities:

The most limiting EDTO significant system time (other than cargo fire suppression) is **### minutes**.

The most limiting cargo fire suppression system time is **### minutes**.

Configuration, Maintenance and Procedures (CMP)

- A document approved by the **State of Design** that contains minimum configuration, operating, and maintenance requirements, hardware life-limits, and Master Minimum Equipment List (MMEL) constraints necessary for an aeroplane/engine combination to meet EDTO type design approval requirements.

- The CMP document is aeroplane model specific and defines the minimum configuration standard for EDTO *(further discussion to be provided in Module 4).*

WonderPlanes

WP-911
EDTO CMP Document

Configuration, Maintenance, Procedure and Dispatch standards for Extended Diversion Time Operations

Revision 50 dated 03/JUNE/2018

This document contains standards applicable to:

Aircraft Model :	WP-911-689
Diversion Time :	Up to 180 min
Document Customized for :	EDTO AIRWAYS
Customized Document Reference :	WP-911-CMP-R50-EDTO-0001

CMP Reference n°: WP-911-CMP-R50

EDTO Type Design Assessment
Aeroplanes with More than Two Engines

Basic concepts:

- EDTO type design approval is not required for aeroplanes with more than two engines to operate beyond the EDTO threshold under ICAO standards.
  - Some States may require EDTO type design approval provided related design and reliability criteria have been defined.
  - FAA for example requires EDTO type design approval for passenger aeroplanes with more than two engines manufactured after Feb, 2015 to operate beyond 180 minutes from an adequate aerodrome.

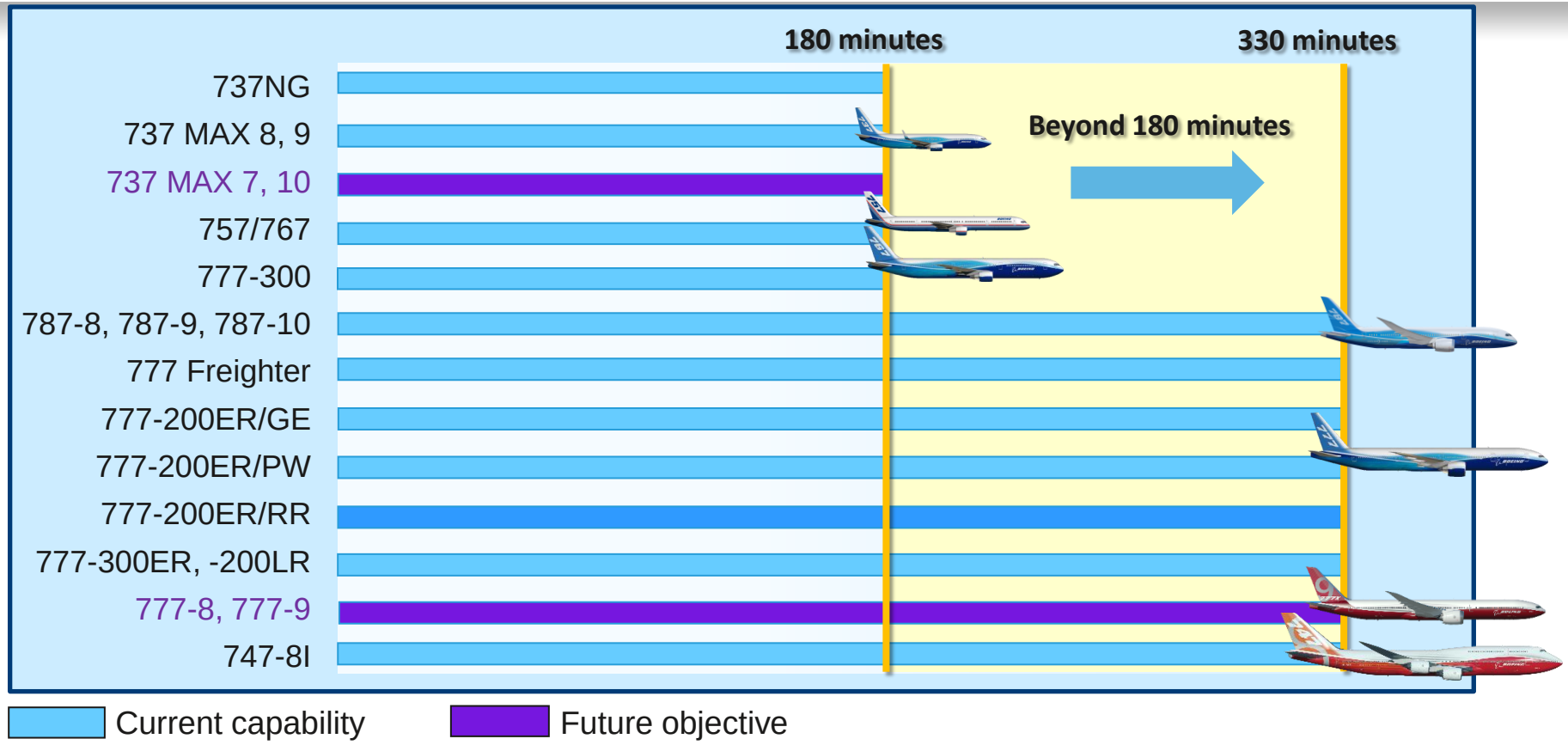
EDTO Type Design Assessment
Aeroplanes with More than Two Engines

Basic concepts (cont'd):

- An assessment of aeroplane time limited systems relevant to EDTO is required to support operations beyond the EDTO threshold
  - The capability of the cargo fire suppression system usually defines the applicable limitation for EDTO
- As per ICAO standards, there are no additional EDTO maintenance requirements for aeroplanes with more than two engines
  - Operational approval and EDTO flight operations program elements remain applicable for operations beyond the EDTO threshold.

