



**Asia-Pacific
Economic Cooperation**

**ENHANCING AVIATION CONNECTIVITY AND
EMISSIONS REDUCTION VIA IMPLEMENTATION OF
PERFORMANCE BASED NAVIGATION (PBN)
ASSISTANCE PROGRAM**

FINAL SITE VISIT REPORT - MEXICO

Transportation Working Group

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APEC Project: TPT 05/2015A

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GLOSSARY

Abbreviations used in this report, and the meanings assigned to them for the purposes of this report are detailed in the following table:

Abbreviation	Meaning
A	
AC	Advisory Circular
AD	Aerodrome
AIP	Aeronautical Information Publication
AIRAC	Aeronautical Information Regulation and Control
AMAN	Arrivals Management System
AMSL	Above Mean Sea Level
ANI	Air Navigation Inspector
ANSP	Air Navigation Service Provider
AOC	Air Operator Certificate
APEC	Asia-Pacific Economic Cooperation
APCH	Approach
APV	Approach Procedure with Vertical Guidance
ATC	Air Traffic Control
ATS	Air Traffic Services
AWS	Automatic Weather Station

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Abbreviation	Meaning
C	
C	Celsius temperature scale
CAT	Category
CASR	Civil Aviation Safety Regulation
CCO	Continuous Climb Operation
CDO	Continuous Descent Operation
CNS/ATM	Communication Navigation Surveillance/Air Traffic Management
COSCAP	ICAO Cooperative Development of Operational Safety & Continuing Airworthiness Programme – North Asia (NA), South Asia (SA) or Southeast Asia (SEA)
CTA	Chief Technical Advisor (COSCAP)
D	
DG	Director General
DGAC	Director General of Civil Aviation (Mexico) aka Dirección General de Aeronáutica Civil
DME	Distance Measuring Equipment (Navigation Aid)
Doc nn	ICAO Document Number nn
E	
EASA	European Aviation Safety Agency
EMS	Emergency Medical Service
eTOD	Electronic Terrain and Obstacle Data
F	
FAA	Federal Aviation Administration (the United States of America)

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Abbreviation	Meaning
FMS	Flight Management System
FOI	Flight Operations Inspector
ft	feet
FVP	Flight Validation Pilot
G	
GA	General Aviation
GLS	GNSS Landing System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System (United States of America)
I	
ICAO	International Civil Aviation Organisation
IFP	Instrument Flight Procedure
IFPP	ICAO Instrument Flight Procedure Panel
IFR	Instrument Flight Rules
IMC	Instrument Meteorological Conditions
ILS	Instrument Landing System
ISA	International Standard Atmosphere

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Abbreviation	Meaning
L	
LNAV	Lateral Navigation
LPV	Localiser Precision with Vertical Guidance
M	
m	metres
MMTO	Toluca Airport, Mexico (ICAO designator)
N	
NDB	Non Directional Beacon (Navigation Aid)
NM or nm	Nautical Mile (= 1.852 km)
O	
OJT	On-the-job training
OLS	Obstacle Limitation Surface
OPS	Operations
OPS SPEC	Operations Specification
P	
PAL	Pilot Activated Lighting System
PANS-OPS	Procedures for Air Navigation Services – Aircraft Operations, ICAO Doc 8168
PBN	Performance Based Navigation

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Abbreviation	Meaning
Q	
QA	Quality Assurance
R	
RNAV	aRea NAVigation
RNP	Required Navigation Performance
RNP AR	Required Navigation Performance Authorisation Required
RO/ATM	Regional Officer/Air Traffic Management (ICAO)
S	
SARP	Standards and Recommended Practices (ICAO)
SBAS	Satellite Based Augmentation System
SENEAM	ATC service provider, Mexico
SID	Standard Instrument Departure route
STAR	Standard Terminal Arrival Route
T	
ToR	Terms of Reference
TSO	Technical Standards Order
V	
VNAV	Vertical Navigation
VOR	Very high frequency Omni directional Range (Navigation Aid)

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE
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Abbreviation	Meaning
W	
WAAS	Wide Area Augmentation System (United States of America)
WGS	World Geodetic System e.g. WGS-84

EXECUTIVE SUMMARY

INTRODUCTION

Asia-Pacific Economic Cooperation (APEC), through the Transportation Working Group (TPTWG), has funded the Enhancing Aviation Connectivity and Emission Reduction via Implementation of Performance Based Navigation (PBN) Assistance Program, which aims to assist APEC members meet International Civil Aviation Organisation (ICAO) requirements for the filing of a PBN Implementation Plan. In the near future, air navigation will be substantially satellite-based and PBN provides the fundamental structure for the implementation of a worldwide satellite-based airspace system. PBN benefits – safety, environmental, cost saving and improved access can be particularly beneficial to the economy of Mexico. Among the many benefits, PBN can potentially provide safe, reliable and efficient air access to Mexico's many airports without the need for expensive ground navigation aids.

PROGRAM STRUCTURE AND REVIEW METHODOLOGY

To execute this program APEC contracted the Ambidji Group to coordinate the work of a team of PBN experts to identify impediments to PBN Implementation, share best practices with stakeholders and make recommendations to enable successful PBN implementation in Mexico.

This report documents the results of two five-day site visits to Mexico City to determine the current state of PBN implementation in Mexico, as well as identification of actions that need to be taken to successfully implement PBN in accordance with the ICAO standards, recommended practices and guidance.

GAP ANALYSIS OF PBN IMPLEMENTATION STATUS

The 2007 ICAO Assembly Resolution A36-23, replaced in 2010 by Resolution A37-11, set global goals for PBN implementation. Chief among these goals is that implementation of the PBN concept was required to be completed by 2016. Effective implementation requires a sound plan and recognizing that PBN implementation has been much slower than expected, ICAO has asked members to review and update their national PBN Implementation Plans.

In order to provide guidance to economies, ICAO developed a PBN State Implementation Plan Standard Template that details the elements that should be included in a PBN plan. The current draft of the Mexico PBN Plan does not satisfy many of the basic plan elements recommended by ICAO. A revised PBN Implementation Plan based on the ICAO template is a necessary first step to achieving full implementation. The Ambidji team has explained the ICAO PBN Implementation Standard template to Mexican stakeholders and has identified in this report the necessary actions required to be undertaken by the various Mexican agencies to complete a mature PBN Implementation Plan.

PBN Implementation in Mexico is estimated by Dirección General de Aeronáutica Civil (DGAC) as approximately one percent complete, and Ambidji agrees that this is a reasonable assessment. Only a few PBN approaches have been published and only one airport has PBN Standard Instrument Departure (SID)/Standard Arrival Route (STAR) procedures. Some internal airways have PBN designations but no action has been made to design an airways system that can achieve the economic and environmental benefits available with PBN.

Despite the lack of PBN implementation, SENEAM procedure design staff and Air Traffic Services (ATS) management do have a good knowledge of PBN and its operational capabilities. Design of PBN procedures at 10 airports is well in hand and further design work is planned. The standard of design work is good and SENEAM appears to have a sound grasp of the development of efficient SID and STAR procedures. Implementation of PBN approach procedures is currently delayed until flight validation can be carried out.

The Ambidji team considers that sufficient technical capability exists with the various Mexican agencies to implement PBN in the short to medium term. There are, however, many areas that can be improved to achieve efficiencies and build an internationally acceptable technical standard of PBN operations. The most significant areas identified include:

- PBN-related regulations require updating in the areas of procedure design oversight and quality assurance, PBN operational approval, PBN flight operations, electronic terrain and obstacle data;
- Procedure designer training in quality assurance and Required Navigation Performance Authorisation Required (RNP AR) procedure design is required;
- Development of an Air Traffic Management (ATM) concept by SENEAM is necessary to facilitate transition to a PBN-based airspace system;
- SENEAM needs to increase procedure design productivity to meet the expected demand;
- SENEAM needs to implement ICAO quality assurance provisions;
- Provision needs to be made for local barometric pressure for PBN approach operations at all instrument airports.

PBN PILOT TRAINING

Significant among the areas requiring attention are DGAC pilot training and flight procedure design quality assurance.

Several recommendations are made in this report relating to the training of DGAC Flight Operations Inspectors (FOIs) in PBN flight operations and PBN Operational Approval. While there are many aspects to PBN, it is fundamentally an aircraft operation and effective oversight of operators and aircrew is essential. DGAC inspectors possess some basic knowledge and experience, but a requirement for further specialist training is identified in this report, particularly for general aviation inspectors.

ICAO in recent years has developed guidance on Quality Assurance for Flight Procedure Design but Mexican procedure design organisations have not yet implemented conforming quality assurance procedures. A key element in the quality assurance process is the validation (including flight validation) of Instrument Flight Procedures (IFPs). Flight validation of new instrument approach procedures should be completed by qualified Flight Validation Pilots (FVPs) but, as Mexico currently has no suitably trained pilots, this deficiency is an issue that requires urgent attention in order not to further delay implementation. Training needed for FVPs will include PBN flight operations training, a FVP course and on-the-job training.

INSTITUTIONAL MANAGEMENT

While this program has identified several areas in which improvement is required in order for Mexico to achieve an internationally recognised standard, progress has not been limited by the lack of fundamental technical knowledge or expertise.

The limited progress is attributed to a general deficiency in institutional management at all levels, with the management approach typically being reactive to implementation demands rather than proactive. PBN Implementation requires the management and co-ordination of the activities of a large number of inter-related disciplines. International experience has been that without close and effective senior management oversight and direction, supplemented by effective project management support at all levels within an organization, PBN implementation will be slow and ineffective.

In addition to the management of the technical, operational and regulatory aspects of PBN, there is also a need to manage the attitudes of all participants. People are by nature generally reluctant or resistant to change and as PBN Implementation involves a change in aviation culture at all levels this aspect must be managed effectively.

ACTION PLAN AND ACTION ELEMENTS

Ambidji has completed an analysis of all aspects of PBN in Mexico and provided a list of actions required to achieve full implementation. The report includes a proposed action plan and timeline, based on discussions with DGAC and SENEAM that, if followed, will achieve full PBN implementation over the next five years. Individual action elements that are necessary to support the action plan are identified and assigned to responsible agencies. It should be noted that dates are based on discussions during the site visits and stakeholders indicated the intention to complete some items prior to the publication of this report. Consequently, some target dates have already passed at the date of this publication.

Intervention is required by DGAC and SENEAM senior management to apply sound project management strategies based on a mature PBN Implementation Plan. The Directors General of both DGAC and SENEAM were briefed by the Ambidji team and understand the need for increased senior management control over PBN implementation aspects.

Provided there exists strong corporate policy to direct and control PBN implementation, supported by sound project management, Ambidji believes that full PBN implementation in Mexico can be achieved by the end of 2021.

SECTION 1: INTRODUCTION

The Ambidji Group Pty. Ltd (Ambidji) is pleased to present this report to the APEC Secretariat to assist Mexico to transition their current PBN Implementation Plan to the next level of implementation maturity so that Mexico is in a better position to introduce the required PBN concepts, air routes and procedures within their regulatory jurisdiction.

This report documents Ambidji's findings and outcomes following two site visits to Mexico City to ascertain Mexico's operational status with implementing ICAO's recommendations, supported by a list of action elements and implementation recommendations where necessary to overcome identified institutional and technical constraints.

1.1 Structure of the Report

This report is structured in the following manner:

- a) **Executive Summary.** An overall summary of the Ambidji team's findings and outcomes arising from the two site visit workshops to Mexico, as well as identification of the necessary action elements and implementation recommendations to finalise Mexico's PBN Implementation Plan;
- b) **Section 1: Introduction and Background to PBN Implementation.** Section 1 provides the reader with background information on the ICAO requirements for PBN implementation and the role of the APEC Secretariat in assisting economies with PBN implementation;
- c) **Section 2: Review Approach and Methodology.** The overall approach and methods utilised by the review team are detailed in this section, as well as identification of the project oversight arrangements and workshop attendees;
- d) **Section 3: Analysis of PBN Implementation Status.** This section provides a detailed review of Mexico's progress with PBN implementation and the identification of institutional and technical constraints limiting full implementation;
- e) **Section 4: PBN Staff Training.** A summary of the training courses available.
- f) **Section 5: Action Plan and Action Elements.** This section presents a time bound Action Plan and reference to the "tear off" Action Element (task) sheets.
- g) **Appendices.** The Appendices contain supplementary and more detailed information that supports the analysis, findings and recommendations prepared by the review team.

1.2 Liaison Officer Support

Ambidji appreciates the level of co-operation and support for the Program provided by all stakeholders.

The excellent support provided by the Program Liaison Officer (LO) Ing José Jimenez is acknowledged with thanks.

1.3 Background to PBN Implementation

At the ICAO 36th General Assembly held in 2007, members agreed (Resolution A36-23) to implement air routes and airport flight procedures in accordance with ICAO's PBN Concept detailed in the ICAO PBN Manual (Doc 9613).

The PBN Concept represents a transition from conventional sensor-based navigation to the dependence on a satellite based navigation system. Consequently, PBN can provide benefits through the facilitation of more efficient flight routes, decreased fuel consumption, reduced emissions, improved air traffic safety, increased airspace and airport utilization, as well as a reduction in flight delays.

A key ICAO objective was for members to have their PBN implementation plans finalized by the end of 2009 to ensure a harmonized global implementation of the concept, to the maximum extent possible, so accrued benefits could be quickly realized by the airline industry.

Full implementation of the PBN concept is required to be completed by the end of 2016.

1.4 Status of Global Implementation

In 2010, ICAO recognized that the global implementation of PBN set by ICAO in Assembly Resolution A36-23 was behind the agreed schedule in some economies, particularly those with developing economies. Consequently, Resolution A37-11 varied Resolution A36-23 to give economies more options to transition to full implementation of the concept. A copy of Resolution A37-11 is available at Appendix A.

The reasons for the slow implementation progress are numerous and each economy faces unique challenges however, whilst many member economies have developed baseline PBN implementation plans, a number of common constraints have been identified that are limiting some economies from proceeding to the next stage of PBN implementation.

Some of the identified constraints include:

- A general lack of knowledge and understanding of PBN technology;
- Lack of easy access to institutions offering PBN technical information and resources;
- Insufficient qualified staff;

- Resistance to change, commonly due to insufficient confidence in PBN;
- Poor co-ordination between stakeholders; and
- No, or ineffective, institutional capacity.

While most economies have prepared a PBN implementation plan, the content and quality of plans varies greatly. In an effort to assist members in developing a comprehensive and useful plan, ICAO developed guidelines supported by a PBN Implementation Plan Template. A copy of the ICAO PBN State Implementation Plan Standard Template is included at Appendix B.

To further assist members in their PBN implementation efforts, ICAO also established a PBN Task Force and Flight Procedure Programme Office in the Asia-Pacific Region. ICAO has requested by State Letter that all members review their PBN implementation plans with respect to the new ICAO plan template and submit a revised plan using the ICAO template. Whilst ICAO can, in some cases, provide assistance to economies with developing and validating PBN flight procedures, some economies are unable to access this support until they have mature PBN implementation plans in place.

1.5 The Performance Based Navigation (PBN) Assistance Program

APEC, through the TPTWG, has funded the above-mentioned program that aims to assist APEC member economies to meet ICAO requirements for the filing of a PBN Implementation Plan.

This program is intended to directly assist the Air Navigation Service Providers (ANSPs) and Civil Aviation Authorities (CAAs) in two member economies, Indonesia and Mexico, to address these challenges. This assistance indirectly impacts additional civil aviation stakeholders, such as airlines and airports (particularly medium and large airports) as PBN implementation can lead to reduced fuel costs, reduced flight delays, safer instrument approaches with vertical guidance to most runway ends and more efficient and safer air traffic control capabilities — thus supporting APEC priorities in reducing emissions, improving supply chain connectivity and securing growth.

1.6 Role of the Ambidji Group

To execute this program APEC has contracted the Ambidji Group to coordinate the work of a team of PBN experts to identify impediments to PBN Implementation, share best practices with stakeholders and make recommendations to enable successful PBN Implementation in both member economies.

SECTION 2: PROGRAM STRUCTURE AND REVIEW METHODOLOGY

2.1. Program Structure and Governance

a) *Review Team Structure*

The Ambidji review team included two experts with significant capability and experience with PBN aspects viz:

- Mr Robert Kennedy, Project Coordinator and PBN Operations Specialist; and
- Mr David VanNess, PBN Flight Procedure Specialist.

b) *Program Oversight*

Oversight of Ambidji's review activities were provided by the United States Federal Aviation Administration (FAA) on behalf of APEC. The nominated Project Overseers were:

- Ms Angela Harris-Clark, FAA Manager, Asia-Pacific, Office of International Affairs;
- Ms Katherine Michaud, Foreign Affairs Specialist, Asia-Pacific.

For the two site visits the FAA, as Project Overseer, was represented by:

Site Visit 1:

- Ms Angela Harris-Clark FAA Manager, Asia-Pacific, Office of International Affairs.

Site Visit 2:

- Mr Bruce W. Kinsler, FAA Manager, Policy and Strategic Planning, Domestic and International Performance Based Navigation;
- Mr William (Bill) Fernandez, FAA RNAV and RNP Approach Specialist;
- Mr Robert Trent Bigler, FAA Aviation Safety Inspector

2.2. Review Methodology

a) *Terms of Reference*

A Terms of Reference (ToR) document prepared by Ambidji and approved by the Project Overseer outlines the specific actions to be performed under the Program. The work approach and methodology was assessed as being appropriate for ensuring the program objectives would be achieved and was, therefore, adopted by the review team.

A copy of the ToR is included at Appendix C.

b) Program Elements

The Project included the following major elements.

- Two PBN experts to conduct the assistance program;
- Development of a Project Summary that details the Contractor's approach to perform the review tasks;
- Development of a draft questionnaire to survey the ANSP, DGAC and other relevant stakeholders in Mexico to identify their perceived challenges to fully implement PBN;
- Preparation of a detailed ToR;
- A review of Mexico's current PBN Plan; and
- Conduct two (2) site visit trips to Mexico to execute the ToR tasks and hold discussions with the Liaison Officer (LO), the Air Navigation Service Provider (ANSP), SENEAM, the DGAC and other relevant stakeholders.

c) Questionnaire

In accordance with the requirements of the RFP, a questionnaire was developed and sent to Mexico prior to the first site visit. The responses received enabled the Ambidji Team to make an initial assessment of the PBN implementation status in Mexico.

The questionnaire requested responses covering each of the following disciplines:

- PBN Plan;
- Regulatory;
- ANSP;
- Fleet Statistics;
- Procedure Design; and
- Airports.

A copy of the Questionnaire including responses is included in Appendix D.

d) Expected Outcomes and Deliverables

A gap analysis for Mexico guided by ICAO requirements and standards, to identify any challenges and recommend actions for Mexico to successfully meet their PBN objectives.

An Action Plan including timeline to outline next steps for Mexico to address the technical, regulatory and operational requirements to enable full PBN implementation.

A Final Report, including, but not be limited to:

- A summary of the best practices shared with Mexico throughout the assistance program;
- An overview of the procedures and requirements to implement PBN routes and procedures, taking into consideration international standards and best practices for managing and safely overseeing the PBN implementation process at the governmental level;
- Recommendations for Mexico to implement and/or revise their regulatory framework to support PBN implementation (including airline equipage requirements);
- A summary of required flight procedure design capabilities; and
- Suggested solutions for Mexico to ensure a properly trained pipeline of staff to design and implement PBN flight procedures.



Attendees at Site Visit 1 – Mexico City

e) Site Visits

Site Visit 1

The first of two site visits was conducted from 8 to 12 August 2016.

The primary purpose of the first visit was to assess the status of PBN implementation in Mexico and to identify any impediments to progress.

The Site Visit 1 report prepared by the Ambidji Team is available at Appendix E.



*Attendees at Site Visit 1 – Mexico City
(L-R: Bob Kennedy, Ambidji; Angela Harris-Clark, FAA; David VanNess;
Ambidji; José Jimenez, DGAC)*

Site Visit 2

The second site visit was conducted from 19 to 23 September 2016. The Site Visit 2 report prepared by the Ambidji Team is available at Appendix F.

During this visit issues identified during site visit 1, including proposed Action Items, were further discussed with stakeholders.

Input from stakeholders regarding achievable target dates and time lines were sought and added to the draft Action Item List.

A copy of the ICAO PBN Implementation Plan template was presented and each element discussed. Stakeholders were encouraged to develop input to the Mexican PBN Implementation Plan for consolidation and final drafting by DGAC.

A meeting with the Director General of DGAC and Director General of SENEAM was convened and the main outcomes of the APEC Program discussed.

SECTION 3: GAP ANALYSIS OF PBN IMPLEMENTATION STATUS

3.1. Outline of the Section

In this Section, individual components of PBN Implementation are examined. Each subject is discussed under the following headings:

- **Analysis**: description of the current situation and identification of implementation gaps or constraints.
- **Action**: description of the actions that must be undertaken/implemented in order for the economy to achieve ICAO obligation compliance or enhancement. Completion of an Action should be considered mandatory.
- **Recommendation**: advice or best practice that may be implemented at the discretion of the economy in order to improve overall safety, responsiveness and efficiency with respect to PBN implementation.

Actions required to assist with PBN implementation are detailed in Action Elements, which are included in Section 5. Each Action Element describes the remedial action required in detail and is intended to be assigned to a responsible manager with a timeline for completion.

3.2. ICAO Assembly Resolution A37-11

ICAO Assembly Resolution A37-11 (Appendix A) urges all members to develop a PBN Implementation Plan. While most economies have prepared an Implementation Plan, the content and quality of plans varies greatly. In an effort to assist members in developing a comprehensive and useful plan, ICAO has developed guidelines and a PBN State Implementation Plan Standard Template. ICAO has requested by State Letter that all members review their PBN Implementation Plans with respect to the new ICAO Plan Template and submit a revised plan using that template.

3.3. Status of Mexico's PBN Plan

The Mexico PBN Implementation Plan does not yet meet ICAO guidelines with regard to the following plan elements:

a) Policy and Implementation Planning:

Details of the relevant PBN Task force, its roles and responsibilities need to be included;

Strategic objectives tailored to Mexico's circumstances need to be included;

Description of the tangible benefits not complete.

b) Assessment of CNS Infrastructure:

No assessment appears to have been conducted. There was also no evidence of a plan for decommissioning of ground aids, if applicable (including timeline).

c) Assessment of Fleet Readiness:

Currently available data is based on 2014 information. Although the data is sufficient for initial planning purposes, the PBN Plan should include an assessment based on the available data.

d) Selection of appropriate PBN navigation specification:

The current PBN Plan requires further development to include more detail;

A clear strategy for selection and implementation of navigation specifications is required;

Mandates (including timelines) for requiring PBN capability need to be developed.

e) Strategies for enroute implementation:

Strategies for enroute implementation, including timeline, are not included in the PBN Plan; Harmonisation with neighbouring FIRs requires further consideration and harmonisation.

f) Strategies for terminal area implementation, including timeline:

Detailed timelines are not available;

Policy for implementation is not yet established.

g) Strategies for Instrument approach implementation, including timeline:

Detailed timelines are not available;

Policy for implementation (priorities) is not yet established;

Consultation practices with stakeholders could be improved;

Status of the Wide Area Augmentation System (WAAS) not established.

h) Plan Coordination:

Detail regarding the coordination and consultation with stakeholders and neighbouring economies that went into writing the plan could be enhanced;

Plan coordination could be improved through assignment of overall responsibility for execution of the plan;

Plan coordination could be improved through assignment of specific responsibility to each organization for achieving targets in the plan;

Frequency and responsibility for review and amendment of the plan is required;

Statement of Stakeholder commitment to the plan is required.

i) Safety Assessment:

A safety assessment to support PBN implementation is required. In the 2015 plan, Mexico addressed the responsibility of the ANSP, in coordination with the DGAC, to conduct an assessment, but there is no evidence that a preliminary assessment was actually completed.

DGAC has indicated that a target date of 31 December 2016 for completion of a new PBN Plan is achievable.

3.4. ICAO PBN Plan Template

The Ambidji team shared the ICAO template with Mexican stakeholders and provided an explanation of each section, with suggestions regarding Mexican responses. All stakeholders were encouraged to develop relevant input to the plan for submission to the DGAC who has the primary responsibility for drafting the Plan.

The ICAO template provides explanation, examples and standard text for various chapters and sections. In many cases, it will be necessary to modify the text to fit Mexico's circumstances. Additionally, in order for Mexico to complete a revised PBN Implementation Plan based on the ICAO template the following key items (with template chapter in parentheses) need to be addressed.

a) Action

DGAC, in consultation with all stakeholders and in close co-operation with SENEAM, to prepare a new PBN Implementation Plan using the ICAO PBN State Implementation Plan Standard Template.

Action Element 1: Prepare PBN Plan

The PBN Implementation Plan should address the following actions:

(Reference to the relevant Chapter of the ICAO PBN Plan Template is included in parenthesis)

- Identify the strategic objectives to be achieved by PBN implementation in Mexico. These could include reduced accident rate in Mexico, increased efficiency and continuity of operations at high traffic airports, reduced environmental impact, etc. (Chapter 1);

Action Element 1a: Prepare PBN Plan: Identify Strategic Objectives

- List assumptions regarding the development and execution of the plan, with applicable constraints. (Chapter 1);

Action Element 1b: Prepare PBN Plan: List Assumptions and Constraints

- While the currently available 2014 study is adequate for initial development of the plan, a more recent study including planned future fleet composition and capabilities is needed. Although it is clear that Mexico has a modern fleet with a high level of PBN capability, to move forward with development of the revised PBN Implementation Plan, up-to-date fleet information and consultation with operators on future fleet plans is necessary to assist in deciding when to implement and mandate PBN capabilities. This task is the responsibility of the DGAC and should be completed as soon as possible in order to inform decisions about other areas of the plan. (Chapter 2)

Action Element 1c: Prepare PBN Plan: DGAC to Conduct Fleet Study

- A study of current CNS/ATM capabilities and future requirements based on a PBN-based airspace structure is required. The study will support PBN planning with recent data enabling selection of the most suitable navigation specifications and setting priorities for implementation based on current and planned future CNS/ATM capability. The study needs to include plans for decommissioning redundant navigation aids as PBN implementation proceeds (Chapter 2).

Action Element 1d: Prepare PBN Plan: SENEAM CNS/ATM Study

- Identify challenges and obstacles to the execution of the PBN implementation plan and how Mexico plans to address those challenges. This would include many of the actions listed later in this report. (Chapter 3).

Action Elements 2, 2a, 2b, 3, 4, 5, 6, 7, 8, 9, 9c, 10, 11, 12, 13, 14, 15, 15a, 16, 17, 17a, 18, 19, 19a, 19b, 21

- In consultation with stakeholders determine implementation targets for short and medium term, and end state (no more than five years) including mandates for PBN equipage/approval, for the various types of PBN operations; enroute, terminal, approach, helicopter and military. As the ICAO goal for completion of PBN implementation by the end of 2016 is no longer achievable, further delay in realising the safety and efficiency benefits of PBN implementation is considered not acceptable. (Chapter 4);

Action Element 1e: Prepare PBN Plan: Determine Implementation Targets

- An assessment of the benefits of PBN is necessary and should be included in the revised PBN Plan. Benefits based on achieving the end state PBN implementation should be assessed in real terms (financial as well as cultural/environmental) resulting from expected reduction in emissions, improvement in safety (reduced accident rate), and more efficient operations. It is particularly important to include the benefits assessment in the Mexico PBN plan in order to inform the public, industry, government and other stakeholders. (Chapter 4);

Action Element 1f: Prepare PBN Plan: DGAC Assess Expected Benefits of PBN

- Responsibility and accountability for timely execution of the plan needs to be clearly assigned. Both DGAC and SENEAM have essential roles in PBN implementation and leadership by the DGs of DGAC and SENEAM is essential for success. Joint action by DGAC and SENEAM to make subordinate directors fully accountable for meeting PBN Plan targets is necessary (Chapter 5);

Action Element 1g: Prepare PBN Plan: DGAC & SENEAM to Assign Responsibility

Action Element 2: DGAC/SENEAM Leadership Initiatives: Implement Management Structure

Action Element 2a: DGAC/SENEAM Leadership Initiatives: Establish PBN Task Force Structure

- A safety assessment is required. An integral part of modern aviation planning is risk management and as PBN implementation constitutes a significant change to the Mexican Airspace System an assessment of the consequential risks is essential. SENEAM should have primary responsibility for the preliminary safety assessment to be included in the revised PBN Implementation Plan as well as post implementation assessment to ensure safety targets are met. (Chapter 6);

Action Element 1h: Prepare PBN Plan: DGAC/SENEAM to Conduct Safety Assessment

- Develop a prioritized list by year of the airports where PBN approaches and terminal area procedures such as SID and STAR procedures are to be implemented (Appendix). A priority list helps stakeholders to plan their future operations, obtain benefits of PBN where they are needed the most, and allows SENEAM to plan their work.

