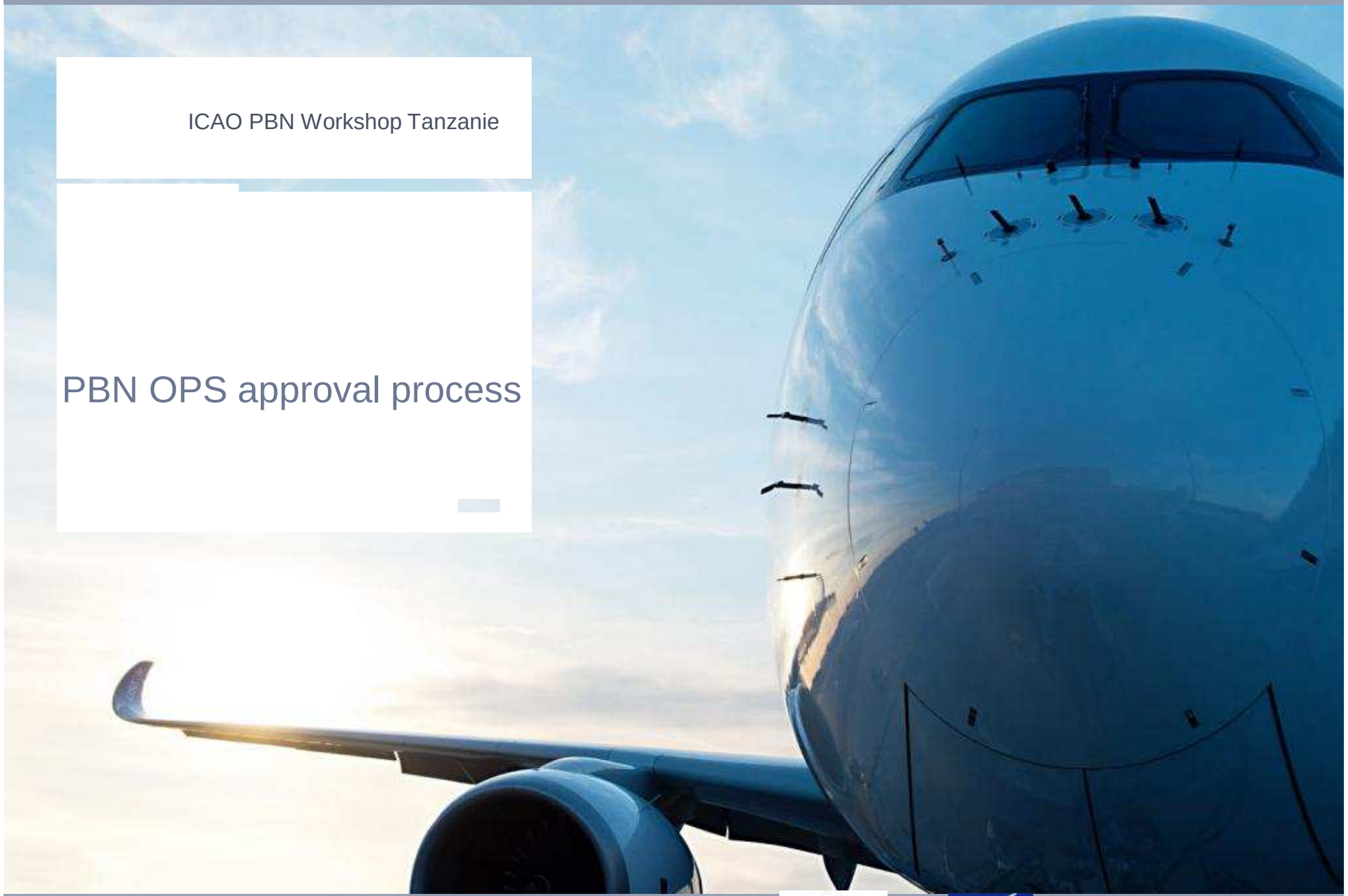
ICAO PBN Workshop Tanzanie

PBN OPS approval process



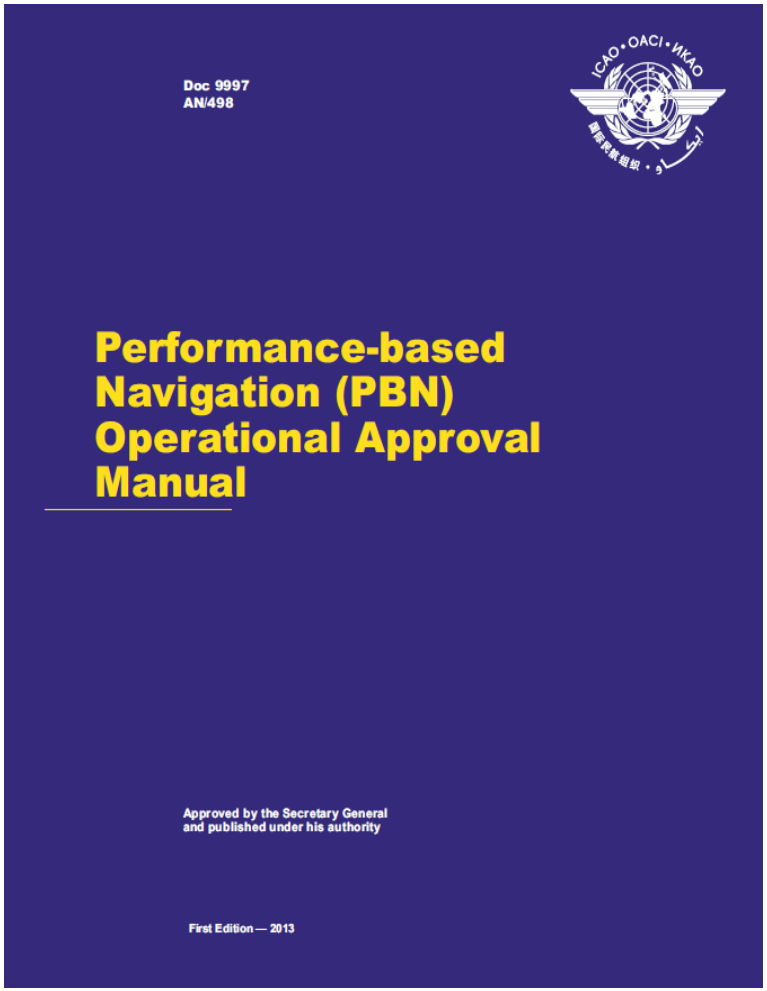
PBN OPS approval Process

- Introduction to Doc 9997 published by ICAO
- PBN nav spec
- PBN application
- Airworthiness and Ops approval process
- OPS Approval Process

PBN OPS approval Process

- Doc 9997 published by ICAO

- Provide guidance on the **operational approval process** for PBN
  - introduction on PBN principles
  - Certification and Operational approval
  - Operational approval guideline
  - Navigation specifications