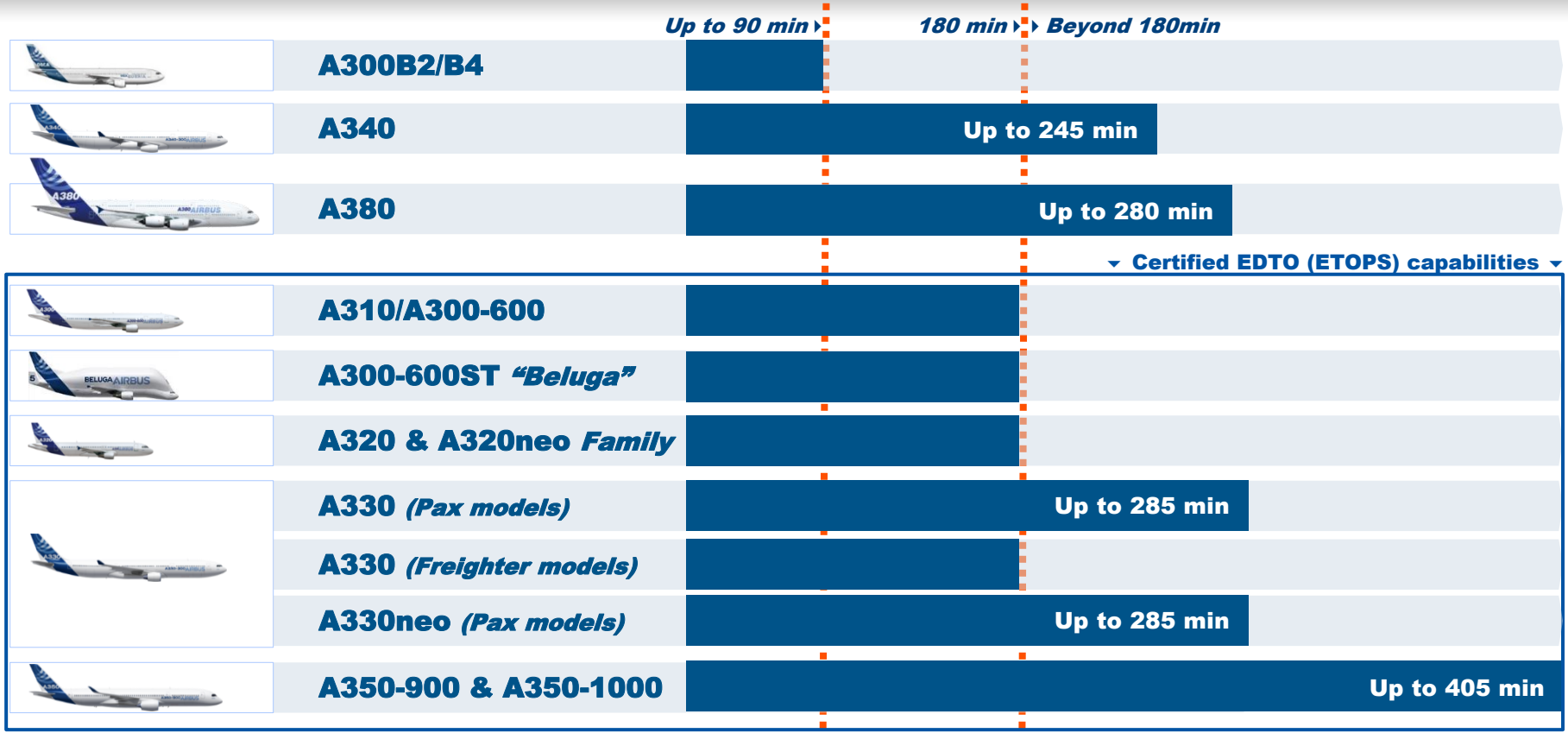
EDTO Design Capabilities Summary

As of January 1st, 2019



EDTO Design Capabilities Summary

As of July 1st, 2019



Module 3 - Outline

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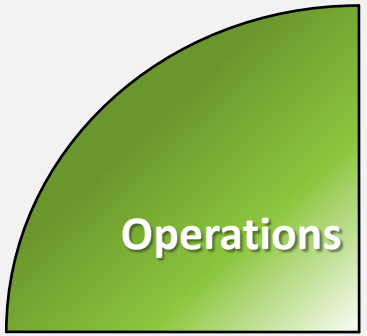
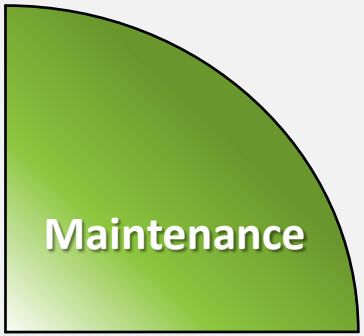
Attendee Poll

Q3.3: What is the Maximum EDTO Diversion Time (MDT) which has been approved by your State?

- Up to 90 minutes
- 120 or 180 minutes
- Greater than 180 minutes
- Never approved EDTO

EDTO Operational Approval





Compliance demonstration:

Responsibility of the Operator

EDTO Operational Approval

ICAO Annex 6

Additional guidance in EDTO Manual Doc 10085

AIR OPS Part SPA (Subpart F)

AMC 20-6

Chapter III, Operational Approval Considerations

PART 121

PART 135

These FAA ETOPS Ops rules have superseded AC 120-42A in 2007

Additional guidance now provided in AC 120-42B

EDTO Operational Approval

Considerations:

- EDTO capable/configured aeroplane
- Approval application
- Operator EDTO programs and documentation
  - Maintenance (Twins only)
  - Flight Operations
- Company training
- Operational validation (e.g. validation flight)
- Operations Specification

EDTO Maintenance Considerations
Two Engine Aeroplanes

Configuration, Maintenance & Procedures (CMP)

- Ensure compliance with EDTO configuration requirements.

