



*International Civil Aviation Organization*

**The First Meeting of ICAO Asia/Pacific Performance based Navigation  
Implementation Coordination Group (PBNICG/1)**

Beijing, China, 10-12 March 2015

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- Agenda Item 5: Implementations of PBN in Terminal Area**
  - Agenda Item 6: Implementations of PBN in Domestic En-route Airspace**
  - Agenda Item 8: Issues and challenges regarding PBN implementations**

**SAFETY ASSESSMENT REQUIREMENT IN PBN IMPLEMENTATION**

(Presented by Secretariat)

**SUMMARY**

This working paper presents the requirement for the safety assessment in PBN implementation and proposes to develop a safety assessment assistant tool which will be used by States in the Asia and Pacific Region. Action by the meeting is requested in paragraph 3.1.

**1. INTRODUCTION**

1.1 Many ICAO documents which are related to PBN implementation outline the need for safety assessment when planning, developing and validating airspace concept and RNAV or RNP implementation. For example, the 22<sup>nd</sup> Meeting of Asia and Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG/22) adopted Asia and Pacific Regional Performance-based Navigation (PBN) Implementation Plan (Version 3.0) which includes “Safety Assessment and Monitoring Requirements” in September 2011.

**2. DISCUSSION**

Safety Assessment Requirements in APAC Regional PBN Implementation Plan

2.1 Asia and Pacific Regional PBN Implementation Plan describes the need for a safety assessment as “to ensure that the introduction of PBN applications within the Asia/Pacific Region is undertaken in a safe manner, in accordance with relevant ICAO provisions, implementation shall only take place following conduct of a safety assessment by the implementing State or group of States that demonstrates that an acceptable level of safety will be met. This assessment may also need to demonstrate that residual levels of risk associated with specific PBN implementations are acceptable. Additionally, after implementation ongoing periodic safety reviews shall be undertaken by the implementing State or group of States, where required, in order to establish that operations continue to meet acceptable levels of safety.”

2.2 Even though APANPIRG requires States to conduct safety assessment when introducing PBN in their airspace, it does not provide any specific guidelines or methods for PBN safety assessment making it difficult for States who implement PBN for the first time to introduce their PBN procedures.

2.3 In addition, as the En-route Monitoring Agency (EMA) which is approved by Regional Airspace Safety Monitoring Advisory Group (RASMAG) of APANPIRG only provides airspace safety assessment, monitoring and implementation services for international airspace in the Asia/Pacific region, safety assessment responsibility within sovereign airspace remains to each State.

Development of PBN Safety Assessment Checklist

2.4 Recognizing the need for a safety assessment assistance to States, ICAO Asia and Pacific Regional Sub-Office (APAC RSO) developed two initial check lists which can be helpful to States in conducting an safety assessment for RNP APCH and SID/STAR (see **Appendix A and B**). The initial check lists integrated best practices and materials being used by Malaysia, Republic of Korea and Thailand. These checklists deal with many items which are used to identify hazards in the PBN procedures such as coordination with relevance entities, airspace restrictions, human error issues, separation issues, etc.

2.5 In terms of ATS routes, as a specific checklist haven't developed, it can be developed considering following items which are described in APAC Regional PBN Implementation Plan:

- a) Establish and maintain a database of PBN approvals;
- b) Pre-implementation - conduct safety and readiness assessments and, for international implementations, report results to RASMAG;
- c) Post-implementation - maintain awareness of data link performance and monitor aircraft horizontal-plane navigation performance and the occurrence of large navigation errors (lateral and longitudinal), implement remedial actions as necessary and, for international implementations, report results to RASMAG;
- d) Monitor operator compliance with State approval requirements after PBN implementation;
- e) Initiate necessary remedial actions in any instances where PBN requirements are not met.

**3. ACTION BY THE MEETING**

3.1 The meeting is invited to:

- a) note the need for safety assessment in PBN implementation;
- b) consider forming a group with a rapporteur to review the checklists in Appendix A and B and to submit the enhanced material to the next PBNICG; and
- c) request the group in coordination with ICAO APAC RSO to draft a similar safety assessment checklist for ATS route intersessionally.

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### Appendix A. PBN Safety Assessment Initial Checklist - RNP APCH

<b>PBN Safety Assessment Initial Checklist – RNP APCH</b>				
Assessor				
Procedure Name		Date		
S : Satisfactory, U : Unsatisfactory, N/A : Not Available				
No.	Check Items	S	U	N/A
1	Were proposed procedures designed and reviewed by the qualified flight procedure designers? ▪ Comments			
2	Did procedure designers coordinate with stakeholders regarding new and/or amended flight procedures? ▪ Comments :			
3	Did relevant ATC facilities review the new and/or amended procedures based on the Letter of Agreement (LOA) between facilities? ▪ Comments :			
4	Are the locations of waypoints and restrictions (speed, altitude, etc.) appropriate for the aircraft types expected to use these procedures? ▪ Comments :			
5	Are there any expected difficulties or possibilities of phonetic confusion in the names used for waypoints and procedures ? ▪ Comments :			
6	Are there any elements that may lead to misinterpretation or other difficulties while using the proposed procedures? ▪ Comments :			
7	Are there any errors on the chart(s)? (Items to focus on: Magnetic Bearings/True Headings, Distances, Climb/Descent Gradients, TAA/MSA, Magnetic Variation, Topography, Location of Obstacles, Coordinates, Restrictions, etc.) ▪ Comments :			
8	Were all obstacles evaluated when calculating OCA/H in the proposed procedures? ▪ Comments :			
9	Was RAIM/GNSS availability considered while designing the proposed procedures? ▪ Comments :			
10	If RAIM/GNSS availability information is provided by entities, other than the ANSP, are there any agreements with those entities regarding the provision these information? ▪ Comments :			
11	Are the descent rates of proposed arrival procedures appropriate to enable aircraft to complete their approaches? ▪ Comments :			