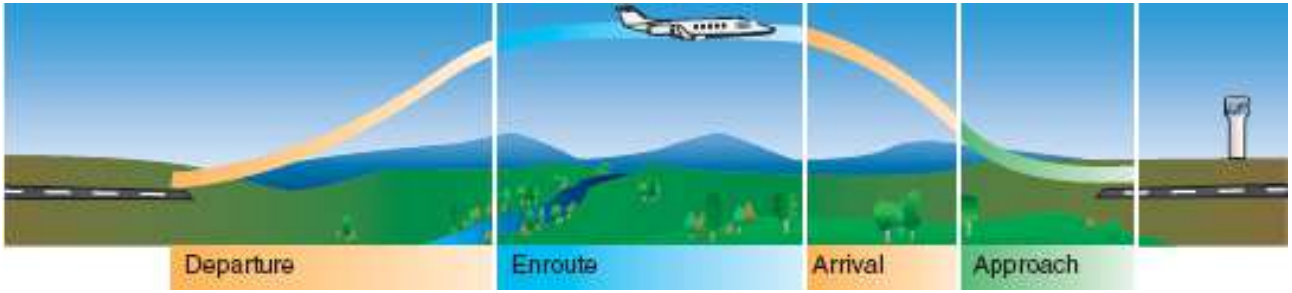


PBN – navigation specifications

- Navigation specifications published to date

Flight Phase								
Navigation specification	*En-route oceanic/ remote*	*En-route continental*	*Arrival*	*Approach*				*Departure*
				Initial	*Intermediate*	*Final*	*Missed*	
RNAV 10	10							
RNAV 5[a]		5	5					
RNAV 2		2	2					2
RNAV 1		1	1	1	1		1[b]	1
RNP 4	4							
RNP 2	2	2						
Advanced RNP[c]	2[d]	2 or 1	1	1	1	0.3	1[b]	1
RNP 1			1[e]	1	1		1[b]	1[e]
RNP 0.3[f]		0.3	0.3	0.3	0.3	—	0.3[b]	0.3
RNP APCH				1	1	0.3[g]	1[b] or 0.3[h]	
RNP AR APCH				1-0.1	1-0.1	0.3-0.1	1-0.1[i]	

