

FINAL SITE VISIT REPORT - INDONESIA

Transportation Working Group

February 2017

APEC Project: TPT 05/2015A

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APEC#217-TR-01.2

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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
Α	
AC	Advisory Circular
AD	Aerodrome
AIP	Aeronautical Information Publication
AIRAC	Aeronautical Information Regulation and Control
AirNav	ATC service provider, Indonesia
AMAN	Arrivals Management System
AMSL	Above Mean Sea Level
ANSP	Air Navigation Service Provider
APEC	Asia-Pacific Economic Cooperation Secretariat
APCH	Approach
APV	Approach with Vertical Guidance
ATC	Air Traffic Control
ATS	Air Traffic Services
AWS	Automatic Weather Station

Abbreviation	Meaning
В	
BKFP	Indonesia DGCA Flight Inspection Unit
BPE	Basic Plan Element
С	
С	Celsius temperature scale
CAT	Category
CASR	Civil Aviation Safety Regulation
ссо	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)
СТА	Chief Technical Advisor (COSCAP)
D	
DAAO	Indonesian Department of Airworthiness and Aircraft Operations
DG	Director General
DGCA	Director General of Civil Aviation (Indonesia)
DGAC	Director General of Civil Aviation (Mexico)
DME	Distance Measuring Equipment (Navigation Aid)
Doc nn	ICAO Document Number nn

Abbreviation	Meaning
E	
EASA	European Aviation Safety Agency
eTOD	Electronic Terrain and Obstacle Data
F	
FAA	Federal Aviation Administration (the United States of America)
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	
ICAI	Indonesia Civil Aviation Institute (also known as STPI in Bahasa Indonesia)
ICAO	International Civil Aviation Organisation
IFP	Instrument Flight Procedure
IFPP	ICAO Instrument Flight Procedure Panel
IFR	Instrument Flight Rules

Abbreviation	Meaning
IMC	Instrument Meteorological Conditions
ILS	Instrument Landing System
ISA	International Standard Atmosphere
J	
JICA	Japan International Cooperation Agency
L	
LNAV	Lateral Navigation
LPV	Localiser Precision with Vertical Guidance
LSALT	Lowest Safe Altitude
М	
m	metres
N	
NDB	Non Directional Beacon
NM or nm	Nautical Mile (= 1.852 km)
0	
OJT	On-the-job training
OLS	Obstacle Limitation Surface
OPS	Operations
OPS SPEC	Operations Specification

Abbreviation	Meaning
Р	
PAL	Pilot Activated Lighting System
PANS-OPS	Procedures for Air Navigation Services – Aircraft Operations, ICAO Doc 8168
PAPI	Precision Approach Path Indicator (Approach Lighting Aid)
PBN	Performance Based Navigation
Q	
QA	Quality Assurance
R	
RHS	Right Hand Side
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
SI	Standard Instruction
SID	Standard Instrument Departure route
STAR	Standard Terminal Arrival Route
STPI	Indonesia Civil Aviation Institute (also known as STPI in Bahasa Indonesia)

Abbreviation	Meaning
Т	
TSO	Technical Standard Order
V	
VNAV	Vertical Navigation
VOR	Very high frequency Omni directional Range
w	
WAAS	Wide Area Augmentation System (United States of America)
WGS	World Geodetic System e.g. WGS-84

EXECUTIVE SUMMARY

INTRODUCTION

The Asia-Pacific Economic Cooperation (APEC) Secretariat, 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 two APEC member economies to 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 island economy of Indonesia. PBN can potentially provide safe, reliable and efficient air access to Indonesia's many islands and most remote areas without the need for expensive ground navigation aids.

PROGRAM STRUCTURE AND REVIEW METHODOLOGY

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 Indonesia.

This report documents the results of two 5-day site visits to Jakarta to determine the current state of PBN implementation in Indonesia, as well as identification of actions that are needed to successfully implement PBN in accordance with the ICAO's 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 the Members to review and update their PBN Implementation Plans.

The existing Indonesian PBN Plan developed in 2011 is very basic and does not provide sufficient detail. A new 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 Indonesian stakeholders and has identified in this report the necessary actions required to be undertaken by the various Indonesian agencies to complete a mature PBN Implementation Plan.

