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PBN Global Developments

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PBN SG/3 (Cairo, Egypt, 11-13 February 2018)



- ICAO Update
- GBAS Support of CAT II/III Operations
- RNAV to RNP Instrument Approach Chart Depiction



SL Ref./Date:
AN 7/62.2.1-16/23
4 April 2016

Adoption of Amendment 90 to Annex 10, Volume I concerning issues associated with global navigation satellite system (GNSS), instrument landing system (ILS) and rationalization of conventional navigation systems.

SL Ref./Date:
AN 11/19.1,
AN 11/19.2-16/66
30 June 2016

Approval of Amendments 7 and 7 to the Procedures for Air Navigation Services — Aircraft Operations, Volume I — Flight Procedures and Volume II — Construction of Visual and Instrument Flight Procedures (PANS-OPS, Doc 8168), respectively concerning minimum obstacle clearance (MOC) reduction for turning departure procedures, the use of course to fix (CF) on departure legs, barometric-vertical navigation (Baro-VNAV) offset procedures, the use of performance-based navigation (PBN) with instrument landing system/microwave landing system/ground-based augmentation system (GBAS) landing system (ILS/MLS/GLS), satellite-based augmentation system (SBAS) and GBAS procedure design requirements, visual segment surface (VSS) penetrations requirements, area minimum altitude (AMA) determination requirements and improvements to airborne collision avoidance system (ACAS) provisions.



SL Ref./Date:

AN 7/62.1.1-16/61
9 June 2016

Proposals for the amendment of Annex 10, Volume I, concerning the global navigation satellite system (GNSS) and the instrument landing system (ILS)

SL Ref./Date:

EB 2017/05
6 January 2017

Electronic Bulletin:
Transition to RNP Chart Instrument Approach Depiction

SL Ref./Date:

AN 7/62.1.2-17/18
30 March 2017

Proposals for the amendment of Annex 10, Volume I, concerning ground-based augmentation system (GBAS) support of Category II/III operations and other enhancements, satellite-based augmentation system (SBAS) and the strategy for introduction and application of non-visual aids to approach and landing



SL Ref./Date:
SP 65/4-17/28
SP 59/4-17/28
7 April 2017

Proposed amendments to restructure PANS-OPS, Volume I, Parts I and II (Phase II) with consequential amendments to Annexes 2 and 6 and the PANS-ATM arising from IFPP/13; and proposal for the amendment of PANS-OPS, Volumes I and II and introduction of Volume III arising from FLTOPSP/3

SL Ref./Date:
SP 65/4-17/78
23 June 2017

Proposed amendments to PANS-OPS, Volumes I and II, Annex 4 and Annex 14, Volume I arising from IFPP/13

SL Ref./Date:
AN 13/2.5-
17/85
3 August 2017

Proposals for the amendment of PANS-ATM (Doc 4444) and PANS-OPS (Doc 8168), Volumes I and II relating to lateral separation and parallel operations



GBAS Support of CAT II/III Operations



GBAS Support of CAT II/III Operations

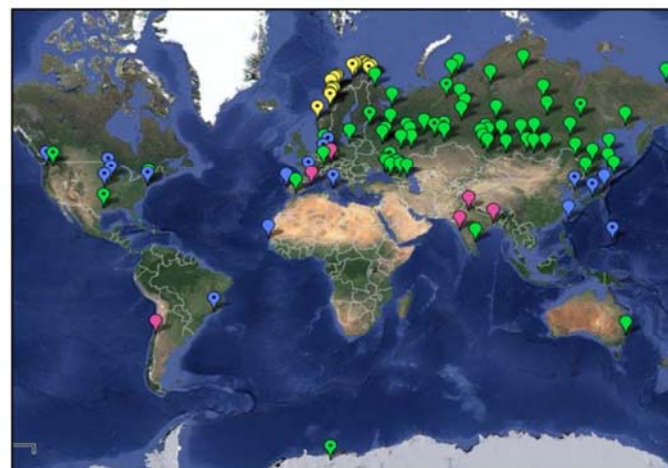
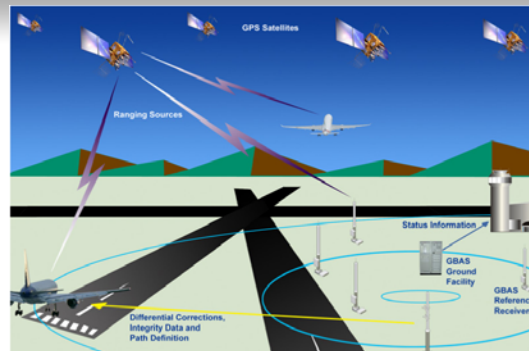
(PfA Ref.: AN 7/62.1.2-17/18 dated 30 March 2017)