PBN applications



RNAV 1

RNAV 5
RNAV 10

RNP 1

RNP APCH

The navigation application uses a navigation specification and the associated NAVAID infrastructure that allows an aircraft to fly in a designated airspace, on a route or on a procedure with the required performance level.

Airworthiness and Ops Approval

The PBN concept requires that

1. The aircraft meets a certain level of performance described in the navigation specification
   - the performance of the on-board system in terms of accuracy, continuity and integrity
   - the functionalities of the system

2. The operator complies with the operational criteria defined in the PBN navigation specification.

Airworthiness and Ops Approval

- The airworthiness certification process ensures that the aircraft complies with certain standards (e.g AC, AMC, CS,…) which guarantees that the level of performance and the functionalities required by the PBN navigation specification are met.

- Operators (Airline) has to demonstrate to their supervisor inspector that the Aircraft is eligible for the PBN operation.

- Eligibility is determined by checking that the adequate airworthiness certification has been done.

Applicable standards

- FAA AC (Advisory Circular)
  - AC 20-xx for Airworthiness criteria (avionics function)
  - AC 90-xx for OPS approval
- EASA AMC 20- xx for PBN are divided into 3 parts :
  - Context - Assumptions
  - Airworthiness criteria (performance, functions, maintenance)
  - OPS approval
- EASA next step : AMC 20-xx related to PBN will be suppressed:
  - Airworthiness part will be inserted in CS-ACNS
  - OPS part will be inserted in AMC's of AIR OPS (European OPS regulation)