PBN Implementation in Indonesia has been slow and progress is well behind the goals set by ICAO. Approximately 39 runway ends are currently provided with a PBN approach procedure representing perhaps less than 10% of the estimated number of eligible runways. Of the 39 PBN approaches published, not all are operational and many require revision. Actual PBN approach flight operations are low and it is noted that there has been some reluctance by Air Traffic Control (ATC) to clear aircraft for PBN approaches.

Very little progress has been made in developing a PBN based domestic airspace structure. There are only a few PBN Standard Instrument Departure (SID) and Standard Terminal Arrival Route (STAR) procedures published, and those procedures are inefficient and not currently delivering any of the potential PBN benefits. ATC continues to rely heavily on radar vectoring for sequencing and separation and has yet to adapt to an airways system based on PBN.

The Ambidji Team considers that sufficient technical capability exists with the various Indonesian agencies to implement PBN in the short to medium term. Indonesia has been the beneficiary of numerous assistance programs since 2011, including an extensive JICA project, which have provided significant levels of PBN-related training and advice. Procedure design capability appears to be relatively robust for Indonesia, with the procedure designers well trained and competent.

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;
- DGCA system of charging for operational approvals is considered too expensive by operators;
- Procedure designer training in quality assurance and Required Navigation Performance Authorisation Required (RNP AR) procedure design is required;
- Development of an Air Traffic Management concept by AirNav is necessary to facilitate transition to a PBN-based airspace system;
- AirNav needs to increase procedure design productivity by increased staffing and obtaining a procedure design automation tool;
- AirNav needs to implement ICAO quality assurance provisions;
- Air Traffic Controller training and instructions, especially for RNP AR operations are needed;
- The new ICAO RNP APCH naming convention to be adopted;
- Provision of local barometric pressure for PBN approach operations at all instrument airports.

PBN PILOT TRAINING

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

Several recommendations are made in this report relating to the training of DGCA 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. DGCA 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 Indonesian 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 Indonesia currently has no suitably trained pilots, this deficiency is an issue which 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 Indonesia 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 also be managed effectively.

ACTION PLAN AND ACTION ELEMENTS

Ambidji has completed an analysis of all aspects of PBN in Indonesia and provided a list of actions required to achieve full implementation. The report includes a proposed action plan and timeline,

based on discussions with DGCA and AirNav 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 DGCA and AirNav senior management to apply sound project management strategies based on a mature PBN Implementation Plan.

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

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SECTION 1: INTRODUCTION

The Ambidji Group Pty. Ltd (Ambidji) is pleased to present this report to the APEC Secretariat to assist Indonesia to transition their current PBN Implementation Plan to the next level of implementation maturity so that Indonesia 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 Jakarta to ascertain Indonesia's operational status with implementing the ICAO 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) <u>Executive Summary.</u> An overall summary of the Ambidji team's findings and outcomes arising from the two site visit workshops to Jakarta, as well as identification of the necessary action elements and implementation recommendations to finalise Indonesia's PBN Implementation Plan;
- b) <u>Section 1: Introduction and Background to PBN Implementation</u>. 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) <u>Section 2: Review Approach and Methodology</u>. 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) <u>Section 3: Gap Analysis of PBN Implementation Status</u>. This section provides a detailed review and gap analysis of Indonesia'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) <u>Section 5: Action Plan and Action Elements</u>. This section presents a time bound Action Plan and reference to the "tear off" Action Element (task) sheets.
- g) <u>Appendices</u>. 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) Mr Fajar Sunarjanto is particularly 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 was required to be completed by 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 members 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 members 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 with 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 provide assistance to members with developing and validating PBN flight procedures, some developing 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 developing 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 as well as 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.

The prime review team was also supported by two subject matter experts (SMEs) from Japan and Thailand to provide the necessary guidance and feedback on Indonesian and regional civil aviation matters. The nominated SME personnel for this review were:

- Mr Pongabha Abhakara, AeroThai; and
- Mr Shohei Oida, All Nippon Airways.

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, Manager, Asia-Pacific Branch
- Ms Katherine Michaud, Foreign Affairs Specialist, Asia-Pacific.

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

Site Visit 1:

- Mr Braks Etta, FAA Air Traffic Representative, Asia-Pacific.
- Mr Jim Spillane, FAA Senior Representative, South East Asia, attended on Day 1 and formally introduced the Program and Team Members.

