



International Civil Aviation Organization

**EIGHTEENTH MEETING OF THE COMMUNICATIONS/NAVIGATION
AND SURVEILLANCE SUG-GROUP (CNS SG/18) OF APANPIRG**

Asia and Pacific Regional Sub-Office, Beijing, China
(21 – 25 July 2014)

Agenda Item 6: Navigation

6.1) Updates on national PBN implementation plan and PBN implementation issues

PBN IMPLEMENTATION PROGRESS AND ICAO SUPPORTS

(Presented by the Secretariat)

SUMMARY

This Information Paper presents information on PBN implementation progress, both globally and within the APAC Regions. It also presents information on ICAO implementation support activities, including the establishment of APAC PBN Implementation Coordination Group (PBNICG).

1. INTRODUCTION

1.1 The APAC region represents one of the fastest growing aviation markets. ICAO forecast predicts that the international revenue passenger kilometers (RPKs) in the APAC Region will almost double that of North America within a decade. IATA estimates that the demand for commercial air travel in the APAC Region will continue to grow at a combined annual growth rate (CAGR) of 8.8% for international passenger market and 11.3% for freight market by 2014. ACI reports that the number of airport passengers in the APAC region was up by 11.3% in 2010.

1.2 Challenges in aviation and needs for higher efficiency in aircraft fuel consumption call for new navigation technologies and operation procedures to be implemented. In respond to this call for actions, ICAO has adopted several conclusions to promote the uses of Performance-Based Navigation (PBN) and Global Navigation Satellite System (GNSS) as the navigation elements of CNS/ATM systems. These navigation technologies and specifications have promising potentials to provide accurate, reliable and seamless position determination and navigation capabilities to airspace users. Implementations of PBN and GNSS facilitate more efficient use of airspace and more flexibility for procedure design. They cooperatively result in improved safety, access, capacity, predictability, operational efficiency, fuel economy, and environmental effects.

1.3 The implementation of Performance-based Navigation is considered one of the highest air navigation priorities. ICAO Assembly Resolution A37-11 reemphasizes the PBN global targets, especially regarding State PBN Implementation Plan and deployment of approach with vertical guidance. A joint industry declaration by all representatives of the air transportation community was also issued to support the global implementation of PBN and call upon all leaders of the civil aviation community to fully support the implementation of PBN into the air navigation system according to the ICAO provisions and established timetable. During the 44th Conference of

Directors General of Civil Aviation, Asia and Pacific Region, IATA expressed that implementation of Performance Based Navigation provides significant safety, efficiency and environmental benefits to operators and service providers.

1.4 In October 2007, the 44th Asia-Pacific DGCA Conference adopted Action Item 44/6 urging States to implement PBN as per ICAO guidance. In September 2009, APANPIRG through its Conclusion 20/41 adopted the first version of the Asia/Pacific Regional PBN Implementation Plan.

2. DISCUSSION

2.1 The implementation of PBN is being progressed globally. Currently, 102 ICAO Member States have established their State PBN Implementation Plans. 38% of all global air routes are now based on PBN and the number of published PBN SID/STAR are continuingly increased.

2.2 Although 69% of all instrument runways globally have at least one PBN approach, only 30% of ICAO Member States are on track to meet the 2014 targets of Assembly Resolution A37-11.

2.3 In the APAC Region, while States with PBN implementation plans covers most of the APAC airspace, only 66% of the APAC States have a PBN Implementation Plan. Majority of the APAC States without a PBN Implementation Plan are Pacific Island States.

2.4 The number of published PBN SID/STAR procedures within the APAC Region continues to be increased. For approach operations, currently 51% of all instrument runways within APAC have published PBN approach procedures.

2.5 Beyond establishing relevant ICAO standards and guidance material, to assist its Member States with on-going PBN planning and implementation, ICAO in cooperation with industry partners such as IATA has organized several PBN implementation focus activities. These activities include PBN symposia, workshops, Go-Team visits, training courses and learning packages. ICAO has also established implementation support offices for PBN implementation in the form of the APAC Regional Sub-Office (RSO) and two Flight Procedure Programmes (FPPs), one for APAC and the other for Africa.

2.6 Additionally, for the APAC region, ICAO will be proposing to APANPIRG an establishment of the APAC PBN Implementation Coordination Group (PBNICG). The APAC PBNICG aims to serve as the primary APAC Regional forum to support PBN implementation with a goal to enhance safety and efficiency of aircraft trajectories and operation. The PBNICG will continue the good works of the now defunct APAC PBN Task Force. The draft Terms of Reference of the PBNICG is provided in the attachment of this paper.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

- a) note the information in this IP ; and
- b) note that States/Administrations are encouraged to request supports from ICAO during their planning and implementation of PBN; and
- c) encourage Pacific Island States without State PBN plans to participate in the PBN Planning Workshop to be conducted in Fiji in the last quarter of 2014; and
- d) support the establishment of the APAC PBNICG.

Draft Terms of Reference (TOR)
APAC PBN Implementation Coordination Group (PBNICG)

- 1) Serve as the primary APAC Regional forum to support PBN implementation with a goal to enhance safety and efficiency of aircraft trajectories and operations. The forum also takes into account activities related to the implementation of relevant ASBU elements, with initial focus on B0-CDO, B0-FRTO, B0-CCO, and B0-APTA. The following are the main topics to be addressed:
 - Monitor PBN implementation of APAC States/Administrations and make recommendations as necessary in areas where ICAO APAC RSO can provide assistance.
 - Through ICAO APAC RSO, provide assistance and guidance to States to update their PBN implementation plans. Identify challenges within State PBN Implementation Plans and PBN implementation activities and assist States in addressing these challenges in a harmonized manner.
 - Taking a multi-disciplinary approach, promote more efficient flight operations and trajectories and, as necessary, addressing related topics including air traffic services (ATS) route network, airspace organization, flexible use of airspace, navigation specification harmonization, and performance and sharing of GNSS/surveillance/communication infrastructures and facilities.
 - Analyse regional indicators associated with Seamless plan items, make recommendations for updating the Seamless Plan, and keep the relevant ANRFs updated.
 - Analyse and report operational benefits of PBN implementations and provide regular PBN implementation updates to ICAO APAC for inclusion in the regional performance dashboard.
- 2) Identify issues/action items which are related to the implementation of PBN and related ASBU elements, and where appropriate, communicate with relevant ICAO panels or working/study groups.
- 3) Coordinate and consult with COSCAPs, FPPs, international organizations, industry partners and volunteering administrations which provide support to PBN implementation.
- 4) Review regional priorities/targets and relevant regional plans as related to PBN implementation and provide recommendations to APANPIRG.

Composition

The PBNICG will compose of multi-disciplinary experts nominated by ICAO member States/Administrations in the Asia and Pacific Regions and International Organizations. Secretariat support for the PBN ICG will be provided by the ICAO APAC RSO with assistance from APAC RO.

Reporting

The PBNICG will report to the APANPIRG and will also provide briefing to the ATM and CNS Sub-group as necessary

Note: The PBNICG, while undertaking the tasks, should take into account of the work being undertaken by relevant ICAO Panels and other study/working groups.

APAC PBN Task Force TOR – Now Defunct

- a) Continue the refinement and ongoing review of the Asia Pacific Regional PBN implementation plan and monitor and report on its application in the region.
- b) Carry out specific studies, develop guidance material and facilities training to assist States with RNAV/RNP implementation in the en-route, terminal, and approach flight phases, taking into account the performance based navigation (PBN) concept, according to the ICAO Strategic Objectives and Global Plan Initiatives (GPI 5, 7, 10, 11, 12, 20, 21)
- c) Assist States in the preparation and review of their PBN implementation documentation and provide feedback to ensure regional harmonization and for possible inclusion in ICAO-developed model documentation.
- d) Develop and review material needed to meet the ICAO initiative on the introduction of APV approaches including Baro-VNAV and RNP-AR as part of the PBN initiative.
- e) Monitor the progress of State PBN implementation, identify constraints to implementation and capture information on the effectiveness (tangible benefits) of State PBN applications.
- f) Continue the review of the PBN Manual and its practical application in the implementation of PBN in the region.
- g) Develop, in coordination with RASMAG, the necessary airspace safety and monitoring requirements for the introduction and continued application of PBN based procedures.
- h) Review activities of PBN Task Force from other regions including their action plans for PBN implementation to ensure harmonization and avoid duplication of work.
- i) Address other regional PBN implementation issues, including the development of staff resources and skills, as needed by safety management. Coordinate and consult with ICAO RSO, COSCAP, industry partners and volunteering administrations who are providing support to State PBN implementation.



