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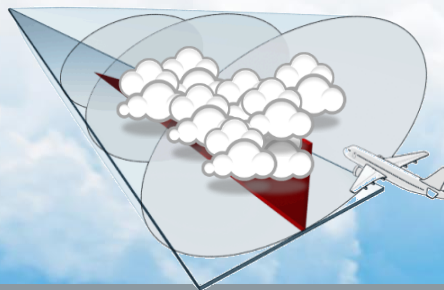
SAFETY

Performance-based Aerodrome Operating Minima

EASA - AWO Consultation Workshop 2016

Cologne 9-11 Nov

Capt. Miguel Marin
A/C/OPS ANB/ ICAO





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Overview Standards Implementation Examples



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Overview



Aerodrome Operating Minima possible



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Overview

Approach
Classification

Aerodrome
Infrastructure

Performance-based
Aerodrome Operating
Minima

Performance-based
Navigation

Advanced
Aircraft



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Performance-based Navigation

- PBN allows vertically guided Approaches at all runways
 - APV (Approach Procedure with Vertical Guidance)
- Steps to make PBN the norm rather than the exception
 - 2014 PBN charting requirements (PANS-OPS Vol 1)
 - 2016 updated performance-based navigation (PBN) provisions Annex 6 (all Parts)

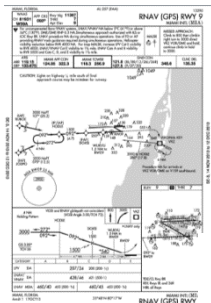


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Performance-based Navigation

PBN Chart Naming - Alignment of Requirements



OPERATIONS SPECIFICATIONS (subject to the approved conditions in the operations manual)			
ISSUING AUTHORITY CONTACT DETAILS ¹			
Telephone:	Fax:	E-mail:	
AOCID:	Operator name ²	Date ³	Signature:
Dita trading name:	18 OTHER INFORMATION Renseignements divers		
Aircraft model ⁴			
Types of operation: Commer			

1. ICAO model flight plan form	
FLIGHT PLAN PLAN DE VOL	
PROPOSED FF →	ADDITIONAL INFORMATION →
PLANNED →	DEPARTURE →
ARRIVAL →	TERMINAL →

PBN/

Indication of RNAV and/or RNP capabilities. Include as many of the descriptors below, as apply to the flight, up to a maximum of 8 entries, i.e. a total of not more than 16 characters.



Navigation specifications for PBN operations ¹⁵			
EDTO ¹⁶ <input type="checkbox"/> N/A	<input type="checkbox"/>	Threshold time ¹⁶ _____ minutes	<input type="checkbox"/>
	<input type="checkbox"/>	Maximum diversion time ¹⁶ _____ minutes	<input type="checkbox"/>
Navigation specifications for PBN operations ¹⁶	<input type="checkbox"/>	<input type="checkbox"/>	16
Continuing airworthiness	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	17
Other ¹⁸	<input type="checkbox"/>	<input type="checkbox"/>	

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/TRU
D1	RNAV 1 all permitted sensors
D2	RNAV 1 GNSS
D3	RNAV 1 DME/DME
D4	RNAV 1 DME/DME/TRU
RNP SPECIFICATIONS	
L1	RNP 4
O1	Basic RNP 1 all permitted sensors
O2	Basic RNP 1 GNSS
O3	Basic RNP 1 DME/DME
O4	Basic RNP 1 DME/DME/TRU
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)

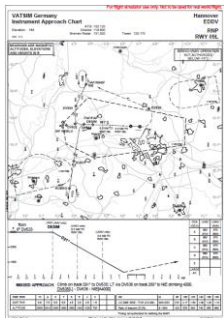


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Performance-based Navigation

PBN Chart Naming - Alignment of Requirements



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Aircraft model ⁴			
Types of operation: Comm			

1. ICAO model flight plan form	
PROPOSED FF	ADDITIONAL INFORMATION PLAN DE VOL
FLYING TIME Temps de vol	DEPARTURE Départ
ARRIVAL Arrivée	FLIGHT PLAN Plan de vol

PBN/

Indication of RNAV and/or RNP capabilities. Include as many of the descriptors below, as apply to the flight, up to a maximum of 8 entries, i.e. a total of not more than 16 characters.