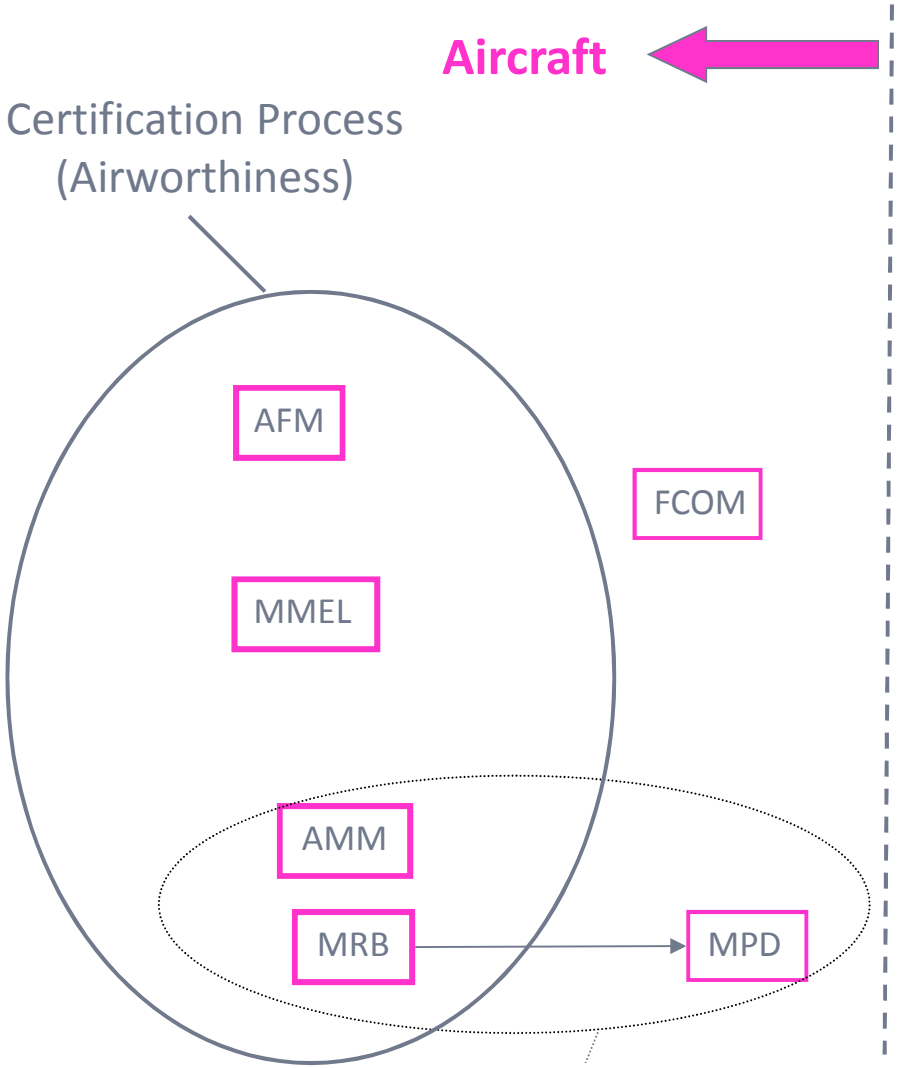
Applicable Standards

Area of application	Navigation accuracy (TSE)	Designation of navigation standard (Before PBN)	Designation of navigation specification: (PBN concept)	EASA	FAA
Oceanic/ Remote	10	RNP 10	RNAV 10	AMC 20-12 « Recognition of FAA order 8400.12a »	FAA order 8400.12a
	4	RNP 4	RNP 4	No document	FAA order 8400.33
En Route Continental	5	BRNAV	RNAV 5	AMC 20-4	AC 20-130A, AC 20-138A,B,C AC 90-96
Terminal	1	PRNAV	RNAV 1	TGL 10	AC 20-130A, AC 20-138A,B,C AC 90-100A
	1	N/A	RNP 1	No document	AC 20-138 B,C AC 90-105

AMC – AMC applicable to PBN

Area of application	**Navigation accuracy (TSE)**	**Designation of navigation standard (Before PBN)**	**Designation of navigation specification: (PBN concept)**	EASA	FAA
Approach	0.3	RNAV(GNSS) LNAV et LNAV/VNAV	RNP APCH LNAV et LNAV/VNAV	AMC 20-27	AC 20-130A, AC 20-138A, AC 20-129, (all replaced by AC 20-138C) AC 90-105
		RNAV(GNSS) LPV	RNP APCH LPV	AMC 20-28	AC 20-138B AC 90-107
	0.3 - 0.1	RNAV (RNP) RNP AR	RNP AR APCH	AMC 20-26	AC 90-101A

Airworthiness and Ops Approval



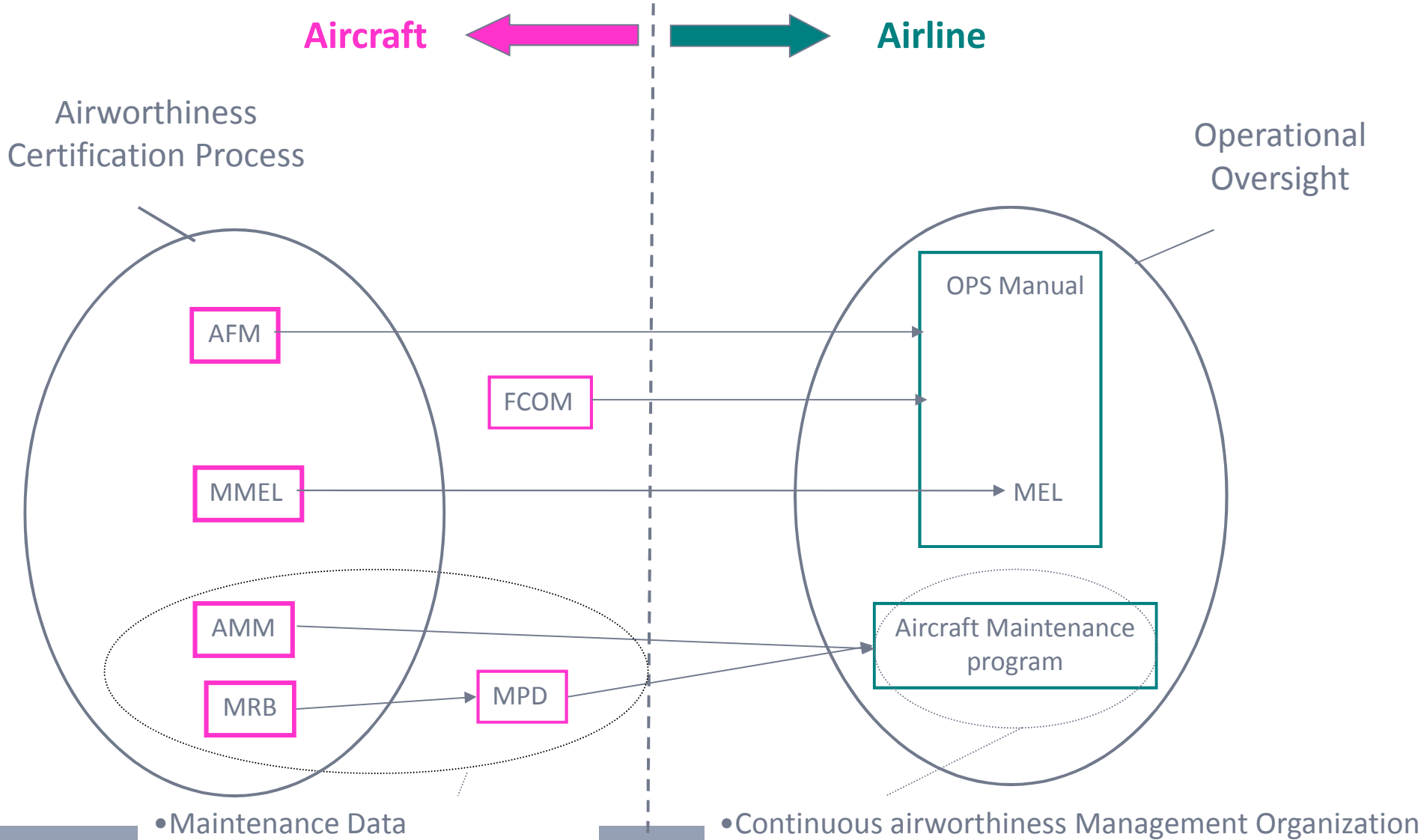
AFM Air Flight Manual
MMEL Master Minimum Equipment List