Action Element 1i: Prepare PBN Plan: SENEAM/DGAC to Develop Priority List

3.5. Implementation Effectiveness of Institutional Management

PBN Implementation worldwide has been much slower than expected. Many economies have failed to achieve the goals set by ICAO and despite the fact that PBN technology (satellite-based navigation) has been available for approximately 20 years, worldwide implementation is still incomplete.

The technology associated with PBN is not complex. Global Navigation Satellite System (GNSS) equipment is widely available and all modern production aircraft are PBN capable (especially in Mexico), yet there is a general failure to take advantage of the capability of modern aircraft and systems.

Typically, the lack of progress is not a result of the lack of equipment or the understanding of its use but, rather, widespread institutional failure to manage the change to a satellite-based system.

Regulatory authorities have been slow to update their operating regulations, to develop PBN flight procedures, to implement the capability to approve and oversee operators or to mandate PBN capability. Airlines worldwide suffer from financial pressure and despite having aircraft with PBN capability they have been slow to invest in PBN, which requires expenditure in terms of training and application for operating approvals, when there are few procedures available to justify investment.

PBN implementation requires the co-ordination of many activities involving numerous agencies, service providers, operators, professional disciplines and thousands of individuals. Success is dependent on the effective management and co-ordination of the various participants and resources in an orderly and timely fashion.

It is the task of effective management that is the most commonly overlooked aspect of PBN implementation worldwide. Typically, economies expend much effort in flight procedure design, training and related tasks but fail to achieve effective implementation. Lack of progress is commonly due to the failure to recognise that all components of PBN must exist concurrently for a PBN operation to be flown and, without continuous active management and co-ordination, success is not achieved.

In this respect, Mexico is no different to many economies. Effort has been expended in recent years on training, design, and regulation development yet progress is minimal and well behind ICAO targets.

Because there are so many individual elements involved in PBN, from the design and validation of procedures to approval and oversight of operators, training of flight crews, dispatchers and air traffic controllers, development of ATC procedures, management of data, redesign of airspace, mandating of PBN capability and much more, implementation either does not occur or is severely constrained unless there is effective high level management.

This Program has identified that, for the most part, Mexican agencies and airlines have the capability to achieve PBN Implementation in the short to medium-term.

For PBN Implementation to succeed in Mexico action needs to be taken to ensure that every aspect of PBN is carefully managed and co-ordinated.

3.6. PBN Task Force

A PBN Task Force has apparently been established; however, there did not appear to be any written terms of reference or minutes of task force meetings.

Assuming that there are no formal records of Task Force activity, a task force should be formally established jointly by the Director-General of DGAC and Director-General SENEAM with

allocated responsibility to ensure that the Mexico PBN Implementation Plan proceeds as scheduled.

Members of the PBN Task Force should be appointed by the DGs and the Task Force should have written ToR. The Task Force should be charged with ensuring that a revised and mature PBN Implementation Plan is completed as soon as practical and submitted to ICAO. The Task Force should be responsible for regular review of progress against the plan, identifying and rectifying any failure to meet the targets set out in the PBN Implementation Plan and reporting to the DG of the DGAC and DG SENEAM at regular intervals.

a) Action

1. The DG of the DGAC to take charge of PBN implementation and in co-operation with the DG, SENEAM, to implement a management structure to oversee PBN implementation. Directorate and Department Heads should be responsible and accountable for their organizations' roles in PBN implementation; and
2. The DG of the DGAC jointly with DG SENEAM to formally establish a PBN Task Force, with written ToR to be responsible to develop and co-ordinate PBN Implementation, with regular reporting to the DGs.

Action Element 2: DGAC/SENEAM Leadership Initiatives: Implement Management Structure

Action Element 2a: DGAC/SENEAM Leadership Initiatives: Establish PBN Task Force Structure

3.7. Cultural Change

a) Analysis

One of the difficulties and a common impediment to PBN Implementation is the need at all levels to understand and embrace a change in aviation culture.

All stakeholders need to understand and accept that PBN is not merely a new technology, but a move to a different concept in aviation that is dependent on electronic automation rather than traditional human skills. Pilots need to recognise that modern aircraft are different, and that piloting is more about management of automation systems than hands-on flying. Similarly, air traffic controllers must understand that in the pursuit of efficiency, management of air traffic has to change to pre-programmed routes with a consequent reduction in controller intervention. Air traffic controllers, like pilots and others, are reluctant to change and need to be persuaded, educated and, if necessary, directed to accept the change to a new way of doing business.

PBN has the capacity to provide many benefits, but benefits are only obtained when PBN capability is effectively used. Air traffic controllers need to be trained to understand that

their role is changing. No longer is radar vectoring the most efficient tool, and increased dependence must be made on efficiently designed SIDs and STARs, with the air traffic controller taking a management rather than a controlling role.

The regulatory agencies of the world must play a leadership role in aviation development in their respective economies. In particular, those persons responsible for the oversight of airlines and other air operators must be advocates for PBN as an avenue to achieving increased safety and efficiency. Regulators need to be the promoters of safe and efficient aviation and to promote and assist operators to participate.

b) Action

DGs of DGAC and SENEAM convene a meeting of all department heads to plan the management of cultural change associated with PBN Implementation;

DGs of DGAC and SENEAM direct the PBN Task Force to take action (workshops/seminars), to address cultural change.

Action Element 2b: DGAC/SENEAM Leadership Initiatives: Manage Cultural Change

3.8. PBN Operating Rules

a) Analysis

The general rules for PBN operations, except for RNP AR procedures, are contained in a circular dated 2010. The rules are a duplication of the relevant sections of the ICAO PBN Manual and are in need of updating to the current version of the PBN Manual and Doc 9997, PBN Operational Approval Manual.

A second circular detailing the requirements for RNP AR operations is in draft form.

DGAC was expecting to issue the RNP AR rules immediately in order to facilitate expected RNP AR operational approval applications without delay.

DGAC expects to complete an updated version of the general rules (except RNP AR) and the RNP AR rules by 31 December 2016.

The final version of the PBN rules should be consolidated into a single document.

Following discussions with the Chief, Standards Department (Departamento de Normas), whose department is responsible for developing operating rules, it was agreed that while personnel in this section have some understanding of PBN, further training is warranted.

The appropriate course of training for persons responsible for developing PBN operating rules is an ICAO PBN Operational Approval Course, typically of one-week duration. As

other persons in DGAC will require the same course, it is suggested that DGAC arrange a course to be conducted in Mexico City and that selected personnel from the Standards Department attend.

b) Action

DGAC to update and revise circulars to reflect the latest version of the ICAO PBN Manual (Doc 9613) and Doc 9997;

DGAC to consolidate all PBN rules into a single circular;

DGAC Departamento de Normas staff to complete PBN Operational Approval training course.

Action Element 3: DGAC Update PBN Operating Rules

Action Element 4: PBN Operational Approval Training for Departamento de Normas

3.9. PBN Operational Approval

a) Analysis

The ICAO PBN Manual (Doc 9613) requires that operators be authorised by their regulator, by means of an Operations Specification (OPS SPEC) endorsement (or Letter of Approval for non-AOC holders) in order to conduct PBN operations. This is a fundamental condition associated with implementation of PBN assuring that all operators conform to a common set of operating standards worldwide.

The DGAC process and procedures for issue of PBN operational approval to air operators in Mexico is managed by engineering staff (Depto de Ingenieria de Operaciones), with flight operational aspects referred as necessary to FOIs in the Flight Operations Section (Direccion de Control). As PBN is primarily a flight operation, most civil aviation administrations direct initial applications for operational approval to the Flight Operations section, with input as required from engineering. However, although the current process is unusual, the arrangements are adequate so there is no need to restructure the approval process.

Several operators reported some dissatisfaction with the approval process, citing long delays and repeated requests by DGAC for information.

There were some anomalies in OPS SPECs including unduly restricting RNAV 2 operations to terminal areas.

A common issue seen with OPS SPECs issued for RNP APCH is that the type of RNP APCH authorized (LNAV, LNAV/VNAV/LPV) is not noted on the OPS SPEC. Updated guidance should reflect this requirement.

DGAC has not published guidelines for applicants detailing the form and content of a conforming application. A lack of guidance material typically results in additional work and a delay in approval, as neither party (applicant or regulator) has the benefit of clear guidelines. As the DGAC faces an increase in the number of applications, publication of clear guidance material is essential. Guidance material should be included in the update to the PBN rules.

b) Action

DGAC to publish guidelines for applicants detailing the requirements for PBN operational approval;

OPS SPECs with an approval for RNP APCH must include a note indicating which specific types of approach are authorised i.e. LNAV, LNAV /VNAV, LPV.

Action Element 5: DGAC Publish PBN Operational Approval Guidelines

c) Recommendation

DGAC to establish service level commitment for the time required to process a conforming application for PBN operational approval, e.g. within 60 days of receipt of application.

3.10. PBN Operational Oversight

a) Analysis

Engineering personnel responsible for operational approval appear to have a good understanding of the PBN Manual.

FOIs lack training in both PBN operations and PBN Operational Approval. This situation is not unexpected as FOIs are not employed on operational flying duties, and there are few PBN procedures published in Mexico. Consequently, there is little opportunity for DGAC inspectors to gain practical experience in PBN operations. Despite these difficulties, it is however, necessary that inspectors tasked with PBN Operational Approval should be trained and competent in PBN flight operations.

As there are approximately 65 FOIs, initially a small group of pilots should be selected to undertake PBN training and act as PBN Subject Matter Experts (SMEs). Subsequently those pilots would be available to mentor other pilots and provide in-house specialist training.

In addition to the requirement for FOIs to be familiar with PBN Operations there is also a need for those inspectors to complete training in the PBN Operational Approval requirements in accordance with the ICAO PBN Manual (Doc 9613).

As soon as possible one or more FOIs should be assigned to the Volaris/Airbus ProSky RNP AR Project to participate in the procedure development process, training and other activities in order to gain practical experience in advance of Volaris submitting an application for approval.

Of the Air Operator Certificate (AOC) holders in Mexico, a large number operate aircraft below 5700 Kg, which are typically equipped with panel mounted “stand-alone” GNSS receivers. As the operation of this type of equipment is quite different to that in an FMS equipped aircraft it is recommended that selected FOIs be trained on this class of equipment. Additionally, flight training schools in Mexico can be expected to add PBN training to their curriculum as more PBN procedures become available in México. Consideration should also be given to the training of inspectors who will be required to conduct oversight of flight training schools.

Although the DGAC has an approval process in place, the Ambidji Team is concerned that inspectors are requiring operators to provide unnecessary detail and in some cases requesting flight demonstrations that are unnecessary. Consequently, the time and effort required by both air operator applicants and DGAC inspectors appears excessive and an impediment to timely PBN implementation.

Many of the items being checked by inspectors can be verified by reference to aircraft manufacturer compliance documentation and operations manuals. In most cases, capability has already been demonstrated to other regulatory authorities (FAA/EASA) and reference to such documentation is usually sufficient.

It is considered that much of the unnecessary detail associated with operational approval is due to a lack of detailed knowledge and experience in PBN operations and that further training for inspectors is warranted. The ICAO Operational Approval Manual (Doc 9997) is now available which can assist. Engineering staff (Depto de Ingenieria de Operaciones) and Inspectors would benefit from completion of an ICAO Operational Approval Course which is required by other DGAC personnel and discussed elsewhere in this report.

b) Action

DGAC to arrange PBN Operations training for an initial group of FOIs;

DGAC to arrange for all remaining FOIs to undertake PBN Operations training;

DGAC FOIs responsible for General Aviation operations <5700Kg to obtain PBN operational experience using stand-alone GNSS receivers;

DGAC to ensure that all FOIs are trained in PBN Operational Approval requirements and DGAC approval processes;

DGAC to arrange a PBN Operational Approval course for an initial group of FOIs and select Airworthiness Inspectors;

DGAC to incorporate PBN Operational Approval in future FOI initial training.

Action Element 6: PBN Training for FOIs: Initial group

Action Element 6a: PBN Training for FOIs: All DGAC FOIs

Action Element 7: PBN Operational Approval Training

Action Element 7a: PBN Operational Approval Training: Incorporate in Initial FOI Training

For training course information, refer to SECTION 4: PBN STAFF TRAINING

c) Recommendation

A Flight Operation inspector should be assigned to the Volaris/Airbus ProSky RNP AR Project to participate in the procedure development process, training and other activities in order to gain practical experience in advance of Volaris submitting an application for approval.

3.11. Flight Procedure Design and Oversight

a) Analysis

The DGAC Sub directorate of Air Navigation has responsibility for oversight of the primary procedure design provider, SENEAM and third party providers.

The following issues were identified:

1. There are no Air Navigation Inspectors (ANIs) in this sub directorate that have PANS OPS procedure design training;
2. There are no written policies or processes relating to their procedure design oversight responsibility;
3. The DGAC has not developed a process for initiating and processing requests for waivers to procedure design criteria; and
4. The DGAC has not established a requirement or periodic interval for review of IFPs.

At least two ANIs should complete PANS OPS procedure design training, both conventional and PBN. Following that training, they should spend at least a month of OJT

with SENEAM designing actual procedures, before assuming their procedure design oversight responsibilities.

México is responsible to ensure that all published IFPs in their airspace can be flown safely by the relevant aircraft. Safety is not only accomplished by application of the technical criteria in PANS OPS and associated ICAO provisions, but also requires measures that control the quality of the process used to apply that criteria, which should include regulations establishing requirements and procedures for oversight of procedure design and validation organisations by the economy. Regulations have been implemented by a number of economies that may be used as a model. An example is the Australian CASR Part 173, which is available for download free of charge on the Australian government website. It is recommended that the DGAC use this model or develop their own regulation.

b) Action

DGAC ANIs responsible for procedure design oversight to complete PANS-OPS training, including RNP AR APCH;

DGAC to develop a regulation for oversight of procedure design organisations and the IFP process.

Action Element 8: PANS OPS Training for DGAC Air Navigation Inspectors

Action Element 9: DGAC Develop Procedure Design Oversight Regulation

3.12. Management of Design Variations

a) Analysis

DGAC requires that IFPs be designed in accordance with ICAO design criteria. The relevant publications are ICAO Doc 8168 *Procedures for Air Navigation Services – Aircraft Operations* (PANS OPS) and ICAO Doc 9905 *Navigation Performance Authorization Required (RNP AR) Procedure Design Manual*.

In the normal course of procedure design, especially where terrain or other factors cause design difficulty, situations will be encountered where a satisfactory operational outcome is not available without deviation from the standard design criteria. In most cases, design deviations are justifiable and often desirable but any deviation should only occur with the approval of DGAC. DGAC needs to develop written requirements to specify the basis upon which design deviations will be reviewed and approved. Applications for approval should include the specific details of the exemption/waiver proposed and a full justification based on an evaluation of the level of safety. Guidance for managing exemptions to criteria should be included in a procedure design and validation oversight regulation.

b) Action

DGAC to publish guidelines for the approval of variations to design criteria;

Applications for approval to include the specific details of the exemption/waiver proposed and a full justification based on an evaluation of the level of safety;

Guidance for managing exemptions to criteria should be included in the procedure design and validation oversight regulation.

Action Element 9a: DGAC Develop Procedure Design Oversight Regulation: Exemptions to Criteria

3.13. Periodic Review of Instrument Flight Procedures

a) Analysis

PANS OPS, Volume 2 (Doc 8168) requires that published procedures be subject to periodic review, including validation, to ensure that they continue to comply with changing criteria, to confirm continued obstacle clearance and that they meet user requirements. Individual economies may establish the interval for periodic review of IFPs according to the needs of the economy. The maximum interval for this review is five years. The Mexican requirement for procedure design review and associated periodic interval should be included in the procedure design and validation oversight regulation.

b) Action

DGAC to publish a periodic requirement for procedure design review of IFPs.

Action Element 9b: DGAC Develop Procedure Design Oversight Regulation: Periodic Review of IFPs

3.14. Flight Procedure Design Capacity

a) Analysis

SENEAM employs a staff of four designers and a Section Manager. Design staff are well trained and experienced in PBN procedure design. The standard of procedure design is very high although improvement in detail is warranted in some cases.

Based on an estimated 60 airports in Mexico that will require PBN procedures, and considering that the amount of design work will vary between major airports such as Mexico City and smaller regional airports, the overall workload over the next three to five years indicates that the current procedure design staffing level is inadequate. The current output of the four designers with due regard for routine non-PBN duties and other

demands on design staff is about 10 airports per year. The expected design requirement indicates an increase in production of about 30 percent is required.

Options for increasing the production of PBN procedures include:

1. **Recruiting additional untrained staff:** New personnel would require training and would not provide additional effective output for at least one year. The cost of training plus one year's unproductive employment is expensive. This option should be considered in the context of anticipated turnover as well as longer term procedure maintenance workload once PBN implementation is complete;
2. **Recruiting additional trained and PBN experienced staff:** This is likely not a viable option due to the worldwide shortage of experienced designers;
3. **Outsourcing design to private enterprise designers:** Many administrations worldwide are choosing this option and there are now numerous companies providing design services. This option may appear expensive but, compared to the training and employment of in-house staff, can be cheaper. Consideration needs to be given to DGAC authorization of contract design organizations, although many design companies have obtained approval in other economies (Australia; Canada; United States of America) and DGAC could choose to accept the accreditation granted by another economy;
4. **Increasing the working hours of current staff:** An immediate increase in production may be achieved by voluntarily increasing the working hours of current staff. Indications are that SENEAM design staff are willing to cooperate.

It is recommended that SENEAM establish priorities for design of PBN approaches and develop a year-by-year program covering all 60 airports, taking into account those already completed or near completion this year and based on a production rate of 12-13 airports per year for 2017-2020.

b) Action

SENEAM to ensure sufficient trained designers are available to meet the expected demand.

Action Element 10: SENEAM to Ensure Sufficient Design Staff

3.15. Flight Procedure Design Quality Assurance

a) Analysis

ICAO has published guidance for the management of IFP design quality in ICAO Doc 9906 *Quality Assurance Manual for Flight Procedure Design*. This document fully details the process of IFP design, including training of designers, procedure design quality

assurance and the validation of procedures. As this is a relatively recent publication Mexico, in common with many economies, has not yet implemented conforming quality assurance procedures.

SENEAM procedure design section does not have written processes in place for procedure design, quality assurance and their part in validation. While they perform quality assurance, they have no knowledge concerning procedure validation (ICAO Doc 9906). It is recommended that ICAO Doc 9906 *Quality Assurance Manual for Flight Procedure Design* is reviewed and conforming processes documented and implemented in compliance with the procedure design and validation oversight regulation to be developed by DGAC.

SENEAM procedure designers are also not familiar with the validation procedures published in ICAO Doc 9906 Volume 5. Designers should the review the validation process in Doc 9906 and if possible participate in relevant sections of the second phase of a Flight Validation Pilot Course.

b) Action

DGAC to include in a procedure design and validation oversight regulation the requirement for all design organisations (including third party design organisations) to implement written procedures conforming to ICAO Doc 9906;

SENEAM to document and implement quality assurance processes conforming to ICAO Pans Ops and Doc 9906;

SENEAM procedure designers to become familiar with the ICAO Pans Ops and Doc 9906 quality assurance (QA) provisions including Doc 9906 Volume 5 processes for validation of IFPs.

Action Element 9c: DGAC Develop Procedure Design Oversight Regulation: Quality Assurance

Action Element 11: SENEAM to Implement ICAO Procedure Design QA Provisions.

Action Element 12: SENEAM Ensure Procedure Designer Familiarity with ICAO QA Provisions.

3.16. Flight Procedure Design (Technical)

a) Analysis

ICAO currently adopts the chart title convention RNAV (GNSS) for RNP APCH procedures. Recognising that it is confusing to use RNAV in the title of an RNP procedure, a new titling convention is to be introduced using RNP for both RNP APCH and RNP AR

APCH charts. As Mexico has published few PBN approaches, it is opportune to adopt the new convention immediately rather than re-title many charts at some future date. If Mexico decides to adopt the new chart, title convention a circular must be published advising the industry of the proposed new charting convention prior to the implementation date.

b) Action

DGAC/SENEAM to adopt new ICAO RNP APCH titling convention.

Action Element 13: DGAC/SENEAM to adopt new ICAO RNP APCH Titling Convention

3.17. Flight Procedure Validation

a) Analysis

Flight Procedure Validation is the final step in the design of IFPs and is conducted after the design is completed and immediately prior to publication.

This phase is an important part of the quality assurance process, which ensures that the flight procedure is operationally sound and that all factors associated with the procedure have been assessed by a properly trained FVP and deemed fit for purpose. The requirement for validation is identified in PANS OPS, Volume 2 (Doc 8168). Guidelines for Validation, including Flight Validation, are provided in ICAO Doc 9906 *Quality Assurance Manual for Instrument Flight Procedure Design* Volume 5.

Doc 9906 is a relatively recent ICAO publication and Mexican authorities, in common with many similar authorities, are not conversant with the processes and have yet to implement conforming quality assurance processes.

The DGAC Flight Inspection Unit is assigned the task of flight validation in Mexico. The Unit is equipped with four Cessna Citation aircraft, two C500 and two C550. The avionics in these aircraft, while not able to validate all PBN operations, are adequate. Any lack of capability in the fleet can be supplemented by utilising full flight simulators that are available in Mexico City. The utilisation rate of unit aircraft is such that additional flight hours required for full PBN implementation can be met by the available Citation aircraft.

The staffing of the DGAC Flight Inspection Unit is sufficient to accommodate additional workload required for PBN implementation.

Two issues require attention:

1. Pilots in the DGAC Flight Inspection Unit have no training or experience in the conduct of PBN Flight Operations, and in particular PBN approach operations; and

2. Pilots in the DGAC Flight Inspection Unit have not been trained as FVPs in accordance with ICAO Doc 9906, Volumes 5 and 6.

The circumstances where pilots in Mexico are not trained in PBN operations is not surprising, given that, PBN approaches are currently only available at two airports and that PBN operations are not in general use in Mexico.

Flight Inspection Pilots routinely conduct simulator recurrent training in the U.S, and there is opportunity to undertake PBN training during, or as an add-on, to future scheduled simulator recurrent training. Alternatively, training could be conducted in Mexico, in the DGAC aircraft, by a qualified instructor from Simulflite or another provider with the required expertise. In this case, the instructor should be qualified and current in the aircraft type and avionics as well as PBN operations for the DGAC aircraft to be used for the training and for future flight validation of PBN procedures.

PBN operations may also be conducted in aircraft equipped with stand-alone receivers commonly installed in general aviation light aircraft (less than 5700 Kg) and, consequently, pilots who are to be trained as FVPs should also be familiar with operations using this type of equipment.

As publication of PBN approach procedures should not occur unless validated by qualified FVPs, immediate action to provide training for pilots of the DGAC Flight Inspection Unit is necessary. Following completion of initial training, FVPs should undergo supervised On-the-Job Training (OJT) under the supervision of an experienced FVP.

b) Action

Pilots in the DGAC Flight Inspection Unit to complete PBN Flight Operations Training;

Recurrent simulator training for pilots in the DGAC Flight Inspection to include PBN operations;

Pilots in the DGAC Flight Inspection Unit to complete a FVP course in accordance with ICAO Doc 9906 Vol 6;

Pilots in the DGAC Flight Inspection Unit to complete supervised OJT after completion of an initial FVP course.

Action Element 14: Flight Inspection Unit PBN Operations Training for Pilots: Initial

Action Element 14a: Flight Inspection Unit PBN Operations Training for Pilots: Recurrent

Action Element 15: Flight Validation Pilot Course for Flight Inspection Pilots

Action Element 15a: Flight Validation Pilot Supervised OJT

c) Recommendation

Pilots in the DGAC Flight Inspection Unit to complete familiarisation training in aircraft equipped with stand-alone GNSS receivers;

PBN training for pilots is detailed in SECTION 4: PBN STAFF TRAINING

3.18. Air Traffic Management (ATM) - Concept of Operations

a) Analysis

SENEAM has a very sound appreciation of PBN and proposals for PBN implementation are consistent with good practice and the achievement of the goals of efficient traffic management and reduction of emissions.

Although SENEAM is proposing action to accelerate PBN implementation, it is without the benefit of a concept of operations. A concept of operations should document the strategies that SENEAM intends to use in the transition to a PBN based structure. The concept of operations and associated strategic objectives should be included in the revised Mexico PBN Implementation Plan.

A concept of operations should include:

- The objectives of PBN Implementation including proposals for improvement in traffic management, reduction in emissions, and the safety of operations;
- The timeline for implementation;
- The basis for revising the domestic airways system including navigation specifications to be used;
- The basis for implementation of PBN SIDs and STARs at selected airports including the navigation specification and order of priority;
- The program for implementation of PBN approaches at all suitable airports including the types of approaches to be used (LNAV, LNAV/VNAV, LPV, RNP AR);
- An order of priority for approach procedure publication including the method for determining priority and arrangements to consult with other stakeholders;
- Proposals for mandating PBN capability, including dates and arrangements for coordination with DGAC, regional neighbours and industry;
- A CNS/ATM plan including proposals and timelines for navaid decommissioning and arrangements for informing the industry, consistent with any proposal to mandate PBN capability.

As the greater part of Mexico is within the United States WAAS coverage, LPV approach procedures should be published (in addition to LNAV and LNAV/VNAV) wherever viable,

providing high quality approach procedures with vertical guidance (APV) capability at as many runways as possible. However, the status of WAAS in Mexico is not clear. It is recommended, therefore, that SENEAM review the terms under which the WAAS signal is to be made available by the United States of America.

b) Action

SENEAM to develop a Concept of Operations appropriate to a GNSS based airspace system.

Action Element 16: SENEAM Concept of Operations

3.19. Air Traffic Management (ATM) - Airways

a) Analysis

Mexico reports that 54 RNAV routes have been published.

Some routes serving international traffic are designated RNP 10. RNAV 5 is presently the ICAO region agreed PBN navigation specification for domestic route structure; however, Mexico has little or no PBN domestic route structure. The applicable options for domestic route specifications are RNAV 5 and RNP 2. Historically the regional default has been RNAV 5 because RNP 2 did not exist. With RNP 2 now available and with the publication of new separation standards in ICAO Doc 4444 *Air Traffic Management*, opportunities now exist to modernise and improve efficiency in the Mexico airspace, by separation of routes by 15 nm in cruise and 7 nm in climb/descent by use of the RNP 2 specification or alternatively using RNAV 5 with a requirement for carriage of GNSS. Since RNAV 5 requires GNSS to receive benefit from these new standards, RNP 2 is the logical choice for an enroute navigation specification.

Any aircraft that is not RNP 2 capable will be able to navigate on RNP 2 or RNP 1 routes but ineligible for separation based on route spacing. As non-RNP 2 capable aircraft would be given lowest priority and (for example) would be less likely to be assigned their preferred level, there will be a financial incentive for operators to obtain RNP capability.

b) Action

SENEAM to assign RNP 2 Navigation Specification to domestic air routes;

SENEAM develop comprehensive plan for transition to a RNP 2 international and oceanic enroute structure.