- Current SARPs for GBAS CAT I; based on a system architecture in which the GBAS ground facility is solely responsible for ensuring the integrity and the continuity of the position solution
- While this was deemed acceptable for Category I, the more demanding Category II/III requirements made such an approach unfeasible.
- The PfA to Annex 10 (dated 30 March 2017), while leaving unchanged the current Category I provisions for backward compatibility reasons, adopts a different approach to deal with Category II/III requirements whereby the responsibility for ensuring integrity and continuity is partially shifted from the ground facility to the aircraft.
- Instead of requiring the ground facility to ensure integrity and continuity by accounting for all possible aircraft conditions (in term of geometry of the set of satellites in use and local ionosphere state), the present proposal requires the ground facility to provide to the airborne receiver sufficient information to enable it to make its own assessment of integrity and continuity of its specific position solution.
- Additional elements of the proposal include modifications to reduce the operational differences between GBAS and ILS.



GBAS Implementation

- Supports all phases of approach, landing, departure, and surface operations within its area of coverage
- Ground Subsystem:
 - 4 Reference receivers
 - GBAS Ground Facility/processing unit
- VHF data broadcast (VDB) transmitter (108.025-117.975 MHz)
- > 37 km operation radius.
- One GBAS for multiple RWYs / Airports (e.g. LFPG 8 ILS CAT III !)
- Optimized curved approaches
- No terrain constraint
- GBAS implementation subject to CBA
- Currently, GBAS CAT I is implemented in more than 100 airports, e.g.:
 - Bremen (EDDW), Malaga (LEMG), Frankfurt (EDDF), Zurich (LSZH), Newark (KEWR), Houston's George Bush (KIAH), Moses Lake (KMWH), Charleston (KCHS), Sydney (YSSY), Chennai (VOMM), Saint Helena (FHSB)
- GBAS CAT III technology is available but further work is needed on operational aspects (regulations, standards, ATC tools definition, Procedure design criteria, ...)



- Operational S-CAT1
- Operational GBAS
- Experimental GBAS
- Planned GBAS

(source: www.flygls.net)



RNAV to RNP Chart Depiction



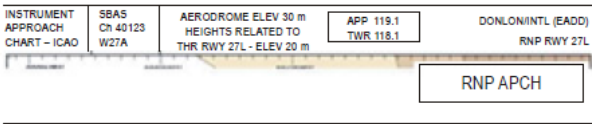
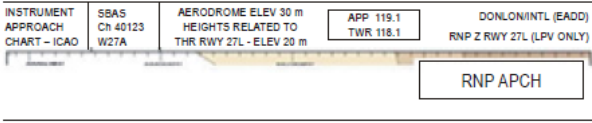
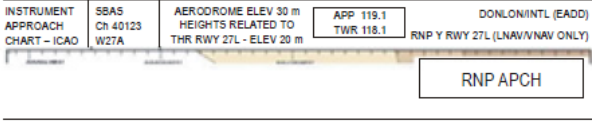
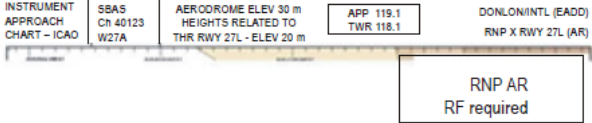
- Inconsistencies with the aeronautical charts, the PBN operational approvals and the avionics displays.
- Amendment 6 to the PANS-OPS (DOC 8168) (applicability date: 13 November 2014) introduced procedure design criteria and charting requirements to support PBN.
- Circular 336 provides guidance to assist States and other stakeholders with the transition from RNAV to RNP approach chart identification (*a new circular has been developed and will be published soon to replace Cir 336*)