FCOM Flight Crew Operation Manual

AMM : Aircraft Maintenance Manual
MRB : Maintenance Review Board

MPD : Maintenance Planning Data

Airworthiness and Ops Approval



- Maintenance Data
- Initial Continuous Airworthiness

- Continuous airworthiness Management Organization
- Maintenance organization

Airworthiness and Ops Approval

The Operations Manual structure.

Part A: General/Basic
all non type-related operational policies, instructions and procedures
A8.1 Flight Preparation

Part B: Airplane Operating Matters
all type-related instructions and procedures.
- •B1 Limitations
- •B2 Normal /
- •B3 Abnormal / contingency operations
- •B5 Flight Planning
- •B9 MEL
- •B12 Aircraft systems

Part C: Route and Aerodrome Instructions and Information

Part D: Training

OPS approval Process

- Granting an ops appproval
- Application file
- Means of compliance

Granting an OPS approval

- The applicant (airline) has to constitute an application file, showing that it complies with the airworthiness criteria and operational requirements.

- The oversight authority identifies the operator's request / needs:
  - Make sure the requested approval is sufficient for the intended operations.
  - Use applicable regulation / documentation.

- Approval is delivered once the study and validation of the application has been done.
- Formalization of the ops approval through the operations specifications

Special limitations[8]:				
SPECIAL AUTHORIZATIONS	**YES**	**NO**	**SPECIFIC APPROVALS[9]**	**REMARKS**
Dangerous goods	☐	☐		
Low visibility operations				
Approach and landing	☐	☐	CAT[10]: _____ RVR: _____ m DH: _____ ft	
Take-off	☐	☐	RVR[11]: _____ m	
RVSM[12] ☐ N/A	☐	☐		
ETOPS[13] ☐ N/A	☐	☐	Maximum diversion time[14]: _____ minutes	
Navigation specifications for PBN operations[15]	☐	☐		[16]
Continuing airworthiness			[17]	
Other[18]	☐	☐		

PBN ops approval Application file

1. type, and registration number of the applicable aircraft
2. List of the navigation systems (name, version or part number, installed number)
3. Aircraft eligibility – airworthiness criteria
4. Description and limitations of the navigation system
6. Ops procedures
   - Flight preparation (RAIM, Aerodrome selection, Flight Plan management
   - Normal procedure (FTE monitoring,…)
   - Abnormal procedure / contingency procedure (in case of system failures, loss of signal, loss of integrity,…)
   - QRH
7. MEL
8. Crew training
9. Navigation database policy
   - LOA type 1 and 2
   - Feedback ; incident report policy
10. Aerodromes information
11. Specific maintenance task if applicable