PBN Implementation Progress and ICAO Supports

presented by the Secretariat

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Why PBN?



Aviation Growth 1990 to 2010 to 2030

Passengers

1990: 1.2 billion



2010: 2.7 billion



2030: 5.9 billion



Aircraft movements

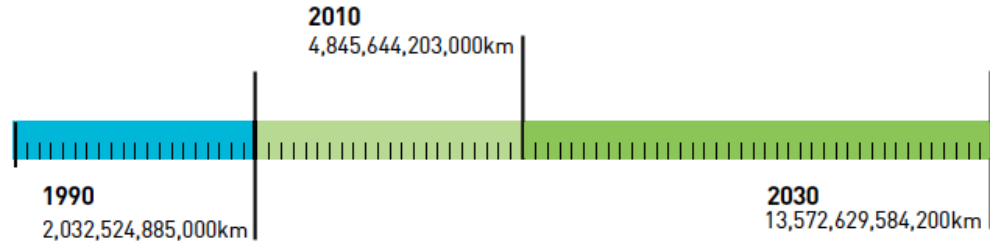


2010:
26 million

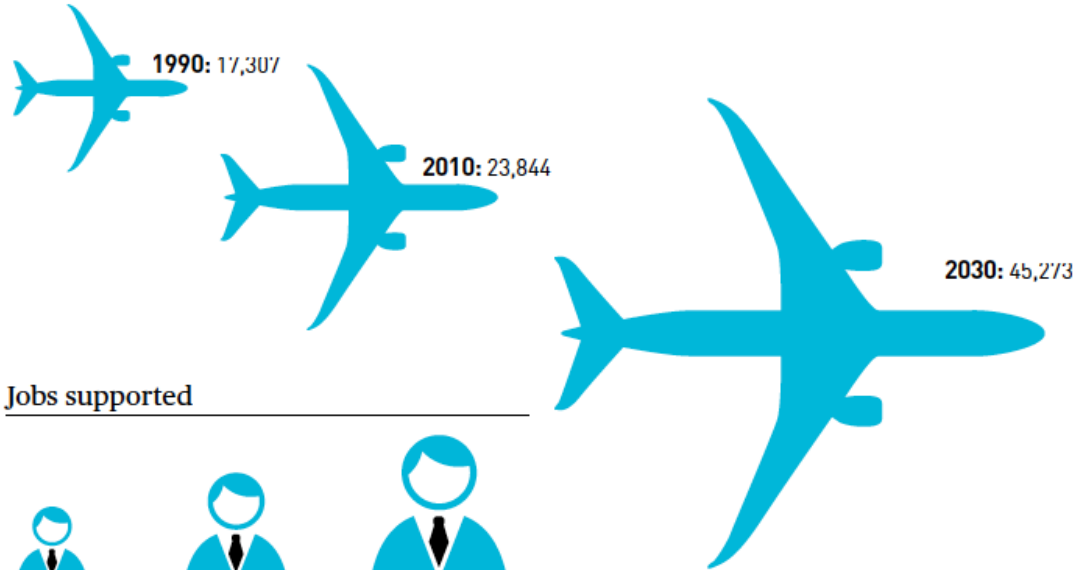


2030:
48.7 million

Passenger kilometres flown



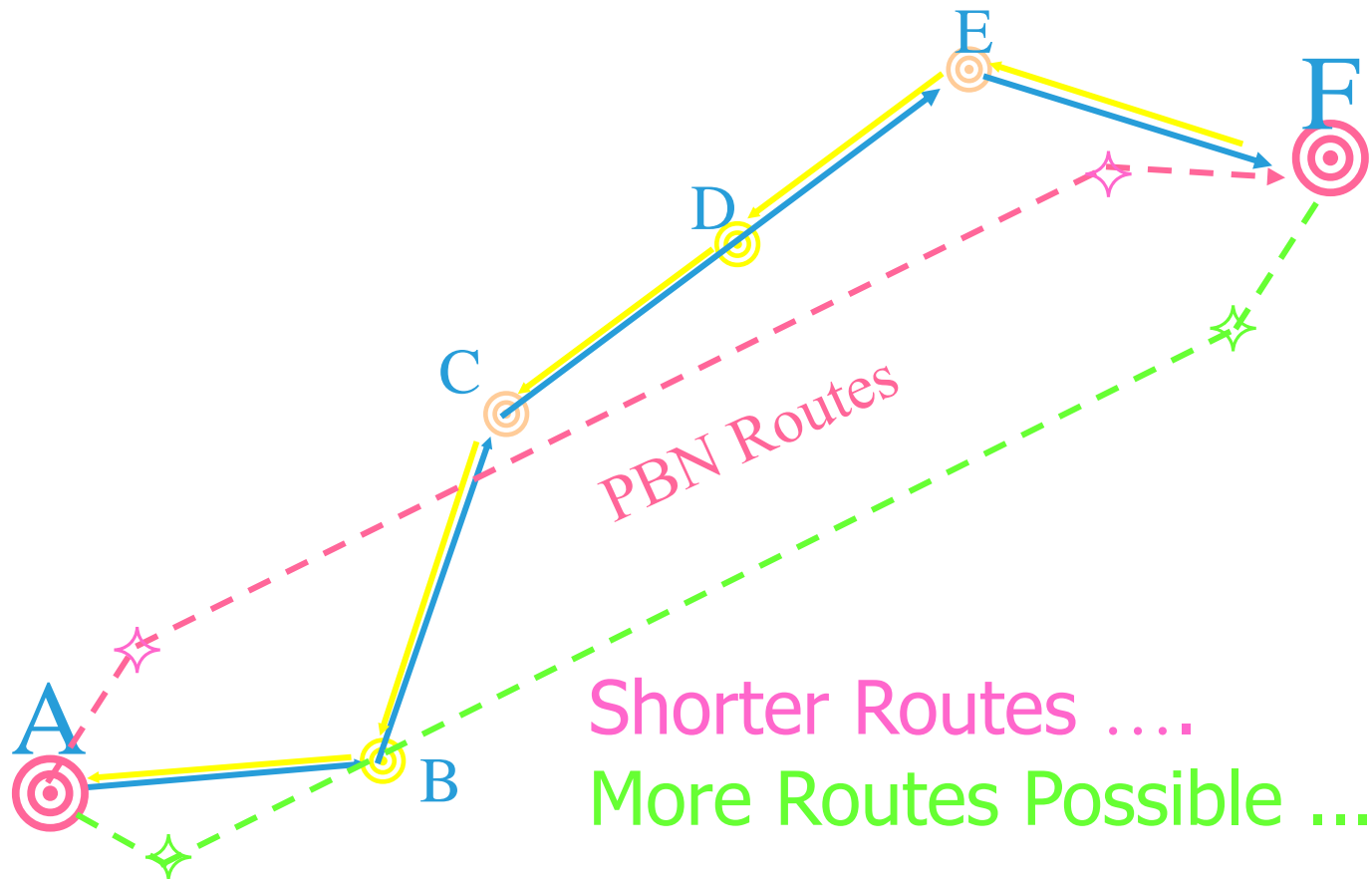
Aircraft in service



Jobs supported



Efficiency and Flexibility - Improve efficiency and flexibility by reducing reliability on the locations of ground-based navigation aids