EDTO Significant Systems List

- Identify systems with heightened maintenance program emphasis

EDTOM

EDTOM Chapter 4

Supplemental Maintenance Program

- EDTO Maintenance Document
- EDTO Pre-departure Service Check
- Limitations on Dual Maintenance
- Verification Program
- Task Identification
- Centralized Maintenance Control
- EDTO Parts Control
- EDTO Reliability Program
- Monitoring Programs
  (IFSD Rate, ECM, Oil Consumption, APU Start)
- EDTO Maintenance Training
- Procedural Changes

EDTO Flight Operations Considerations

Approval Route Planning

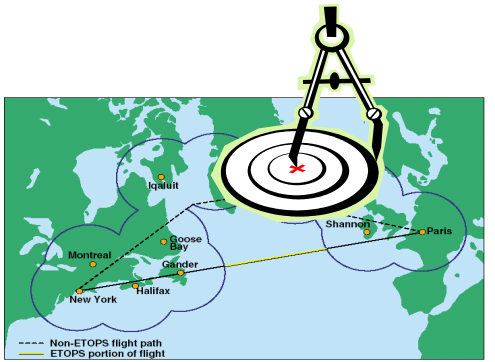
- Define EDTO Routes
- Identify Adequate Enroute Alternates
- Determine EDTO Diversion Time and Speed
- Establish EDTO Area of Operations

Dispatch Planning

- EDTO Flight Planning System
- Identify EDTO Alternate Aerodromes
- Communication/Flight Following
- Establish EDTO Area of Operations

Documentation and Training

- EDTO MEL Provisions
- APU Inflight Start Procedures
- EDTO Check Airman Program
- EDTO Operating Procedures
- Flight Crew & Dispatcher Training



EDTO Operational Approval Methods
Two Engine Aeroplanes

- **Service Experience Method:**
  - EDTO operational approval obtained after some minimum non-EDTO service experience on the candidate aeroplane/engine combination, typically:
    - 12 months minimum non-EDTO experience for 120 minute approval
    - 12 months experience at 120 minutes for 180 minute approval
    - Additional experience for beyond 180 minutes approval
  - Legacy (conventional) EDTO approval methodology
  - Still an approval option today depending on time constraints and operator experience
  - Initial application should typically be submitted at least *60 days* before start of EDTO

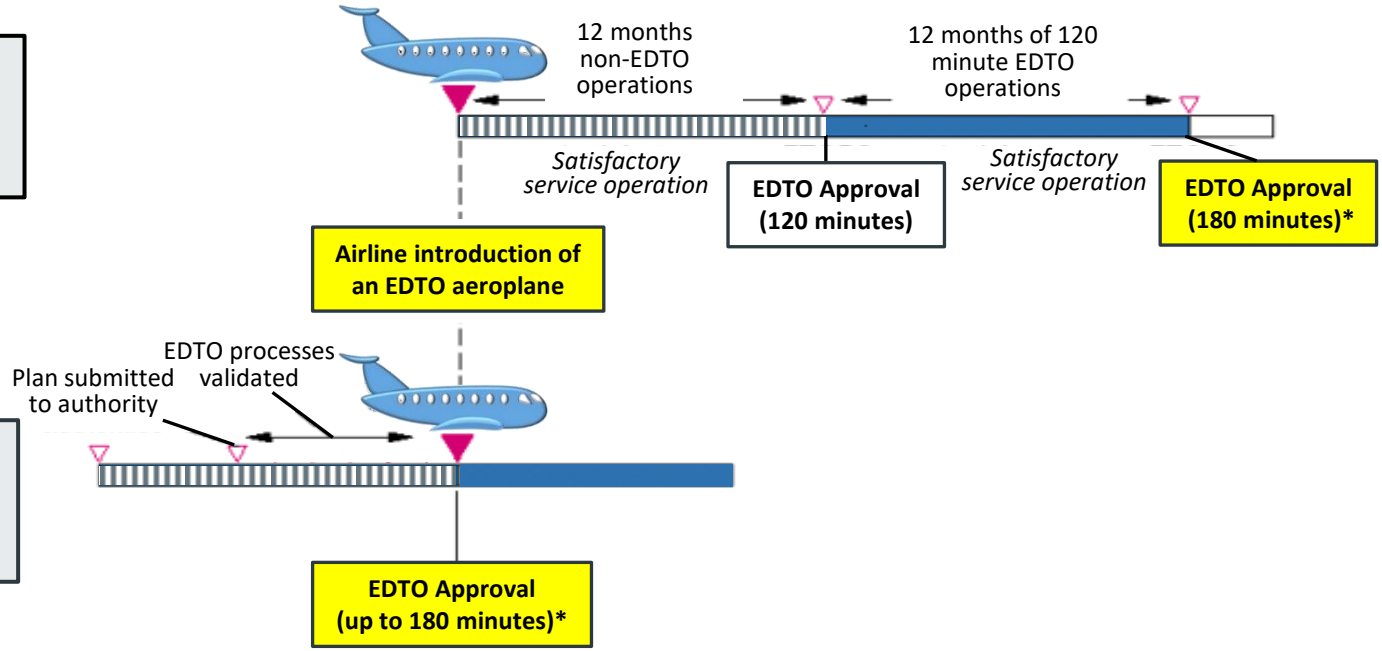
EDTO Operational Approval Methods
Two Engine Aeroplanes

