



ICAO | UNITING AVIATION

African Flight Procedure Programme (AFPP)

Quality Assurance For Instrument Flight Procedure Implementation

Nairobi, Kenya – 3-6 November 2015
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- ✓ PBN concept
- ✓ ASBU system
- ✓ PBN concept advantages
- ✓ PBN implementation stakeholders
- ✓ PBN implementation documentation
- ✓ PBN National Plans status
- ✓ 2010, ICAO Resolution A37-11, PBN implementation
- ✓ PBN approach procedures implementation status in African States
- ✓ PBN SIDs and STARs implementation status in African States
- ✓ PBN procedures implementation status in African States
- ✓ ICAO-AFPP/AFCAC PBN Survey, May 2015



PBN CONCEPT ESTABLISHED IN 2008

- ✓ Area navigation based on performance requirements for aircraft operating along an ATS route, on an instrument approach procedure or in a designated airspace. (ICAO Doc 9613)





The implementation of Performance-Based Navigation, or PBN, is presently the global aviation community's highest Air Navigation priority.



TODAY

AFPP



THE CONCEPT IS MATURE



**It is key to the implementation of
ICAO's Aviation System Block
Upgrades (ASBU).**

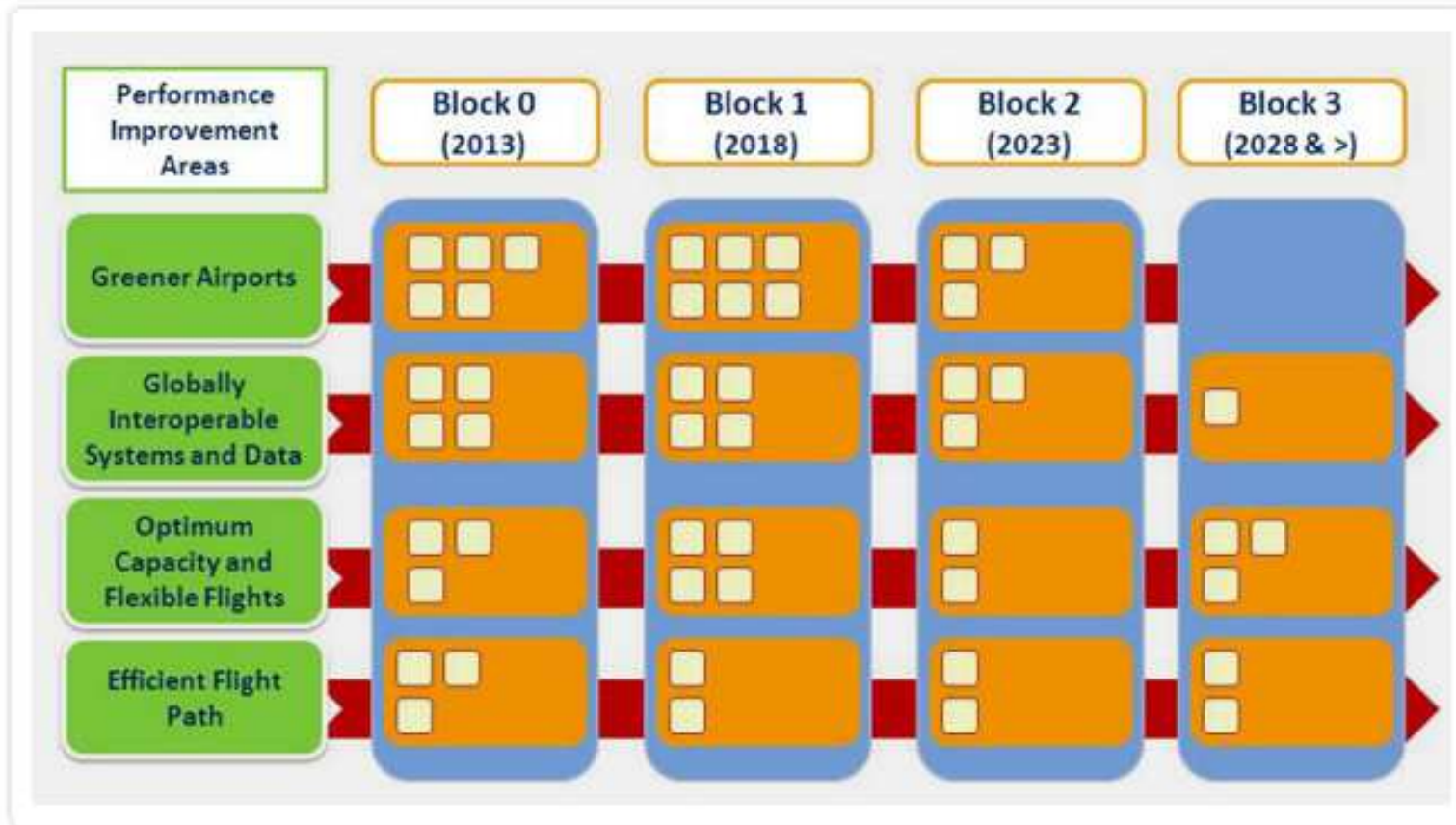


ASBU Framework

Aviation System Block Upgrades - ASBUs (Edition March 2013)