Site Visit 2:

- Mr Braks Etta, FAA Air Traffic Representative, Asia-Pacific.
- 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, DGCA and other relevant stakeholders in Indonesia to identify their perceived challenges to fully implement PBN.
- Preparation of a detailed ToR;
- A review of Indonesia's current PBN Plan; and
- Conduct two (2) site visit trips to Indonesia to execute the ToR tasks and hold discussions with the LO, ANSP, DGCA and other relevant stakeholders.

c) Questionnaire

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

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 Indonesia guided by ICAO requirements and standards, to identify any challenges and recommended actions for Indonesia to successfully meet their PBN objectives.

An Action Plan including timeline to outline next steps for Indonesia 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 Indonesia 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 Indonesia to implement and/or revise their regulatory framework to support PBN implementation (including airline equipage requirements);
- A summary of required flight procedure design capabilities;
- Suggested solutions for Indonesia to ensure a properly trained pipeline of staff to design and implement PBN flight procedures; and,
- Identification of ground based navigation equipment required to implement PBN flight procedures.

e) Site Visits

Site Visit 1

The first of two site visits was conducted from 29 August to 2 September 2016.

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

The Site Visit 1 report prepared by the Ambidji Team is available at Appendix E. The Site Visit 1 report also contains a list of workshop attendees.

Site Visit 2

The second site visit was conducted from 10 to 14 October 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 Indonesian PBN. Implementation Plan for consolidation and final drafting by DGCA.

A meeting with the DGCA Director of Air Navigation 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 gaps.
- <u>Action</u>: 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.

Actions are detailed in Action Elements that are included in Section 5. Each Action Element 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 members 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 Indonesia's PBN Plan

Indonesia has a basic PBN implementation plan in place that was prepared in 2011. The plan is very brief and 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. Furthermore, it is observed that few of the objectives identified in the 2011 PBN Plan had been achieved to date.

Indonesia, therefore, requires assistance to overcome some of the institutional constraints listed in previous sections so that they can revise their PBN implementation plan in line with the ICAO template and transition to the next stage of development, giving Indonesia the opportunity to access the support of the ICAO Asia-Pacific PBN Implementation Coordination Group (ICG) and Flight Procedure Programme Office.

3.4. ICAO PBN Plan Template

The Ambidji team shared the ICAO template with Indonesian stakeholders and provided an explanation of each section, with suggestions regarding Indonesian responses. All stakeholders were encouraged to develop relevant input to the plan for submission to the DGCA 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 Indonesia's circumstances. Additionally, in order for Indonesia 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

DGCA, in consultation with all stakeholders, and in close co-operation with AirNav Indonesia, 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:

(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 Indonesia. These could include reduced accident rate in Indonesia, reduced accident rate in West Papua, increased efficiency and continuity of operations at high traffic airports, 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

A Fleet Capability study is required to provide recent valid data on which to base implementation decisions. Currently there is little recorded information available, although it is clear that Indonesia has a modern fleet with a high level of PBN capability. This task is the responsibility of the Directorate General of Civil Aviation (Direktorat Jenderal Perhubungan Udara) 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: DGCA to Conduct Fleet Study

 A study of current CNS/ATM capabilities and future requirements based on a PBNbased 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 fleet capability. The study needs to include plans for decommissioning redundant navigation aids as PBN implementation proceeds (Chapter 2).

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

 Identify challenges and obstacles to the execution of the PBN implementation plan and how Indonesia 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, 7b, 8, 9, 10, 10a, 12, 13, 14, 14a, 15, 16, 16a, 16b, 17, 18, 19, 19a, 19b, 21, 22, 23, 24

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 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 Indonesian PBN plan in order to inform the public, industry, government and other stakeholders. (Chapter 4);

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

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

Action Element 1g: Prepare PBN Plan: DGCA & AirNav to Assign Responsibility

Action Element 2: DGCA/AirNav Leadership Initiatives: Implement Management Structure

Action Element 2a: DGCA/AirNav 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 Indonesian airspace system an assessment of the consequential risks is essential. AirNav 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: DGCA/AirNav 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 AirNav to plan their work.

Action Element 1i: Prepare PBN Plan: AirNav/DGCA to Develop Priority List

3.5. Implementation Effectiveness of Institutional Management

a) Analysis

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. GNSS equipment is widely available and all modern production aircraft are PBN capable (especially in Indonesia) 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 equipage 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 Indonesia is no different to many economies. Much effort has been expended in recent years on training, design, and regulation development and many PBN assistance activities, including the five year (2010-2015) JICA Capacity Development Project for Improvement on Aviation Safety Policy, 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, despatchers 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.