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B1	RNAV 5 all permitted sensors
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C2	RNAV 2 GNSS
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Performance-based Navigation



- Applicable 10 Nov 2016
- 7.2.2 & 7.2.3* clarifies requirements
 - NAVSPEC information in AFM and MEL
 - Normal, abnormal and contingency procedures
 - Flight crew proficiency requirements
 - Training
 - Maintenance
- Clarifies which NAVSPECs require a specific approval

* Annex 6 Part I reference. Similar text exists in Parts II & III



Approach Classification

- Performance Based Approach Classification
 - Removes the terms Non Precision, APV & Precision from the operation
- The Approach Classification is not sensor specific, instead
 - Based on the point from which visual references are required
- Baseline for future operational enhancements
 - HUD, EVS, SVS



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Approach Classification

Type A 2D



Horizontal
Guidance



Horizontal
and
Vertical
Guidance



250 ft

Type A: Instrument approach operation 250' at or **above**

Type B 3D



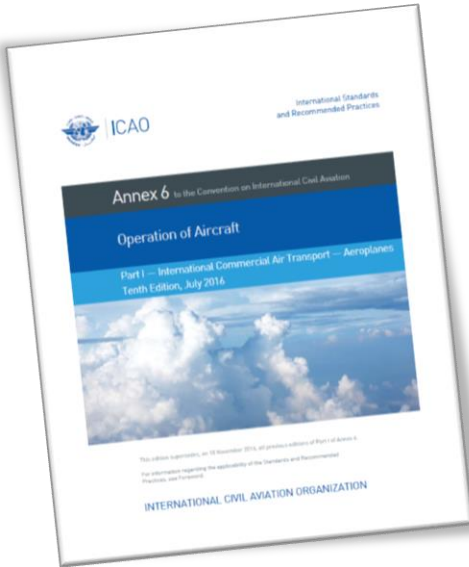
Horizontal and
Vertical
Guidance



200 ft

Type B: Instrument approach operation **below** 250'

Approach Classification



- Applicable since 2014
- Defines instrument approach procedure and instrument approach operation
- 4.2.8.3* makes the approach classification a Standard

* Annex 6 Part I reference. Similar text exists in Parts II & III



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Aerodrome Infrastructure

- Required runway visual aids tied to Approach Operation Type instead of sensor
- Performance-based classification allows for gradual phased improvements
- No large step-change in costs to gain improvement in Operating Minima



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Aerodrome Infrastructure

- Improvements can be:
 - Visual aids
 - Lighting
 - Standby systems
 - RVR measuring equipment



Aerodrome Infrastructure

- Commensurate ground infrastructure





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Aerodrome Infrastructure



- Applicable since 2014
- Instrument RWY definitions - Required runway visual aids tied to Approach Operation Type instead of sensor
- Non-Instrument RWY definition – allows for instrument approach procedures



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Advanced Aircraft

- Instrument approach procedures use a “basic” aircraft baseline
- Additional aircraft equipage has potential for further benefits
- Performance **enhancements** may lead to **lower** minima
 - Basic principle of a performance-based system
- Can be used in many different situations