- **Accelerated EDTO Method:**
  - EDTO operational approval obtained without gaining non-EDTO service experience or with reduced non-EDTO service experience on the candidate aeroplane/engine combination
  - Primary focus is on EDTO **process validation** and **compensating factors**
  - Allows up to 180 minute EDTO at initial service entry. Prior EDTO service experience is typically required for approval of EDTO beyond 180 min.
  - Policy jointly created by JAA/FAA and included in most State EDTO standards *(e.g. EASA AMC 20-6, FAA AC 120-42B, TCCA TP6327E, CASA CAO 82.0…)*
  - Has become the industry standard for EDTO operational approval
  - Initial application should be submitted at least *6 months* before start of EDTO

EDTO Operational Approval Methods
Comparison

In-service Method
Initial application at least 60 days before start of EDTO

Accelerated Method
Initial application at least 6 months before start of EDTO



Note: Approval for beyond 180 minute EDTO requires prior authorization for 180 minute EDTO

EDTO Operational Approval Methods

Aeroplanes with More than Two Engines

- **Either the Service Experience or Accelerated EDTO approval methods may be used:**
  - **Both methods**: Unlike two engine aeroplanes, there is no upper limit (e.g. 180 minutes) for initial EDTO approval. Operators may apply for approval up to the maximum EDTO capability of the candidate aeroplane/engine combination.
  - **Service Experience Method**: Unlike two engine aeroplanes, there are no specific service experience time requirements or 'steps' in diversion time approvals.

    Any amount of non-EDTO experience on a candidate aeroplane/engine combination may therefore be credited in the EDTO approval application.
  - **Accelerated Method**: This method would be selected to achieve EDTO approval with no or reduced prior service experience with the candidate aeroplane/engine combination.

    As with two engine aeroplanes, process validation and compensating factors should form the basis of the EDTO approval application

Open Discussion

Accelerated EDTO Approval Considerations

- What **compensating factors** might be considered for an experienced EDTO operator seeking EDTO approval on another aeroplane/engine type?

- What **compensating factors** might be considered for an operator applying for a first time EDTO approval?

EDTO Operational Approval
Compensating Factors

In-service EDTO approval :

- No special strategy is required (Action plan only needed in case of non compliance)
- No compensating factors are required
- Judgment criteria straight forward: **experience with candidate aircraft**

Accelerated EDTO approval:

- Defined strategy and open communication needed between airline & authority
- **Compensating factors** and **process validation** are basis of approval
- **Facts and engineering judgment** are used to determine “EDTO capability”

EDTO Operational Approval
Compensating Factors

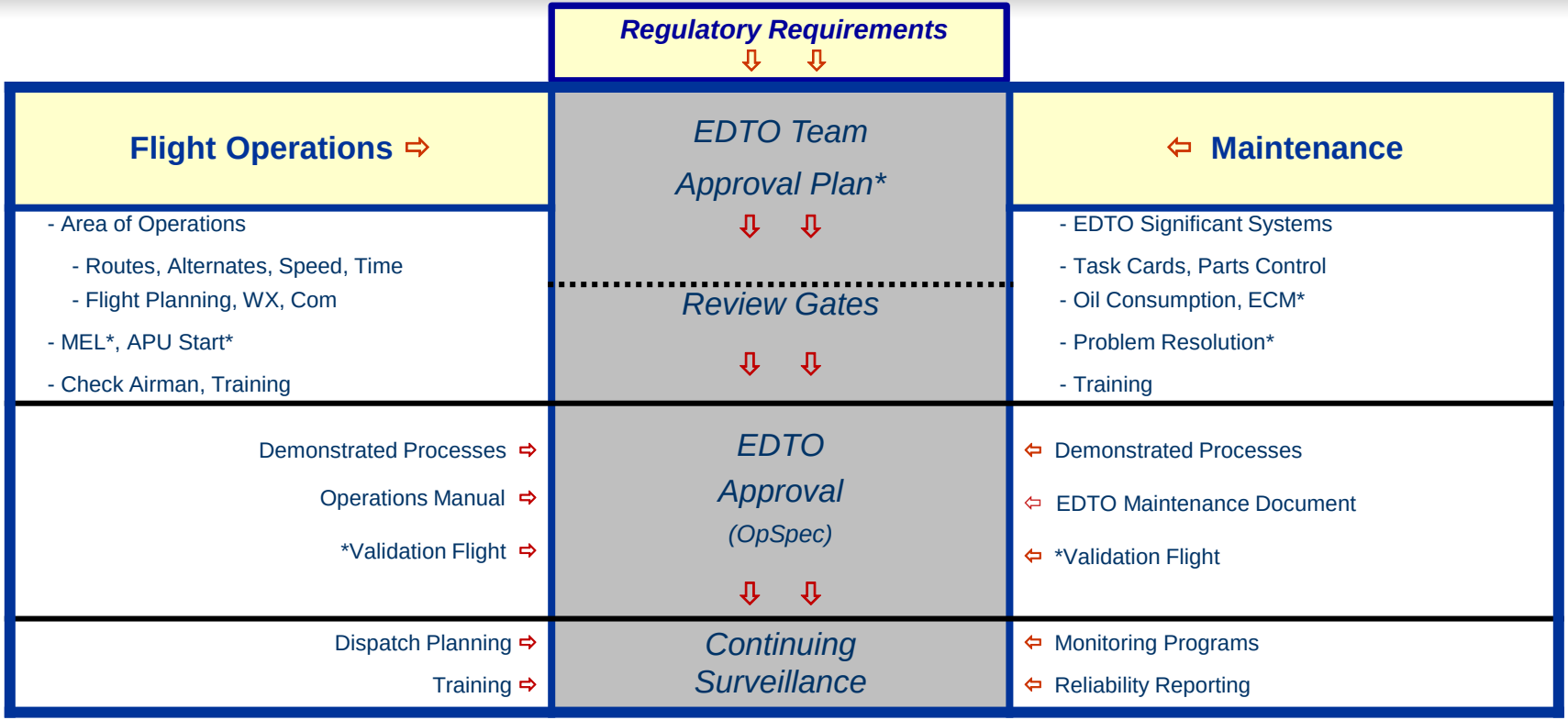
Compensating factors:

- Previous experience with other airframe or engines of similar technology
- Previous EDTO experience (related experience)
- Specific EDTO training
- EDTO simulation
- ...