Means of compliance

- A/C eligibility
- Description and Limitations of the system
- MEL – management
- Flight Preparation
- Normal procedure
  - Prior to commencing the PBN operation
  - During the PBN operation
- Abnormal / contingency procedure
- Navigation Data Base
- Crew Training
- OPS Specs

A/C eligibility

- The airline has to demonstrate that its aircraft have the functional capability and performance to fly PBN procedures.
- The performance and functional capability of the aircraft should be typically be confirmed by reference to statements in
  - the Aircraft Flight Manual (AFM) or
  - Pilot Operating Handbook (POH),
  - Or any documents referenced in the AFM

- Where such a reference cannot be found in the AFM or POH :
- A/C manufacturer / TC Holder, the STC holder or the organisation having a privilege to approve minor changes may be consulted to make the aircraft compliant with the expected performance required by the PBN navigation specification

A/C eligibility

- As some RNAV procedures have been developed prior to publication of the PBN manual, it is not always possible to find a clear statement of aircraft capability towards PBN in the AFM or POH.
- Sometimes however, aircraft eligibility for certain PBN navigation specifications can rely on the aircraft performance certified for RNAV procedures prior to publication of the PBN manual.
- A guidance material, developed by EASA, lists the various references which may be found in the AFM, POH or other acceptable documents in order to consider the aircraft's eligibility for a specific PBN navigation specification.

Description and Limitations of the system

- A detailed description of the navigation system should be described in the Operations Manual
  - Type and number of installed Navigaition system
  - Pilot's guide

- Description of the sensors used by the navigation system to compute the aircrfat positioning and associated limitations (time limitation in case of IRS, ..)

- What are the reversion possibility in case of failure cases of the system (e.g. reversion from GNSS positioning computation to IRS or DME/DME or DME/DME/IRS if applicable)

MEL management

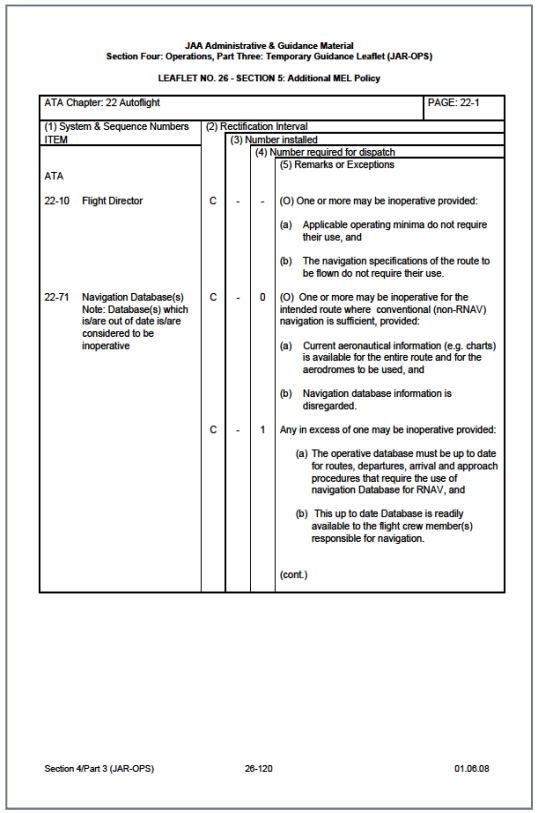
- The operator has to amend MEL to identify the minimum equipment necessary to satisfy PBN operations.

- The AFM limitations have to be taken into account when establishing the MEL (Use of AP or FD may be required, time limitations of the IRS,..)

- Database has also to be taken into account in the MEL management (in case of currency issue,…)

MEL management

- From the MMEL, airline develops a MEL taking into account its operational capability.
  - Loss of functions (systems)
  - Database out of date (TGL 26)



JAA Administrative & Guidance Material
Section Four: Operations, Part Three: Temporary Guidance Leaflet (JAR-OPS)