This Program has identified that, for the most part, Indonesian agencies and airlines have the capability to achieve full PBN implementation in the short to medium term.

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

3.6. PBN OPS Working Group

A PBN OPS Working Group had been set up under the DGCA/ICAO INS13801 PROJECT: *ENVIRONMENTAL MEASURES IN CIVIL AVIATION*. Very useful progress had been achieved at the February 2016 initial meeting and a number of workshops are planned for 2016.

The objective of the working group is:

<u>Objective:</u> support the effective implementation of PBN in Indonesia as well as other operational efficiency measures related with Air Traffic Management.

The ToR and constitution of the working group should be amended to formally establish a PBN Implementation Task Force with responsibility to the Director-General (DG) to ensure that the Indonesia PBN Implementation Plan proceeds as scheduled.

Members of the PBN Task Force should be appointed by the DG with written Terms of Reference. 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 DGCA and President-Director of AirNav at regular intervals.

a) Action

- DG of the DGCA to take charge of PBN implementation and in co-operation with the President-Director, AirNav Indonesia, 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; and
- 2. DG of the DGCA jointly with President-Director AirNav 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 DG and President-Director;

Action Element 2: DGCA/AirNav Leadership Initiatives: Implement Management Structure

Action Element 2a: DGCA/AirNav 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, 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 CAA's of the world in their role as the regulator, 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 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

DG of DGCA and President-Director AirNav Indonesia jointly convene a meeting of all department heads to plan the management of cultural change associated with PBN implementation.

DG of DGCA and President-Director AirNav Indonesia direct the PBN Task Force to take action (workshops/seminars), to address cultural change.

Action Element 2b: DGCA/AirNav Leadership Initiatives: Manage Cultural Change

3.8. PBN Operating Rules

a) Analysis

The pilot training and qualification requirements for PBN are contained in Civil Aviation Safety Regulations (CASR) Part 91, Amendment 4, dated 20 May 2014, and CASR Part 121, Amendment 12, dated 27 July 2015.

The general rules for PBN operational approvals are contained in Staff Instruction (SI) 8900-4.1, dated 24 April 2014.

Instruction SI 8900-4.1 does not reflect the current edition of the ICAO PBN Manual (Doc 9613) and does not include new navigation specifications Required Navigation Performance 2 (RNP 2), Advanced RNP, and RNP 0.3.

There is no reference in SI 8900-4.1 to the ICAO PBN Operational Approval Manual (Doc 9997).

b) Action

DGCA to update SI 8900-4.1 to conform to the latest edition of ICAO PBN Manual (doc 9613)

SI 8900-4.1 to include reference to the use of the ICAO PBN Operational Approval Manual

Action Element 3: DGCA to update SI 8900-4.1

3.9. PBN Operational Approval

a) Analysis

The ICAO PBN Manual (Doc 9613) requires that operators are 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 general procedures for issuing an OPS SPEC authorising PBN operations are sound and working reasonably well. The DGCA staff have a good working knowledge of PBN and ICAO guidance relating to the approval of PBN operations in accordance with the ICAO PBN Manual (Doc 9613). Good use is made of PBN Job Aids.

The Ambidji Team noted several comments from operators that the process of PBN operational approval is inefficient and is causing significant delays and expense to operators.

DGCA has not published guidance material on the content requirements for applications for PBN approval which would ensure that both applicants and DGCA inspectors have clear guidelines on the requirements for approval.

Cases were reported which appear to indicate that DGCA is imposing unnecessary requirements for approval. Complaints were also received that DGCA had made repeated requests for information, causing delays in obtaining approval.

Operators applying for RNAV1/RNP1 (SID/STAR) operational approval are unnecessarily required by DGCA to demonstrate capability in flight. The evaluation of RNAV1/RNP1 aircraft capability or flight procedures either in actual flight or in a full flight simulator is not a normal requirement for issue of the relevant OPS SPEC. DGCA uses a "validation" form for this purpose but many of the items listed on the "validation" form are normally addressed by the aircraft manufacturer and compliance can be determined by reference to manufacturer compliance documentation or operations manuals. For modern

production aircraft, compliance is normally determined by desktop examination of operator/manufacturer supplied documentation and only in unusual cases, such as an aircraft where after-market GNSS or Flight Management System (FMS) modifications have been installed, would flight demonstration in the aircraft or simulator be warranted.