Quality Assurance, instrument flight procedures implementation



Quality Assurance, instrument flight procedures implementation

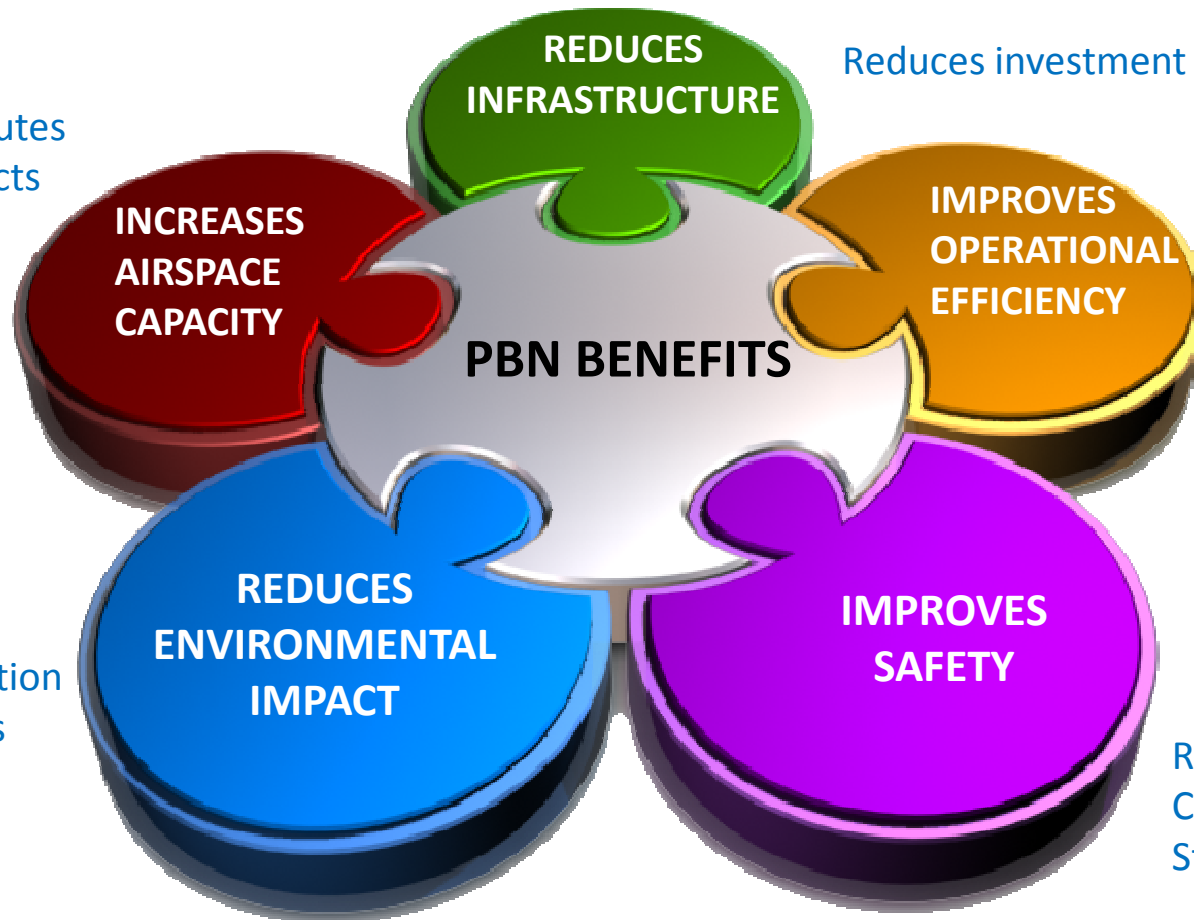


2013

Performance Improvement Area 1: Airport Operations			
Block 0	Block 1	Block 2	Block 3
<p><u>B0-APTA</u> Optimization of Approach Procedures including vertical guidance This is the first step toward universal implementation of GNSS-based approaches.</p>	<p><u>B1-APTA</u> Optimised Airport Accessibility This is the next step in the universal implementation of GNSS-based approaches.</p>		
<p><u>B0-WAKE</u> Increased Runway Throughput through Optimized Wake Turbulence Separation Improved throughput on departure and arrival runways through the revision of current ICAO wake vortex separation minima and procedures.</p>	<p><u>B1-WAKE</u> Increased Runway Throughput through Dynamic Wake Turbulence Separation Improved throughput on departure and arrival runways through the dynamic management of wake vortex separation minima based on the real-time identification of wake vortex hazards.</p>	<p><u>B2-WAKE (*)</u> Advanced Wake Turbulence Separation (Time-based) The application of time-based aircraft-to-aircraft wake separation minima and changes to the procedures the ANSP uses to apply the wake separation minima.</p>	
<p><u>B0-RSEQ</u> Improved Traffic Flow through Sequencing (AMAN/DMAN) Time-based metering to sequence departing and arriving flights.</p>	<p><u>B1-RSEQ</u> Improved Airport operations through Departure, Surface and Arrival Management Extended arrival metering, Integration of surface management with departure sequencing bring robustness to runways management and increase airport performances and flight efficiency.</p>	<p><u>B2-RSEQ</u> Linked AMAN/DMAN Synchronised AMAN/DMAN will promote more agile and efficient en-route and terminal operations</p>	<p><u>B3-RSEQ</u> Integrated AMAN/DMAN/SMAN Fully synchronized network management between departure airport and arrival airports for all aircraft in the air traffic system at any given point in time.</p>
<p><u>B0-SURF</u> Safety and Efficiency of Surface Operations (A-SMGCS Level 1-2) Airport surface surveillance for ANSP.</p>	<p><u>B1-SURF</u> Enhanced Safety and Efficiency of Surface Operations- SURF, SURF IA and Enhanced Vision Systems (EVS) Airport surface surveillance for ANSP and flight crews with safety logic, cockpit moving map displays and visual systems for taxi operations.</p>	<p><u>B2-SURF</u> Optimized Surface Routing and Safety Benefits (A-SMGCS Level 3-4 and SVS) Taxi routing and guidance evolving to trajectory based with ground / cockpit monitoring and data link delivery of clearances and information. Cockpit synthetic visualisation systems.</p>	
<p><u>B0-ACDM</u> Improved Airport Operations through Airport-CDM Airport operational improvements through the way operational partners at airports work together.</p>	<p><u>B1-ACDM</u> Optimized Airport Operations through Airport-CDM Airport operational improvements through the way operational partners at airports work together.</p>		
	<p><u>B1-RATS</u> Remotely Operated Aerodrome Control Remotely operated Aerodrome Control Tower contingency and remote provision of ATS to aerodromes through visualisation systems and tools.</p>		