Action Element 17: SENEAM ATM: Assign PBN Navigation Specifications

Action Element 17a: SENEAM ATM: Transition to PBN En route Structure

3.20. Air Traffic Management (ATM) - Terminal Procedures

a) *Analysis*

The effective use of PBN SIDs and STARs can significantly improve efficiency and reduce emissions.

RNAV 1 SID and STAR procedures have only been published at one airport in Mexico (Toluca, MMTO).

SENEAM procedure designers and senior managers have a good understanding of PBN arrival and departure design and proposed procedures have potential to deliver significant improvement in efficiency.

Several new PBN SID and STAR procedures are under development. Where possible, STARs are being designed for continuous descent operations (CDO) and SIDs designed for continuous climb operations (CCO).

SENEAM should in consultation with stakeholders develop a schedule for implementation of SIDs and STARs based on an order of priority and consideration of relevant factors such as traffic volume, weather, terrain, and other factors.

Since there are so few RNAV 1 procedures currently published, it is appropriate to designate existing and all new SIDs and STARs RNP 1 as soon as appropriate notice can be given to the aviation community.

b) *Action*

SENEAM to complete a schedule for the implementation of SID and STAR at all airports where needed;

SENEAM to consult with DGAC and stakeholders in determining the requirements and order of priority;

SENEAM to designate all SID/STAR procedures RNP 1.

Action Element 1i: Prepare PBN Plan: SENEAM/DGAC Develop Priority List

Action Element 17: SENEAM ATM: Assign PBN Navigation Specifications

3.21. Air Traffic Management (ATM) - Instrument Approaches

a) *Analysis*

Very few PBN approaches have been published in Mexico. No APV procedures that contribute to meeting the ICAO Resolution A37-11 goals have been published.

SENEAM has selected 22 airports out of approximately 60 airports served by air traffic control (ATC) within Mexico for the first phase of their PBN procedure design effort. Of the 22 airports currently identified, design work is in progress for 10 airports, of which five airports are near completion and ready for validation. Further progress on the five completed airports is now delayed until DGAC FVPs are trained.

It is recommended that SENEAM develop a program, including target dates, for PBN implementation at all airports. The program should include an assessment of priorities based on factors such as traffic density, existing approach procedures, weather, terrain, runway conditions, etc. The rollout program and priorities should be developed in consultation with all stakeholders.

Volaris has contracted with Airbus/Prosky to develop RNP AR APCH procedures at several airports. There is significant benefit to be gained by liaison between DGAC, SENEAM, Volaris and Prosky during the developmental phase. Experience in other economies is that early co-ordination can facilitate operational approval and costs associated with delays, retraining of crews, and re-design of procedures.

b) Action

SENEAM to complete a schedule for the implementation of PBN approaches at all airports;

SENEAM to consult with stakeholders in determining the requirements and order of priority.

Action Element 1i: Prepare PBN Plan: SENEAM/DGAC Develop Priority List

c) Recommendation

DGAC and SENEAM cooperate with airlines and designers during the development of RNP AR APCH procedures.

3.22. Air Traffic Management (ATM) - CNS/ATM

a) Analysis

SENEAM should conduct a study of CNS/ATM capability to be included in the PBN Implementation Plan. This should include a program with timeline for the decommissioning of navigation aids (navaids) not required as a back-up to PBN navigation. In Mexico, it would be appropriate to decommission all NDBs but to retain a minimum number of VORs and DMEs as a backup system in the unlikely event of a general loss of GNSS. ILS and/or new GLS landing systems should be retained and will not be replaced by PBN operations.

An assessment of the estimated cost savings to be expected should also be included in the PBN Plan.

The decommissioning of nav aids should be consistent with any proposal to mandate PBN capability.

b) Action

SENEAM to conduct a CNS/ATM Study to define requirements in a PBN based airspace system.

Action Element 1d: Prepare PBN Plan: SENEAM CNS/ATM Study

3.23. Air Traffic Management (ATM) - PBN Capability Mandate

a) Analysis

Mexico should consider and include in the PBN Plan a timeframe for mandating PBN capability (i.e. GNSS equipage) in Mexican Airspace.

A mandate has the advantage of enabling maximum PBN participation and achievement of benefits. It is clear that the majority of aircraft operating in Mexican airspace are modern and GNSS equipped and, therefore, able to comply with a mandate without significant expense.

b) Action

DGAC in consultation with SENEAM and the industry to mandate PBN capability on a schedule consistent with the New Mexico PBN Implementation Plan.

Action Element 18: DGAC to Mandate PBN Capability

3.24. Airlines

a) Analysis

As there are very few PBN procedures published in Mexico, air operators in general have only applied for operational approval for those navigation specifications they need for operations outside Mexico. One operator, Volaris, has engaged Airbus ProSky to develop RNP AR Approach procedures at two airports in Mexico and to assist them with the RNP AR operational approval application, which is under development.

The air operators are supportive of the government's PBN implementation efforts and can be expected to apply for approvals in greater numbers once they see that procedures will be available.

Operators reported dissatisfaction with the approval process, the main issues being delays in obtaining approvals, repeated requests for additional information, and unnecessary flight checking of basic PBN operations by FOIs. The operators also provided some examples of actual OPS SPECs they had been issued that indicate a lack of understanding of some finer points of PBN on the part of the DGAC. For example, DGAC issued an RNAV 2 approval to AeroMexico, but limited the approval to terminal areas only, meaning they could not fly the U.S. Q routes.

A proposal that DGAC issue clear guidelines for applicants was well supported by the air operators, who agree that this action will go a long way to improving the approvals process.

There is general agreement among operators that communication between operators and the DGAC needs to improve. Based on some examples given, this could be extended to include communication between operators and SENEAM. Overall, operators indicated enthusiastic support for timely PBN Implementation and a willingness to co-operate with the DGAC and SENEAM.

Operators should involve DGAC inspectors, especially FOIs, in development of their PBN capability and applications at an early stage. This is particularly relevant to the current project by Volaris to implement RNP AR approach procedures, in association with Airbus ProSky, at Tijuana and Guadalajara.

Volaris has contracted Airbus Prosky to develop RNP AR procedures. DGAC, in consultation with SENEAM, has reviewed the procedures and provided feedback to the airline concerning airspace/air traffic concerns and elements of procedure design that may not comply with ICAO criteria.

DGAC does not have a process in place for issuing waivers or exemptions to procedure design criteria. Although the Volaris procedures are being designed by a third party, the economy has ultimate authority and it is DGAC's responsibility to issue instructions regarding design standards and to approve any deviations.

It is necessary for all parties to work closely together to develop design solutions that meet the needs of both the operator and air traffic organisation. Consultation and a willingness to compromise are key to success, particularly in the early stages of implementation when all parties are inexperienced. Operators and ATC should not expect to "get it right" the first time and to anticipate changes as experience is gained.

Operators expressed strong support and enthusiasm for PBN implementation and expressed their willingness to support the DGAC and SENEAM in that effort wherever they could, including with simulator time and training, as needed.

b) Action

DGAC to review and publish requirements for PBN Operational Approval.

Action Element 5: DGAC Publish PBN Operational Approval Guidelines

c) Recommendation

DGAC adopts a policy of collaboration with operators at an early stage of the PBN Operational Approval process;

DGAC to encourage operators to submit applications for Operational Approval.

3.25. Military

a) Analysis

The Air Force has a fleet of aircraft that includes a number of types (e.g. B737NG, CASA 295, T-6C) that are capable of PBN operations. The Mexico Air Force has no current PBN experience but acknowledges that there is the opportunity to participate and to gain significant benefit from PBN. It is recommended that the Air Force participate in DGAC training programs where possible.

b) Recommendation

DGAC to assist Military operators to participate in PBN by sharing experience, providing technical advice and offering places in DGAC arranged training courses.

3.26. Airports

a) Analysis

Discussion with the airports focused on the Electronic Terrain and Obstacle Data (eTOD) requirements in Annex 15 and the importance of that data for PBN implementation. Only the old and New Mexico City International Airports were represented.

Airports are not well informed about their responsibilities regarding the provision of airport and obstacle data, specifically eTOD, in accordance with ICAO Annex 15. The operators were open to providing the data if required to by the DGAC.

DGAC has not established regulations relating to responsibility for eTOD.

The benefits of collecting eTOD and implementing PBN at the existing Mexico City airport were emphasised despite the expectation that it is scheduled to be closed in approximately 4 years.

The DGAC has a process for prior approval of new construction within 10 miles of airports, however the application, if approved, is retained as a paper file.

Airports are not required to provide the DGAC with eTOD data in accordance with ICAO Annex 15. The DGAC has assigned responsibility for compliance with Annex 15 to the Air Navigation Directorate and for Annex 14 to the Airports Directorate. Because of this division of responsibility, the Airports Directorate, the organization within DGAC that deals with airports, has not required airports to provide eTOD data. The importance of good obstacle data to the procedure design process was emphasized. Notwithstanding the availability of eTOD, the importance to the procedure designer of surveyed WGS-84 coordinates for the runway ends is emphasized. Options were discussed for the Airports and Air Navigation Directorate to work together on the eTOD issue.

Responsibility for area 2, 3 and 4 data should be transferred to the Airports Directorate. The Airports Directorate needs to amend airport regulations to require airport operators to provide eTOD Area 2, 3 and 4 data in accordance with Annex 15 as a condition of certification. Recognizing that collection of this data can be expensive, this regulation should provide a means for the airport to request waivers of portions of the requirement based on suitable justification. For example, the size of the Area 2d data collected could be reduced based on the anticipated needs for procedure design and technical capabilities of the collection method.

The Directorate of Air Navigation should retain responsibility for Area 1 data and work with the economy's mapping agency to determine the suitability of their existing data to meet the Area 1 requirement and work toward eventual full compliance with the Annex 15 Standards and Recommended Practices (SARP).

DGAC Airports Directorate now maintains an Excel database of approved obstacles, which is available to procedure designers. Collection of eTOD is an important safety initiative that is only partially met if the data is not made available to the international community. The international standard for sharing this data is AIXM 5.1. In order to maximize use by procedure designers, avionics manufacturers and others, the DGAC should work with SENEAM to include the electronic database of all approved and known obstacles, as well as all available eTOD, in the SENEAM AIXM 5.1 database project.

b) Action

DGAC to regulate responsibility for the control of obstacles in the vicinity of airports (Annex 14) and the compilation of Electronic Terrain and Obstacle Data (eTOD) required under Annex 15

DGAC to include building application data and all available eTOD in AIXM database

Action Element 19: Annex 15 eTOD

Action Element 19a: Airports Directorate responsibility for eTOD

Action Element 19b: Airports to be required to collect eTOD

Action Element 19c: Area 2 and 4 eTOD

Action Element 19d: Area 1 eTOD

Action Element 19e: Incorporate eTOD in AIXM Database

Action Element 20: Convert the obstacle database to AIXM

3.27. Infrastructure

a) Analysis

One of the significant benefits of PBN implementation is the utilisation of aircraft on-board capability independent of any ground-based infrastructure. Consequently, many of the existing navigation aids in Mexico will become redundant and can be decommissioned with consequent significant cost savings.

Where APV procedures (LNAV/VNAV, LPV or RNP AR) are implemented, a local source of barometric pressure is required. This requirement can be met at non-towered airports by installing an automatic weather system with VHF broadcast facility in those locations, or the use of accredited ground observers to pass accurate barometric pressure to aircraft.

b) Action

DGAC and SENEAM to include in PBN Implementation planning arrangements for the provision of accurate local barometric pressure information

Action Element 21: Provision of Local Barometric Pressure for PBN Instrument Approach Operations

SECTION 4: PBN STAFF TRAINING

4.1. PBN Staff Training

Good training is the necessary foundation for a professional aviation work force. Training is also one of the most important elements of quality assurance. To ensure a properly trained pipeline of staff to design and implement PBN flight procedures it is recommended that the DGAC establish standards for the required competency level for each discipline. Each organisation with responsibilities for PBN implementation should develop a written training program that ensures staff are trained to the required competency level.

The training program for every discipline should include initial, recurrent/refresher and on-the-job (OJT) training. The DGAC should ensure that the training programs result in training to the required competency level.

The following addresses the primary tasks that are involved in PBN procedure design and implementation. Action Elements referred to later in this report address all the initial training needed, as well as known recurrent training required. Provided the required resources are allocated for staffing and training, the following PBN and PBN-related training will provide adequate qualified staff throughout the implementation period and beyond.

Regulatory		
Position	Type of Training	Training Subject
Selected Standards staff that write PBN policy and regulation	Initial	PBN Operational Approval
Selected Standards staff that write PBN policy and regulation	Recurrent	PBN, Operational Approval, new or amended ICAO & DGAC guidance
Flight Operations Inspector	Initial	PBN Operational Training
Flight Operations Inspector	Recurrent	PBN Operational Training
Flight Operations Inspector	Initial	PBN Operational Approval
Flight Operations Inspector	Recurrent	PBN, Operational Approval, new or amended ICAO & DGAC guidance
Flight Operations Inspector	OJT	PBN Operational Approval
Airworthiness Inspector (selected)	Initial	PBN Operational Approval

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Regulatory (continued)		
Position	Type of Training	Training Subject
Airworthiness Inspector (selected)	Recurrent	PBN, Operational Approval, new or amended ICAO & DGAC guidance

Validation		
Position	Type of Training	Training Subject
Flight Validation Pilot	Initial	PBN Operational Training
Flight Validation Pilot	Recurrent	PBN Operational Training
Flight Validation Pilot	Initial	Flight Validation Pilot
Flight Validation Pilot	Recurrent	PANS OPS
Flight Validation Pilot	Recurrent	PBN, new or amended ICAO & DGAC guidance
Flight Validation Pilot	OJT	Flight Validation Pilot

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Procedure Design		
Position	Type of Training	Training Subject
Procedure Designer	Initial	PANS OPS Procedure Design, PBN & Conventional
Procedure Designer	OJT	PANS OPS Procedure Design, PBN & Conventional
Procedure Designer	Recurrent	PANS OPS Procedure Design, PBN & Conventional
Procedure Designer	Initial	Validation segment of FVP Training
Procedure Designer	Recurrent	PBN, new or amended ICAO & DGAC guidance
Procedure Designer	Initial	PANS OPS/Doc 9905 RNP AR Procedure Design

Air Traffic Control		
Position	Type of Training	Training Subject
Air Traffic Controller	Initial	PBN Familiarization
Air Traffic Controller	Recurrent	PBN, new or amended ICAO & DGAC guidance
Air Traffic Controller (where required)	Initial	PBN Familiarization: RNP AR specific

4.2. PBN Operations Flight Training

Reference is made to Section 3 GAP ANALYSIS OF PBN IMPLEMENTATION STATUS to PBN training for DGAC pilots. Details of the training courses required are included in this section.

PBN Operations flight training is required for the following persons:

- Selected DGAC FOIs who are responsible for evaluation of applications for PBN Operational approval;

- Pilots in the DGAC Flight Inspection Unit who are to be tasked with Flight Validation duties.

Two classes of PBN Operations are relevant.

- a) For persons responsible for oversight of the major carriers operating FMS equipped aircraft (e.g. B737/A320) training could be managed by arrangement with operators experienced in PBN operations. Training can be “on-the-job” and gained by participating or observing operator flight crew training, which is part of the normal duty for FOIs.
- b) Pilots responsible for oversight of operators of smaller general aviation aircraft not equipped with FMS require more detailed training due to the characteristics of the “stand-alone” receivers installed in this class of aircraft.

It is understood that some flight training organisations in Mexico may have the ability to provide this type of training. If local training is not available, the appropriate training is commonly available at any flight training school in the United States of America where this type of operation has been in use for nearly 20 years. A typical course of training will involve classroom study and 5 to 10 hours’ flight training in a light aircraft and/or fixed base simulator. Course duration can be expected to be 1 to 2 weeks.

4.3. PBN Operational Approval Training

PBN Operational Approval training is required for the following personnel:

- Selected persons in the Standards Department (Departamento de Normas) responsible for developing and maintaining PBN operating rules. (2 estimated);
- Selected persons in the Engineering and Operations Department (Depto de Ingenieria de Operaciones) responsible for administering PBN Operational Approvals (8 estimated);
- Flight Operations (Direccion de Control) Inspectors (pilots) responsible for evaluating applications for operational approvals (20 estimated).

As an estimated 30 or more persons are likely to require training, it is suggested that a course is conducted in Mexico. Some places in the class should also be offered to air operator senior or technical pilots.

PBN Operational Approval courses are conducted on request by ICAO. Courses are usually of 1-week duration and all course work is conducted in the classroom. It is recommended that attendees have experience in PBN operations prior to attending.

4.4. Flight Validation Pilot Training

FVP training is required by the following personnel.

- Pilots in the DGAC Flight Inspection Unit (Direccion de Verificacion Aeroportuaria);

- Selected DGAC Flight Operations (Direccion de Control) Inspectors (pilots) who are responsible for the oversight of PBN operations and IFPs, especially RNP AR;
- Procedure designers from both DGAC and SENEAM should attend the validation portion of the course, in order to have a complete understanding of the validation process.

FVP training should be conducted in accordance with ICAO Doc 9906 *Quality Assurance for Instrument Flight Procedure Design* Volumes 5 and 6.

Pilots attending this course should be qualified and experienced in PBN operations including RNP APCH and/or RNP AR APCH. It is recommended that DGAC pilot inspectors planning to attend FVP training seek the co-operation of Mexican air operators who have relevant experience in order to gain the required experience in PBN operations.

FVP training involves three elements. As FVP responsibility involves the operational evaluation of instrument arrival, approach and departure procedures, a basic understanding of the principles of IFP design (ICAO Doc 8168) is necessary. This classroom module typically involves approximately 2 weeks' classroom training.

A second classroom/simulator module, typically of about 5-6 days' duration, covers the conduct of validation (including flight validation). Material to be covered is detailed in ICAO Doc 9906, Volumes 5 and 6.

The third element of FVP training is supervised on-the-job training (OJT). It is recommended that OJT be conducted by a highly qualified, experienced FVP mentoring and advising new FVPs through the entire validation process on real procedures until they meet the desired level of proficiency in validation tasks. This could best be achieved initially by waiting until there are a number of procedures ready for validation then bringing in an expert for 1-2 weeks to provide OJT to some of the FVPs who have attended the FVP course. Depending on their progress, this may or may not need to be repeated. Once some FVPs are fully qualified they should be able to provide OJT to other FVPs in the Flight Inspection Unit.

ICAO conducts infrequent FVP courses based on demand. It is recommended that DGAC contact the ICAO NACC Regional Office RO/ATM as soon as practical to arrange a course. DGAC may consider hosting a course in Mexico, inviting participants from other Latin and South American economies, as it can be expected that other authorities in the region are also in need of FVP training. Convening a course in Mexico is likely to be less expensive than sending individual pilots overseas for training.

The Ambidji Team has informally advised the ICAO NACC Regional Office RO/ATM to expect a request from DGAC for PBN Operational Approval and FVP courses.

SECTION 5: ACTION PLAN AND ACTION ELEMENTS

5.1. General

In Section 3 GAP ANALYSIS OF PBN IMPLEMENTATION STATUS a number of **Actions** are identified which are required to implement PBN in Mexico.

An **Action Plan** (see below) provides a chronological order for implementation of those Actions, based on the Ambidji Team's assessment of capability and discussions with relevant stakeholders.

To supplement the action plan, each action is supported by one or more **Action Elements**. Each action element assigns a task or group of tasks to a single responsible person or department. The responsible agency is able to clearly identify which elements are relevant to their organization and to "tear off" the applicable sheet that gives the necessary information for that action to be completed and implemented.

In this way the responsibility for completion of the many individual elements of PBN Implementation is clearly identified and progress co-ordinated and monitored to achieve the Action Plan objectives.

An Action Element index is included at paragraph 5.3 while the various Action Element task sheets are included at Appendix H.

5.2. Proposed Action Plan

The Ambidji Team has prepared a high level Action Plan that prioritizes the remedial actions required in time order. This section summarizes the Actions required. The dates referenced in the action items represent the intentions of the various agencies *at the time of discussion during the second site visit*. To the credit of the stakeholders concerned, action on some items commenced immediately and, consequently, several target dates predate the publication date of this report.

- 1. Actions to be undertaken with immediate effect:** DG of the DGAC takes charge of PBN implementation:
 - Meet directly with Director General SENEAM on the subject of working together to achieve PBN implementation
 - Jointly with President-Director SENEAM appoint a PBN Task Force, reporting regularly to him, and responsible to develop and execute the PBN Implementation Plan
 - Make their directors responsible and accountable for their organizations' roles in PBN implementation
 - Make required resources available

2. Actions to be completed by 31/12/2016:

- Revise and publish Mexico's PBN Implementation Plan including supporting tasks;
 - Identify strategic objectives
 - List assumptions & constraints
 - Fleet Capability Review;
 - CNS/ATM Capability Review;
 - Determine implementation targets
 - Assess expected benefits of PBN
 - Safety Assessment;
 - SENEAM Concept of Operations.
 - Develop priority list.

- Issue Aeronautical Information Circular informing aviation community of major future events in the revised plan;
 - 30/06/2017: Implement RNP 1 replacing RNAV 1, and RNP 2 replacing RNAV 5 for domestic enroute,
 - 30/06/2017: Implement RNP naming in lieu of RNAV(GNSS) for approach
 - By 31/12/2017: RNP 2 routes will be published between city pairs
 - 31/12/2018: Implement RNP 2 to replace RNAV 10 on Oceanic routes
 - 2017-2021: Publish PBN approaches to 12 or more airports per year, see SENEAM website for schedule
 - 2017-2020: Publish RNP 1 SIDs and STARs at 22 airports at a rate of 5-6 per year, see SENEAM website for schedule
 - 31/12/2019: Mandate RNP 1
 - 31/12/2021: Mandate RNP 2 for all enroute, and mandate RNP APCH

- Update AIC CO AV-11/09 to latest edition of PBN Manual
- Organize recommended pilot training for 1st quarter, 2017. Includes PBN operations, FVP, Operational Approval
- Resolve "use of WAAS" issue
- SENEAM to address requirement for additional procedure design capability
- Develop website, accessible by the public, on SENEAM site with information on progress against the PBN procedure goals and schedule of airports to get new PBN procedures

- Begin coordination in international fora for implementation of RNP 2 on international routes:
- Set service level requirements for various PBN-related actions, for example:
 - Complete applications from operators for PBN operational approval will be processed by DGAC within 60 days
 - Procedures received for validation by Flight Inspection Unit will be validated within 45 days unless rework is required

3. Actions to be completed by 31/03/2017:

- Complete all recommended training for 1st quarter, 2017. Includes PBN operations, FVP, Operational Approval
- Complete other updates to rules and regulations. Includes eTOD, procedure design oversight, periodic review of procedures, waivers to procedure design criteria
- Coordinate with data houses (Jeppesen, Lido) on exact AIRAC cycle to publish name change for RNAV 1 and RNAV(GNSS) procedures
- Quarterly review of progress against procedure design targets

4. Actions to be completed by 30/06/2017:

- Publish first RNP 2 domestic City-Pair route
- Publish all existing RNAV 1 procedures as RNP 1
- Publish change of name of all existing RNAV (GNSS) procedures to RNP, along with other required charting changes
- Publish first batch of PBN approaches, including those developed in 2016
- Quarterly review of progress against procedure design targets

5. Actions to be completed by 30/09/2017:

- Quarterly review of progress against procedure design targets.

6. Actions to be completed by 31/12/2017:

- Continue domestic airway route redesign with RNP 2
- Publish PBN approaches at all International Airports by priority list
- Implement RNP 1 SID and STAR at high traffic international airports
- Complete new fleet capability study
- Annual review of progress against PBN Plan targets
- Implement periodic review of published procedures

7. Actions to be completed by 31/12/2018:

- Complete domestic airway route redesign with RNP 2
- Implement RNP 2 to replace RNAV 10 on oceanic routes and on international routes
- Mandate RNP 2 capability in domestic airspace
- Mandate RNP 1 for terminal area operations
- Publish SID and STAR at remaining international airports (where required)
- Publish PBN approaches at all high priority domestic airports by priority list
- Annual review of progress against PBN Plan targets

8. Actions to be completed by 31/12/2019:

- Publish PBN approaches at all airports with IFR traffic by priority list
- Mandate RNP 1
- Publish SID and STAR at airports with regular commercial service (where required)
- Complete collection of eTOD at certified airports
- Update plan for helicopter PBN operations
- Annual review of progress against PBN Plan targets

9. Actions to be completed by 31/12/2020:

- Publish PBN approaches at all airports with IFR traffic by priority list.
- Publish SID and STAR at remaining airports (where required)
- Annual review of progress against PBN Plan targets

10. Actions to be completed by 31/12/2021:

- Publish PBN approaches at all remaining airports with IFR traffic.
- Complete all elements of 2016 PBN Implementation Plan
- Complete AIXM database with eTOD available for use
- Mandate RNP 2 for all enroute
- Mandate RNP APCH
- Annual review of progress against PBN Plan targets

5.3. Action Elements Index (refer Appendix H)

Action No	Topic	Paragraph No.
1	Prepare PBN Plan	3.4
1a	Prepare PBN Plan: Identify Strategic Objectives	3.4
1b	Prepare PBN Plan: List Assumptions & Constraints	3.4
1c	Prepare PBN Plan: DGAC Conduct Fleet Study	3.4
1d	Prepare PBN Plan: SENEAM CNS/ATM Study	3.4, 3.22
1e	Prepare PBN Plan: Determine Implementation Targets	3.4
1f	Prepare PBN Plan: DGAC Assess Expected Benefits of PBN	3.4
1g	Prepare PBN Plan: DGAC & SENEAM to Assign Responsibility	3.4
1h	Prepare PBN Plan: DGAC/SENEAM to Conduct Safety Study	3.4
1i	Prepare PBN Plan: SENEAM/DGAC Develop Priority List	3.4, 3.20, 3.21
2	DGAC/SENEAM Leadership Initiatives: Implement Management Structure	3.4, 3.6
2a	DGAC/SENEAM Leadership Initiatives: Establish PBN Task Force Structure	3.4, 3.6
2b	DGAC/SENEAM Leadership Initiatives: Manage Cultural Change	3.4, 3.7
3	DGAC Update PBN Operating Rules	3.4, 3.8
4	PBN Operational Approval Training for Depto de Normas	3.4, 3.8
5	DGAC Publish PBN Operational Approval Guidelines	3.4, 3.9, 3.24
6	PBN Training for FOIs: Initial Group	3.4, 3.10
6a	PBN Training for FOIs: all DGAC FOIs	3.10

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Action No	Topic	Paragraph No.
7	PBN Operational Approval Training	3.4, 3.10
7a	PBN Operational Approval Training: Incorporate in Initial FOI Training	3.10
8	PAN OPS Training for DGAC Air Navigation Inspectors	3.4, 3.11
9	DGAC Develop Procedure Design Oversight Regulation	3.4, 3.11
9a	DGAC Develop Procedure Design Oversight Regulation: Exemptions to Criteria	3.12
9b	DGAC Develop Procedure Design Oversight Regulation: Periodic Review of IFP	3.13
9c	DGAC Develop Procedure Design Oversight Regulation: Quality Assurance	3.4, 3.15
10	SENEAM to Ensure Sufficient Design Staff	3.4, 3.14
11	SENEAM to Implement ICAO Procedure Design QA Provisions	3.4, 3.15
12	DGAC/SENEAM Ensure Procedure Designer Familiarity with ICAO QA Provisions	3.4, 3.15
13	DGAC/SENEAM Adopt New ICAO RNP APCH Titling Convention	3.4, 3.16
14	Flight Inspection Unit PBN Operations Training for Pilots: Initial	3.4, 3.17
14a	Flight Inspection Unit PBN Operations Training for Pilots: Recurrent	3.17
15	Flight Validation Pilot Course for Flight Inspection pilots	3.4, 3.17
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16	SENEAM Concept of Operations	3.4, 3.18
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17a	SENEAM ATM: Transition to PBN Enroute Structure	3.4, 3.19