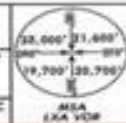


ZULS/LXA
GONNGA

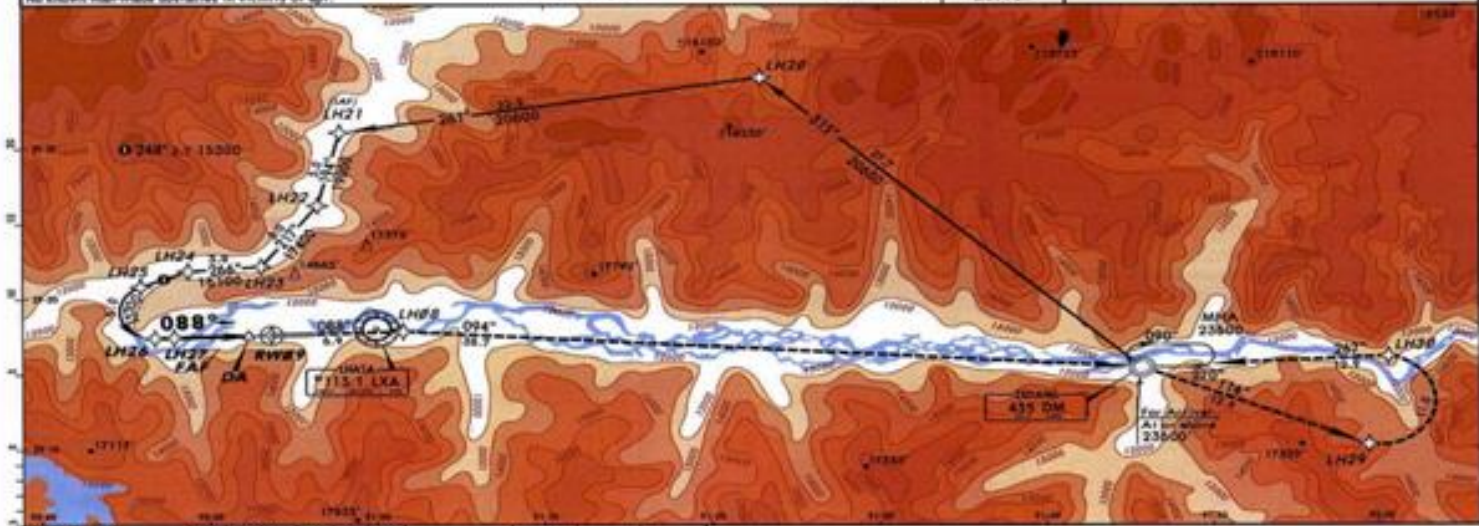
CHINA SOUTHWEST AIRLINES
PROF **12-1**

LHASA, PR OF CHINA
RNAV (RNP 0.15) Rwy 09

LHASA Tower			
130.0			
ENAV	Final Appch Crz 088°	Minimum Alt LH27/FAF 13400' / 4084m	DA(W) 12160' / 3706m (448')
			App Elev 11712' / 3569m
MISSED APCH: Climb direct to LH88 to 13000'. Cross LH88 at 13000' or above. Climb to 19300'. Turn RIGHT direct to DM NDB to 19300' or above. Climb to 23500'. Turn RIGHT to LH29, then turn LEFT to LH38, then direct to DM NDB to 23500' or above and hold.		Trans level: By ATC	
All Set: N/A		Trans alt: By ATC	
No known man-made obstacles in vicinity of apr.			



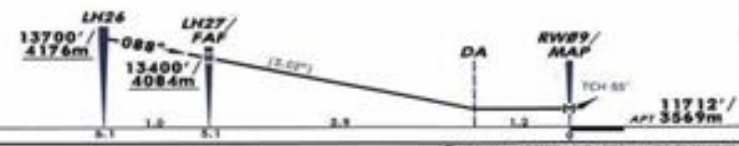
PROCEDURE NOT TO BE USED FOR NAVIGATION. FOR DEMONSTRATION USE ONLY.



Indicated Air	100	120	140	160	180	200
Pressure Alt	13,000	13,400	13,800	14,200	14,600	15,000
MAP at 088°						

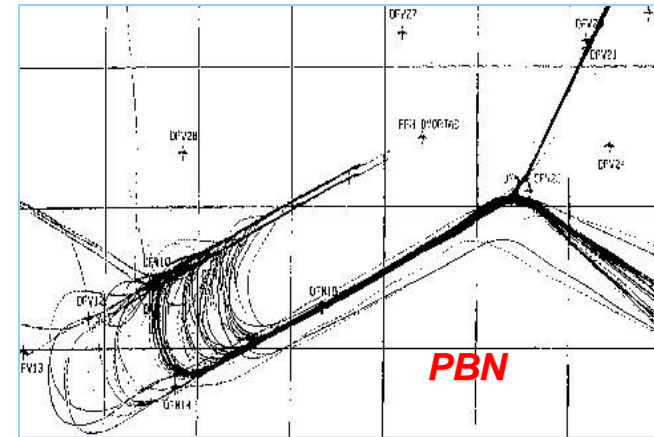
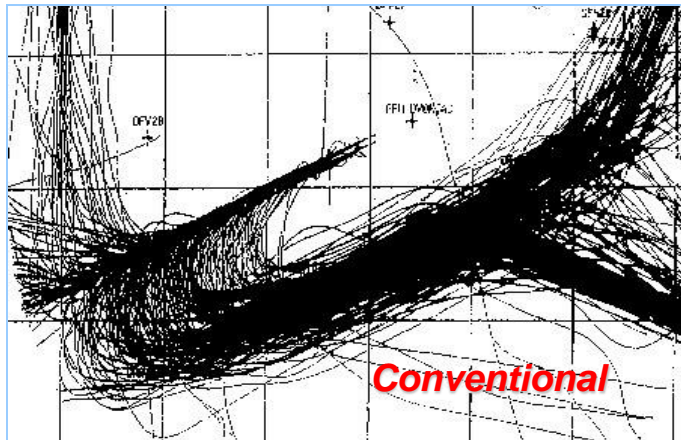
MIN 13000' -D- LH88

STRAIGHT-IN LANDING RWY09	CIRCLE-TO-LAND
DA(W) 12160' / 3706m (448')	
1/5	NOT AUTHORIZED



CHANGED: New procedure.

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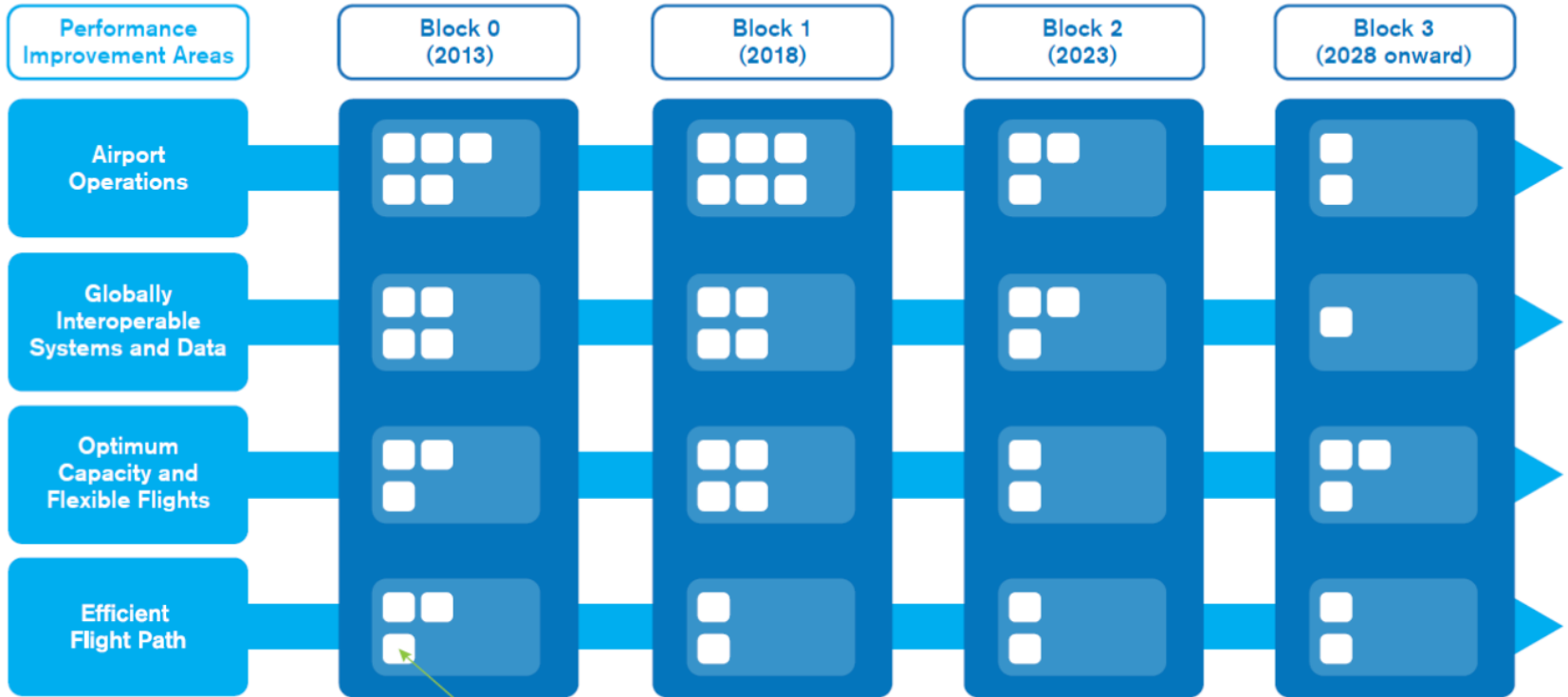
“RNAV and RNP specifications facilitate more efficient design of airspace and procedures which collectively result in improved safety, access, capacity, predictability, operational efficiency, and environmental effects. Specifically, improved access and flexibility for point-to-point operations help enhance reliability and reduce delays by defining more precise terminal area procedures. They also provide fuel and emissions savings.” - FAA