DGCA is following guidance material for approval of RNP AR APCH operations which in many cases is unduly conservative. RNP AR APCH has now become more widely accepted worldwide and much operational experience has been gained over the last 10 years. Consequently, the very conservative approach to RNP AR APCH approvals that was adopted in the developmental phase (circa 2004-2008) is no longer warranted. For example, DGCA has required Lion Air to demonstrate 100 operations in visual conditions to qualify for approval. This has proven to be difficult to achieve in a reasonable period. A more practical requirement would be to grant approval when the FOI and other stakeholders (ATC) are satisfied that all relevant conditions are met.

b) Action

DGCA to issue guidelines for operators detailing operational approval application requirements.

DGCA to issue updated staff guidance on the administration of PBN Operational Approvals

DGCA to review the requirements for PBN approvals, including RNP AR APCH approvals, to ensure compliance with ICAO PBN Manual without imposing any unnecessary elements;

OPS SPECs approving RNP APCH operations should include a note indicating which specific types of approach are authorised i.e. LNAV, LNAV /VNAV, and/or LPV.

Action Element 4: DGCA to Review Operational Approval Guidelines

c) Recommendation

DGCA 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

DGCA employs both staff (27) and contract (72) Flight Operations (pilot) Inspectors and a number of new inspectors (45) have been, or are being, recruited from ab initio flight training programs.

Senior staff inspectors are suitably qualified and experienced in PBN operations in FMS equipped aircraft, e.g. B737NG/A320, and are generally familiar with operational approval requirements.

The qualifications and PBN operational experience of contract inspectors could not be determined but, as most are recruited from airlines, it is likely that they have some familiarity with PBN in FMS equipped aircraft. It is understood that these inspectors have completed basic inspector training but have not been trained in PBN operational approval requirements.

There are approximately 15 permanent general aviation and helicopter FOIs responsible for oversight of smaller general aviation aircraft operations and flight training schools. Inspectors in this category do not have relevant PBN experience or training and have not been trained in PBN Operational Approval requirements.

Smaller aircraft, including twin turboprop aircraft such as DHC6 Twin Otter, BE-200/300/350 King Air as well as smaller general aviation aircraft (e.g. BE-55/BE-58/C421/C208 Caravan) and helicopters are typically fitted with stand-alone panel mounted basic GNSS receivers. This type of receiver is generic and capable of RNP APCH LNAV approach operations, as well as RNAV 1/RNP 1/RNP 2/RNAV 5 operations. GNSS operations were originally (1990s) based on this class of equipment and it has only been in more recent years that GNSS operations have been extended to include FMS aircraft such as the B737NG and Airbus A320. The operation of stand-alone equipment is quite different to operations in aircraft fitted with an FMS and requires training in that type of equipment.

Suitably equipped training aircraft are available at the STPI/ICAI flight training school, but instructors have not been trained in PBN operations. It is recommended that at least 2 senior STPI instructors obtain flight training in the operation of basic stand-alone receivers such as the Garmin 430. Training of this type is not available in Indonesia, but is commonly available in neighbouring economies such as Australia or New Zealand.

Following completion of training, STPI would be equipped to train DGCA general aviation FOIs who would then be qualified to oversight general aviation PBN operations.

Similarly, pilots from the BKFP Flight Inspection Unit would be able to gain experience on stand-alone GNSS systems at STPI, which will better qualify them to validate PBN procedures.

b) Action

DGCA General Aviation FOIs to be trained in PBN operations in light general aviation aircraft equipped with stand-alone GNSS receivers.

DGCA to ensure that all FOIs are suitably qualified in PBN flight operations relevant to their assigned duties.

DGCA arrange for PBN Operational Approval training course to train initial cadre of general aviation and helicopter FOIs, as well as contract FOIs.

DGCA to ensure that all FOIs are trained in PBN Operational Approval requirements and DGCA approval processes.

DGCA to include PBN Operations and PBN Operational Approval requirements in initial FOI training.

Action Element 5: PBN Training for FOIs: GA FOIs

Action Element 5a: PBN Training for FOIs: All DGCA FOIs

Action Element 6: PBN Operational Approval Training

Action Element 6a: PBN Operational Approval Training: Incorporate in Initial

FOI Training

Action Element 22: PBN Training for STPI/ICAI instructors

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

3.11. Flight Procedure Design and Oversight

a) Analysis

The DGCA has responsibility for oversight of the primary procedure design provider, AirNav Indonesia, as well as all third party design providers.

