



International Civil Aviation Organization

SIP/2012/ASBU/Dakar-WP/16 A

Aviation System Block Upgrades

Module N° B0-65/PIA-1

Optimization of Approach Procedures

Including Vertical Guidance

Workshop on preparations for ANConf/12 – ASBU methodology
(Dakar, 16-20 July 2012)

Module N° B0-65

Optimization of Approach Procedures Including Vertical Guidance



Summary	<p>-PBN-T: First step toward universal implementation of GNSS-based approaches.</p> <p>-Achieved through application of Basic GNSS, Baro VNAV, SBAS and GBAS.</p>
Main Performance Impact	KPA-01 Access/Equity, KPA-02 Capacity, KPA-04 Efficiency, KPA-05 Environment, KPA-10 Safety
Operating Environment/Phases of Flight	Approach
Applicability Considerations	This module is applicable to all instrument and precision instrument runway ends, and to a limited extent, non-instrument runway ends
Global Concept Component(s)	AUO – Airspace User Operations AO – Aerodrome Operations
Global Plan Initiatives (GPI)	GPI-5 RNAV and RNP (PBN); GPI-14 Runway Operations GPI-20 WGS84
Pre-Requisites	NIL



- Limited number of GNSS-based PBN implemented, compared with conventional procedures.

Module N° B0-65 – Change Brought by the Module



- **PBN-Terminal** procedures require no ground-based Nav Aids .
- Allows designers complete flexibility in determining final approach lateral /vertical paths.
- States can implement GNSS-based PBN approach procedures with basic GNSS avionics with or without Baro VNAV capability, and for aircraft equipped with SBAS/GBAS avionics.
- Designed for runways with or without conventional approaches → providing benefits to PBN-capable aircraft.
- Key to maximum benefits is aircraft equipage.

Module N° B0-65 – Intended Performance Operational Improvement



Access and Equity	Increased aerodrome accessibility
Capacity	Removal of requirement for sensitive and safety-critical areas resulting in increased runway capacity.
Efficiency	Benefits of lower approach minima: fewer diversions, over flights, cancellations and delays resulting in reduced fuel burn
Environment	Reduced CO ₂
Safety	Stabilized approach paths
CBA	Aircraft operators and ANSPs can quantify the benefits of lower minima by using historical aerodrome weather observations and modelling airport accessibility with existing and new minima. CBA is positive

Module N° B0-65 – Necessary Procedures (Air & Ground)



- Documents providing background and implementation guidance for ANS providers, aircraft operators, airport operators and aviation regulators:
 - PBN Manual
 - GNSS Manual
 - Annex 10
 - PANS-OPS Volume I
 - Manual on Testing of Radio Navigation Aids (Doc 8071) Volume II
 - Quality Assurance Manual for Flight Procedure Design (Doc 9906)

Module N° B0-65 – Necessary System Capability



- **Avionics**

- PBN approach procedures can be flown with basic IFR GNSS avionics
- TSO C129 receivers with RAIM
- Basic IFR GNSS receivers integrated with Baro VNAV functionality to support vertical guidance to LNAV/VNAV minima
- Aircraft with SBAS avionics (TSO C145/146) can fly approaches with vertical guidance to LPV minima, as low as ILS Cat I minima
- Aircraft require TSO C161/162 avionics to fly GBAS approaches

- **Ground Systems**

- SBAS-based procedures do not require infrastructure at the airport, but SBAS elements (e.g. reference stations, master stations, GEO satellites) must be in place
- A GBAS station can support vertically guided Cat I approaches to all runways at that aerodrome

Module N° B0-65 – Training and Qualification Requirements



- Training in the operational standards and procedures are required for this module
- Likewise, the qualifications requirements are identified in the regulatory requirements

Module N° B0-65 – Regulatory/Standardization Needs and Approval Plan (Air & Ground)



- Regulatory/Standardization:
 - No new or updated regulatory guidance or standards documentation is needed at this time.
- Approval Plans:
 - No new or updated approval criteria is needed at this time. Implementation plans should reflect available aircraft, ground systems and operational approvals

- **Standards**

- ICAO Annex 10 — *Aeronautical Telecommunications, Volume I — Radio Navigation Aids*. As of 2011 a draft SARPs amendment for GLS to support Category II/III approaches is completed and is being validated by States and industry.

- **Procedures**

- ICAO Doc 8168, *Aircraft Operations*.

- **Guidance Material**

- ICAO Doc 9674, *World Geodetic System — 1984 (WGS-84) Manual*;
- ICAO Doc 9613, *Performance-based Navigation (PBN) Manual*;
- ICAO Doc 9849, *Global Navigation Satellite System (GNSS) Manual*;
- ICAO Doc 9906, *Quality Assurance Manual for Flight Procedure Design, Volume 5 — Validation of Instrument Flight Procedures*;
- ICAO Doc 8071, *Manual on Testing of Radio Navigation Aids, Volume II — Testing of Satellite-based Radio Navigation Systems*;
- ICAO Doc 9931, *Continuous Descent Operations (CDO) Manual*.

- **Approval Documents**

- FAA AC 20-138(), TSO-C129/145/146()
- ICAO Doc 4444, *Procedures for Air Navigation Services — Air Traffic Management*;
- ICAO Flight Plan Classification;
- ICAO Doc 8168, *Aircraft Operations*;
- ICAO Doc 9613, *Performance Based Navigation Manual*;
- ICAO Annex 10 — *Aeronautical Telecommunications*;
- ICAO Annex 11 — *Air Traffic Services*;
- ICAO Doc 9674, *World Geodetic System — 1984 (WGS-84) Manual*



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Benefits - Main Key Performance Areas (KPA)

KPAs	Access	Capacity	Efficiency	Environment	Safety
Applicable	Y	Y	Y	Y	Y

- **Elements**

- **APV with Baro VNAV**
- **APV with SBAS**
- **APV with GBAS**

To be reflected in ANRF

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