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Action No	Topic	Paragraph No.
18	DGAC to Mandate PBN Capability	3.4, 3.23
19	Annex 15 eTOD	3.4, 3.26
19a	Airports Directorate Responsibility for eTOD	3.4, 3.26
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19c	Area 2 and 4 eTOD	3.26
19d	Area 1 eTOD	3.26
19e	Incorporate eTOD in AIXM Database	3.26
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21	Provision of Local Barometric Pressure for PBN Instrument Approach Operations	3.4, 3.27

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APPENDIX B	ICAO PBN Implementation Plan Template
APPENDIX C:	Terms of Reference
APPENDIX D:	Questionnaire
APPENDIX E:	Site Visit 1 Report
APPENDIX F:	Site Visit 2 Report
APPENDIX G:	Summary of Best Practice
APPENDIX H	Action Element Task Sheets

APPENDIX A

ICAO Resolution A37-11

Resolution A37-11: Performance-based navigation global goals

Whereas a primary objective of ICAO is that of ensuring the safe and efficient performance of the global Air Navigation System;

Whereas the improvement of the performance of the air navigation system on a harmonized, worldwide basis requires the active collaboration of all stakeholders;

Whereas the Eleventh Air Navigation Conference recommended that ICAO, as a matter of urgency, address and progress the issues associated with the introduction of area navigation (RNAV) and required navigation performance (RNP);

Whereas the Eleventh Air Navigation Conference recommended that ICAO develop RNAV procedures supported by global navigation satellite system (GNSS) for fixed-wing aircraft, providing high track and velocity-keeping accuracy to maintain separation through curves and enable flexible approach line-ups;

Whereas the Eleventh Air Navigation Conference recommended that ICAO develop RNAV procedures supported by GNSS for both fixed- and rotary-wing aircraft, enabling lower operating minima in obstacle-rich or otherwise constrained environments;

Whereas Resolution A33-16 requested the Council to develop a programme to encourage States to implement APV utilizing such inputs as GNSS or distance-measuring equipment (DME)/DME, in accordance with ICAO provisions;

Recognizing that not all airports have the infrastructure to support APV operations and not all aircraft are currently capable of APV; Recognizing that many States already have the requisite infrastructure and aircraft capable of performing straight-in approaches with lateral guidance (LNAV approaches) based on the RNP specifications and that straight-in approaches provide demonstrated and significant safety enhancements over circling approaches;

Recognizing that the Global Aviation Safety Plan has identified Global Safety Initiatives (GSIs) to concentrate on developing a safety strategy for the future that includes the effective use of technology to enhance safety, consistent adoption of industry best practices, alignment of global industry safety strategies and consistent regulatory oversight;

Recognizing that the Global Air Navigation Plan has identified Global Plan Initiatives (GPIs) to concentrate on the incorporation of advanced aircraft navigation capabilities into the air navigation system infrastructure, the optimization of the terminal control area through improved design and management techniques, the optimization of the terminal control area through implementation of RNP and RNAV SIDs and STARs and the optimization of terminal control area to provide for more fuel efficient aircraft operations through FMS-based arrival procedures; and

Recognizing that the continuing development of diverging navigation specifications would result in safety and efficiency impacts and penalties to States and industry;

Noting with satisfaction that planning and implementation regional groups (PIRGs) have completed regional PBN implementation plans; and

Recognizing that not all States have developed a PBN implementation plan by the target date of 2009;

The Assembly:

1. *Urges* all States to implement RNAV and RNP air traffic services (ATS) routes and approach procedures in accordance with the ICAO PBN concept laid down in the *Performance-based Navigation (PBN) Manual* (Doc 9613);
2. *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;
 - b) ICAO develop a coordinated action plan to assist States in the implementation of PBN and to ensure development and/or maintenance of globally harmonized SARPs, Procedures for Air Navigation Services (PANS) and guidance material including a global harmonized safety assessment methodology to keep pace with operational demands
3. *Urges* that States include in their PBN implementation plan provisions for implementation of approach procedures with vertical guidance (APV) to all runway ends serving aircraft with a maximum certificated take-off mass of 5 700 kg or more, according to established timelines and intermediate milestones;
4. *Instructs* the Council to provide a progress report on PBN implementation to the next ordinary session of the Assembly, as necessary;

**ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE
BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)**

5. Requests the Planning and Implementation Regional Groups (PIRGs) to include in their work programme the review of status of implementation of PBN by States according to the defined implementation plans and report annually to ICAO any deficiencies that may occur; and
6. Declares that this resolution supersedes Resolution A36-23.

APPENDIX B

ICAO PBN State Implementation Plan Standard Template



Performance Based Navigation (PBN) State Implementation Plan Standard Template

International Civil Aviation Organization

Instructions

[This document is an example template of a State PBN Implementation Plan and provides step-by-step guidance to States on how to establish their own national plan in a standard consistent way in relation to Assembly Resolutions, ICAO SARPs, GANP, GASP, Regional plans and other related documents.

The requirement for a State PBN Implementation Plan is detailed in Assembly Resolution 37-11.

In developing a State Implementation Plan, it is essential that all aviation stakeholders are involved. This is a collaborative exercise, and input from the airspace users is key to developing an effective and achievable plan. (See Doc 9992).

This template includes, boilerplate text, and fields that should be replaced with the values specific to the State PBN Implementation Plan.

- **Blue** italicized text enclosed in square brackets ([text]) provides instructions to the document author, including explanation on the intent, assumptions and context for content that should be included in this document.
- Text and tables in **Black** are provided as boilerplate examples of wording and formats that may be used or modified as appropriate to a specific plan. These are offered only as suggestions to assist in developing planning documents; they are not mandatory formats.

When using this template for your PBN Implementation Plan, it is recommended that you follow these steps:

1. *Modify boilerplate text as appropriate to address the State's own requirements.*
2. *Add extra chapters and sections which are not included in the template to provide more detailed information or to address specific State issues.*
3. *Complete the chapters and sections that the template contains as these are mandatory fields to be filled.]*

ICAO Reference documents:

*Assembly Resolution A37-11
Global Air Navigation Plan (GANP)
Performance-based Navigation (PBN) Manual (Doc 9613)
Procedures for Air Navigation Services — Air Traffic Management (PANS-ATM, Doc 4444)
Procedures for Air Navigation Services — Aircraft Operations (PANS-OPS, Doc 8168)
Continuous Descent Operations (CDO) Manual (Doc 9931)
Continuous Climb Operations (CCO) Manual (Doc 9993)
Manual on the Use of Performance-based Navigation (PBN) in Airspace Design (Doc 9992)
PBN Business Case Development guidance (TBD)*

SUMMARY OF AMENDMENTS

Date	Amendment #	Name	Signature

EXECUTIVE SUMMARY

[This section provides a summary of the key points of the plan including the actions to be taken by all stakeholders.]

It should briefly describe:

- *the purpose of the plan*
- *the key stakeholders that were involved;*
- *the strategic objectives, ,*
- *the airspace affected, ,*
- *the benefits that are expected and;*
- *the final end state to be achieved.*

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(Insert here)

[List the specifics as per the template format (State can add more if required)]

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Appendices [add as required]

A A37-11 Resolution

B. PBN Implementation Schedule for en-route, terminal and approach

C. References

Glossary of Definitions/Acronyms/Abbreviations

The following table provides definitions and explanations for terms and acronyms relevant to the content presented within this document.

Term	Definition
<i>[Insert Term]</i>	<i><Provide definition of term and acronyms used in this document.></i>
ANSP	Air Navigation Service Provider
APCH	Approach
ATM	Air Traffic Management
CNS	Communication, Navigation, Surveillance
GANP	Global Air Navigation Plan
GASP	Global Air Safety Plan
ICAO	International Civil Aviation Organization
NAVAID	Navigation Aid
PBN	Performance-based navigation
RNAV	Area Navigation
RNP	Required Navigation Performance
SARPs	Standards and Recommended Practices
SID	Standard Instrument Departure
STAR	Standard Terminal Arrival

CHAPTER 1

OVERVIEW

1.1 BACKGROUND

[This subsection provides an overall system overview, any requirements to implement the system. This section should be completed at a very high level. It may be as long as necessary, but most information should be contained in a half of a page. This section is intended to provide the background information necessary to indicate the process that the system has been going through from past to present.]

1.2 PURPOSE

[This subsection describes the purpose of the plan and identifies the system to be implemented.]

1.3 STRATEGIC OBJECTIVES

[Describe objectives of the State PBN Implementation Planning.]

- *[Insert description of the first objective. (For example -Efficiency and capacity – implementation of PBN routes, RNP SIDs and STARs, Terminal airspace redesigns)]*
- *[Insert description of the second objective (For example – Safety – implementation of RNP APCH procedures with vertical guidance, straight-in approach procedures).]*
- *[Add additional objectives as necessary (For example reduced environmental impact, reduction in ground-based navigation aids, etc)]*

Examples of Strategic objectives include:

- Achieve a total performance-based area navigation environment with defined ICAO PBN Navigation Specification designator values for all operations and airspaces;
- Address current and forecast airspace capacity and operational efficiency issues through application of the ICAO PBN concept;
- Maximize the use of current and emerging navigation (GBAS and SBAS), air traffic management and aircraft avionics systems
- Utilize PBN to reduce environmental impact from aviation through more efficient operations that result in a less fuel burn and noise emissions

1.4 ASSUMPTIONS

[This subsection describes the assumptions made regarding the development and execution of this document as well as the applicable constraints. It is useful to identify the most important assumptions in the State Implementation Plan to test these assumptions and to accommodate these unexpected outcomes. Some items to consider when identifying the assumptions and constraints are:

- *Capacity and efficiency*
- *Infrastructure and equipment*
- *Airspace*
- *Aircraft equipage*
- *Environmental factors,*
- *Existing and emerging Technology ...]*

CHAPTER 2

Performance-based Navigation (PBN)

2.1 PBN CONCEPT

[This section is provided to describe the general PBN Concept, show that the concept is fully understood, and explain how it will be implemented by the State,. PBN sets clear performance requirements for flight operations. PBN involves a major shift from conventional ground based navigation and procedures to satellite based navigation and area navigation procedures. Details can be found in Doc 9613 and Doc 9992]. Example text follows:

The PBN Concept is based on a shift from sensor-based navigation to performance based. The PBN concept specifies that aircraft area navigation system performance is defined in terms of accuracy, integrity, continuity and functionality. It explains and describes the performance-based RNAV and RNP navigation specifications that can be applied to oceanic, enroute and terminal airspace, to improve safety, efficiency and capacity, as well as reduce the environmental impact. These specifications also detail the navigation sensors and equipment necessary to meet the performance requirement.

The application of a PBN specification depends on many factors – the navigation infrastructure, communications capability, surveillance capability, the operational requirement, the aircraft fleet capability and operational approvals, etc. In determining which PBN specification to apply, these factors must be taken into consideration in consultation with all stakeholders.

For [state the Country], the application of the PBN concept is important mainly for [explain the main reasons – safety (procedures with vertical guidance), efficiency, capacity, environment, redundancy, etc]

2.2 CURRENT IMPLEMENTATION STATUS

[This subsection provides information with respect to the current status of RNAV and RNP operations for different phases of flight in the State.]

2.2.1 Oceanic, Remote and Continental Enroute

2.2.2 Terminal Areas (SIDs and STARs)

2.2.3 Approach

2.2.4 Helicopter Operations

2.2.5 Military Operations

[Use of a table is recommended]

2.3 PBN APPROACHES WITH AND WITHOUT VERTICAL GUIDANCE

[This subsection provides information on the importance of instrument approach procedures with vertical guidance and on the current status of APV implementation] *[[This can also be covered under PBN Status under 2.2.3, if preferred.]*

PBN facilitates the implementation of instrument approaches with vertical guidance (APV) to all runway ends. This has a significant safety impact, as non-precision approaches (dive and drive) with no vertical guidance can be removed. It has been proven that approach procedures with vertical guidance are 25% safer than procedures with no vertical guidance. Furthermore, PBN facilitates the design and implementation of APV to runways that do not currently have an approach capability, thus improving airport accessibility and flight operations efficiency.

Therefore, [state Country, in collaboration with the airspace users] places a high priority on the design and implementation of PBN approach procedures with vertical guidance in concert with Assembly Resolution A37-11, to improve both safety and efficiency.

2.4 AIRCRAFT FLEET CAPABILITIES

[This subsection is provided to show the current PBN capability of aircraft flying within and over the State airspace and the traffic forecast over the timeframe of the plan, as this is essential for the development of the plan..]

2.5 CNS/ATM CAPABILITIES

[This subsection is provided to show the current status of Ground and Space based NAVAIDs, Communications and ATM infrastructure that the State has already established and which enables the implementation of PBN.]

2.6 BENEFITS OF PBN AND GLOBAL HARMONIZATION

[This subsection describes the benefits that the State is planning to achieve from the implementation of PBN and the cooperation with the other national, regional and international stakeholders in line with GASP, GANP and regional plans.]

PBN offers a number of advantages over the sensor-specific method of developing airspace and obstacle clearance criteria. For example:

- a) It reduces the need to maintain sensor-specific routes and procedures and their associated costs (e.g. VOR, NDB, DME);*
- b) Enhances safety by allowing for straight-in approach procedures with vertical guidance as a primary approach or back up to existing precision approach procedures;*
- c) Improves airport accessibility under all weather conditions;*
- d) Allows for more efficient use of airspace, thus increasing capacity;*

- e) Improves operational efficiency through user preferred routings, reduced delays and holds, and enables continuous descent and continuous climb operations;
- f) Lessens the environmental impact by contributing to reduced aircraft fuel burn and noise emissions

For [state Country], the main focus is on [explain the main benefits that the State wants to achieve and how this relates to harmonization within the region]

CHAPTER 3

IMPLEMENTATION CHALLENGES

3.1 SAFETY

[This subsection describes what kind of challenges States face and what measures have been taken for the safe operations during the transition to PBN operations.]

3.2 AIRCRAFT FLEET EQUIPMENT

[This subsection describes the existing aircraft fleet capability for the air operators that transit the State airspace (fly in, out, and over) and the air operators that fly solely within the State airspace against the PBN concept.]

3.3 INFRASTRUCTURE

[This subsection describes the challenges with respect to the equipment and infrastructure which are essential requirements for the implementation of PBN concept.]

3.4 EFFICIENCY and CAPACITY

[This subsection shows how the new system will help the State through the increase in the capacity and efficiency to meet the demand in the aviation sector.]

3.5 ENVIRONMENT (NOISE and EMISSIONS)

[This subsection shows the environmental challenges and how the PBN Concept will help State reduce the environmental effect of operations.]

3.6 REGULATORY

[This subsection shows the regulatory changes that may be necessary and the timelines to implement in order to facilitate implementation of the PBN Concept.]

3.7 RESOURCES

[This subsection identifies any additional resources that are required to facilitate implementation of the PBN concept.]

3.8 AIR NAVIGATION SERVICE PROVIDER

[This subsection identifies any issues that may need to be addressed with the ANSP. It may include ATCO training, procedure design training, etc.]

CHAPTER 4

IMPLEMENTATION

[This section provides the targets and schedule for these targets to be accomplished in the short, medium and long term. It is recommended that the minimum time for each term is 3 years – State can assign a longer period if it so desires]

4.1 SHORT TERM (Show applicable years – e.g. 2016-2019)

4.1.1 Oceanic, Remote and Continental Enroute

4.1.2 Terminal Areas (SIDs and STARs)

4.1.3 Approach

4.1.4 Helicopter Operations

4.1.5 Military Operations

4.2 MEDIUM TERM (Show applicable years – e.g. 2020-2023)

4.2.1 Oceanic, Remote and Continental Enroute

4.2.2 Terminal Areas (SIDs and STARs)

4.2.3 Approach

4.2.4 Helicopter Operations

4.2.5 Military Operations

4.3 LONG TERM OBJECTIVES (Show applicable years – e.g. 2024-2027)

4.3.1 Oceanic, Remote and Continental Enroute

4.3.2 Terminal Areas (SIDs and STARs)

4.3.3 Approach

4.3.4 Helicopter Operations

4.3.5 Military Operations

[As this is further out, it may be more general and not follow the specific sub-paras above.]

4.4 END STATE (Show Year)

[Describe the end state and when it will be achieved. This can then be used in the executive summary.] The end state should relate to the Strategic Objectives and could also include:

- PBN Specs implemented and where (Oceanic, Enroute, Terminal)
- Relationship to the objectives of A37-11 (met, partially met)
- Total expected Improvements to safety, efficiency and capacity
- Total expected environmental benefits from reduced fuel burn and noise emissions

CHAPTER 5

PLAN COORDINATION

5.1 COORDINATION AND CONSULTATION

[This section addresses the coordination, collaboration and consultation process that the State will utilize with all stakeholders - the operators operating within the State, ANSPs, aerodrome operators, regional and international organizations - during the preparation and implementation phase of the plan. There should be consensus on the resultant implementation plan.]

5.2 PLAN RESPONSIBILITY

[Describe the appropriate authority having responsibility for the effective and efficient performance of the State's PBN implementation plan.

[Describe the ultimate responsibility for each organizations being involved to the plan to fulfil all requirements in order to achieve the targets set in the plan.]

5.3 PLAN REVIEW

[Describe the amendment process – for example the plan will be reviewed after each term timeframe, amendments will be solicited from all stakeholders and the plan will be amended as required]

Chapter 6

SAFETY

6.1 PRELIMINARY SAFETY ASSESSMENT AND RISK ANALYSIS

[This subsection defines the possible scenarios and safety analysis that may be required to identify hazards and control the potential consequences in order to reach an acceptable level of safety. It should include the safety assessment and risk analysis process performed in line with ICAO Safety Management Manual (Doc 9853).]

6.2 IMPLEMENTATION SAFETY ASSESSMENT

[This subsection provides information with respect to the analysis that will be performed after the implementation of PBN procedures to see if the safety requirements are met.]

APPENDIX A

Assembly Resolution A37-11

PERFORMANCE BASED NAVIGATION GLOBAL GOALS

Note: Resolution A37-11 is a result of the 11th Air Navigation Conference recommendations on area navigation implementation and Resolution A33-16 that requested Council to develop a program to encourage States to implement approach procedures with vertical guidance. The main points of Resolution A37-11 are as follows:

{Preamble Removed}

The Assembly

1. *Urges* all States to implement RNAV and RNP air traffic services (ATS) routes and approach procedures in accordance with ICAO PBN concept laid down in the Performance-based Navigation (PBN) Manual (DOC 9613);
2. *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% by 2010, 70% 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 and where there are no aircraft suitably equipped for APV operations with a maximum certificated take-off mass of 5700 kg or more;
 - b) ICAO develop a coordinated action plan to assist States in the implementation of PBN and to ensure development and/or maintenance of globally harmonized SARPs, Procedures for Air Navigation Services (PANS) and guidance material including a global harmonized safety assessment methodology to keep pace with operational demands;
3. *Urges* that States include in their PBN implementation plan provisions for implementation of approach procedures with vertical guidance (APV) to all runway ends serving aircraft with a

maximum certificated take-off mass of 5700kg or more, according to established timelines and intermediate milestones;

4. *Instructs* the Council to provide a progress report on PBN implementation to the next ordinary session of the Assembly, as necessary;
5. *Requests* the Planning and Implementation Regional Groups (PIRGs) to include in their work programme, the review of status of implementation of PBN by States according to the defined implementation plans and report annually to ICAO any deficiencies that may occur; and
6. *Declare* that this resolution supersedes Resolution A36-23.

APPENDIX B

PBN Implementation Schedule for En-route, Terminal and Approach Procedures

PBN Specification	En-route (Oceanic, Remote, Continental)	Terminal Airspace SIDs, STARs	Approach Procedures
<i>RNAV 10</i>			
<i>RNAV 5</i>			
<i>RNAV 2</i>			
<i>RNAV 1</i>			
<i>RNP 4</i>			
<i>RNP 2</i>			
<i>RNP 1</i>			
<i>Advanced RNP</i>			
<i>RNP APCH</i>			
<i>RNP AR APCH</i>			
<i>RNP 0.3</i>			

[For each box indicate timeframe for implementation and where specifications will be used (if applicable. For example, indicate the airports, terminal airspace or en-route airspace). If some are not to be used or are not applicable, indicate N/A.]

APPENDIX C

References

[Insert the name, version number, description, and physical location of any documents referenced in this document. Add rows to the table as necessary.]

The following table summarizes the documents referenced in this document.

Document Name	Description	Location
<i><Document Name and Version Number></i>	<i><Document description></i>	<i><URL or location where document is located></i>

[This should include other documents besides ICAO docs – regional plans, state plans, etc]

APPENDIX 4 (and others)

[If required to support information in the main part of the plan. For example list of organizations that will be consulted, etc].

APPENDIX C

Terms of Reference

PROPOSED TERMS OF REFERENCE

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM

(TPT 05/2015A)

MEXICO 2016



**Asia-Pacific
Economic Cooperation
Secretariat**

5 July 2016



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PROPOSED TERMS OF REFERENCE

TPT 05/2015A Mexico

1. INTRODUCTION

The APEC Secretariat, through the Transportation Working Group, is funding the *“Enhancing Aviation Connectivity and Emissions Reduction via Implementation of Performance Based Navigation (PBN) Assistance Program”*.

To execute this program, APEC has contracted with the Ambidji Group to provide a team of Performance Based Navigation (PBN) experts to assist Mexico to take the current PBN implementation plan to the next level of implementation maturity so that Mexico is in a better position to introduce the required PBN concepts, air routes and procedures in order to maximize the economic and safety benefits available with Performance Based Navigation.

This document sets out the Terms of Reference for the Program including the agenda for two site visits by a team of experts.

2. BACKGROUND

At the 2007 International Civil Aviation Organization (ICAO) General Assembly, member states agreed to urge all economies to implement routes and airport procedures in accordance with ICAO PBN implementation. Full implementation of PBN facilitates more efficient flight routes, which leads to positive benefits such as, but not limited to, decreased fuel consumption, decreased emissions, improved air traffic safety and decreased flight delays. While ICAO has established PBN Task Forces and Flight Procedure Programme offices in some regions that can assist ICAO economies with developing and validating PBN flight procedures, some developing economies have been unable to access this support until they have mature PBN implementation plans in place. This includes Mexico.

Mexico has a baseline PBN implementation plan in accordance with ICAO guidelines, but has requested assistance to identify and resolve challenges that are preventing the further development and implementation of mature PBN plans. This program will directly assist Mexico’s air navigation service provider (ANSP) and Regulatory Authority to address these challenges. This assistance will indirectly impact additional civil aviation stakeholders, such as airlines and airports (particularly medium and large airports) as PBN implementation can lead to reduced fuel costs, reduced flight delays and more efficient and safer air traffic control capabilities - thus supporting APEC

priorities in reducing emissions, improving supply chain connectivity and securing growth.

3. PROJECT OBJECTIVE

The objective of this program is to enable Mexico to develop a mature PBN implementation plan, leading to enhanced PBN flight routes and procedures.

4. PROJECT SCOPE OF WORK

The Project includes the following elements:

1. **Questionnaire.** In order to assist the Ambidji Project Team to be familiar with the current PBN implementation status and experience in Mexico a questionnaire has been developed which seeks input from stakeholders.
2. **Terms of Reference (ToR).** A detailed ToR, considering responses to the questionnaire, which outlines actions to be completed under this program.
3. **Review PBN implementation plan.** The Ambidji Team will review and evaluate Mexico's current PBN Plan and any proposed revisions
 - a. **Develop Gap Analysis.** Ambidji will conduct a gap analysis, guided by ICAO requirements and standards, to identify challenges to PBN implementation.
 - b. **Develop Action Plan.** Ambidji will develop an action plan that identifies the steps required by Mexico to address technical, regulatory and operational requirements enabling mature PBN implementation. The Action Plan will include a timeline for each recommended action.
4. **Site Visit #1.** A team of two Ambidji PBN experts will travel to Mexico to conduct the first of two site visits, 8-12 August 2016.
5. **Gap Analysis.** On completion of the first site visit Ambidji expects to have sufficient information to prepare a draft gap analysis. This gap analysis will include the results of the review of the current PBN implementation plan.
6. **Action Plan.** Based on the draft gap analysis a draft action plan will be prepared that will take into account the circumstances identified during the first site visit. The draft Action Plan will then become the focus of the second site visit.
7. **Site Visit #2.** The team of two Ambidji PBN experts will return to Mexico for the second site visit 19-23 September 2016. The relevant portions of the draft Gap Analysis and Action Plan will be reviewed with the responsible organizations to ensure understanding of the gaps identified, as well as obtain commitments and establish timelines for the proposed Action Plan.

8. **Report:** Ambidji will prepare a Final Report which will include:
 - a. A summary of the findings arising from the gap analysis;
 - b. A summary of the best practices shared with Mexico throughout the assistance program;
 - c. An overview of the procedures and requirements to implement PBN routes and procedures, taking into consideration international standards and best practices for managing and safely overseeing the PBN implementation process at the governmental level;
 - d. Recommendations for Mexico to implement and/or revise their regulatory framework to support PBN implementation (including airline equipage requirements);
 - e. A summary of required flight procedure design capabilities;
 - f. Suggested solutions for Mexico to ensure a properly trained pipeline of staff to design and implement PBN flight procedures;

5. SCOPE OF FIRST SITE VISIT

The first of two site visits by the Ambidji Project Team is to take place in Mexico City from 8 to 12 August.

The primary purpose of the first visit is to evaluate the current PBN status in Mexico and to identify impediments to full implementation.

The format of the site visit is expected to be:

- **Day 1:** A meeting of all stakeholders and interested parties. The objectives of the project will be explained and the agenda for the site visit outlined. We will also review the current PBN implementation plan and any proposed revisions. This will provide an opportunity for participants to ask technical and other questions and for cross-discipline discussion, moderated by the project team.
- **Days 2-4:** Meetings will be conducted with each of the individual organizations involved in the project, including the Regulatory Authority, ANSP, procedure design organization, airports, airlines and any other interested party.
- **Day 5:** A meeting of all stakeholders will be convened to enable the project team to provide an interim summary of the site visit, and to outline the next steps, including the second site visit. All participants will be encouraged to provide feedback and ask further questions at this meeting.

6. APEC TEAM

The APEC Team consists of PBN experts including:

- Mr Robert Kennedy (Ambidji Group) who will act as Project Coordinator and PBN Operations Specialist; and
- Mr David VanNess (Ambidji Group), PBN Flight Procedure Specialist

7. PROPOSED TOPICS

Based on feedback from the questionnaire and discussions with DGAC staff and taking into account the considerable amount of PBN development work already completed in Mexico, the following topics are proposed:

1. **DGAC:** Review PBN operational regulatory documentation with regard to the adequacy of legislation and regulations to support the implementation of PBN.
2. **DGAC:** Review existing airline PBN operational approvals (including operating manuals, OPSPECS, approval procedures and flight crew training) to determine if any action is required on the part of the DGAC and airlines to meet current industry standards for PBN operations. Review the qualifications, training, experience and capability of inspectors tasked with PBN operational approvals. Review procedures for administration of PBN approvals and surveillance of operators.
3. **DGAC:** Review regulatory procedures for oversight of the design and validation of instrument flight procedures. Review regulator's qualifications, training, experience and capability for oversight of the procedure design organization.
4. **DGAC:** Flight Validation. Review flight validation procedures, including the qualifications, training, experience and capability of flight validation pilots tasked with validating PBN instrument flight procedures (IFPs).
5. **DGAC/SENEAM:** Review plans and goals for a minimum operational network of DME's and other ground infrastructure subsequent to PBN implementation.
6. **SENEAM PROCEDURE DESIGN:** Review the qualifications, training, experience and capability of procedure designers tasked with developing PBN IFPs. Review the quality assurance system including validation and periodic review and revalidation of procedures. Examine the number and type of PBN IFPs published, and capacity to develop additional PBN IFPs. Discuss plans to meet ICAO goals.