The DGCA has sufficient personnel trained and experienced in Procedures for Air Navigation Services – Aircraft Operations (PANS OPS) procedure design, both conventional and PBN. They have several procedure design automation tools. They do not have specific training in RNP AR APCH procedure design.

Indonesia has published CASR 173 which sets out the requirements for the design of IFPs including approval of design organisations.

Volaris and Lion Air have contracted 3rd Party procedure design organisations to develop RNP AR APCH flight procedures at selected airports. To date six RNP AR APCH procedures have been published. Although the design work is being carried out by private companies, Indonesia DGCA has responsibility for all published procedures and is responsible for the oversight of 3rd party providers of procedure design services (e.g. Boeing/Jeppesen and Airbus/Prosky).

AirNav Indonesia, Garuda, Boeing/Jeppesen and Airbus/ProSky all have procedure design organizations that must be certificated by DGCA and be compliant with CASR Part 173. No evidence was available to indicate that CASR Part 173 is being enforced effectively and it is concluded that AirNav and Garuda do not fully comply.

The DGCA has not fully implemented the written policies or processes relating to their procedure design oversight responsibility under CASR Part 173;

CASR Part 173 does not refer to or conform to ICAO Doc 9906 Quality Assurance Manual for Instrument Flight Procedure Design.

b) Action

DGCA to ensure all flight procedure design organisations are fully compliant with CASR Part 173

DGCA to train select procedure designers in RNP AR APCH procedure design.

DGCA to review and amend CASR Part 173 and include the requirement to conform to the quality assurance provisions of PANS OPS, Volume 2 (ICAO Doc 8168) and ICAO Doc 9906.

Action Element 7: DGCA Review and Amend CASR Part 173: Quality

Assurance

Action Element 8: DGCA/AirNav RNP AR Procedure Design Training

3.12. Management of Design Variations

a) Analysis

DGCA regulations require that IFPs are designed in accordance with ICAO design criteria. The relevant publications are ICAO Doc 8168 *Procedures for Air Navigation Services – Aircraft Operations* and ICAO Doc 9905 *Required 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 DGCA. However, there are no published requirements that specify the basis upon which design deviations will be reviewed and approved.

b) Action

DGCA to publish guidelines for the approval of variations to design criteria.

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 the procedure design and validation oversight regulation. (CASR Part 173).

Action Element 7a: DGCA review and amend CASR Part 173: Exemptions to Criteria

3.13. Periodic Review of Instrument Flight Procedures

a) Analysis

PANS OPS (Doc 8168) Volume 2 requires that published procedures are 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. DGCA SI 173-01 dated 24 March 2014 states that IFPs are subject to review by the Directorate of Air Navigation every five years, but does not mandate the review or assign responsibility for the review to AirNav or other procedure design organisation responsible for maintenance of IFPs.

b) Action

DGCA to include in CASR Part 173 a requirement for periodic procedure design review of IFPs.

Action Element 7b: DGCA Review and Amend CASR Part 173: Periodic Review of IFPs

3.14. PBN Operations to be extracted from an approved on-board Navigation Database

a) Analysis

DGCA reported that when Garuda submits a procedure for publication, and DGCA approves the procedure, a letter of authorization is issued to the airline allowing them to start using the procedure immediately, and prior to publication in the AIP. This is an unsafe practice and should not be permitted, especially with respect to PBN procedures, which must only be accessed from the aircraft database. Procedures do not appear in the navigation database until they are published by a competent provider (e.g. Jeppesen/Lido).

Although subsequent advice from Garuda personnel is that company practice as written on their Operations document was NOT to operate until procedures were available in the company Navigation Database, it is essential that Indonesian regulations ensure that there is no possibility of operations being permitted unless derived from an approved onboard navigation database.

b) Action

DGCA to ensure that regulations prohibit any PBN operation that is not extracted from an approved and current on-board navigation database.

Action Element 9: All PBN Procedures to be extracted from approved Nav Database

3.15. PBN Operations in West Papua

a) Analysis

Eastern Indonesia (West Papua) is an area of high interest to the DGCA due to the challenging terrain and weather in that area and consequent safety concerns. The general design criteria (detailed in ICAO Doc 8168) are difficult to apply effectively in such terrain and, as most of the aircraft operating in West Papua are smaller aircraft that are not capable of RNP AR APCH, an alternative design solution is needed. AirNav and DGCA procedure designers are considering possible options for new criteria such as "guided VFR"¹.