12	<p>Do missed approach procedures enable aircraft to climb to the assigned altitude/s? Are climb gradients specified where the climb gradient exceeds the standard missed approach climb gradient of 2.5%?</p> <ul style="list-style-type: none"> <li>▪ Comments</li> </ul>			
13	<p>Do the proposed procedures take into account adequate separation between aircraft using these approaches and other aircraft using conventional approaches (ILS, VOR, NDB)?</p> <ul style="list-style-type: none"> <li>▪ Comments :</li> </ul>			
14	<p>Have any alternative procedures been instituted if an aircraft conducting the proposed procedure/s are unable to complete the assigned procedure due to temporary GNSS signal abnormality, airborne system failures, technical problems or other difficulties?</p> <ul style="list-style-type: none"> <li>▪ Comments :</li> </ul>			
15	<p><b>For LNAV/VNAV Procedures:</b> Is the location of the altimeter setting source appropriate for the use of the Baro-VNAV approach procedure?</p> <ul style="list-style-type: none"> <li>▪ Comments :</li> </ul>			
16	<p><b>For LNAV/VNAV Procedure:</b> Is published minimum temperature reasonable for the application of the Baro-VNAV procedure?</p> <ul style="list-style-type: none"> <li>▪ Comments :</li> </ul>			
17	<p>Has implementation training been planned for air traffic controllers on the use of the proposed procedures?</p> <ul style="list-style-type: none"> <li>▪ Comments :</li> </ul>			
18	<p>Are there any items requiring special authorization in the proposed procedures? If any, were sufficient reviews on criteria conducted and was the rationale for requiring such special authorization reasonable and necessary?</p> <ul style="list-style-type: none"> <li>▪ Comments :</li> </ul>			

### Appendix B. PBN Safety Assessment Initial Checklist - SID/STAR

<b>PBN Safety Assessment Initial Checklist – SID/STAR</b>				
Assessor				
Procedure Name		Date		
<b>S : Satisfactory, U : Unsatisfactory, N/A : Not Available</b>				
No.	Check Items	S	U	N/A
1	Did procedure designers coordinate with related entities regarding new and/or amended flight procedures? ▪ Comments :			
2	Did related ATC facilities review new and/or amended procedures based on the Letter of Agreement (LOA) between facilities? ▪ Comments :			
3	Are the location of waypoint and restrictions (speed, altitude, etc.) appropriate for the aircraft that is expected to use the procedures? ▪ Comments :			
4	Are there any expected difficulties or the possibility of confusion on the name of waypoints and procedures phonetically? ▪ Comments :			
5	Are there any parts that may lead mistakes or difficulties while using the proposed procedures? ▪ Comments :			
6	Are there any errors on the chart(s)? (check items : magnetic bearing/true heading, distance, climb/descent gradient, TAA/MSA, magnetic variation, topography, location of obstacle, coordinates, restrictions, etc.) ▪ Comments :			
7	Were proposed procedures designed and reviewed by the qualified flight procedure designers? ▪ Comments :			
8	Were obstacles evaluated in the proposed procedures? ▪ Comments :			
9	Were coverage and limitations of available avionics, ground navigational aids and GNSS considered while designing the proposed procedures? ▪ Comments :			
10	Were traffic flows in the terminal area considered while designing the proposed procedures? ▪ Comments :			
11	Are climb/descent rates of the proposed procedures appropriate to enabling the climb/descent within the airspace? ▪ Comments :			
12	Does separation applied between instrument flight procedures of neighbouring airport, airspaces including special use airspaces (SUAs) and the proposed procedures satisfy separation criteria specified in <i>ATC Procedures and Instrument Procedure Design Manual</i> ? ▪ Comments :			

13	Do the proposed procedures consider separation between aircraft using PBN procedures and aircraft using other procedures? ▪ Comments :			
14	Were the proposed procedures considered current and expected future airspace capacity? ▪ Comments :			
15	Are there any alternative methods when an aircraft conducting a proposed procedure is unable to conduct the procedure because of ground/satellite/airborne system failures, technical problems or other difficulties? ▪ Comments :			
16	Is there any training plan for air traffic controllers on the proposed procedures? ▪ Comments :			
17	Are there any items requiring special authorization in the proposed procedures? If any, were sufficient reviews on criteria conducted and was rationale for requiring special authorization reasonable? ▪ Comments :			