7. **SENEAM ATS:** Discuss the benefits of PBN implementation and the need for ATS to take a lead role in PBN implementation in order to obtain efficiency and safety benefits. Discuss the potential of mandating PBN operational capability to achieve the benefits and to meet ICAO goals.
8. **SENEAM ATS:** Review the PBN standard operating procedures and training provided to ATS staff. Inspect the existing en-route structure and existing and proposed PBN route specifications. Assess current and proposed terminal procedures (SID/STAR) including design, efficiency, arrivals management and incorporation of CCO/CDO techniques. Discuss utilization rates of published PBN approach procedures, and ATC acceptance and support for PBN. ATC access to aircraft PBN equipage/capability information on the flight plan. Discuss co-ordination between ATS and Procedure Design.
9. **AIR OPERATORS:** Review operator training, experience, capability and operational approval status for PBN IFPs. Discuss operator demand for PBN procedures. Discuss need for operators to be proactive in order to achieve safety, efficiency and environmental benefits. Review PBN approach procedures including safety benefits, and existing or proposed RNP APCH LNAV/VNAV, LPV and RNP AR APCH projects. Review OPSPEC PBN provisions. Examine operator compliance with PBN flight plan requirements. Discuss operator requirements for PBN operations in foreign airspace.
10. **AERODROME OPERATORS:** Discuss airport operator participation in PBN implementation. Discuss role of PBN in aerodrome safety, environmental and capacity planning.

8. DELIVERY METHOD

Apart from Day 1 and Day 5 which will be general and open sessions, it is proposed that all other sessions will be conducted on-site in the vicinity of each organization's offices or work areas as "round the table" working groups. This format is intended to permit contact with all levels in each organization. Where necessary the APEC team will provide briefings and technical advice on specific subjects. All meetings will be informal and active and open discussion will be encouraged.

9. SCHEDULE

The proposed schedule for the first site visit is shown in Table 1. If required, session times can be re-arranged to suit the availability of key staff.

10. ATTENDANCE

The success of the APEC Team visit depends upon the attendance of DGAC and stakeholder personnel with direct responsibility for the tasks to be reviewed.

The following key personnel should attend the Site Visit 1 sessions associated with their responsibilities:

- **DAY 1 & 5:** All stakeholders including:
 - SENEAM/ATS senior staff
 - Flight Operations inspectors
 - DGAC regulatory personnel
 - DGAC Oversight inspectors
 - Flight Procedure Design Managers
 - Flight Validation Manager/ Pilots/Crew
 - Airline operator senior pilots/training and flight operations staff (pilots)
 - Aerodrome management/planning staff
- **DAY 2:**
 - DGAC Regulatory personnel - General
 - DGAC Oversight personnel-Procedure Design & Validation
 - Flight Procedure Design manager
 - Flight Operations Inspectors
 - Airline senior operational pilots and training staff
 - Flight validation manager/pilots/crew
- **DAY 3:**
 - Flight Procedure Design manager/staff
 - Aerodrome management/planning staff
- **DAY 4:**
 - ATS senior operational and training staff
 - SENEAM Safety Inspectors
 - Airline operator senior pilots/training and flight operations staff (pilots)

TABLE 1: SITE VISIT 1 SCHEDULE

APEC PBN VISIT #1					
SCHEDULE					
Timing	Day 1 (Mon)	Day 2 (Tues)	Day 3 (Wed)	Day 4 (Thur)	Day 5 (Fri)
0900 1015	<i>Registration and Opening Ceremony</i>	<i>DGAC (Dirección de Ingeniería, Normas y Certificación) General Regulatory</i>	<i>SENEAM (Dirección de Navegación e Información Aeronáutica) Procedure Design Organization</i>	<i>SENEAM Air Traffic Services (Dirección de Tránsito Aéreo)</i>	<i>Conclusion and Debriefing Presentation of preliminary findings</i>
1030 1200	<i>Program Outline Briefing</i>	<i>DGAC (Dirección de Verificación Aeroportuaria) Flight Operations Standards</i>			
1200 1300	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
1300 1415	<i>Review of PBN Implementation Plan General Discussion and Input from Stakeholders</i>	<i>DGAC (Dirección de Verificación Aeroportuaria) Flight Operations Standards & Flight Validation Organization</i>	<i>SENEAM (Dirección de Navegación e Información Aeronáutica) Procedure Design Organization</i>	<i>At SENEAM Air Operators</i>	<i>Spare</i>
1430 1600		<i>DGAC (Departamento de Control de Tránsito Aéreo) Procedure Design Oversight</i>	<i>At SENEAM Aerodrome Operators</i>		<i>APEC Team Departs</i>

11. REFERENCE DOCUMENTATION

Any relevant existing regulatory or guidance documentation should be forwarded to the APEC Team for review prior to the first site visit.

12. SECOND SITE VISIT

The second of two site visits by the Ambidji Project Team is to take place in Mexico City from 19 to 23 September 2016

The primary purpose of the second visit is to present the draft Gap Analysis, share best practices and finalize an Action Plan.

The format of the site visit is expected to be:

- **Day 1:** A meeting of all stakeholders and interested parties. The draft gap analysis will be presented and discussed. The draft Action Plan will be presented and discussed the project will be explained and the agenda for the site visit outlined. This will provide an opportunity for participants to ask technical and other questions and for cross-discipline discussion, moderated by the project team.
- **Days 2-4:** Meetings will be conducted with each of the individual organizations involved in the project, including the Regulatory Authority, ANSP, procedure design organization, airports, airlines and any other interested party. The meetings will focus on ensuring a shared understanding of what is needed for mature implementation of PBN in their area. Managers with authority to make decisions that affect their organisation's participation in PBN implementation should attend in order to be fully informed and to ensure effective co-ordination with other stakeholders. Managers may be accompanied by whatever staff they need to support them in their decision making.
- **Day 5:** A meeting of all stakeholders will be convened to enable the project team to provide an interim summary of the site visit, particularly the Actions and timelines agreed to by the various managers, as well as any modifications to the Gap Analysis. The Ambidji team will outline the next steps. All participants will be encouraged to provide feedback and ask further questions at this meeting.

The Program for Site Visit 2, subject to modification, is shown in Table 2.

13. ASSISTANCE TO THE TEAM MEMBERS BY DGAC

The APEC Team site visit will be fully funded by APEC. However in the interest of maximizing the time available for this visit, it is requested that DGAC contribute to the program by providing the venue for these site visits, transport to/from the APEC Team hotel, as well as lunch/refreshments daily for the APEC Team and DGAC/Stakeholder participants.

On Days 1 & 5 a meeting room with sufficient seating to accommodate representatives from all stakeholders is requested. It is anticipated that 30 or more persons would attend.

On Days 2-4 a smaller room with seating for 10-12 persons should be sufficient.

TABLE 2: SITE VISIT 2 SCHEDULE

APEC PBN VISIT #2					
SCHEDULE					
Timing	Day 1 (Mon)	Day 2 (Tues)	Day 3 (Wed)	Day 4 (Thur)	Day 5 (Fri)
0900 1015	<i>Registration and Opening Ceremony</i>	<i>DGAC (Dirección de Ingeniería, Normas y Certificación) General Regulatory</i>	<i>SENEAM (Dirección de Navegación e Información Aeronáutica) Procedure Design Organization</i>	<i>SENEAM Air Traffic Services (Dirección de Tránsito Aéreo)</i>	<i>Conclusion and Debriefing Presentation of preliminary findings</i>
1030 1200	<i>Program Outline Briefing</i>	<i>DGAC (Dirección de Verificación Aeroportuaria) Flight Operations Standards</i>			
1200 1300	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
1300 1415	<i>Review of PBN Implementation Plan General Discussion and Input from Stakeholders</i>	<i>DGAC (Dirección de Verificación Aeroportuaria) Flight Operations Standards & Flight Validation Organization</i>	<i>SENEAM (Dirección de Navegación e Información Aeronáutica) Procedure Design Organization</i>	<i>At SENEAM Air Operators</i>	<i>Spare</i>
1430 1600		<i>DGAC (Departamento de Control de Tránsito Aéreo) Procedure Design and Validation Oversight</i>	<i>At SENEAM Aerodrome Operators</i>		<i>APEC Team Departs</i>

APPENDIX D

Questionnaire



TPT 05/2015A - Enhancing Aviation Connectivity and Emissions Reduction via Implementation of Performance Based Navigation (PBN) Assistance Program

QUESTIONNAIRE INSTRUCTIONS

- 1 The questionnaire is intended to provide a summary of the current PBN implementation status in your economy.
- 2 The information you supply will enable the Project Team to develop Terms of Reference for an initial site visit. During that site visit issues affecting your PBN implementation progress will be discussed in detail.
- 3 The questionnaire contains six sheets which should be completed by the individual organizations with relevant responsibility. Where your economy has more than one organization in the economy with responsibility for an area, each of those organizations should complete a separate relevant sheet. For example, if the economy has more than one ANSP, then each ANSP should complete their own ANSP sheet.
- 4 The Project Liaison Officer will co-ordinate responses and should return one electronic copy containing all responses.
- 5 Respondents should do their best to provide as much information as readily available, but as the questionnaire is only the beginning of a complete review of your PBN implementation, if information is not immediately available responses should not be delayed.
- 6 The completed questionnaire is due for return to Ambidji by Friday 24 June.
- 7 If all information is not available by 24th June please provide an interim response by that date so that the Project Team can commence work on reviewing your responses. A final questionnaire should be provided as soon as possible thereafter.
- 8 Your co-operation in providing a full and timely response will be appreciated to enable the Project to be completed on schedule.
- 9 Any additional information not mentioned in this questionnaire is welcome. Please attach additional documents if space is not available in the spreadsheet.
- 10 Any questions may be directed to Mr Robert (Bob) Kennedy, the Ambidji Project Team Leader, by email at rkennedy@ambidji.aero or tel +61 414326804 (Australian Eastern Time); or Mr David (Dave) VanNess, by email at dvanness@ambidji.aero or tel +1 678-640-5978 (US Eastern Daylight Savings Time).

PBN Implementation Questionnaire-PBN Plan

Filled out by:

Organization:

P1

Is there a PBN Implementation Plan for your economy?

Yes.

If so please provide copy of latest version in English.

Only in spanish.

P2

Has the PBN Plan been submitted to ICAO for assessment?

Yes.

If so please provide the outcome of that assessment.

No comments from ICAO.

P3

What is the extent of your achievement of the APAC PBN goal as set out in Resolution A37-11 for the implementation of approach procedures with vertical guidance (APV), including LNAV only minima, for all instrument runway ends, either as the primary approach or as a backup for precision approaches by 2016?

1%

PBN Implementation Questionnaire-Regulator

Filled out by:		Organization:
R1	Is there a PBN Implementation Working Group established in your economy?	Yes.
	If so please list stakeholders that are represented?	Civil Aviation Authority, Air Navigation Service Provider (ANSP), Operators, Airports, ICAO.
	How often does it meet and when was last meeting?	The PBN Implementation working group meets once or twice a year, the last meeting was on November 19, 2015
R2	Are implementing civil aviation regulations in place to allow for PBN operations and regulatory oversight of those operations?	Regulations for PBN operations have been develop and for surveillance have not been issued.
R3	Is there a timeline for mandating ADS/B and/or PBN equipage?	For ADS-B 2020 will be the deadline, for PBN there is no set date yet.
R4	How many carriers have applied for or obtained PBN operating approval? Please provide a summary.	74 Requests.
R5	Does the Regulator have flight operations and/or airworthiness inspectors qualified to issue PBN operating approvals?	Yes, 9 operations inspectors and 2 airworthiness inspectors.
R6	Does the regulator possess sufficient trained inspectors to administer PBN approvals, including RNP APCH and/or RNP AR APCH?	No, only 6 operations inspectors trained.
R7	What impediments to PBN Implementation is the regulator experiencing?	The Design of Procedures PBN and Certification of these, Analysis and Redesing of Airspace, ASBU.

PBN Implementation Questionnaire-Air Navigation Service Provider(s)

Filled out by:		
Number	QUESTION	RESPONSE
A1	Have any RNAV routes been published? If so please provide a summary.	México has 54 RNAV ATS routes published (regional and domestic).
A2	Are any RNAV routes (if implemented) PBN compliant, e.g. RNAV5, RNP4, RNP2, RNAV(RNP)10?	All of the RNAV ATS routes are compliant with the PBN concept.
A3	Have any RNAV SID/STAR been published? If so please provide a summary.	MMTO is the only airport with published RNAV SIDs and STARs; 1 RNAV SID and 1 RNAV STAR for each threshold.
A4	Are any RNAV SID/STAR PBN compliant, e.g. RNAV1, RNAV2, RNP1?	No.
A5	Has carriage of GNSS or PBN capability been mandated in your airspace.	No.
A6	Does any adjoining airspace mandate PBN capability?	No.
A7	Does ATC have ready access to the ICAO flight plan PBN equipage/capability codes filed by each aircraft?	Yes.
A8	Do you have any plans to mandate PBN capability?	Yes.
A9	Are there airports that routinely experience ATC Delays?	-
	Arrivals?	Yes.
	Departures?	Yes.
A10	Have Continuous Climb and Descent procedures been implemented?	Yes.
A11	Is an arrivals management program in operation?	Yes.
A12	Are there Plans/Requirements for a Minimum Operation Network (DME and VOR)?	No.
A13	What impediments to PBN Implementation is the ANSP experiencing?	Considering that SENEAM is commencing the PBN implementation in all the country (enroute structure and airport procedures); the coordination between ATC and procedure designers needs to be enhanced.

PBN Implementation Questionnaire-Fleet Statistics

Filled out by:		Organization:
Number	QUESTION	RESPONSE
F1	Has a survey been conducted to evaluate airline fleet PBN equipage or qualification?	Yes.
F2	Is data available on foreign carrier PBN equipage/readiness?	Yes, but only 4 airlines
F3	Is data available on domestic carrier PBN equipage/readiness?	Yes.
F4	Approximately what proportion of your IFR aircraft operations are:	-
	Overflying	Approximately 7%.
	International	Approximately 25%.
	Domestic jet	Approximately 65% (all domestic IFR flights).
	Domestic commuter	(Unable to determine).
	Domestic private	Approximately 13% (of IFR total).
	IFR Helicopter	Approximately 0.1% (of IFR total).
F5	Do operators routinely include the correct ICAO flight plan PBN equipage/capability codes on each flight plan?	Yes.
F6	Has the airline industry in your economy expressed interest or concerns regarding PBN? For example are airlines reluctant to change or advocate change?	Yes, both cases, we have held meetings with the operators interested in the implementation of PBN and obtain operational approval (VIVAAEROBUS, VOLARIS, INTERJET, AEROLITORAL), also with operators by the current level of equipment of their aircraft it is difficult to obtain operational approval for some navigation specifications (AEROMAR).
F7	Has industry consultation on PBN implementation been conducted?	Yes, they have requested information about the number of routes and airways the currently require PBN.
F8	What impediments to PBN Implementation are air operators experiencing?	Lack of regulations and procedures approved in the Aeronautical Information Publication (AIP).

PBN Implementation Questionnaire-Procedure Design Organization(s)

Filled out by:	Organization:	
Number	QUESTION	RESPONSE
PD1	What procedure design capability is available?	Conventional and PBN according to ICAO design criteria.
	In house?	Conventional and PBN according to ICAO design criteria.
	Contract?	No.
PD2	For each PD organization please advise:	
	Is the procedure design organization qualified to design PBN procedures?	Yes.
	PBN SIDs/ STARs	Yes.
	RNP APCH LNAV and LNAV/VNAV	Yes.
	RNP APCH LP and LPV	Yes.
RNP AR APCH	Yes.	
PD3	For each PD organization please advise:	
	Does the PD use an automation tool?	Yes.
	Is a Quality Assurance Process in place for:	Yes.
	Initial design	Yes.
Periodic review of existing procedures?	Only when ATC request changes or when the nav aids network is modified.	
PD4	Is digital terrain data available to Procedure Design organizations? ICAO ETOD compliant?	Procedure designers have access to DTMs and some DSMs, non compliant with ETOD criteria.
PD5	Is there an obstacle database set up for your economy?	The Authority has a database of the obstacles that they approve; but there are unknown obstacles.
PD6	Is there regulatory oversight of procedure design providers and organizations?	Yes.
PD7	What organization provides oversight?	Dirección de Verificación Aeroportuaria. (DGAC)
PD8	Does oversight organization have the necessary training, resources and experience to fulfill it's responsibilities?	No.
PD9	Is validation of PBN Instrument Flight Procedures conducted?	Yes.
	What organization(s) conduct validation?	Dirección de Verificación Aeroportuaria. (DGAC)
	What training has been conducted in validation techniques?	Engineers Aerodata Systems.
	How is flight validation accomplished?	In airplane Cessna 500/550 and recorded in Flight Inspection System.
PD10	Has training of Flight Validation Pilots been conducted.	No everybody pilots.
PD10	What impediments to PBN Implementation is the Procedure design organization experiencing?	Flight validation.

PBN Implementation Questionnaire-Aerodrome Operators

Filled out by:	Organization:	
Number	QUESTION	RESPONSE
AD1	Do aerodrome operators in your economy play a role in PBN implementation at their aerodromes?	Not at this moment but yes on the future.
AD2	What role do they play?	Service Provider, Operators.
AD3	Does the aerodrome operator develop or contract for development and validation of instrument Flight Procedures?	No
AD4	Does the aerodrome operator install or contract for installation of ground navigation aids?	No, the ground navigation aids depends of ANSP (SENEAM)
AD5	Approximately what proportion of your IFR aircraft operations are:	-
	Overflying	Approximately 7%.
	International	Approximately 25%.
	Domestic jet	Approximately 65% (all domestic IFR flights).
	Domestic commuter	(Unable to determine).
	Domestic private	Approximately 13% (of the IFR total).
	IFR Helicopter	Approximately 0.1% (of the IFR total).
AD6	Has consultation on PBN implementation been conducted with the aerodrome operators?	Not yet.
AD7	What impediments to PBN Implementation are aerodrome operators experiencing?	Obstacle Charts, eTOD

APPENDIX E

Site Visit 1 Report

**ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION
VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION
(PBN) ASSISTANCE PROGRAM**

(TPT 05/2015A)

SITE VISIT 1 – MEXICO

(8 - 12 AUGUST 2016)



**Asia-Pacific
Economic Cooperation
Secretariat**

19 August 2016

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Site Visit 1 – Mexico

(8 – 12 August 2016)

1. INTRODUCTION

The first of two site visits to Mexico was conducted between 8 and 12 August 2016.

This report provides an interim summary of the activities conducted during this site visit. In addition to this summary, spreadsheets detailing an Issues List and Action Plan will be included in the Final Report.

Reference may also be made to the Terms of Reference document, which details the program activities for both Site Visits.

2. SCOPE OF FIRST SITE VISIT

The first of two site visits by the Ambidji Team took place in Mexico City from 8 to 12 August.

The primary purpose of the first visit was to evaluate the existing PBN status in Mexico and to identify impediments to full implementation.

The format of the site visit was as follows:

- **Day 1:** A meeting of all stakeholders and interested parties. The objectives of the project were explained and the agenda for the site visit outlined.
- **Days 2-4:** Meetings were conducted with each of the individual organizations involved in the project.
- **Day 5:** A meeting of all stakeholders was reconvened and a summary of the findings of the Ambidji Team was provided

3. AMBIDJI TEAM

The Ambidji Team consists of PBN experts including:

- Mr Robert Kennedy (Ambidji Group), Project Coordinator and PBN Operations Specialist; and
- Mr David VanNess (Ambidji Group), PBN Flight Procedure Specialist

4. FAA

The FAA was represented by Ms Angela Harris-Clark.

5. WORKSHOP ATTENDEES

A list of workshop attendees is located at Attachment D.

6. SUMMARY OF DAILY ACTIVITIES

The following paragraphs provide a summary of all activities and outcomes arising from each day of the Site Visit workshop.

6.1. Day 1: **Monday 8 August 2016**

A meeting of all stakeholders was conducted at the offices of the DGAC in Mexico City.

Representatives from the following organisations attended:

- DGAC;
- SENEAM;
- Air Operators;
- Air Force; and
- New Mexico City Airport.

Mr Kennedy presented a PowerPoint summary outlining the Project and the activities for Site Visit 1 (refer *Attachment A Project Overview*).

A useful discussion involving all stakeholders followed. This discussion enabled the Ambidji Team, as well as the attending stakeholders to gain an overview of the general PBN situation.

Mr VanNess presented a PowerPoint outlining the contents required in a PBN Implementation Plan that meets the ICAO guidelines (Refer *Attachment B PBN Plan Essentials*).

6.2. Day 2: **Tuesday 9 August 2016**

DGAC: Review of PBN Rules

The status of PBN Rules was reviewed.

The general rules for PBN operations, except RNP AR are contained in a circular dated 2010. The rules are a duplication of the relevant sections of the ICAO PBN Manual but are in need of updating to the current version of the PBN Manual.

A second circular detailing the requirements for RNP AR operations is in draft form.

Following discussions with Snr Emilio Valencia Garcia, whose department is responsible for developing operating rules, it was agreed that while personnel in this section have some understanding of PBN, further training is warranted.

DGAC: Procedure Validation

Personnel representing the DGAC Flight Inspection Unit were interviewed with regard to arrangements for the Validation, (including Flight Validation) of PBN Instrument Flight Procedures (IFPs).

Guidelines for procedure validation are included in ICAO Doc 9906, which identifies that personnel responsible for conducting validation of flight procedures should be trained Flight Validation Pilots (FVPs).

Two issues were identified:

1. Pilots in the DGAC Flight Inspection Unit have no training in the conduct of PBN Flight Operations, and in particular PBN approach operations.
2. Pilots in the DGAC Flight Inspection Unit have not been trained as Flight Validation Pilots.

The fact that pilots in Mexico are not trained in PBN operations is not surprising, given that PBN approaches are currently only available at 2 airports, and that PBN operations are not in general use in Mexico.

Training in PBN flight operations is available and it is suggested that, as Flight Inspection Pilots routinely conduct simulator recurrent training in the U.S, the opportunity be taken to conduct PBN training during, or as an add-on, to future scheduled simulator recurrent training.

As PBN operations may also be conducted in aircraft equipped with stand-alone receivers commonly installed in General Aviation light aircraft (less than 5700 Kg), pilots who are to be trained as Flight Validation Pilots (FVP) should also complete training using this type of equipment. Such training is not normally available in a full flight simulator, but many flight schools in the U.S. will be equipped with fixed base or desktop simulators.

FVP training involves two elements. As FVP responsibility involves the operational evaluation of instrument arrival, approach and departure procedures, a basic understanding of the principles of instrument flight procedure design (ICAO Doc 8168) is necessary. This module typically involves approximately 2 weeks classroom training.

A second module, typically of about 5-6 days duration covers the conduct of validation (including flight validation). Material to be covered is detailed in ICAO Doc 9906, Volumes 5 and 6.

FVP training is not widely available and courses are conducted infrequently. It is recommended that DGAC makes enquiries regarding course availability as soon as possible.

It is recommended that DGAC consider hosting a course in Mexico, inviting participants from other Latin and South American economies, as it can be expected that other authorities in the region are also in need of FVP training. Convening a course in Mexico is likely to be less expensive than sending individual pilots overseas for training.

As the implementation of PBN approach procedures cannot proceed without qualified FVPs, immediate action to provide training for pilots of the DGAC Flight Inspection Unit is a necessary step for PBN Implementation to proceed.

The DGAC Flight Inspection Unit is equipped with two Cessna Citation aircraft, one C500 and one C550. The avionics in these aircraft, while not able to validate all PBN operations, is considered adequate. Any lack of capability in the fleet can be supplemented by utilising full flight simulators, which are available in Mexico City. The annual flight hours currently being flown by the two aircraft was also considered and the additional flight hours required for PBN Implementation assessed. The additional flight hours required for full PBN implementation can be met by the two available Citation aircraft.

The staffing of the DGAC Flight Inspection Unit was also considered and the additional workload required for PBN implementation can be met with the current number of pilots.

DGAC: PBN Operational Approval

The DGAC process and procedures for issue of PBN operational approval to air operators was examined. The process in Mexico is managed by engineering staff (Depto de Ingenieria de Operaciones), with flight operational aspects referred as necessary to Flight Operations Inspectors in the Flight Operations Section (Direccion de Control). As PBN is primarily a flight operation, most civil aviation administrations direct initial applications for operational approval to the Flight Operations section, with input as required from engineering. However, although the current process is unusual, there is no need to restructure the approval process.

Engineering personnel responsible for operational approval appear to have a good understanding of the PBN Manual. Only one pilot from Flight Operations was available for interview on Day 2, but it appears that Flight Operations pilots do not have adequate experience in PBN flight operations or PBN Operational Approval.

Note: A meeting was subsequently held with the head of Flight Operations (Direccion de Control) and a staff Flight Operations Inspector on Friday, 12 August. Refer to details of this meeting later in this report.

It was noted that the DGAC does not publish guidelines for applicants detailing the form and content of a conforming application. A lack of guidance material typically results in additional work and a delay in approval, as neither party (applicant or regulator) has clear guidelines to work with. As the DGAC faces a very large number of applications in the future as PBN implementation gets under way, action to develop clear guidance material is highly recommended.

Although the DGAC appears to have an approval process in place, the Ambidji Team is concerned that inspectors are requiring operators to provide unnecessary detail and in some cases requesting flight demonstrations that are entirely unnecessary. Consequently, the time and effort required by both air operator applicants and DGAC inspectors appears excessive and an impediment to timely PBN implementation. Consequently, it is recommended that the approval process be reviewed and streamlined. It is expected that much of the unnecessary detail associated with operational approval is due to a lack of

detailed knowledge and experience in PBN operations and that further training for inspectors is warranted. The ICAO Operational Approval Manual is now available which can assist. In addition, the DGAC is advised to seek guidance from experts in PBN Operational Approval.

DGAC: Fleet Capability Review

In order for a mature PBN Implementation Plan to be developed it is necessary that there be a sound knowledge of the PBN capabilities of the aircraft fleet being operated in Mexico, by both domestic and foreign operators. Currently there is little recorded information available, although it is clear that Mexico has a modern and generally PBN-capable fleet.

As this task falls under the scope of the DGAC, it is recommended that work be undertaken as soon as possible to assess the PBN readiness of both the domestic and international aircraft operating in Mexico airspace.

6.3. Day 3: Wednesday 10 August 2016

SENEAM: Flight Procedure Design

A meeting with SENEAM Flight Procedure Design staff and SENEAM Management was conducted at the offices of SENEAM.

SENEAM employs a staff of four designers and a Section Manager. Design staff are well trained and experienced in PBN procedure design. A number of procedures in draft form were examined and, apart from minor suggestions for improvement, the standard was assessed to be very high.

SENEAM has selected 22 airports out of approximately 60 airports served by ATC within Mexico for the first phase of their PBN procedure design effort. Of the 22 airports currently identified, design work is in progress for 10 airports, of which 5 airports are near completion and ready for validation. Unfortunately, further progress on the 5 completed airports is now delayed until DGAC Flight Validation Pilots are trained.

The potential workload of the Procedure Design section was assessed. Based on the assumption that approximately 60 airports in Mexico will require PBN procedures, and considering that the amount of design work will vary between major airports such as Mexico City and smaller regional airports, the overall workload over the next 3 to 5 years was estimated. Similarly, the output of the four designers was considered with due regard for routine non-PBN duties and other demands on design staff. After some discussion it was agreed that it is unlikely that SENEAM has sufficient staff to achieve the design for procedures within Mexico over the short to medium term.

Options for increasing the production of PBN procedures were discussed and included:

- a) **Recruiting additional untrained staff:** New personnel would require training and would not provide additional effective output for at least one year. The cost of training plus one year's unproductive employment is expensive.