Our Targets and Commitments



Global Air Navigation Plan (GANP)

Objectives and Priorities



PRIORITIES

PERFORMANCE BASED NAVIGATION (PBN)

CONTINUOUS DESCENT AND CLIMB OPERATIONS (CDO/CCO)

COLLABORATIVE DECISION-MAKING (CDM & A-CDM) & ATFM

A37-11 PBN Global Targets

- **States complete a PBN Implementation Plan to achieve:**
 - Approach procedures with vertical guidance (APV (Baro-VNAV) including LNAV-only minima for all instrument runway ends by 2016:
 - 30% by 2010, 70% by 2014
 - Straight-in LNAV only procedures as an exception to the above where there is:
 - no local altimeter setting; and
 - no aircraft equipped for APV with max certified mass of 5700kg or more





- ICAO
- IATA
- CANSO
- IFATCA
- IFALPA
- IBAC
- ICCAIA
- ACI
- FHA
- FSF



Industry Declaration in support of Performance-based Navigation (PBN)

We, as representatives of the air transportation community,

Affirming our joint responsibility to seek continual improvements to the safety, access, capacity, efficiency and environmental sustainability of the air transportation system,

Recognizing that Performance-based Navigation (PBN) provides a catalyst for these improvements to air traffic operations, while enabling a seamless and cost effective solution throughout the entire flight,

Recognizing the work of ICAO in formulating and publishing globally harmonized Area Navigation (RNAV) and Required Navigation Performance (RNP) provisions, now known as Performance-based Navigation (PBN),

Recalling that Resolution A36-23 of the 36th ICAO General Assembly whereby States are urged to implement PBN procedures in accordance with the established timetable,

We resolve:

To support the timetable set out by ICAO for the global implementation of PBN,

To collectively work to facilitate the implementation of PBN, and

To assist States, regions and other stakeholders in their development and execution of a complete PBN implementation plan.

We call upon:

All leaders of the civil aviation community, to fully support implementation of PBN into the air navigation system according to the ICAO provisions and established timetable.



Roberto Kobeh González, Council President



Giovanni Bisignani, Director General and CEO



Alexander ter Kuile, Secretary General



Marc Baumgartner, President & CEO



Capt. Carlos Limon, President



Donald D. Spruston, Director General



François Gayet, Chairman



Angela Gittens, Director General



Matthew S. Zuccaro, President



William R. Voss, President & CEO



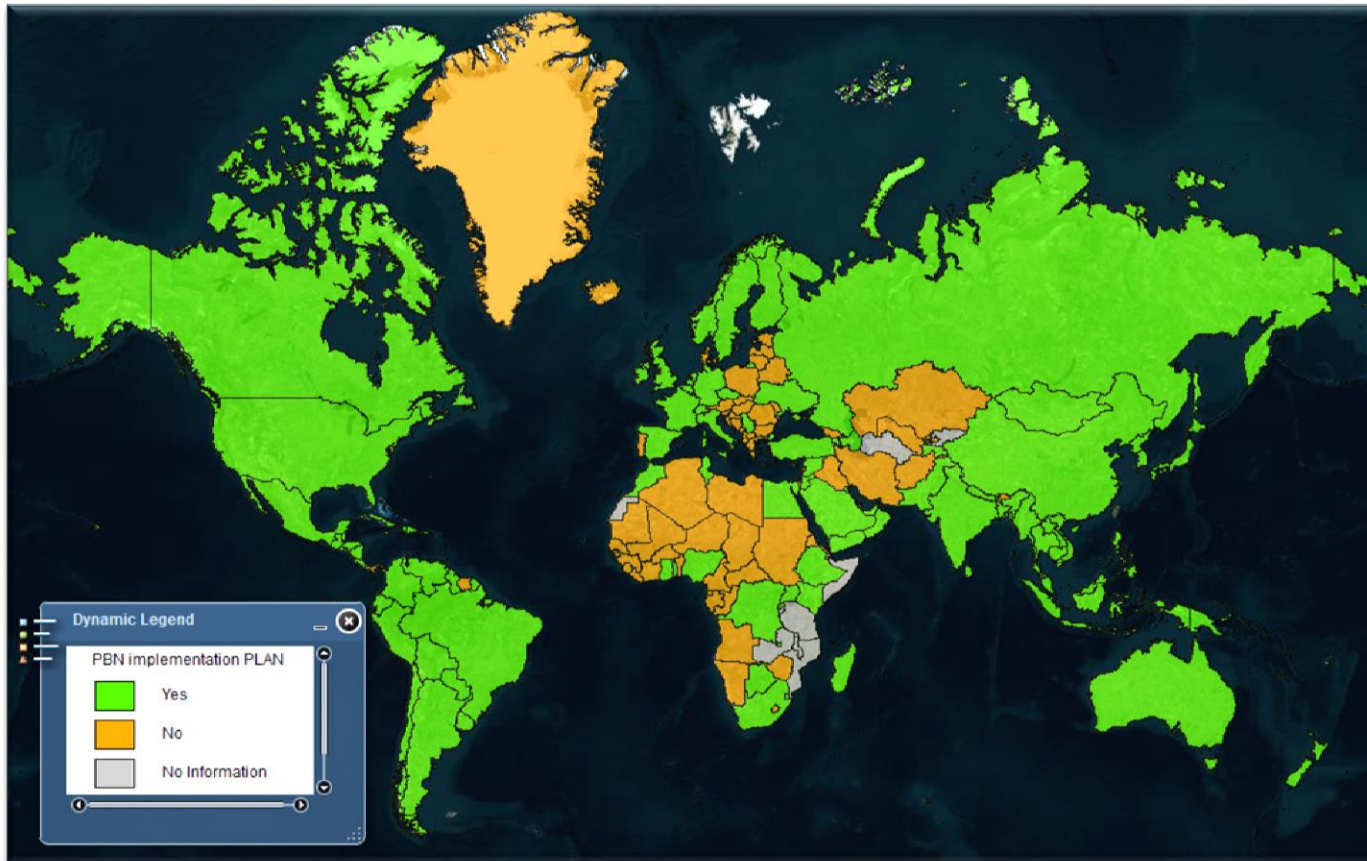
Extract from Report of the 44th DGCA Conference ...

“During the 44th Conference of Directors General of Civil Aviation, Asia and Pacific Region in October 2007, IATA expressed that implementation of Performance Based Navigation provides significant safety, efficiency and environmental benefits to operators and service providers.”