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Advanced Aircraft





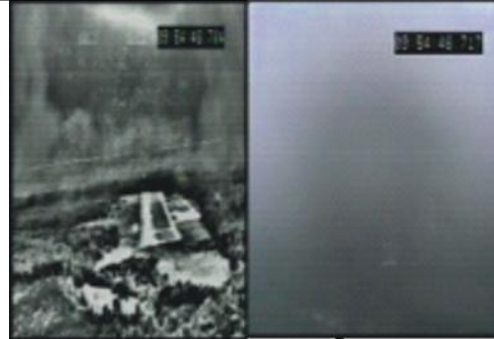
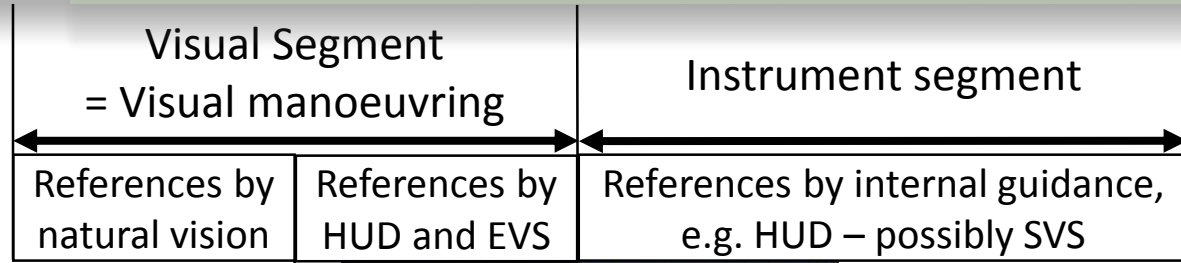
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Advanced Aircraft



Advanced Aircraft



MDA/H, DA/H

H above THR
(H=30 m(100ft) or 60 m(200 ft))



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Advanced Aircraft



- Applicable since 2014
- 4.2.8.1.1* Operational Credits for Enhanced Visions Systems
 - EVS, SVS, CVS, HUD
- Credits include:
 - Minima below baseline aerodrome operating minima
 - Reduced infrastructure requirements
 - Reduced visibility requirement

* Annex 6 Part I reference. Similar text exists in Parts II & III



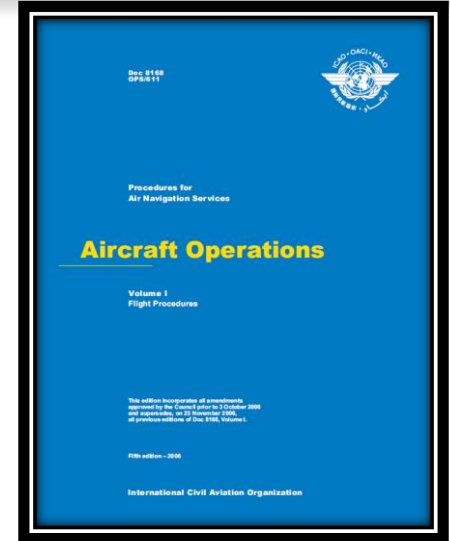
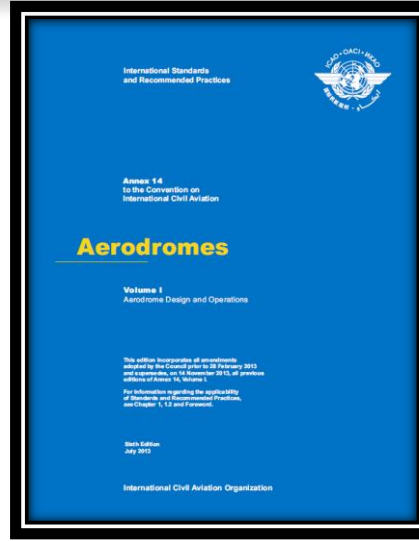
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PB Aerodrome Operating Minima



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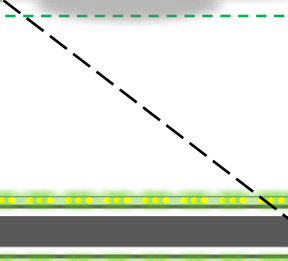
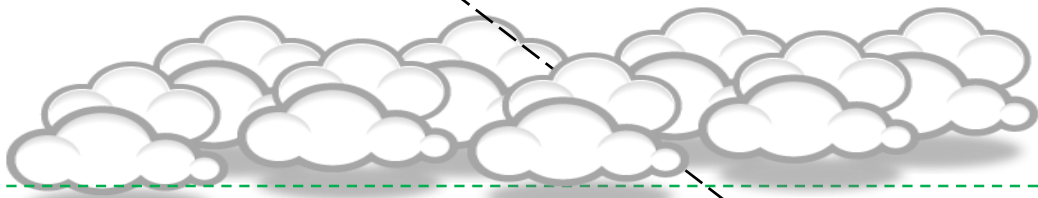
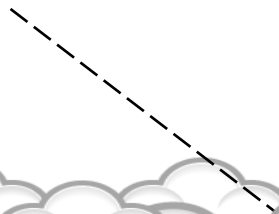