2013		Performance Improvement Area 4: Efficient Flight Path – Through Trajectory-based Operations		2023
Block 0	Block 1	Block 2	Block 3	
<p><u>B0-CDO</u> Improved Flexibility and Efficiency in Descent Profiles (CDO) Deployment of performance-based airspace and arrival procedures that allow the aircraft to fly their optimum aircraft profile taking account of airspace and traffic complexity with continuous descent operations (CDOs)</p>	<p><u>B1-CDO</u> Improved Flexibility and Efficiency in Descent Profiles (CDOs) using VNAV Deployment of performance-based airspace and arrival procedures that allow the aircraft to fly their optimum aircraft profile taking account of airspace and traffic complexity with Optimised Profile Descents (OPDs).</p>	<p><u>B2-CDO</u> Improved Flexibility and Efficiency in Descent Profiles (CDOs) using VNAV, required speed and time at arrival Deployment of performance based airspace and arrival procedures that optimise the aircraft profile taking account of airspace and traffic complexity including Optimised Profile Descents (OPDs), supported by Trajectory-Based Operations and self-separation.</p>		
	2018			
<p><u>B0-TBO</u> Improved Safety and Efficiency through the initial application of Data Link En-Route Implementation of an initial set of data link applications for surveillance and communications in ATC.</p>	<p><u>B1-TBO</u> Improved Traffic Synchronization and Initial Trajectory-Based Operation. Improve the synchronisation of traffic flows at en-route merging points and to optimize the approach sequence through the use of 4DTRAD capability and airport applications, e.g.; D-TAXI, via the air ground exchange of aircraft derived data related to a single controlled time of arrival (CTA).</p>		<p><u>B3-TBO</u> Full 4D Trajectory-based Operations Trajectory-based operations deploys an accurate four-dimensional trajectory that is shared among all of the aviation system users at the cores of the system. This provides consistent and up-to-date information system-wide which is integrated into decision support tools facilitating global ATM decision-making.</p>	
<p><u>B0-CCO</u> Improved Flexibility and Efficiency in Departure Profiles - Continuous Climb Operations (CCO) Deployment of departure procedures that allow the aircraft to fly their optimum aircraft profile taking account of airspace and traffic complexity with continuous climb operations (CCOs).</p>	<p><u>B1-RPAS</u> Initial Integration of Remotely Piloted Aircraft (RPA) Systems into non-segregated airspace Implementation of basic procedures for operating RPA in non-segregated airspace including detect and avoid.</p>	<p><u>B2-RPAS</u> RPA Integration in Traffic RPA implements refined operational procedures that cover lost link (including a unique squawk code for lost link) as well as enhanced detect and avoid technology.</p>	<p><u>B3-RPAS</u> RPA Transparent Management RPA operate on the aerodrome surface and in non-segregated airspace just like any other aircraft.</p>	