So where are we today? – Global Pictures

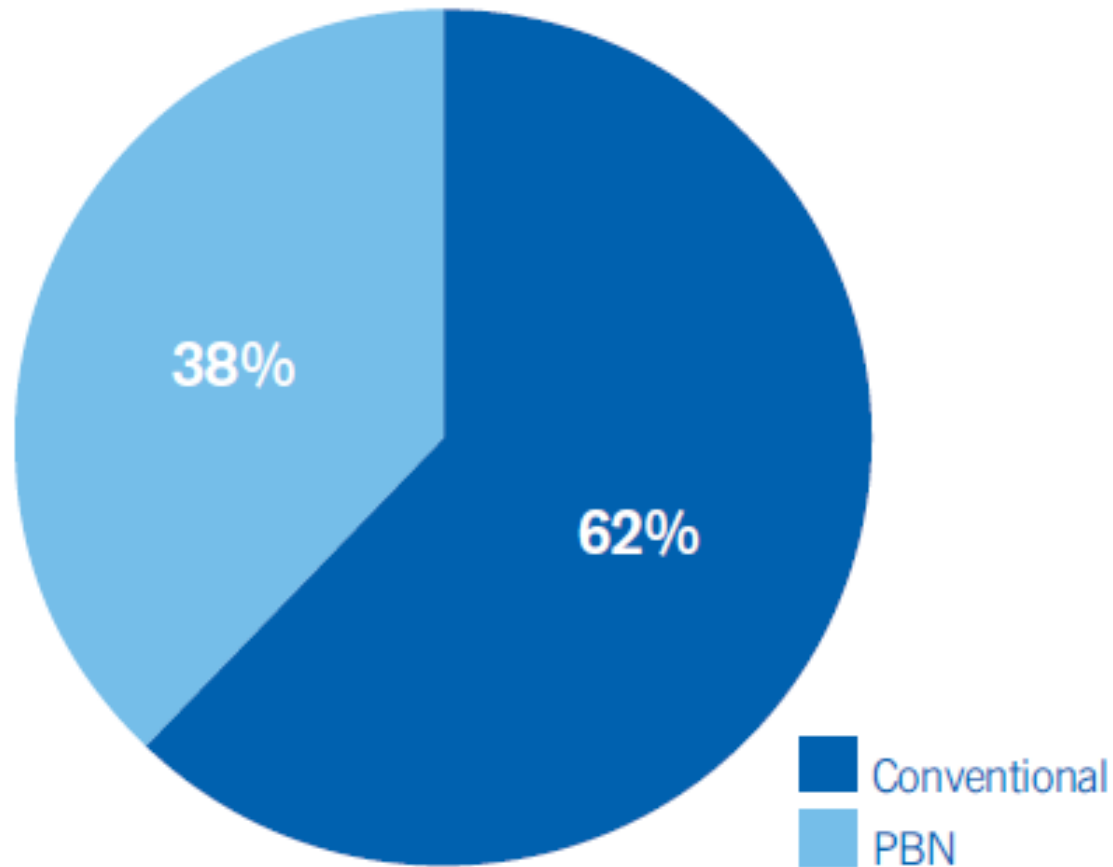


Global Implementation Status

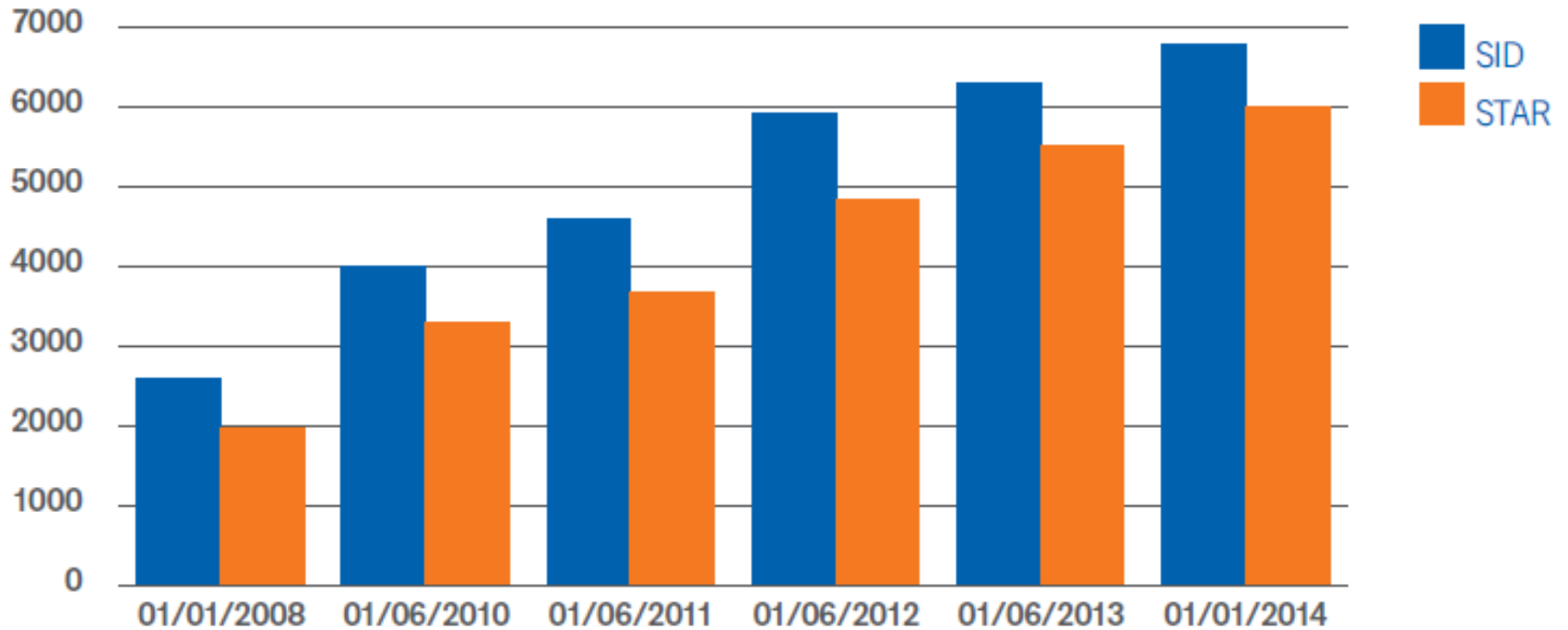


**Only 102 States
(or 53%)
have a PBN
Implementation
Plan**

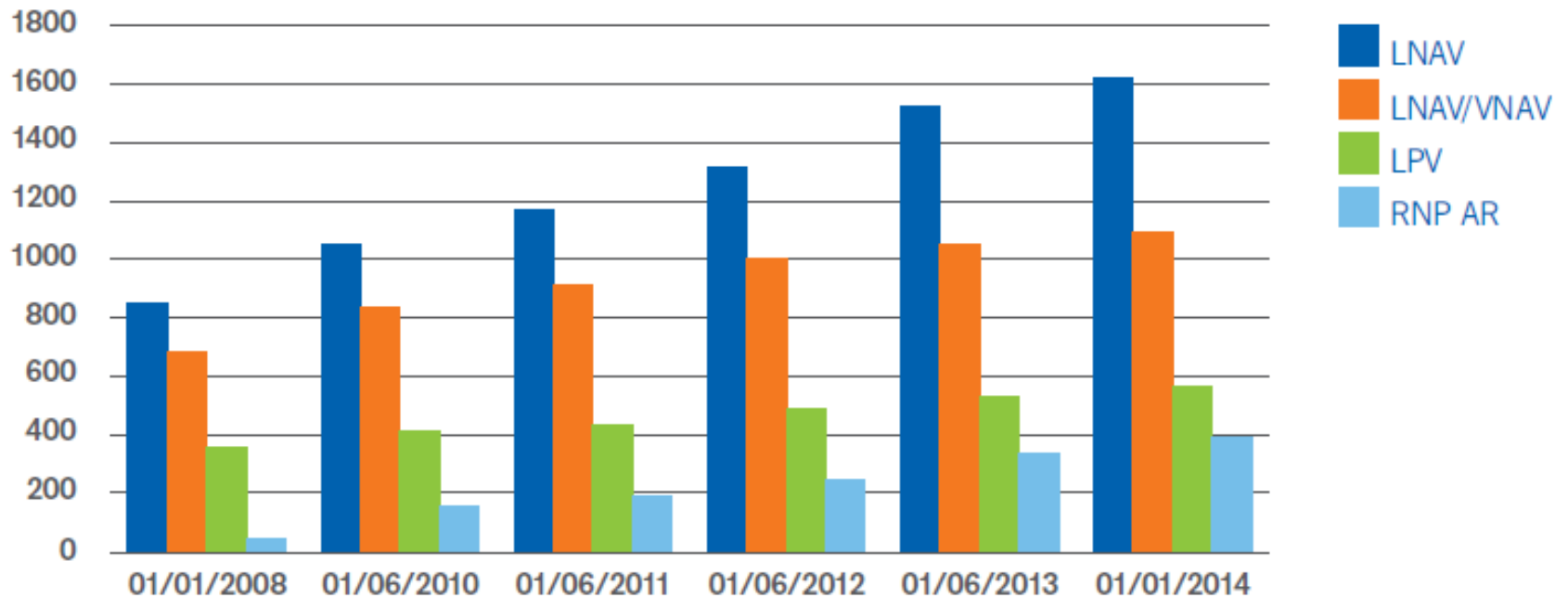
PBN Versus Conventional Routes



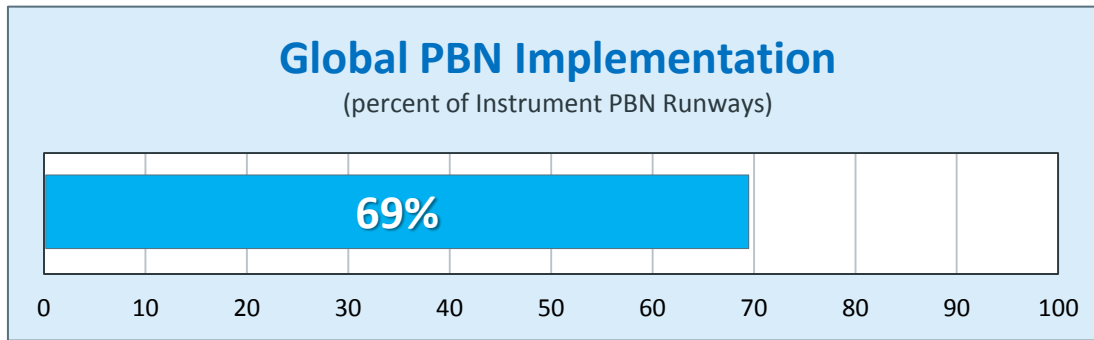
Global PBN SID & STAR Growth