Required amount of compensating factors depends on:

- EDTO objectives (max DT, operational experience at start of EDTO, …)
- Organization (Current vs EDTO)
- Experience
  - EDTO / long range / route(s) / aircraft-engine technology
  - Experience with EDTO procedures from any real or simulated EDTO program
- ...

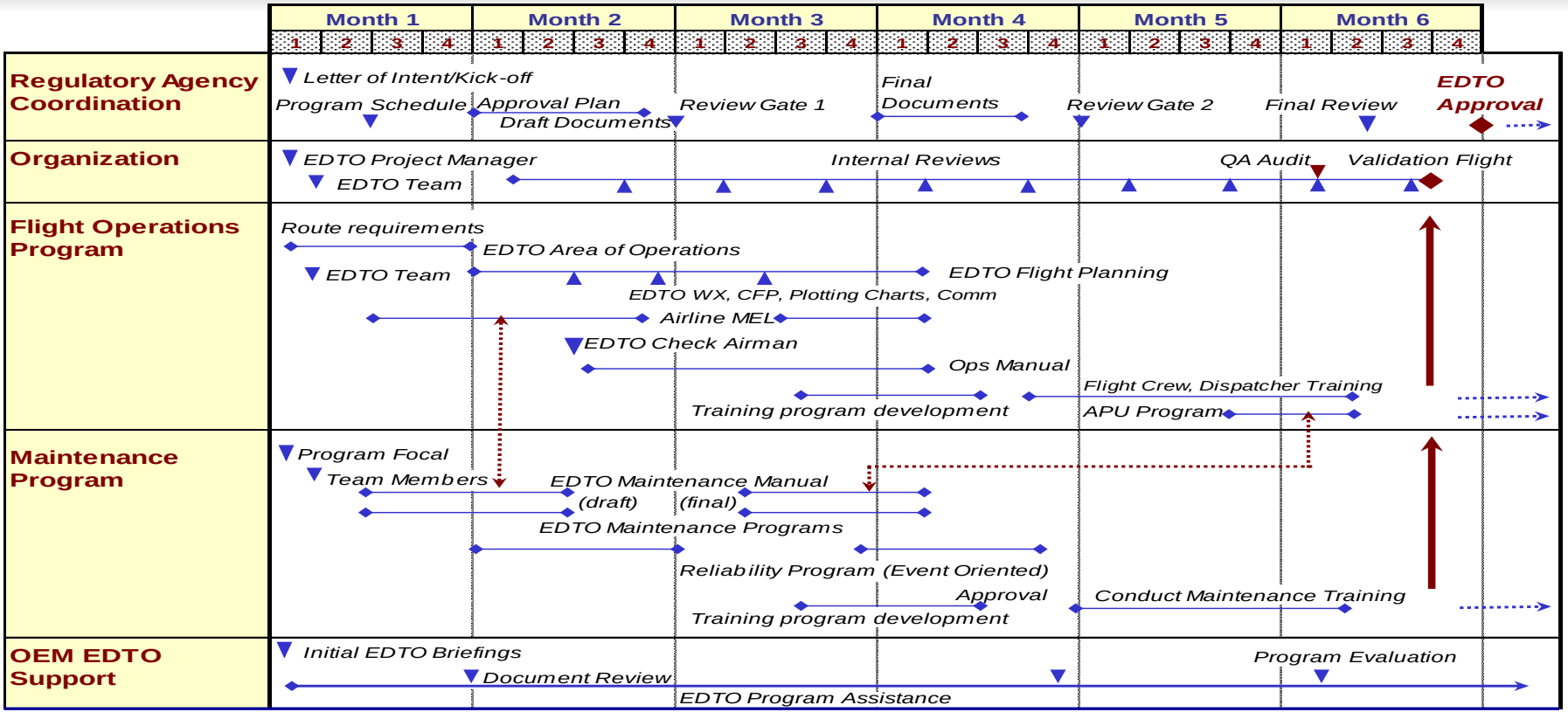
EDTO Operational Approval Process



** Involves coordination between departments*

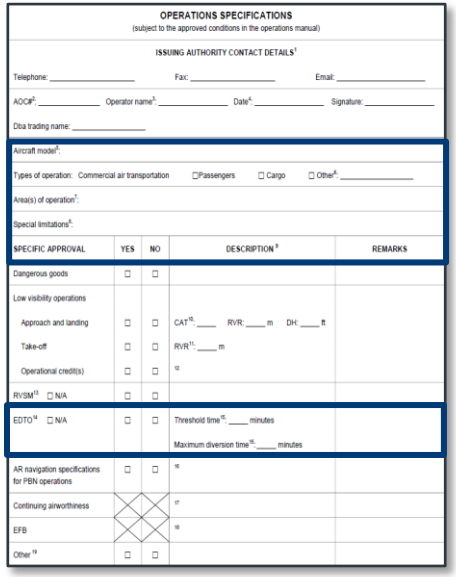
EDTO Operational Approval Timeline

Example



Operations Specifications for EDTO

EDTO operational authorization constitutes a 'Specific Approval' which should be listed in the Operations Specification for each approved aeroplane type:



OPERATIONS SPECIFICATIONS
(subject to the approved conditions in the operations manual)

ISSUING AUTHORITY CONTACT DETAILS[1]

Telephone: _____ Fax: _____ Email: _____

AOC#[2]: _____ Operator name[3]: _____ Date[4]: _____ Signature: _____

Dba trading name: _____

Aircraft model[5]:

Types of operation: Commercial air transportation ☐Passengers ☐ Cargo ☐ Other[6]: _____

Area(s) of operation[7]:

Special limitations[8]:

SPECIFIC APPROVAL	YES	NO	DESCRIPTION [9]	REMARKS
Dangerous goods	☐	☐		
Low visibility operations				
Approach and landing	☐	☐	CAT[10]: ____ RVR: ____ m DH: ____ ft	
Take-off	☐	☐	RVR[11]: ____ m	
Operational credit(s)	☐	☐	[12]	
RVSM[13] ☐ N/A	☐	☐		
EDTO[14] ☐ N/A	☐	☐	Threshold time[15]: ____ minutes Maximum diversion time[15]: ____ minutes	
AR navigation specifications for PBN operations	☐	☐	[16]	
Continuing airworthiness			[17]	
EFB			[18]	
Other[19]	☐	☐		

Annex 6, Part 1 - Appendix 6
Operations Specification Template

OPERATIONS SPECIFICATIONS
(subject to the approved conditions in the operations manual)

Aircraft model[5]:

Area(s) of operation[7]:

SPECIFIC APPROVAL	YES	NO	DESCRIPTION[9]	REMARKS
EDTO[14] ☐ N/A	☐	☐	Threshold time[15]: ___ minutes Maximum diversion time[15]: ___ minutes	

EDTO Related Content

Some States have implemented different OpSpec formats

Operations Specifications
EDTO Related Content

OPERATIONS SPECIFICATIONS (subject to the approved conditions in the operations manual)				
Aircraft model[5]:				
Area(s) of operation[7]:				
SPECIFIC APPROVAL	**YES**	**NO**	**DESCRIPTION[9]**	**REMARKS**
EDTO[14] ☐ N/A	☐	☐	Threshold time[15]: ___ minutes Maximum diversion time[15]: ___ minutes	

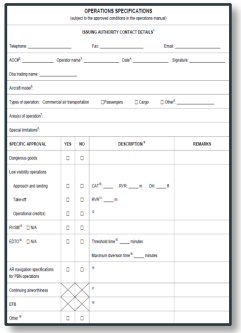
Notes:-

5. *Insert the CAST/ICAO designation of aircraft make, model and series or master series, if a series has been designated (e.g. Boeing-737-3K2 or Boeing-777-232). The CAST/ICAO taxonomy is available at http://www.intlaviationstandards.org/.*
7. *List the geographical area(s) of authorized operations (by geographic coordinates or specific routes, flight information region or national or regional boundaries).*
9. *List in this column the most permissive criteria for each approval or the approval type (with appropriate criteria)*
14. *If extended diversion time operations (EDTO) approval does not apply based on the provisions of of Chapter 4, 4.7 select "N/A". Otherwise a threshold time and maximum diversion time must be specified.*
15. *The threshold time and maximum diversion time may also be listed in distance (NM) as well. Details of each particular aeroplane-engine combination for which the threshold time is established and maximum diversion time has been granted may be listed under 'remarks'. One line per approval may be used if different approvals are granted.*

Operations Specifications for EDTO

Diversion Time Considerations

- **Maximum Diversion Time (MDT):** Approval time levels and use conditions may vary among State regulations
  - Specific approval time levels up to 180 minutes (e.g. 75 min, 90 min, 120 min…)
  - Specific approval time levels above 180 minutes (e.g. 240 minutes, beyond 240 minutes…)
  - Operational extension on a flight by flight exception basis (e.g. 138 minutes, 207 minutes)
  - Regional applicability



OPERATIONS SPECIFICATIONS

ISSUING AUTHORITY CONTACT DETAILS

SPECIFIC APPROVAL	YES	NO	DESCRIPTION	REMARKS
Dangerous goods	☐	☐		
Low visibility operations				
Approach and landing	☐	☐	CAT ___ RVR: ___ m DH: ___ ft	
Take-off	☐	☐	RVR ___ m	
Operational credit(s)	☐	☐		
RVSM ☐ N/A	☐	☐		
EDTO ☐ N/A	☐	☐	Threshold time ___ minutes Maximum diversion time ___ minutes	
AR navigation specifications for PBN operations	☐	☐		
Continuing airworthiness				
ETS				
Other	☐	☐		

- **Threshold Time:** Not intended to be AEC or area specific absent special circumstances. Typically a single value should be listed in the Operations Specification based on applicable State regulations, even when different MDT approval levels are specified.