- Until 30 November 2022, approach charts depicting procedures that meet the RNP APCH navigation specification criteria must include either the term RNP or RNAV (GNSS) in the identification (e.g. RNP RWY 23 or RNAV (GNSS) RWY 23). However, from 1 December 2022, only the term RNP will be permitted.
- Until 30 November 2022, approach charts depicting procedures that meet the RNP AR APCH navigation specification criteria must include either the term RNP (AR) or RNAV (RNP) in the identification (e.g. RNAV (RNP) RWY 23). However, from 1 December 2022, only the term RNP (AR) will be permitted.



Examples

Old naming	Interim (current) naming	Final Naming	
RNAV (GPS) RWY 23	RNAV _(GNSS) RWY 23	RNP RWY 23	 <p>Chart identification PBN requirements box</p>
RNAV (GNSS) RWY 23	RNAV _(GNSS) RWY 23	RNP RWY 23	 <p>(LPV only)</p>
RNAV (RNP) RWY 23	RNAV _(RNP) RWY 23	RNP RWY 23 (AR)	 <p>(LNAV/VNAV only)</p>
			 <p>(AR)</p>

- States may decide to go directly from the old naming convention to the final convention




- The chart identification must include the runway identification for straight-in landing (RNP RWY 23)
- For circling procedure; a letter designator (a, b, c, etc.); example: RNP A
- When more than one PBN approach procedure exists for the same runway: e.g. RNP Z RWY 23, RNP Y RWY 23



- Status of PBN Charting Depiction is at **Appendix A**, for the review by the meeting.

AIM SG/3-WP/14
APPENDIX A

 International Civil Aviation Organization
ELECTRONIC BULLETIN
For information only

EB 2017/05 6 January 2017

TRANSITION TO RNP CHART INSTRUMENT APPROACH DEPICTION

1. On 13 November 2014, Amendment 6 to Doc 8168, *Procedures for Air Navigation Services — Aircraft Operations, Volume II — Construction of Visual and Instrument Flight Procedures*, presented a change to the approach charts by introducing the “PBN Requirements Box” and a change in chart identifications for performance-based navigation (PBN) approaches (**Attachment**).
2. Amendment 6 allows for a transition period between 13 November 2014 and 30 November 2022 during which use of existing and new chart identifications would be acceptable. ICAO Circular 336, *Area Navigation (RNAV) to Required Navigation Performance (RNP) Instrument Approach Chart Depiction*, was produced in support of Amendment 6 to provide guidance on the change, in particular managing the risks involved during the transition period. However, since adoption of Amendment 6, concerns have been raised regarding the implementation of this change. The attention of the 39th Session of the Assembly was drawn to these concerns, and ICAO was encouraged to update the guidance available and develop a regionally coordinated transition plan to support the effective rollout of the change.
3. To address concerns related particularly to transition arrangements and potential confusion for operators being faced with variations in chart titling during the transition period, Circular 336 is to be replaced by new guidance material. This new material, which will also use feedback provided by early adopting States, will contain a redesigned risk assessment and extensive guidance for transition planning covering key considerations such as consultation, communication planning and impact assessment.
4. The new transition planning guidance material will emphasize the need for connection and synchronization between global, regional and State transition planning.
5. The guidance is expected to be available in summer 2017. Until the guidance and regional transition plans are available, the following is recommended:
 - a) States that have already started implementing the chart naming provisions of Amendment 6 to Doc 8168 should not revert back to the old names, but should not continue further implementation until this can be coordinated with the regional transition plan; and
 - b) States planning their implementation of Amendment 6 should wait for the development of the regional transition plan which will be based on the improved guidance material replacing Circular 336.