Global PBN Instrument Approach Growth

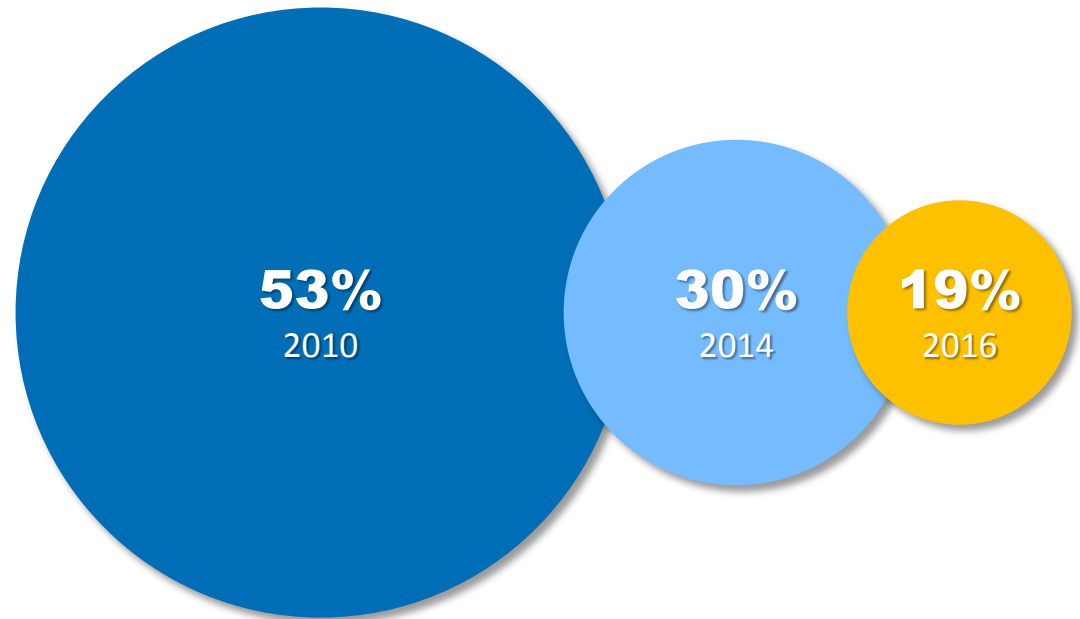


Global Implementation Status (2)



*Although **69%** of all instrument runways have at least 1 PBN approach. . .*

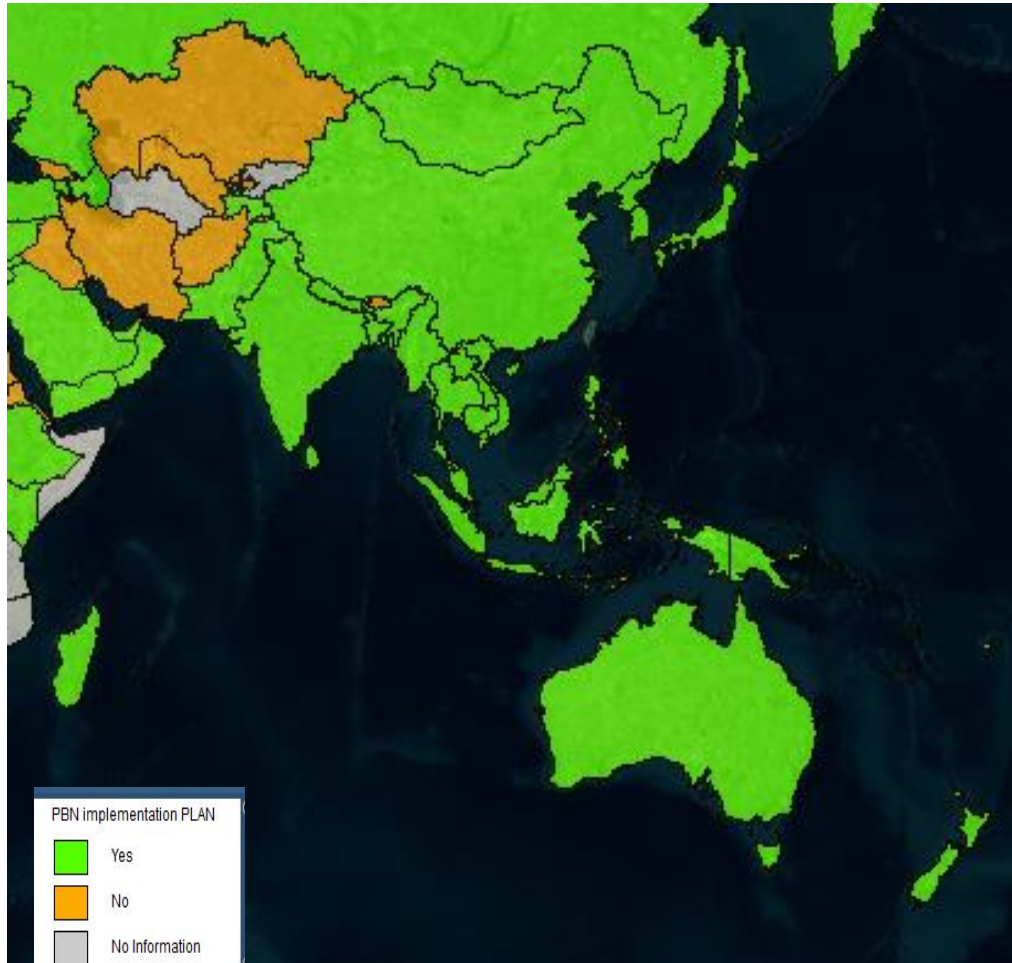
*. . . only **30%** of ICAO Member States are on track to meet the 2014 targets of Assembly Resolution A37-11*