- b) **Recruiting additional trained and PBN experienced staff:** This is likely not a viable option due to the worldwide shortage of experienced designers.
- c) **Outsourcing design to private enterprise designers:** Many administrations worldwide are choosing this option and there are now numerous companies providing design services. This option may appear expensive but, compared to the training and employment of in-house staff, can be cheaper. Consideration needs to be given to DGAC authorization of contract design organizations, although many design companies have obtained approval in other economies (Australia; Canada; the United States of America) and DGAC could choose to accept the accreditation granted by another economy.
- d) **Increasing the working hours of current staff:** An immediate increase in production may be achieved by voluntarily increasing the working hours of current staff. Indications are that SENEAM design staff are willing to cooperate.

AIRPORT OPERATORS

The Ambidji Team met with representatives of two airport operators. Airports are supportive of PBN although there is limited understanding of the benefits available.

Airports are not well informed about their responsibilities regarding the provision of airport and obstacle data, specifically Electronic Terrain and Obstacle Data (eTOD) in accordance with ICAO Annex 15. The operators were open to providing the data if required to by the DGAC.

6.4. Day 4: Thursday 11 August 2016

SENEAM ATS

A meeting was held with SENEAM Air Traffic Control staff and Management. The Ambidji Team examined current and proposed samples of arrival and departure procedures (SIDs and STARs) and discussed proposed implementation strategies and techniques.

SENEAM has a very sound appreciation of PBN and proposals for PBN implementation are consistent with good practice and the achievement of the goals of efficient traffic management and reduction of emissions.

It is recommended that SENEAM develop a program, including target dates, for PBN implementation at all airports. The program should include an assessment of priorities based on factors such as traffic density, existing approach procedures, weather, terrain, runway conditions, etc. The rollout program and priorities should be developed in consultation with all stakeholders.

SENEAM should conduct a study of CNS/ATM capability and include in the PBN Implementation Plan a program with timeline for the decommissioning of navigation aids not required as a back-up to PBN Navigation. An assessment of the estimated cost savings to be expected should also be included in the PBN Plan.

AIR OPERATORS

A meeting attended by a good representation of Mexican air operators, including AeroMexico, Volaris and Mexico's Air Force was held.

Air operator experience with the process of obtaining operational approval was reviewed. Some dissatisfaction with the approval process is evident, with the main issues being delays in obtaining approvals, repeated requests for additional information, and unnecessary flight checking of basic PBN operations by Flight Operations Inspectors. The operators also provided some examples of actual Ops Specs they had been issued that indicate a lack of understanding of some finer points of PBN on the part of the DGAC. For example, DGAC issued an RNAV 2 approval to AeroMexico, but limited the approval to terminal areas only, meaning they could not fly the U.S. Q routes.

The Ambidji Team discussed with the representatives of the air operators the discussion held earlier in the week with DGAC staff responsible for operational approvals. The recommendation that DGAC issue clear guidelines for applicants was well supported by the air operators, and will go a long way to improve the situation.

There was general agreement among operators that communication between operators and the DGAC needs to improve. Based on some examples given, this could be extended to include communication between operators and SENEAM as well. Overall, operators indicated enthusiastic support for timely PBN Implementation and a willingness to cooperate with the DGAC.

The Ambidji Team recommended that operators involve DGAC inspectors, especially flight operations inspectors, in development of their PBN capability and applications at an early stage. This is particularly relevant to the current project by Volaris to implement RNP AR approach procedures, in association with Airbus ProSky, at Tijuana and Guadalajara.

The Air Force has a fleet of aircraft that includes a number of types (e.g. B737NG, CASA 295, T-6C) that are capable of PBN operations. The Mexico Air Force has no current PBN experience but acknowledges that there is the opportunity to participate and to gain significant benefit from PBN. It is recommended that the Air Force participates in DGAC training programs where possible.

6.5. Day 5: Friday 12 August 2016

A meeting of all stakeholders was reconvened at DGAC Mexico City for the purpose of providing a summary of the information obtained during the week.

Mr Kennedy provided a PowerPoint presentation outlining the current situation relevant to each of the stakeholders and a summary of actions required (refer *Attachment C Site Visit 1 Summary*).

In summary:

- Despite the very limited PBN implementation to date, Mexico is well placed to achieve full PBN implementation in the short to medium term.

- Serious impediments to progress were identified including:
 - Training required for DGAC pilots to enable validation of PBN flight procedures
 - Training of DGAC Flight Operations Inspectors.

Although a PBN Implementation Task force has been established, it is recommended that the Task Force be formally appointed by joint authority of the Director General of Civil Aviation and the Director General of SENEAM in a document detailing the composition, roles and responsibilities of the Task Force. The enabling document should appoint selected well-qualified individuals representing key stakeholders and include a Mission Statement requiring the Task Force to undertake the supervision of PBN Implementation. The Task Force should be specifically charged with ensuring that a revised and mature PBN Implementation Plan is completed as soon as practical (before end 2016) and submitted to ICAO. The Task Force should be responsible for regular review of progress against the plan, identifying and rectifying any failure to meet the targets set out in the PBN Implementation Plan and reporting to the DG of Civil Aviation and DG SENEAM at regular intervals.

The Ambidji Team outlined the next steps that are to be taken which will include an Action Plan to be discussed during Site Visit 2, scheduled for 19 to 23 September.

Stakeholders were encouraged to consider their responses to the activities of Site Visit 1 and to be prepared to have further and more detailed input during Site Visit 2 when the proposed Action Plan will be presented for discussion. Stakeholders were reminded that the objective at the conclusion of Site Visit 2 is to be able to prepare a mature revised Mexico PBN Plan.

SUPPLEMENTARY MEETINGS

Following the final general session, the Ambidji Team conducted additional meetings to meet DGAC personnel that had not been available earlier in the week.

DGAC AIRPORT INSPECTORS

Mr VanNess met with Ing Jimenez representing the Air Navigation Directorate and a staff member from the DGAC Airports Directorate regarding airport obstacle data. The DGAC does have a process for prior approval of new construction within 10 miles of airports, however the application, if approved, presently remains in a paper file. Airports are not required to provide the DGAC with eTOD data in accordance with ICAO Annex 15. The DGAC has assigned responsibility for compliance with Annex 15 to the Air Navigation Directorate and for Annex 14 to the Airports Directorate. As a result of this division of responsibility, the Airports Directorate, the organization within DGAC that deals with airports, has not required airports provide eTOD data. The importance of good obstacle data to the procedure design process was emphasized. Options were discussed for the Airports and Air Navigation Directorate to work together on the eTOD issue.

It was recommended that for tracking purposes and use by procedure designers, avionics manufacturers and others, that the DGAC establish an electronic database of all approved obstacles.

DGAC FLIGHT OPERATIONS

The Ambidji Team met with the head of DGAC Flight Operations (Dirección de Control) and one of the DGAC Flight Operations Inspectors to discuss operational approval of PBN procedures.

It was acknowledged that Flight Operations Inspectors need training in both PBN operations and PBN Operational Approval.

As there are approximately 65 Flight Operations Inspectors, it was suggested that initially a small group of pilots be selected to undertake PBN training and act as PBN Subject Matter Experts (SMEs). Subsequently those pilots would be available to mentor other pilots and perhaps to provide in-house specialist training.

It was also recommended that as soon as possible one or more flight operations inspectors be assigned to the Volaris/Airbus ProSky RNP AR Project in order to participate in the procedure development process, training and other activities, in order to gain practical experience in advance of Volaris submitting an application for approval.

Of the AOC holders in Mexico, a large number operate aircraft below 5700 Kg which are typically equipped with panel mounted “stand-alone” GNSS receivers. As the operation of this type of equipment is quite different to that in an FMS equipped aircraft it is recommended that selected flight operations inspectors be trained on this class of equipment. Additionally, flight training schools in Mexico can be expected to add PBN training to their curriculum as more PBN procedures become available in México. Consideration should also be given to the training of inspectors who will be required to conduct oversight of flight training schools.

7. CONCLUSION

The Ambidji Team appreciates the level of co-operation and support for the Program provided by all stakeholders.

The excellent support provided by the Program Liaison Officer Ing. José Jimenez is acknowledged with thanks.

ATTACHMENT A

PROJECT OVERVIEW

APEC TPT 15/2015A
ENHANCING AVIATION CONNECTIVITY and EMISSIONS
REDUCTION via IMPLEMENTATION of PERFORMANCE BASED
NAVIGATION (PBN) ASSISTANCE PROGRAM

PROJECT OVERVIEW



Asia-Pacific
Economic Cooperation

Mexico City 8th August 2016



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APEC PROGRAM OVERVIEW



- Assist APEC member economies to develop a mature PBN Implementation Plan
- Member Economies are Mexico and Indonesia
- Evaluate current PBN Plan and Status
- Identify long-term PBN Objectives
- Develop a PBN Implementation Gap Analysis
 - Site Visit 1 Mexico City 8-12 Aug
- Develop PBN Action Plan with Timelines
 - Site Visit 2 Mexico City 19-23 Sep

*Please refer to the
Terms of Reference
for Full Details*

GOALS

The goals of the **1st Site Visit** are to:

- Evaluate the current PBN status in Mexico
- Identify impediments to full implementation
- Provide technical advice to stakeholders

FACILITATORS



Robert (Bob) Kennedy

Ambidji

Project Coordinator and PBN Operations Specialist

Dave VanNess

Ambidji

PBN Flight Procedures Specialist

Ing José I. Gil Jimenéz

Deputy Manager for Air Navigation, DGAC

Project Liaison Officer

DAILY SCHEDULE



Day 1

- Program Overview, Review of PBN Implementation Plan, General Discussion and Input from Stakeholders

Day 2

- Meetings with DGAC stakeholders (at DGAC)

Day 3

- Meetings with SENEAM and aerodrome stakeholders (at SENEAM)

Day 4

- Meetings with SENEAM and air operator stakeholders (at SENEAM)

Day 5

- Debriefing, presentation of preliminary findings (at DGAC)

TODAY'S AGENDA



- Informal
- All topics are open for discussion
- All stakeholders are invited to participate
- Share your experience with partner organizations
- Identify issues and impediments
- Discuss priorities and goals

Your opportunity to contribute to the future of PBN in Mexico

DAILY SCHEDULE



0900 Start

1015 Break

1200-1300 Lunch

1415 Break

1600 Finish

COMMENTS



Program can change to meet the needs of participants

Proceedings will be informal

Everybody is invited to participate

Your input is vital

Please ask questions

Objective is to achieve real outcomes

ENHANCING AVIATION CONNECTIVITY and EMISSIONS
REDUCTION via IMPLEMENTATION of PERFORMANCE BASED
NAVIGATION (PBN) ASSISTANCE PROGRAM



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Economic Cooperation



AMBIDJI

QUESTIONS?

ATTACHMENT B

PBN PLAN ESSENTIALS

APEC TPT 05/2015A
ENHANCING AVIATION CONNECTIVITY and EMISSIONS
REDUCTION via IMPLEMENTATION of PERFORMANCE BASED
NAVIGATION (PBN) ASSISTANCE PROGRAM

PBN PLAN ESSENTIALS



Asia-Pacific
Economic Cooperation

Mexico City 8th August 2016



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APEC PROGRAM OVERVIEW



- Assist APEC member economies to develop a mature PBN Implementation Plan
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GOALS



The goals of the **1st Site Visit** are to:

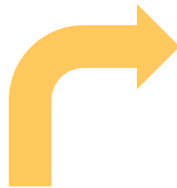
- Evaluate the current PBN status in Mexico
- Identify impediments to full implementation
- Provide technical advice to stakeholders

PBN IMPLEMENTATION: 1st STEP



AMBIDJI

- Develop a good plan
- Follow the plan
- Keep the plan up-to-date



PLAN DE IMPLANTACIÓN DE
NAVEGACIÓN BASADA EN LA
PERFORMANCE (PBN)
EN EL ESPACIO AÉREO
DE MÉXICO
2015

(PI-PBN México)

PLAN CONTENTS



- Executive Summary, Table of Contents, Glossary
- Overview
- PBN
- Implementation Challenges
- Implementation Targets
- Coordination with Stakeholders
- Safety
- Appendices

OVERVIEW



- Background
- Purpose
- Strategic Objectives
- Assumptions & Constraints

Your vision of the future of PBN in Mexico

PBN



- PBN Concept
- Current PBN Implementation Status
- Aircraft Fleet Capabilities
- Economy CNS/ATM Capabilities
- Benefits of PBN and Global Harmonization



Where is Mexico now with PBN??



ENHANCING AVIATION CONNECTIVITY and EMISSIONS REDUCTION via IMPLEMENTATION of PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM



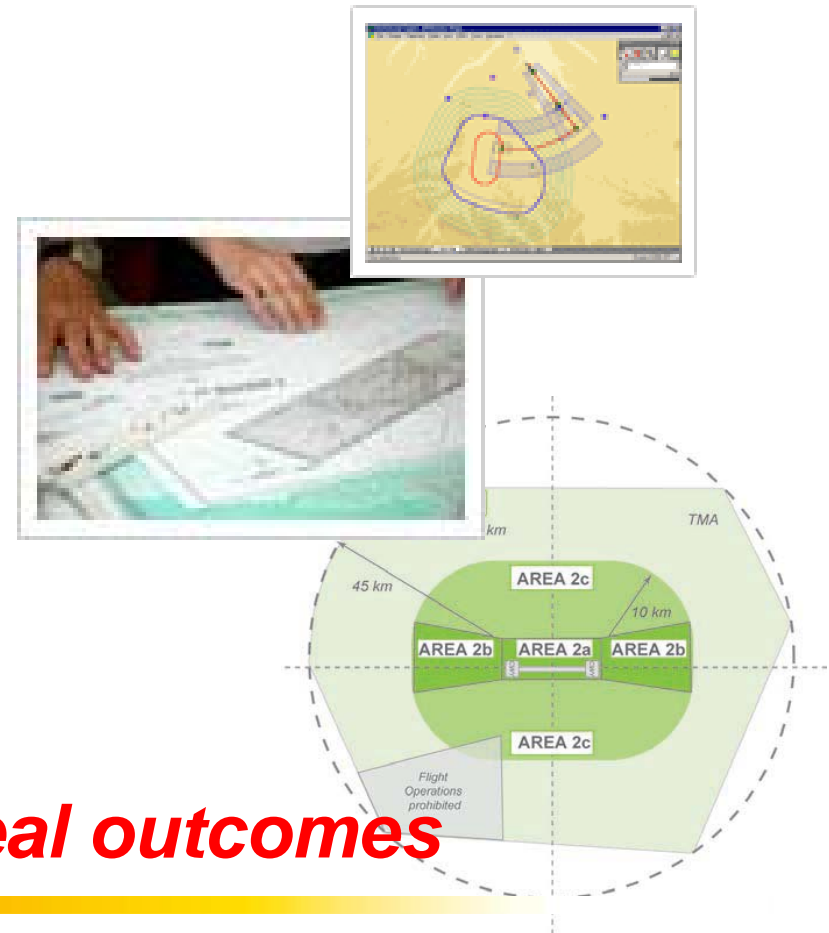
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IMPLEMENTATION CHALLENGES



AMBIDJI

- Safety
- Aircraft Equipage
- Infrastructure
- Efficiency and Capacity
- Environment (Noise and Emissions)
- Regulatory
- Resources
- Air Navigation Service Provider (ANSP)



Objective is to achieve real outcomes

IMPLEMENTATION TARGETS



AMBIDJI

- Short Term (2016-2019)
- Medium Term (2020-2022)
- Long Term (2023 and beyond)
- End State (year)



Assembly Resolution A37-11 calls for 100% of
runways to have a PBN approach by 2016

Time is running out!



ICAO SAFETY



Visit us today!
icao.int/safety/pbn

***Objective: to give stakeholders information for
their future planning and procurement decisions***

PLAN COORDINATION



- Coordination and Consultation
- Plan Responsibility
- Plan Review

Objective: to give stakeholders input and keep them informed on Mexico's PBN implementation

SAFETY



- Preliminary Safety Assessment
- Post-implementation Safety Assessment

Objective: Implement PBN, but do it safely

APPENDICES



AMBIDJI

- Assembly Resolution A37-11
- Detailed Implementation Schedule
- References
- Additional appendices as required

***Objective: to give stakeholders additional
detailed information on Mexico's PBN
implementation***

ENHANCING AVIATION CONNECTIVITY and EMISSIONS
REDUCTION via IMPLEMENTATION of PERFORMANCE BASED
NAVIGATION (PBN) ASSISTANCE PROGRAM



QUESTIONS?

ATTACHMENT C

SITE VISIT 1 SUMMARY

APEC TPT 15/2015A
ENHANCING AVIATION CONNECTIVITY and EMISSIONS
REDUCTION via IMPLEMENTATION of PERFORMANCE BASED
NAVIGATION (PBN) ASSISTANCE PROGRAM

SITE VISIT 1 SUMMARY



Asia-Pacific
Economic Cooperation

Mexico City 12th August 2016



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GOALS



The goals of the **1st Site Visit** are to:

- Evaluate the current PBN status in Mexico
- Identify impediments to full implementation
- Provide technical advice to stakeholders

ENHANCING AVIATION CONNECTIVITY and EMISSIONS
REDUCTION via IMPLEMENTATION of PERFORMANCE BASED
NAVIGATION (PBN) ASSISTANCE PROGRAM



MEXICO PBN STATUS



GOOD POSITION TO ACHIEVE IMPLEMENTATION

PROVIDED

SOME ROADBLOCKS ARE REMOVED

ENHANCING AVIATION CONNECTIVITY and EMISSIONS
REDUCTION via IMPLEMENTATION of PERFORMANCE BASED
NAVIGATION (PBN) ASSISTANCE PROGRAM



DGAC STANDARDS



AMBIDJI

PBN RULES AVAILABLE

RNP AR RULES IN DRAFT

RULES NEED UPDATING

PBN TRAINING REQUIRED

ENHANCING AVIATION CONNECTIVITY and EMISSIONS
REDUCTION via IMPLEMENTATION of PERFORMANCE BASED
NAVIGATION (PBN) ASSISTANCE PROGRAM



DGAC FLIGHT VALIDATION



ENOUGH CREWS

ADEQUATE AIRCRAFT AVAILABILITY

AIRCRAFT AVIONICS ADEQUATE

PILOTS UNTRAINED IN PBN OPERATIONS

PILOTS UNTRAINED IN VALIDATION

DGAC OPS APPROVAL



AMBIDJI

PROCESS IN PLACE

GOOD UNDERSTANDING OF PBN

APPROVALS TOO COMPLICATED

FLIGHT OPS PILOTS NEED TRAINING

PBN OPERATIONS

PBN OPERATIONAL APPROVAL

SENEAM – PROCEDURE DESIGN



AMBIDJI

CAPABLE DESIGN STAFF

GOOD KNOWLEDGE OF PBN DESIGN

QUALITY ASSURANCE PROCEDURES

INSUFFICIENT STAFF

TRAINING IN VALIDATION NEEDED

SENEAM – AIR TRAFFIC



GOOD APPLICATION OF PBN

ON TRACK TO ACHIEVE PBN EFFICIENCIES

NEED TO DETERMINE GOALS

DETAILED TIMELINE FOR IMPLEMENTATION

IDENTIFY PRIORITIES

CONSULT WITH CUSTOMERS

ENHANCING AVIATION CONNECTIVITY and EMISSIONS
REDUCTION via IMPLEMENTATION of PERFORMANCE BASED
NAVIGATION (PBN) ASSISTANCE PROGRAM



AIRPORT OPERATORS



AMBIDJI

NO SIGNIFICANT ISSUES

MUST PROVIDE ANNEX 15 (eTOD) DATA

PARTICIPATE IN SETTING GOALS

ENHANCING AVIATION CONNECTIVITY and EMISSIONS
REDUCTION via IMPLEMENTATION of PERFORMANCE BASED
NAVIGATION (PBN) ASSISTANCE PROGRAM



AIR OPERATORS



AMBIDJI

SUPPORTERS OF PBN

WILLING TO WORK WITH DGAC

MUST PARTICIPATE IN SETTING GOALS

SOME FRUSTRATION WITH APPROVALS

NEED DGAC TO DETAIL REQUIREMENTS

ENHANCING AVIATION CONNECTIVITY and EMISSIONS
REDUCTION via IMPLEMENTATION of PERFORMANCE BASED
NAVIGATION (PBN) ASSISTANCE PROGRAM



PBN TASK FORCE



AMBIDJI

FORMALLY ESTABLISH TASK FORCE

REPRESENTATION FROM MAJOR STAKEHOLDERS

ADOPT A MISSION STATEMENT

DRIVE PBN IMPLEMENTATION

REVIEW PROGRESS vs PLAN

TAKE ACTION TO KEEP ON TRACK

SUMMARY



AMBIDJI

MEXICO CAN ACHIEVE FULL IMPLEMENTATION

In Short to Medium Term

PROVIDED ACTION IS TAKEN

To remove the ROADBLOCKS

NEXT STEPS - AMBIDJI



Prepare an Action Plan

Site Visit 2 September 19 – 23

Present Action Plan for review by Stakeholders

NEXT STEPS - STAKEHOLDERS



AMBIDJI

Build on this week's discussions

Take action where possible

Start thinking about how to move forward

Think about your goals and timeline

Be ready to contribute to Site Visit 2

ENHANCING AVIATION CONNECTIVITY and EMISSIONS
REDUCTION via IMPLEMENTATION of PERFORMANCE BASED
NAVIGATION (PBN) ASSISTANCE PROGRAM



THANK YOU

ATTACHMENT D

LIST OF WORKSHOP ATTENDEES

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Y TRANSPORTESAsia-Pacific
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NOMBRE Y CARGO	ORGANIZACIÓN	DIRECCIÓN	TELÉFONO	CORREO ELECTRÓNICO
ALVARO EDGAR PÉREZ GALINDO INSPECTOR VERIFICADOR AERONÁUTICO	DIRECCIÓN GENERAL DE AERONÁUTICA CIVIL	BLVD. ADOLFO LÓPEZ MATEOS NO. 1990, COL. LOS ALPES, DEL. ALVARO OBREGÓN, C.P. 01010, CIUDAD DE MÉXICO		
EDGAR GONZALEZ FLORES INSPECTOR VERIFICADOR AERONÁUTICO	DIRECCIÓN GENERAL DE AERONÁUTICA CIVIL	BLVD. ADOLFO LÓPEZ MATEOS NO. 1990, COL. LOS ALPES, DEL. ALVARO OBREGÓN, C.P. 01010, CIUDAD DE MÉXICO		
SANDRA FABIOLA CARRERA PEÑA	DIRECCIÓN GENERAL DE AERONÁUTICA CIVIL	BLVD. ADOLFO LÓPEZ MATEOS NO. 1990, COL. LOS ALPES, DEL. ALVARO OBREGÓN, C.P. 01010, CIUDAD DE MÉXICO		

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ROBERT KENNEDY	THE AMBIDJI GROUP PTY LTD			
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SCT

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COMUNICACIONES
Y TRANSPORTES



**Asia-Pacific
Economic Cooperation**

NOMBRE Y CARGO	ORGANIZACIÓN	DIRECCIÓN	TELÉFONO	CORREO ELECTRÓNICO
DAVID VANNESS	THE AMBIDJI GROUP PTY LTD			
ANGELA HARRIS CLARK MANAGER	ASIA PACIFIC APC-10 OFFICE OF INTERNATIONAL AFFAIRS			

APPENDIX F

Site Visit 2 Report

**ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION
VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION
(PBN) ASSISTANCE PROGRAM**

(TPT 05/2015A)

SITE VISIT 2 – MEXICO

(19 - 23 SEPTEMBER 2016)



**Asia-Pacific
Economic Cooperation
Secretariat**

September 2016

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Site Visit 2 – Mexico

(19th to 23rd September 2016)

1. INTRODUCTION

The second of two site visits to Mexico was conducted between 19 and 23 September 2016.

This report provides a summary of the activities conducted during this site visit.

Reference may also be made to the Terms of Reference document, which details the program activities for both Site Visits.

2. SCOPE OF SECOND SITE VISIT

The primary purpose of the second visit was to follow up on issues identified during the first site visit and to discuss with stakeholders the Actions proposed to permit Mexico to move to full implementation.

The format of the site visit was as follows:

- **Day 1:** A meeting of all stakeholders and interested parties. A summary of the issues identified during Site Visit 1 was reviewed. The ICAO PBN Implementation Plan Template was shared and explained.
- **Days 2, 3 & 4:** Meetings were conducted with individual organizations involved in the project.
- **Day 5:** A meeting of all stakeholders was reconvened and a summary of the findings of the Ambidji Team was provided

3. AMBIDJI TEAM

The Ambidji Team consists of PBN experts including:

- Mr Robert Kennedy (Ambidji Group), Project Coordinator and PBN Operations Specialist; and
- Mr David VanNess (Ambidji Group), PBN Flight Procedure Specialist.

4. FAA

The FAA was represented by:

- Mr Bruce W. Kinsler, FAA Manager, Policy and Strategic Planning, Domestic and International Performance Based Navigation;
- Mr William (Bill) Fernandez, FAA RNAV and RNP Approach Specialist;
- Mr Robert Trent Bigler, FAA Aviation Safety Inspector.

5. SUMMARY OF DAILY ACTIVITIES

5.1. Day 1: Monday 19 September 2016

A meeting of all stakeholders was conducted at the offices of the DGAC in Mexico City.

Representatives from the following organisations attended:

- DGAC;
- SENEAM;
- Air Operators;
- Air Force; and
- New Mexico City Airport.

Mr Kennedy presented a PowerPoint summary reviewing the outcomes of site visit 1.

The draft Action Items arising from Site Visit 1 were presented for discussion. Input from stakeholders regarding achievable target dates and time lines were sought and added to the draft Action Item List.

A copy of the ICAO PBN Implementation Plan template was presented and each element discussed, with suggestions and examples. Stakeholders were encouraged to consider individual input to the Mexican PBN Implementation Plan for further discussion with individual stakeholder during the remainder of Site Visit 2.

Helicopter operators Aerolineas Executivos and Avimex attended. Part 135 operations from Toluca to Mexico City and other destinations using a mix of Bell 407 and Agusta 109 helicopters were discussed. Helicopter operations are also conducted in other parts of Mexico, including oil platforms in the Gulf of Mexico. It is expected that most of helicopter fleet is equipped with at least basic GNSS equipment and there is interest in the possibility of helicopter PBN procedures in the future. Helicopter operators were advised that the priority for PBN implementation would initially be focused on IFPs for the fixed wing fleet, but requests for helicopter IFPs should be directed to the DGAC.

The Ambidji Team highlighted the benefits of a PBN Implementation Task Force responsible for ensuring that the Mexico PBN Implementation Plan proceeds on schedule.

It was emphasised that top level endorsement of the Task Force is highly desirable and it is suggested that a Task Force is appointed jointly by the DGs of DGAC and SENEAM. The Task Force should have clearly defined Terms of Reference with responsibility to ensure PBN Implementation proceeds on schedule and with the requirement to report regularly to the joint DGs.

5.2. Day 2: Tuesday 20 September 2016

A meeting with the Flight Standards (Depto de Normas) chief and personnel focused on timelines for revision of the PBN AC and publication of the draft RNP AR AC as well as PBN Operational

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Approval training for the chief and staff. It is intended to publish the RNP AR AC immediately, in order to not delay expected applications from operators for RNP AR approval. A review and update of the general PBN AC is expected to be completed by 31 December 2016.

As the Engineering and Operations Directorate was also represented, Ambidji advised the two departments to work closely together to include PBN operational approval application guidance and the RNP AR AC material in the revised PBN AC.

As it is expected that the Direccion de Control will arrange PBN Operational Approval training for their Flight Operations Inspectors, provision needs to be made for personnel from Flight Standards to attend. The chief of Flight Standards estimated that 6 people from his department including himself, should attend PBN training.

A meeting was held with representatives of the Flight Inspection Unit who have the vital role of Flight Validation. The importance of validation was emphasized; particularly as a number of procedures are waiting for validation before they can be published. It was confirmed during that meeting that the Flight Inspection Unit has 4 Citation aircraft (2 C500, 2 C550), all with UNS-1Fw FMS.