An alternative option which should be considered is to make use of the relatively new RNP 0.3 Navigation Specification now available in the PBN Manual (Doc 9613). This specification is applicable to low speed aircraft, typically helicopters and smaller CAT A/B performance aircraft. Preliminary evaluation by DGCA of one example airport indicates that with the RNP 0.3 criteria a straight-in approach could be designed, with acceptable minima, where no viable approach would be available using RNP APCH LNAV design criteria.

Although the use of the RNP 0.3 navigation specification will not solve all such problems in West Papua, solutions based on RNP 0.3 design criteria are likely to achieve a more acceptable and safer outcome. This option is immediately available whereas any proposal for new ICAO design criteria will require a number of years to develop.

DGCA has expressed an interest in contributing a panel member to the ICAO Instrument Flight Procedure Panel (IFPP) in order to assist in developing criteria that can be applied in areas of difficult terrain, including West Papua. Participation is encouraged and

¹ Guided VFR is a proposed arrival/approach design concept that uses PBN lateral navigation guidance in limited visual conditions where the flight crew is responsible for terrain and obstacle clearance by visual reference to the ground or water. The concept is currently under consideration by ICAO.

information regarding the process to nominate an Indonesian procedure design expert to the IFPP has been provided to DGCA.

b) Recommendation

DGCA investigate the use of the RNP 0.3 Navigation Specification in West Papua.

DGCA nominates a Flight Procedure Design expert to the ICAO Instrument Flight Procedure Panel

3.16. 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 Indonesia, in common with many economies, has not yet implemented conforming quality assurance procedures.

Procedure designers are unfamiliar with the quality assurance provisions of PANS OPS and Doc 9906.

Quality assurance processes of all procedure design organisations should be in writing, and the requirement for a documented quality assurance process should be included in CASR Part 173. In order to implement PBN in Indonesia in accordance with ICAO guidelines, all design organisations (AirNav, Garuda and DGCA) should take immediate steps to familiarise themselves with Doc 9906 and to implement appropriate quality assurance procedures. Space should be made for the procedure designers to attend the validation portion of the FVP course, so that they can gain a full understanding of the validation process.

AirNav has developed a Procedure Design Operations Manual in draft form (in Bahasa Indonesia) that, when published, should also address the written processes for quality assurance.

b) Action

DGCA to review and amend CASR Part 173 as necessary to require all IFP design organisations (including 3rd party design organisations) to implement written procedures conforming to ICAO Doc 9906.

All Procedure design organisations to ensure their procedure designers are familiar with the quality assurance provisions of PANS OPS and Doc 9906.

AirNav to implement the quality assurance provisions of PANS OPS and Doc 9906.

Action Element 7: DGCA Review and Amend CASR Part 173: Quality

Assurance

Action Element 23: DGCA/AirNav/Garuda Ensure Procedure Designer

Familiarity with QA Provisions

Action Element 24: AirNav to implement ICAO Procedure Design QA Provisions

c) Recommendation

Procedure designers attend the validation portion of the FVP course.

3.17. Flight Procedure Design Capacity

a) Analysis

AirNav, as Indonesia's ANSP, is responsible for the bulk of the flight procedures to be designed in Indonesia. AirNav currently employs only two full time procedure designers but has approximately 18 additional qualified flight procedure designers (of which about 8 have received PBN design training) who are presently employed in other roles, primarily as air traffic controllers.

Garuda has two designers, who work on procedures of particular interest to the company.

The procedure designers from all organisations appear to be competent, well trained and generally conversant in the ICAO Doc 8168 PANS OPS criteria. Many of the trained procedure designers presently employed as air traffic controllers probably have very little actual procedure design experience, or recent experience, and will require supervised on-the-job training (OJT) until they reach the required level of proficiency. The present full time procedure designers should be able to fill the role of OJT Instructor.

No procedure designers at either AirNav or DGCA have RNP AR APCH procedure design training. Some expertise in RNP AR is necessary since there are published RNP AR Approach procedures in Indonesia that will require review and more are planned.

Some airlines have contracted to third party private design organisations (Airbus ProSky, Boeing/Jeppesen) to design RNP AR APCH procedures at selected airports.

DGCA has automated procedure design tools, although since the separation of the service provider (AirNav) from the regulator, DGCA is responsible for oversight and not currently tasked to design new procedures. AirNav has no procedure design automation tool, although purchase of a tool is in the procurement process, which is expected to be completed by the end of 2016 for delivery in 2017. As the design of flight procedures will

constitute a major task, sharing of valuable automation tool resources between AirNav and DGCA should be considered.