Operations Specifications
EDTO MDT content example

OPERATIONS SPECIFICATIONS (subject to the approved conditions in the operations manual)				
Operator name: **EDTO Airways**				
Aircraft Model: **WonderPlanes WP-911 and WP-911SuperPlus**				
Area(s) of Operation: **Atlantic Ocean NAT/MNPS, North Pacific**				
SPECIFIC APPROVAL	**YES**	**NO**	**DESCRIPTION**	**REMARKS**
EDTO ☐ N/A	☑	☐	Threshold time: **60** minutes Maximum diversion times: **WP-911/RG3350-89: 240 minutes** **WP-911SuperPlus/RG3350-SP: 180 minutes**	**WP-911/RG3350-89:** • **240 minutes authorization applies to the North Pacific area for use on a flight by flight exception basis. Authorization is otherwise limited to 180 minutes.**

Example

EDTO MDT Approvals by AEC

Example State Use Condition

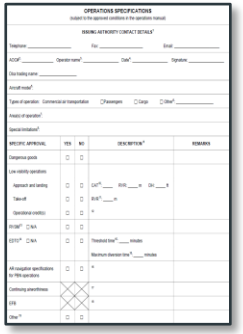
Operations Specifications for EDTO

Time Limited System (TLS) Considerations

Annex 6, Part 1 - 4.7.2.3: When approving the appropriate maximum diversion time for the operator of a particular aeroplane type engaged in extended diversion time operations, the State of the Operator shall ensure that:

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

- For EDTO beyond 180 minutes, Maximum Diversion Time (MDT) and Time Limited System (TLS) capabilities should be listed separately:
  - TLS diversion planning is based on forecast winds whereas MDT planning is a still air consideration, so the two times are not directly comparable.
  - TLS planning considers both AEO (cargo fire suppression) and OEI (other most limiting system) diversion flight conditions, so again represents a separate planning consideration from EDTO MDT.
  - Listing TLS and MDT capabilities separately for EDTO beyond 180 minutes removes potential confusion while preserving intent of Annex 6 language
  - Additional discussion on TLS planning considerations will be provided in Module 5



Operations Specifications
EDTO MDT content example

OPERATIONS SPECIFICATIONS
(subject to the approved conditions in the operations manual)

Example

Operator name: EDTO Airways

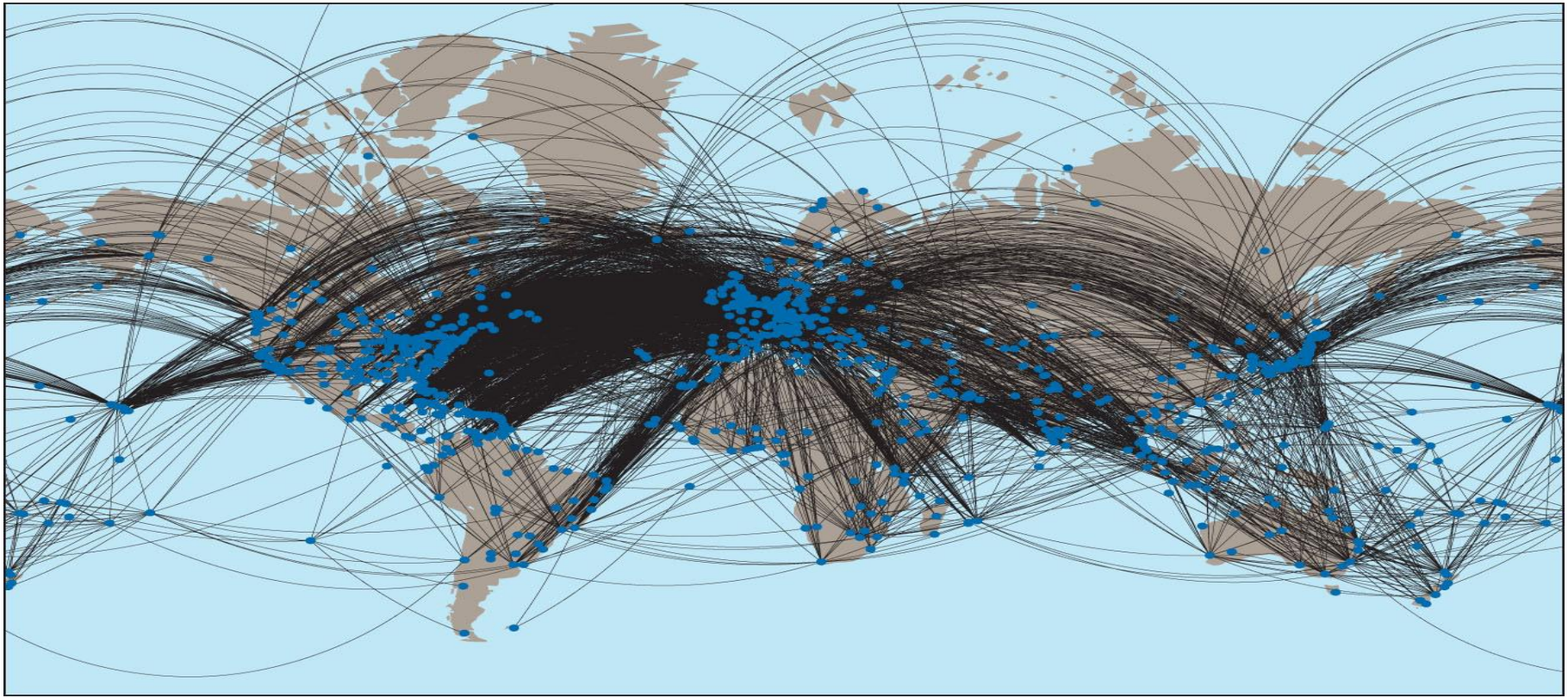
Aircraft Model: WonderPlanes WP-911 and WP-911SuperPlus

Area(s) of Operation: Atlantic Ocean NAT/MNPS, North Pacific

SPECIFIC APPROVAL	YES	NO	DESCRIPTION	REMARKS
EDTO ☐ N/A	☑	☐	Threshold time: 60 minutes Maximum diversion times: WP-911/RG3350-89: 240 minutes WP-911SuperPlus/RG3350-SP: 180 minutes	**WP-911/RG3350-89:** • 240 minutes authorization applies to the North Pacific area for use on a flight by flight exception basis. Authorization is otherwise limited to 180 minutes. • **Diversion planning may not exceed the following EDTO time limited system capabilities:** **Cargo Fire Suppression: ### Minutes** **Other most limiting system: ### Minutes**