LEAFLET NO. 26 - SECTION 5: Additional MEL Policy

ATA Chapter: 22 Autoflight — PAGE: 22-1

(1) System & Sequence Numbers ITEM	(2) Rectification Interval	(3) Number installed	(4) Number required for dispatch	(5) Remarks or Exceptions
ATA				
22-10 Flight Director	C	-	-	(O) One or more may be inoperative provided: (a) Applicable operating minima do not require their use, and (b) The navigation specifications of the route to be flown do not require their use.
22-71 Navigation Database(s) Note: Database(s) which is/are out of date is/are considered to be inoperative	C	-	0	(O) One or more may be inoperative for the intended route where conventional (non-RNAV) navigation is sufficient, provided: (a) Current aeronautical information (e.g. charts) is available for the entire route and for the aerodromes to be used, and (b) Navigation database information is disregarded.
	C	-	1	Any in excess of one may be inoperative provided: (a) The operative database must be up to date for routes, departures, arrival and approach procedures that require the use of navigation Database for RNAV, and (b) This up to date Database is readily available to the flight crew member(s) responsible for navigation.

(cont.)

Section 4/Part 3 (JAR-OPS) 26-120 01.06.08

Flight Preparation

- **MEL :** Any MEL restriction has to be observed
- **Flight Plan :** has to be fill in appropriately in accordance with PBN nav spec for which the airline has been approved.
- **Route and Departure / Arrival selection :** The operator/crew has to check that the RNAV procedure is adequate with its aircraft configuration. (For instance, some RNAV 1 procedures are exclusively protected with GNSS and cannot be flown by aircraft certified for RNAV 1 without GNSS)
- **Destination alternate** : When a destination alternate aerodrome is required, it should not rely on GNSS if the destination is accessible only with a GNSS procedure.

Flight Preparation

- **NOTAM :** The crew must check any NOTAM or instructions which impact the PBN procedure (operator instructions, GPS notam, RAIM notam,..)

- **Navigation Data bases :** The crew has to cheeck that the database iss current and covers the selected flight/procedure.

- **RAIM / FDE :** For procedures relying on GNSS, RAIM availability has to be confirmed 15mn before and after the scheduled PBN procedure.
- For certain avionics architecture, RAIMprediction may not be required (refer to AFM limitation section)
- If the RAIM availability cannot be confirmed, the flight has to be delayed or another procedure which does not rely on GNSS has to be selected.
- A FDE prediction may be necessary (RNAV 10 / RNP 4)

Flight Preparation - Flight Plan

Item 10 = R and Item 18 = PBN / following letters in accordance with the following table

	RNAV SPECIFICATIONS
A1	RNAV 10 (RNP 10)
B1	RNAV 5 all permitted sensors
B2	RNAV 5 GNSS
B3	RNAV 5 DME/DME
B4	RNAV 5 VOR/DME
B5	RNAV 5 INS or IRS
B6	RNAV 5 LORANC
C1	RNAV 2 all permitted sensors
C2	RNAV 2 GNSS
C3	RNAV 2 DME/DME
C4	RNAV 2 DME/DME/IRU
D1	RNAV 1 all permitted sensors
D2	RNAV 1 GNSS
D3	RNAV 1 DME/DME
D4	RNAV 1 DME/DME/IRU
	RNP SPECIFICATIONS
L1	RNP 4
01	Basic RNP 1 all permitted sensors
02	RNP 1 de base GNSS
03	RNP 1 de base DME/DME
04	RNP 1 de base DME/DME/IRU
S1	RNP APCH
S2	RNP APCH with BARO-VNAV
T1	RNP AR APCH with RF (special authorization required)
T2	RNP AR APCH without RF (special authorization required)

Normal procedure

Prior to commencing the PBN operation

- **Procedure check** : loaded procedure must be checked against the chart.
  - The waypoint sequence.
  - Reasonableness of the tracks and distances of the approach legs, and the accuracy of the inbound course
- As a minimum, this check could be a simple inspection of a suitable map display.
- Confirm that the correct sensor has been selected. Check the Referenced Radio Navaid if applicable.

- **ATC tactical interventions may include radar headings,** In complying with ATC instructions, ‘direct to’ clearances to waypoints may be necessary. Those Waypoints have to be loaded from the data base (no manual creation).