More efficient direct routes
Reduces airspace conflicts

Reduces investment in ground-based systems

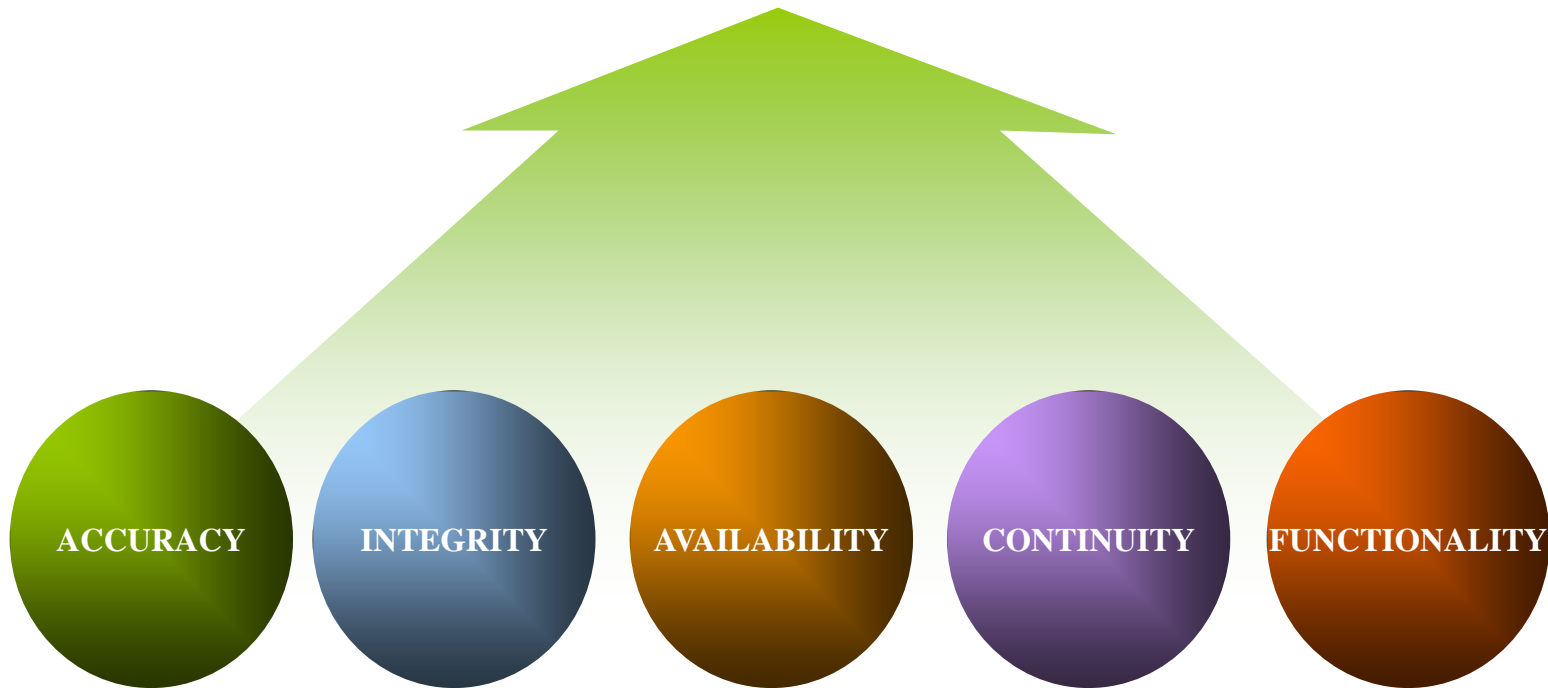
Reduces time in flight
in more direct routes
Reduces fuel costs