So where are we today? – Regional Progress



66% of the APAC States have a PBN Implementation Plan



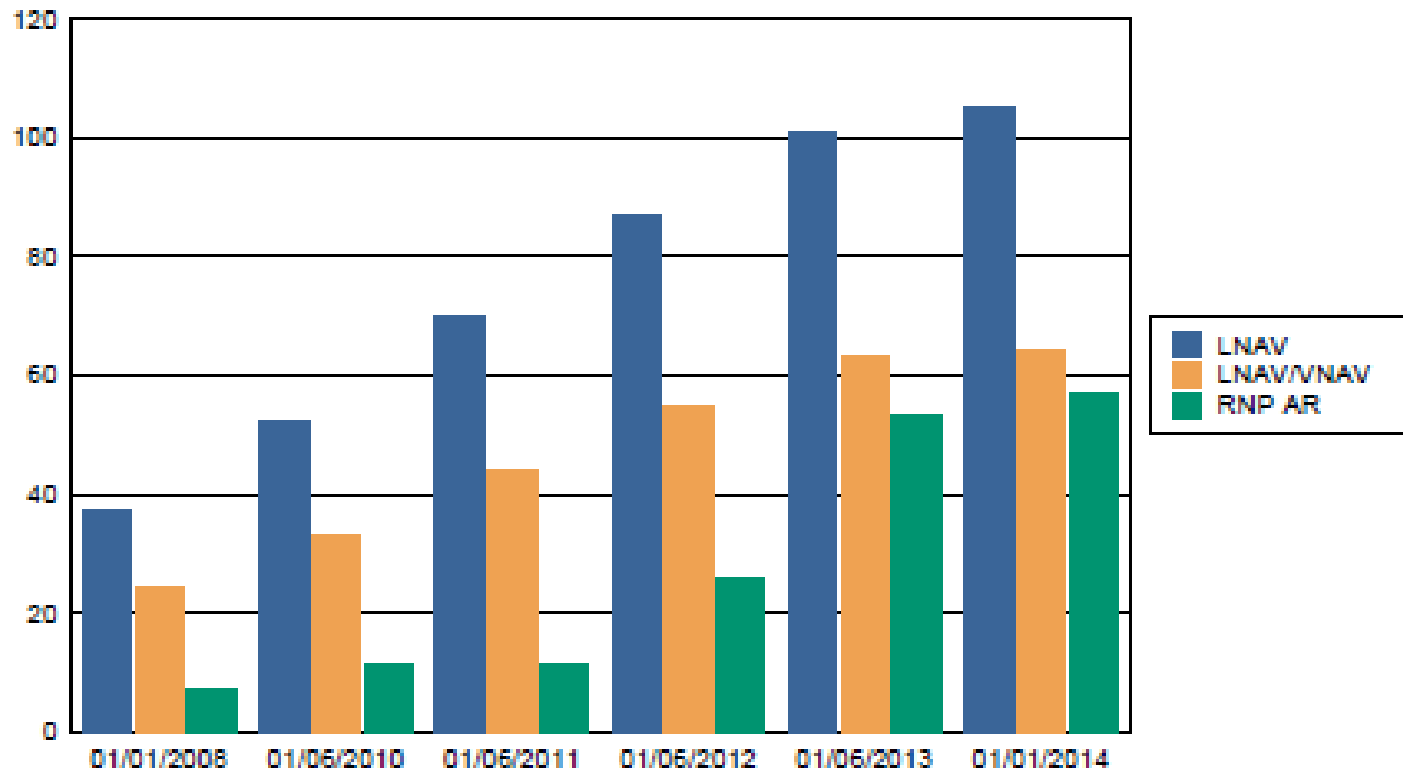
PBN Plan

Australia
Bangladesh
Cambodia
China
Democratic Peoples Republic of Korea
Fiji
India
Indonesia
Japan
Lao People's Democratic Republic
Malaysia
Maldives
Mongolia
Myanmar
Nepal
New Zealand
Pakistan
Papua New Guinea
Philippines
Republic of Korea
Singapore
Sri Lanka
Thailand
Tonga
Vietnam

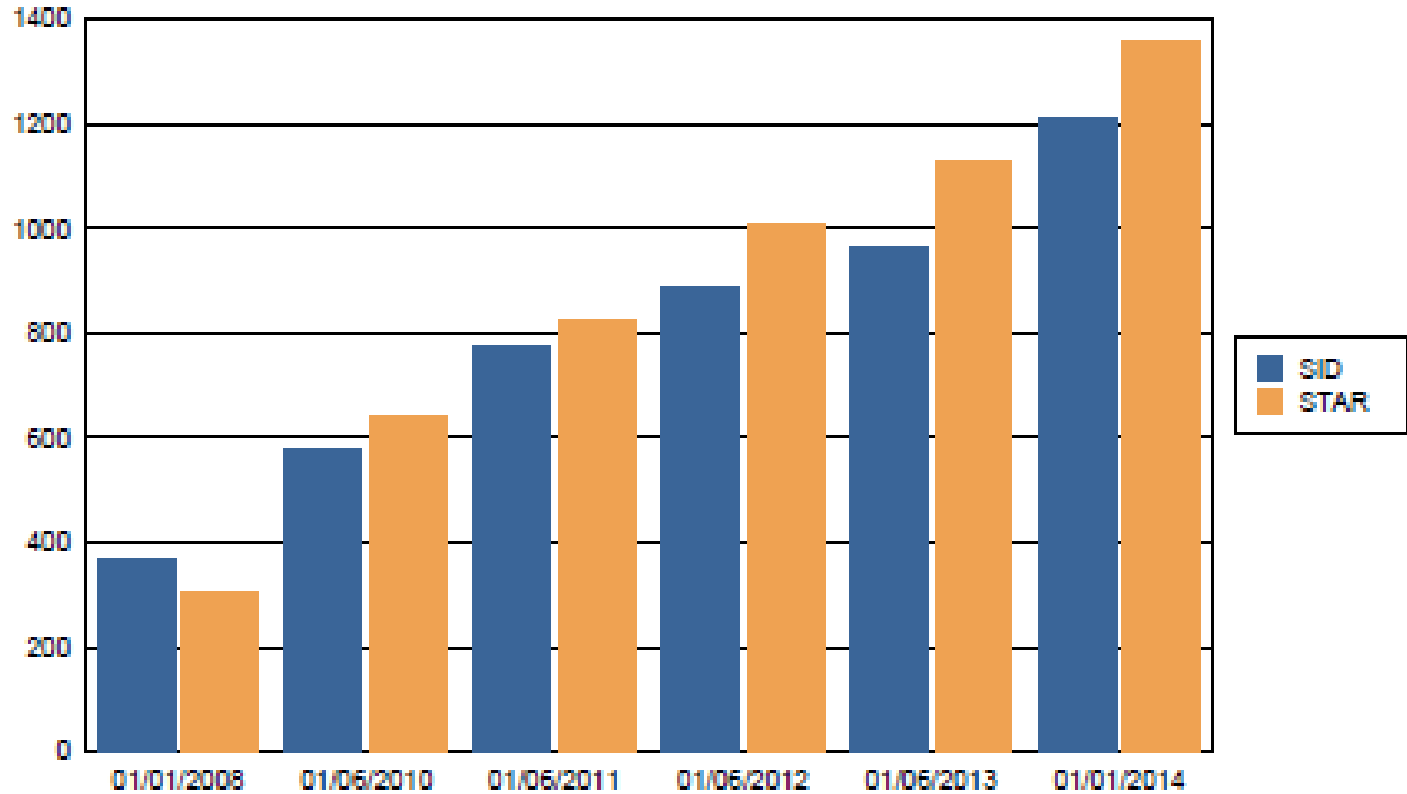
NO PBN Plan

Afghanistan
Bhutan
Brunei Darussalam
Cook Islands
Kiribati
Marshall Islands
Micronesia (Federated States of)
Nauru
Palau
Samoa
Solomon Islands
Timor-Leste
Vanuatu

