

International Civil Aviation Organization

ASBU/SIP/Lima/2012-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  
(Lima, 16-20 April 2012)

## Module N° B0-65



### Optimization of Approach Procedures Including Vertical Guidance

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

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## Module N° B0-65 – Baseline



- 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



<b>Access and Equity</b>	Increased aerodrome accessibility
<b>Capacity</b>	Removal of requirement for sensitive and safety-critical areas on precision approaches.
<b>Efficiency</b>	Cost savings → benefits of lower approach minima: fewer diversions, over flights, cancellations and delays.; higher airport capacity:
<b>Environment</b>	Reduced fuel burn
<b>Safety</b>	Stabilized approach paths
<b>CBA</b>	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

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## 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)

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## 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

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## 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

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## 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

## Module N° B0-65 – Reference Documents



- **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*

Module N° B0-65 Implementation  
- Benefits and Elements



**Optimization of Approach Procedures  
Including Vertical Guidance**

- **Benefits: Access, Capacity, Efficiency, Environment and Safety**
- **Elements**
  - APV with Baro VNAV/APV with SBAS /APV with GBAS

**To be reflected in ANRF**

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