Reduces fuel consumption
Less CO2 gas emissions

Reduces CFIT
Consistent and predictable paths
Stabilized approach paths



Performance Based Capability

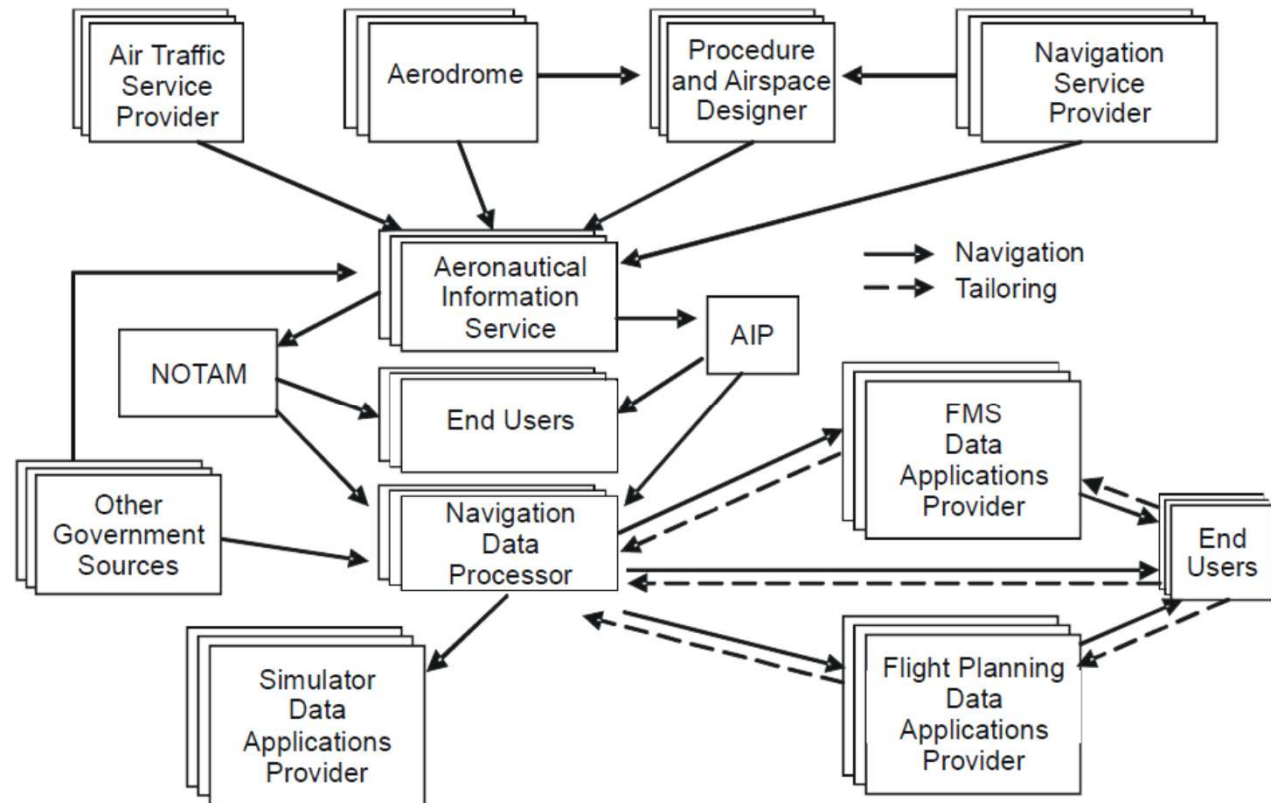


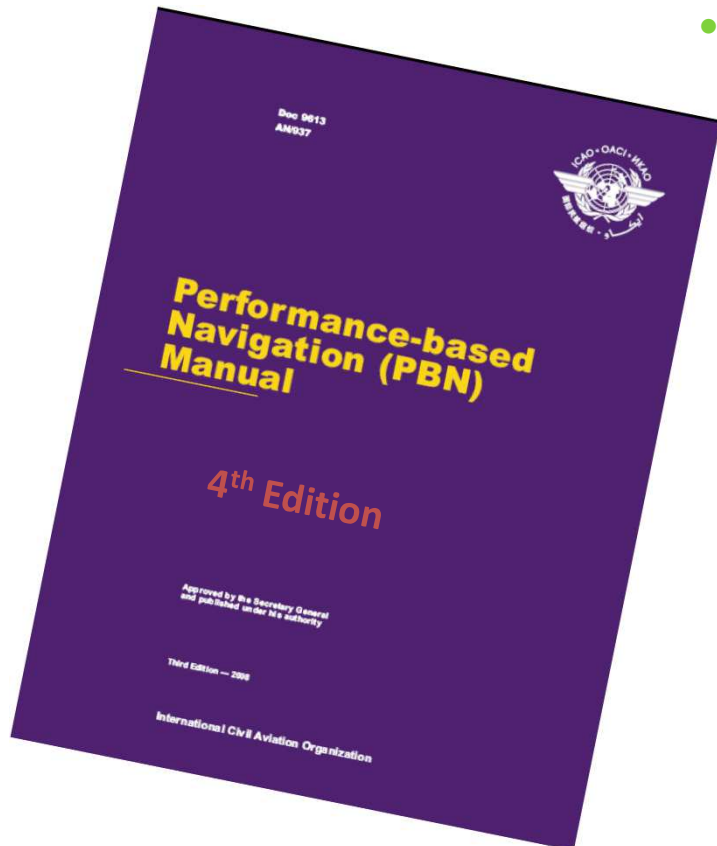


PBN implementation involves many different stakeholders and processes from airborne equipment to airspace infrastructure development.