Example TLS listing for beyond 180 Minutes

EDTO/ETOPS Worldwide Operations



Boeing EDTO/ETOPS Operations

As of September 30th, 2018

Airplane Model	FleetSize		Initial Delivery Month	Current EDTO Approvals	EDTO			
					Flight Cycles		Flight Hours	
	Total	EDTO			Month	Cumulative	Month	Cumulative
737-3/4/500	1,988	10	Jul 1986	7	59	309,843	206	1,030,116
737-6/7/8/900	7,011	1,005	Mar 1998	63	10,796	1,340,549	44,834	5,617,607
737-MAX	390	55	Jun 2017	10	1,092	7,104	6,117	41,729
737 Model totals	**9,389**	**1,070**		**70***	**11,947**	**1,657,496**	**51,157**	**6,689,452**
757/PW	433	71	Nov 1984	10	1,206	313,308	6,901	1,478,332
757/RR	617	142	Mar 1983	25	2,723	616,425	17,269	3,762,327
757 Model totals	**1,050**	**213**		**31***	**3,929**	**929,733**	**24,170**	**5,240,659**
767/GE	791	305	Nov 1982	46	5,700	2,706,978	43,923	22,101,834
767/PW	315	132	Aug 1982	21	4,112	1,726,966	32,551	13,819,640
767/RR	31	1	Feb 1990	1	2	145,849	14	1,255,875
767 Model totals	**1,137**	**438**		**51***	**9,814**	**4,579,793**	**76,488**	**37,177,349**
777/GE	1,207	1,103	Nov 1995	85	26,633	2,852,408	269,086	28,836,152
777/PW	174	94	May 1995	13	2,165	613,263	19,211	5,304,062
777/RR	226	150	Mar 1996	18	2,861	978,796	24,141	8,920,408
777 Model totals	**1,607**	**1,347**		**61***	**31,659**	**4,444,467**	**312,438**	**43,060,622**
787/GE	532	429	Mar 2012	43	12,297	422,541	113,119	3,828,854
787/RR	328	266	Sep 2011	27	6,887	209,049	60,275	1,819,916
787 Model totals	**860**	**695**		**49***	**19,184**	**631,590**	**173,394**	**5,648,770**
Fleet totals	**14,043**	**3,763**		**161***	**76,533**	**12,243,079**	**637,647**	**97,816,852**

* Model total and Fleet total EDTO approvals reflect unique operators (operators of multiple models are only counted once)

Airbus EDTO/ETOPS Operations

As of 1st QTR 2019

Aircraft Family	Total FH	Nb of operators	Aircraft delivered	EDTO FH	EDTO FH in %	EDTO operators in %	EDTO aircraft in %
A310 A300-600	25,000,000	63	567	2,900,000	<2%	~10%	~10%
A320	230,000,000	323	8,512	3,000,000	<2%	~15%	~30%
A330	50,400,000	144	1,427	17,600,000	~35%	~90%	100%
A350	1,500,000	23	240	500,000	~30%	100%	100%
Fleet Totals	**306,900,000**		**10,746**	**24,000,000**			

Module 3 - Outline

Part I — EDTO Approval Major Elements

Part II — Responsibilities of Contracting States

Part III — EDTO Type Design Approval Process

Part IV — EDTO Operational Approval Process

Part V — **Review questions**

Part VI — Practical Exercise

Module 3 Review Questions

Q3.4: EDTO operations for **two engine aeroplanes** requires:

- EDTO Type Design Approval
- EDTO Operational Approval
- EDTO Flight Operations Program
- EDTO Maintenance Program
- Both EDTO Operational Approval and EDTO Flight Operations Program
- All of the above

Module 3 Review Questions

Q3.5: EDTO operations for **aeroplanes with more than two engines** requires:

- EDTO Type Design Approval
- EDTO Operational Approval
- EDTO Flight Operations Program
- EDTO Maintenance Program
- Both EDTO Operational Approval and Flight Operations Program
- All of the above

Module 3 Review Questions

Q3.6: EDTO **Type Design Approval** is the responsibility of:

- The State of the Operator
- The State of Registry
- The State of Design
- ICAO Headquarters

Module 3 Review Questions

Q3.7: Which of the following does not apply to the early EDTO type design process?

- EDTO Testing
- Operational Procedures Validation
- Problem Tracking and Resolution
- Stall Speed Certification

Module 3 Review Questions

Q3.8: EDTO **Operational Approval** is the responsibility of:

- The State of the Operator
- The State of Registry
- The State of Design
- ICAO Regional Office

Module 3 Review Questions

Q3.9: Chose the most appropriate definition of the term '**AEC**':

- ARINC to Ethernet Converter
- Aeroplane/Engine Combination
- Adaptive Echo Cancellation
- Aft Electronics Center

Module 3 Review Questions

Q3.10: Chose the most appropriate definition of the term '**CMP**':

- Configuration, Maintenance and Procedures
- Celestial Mapping Program
- Certification Management Plan
- Condition Monitoring Panel

Module 3 - Outline

Part I — EDTO Approval Major Elements

Part II — Responsibilities of Contracting States

Part III — EDTO Type Design Approval Process

Part IV — EDTO Operational Approval Process

Part V — Review Questions

Part VI — Practical Exercise

Questions?

EDTO Workshop

End of Module 3 - Approval Process