Mr Van Ness reported on discussions with Simulflite (United States of America) regarding possible PBN operations training for Flight Inspection Unit pilots at the next scheduled recurrent training planned for October 2016. Options for PBN Operational Training and Flight Validation Pilot Training were discussed.

In the afternoon a meeting was convened with Direccion de Control Flight Operations Inspectors and a broad range of operations discussed, including airlines, general aviation, helicopters and training.

There are approximately 60 FOIs in the DGAC. FOIs with airline duties do not have PBN flight operations training. It was recommended that FOIs obtain the necessary experience by participating in operators' simulator and ground training for PBN approaches. FOIs tasked with general aviation and helicopter oversight also do not have PBN experience and need PBN operations training in stand-alone GNSS equipped aircraft. Training with basic GNSS equipment is readily available but the DGAC should investigate the possibility that local training organisations have the necessary equipment and experience.

All FOIs will eventually need to attend a PBN Operational Approval course in order to properly fulfil their responsibility for approval and oversight of PBN operations. PBN operational approval should be incorporated in the DGAC basic FOI training at the earliest opportunity.

It was noted that PBN rules applicable to general aviation operations are not written. The need to develop a simple system of approval for small operators, including private operators was discussed. In many cases, particularly where operators do not operate under an OPSPEC, the approval process applicable to airlines may not be warranted. The concept of self-approval, which is adopted by some economies, was discussed. Direccion de Control indicated that rules could be written and published by March 31, 2017.

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Most helicopter operations in Mexico currently are VFR and helicopter FOIs do not have any PBN experience. Ambidji suggested that in the future regulations will be required to permit helicopter IFR operations which consequently include PBN. It was noted that in many economies' helicopter night operations, particularly for Part 135 operations and EMS, are required to be IFR due to the high accident risk experience worldwide during night VFR operations. In most economies IFR is now required for helicopter EMS operations.

5.3. Day 3: Wednesday 21 September 2016

SENEAM

The priorities for the design of PBN approaches were discussed. A draft year by year priority list of all 60 airports was developed, taking into account airports where design is already complete or to be completed in 2016 and based on a production rate of 12-13 airports per year for 2017-2020.

DGAC, with the help of SENEAM, has reviewed RNP AR Approaches designed by a third party provider, and identified some deviations from ICAO criteria. This experience has highlighted the fact that DGAC does not have a regulation governing the oversight of procedure design organisations and that there is no policy on addressing exemptions or waivers for deviations from the PANS OPS criteria.

It was noted that DGAC is using some SENEAM procedure design expertise because none of the DGAC Air Navigation Inspectors (ANIs) have any PANS OPS training. Oversight of all instrument flight procedure design organisations should be conducted by persons who are conversant with design processes and criteria. DGAC ANIs need to complete PANS OPS training, including RNP AR, and undergo at least one month of OJT with SENEAM to properly qualify them for their ANI duties in procedure design oversight.

Quality assurance (QA) processes in the SENEAM procedure design unit are applied, but are not documented in writing. Procedure designers are not familiar with the QA requirements of PANS OPS (Doc 8168) and the *Quality Assurance Manual for Flight Procedure Design* (Doc 9906). Designers are not conversant with the procedure for validation (including Flight Validation) in Doc 9906. Reviews of IFPs are only when there is a change due to new data or ATC/User request. ICAO PANS OPS (Doc 8168) stipulates that periodic review of IFPs should be conducted at least every 5 years. Requirements for documented QA procedures, including validation and periodic review need to be published in a DGAC Procedure Design Oversight regulation.

In order to understand the procedure design role in validation and flight validation it is recommended that designers attend the validation portion of a Flight Validation Pilot (FVP) course.

Toluca RNAV (GNSS) approaches were discussed and it was recommended that the existing procedures be reviewed and validated.

Procedure designers advised that in many cases runway ends are not surveyed. Although DGAC should have the latest information that is not always the case and often the procedure designers

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have to contact the airport to get the information or have the airport do a new survey. The critical importance of current survey for runway ends was emphasised, as well as the need for Annex 15 eTOD.

The SENEAM procedure design unit has 4 full time procedure designers that can design for 10 airports per year. Procedure design staffing is insufficient for the anticipated PBN implementation rate of 12 or 13 airports per year. Staffing will need to increase to 5 or 6 designers to accommodate the increased rate and also keep up with other tasks such as obstacle evaluations and periodic reviews of all published IFPs.

In the course of discussing the value of including LPV minima on all RNP APCH approaches (within the service volume), procedure designers stated that LPV minima had not been published due to doubts about whether Mexico could use the WAAS system, even though most of the economy has coverage. Although the necessary WAAS ground stations have been installed in Mexico and agreements between Mexico and the United States of America for use of the WAAS signal are believed to have been made, SENEAM ATC management was not able to confirm that LPV procedures can be published. FAA personnel present at the meeting knew of no obstacle to Mexico's use of the system, which has several ground reference stations in SENEAM facilities. As a matter of priority, this doubt should be resolved as soon as possible.

5.4. Day 4: Thursday 22 September 2016

AIRPORTS

Discussion on Day 4 with the airports focused on the eTOD requirements in Annex 15 and the importance of that data for PBN implementation. Only the old and new Mexico City International Airports were represented. Discussed the benefits of collecting eTOD and implementing PBN at the existing Mexico City airport even though it is supposed to be closed in only 4 years.

AIRLINES

The operator meeting on Day 4 was very well attended, with representation from several airlines, business aviation and the military. The draft SENEAM procedure design priority list and timeline was reviewed with considerable positive response by the operators. The operators were provided with a copy of the list so they could review it in more detail and provide their input to DGAC and SENEAM at a later date.

Considerable time was spent reviewing RNP AR procedures that Volaris submitted to DGAC for approval. DGAC with the help of SENEAM provided feedback to the airline concerning some parts of the procedures' design that do not comply with ICAO criteria, as well as airspace/air traffic concerns. The Ambidji team discussed waivers or exemptions to criteria as well as the need to work closely with the air traffic organisation to work out a solution that meets the needs of both the operator and air traffic organisation. This discussion was particularly useful as it exposed the other operators to the benefits that can be obtained with RNP AR and further spurred their interest in PBN implementation.

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Operators expressed strong support and enthusiasm for PBN implementation and expressed their willingness to support the DGAC and SENEAM in that effort wherever they could, including with simulator time and training, as needed.

5.5. Day 5: Friday 23 September 2016

A meeting of all stakeholders was reconvened at DGAC Mexico City for the purpose of providing a summary of the information obtained during the week.

DIRECTOR GENERAL BRIEFING

Following completion of the final general stakeholder session a meeting was conducted with the DGs of DGAC and SENEAM.

A briefing on the outcomes of the Program was provided and both DGs indicated enthusiastically their support for PBN Implementation.

The Ambidji Team highlighted some key points that warranted attention at senior management level.

- The importance of high level oversight of PBN Implementation was discussed and it was recommended that the existing voluntary PBN Task Force is formally established by the joint DGs tasked with oversight of PBN Implementation. It is suggested members be formally appointed, that the Task Force operates in accordance with a written Terms of Reference and is required to report regularly to the joint DGs.
- Several training requirements that are urgently required will require some allocation of funding. The costs are not considered to be high, but currently there is no budget for this expenditure. Training includes:

Flight Inspection/Flight Validation Pilot training

Flight Operations Inspector (Pilot) training

The DGs indicated that funds would be made available.

APPENDIX G

Summary of Best Practice

SUMMARY OF BEST PRACTICE

During both site visits, the Ambidji Team had numerous discussions that relate to the adoption of best practice. Where appropriate best practice is reflected in the Actions and Recommendation contained in the body of this report.

This section summarizes best practices shared with Mexico during the course of the two site visits.

Regulatory

- Regulation of IFP design should:
 - Require all flight procedures design organizations (including 3rd party designers) to be properly authorized;
 - Ensure that all flight procedure design organizations (including 3rd party designers) are fully compliant with the relevant regulation;
 - Require that all flight procedure design organizations implement documented quality assurance processes conforming to ICAO Doc 9906;
 - Require that procedure design organizations (including 3rd party designers) have training programs developed in accordance with Doc 9906 Vol 2, including on-the-job training, refresher training and recurrent training;
 - Include provision for the approval of variations to ICAO design criteria;
 - Include the requirement for the periodic review of IFPs, including the maximum interval;
 - Require that procedure design oversight inspectors be trained and have some experience in all relevant types of procedure design.

Operational Approval

- Procedures for application and granting of PBN Operational Approval should be thorough but efficient. Care should be exercised to ensure that the process does not result in unnecessary workload for inspectors and applicants;
- OPSPECS approving RNP APCH operations should include a note indicating which specific types of approach are authorized i.e. LNAV, LNAV /VNAV, and/or LPV;
- DGAC should publish clear guidelines detailing the requirements for Operational Approval. Guidelines should be followed by both inspectors and applicants;
- FOIs with general aviation responsibilities should have PBN training in basic stand-alone GPS receivers (e.g. Garmin 430).

Procedure Design

- All runway ends should be provided with an APV wherever physically possible;
- Every ILS should be backed up by an APV;
- The published vertical approach gradient for PBN approach procedures (except LPV) should be designed to take into account the ambient air temperature in accordance with ICAO Doc 8168. (Typically 2.8° in ISA +15 conditions);
- Provision should be made for the adoption of new ICAO chart titling convention for approaches (RNP to replace RNAV (GNSS)).

Validation

- Validation of IFPs to be in accordance with ICAO Doc 9906 Volume 5;
- Procedure designers to be familiar with validation procedures detailed in ICAO Doc 9906 Vol 5;
- Pilots responsible for validation/flight validation to be qualified in accordance with ICAO Doc 9906 Vol 6, including supervised OJT;
- FVPs should have PBN training in basic stand-alone GPS receivers (e.g. Garmin 430).