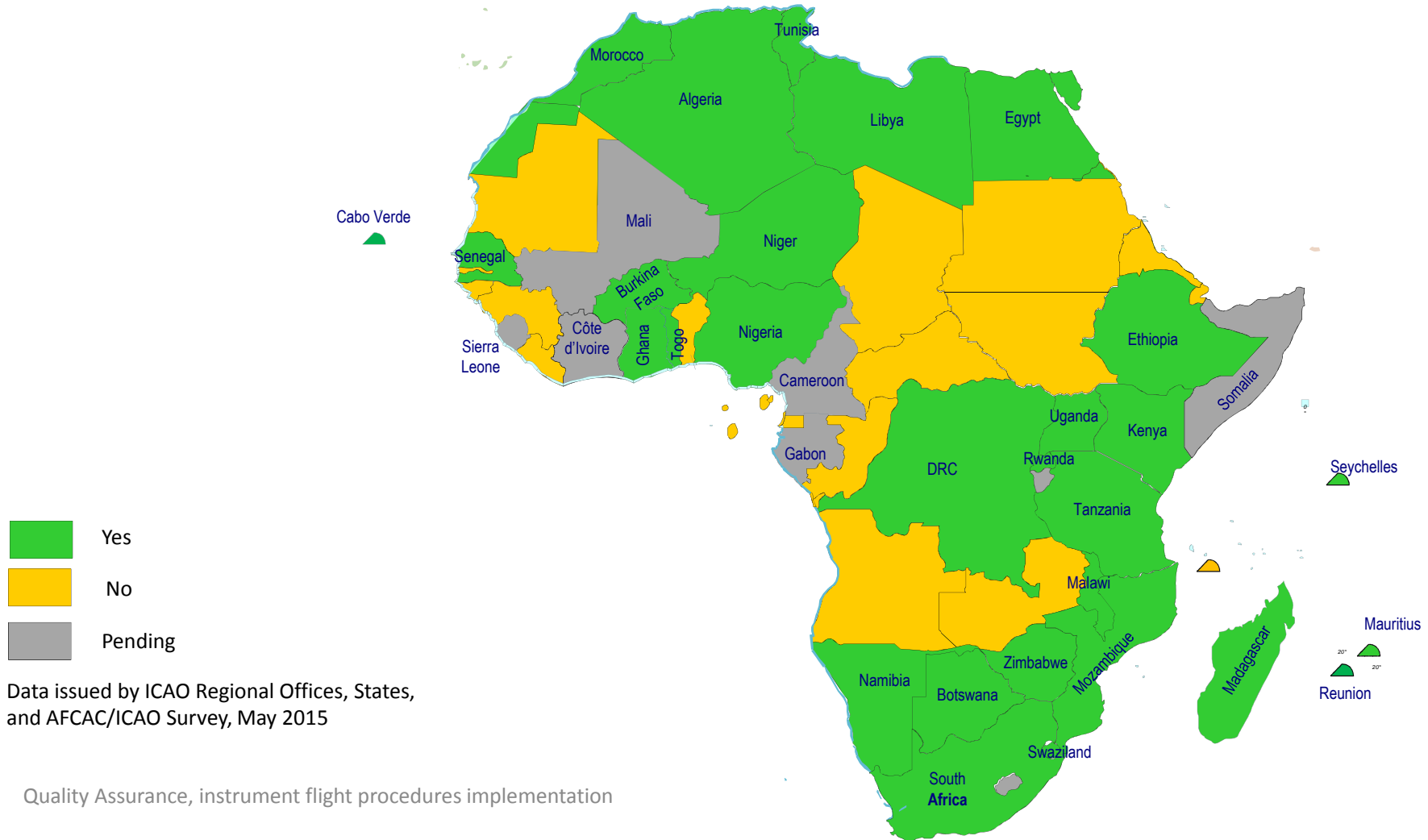


- ✓ Participants involved in an instrument flight procedure implementation





- All activities are determined in reference to ICAO regulations and PBN documents
 - **Doc 8168** Aircraft Operations (*vol 2, construction of flight procedure*)
 - **Doc 9613** PBN Manual
 - **Doc 9674** World Geodetic System Manual
 - **Doc 9859** Safety Management Manual
 - **Doc 9881** Guidelines for Electronic Terrain, Obstacle and Aerodrome Mapping Information
 - **Doc 9905** Manual for RNP-AR procedure design
 - **Doc 9906** Quality Assurance Manual for Flight Procedure Design (*quality assurance system, procedure designer training, software validation, procedure design construction, procedure validation, pilot training and evaluation*)
 - **Doc 9931** Continuous Descent Operations (CDO) Manual
 - **Doc 9992** Manual on Use of PBN in Airspace Design
 - **Doc 9993** Continuous Climb operations (CCO) Manual
 - **Doc 9997** PBN Operational Approval Manual





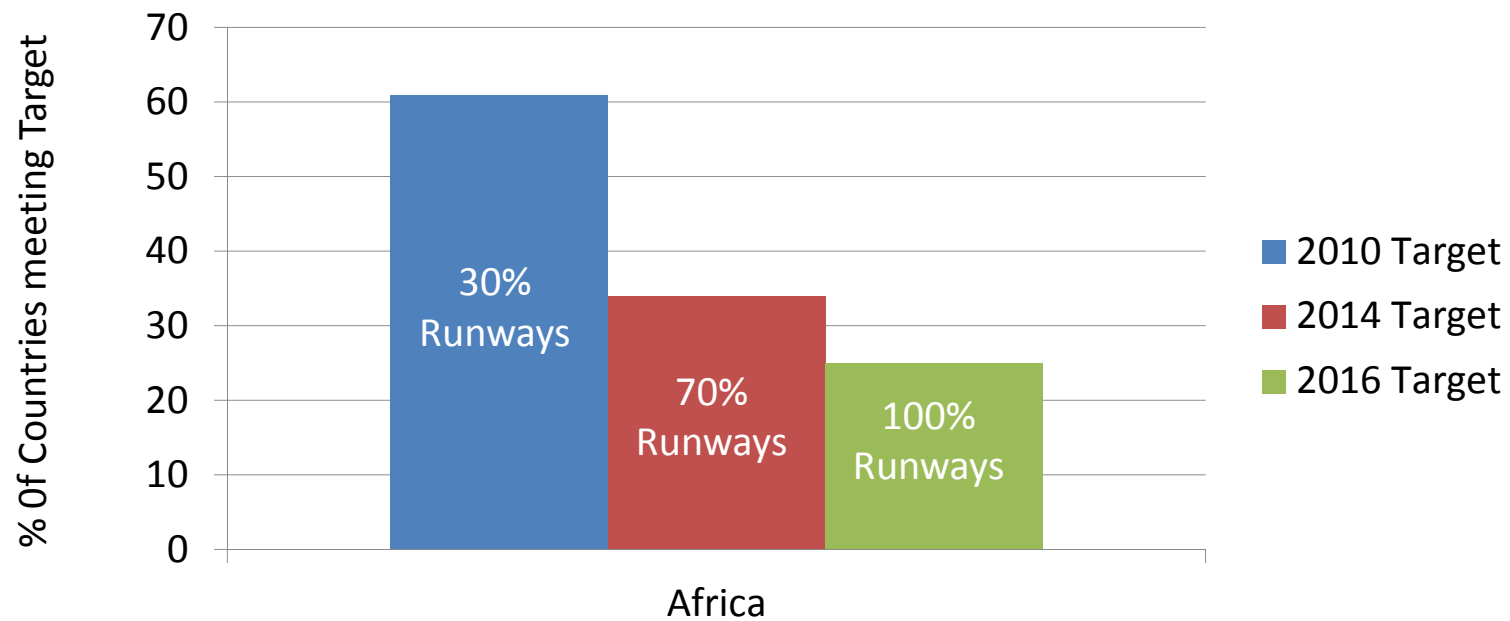
Resolution A37-11 : Global objectives for performance based navigation

Resolves that:

- a) States complete a PBN implementation plan as a matter of urgency to achieve:
 - 1) implementation of RNAV and RNP operations (where required) for en route and terminal areas according to established timelines and intermediate milestones;
 - 2) implementation of approach procedures with vertical guidance (APV) (Baro-VNAV and/or augmented GNSS), including LNAV-only minima, for all instrument runway ends, either as the primary approach or as a back-up for precision approaches by 2016 with intermediate milestones as follows: 30 per cent by 2010, 70 per cent by 2014; and
 - 3) implementation of straight-in LNAV-only procedures, as an exception to 2) above, for instrument runways at aerodromes where there is no local altimeter setting available and where there are no aircraft suitably equipped for APV operations with a maximum certificated take-off mass of 5 700 kg or more;