International Standards are available



* All Annex 6

Traditional Requirements



Runway Lights

Runway Markings

28

RUNWAY

INVESTMENT



Basic-Minima

Redundancies

NAV System



Performance-based Requirements



INVESTMENT



Trade-off Minima

Basic Minima

Redundancies NAV System



Runway Lights

Runway Markings

28

RUNWAY



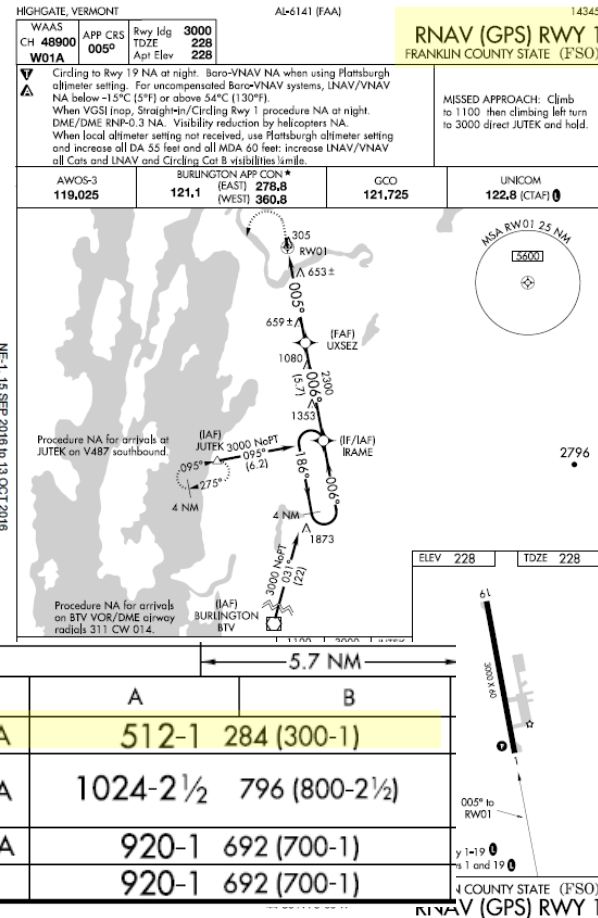
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Franklin County (KFSO)



Basic runway



NE-1, 15 SEP 2016 to 13 OCT 2016

Advanced Aircraft Path

INVESTMENT



Baseline Minima

Advanced aircraft benefit

Operational Credit

Runway Lights

28

Runway Markings

RUNWAY



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Combined Vision System

- Synthetic Vision
- IR imagery
- Falcon 900 EX
- Bordeaux (LFBD) ILS 23



- **Summary**

- Flexible
- Phased introduction
- Improved airport access
- Available today.





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Central American
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(NACC) Office
Mexico City

South American
(SAM) Office
Lima

ICAO
Headquarters
Montréal

Western and
Central African
(WACAF) Office
Dakar

European and
North Atlantic
(EUR/NAT) Office
Paris

Middle East
(MID) Office
Cairo

Eastern and
Southern African
(ESAF) Office
Nairobi

Asia and Pacific
(APAC) Sub-office
Beijing

Asia and Pacific
(APAC) Office
Bangkok



THANK YOU



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Quiz -Old Naming

A. RNAV (GNSS) RWY 15

B. RNAV (RNP) RWY 15

NAVSPEC Legend

APCH – Approach

AR – Authorization Required

Which is an RNP approach? **A & B**

Which one requires a Specific Approval? **B**



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Quiz -New Naming

A. RNP (APCH) RWY 15

B. RNP (AR) RWY 15

NAVSPEC Legend

APCH – Approach

AR – Authorization Required

Which is an RNP approach? **A & B**

Which one requires a Specific Approval? **B**