- **Contingency procedures** must be reviewed

Normal procedure

During the PBN operation

- Manufacturer’s instruction must be adhered to (SOP)
- Appropriate display must be displayed
- Lateral and vertical (if applicable) deviations must not exceed prescribed values
- Altitude and speed constraints must be observed
- Monitor the navigation systems alerts
- The procedure must be discontinued in case of integrity alerts, the navigation accuracy cannot be met (NSE), the deviations exceed the prescribed values (FTE), any doubt on the nav database (PDE)

Abnormal / contingency procedure

- Documented procedures to cover :
  - Loss of the navigation system (FMS, GNSS « stand alone »)
  - Integrity alerts, loss of the integrity alerting function (UNABLE RNP, GPS PRIMARY LOST…).
  - Suspected navigation data base
  - Lateral / Vertical deviations must not exceed prescribed values.
- In case of any loss of PBN capability, ATC must be advised.
- Phraseology in accordance with Doc 4444 – Unable RNAV due to equipment

Navigation Data Base

Navigation data base integrity

- Shall comply with ED 76/DO 200A methodology standard or an equivalent approved procedure => LOA type 2 and type 1

Quality Monitoring

- The operator should continue to monitor both the process and the products in accordance with the quality system required by the applicable operational regulations.

Data Distribution

- The operator should implement procedures that ensure timely distribution and insertion of current and unaltered electronic navigation data to all aircraft that require it.

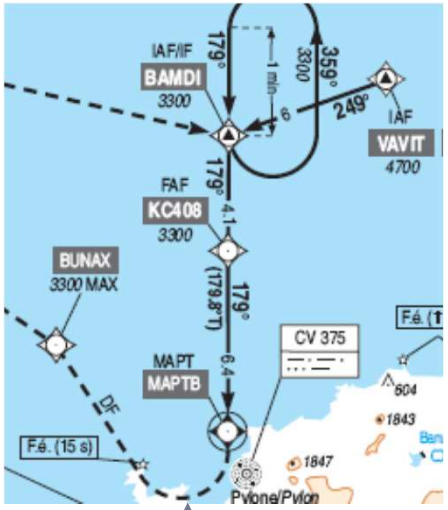
Data Management on Board

- The version of the loaded navigation database is checked for validity by the flight crew
- Prior to use, the procedure is checked against the chart by the flight crew (wpt sequence, transition, leg length, magnetic bearing, altitude and speed constraints)

Feed back and reporting errors found

- Any database errors are addressed expeditiously
- Reported back to the database suppliers

Navigation Database



1

REPERES *FIXES*	IDENTIFICATION *IDENTIFICATION*	COORDONNEES *COORDINATES*	CODAGE PROPOSE *PROPOSED CODING*	STATUT *STATUS*
IAF	VAVIT	42° 48' 38.6"N - 008° 55' 09.4"E	IF	Fly By
IAF/IF	BAMDI	42° 46' 34.5"N - 008° 47' 30.4"E	IF/TF	Fly By
FAF	KC408	42° 42' 28.4"N - 008° 47' 31.7"E	TF	Fly By
MAPT	MAPTB	42° 36' 01.31"N - 008° 47' 33.54"E	TF	Fly Over
MATF	BUNAX	42° 39' 16.0" N - 008° 39' 11.0" E	DF	Fly By
MATF	CALNO	42° 47' 58.0" N - 008° 21' 52.0" E	TF	Fly Over
MATF	BAMDI	42° 46' 34.5" N - 008° 47' 30.4" E	DF	Fly Over

LOA type 1
Jeppesen
Lido
…

2

Crew gross check

LOA type 2
Honeywell
Thales
Collins, Universal,
Garmin,…

3

Crew Training

Knowledge

- Area Navigation Principles
- PBN principle (performance monitoring, integrity, continuity, functionality) RNP vs RNAV
- Navigation systems and their limitations
- Displays, controls
- SOPs
- Flight planning

Important :
How to manage FTE and NSE !

Flight Training / initial and recurrent training

- Depend on operators experience
- In general flight training not required for en-route operations
- RNP APCH requires flight training
- Recurrent training will depend on operator's network.

OPS Specs

- Amend the OPS Specs in accordance with the granted PBN approval.
- one per type of aircraft

AUTORISATIONS SPÉCIALES (SPECIAL AUTHORIZATIONS)	**OUI** (YES)	**NON** (NO)	**APPROBATIONS PARTICULIÈRES** (SPECIFIC APPROVALS)	**OBSERVATIONS** (REMARKS)
Spécifications de navigation pour l'exploitation PBN *(Navigation specifications for PBN operations)*	☐	☐		

RNAV5 (BRNAV)
RNAV1 (PRNAV) ou PRNAV
RNP 4
RNP 10
RNP APCH - LNAV
RNP APCH - LNAV/VNAV
RNP APCH - LPV