International Airport Approach Type – ASIAPAC

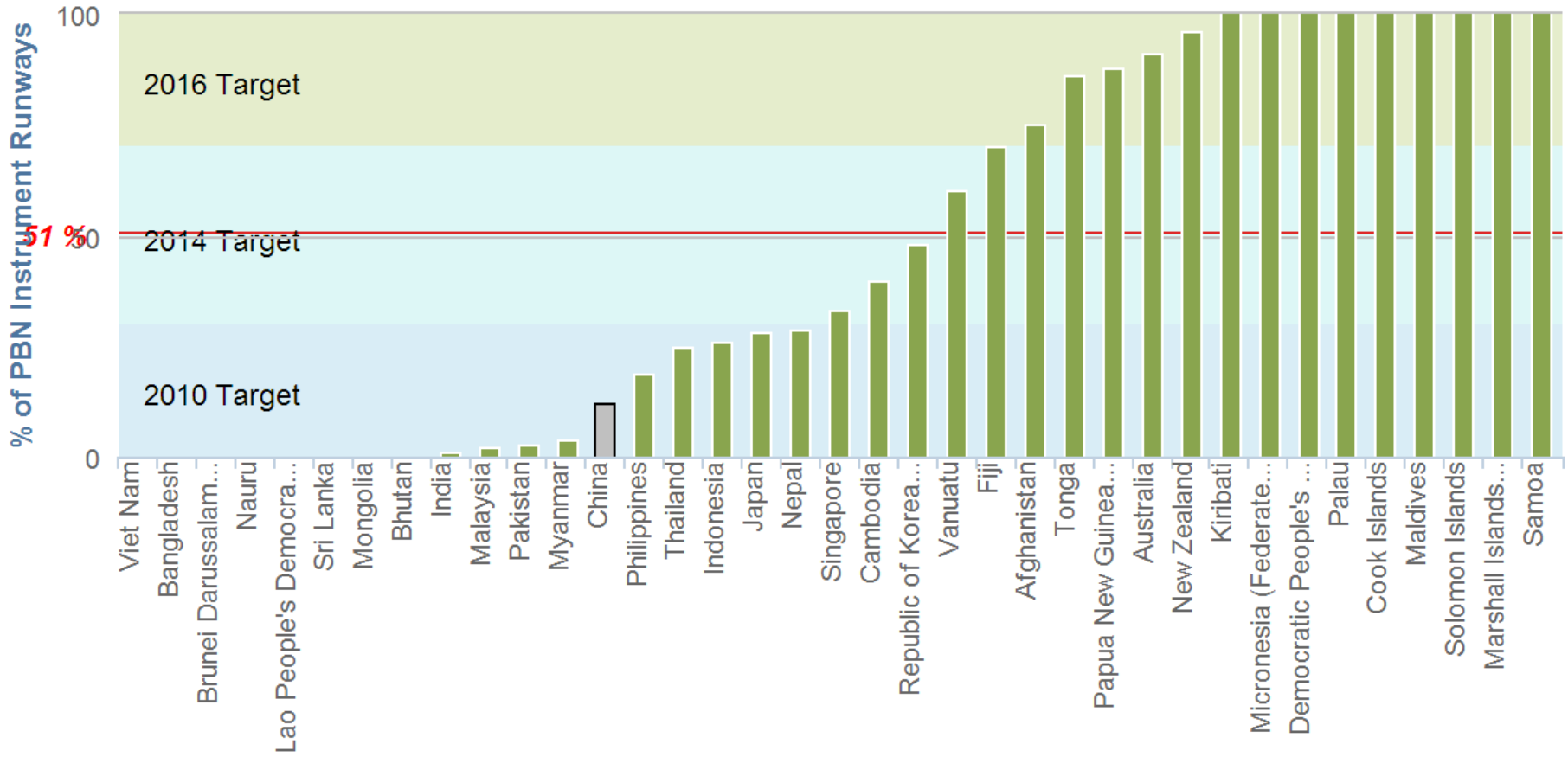


International SID & STAR – ASIAPAC



Regional PBN Implementation

% of PBN Runways per Country for World



What has ICAO done to help States with implementation? . . .





ICAO PBN Focus

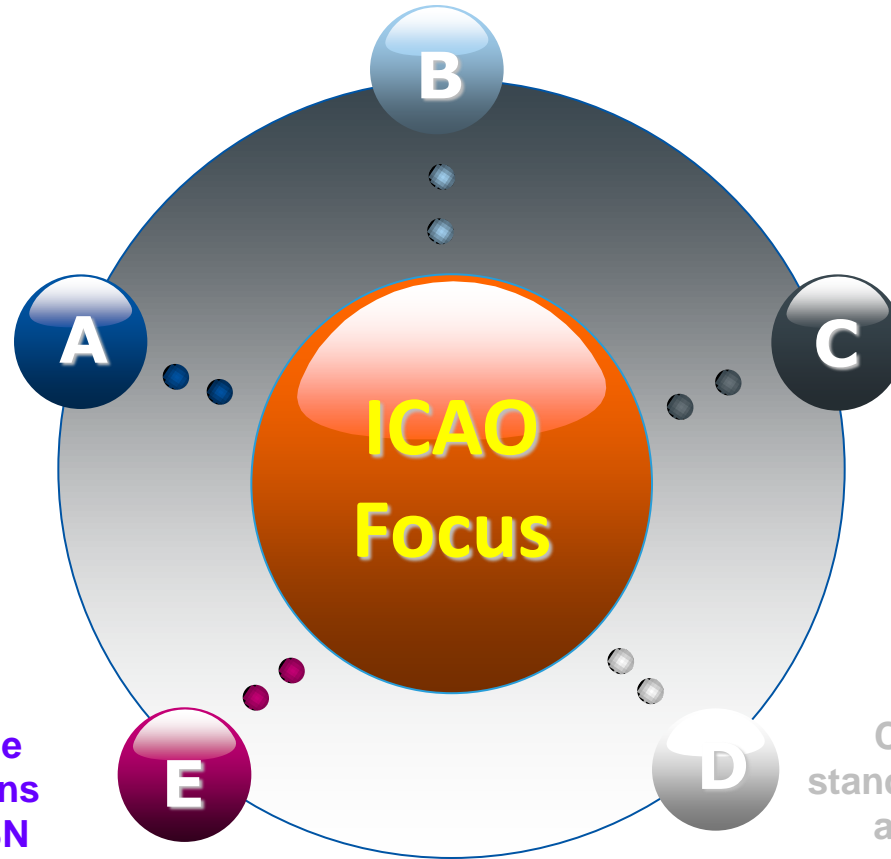
Support to Regional Offices,
Sub-Offices, FPP Offices

PBN symposia,
workshops, guidance
material

Training - Formal
courses and
computer-based
learning packages

Support for the
ASBU provisions
enabled by PBN

Continuing PBN
standards development
and amendment



PBN Documentation Framework



- PANS Ops Volume II
- PBN Manual (Doc 9613) 4th Edition
- RNP AR Procedure Design Manual (Doc 9905)
- PBN Ops Approval Manual (Doc 9997)*
- Manual on PBN Use in Airspace Design (Doc 9992)*
- CDO Manual (Doc 9931)
- CCO Manual (Doc 9993)*
- GNSS Manual (Doc 9849)
- Procedure QA Manual (Vol 1 to Vol 6) (Doc 9906)

* New

Flight Procedures Programme (FPP)

- **Beijing, China**
 - Now in Regional Sub-Office
- **Dakar, Senegal**
 - FPP Office established June 2014





ICAO/IATA PBN GO Teams

- **Expert Teams Visits to address specific implementation issues**
 - Phase I (PBN Requirements Assessment) completed
 - Phase II (Airspace Design and Operations Approvals) will be completed in early July (Last visit to China)
- **Future GO Team Visits will be specific to Region and State requirements for PBN Implementation**
 - On request basis
- **Focus/Services provided will be:**
 - PBN Assessments / Gap Analysis
 - PBN Plan Development
 - Training
 - Implementation Assistance

Completed Global Visits Phase (I and II)	
Thailand (2)	UAE (2)
Mexico	Kenya
Germany	India
Ecuador	Russia
South Africa	USA (CAR/SAM)



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Establishment of APAC PBN Implementation Coordination Group (PBNICG)

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Dakar

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North Atlantic
(EUR/NAT) Office
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(MID) Office
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Southern African
(ESAF) Office
Nairobi

Asia and Pacific
(APAC) Office
Bangkok

Asia and Pacific
Regional Sub-Office
Beijing (APAC RSO)

Thank You