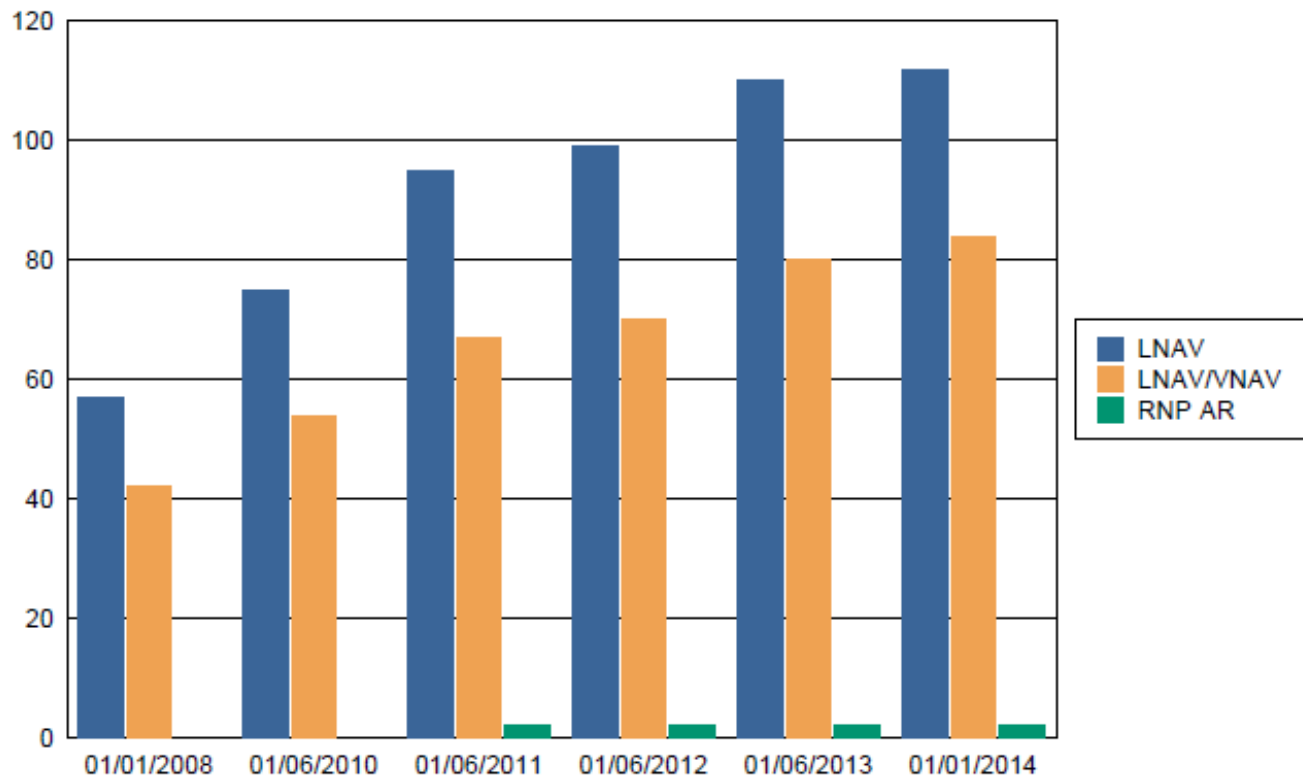


**Assembly Resolution A37-11 on PBN Implementation
RNP Approach**





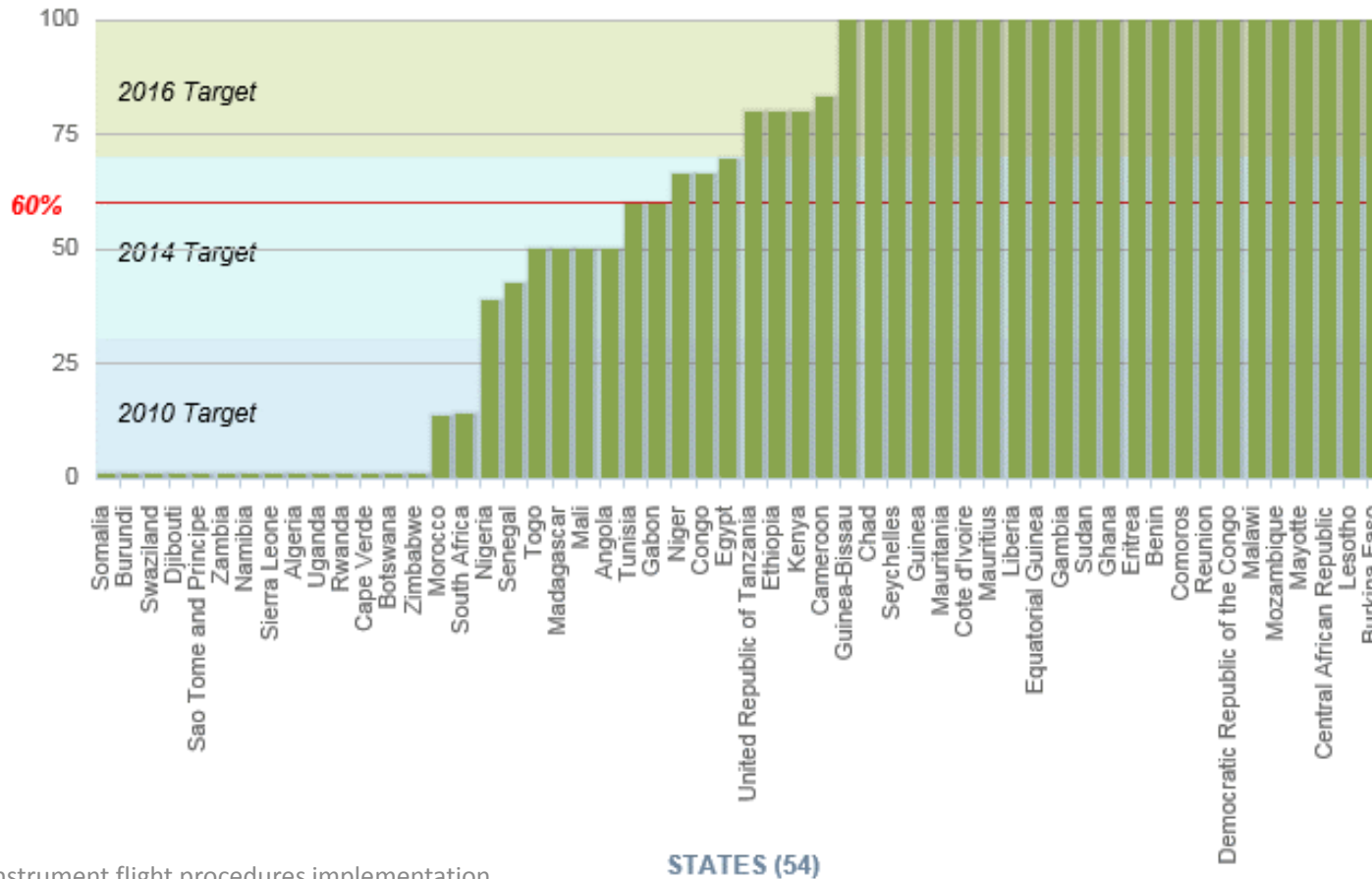
AFI REGION – PBN Instrument Approaches





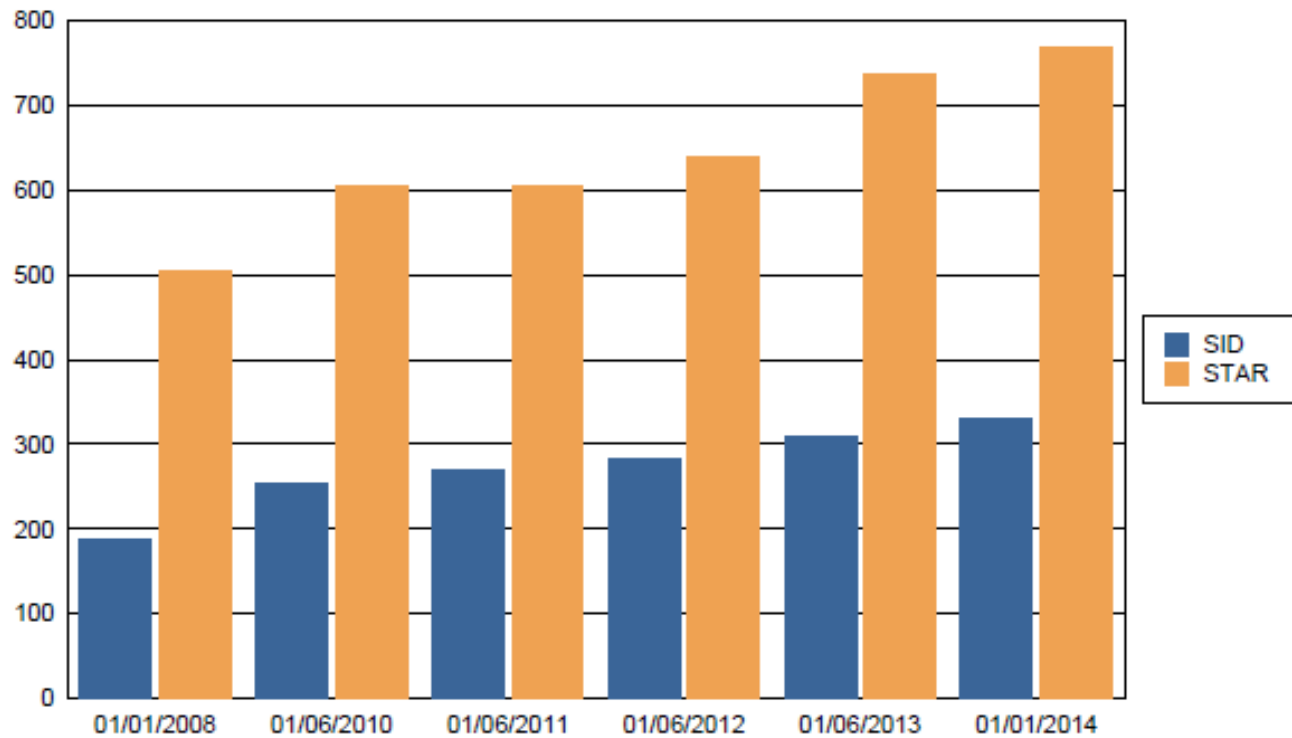
Implementation of PBN Approach Procedures for Africa

% of instrument runways at international aerodromes with APV or LNAV-only procedures





International SID & STAR – AFI





- ✓ International airports
- ✓ PBN approach procedures, SIDs and STARs implementation

PBN flight procedures in ESAF area

PBN flight procedures in WACAF area



✓ ICAO-AFPP/AFCAC PBN Survey, May 2015

AFPP

- Information about National PBN Plan development
 - Challenges impeding development
 - Assistance requested

- Flight procedures implementation
 - Conventional
 - PBN

- Flight procedures implementation oversight service
 - Design
 - Approval

- ICAO State Letter, November 2016



Thank You