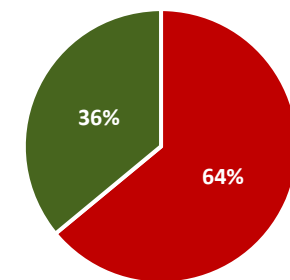
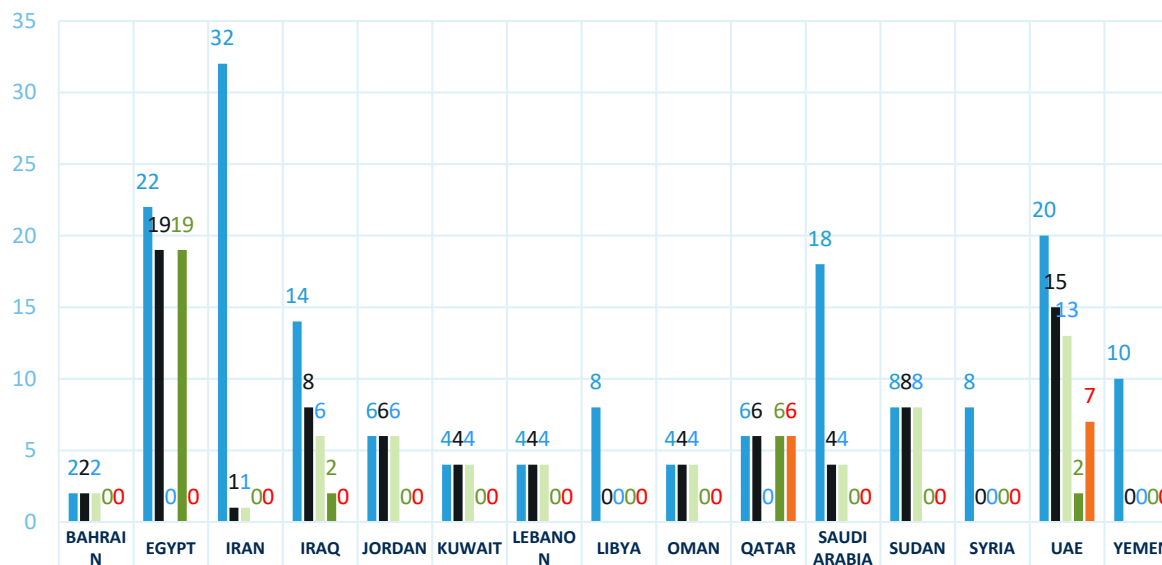
Enclosure:
Extract from Amendment 6 to Doc 8168

Issued under the authority of the Secretary General

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PBN Chart Status



■ Interim (52) ■ Final (29)

	BAHRAIN	EGYPT	IRAN	IRAQ	JORDAN	KUWAIT	LEBANON	LIBYA	OMAN	QATAR	SAUDI ARABIA	SUDAN	SYRIA	UAE	YEMEN
# of RWY ends	2	22	32	14	6	4	4	8	4	6	18	8	8	20	10
# of PBN RWYs	2	19	1	8	6	4	4	0	4	6	4	8	0	15	0
Interim (PBN Charting) implemented	2	0	1	6	6	4	4	0	4	0	4	8	0	13	0
Final (PBN Charting) implemented	0	19	0	2	0	0	0	0	0	6	0	0	0	2	0
PBN Requirement Box / Chart Notes	0	0	0	0	0	0	0	0	0	6	0	0	0	7	0



- The meeting is invited to:
 - note the information provided in this presentation;
 - review and update the status of RNAV to RNP Charting Depiction, at **Appendix A**; and
 - agree on a date for the implementation of RNAV to RNP Chart Depiction.



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