APPENDIX H

Action Element Task Sheets

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	1	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input checked="" type="checkbox"/> Urgent <input type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	Prepare PBN Plan DGAC, in consultation with all stakeholders, and in close co-operation with SENEAM, to prepare a new PBN Implementation Plan using the ICAO PBN State Implementation Plan Standard Template.		
Issue	Mexico has a basic PBN implementation plan in place that was prepared in 2015. The plan does not represent a mature PBN Implementation Plan as it does not contain many of the elements ICAO has identified as being essential in its PBN Implementation Plan Template.		
Comment (or Background)	ICAO Assembly Resolution A37-11 urges all members to develop a PBN Implementation Plan. While most members have prepared an Implementation Plan, the content and quality of plans varies greatly. In an effort to assist economies in developing a comprehensive and useful plan ICAO has developed guidelines and a PBN State Implementation Plan Standard Template. ICAO has requested by State Letter that all members review their PBN Implementation Plans with respect to the new ICAO Plan Template and submit a revised plan using that template.		
Organisation	DGAC and SENEAM		
Responsible Person/Department	DG and President-Director		
Target Date	December 31, 2016		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	1a	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input checked="" type="checkbox"/> Urgent <input type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	Prepare PBN Plan: Identify Strategic Objectives		
	Identify the strategic objectives to be achieved by PBN implementation in Mexico.		
Issue	A robust PBN Implementation Plan requires that the economy identify the objectives they seek to achieve by implementing PBN.		
Comment (or Background)	These could include reduced accident rate in Mexico, increased efficiency and continuity of operations at high traffic airports, reduced environmental impact, etc. (Chapter 1 of template)		
Organisation	DGAC and SENEAM		
Responsible Person/Department	DG and President-Director		
Target Date	December 31, 2016		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	1b	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input type="checkbox"/> Urgent <input checked="" type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	Prepare PBN Plan: List Assumptions and Constraints		
	List assumptions regarding the development and execution of the plan, with applicable constraints.		
Issue	Authors of the PBN Implementation Plan must identify and list any assumptions and/or constraints they are working under as they develop the plan.		
Comment (or Background)	Some items to consider when identifying assumptions and constraints are listed in the ICAO Standard Template (Chapter 1).		
Organisation	DGAC Directorate of Air Navigation		
Responsible Person/Department	Director of Air Navigation		
Target Date	December 31, 2016		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	1c	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input checked="" type="checkbox"/> Urgent <input type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	Prepare PBN Plan: DGAC to Conduct Fleet Study DGAC to conduct a study of the current and future planned PBN capabilities of the domestic and international fleets operating in Mexico.		
Issue	The fleet capability study available is from 2014. While this is adequate for initial development of the plan, a more current study including planned future fleet composition and capabilities is needed. The fleet capability study is required for the PBN Plan.		
Comment (or Background)	While the 2014 study is adequate for initial development of the plan, a more recent study including planned future fleet composition and capabilities is needed. Although it is clear that Mexico has a modern fleet with a high level of PBN capability, to move forward with development of the revised PBN Implementation Plan, up-to-date fleet information and consultation with operators on future fleet plans is necessary to assist in deciding when to implement and mandate PBN capabilities. This task is the responsibility of the Directorate General of Civil Aviation and should be completed as soon as possible in order to inform decisions about other areas of the plan. (Chapter 2 of template)		
Organisation	DGAC Directorate of Air Navigation		
Responsible Person/Department	Director of Air Navigation		
Target Date	December 31, 2016		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	1d	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input checked="" type="checkbox"/> Urgent <input type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	Prepare PBN Plan: SENEAM CNS/ATM Study SENEAM to conduct study of current CNS/ATM capabilities and future requirements based on a PBN-based airspace structure.		
Issue	There is no current CNS/ATM study available. This is required for the PBN Plan.		
Comment (or Background)	The study will support PBN planning with recent data enabling selection of the most suitable navigation specifications and setting priorities for implementation based on current and planned future CNS/ATM capability. It is recommended to include data on navigation aids requirements, current and planned future radar and ADS-B surveillance capabilities, and VHF direct pilot-controller communications capabilities. Data from this study will be used to facilitate various aspects of PBN implementation such as route spacing and design of terminal and approach procedures. The study also should include plans for decommissioning redundant navigation aids as PBN implementation proceeds.		
Organisation	SENEAM		
Responsible Person/Department	SENEAM		
Target Date	December 31, 2016		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	1e	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input type="checkbox"/> Urgent <input checked="" type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	Prepare PBN Plan: Determine Implementation Targets DGAC and SENEAM, in consultation with stakeholders, determine implementation targets for short and medium term, and end state (no more than 5 years) including mandates for PBN equipage/approval, for the various types of PBN operations.		
Issue	Detailed implementation targets have not been determined. Planned dates for mandate of PBN equipage not determined. Required for the PBN Plan.		
Comment (or Background)	In consultation with stakeholders determine implementation targets for short and medium term, and end state (no more than 5 years) including mandates for PBN equipage/approval, for the various types of PBN operations; enroute, terminal, approach, helicopter and military. As the ICAO goal for completion of PBN implementation by the end of 2016 is no longer achievable, further delay in realizing the safety and efficiency benefits of PBN implementation is not acceptable. (Chapter 4);		
Organisation	DGAC and SENEAM		
Responsible Person/Department	DGAC and SENEAM		
Target Date	December 31, 2016		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	1f	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input checked="" type="checkbox"/> Urgent <input type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	Prepare PBN Plan: DGAC Assess Expected Benefits of PBN DGAC, with input from SENEAM, operators and other stakeholders to assess expected benefits of PBN.		
Issue	An assessment of the benefits of PBN is necessary and should be included in the revised PBN Plan		
Comment (or Background)	Benefits based on achieving the end state PBN implementation should be assessed in real terms (financial as well as cultural/environmental) resulting from expected reduction in emissions, improvement in safety (reduced accident rate), and more efficient operations. It is particularly important to include the benefits assessment in the Mexico PBN plan in order to inform the public, industry, government and other stakeholders. (Chapter 4)		
Organisation	DGAC Directorate of Air Navigation		
Responsible Person/Department	Director of Air Navigation		
Target Date	December 31, 2016		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	1g	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input checked="" type="checkbox"/> Urgent <input type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	Prepare PBN Plan: DGAC & SENEAM to Assign Responsibility DG of DGAC and DG SENEAM to take joint action to make subordinate directors fully accountable for meeting PBN Plan targets.		
Issue	Responsibility and accountability for timely execution of the plan needs to be clearly assigned.		
Comment (or Background)	For PBN Implementation to succeed in Mexico action needs to be taken to ensure that every aspect of PBN is carefully managed and coordinated. Both DGAC and SENEAM have essential roles in PBN implementation and leadership by the Director-General of DGAC and the Director-General of SENEAM is essential for success. Joint action by DGAC and SENEAM to make subordinate directors fully accountable for meeting PBN Plan targets is necessary. (Chapter 5)		
Organisation	DGAC and SENEAM		
Responsible Person/Department	DG of DGAC and DG SENEAM		
Target Date	December 31, 2016		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	1h	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input checked="" type="checkbox"/> Urgent <input type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	Prepare PBN Plan: DGAC/SENEAM to Conduct Safety Study SENEAM, with input from DGAC and stakeholders to conduct a preliminary safety study of the risks, hazards and mitigations associated with executing the new PBN Implementation Plan.		
Issue	A pre-implementation safety assessment is required		
Comment (or Background)	An integral part of modern aviation planning is risk management and as PBN implementation constitutes a significant change to the Mexican airspace system, an assessment of the consequential risks is essential. SENEAM should have primary responsibility for the preliminary safety assessment to be included in the revised PBN Implementation Plan as well as post implementation assessment to ensure safety targets are met. (Chapter 6)		
Organisation	SENEAM		
Responsible Person/Department	SENEAM		
Target Date	December 31, 2016		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	1i	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input type="checkbox"/> Urgent <input checked="" type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	Prepare PBN Plan: SENEAM/DGAC Develop Priority List SENEAM, with input from DGAC and stakeholders to develop a prioritized list by year of the airports where PBN approaches and terminal area procedures such as Standard Instrument Departure (SID) and Standard Arrival Route (STAR) procedures are to be implemented (Appendix).		
Issue	A priority list of approaches and terminal procedures to be implemented is required.		
Comment (or Background)	A priority list helps stakeholders to plan their future operations, obtain benefits of PBN where they are needed the most, and allows SENEAM to plan their work.		
Organisation	DGAC and SENEAM		
Responsible Person/Department	DG of DGAC and DG SENEAM		
Target Date	December 31, 2016		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	2	<input type="checkbox"/> Required <input checked="" type="checkbox"/> Recommended	<input type="checkbox"/> Urgent <input checked="" type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	DGAC/SENEAM leadership Initiatives: Implement Management Structure DG of the DGAC to take charge of PBN implementation and in co-operation with the DG, SENEAM, to implement a management structure to oversee PBN implementation. Directorate and Department Heads should be made responsible and accountable for their organizations' roles in PBN implementation.		
Issue	A management structure to ensure PBN implementation is not clearly established.		
Comment (or Background)	<p>PBN implementation requires the co-ordination of many activities involving numerous agencies, service providers, operators, professional disciplines and thousands of individuals. Success is dependent on the effective management and co-ordination of the various participants and resources in an orderly and timely fashion. It is the task of effective management that is the most commonly overlooked aspect of PBN implementation worldwide. Lack of progress is commonly due to the failure to recognize that all components of PBN must exist concurrently for a PBN operation to be flown, and without continuous active management and co-ordination success is not achieved.</p> <p>In this respect Mexico is no different to many economies. Much effort has been expended in recent years on training, design, regulation development and many PBN assistance activities, yet progress is minimal and well behind ICAO targets. Because there are so many individual elements involved in PBN, from the design and validation of procedures, to approval and oversight of operators, training of flight crews, dispatchers and air traffic controllers, development of ATC procedures, management of data, redesign of airspace, mandating of PBN capability and much more, implementation does not happen unless there is effective high level management.</p> <p>This Program has identified that, for the most part, Mexican agencies and airlines have the capability to achieve full PBN implementation in the short to medium term.</p> <p>For PBN implementation to succeed in Indonesia action needs to be taken to ensure that every aspect of PBN is carefully managed and coordinated.</p>		
Organisation	DGAC and SENEAM		
Responsible Person/Department	DG of DGAC and DG SENEAM		
Target Date	December 31, 2016		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	2a	<input type="checkbox"/> Required <input checked="" type="checkbox"/> Recommended	<input type="checkbox"/> Urgent <input checked="" type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	DGAC/SENEAM leadership Initiatives: Establish a PBN Task Force Structure DG Civil Aviation and President-Director SENEAM jointly formally create a PBN Task Force, appoint members, and establish responsibilities		
Issue	Leadership, membership and responsibilities of Mexico's PBN Implementation Task Force are not clearly established.		
Comment (or Background)	This course of action is highly recommended as collectively SENEAM and DGAC play the key roles in PBN implementation. An unequivocal statement of commitment to PBN implementation and clear delineation of responsibilities and accountability by these leaders should go a long way toward ensuring that PBN implementation remains a priority for these organizations.		
Organisation	DGAC and SENEAM		
Responsible Person/Department	DG of DGAC and DG SENEAM		
Target Date	December 31, 2016		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	2b	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input type="checkbox"/> Urgent <input checked="" type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	DGAC/SENEAM leadership Initiatives: Manage Cultural Change DG of DGAC and DG SENEAM jointly convene a meeting of all department heads to plan the management of cultural change associated with PBN implementation. DG of DGAC and DG SENEAM direct the PBN Task Force to take action (workshops/seminars), to address cultural change.		
Issue	Air Traffic Controllers, like pilots and others, are reluctant to change and need to be persuaded, educated and if necessary directed to accept the change to a new way of doing business.		
Comment (or Background)	One of the difficulties and a common impediment to PBN implementation is the need at all levels to understand and embrace a change in aviation culture.		
Organisation	DGAC and SENEAM		
Responsible Person/Department	DG of DGAC and DG SENEAM		
Target Date	December 31, 2016		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	3	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input type="checkbox"/> Urgent <input checked="" type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	<p>DGAC Update PBN Operating Rules</p> <p>DGAC to update and revise circulars to reflect the latest version of the ICAO PBN Manual (Doc 9613) and Doc 9997</p> <p>DGAC to consolidate all PBN rules into a single circular</p>		
Issue	<p>Mexico's PBN Instruction, AC CO AV-11/09, is out of date. Does not reflect changes in the latest edition of the ICAO PBN Manual (Doc 9613)</p>		
Comment (or Background)	<p>The latest edition of the ICAO PBN Manual (Doc 9613) includes additional navigation specifications including Advanced RNP, RNP 2, RNP 0.3, RNP APCH part B; some of which Mexico can expect to implement in the near term. Operators need up-to-date guidance in order to apply for operational approval. The latest edition of the Operational Approval Manual (Doc 9997) has relevant guidance and has also been updated to reflect changes to Doc 9613. The RNP AR rules are contained in a separate draft circular to be published in October 2016. This AC should be combined with the PBN AC into one document when it is updated.</p>		
Organisation	<p>DGAC, Standards Department (Departamento de Normas)</p>		
Responsible Person/Department	<p>DGAC, Chief of Standards Department</p>		
Target Date	<p>December 31, 2016</p>		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	4	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input type="checkbox"/> Urgent <input checked="" type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	PBN Operational Approval Training for Depto de Normas DGAC Flight Standards Department (Departamento de Normas) staff to complete PBN Operational Approval training course.		
Issue	Standards Department staff do not have PBN operational approval training.		
Comment (or Background)	<p>Following discussions with the Chief, Standards Department (Departamento de Normas), whose department is responsible for developing operating rules, it was agreed that while personnel in this section have some understanding of PBN, further training is warranted.</p> <p>The appropriate course of training for persons responsible for developing PBN operating rules is an ICAO PBN Operational Approval Course, typically of one-week duration. As other persons in DGAC will require the same course, it is suggested that DGAC arrange a course to be conducted in Mexico City and that selected personnel from the Standards Department attend.</p>		
Organisation	DGAC, Standards Department (Departamento de Normas)		
Responsible Person/Department	DGAC, Chief of Standards Department		
Target Date	March 31, 2017		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	5	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input type="checkbox"/> Urgent <input checked="" type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	DGAC Publish Operational Approval Guidelines DGAC to publish guidelines for applicants detailing the requirements for PBN operational approval OPS SPECS with an approval for RNP APCH must include a note indicating which specific types of approach are authorised i.e. LNAV, LNAV /VNAV, LPV.		
Issue	Several comments from operators noted that the process of PBN operational approval is inefficient and is causing significant delays and expense to operators. DGAC has not published guidance material on the content requirements for applications for PBN approval Cases were reported which appear to indicate that DGAC is imposing unnecessary requirements for approval. Complaints were also received that DGAC had made repeated requests for information, causing delays in obtaining approval.		
Comment (or Background)	There were some anomalies in Operations Specifications (OPS SPECS) including unduly restricting RNAV 2 operations to terminal areas. A common issue seen with OPS SPECS issued for RNP APCH is that the type of RNP APCH authorized (LNAV, LNAV/VNAV/LPV) is not noted on the OPS SPEC. Updated guidance should reflect this requirement. DGAC has not published guidelines for applicants detailing the form and content of a conforming application. A lack of guidance material typically results in additional work and a delay in approval, as neither party (applicant or regulator) has the benefit of clear guidelines. As the DGAC faces an increase in the number of applications, publication of clear guidance material is essential. DGAC should also consider establishing a service level commitment for the time required to process a conforming application for PBN operational approval, e.g. within 60 days of receipt of application. Department of Engineering and Operations should work closely with the Standards Department to include this material in the update to the PBN AC. (see Action Element 3)		
Organisation	DGAC, Department of Engineering and Operations		
Responsible Person/Department	DGAC, Chief, Department of Engineering and Operations		
Target Date	December 31, 2016		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	6	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input checked="" type="checkbox"/> Urgent <input type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	PBN Training for FOIs: Initial Group DGAC to arrange PBN Operations training for an initial group of Flight Operations Inspectors DGAC Flight Operations Inspectors responsible for general aviation operations to obtain PBN operational experience using stand-alone GNSS receivers.		
Issue	Flight Operations Inspectors (pilots) are not trained in PBN flight operations		
Comment (or Background)	<p>Flight Operations Inspectors lack training in PBN operations. This situation is not unexpected as Flight Operations Inspectors are not employed on operational flying duties, and there are few PBN procedures published in Mexico. Consequently, there is little opportunity for DGAC inspectors to gain practical experience in PBN operations. Despite these difficulties it is however necessary that inspectors tasked with PBN Operational Approval should be trained and competent in PBN flight operations.</p> <p>As there are approximately 65 Flight Operations Inspectors, initially a small group of pilots should be selected to undertake PBN training and act as PBN Subject Matter Experts (SMEs). Subsequently those pilots would be available to mentor other pilots and provide in-house specialist training.</p> <p>Of the Air Operator Certificate (AOC) holders in Mexico, a large number operate aircraft below 5700 Kg which are typically equipped with panel mounted "stand-alone" GNSS receivers. As the operation of this type of equipment is quite different to that in an FMS equipped aircraft it is recommended that selected flight operations inspectors with general aviation responsibilities be trained on this class of equipment. Additionally, flight training schools in Mexico can be expected to add PBN training to their curriculum as more PBN procedures become available in México. Consideration should also be given to the training of inspectors who will be required to conduct oversight of flight training schools.</p>		
Organisation	DGAC, Direccion de Control		
Responsible Person/Department	DGAC, Director, Direccion de Control		
Target Date	March 31, 2017		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	6a	<input type="checkbox"/> Required <input checked="" type="checkbox"/> Recommended	<input type="checkbox"/> Urgent <input type="checkbox"/> Important <input checked="" type="checkbox"/> Routine
ACTION	PBN Training for FOIs: All DGAC FOIs		
	DGAC to arrange for all remaining Flight Operations Inspectors to undertake PBN Operations training		
Issue	Flight Operations Inspectors (pilots) are not trained in PBN flight operations		
Comment (or Background)	In the mid to long term PBN will be the default operation for enroute and terminal operations, with ILS/GLS and PBN for approach operations. For this reason, all flight operations inspectors will eventually need to be trained and qualified for PBN. It is anticipated that new hire FOI's in the future will already have training and experience in PBN operations.		
Organisation	DGAC, Direccion de Control		
Responsible Person/Department	DGAC, Director, Direccion de Control		
Target Date	December 31, 2017		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	7	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input checked="" type="checkbox"/> Urgent <input type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	PBN Operational Approval Training DGAC to ensure that all Flight Operations Inspectors are trained in PBN Operational Approval requirements and DGAC approval processes. DGAC to arrange a PBN Operational Approval course for an initial group of Flight Operations Inspectors and select Airworthiness Inspectors.		
Issue	Flight Operations Inspectors (pilots) are not trained in PBN Operational Approval		
Comment (or Background)	<p>There are approximately 65 Flight Operations Inspectors (FOI) including some tasked with general aviation and helicopter oversight. They have not been trained in PBN Operational Approval requirements.</p> <p>An initial cadre of FOI's, once qualified in PBN flight operations, needs to be trained in PBN operational approval. This is typically a 5-day course of classroom instruction, which in the past has been available through ICAO or from some private organisations.</p> <p>Some Airworthiness Inspectors and Standards Department staff should also attend the PBN Operational Approval training in order to gain a full understanding of the PBN approval process</p>		
Organisation	DGAC, Direccion de Control		
Responsible Person/Department	DGAC, Director, Direccion de Control		
Target Date	March 31, 2017		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	7a	<input type="checkbox"/> Required <input checked="" type="checkbox"/> Recommended	<input type="checkbox"/> Urgent <input type="checkbox"/> Important <input checked="" type="checkbox"/> Routine
ACTION	PBN Operational Approval Training: Incorporate in Initial FOI Training DGAC to ensure that all Flight Operations Inspectors are trained in PBN Operational Approval requirements and DGAC approval processes. DGAC to include PBN Operations and PBN Operational Approval requirements in initial FOI training.		
Issue	Flight Operations Inspectors (pilots) are not trained in PBN Operational Approval		
Comment (or Background)	Since PBN will be the default for most operations in the future, training in PBN operational approval and oversight should be incorporated into the regular training received by all FOI's. It is expected that future FOI candidates will already have PBN operational experience.		
Organisation	DGAC, Direccion de Control		
Responsible Person/Department	DGAC, Director, Direccion de Control		
Target Date	June 30, 2018		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	8	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input type="checkbox"/> Urgent <input checked="" type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	PANS OPS Training for DGAC Air Navigation Inspectors DGAC Air Navigation Inspectors (ANI) responsible for procedure design oversight to complete PANS-OPS training, including RNP AR APCH.		
Issue	There are no Air Navigation Inspectors that have PANS OPS procedure design training		
Comment (or Background)	At least two Air Navigation Inspectors should complete PANS OPS procedure design training, both conventional and PBN, to include RNP AR. Following that training they should be given at least a month of supervised OJT with SENEAM, designing actual procedures, before assuming their procedure design oversight responsibilities.		
Organisation	DGAC, Directorate of Air Navigation		
Responsible Person/Department	DGAC, Director of Air Navigation		
Target Date	December 31, 2017		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	9	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input type="checkbox"/> Urgent <input checked="" type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	DGAC Develop Procedure Design Oversight Regulation		
	DGAC to develop a regulation for oversight of procedure design organisations and the instrument flight procedure process.		
Issue	The DGAC does not have a regulation or written policy for the oversight of procedure design organisations.		
Comment (or Background)	<p>The DGAC is responsible to ensure that all published instrument flight procedures in their airspace can be flown safely by the relevant aircraft. Safety is not only accomplished by application of the technical criteria in PANS OPS and associated ICAO provisions, but also requires measures that control the quality of the process used to apply that criteria, which should include regulations establishing requirements and procedures for oversight of procedure design and validation organizations by the economy. Regulations have been implemented by a number of economies which may be used as a model. An example is the Australian CASR Part 173 which is available for download free of charge on the Australian government website. It is recommended that the DGAC use this model or develop their own regulation.</p>		
Organisation	DGAC, Directorate of Air Navigation		
Responsible Person/Department	DGAC, Director of Air Navigation		
Target Date	June 30, 2017		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	9a	<input type="checkbox"/> Required <input checked="" type="checkbox"/> Recommended	<input type="checkbox"/> Urgent <input checked="" type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	<p>DGAC Develop Procedure Design Oversight Regulation: Exemptions to Criteria</p> <p>DGAC to publish guidelines for the approval of variations to design criteria.</p> <p>Applications for approval should include the specific details of the exemption/waiver proposed and a full justification based on an evaluation of the level of safety.</p> <p>Guidance for managing exemptions to criteria should be included in the procedure design and validation oversight regulation.</p>		
Issue	<p>DGAC does not have a process for initiating and processing requests for waivers to procedure design criteria, e.g. RNP AR APCH</p>		
Comment (or Background)	<p>Currently DGAC requires procedures to be designed in accordance with the criteria in ICAO PANS OPS (Doc 8168) and ICAO RNP AR Design Manual (Doc 9905). ICAO design criteria is guidance material only and economies have the right to vary design rules when necessary. Doc 8168 states "While uniform application of the basic procedures in this document is very desirable, latitude is permitted for the development of detailed procedures which may be needed to satisfy local conditions." As Mexico has areas of significant and difficult terrain there will be occasions when adjustments need to be made. DGAC should have written requirements for procedure design organizations, including SENEAM, to request waivers or exemptions from the criteria. These requirements should include the specific nature of the exemption, why it is necessary or desirable, and a full justification showing the equivalent level of safety.</p>		
Organisation	<p>DGAC, Directorate of Air Navigation</p>		
Responsible Person/Department	<p>DGAC, Director of Air Navigation</p>		
Target Date	<p>June 30, 2017</p>		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	9b	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input type="checkbox"/> Urgent <input checked="" type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	DGAC Develop Procedure Design Oversight Regulation: Periodic Review of IFP DGAC to publish a periodic requirement for procedure design review of instrument flight procedures.		
Issue	PANS OPS, Volume 2 (Doc 8168) requires that published procedures shall be subjected to a periodic review, including validation. DGAC does not have a regulation or written policy to address periodic reviews.		
Comment (or Background)	Instrument Flight procedures must be periodically reviewed to ensure that they continue to comply with changing criteria, to confirm continued adequate obstacle clearance and that they meet user requirements. Doc 8168 states that "The individual States shall establish the interval for periodic review of instrument flight procedures according to the needs of the State. The maximum interval for this review is five years." It is recommended that the requirement for procedure design review and associated periodic interval be included in the procedure design and validation oversight regulation.		
Organisation	DGAC, Directorate of Air Navigation		
Responsible Person/Department	DGAC, Director of Air Navigation		
Target Date	June 30, 2017		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	9c	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input type="checkbox"/> Urgent <input checked="" type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	DGAC Develop Procedure Design Oversight Regulation: Quality Assurance DGAC to include in procedure design and validation organization (including 3rd party design organizations) oversight regulation the requirement for those organizations to implement written procedures conforming to ICAO Doc 9906.		
Issue	DGAC does not have regulation or written policy requiring procedure design and validation organizations to conform to ICAO Doc 9906 <i>Quality Assurance Manual for Flight Procedure Design</i> .		
Comment (or Background)	ICAO has published guidance for the management of instrument flight procedure design quality in ICAO Doc 9906 Quality Assurance Manual for Flight Procedure Design. This document fully details the process of instrument flight procedure design, including training of designers, procedure design quality assurance and the validation of procedures. As this is a relatively recent publication Mexico, in common with many economies, has not yet implemented conforming quality assurance procedures. At present SENEAM, and Airbus/ProSky have procedure design organizations that should fully comply with provisions of a procedure design oversight regulation and be authorized by the DGAC.		
Organisation	DGAC, Directorate of Air Navigation		
Responsible Person/Department	DGAC, Director of Air Navigation		
Target Date	June 30, 2017		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	10	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input type="checkbox"/> Urgent <input checked="" type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	SENEAM to Ensure Sufficient Design Staff		
	SENEAM to increase procedure design production capability to meet a proposed 4-5 year implementation target.		
Issue	The current full time procedure design staff (4) is not sufficient to accomplish projected PBN procedure design workload of 12-13 airports/year		
Comment (or Background)	<p>SENEAM employs a staff of four designers and a Section Manager. Design staff are well trained and experienced in PBN procedure design. The standard of procedure design is very high although improvement in detail is warranted in some cases.</p> <p>Based on an estimated 60 airports in Mexico that will require PBN procedures, and considering that the amount of design work will vary between major airports such as Mexico City and smaller regional airports, the overall workload over the next 3 to 5 years indicates that the current procedure design staffing level is inadequate. The current output of the four designers with due regard for routine non-PBN duties and other demands on design staff is about 10 airports per year. The expected design requirement indicates an increase in production of about 30% is required.</p> <p>Procedure design productivity is key to the PBN Implementation Plan timeline. An assessment of the current capability suggests that Mexico will need approximately 5-6 full time equivalent procedure designers over the next 4-5 years.</p>		
Organisation	SENEAM, Directorate of Air Navigation		
Responsible Person/Department	SENEAM, Director of Air Navigation		
Target Date	December 31, 2016 and ongoing		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	11	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input type="checkbox"/> Urgent <input checked="" type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	SENEAM to Implement ICAO Procedure Design QA Provisions SENEAM to implement the quality assurance provisions of PANS OPS and Doc 9906.		
Issue	SENEAM has not fully implemented the quality assurance provisions of PANS OPS and Doc 9906.		
Comment (or Background)	Quality assurance processes of all procedure design organizations should be in writing, and the requirement for a documented quality assurance process should be included in the DGAC Procedure Design Oversight regulation.		
Organisation	SENEAM, Directorate of Air Navigation		
Responsible Person/Department	SENEAM, Director of Air Navigation		
Target Date	June 30, 2017		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	12	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input checked="" type="checkbox"/> Urgent <input type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	DGAC/SENEAM Ensure Procedure Designer Familiarity with ICAO QA Provisions All Procedure design organizations to ensure their procedure designers are familiar with the quality assurance provisions of PANS OPS and Doc 9906.		
Issue	Procedure designers are unfamiliar with the quality assurance provisions of PANS OPS and Doc 9906.		
Comment (or Background)	In order to implement PBN in Mexico in accordance with ICAO guidelines, all design organisations (SENEAM and DGAC) should take immediate steps to familiarise their procedure designers with the quality assurance provisions of PANS OPS and Doc 9906 and to implement appropriate quality assurance procedures. Space should be made for the procedure designers to attend the validation portion of the Flight Validation Pilot (FVP) course, so that they can gain a full understanding of the IFP validation process.		
Organisation	DGAC, Directorate of Air Navigation SENEAM, Directorate of Air Navigation		
Responsible Person/Department	DGAC, Director of Air Navigation SENEAM, Director of Air Navigation		
Target Date	March 31, 2017		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	13	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input type="checkbox"/> Urgent <input checked="" type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	Adopt New ICAO RNP APCH Titling Convention DGAC/SENEAM to adopt new ICAO RNP APCH titling convention		
Issue	Mexico has not yet adopted the new ICAO RNP APCH Chart Titling Convention		
Comment (or Background)	<p>ICAO currently uses the chart title convention RNAV (GNSS) for RNP APCH procedures. Recognising that it is confusing to use RNAV in the title of an RNP procedure, a new titling convention is to be introduced using RNP for both RNP APCH and RNP AR APCH charts. Compliance is required by 2022. ICAO recommends that members should plan to complete the transition as soon as possible and not wait until 2022.</p> <p>As Mexico has published few PBN approaches it would be opportune to adopt the new convention immediately rather than re-title many charts at some future date. When Mexico does adopt the new chart title convention an aeronautical information circular must be published advising the industry of the proposed new charting convention prior to the implementation date.</p>		
Organisation	SENEAM, Directorate of Air Navigation DGAC, Directorate of Air Navigation		
Responsible Person/Department	SENEAM, Directorate of Air Navigation DGAC, Directorate of Air Navigation		
Target Date	June 30, 2017		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	14	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input checked="" type="checkbox"/> Urgent <input type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	Flight Inspection Unit PBN Operations Training for Pilots: Initial Pilots in the DGAC Flight Inspection Unit to complete PBN flight operations training		
Issue	Flight Inspection/Flight Validation pilots are not trained in PBN flight operations		
Comment (or Background)	The Flight Inspection Unit will be responsible for validation of all PBN instrument flight procedures (IFPs). Their aircraft are suitably equipped for the flight portion of the validation process. The pilots however must first be trained and qualified to fly PBN IFPs. Understandably, since Mexico does not have a significant number of PBN IFPs, they have never received this training. Training can be completed as an add-on to simulator recurrent training or locally in the Flight Inspection aircraft, by bringing in a qualified instructor. This is a critical step as PBN IFPs that are completed will need to wait for validation until FVPs are trained before they can be published. Additional training for FVPs in PBN operations using stand-alone receivers is highly desirable in order that pilots are competent to assess the “flyability” of PBN procedures using all types of avionics. Suitably equipped aircraft may be available in local flight training schools and certainly are available at any flight school in the U.S.		
Organisation	DGAC, Flight Inspection Unit		
Responsible Person/Department	DGAC, Director, Flight Inspection Unit		
Target Date	January 31, 2017		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	14a	<input type="checkbox"/> Required <input checked="" type="checkbox"/> Recommended	<input type="checkbox"/> Urgent <input type="checkbox"/> Important <input checked="" type="checkbox"/> Routine
ACTION	DGAC Flight Inspection Unit PBN Operations Training for Pilots: Recurrent Recurrent training for Pilots in the DGAC Flight Inspection Unit to include PBN operations		
Issue	Flight Inspection/Flight Validation pilots are not trained in PBN flight operations		
Comment (or Background)	Once qualified, PBN operations should be included in the regular simulator recurrent pilot training for all Flight Validation Pilots.		
Organisation	DGAC, Flight Inspection Unit		
Responsible Person/Department	DGAC, Director, Flight Inspection Unit		
Target Date	March 31, 2017		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	15	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input checked="" type="checkbox"/> Urgent <input type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	Flight Validation Pilot Course for Flight Inspection Pilots Pilots in the DGAC Flight Inspection Unit to complete a Flight Validation Pilot Course in accordance with ICAO Doc 9906 Vol 6.		
Issue	Flight Inspection/Flight Validation pilots are not trained in instrument flight procedure validation		
Comment (or Background)	Once qualified as pilots in PBN operations, the pilots of the Flight Inspection Unit must then become qualified Flight Validation Pilots (FVPs). This is a critical step as PBN IFPs that are completed will need to wait for validation until FVPs are trained before they can be validated and published. ICAO Doc 9906, Volume 6 has guidance on FVP training. ICAO has conducted 2 FVP courses in the Asia-Pacific Region over the last 4 years. It is recommended that procedure designers attend the validation portion of the Flight Validation Pilot (FVP) course. Selected DGAC Flight Operations (Direccion de Control) Inspectors (pilots) who are responsible for the oversight of PBN operations and instrument flight procedures, especially RNP AR, should also attend the full course.		
Organisation	DGAC, Flight Inspection Unit		
Responsible Person/Department	DGAC, Director, Flight Inspection Unit		
Target Date	March 31, 2017		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	15a	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input type="checkbox"/> Urgent <input checked="" type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	Flight Validation Pilot Supervised OJT		
Issue	Pilots in the DGAC Flight Inspection Unit to complete supervised OJT after completion of an initial FVP Course.		
Comment (or Background)	After completing an initial FVP course Flight Inspection/Flight Validation pilots will require practical experience and guidance in procedure validation until fully proficient.		
Organisation	Following completion of the FVP ground school course FVP pilots must receive supervised OJT from a qualified and experienced flight validation pilot as laid out in Doc 9906, Volume 6. This could best be achieved initially by waiting until there are a number of procedures ready for validation then bringing in an expert for 1-2 weeks to provide OJT to some of the FVPs who have attended the FVP course. Depending on their progress this may or may not need to be repeated. Once some FVPs are fully qualified they should be able to provide OJT to other FVPs in the Flight Inspection Unit.		
Responsible Person/Department	DGAC, Flight Inspection Unit		
Target Date	DGAC, Director, Flight Inspection Unit		
	June 30, 2017		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	16	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input checked="" type="checkbox"/> Urgent <input type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	SENEAM Concept of Operations SENEAM Mexico to develop a Concept of Operations appropriate to a GNSS-based airspace system.		
Issue	A concept of operations is necessary to provide a sound basis for the Mexico PBN Plan.		
Comment (or Background)	Although SENEAM is taking action to accelerate PBN implementation, it is without the benefit of a concept of operations. A concept of operations should document the strategies that SENEAM Mexico intends to use in the transition to a PBN-based structure. The concept of operations and associated strategic objectives should be included in the revised Mexico PBN Implementation Plan. It is recommended that a Concept of Operations statement be drafted as a matter of high priority.		
Organisation	SENEAM, Directorate of Air Navigation		
Responsible Person/Department	SENEAM, Director of Air Navigation		
Target Date	December 31, 2016		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	17	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input type="checkbox"/> Urgent <input checked="" type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	SENEAM ATM: Assign PBN Navigation Specifications SENEAM to assign RNP 2 Navigation Specification to domestic air routes SENEAM to designate all SID/STAR procedures RNP 1		
Issue	SENEAM has not selected a navigation specification for domestic PBN routes. SENEAM has designated existing PBN STARs RNAV 1 with GNSS required.		
Comment (or Background)	<p>The applicable options for domestic route specifications are RNAV 5 and RNP 2. Historically the regional default has been RNAV 5 because RNP 2 did not exist. With RNP 2 now available and with the publication of new separation standards in ICAO Doc 4444 <i>Air Traffic Management</i>, opportunities now exist to modernise and improve efficiency in the Mexican airspace, by separation of routes by 15 nautical miles (nm) in cruise and 7nm in climb and descent by use of the RNP 2 specification or alternatively using RNAV 5 with a requirement for carriage of GNSS. Since RNAV 5 requires GNSS to receive benefit from these new standards, RNP 2 is the logical choice for an enroute navigation specification.</p> <p>Since there are so few RNAV 1 procedures currently published, it is appropriate to designate existing and all new SIDs and STARs RNP 1 as soon as appropriate notice can be given to the aviation community. The current RNAV 1 procedures require RNAV 1 operational approval on the basis of GNSS equipage which is essentially RNP 1. Some ICAO members already mandate RNP 1 capability.</p>		
Organisation	SENEAM, Directorate of Air Navigation		
Responsible Person/Department	SENEAM, Director of Air Navigation		
Target Date	June 30, 2017		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	17a	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input type="checkbox"/> Urgent <input checked="" type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	SENEAM ATM: Transition to PBN Enroute Structure SENEAM to develop comprehensive plan for transition to a PBN domestic enroute structure SENEAM to develop comprehensive plan for transition to a RNP 2 international and oceanic enroute structure		
Issue	SENEAM does not have a plan for transitioning to a PBN enroute structure.		
Comment (or Background)	<p>The applicable options for domestic route specifications are RNAV 5 and RNP 2. Historically the regional default has been RNAV 5 because RNP 2 did not exist. With RNP 2 now available and with the publication of new separation standards in ICAO Doc 4444 <i>Air Traffic Management</i>, opportunities now exist to modernise and improve efficiency in the Mexican airspace, by separation of routes by 15 nautical miles (nm) in cruise and 7nm in climb and descent by use of the RNP 2 specification or alternatively using RNAV 5 with a requirement for carriage of GNSS. Since RNAV 5 requires GNSS to receive benefit from these new standards, RNP 2 is the logical choice for an enroute navigation specification.</p> <p>RNP 2 is the end state for international and oceanic routes and allows for reduced separation versus RNAV 10 or RNP 4. There is no advantage to be gained from keeping RNAV 10 or planning for RNP 4.</p> <p>See ICAO Cir 341-AN/184 <i>Guidelines for the Implementation of Lateral Separation Minima</i> for additional planning guidance.</p>		
Organisation	SENEAM, Directorate of Air Navigation		
Responsible Person/Department	SENEAM, Director of Air Navigation		
Target Date	December 31, 2016		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	18	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input type="checkbox"/> Urgent <input checked="" type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	DGAC to Mandate PBN Capability		
	DGAC in consultation with SENEAM and the industry to mandate PBN capability on a schedule consistent with the revised Mexico PBN Implementation Plan		
Issue	Mexico does not currently mandate PBN capability.		
Comment (or Background)	Mexico should consider and include in the PBN Plan a timeframe for mandating PBN capability (i.e. GNSS equipage) in Mexican airspace. A mandate has the advantage of enabling maximum PBN participation and achievement of benefits. It is clear that the majority of aircraft operating in Mexican airspace are modern and GNSS equipped and, therefore, able to comply with a mandate without significant expense.		
Organisation	DGAC, Directorate of Air Navigation		
Responsible Person/Department	DGAC, Director of Air Navigation		
Target Date	December 31, 2021		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	19	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input type="checkbox"/> Urgent <input checked="" type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	Annex 15 eTOD DGAC to take necessary steps to conform to Annex 15 requirements for collection and distribution of eTOD. See also 19a, 19b, 19c, 19d, 19e		
Issue	Obstacle information available to procedure designer is not complete. Annex 15 eTOD information is not available for all airports.		
Comment (or Background)	Annex 15 establishes requirements for the economy to make available certain electronic terrain and obstacle data (eTOD) by 2015. A major driver of these requirements was the expected surge in development of PBN IFPs as PBN was implemented around the world. This data is very important to the PBN procedure design, particularly approach procedures.		
Organisation	SENEAM		
Responsible Person/Department	SENEAM, DGAC		
Target Date	To be determined		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	19a	<input type="checkbox"/> Required <input checked="" type="checkbox"/> Recommended	<input type="checkbox"/> Urgent <input checked="" type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	Airports Directorate Responsibility for eTOD		
	DGAC transfer responsibility for Annex 15 eTOD data, except Area 1, to Airports Directorate		
Issue	Obstacle information available to procedure designer is not complete. Annex 15 eTOD information is not available for all airports		
Comment (or Background)	Discussion with Air Navigation Directorate revealed that because Air Navigation Directorate had no authority to require eTOD from airports, they can only ask the airports to provide the information, which has not been effective. As the agency responsible for airports, it is appropriate that Airports Directorate take responsibility for management of airport-specific eTOD.		
Organisation	DGAC, Air Navigation Department DGAC Airports Directorate		
Responsible Person/Department	DGAC, Director of Air Navigation		
Target Date	December 31, 2016		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	19b	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input type="checkbox"/> Urgent <input checked="" type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	Airports to be Required to Collect eTOD DGAC to regulate responsibility for the control of obstacles in the vicinity of airports (Annex 14) and the compilation of Electronic Terrain and Obstacle Data (eTOD) required under Annex 15. Require airports to provide Annex 15 eTOD for areas 2 and 4 (if applicable) as part of the airport certification and re-certification process. New certifications and re-certifications not to be issued without eTOD, pending revision of regulations. Regulate that airports provide Area 3 eTOD in accordance with Annex 15, 10.1.8 and areas 2b, 2c, 2d in accordance with 10.1.7.		
Issue	Obstacle information available to procedure designer is not complete. Annex 15 eTOD information is not available for all airports		
Comment (or Background)	Responsibility for eTOD is currently not determined and it is recommended that Airports takes on this role. Airport regulations need to be amended to include Annex 15 eTOD requirements. Collection of eTOD data may actually only be required at about 23 airports in Mexico that are required to be certified, out of the 60+ that may have PBN approach procedures. Further regulatory action to apply this requirement to registered airports with instrument approach procedures should be considered.		
Organisation	DGAC, Air Navigation Department		
Responsible Person/Department	DGAC, Air Navigation Department		
Target Date	June 30, 2017		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	19c	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input type="checkbox"/> Urgent <input checked="" type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	Area 2 and 4 eTOD		
	Complete collection of eTOD for areas 2 and 4 (if applicable) for all airports where required		
Issue	Obstacle information available to procedure designer is not complete. Annex 15 eTOD information is not available for all airports		
Comment (or Background)	When the required amendments to the Airport regulation are promulgated, DGAC should proceed with enforcement. Action would be acceptable on a case-by-case basis to reduce the Area 2d coverage requirement to less than 45 km to reduce costs of eTOD collection, based on the technical capabilities of the collection method and the anticipated IFPs at the airport. The goal should still be to work toward eventual full compliance with the Annex 15 Standards and Recommended Practices (SARP).		
Organisation	DGAC, Air Navigation Department		
Responsible Person/Department	DGAC, Air Navigation Department		
Target Date	December 31, 2019		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	19d	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input type="checkbox"/> Urgent <input checked="" type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	Area 1 eTOD Obtain Annex 15 eTOD for Area 1, the entire economy of Mexico, or confirm compliance and/or adequacy of the relevant mapping agency data to fulfill this requirement.		
Issue	Obstacle information available to procedure designer is not complete. Annex 15 eTOD information is not available for all airports		
Comment (or Background)	The Directorate of Air Navigation should retain responsibility for Area 1 data and work with the economy's mapping agency to determine the suitability of their existing data to meet the Area 1 requirement. The first step should be to confirm characteristics of the relevant database as it relates to the Annex 15 requirements for accuracy and obstacle identification. Even if it does not meet every requirement of Annex 15 it may be usable while working toward eventual full compliance with the Annex 15 Standards and Recommended Practices (SARPs).		
Organisation	DGAC, Directorate of Air Navigation		
Responsible Person/Department	DGAC, Director of Air Navigation		
Target Date	December 31, 2016		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	19e	<input type="checkbox"/> Required <input checked="" type="checkbox"/> Recommended	<input type="checkbox"/> Urgent <input checked="" type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	Incorporate eTOD in AIXM Database		
Issue	SENEAM AIXM database does not include eTOD.		
Comment (or Background)	Collection of eTOD is an important safety initiative that is only partially met if the data is not made available to the international community. The international standard for sharing this data is AIXM 5.1		
Organisation	DGAC, Air Navigation Department		
Responsible Person/Department	SENEAM, Director of Air Navigation DGAC, Air Navigation Department		
Target Date	To be determined		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	20	<input type="checkbox"/> Required <input checked="" type="checkbox"/> Recommended	<input type="checkbox"/> Urgent <input checked="" type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	Convert the Economy's Obstacle Database to AIXM Format DGAC to work with SENEAM to include the electronic database of all approved and known obstacles in the SENEAM AIXM 5.1 database project.		
Issue	Obstacle information from approved building and tower construction permits in the vicinity of airports is only available as excel file. This data is not presently included in the SENEAM AIXM database		
Comment (or Background)	DGAC's Airports Directorate maintains a database of approved obstacles, which is available to procedure designers. Collection of eTOD is an important safety initiative that is only partially met if the data is not made available to the international community. The international standard for sharing this data is AIXM 5.1. In order to maximize use by procedure designers, avionics manufacturers and others, DGAC should include the electronic database of all approved and known obstacles, as well as all available eTOD, in the SENEAM AIXM 5.1 database project.		
Organisation	DGAC, Air Navigation Department		
Responsible Person/Department	DGAC, Air Navigation Department SENEAM, Director of Air Navigation		
Target Date	To be determined		

ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

ACTION No.	21	<input checked="" type="checkbox"/> Required <input type="checkbox"/> Recommended	<input type="checkbox"/> Urgent <input checked="" type="checkbox"/> Important <input type="checkbox"/> Routine
ACTION	Provision of Local Barometric Pressure for PBN Instrument Approach Operations DGAC and SENEAM to include in PBN implementation planning arrangements for the provision of accurate local barometric pressure information.		
Issue	Many airports where implementation of PBN approach procedures is planned do not have an official source of current barometric pressure information for the pilot.		
Comment (or Background)	Where IFPs are in use pilots require a source from which to obtain the current barometric pressure. Where APV procedures (LNAV/VNAV or RNP AR) are implemented, a local source of barometric pressure is required. This requirement can be met at non-towered airports by installing an automatic weather system with VHF broadcast facility in those locations, or the use of accredited ground observers to pass accurate barometric pressure to aircraft.		
Organisation	SENEAM, Directorate of Air Navigation		
Responsible Person/Department	SENEAM, Director of Air Navigation		
Target Date	December 31, 2019		

APEC Project: TPT 05/2015A

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