AirNav intends to implement PBN procedures at the rate of 40 airports per year. Based on the estimated requirement to design procedures at 150 to 200 airports this suggests a four to five year roll-out.

It is considered that 10 to 12 full time designers will be required over the next four to five years to achieve the projected implementation rate. Considering that most qualified designers in AirNav are currently employed on other duties, and that a procedure design automation system is still in the procurement phase, it can be expected that the achieved rate of implementation in the first year may be lower than planned. AirNav will also require other designers to handle routine non-PBN tasks.

STPI conducts ab-initio and advanced Procedure Design courses on demand providing an ongoing source of trained procedure designers.

Provided qualified designers are reassigned to flight procedure design duties there is adequate resources available to meet the expected procedure design demand.

b) Action

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

AirNav/DGCA to ensure all procedure designers are familiar with the ICAO quality assurance (QA) provisions

AirNav to train selected procedure designers in RNP AR APCH procedure design.

AirNav to ensure availability of procedure design automation tool

Action Element 8: DGCA/AirNav RNP AR Procedure Design Training

Action Element 10: AirNav Procedure Design Productivity: Ensure Sufficient

Design Staff

Action Element 10a: AirNav Procedure Design Productivity: Procedure Design

Automation Tool Procurement

c) Recommendation

AirNav immediately reassign fully trained procedure designers from ATC to full time procedure design duties, under supervised OJT until proficient.

Provide PBN procedure design training to designers that have only attended the conventional Pans Ops training. Reassign these procedure designers to full time

procedure design as previously reassigned designers complete supervised OJT. Continue until desired full time procedure design capacity is reached.

Additional Strategies for Increasing Procedure Design Staffing

- Share workload with Garuda and DGCA. Between these two organisations there are 6 to 8 trained procedure designers. DGCA should consider reviewing design staff roles and general workload in order to accept some procedure design workload.
- Recruit additional untrained staff: New personnel require extensive training and do not provide additional effective output for at least one year. The cost of training plus one year's unproductive employment is expensive and should be considered in the context of anticipated personnel turnover as well as longer term procedure maintenance workload once PBN implementation is complete.
- Recruiting additional trained and PBN-experienced staff: This is not likely to be a viable option due to the worldwide shortage of experienced designers.
- 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 DGCA authorisation of contract design organisations, although many design companies have obtained approval in other economies (Australia, Canada, United States of America) and DGCA may agree to accept an accreditation granted by another economy.

3.18. Flight Procedure Design (Technical)

a) Analysis

As the ambient operating temperature throughout Indonesia is consistently close to International Standard Atmosphere (ISA) +15° Celsius, the published vertical profile on PBN approaches should be approximately 2.8° instead of the current 3° due to the effect of temperature on the achieved approach gradient. Publishing a (typical) 2.8° will result in the achieved actual vertical profile being close to the optimum 3° for most approaches, most of the time. Guidelines for calculation of the approach angle due to temperature differential are provided in ICAO Doc 8168.

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.

As Indonesia 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 Indonesia 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.

b) Action

DGCA/AirNav to adopt new ICAO RNP APCH titling convention

Action Element 11: Adopt New ICAO RNP APCH Titling Convention

c) Recommendation

AirNav review all published procedures with LNAV/VNAV minima and all RNP AR APCH procedures and consider changing published angle to approximately 2.8° where appropriate. Consider temperature differential when determining angle to publish for all future new procedures. For RNP AR APCH procedures, consult with the operator(s) first.

3.19. 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 stated 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 Indonesian authorities, in common with many similar authorities, are not conversant with the processes and have yet to implement conforming quality assurance processes.

The DGCA Flight Inspection Unit, BKFP, is responsible for validation, (including flight validation) of PBN IFPs. The flight inspection unit operates in accordance with Indonesia Advisory Circular (AC) 171-5 that includes requirements for flight inspection and flight validation. Procedures for validation of flight procedures require updating to conform to ICAO Doc 9906.

The Flight Inspection Unit, employs 31 pilots (nine captains and 22 co-pilots) in addition to engineering and support staff. The unit operates six Beechcraft King Air aircraft (four BE200 and two BE350) in the flight calibration role. These aircraft are equipped with

Collins ProLine 21 avionics and Collins FMS. The unit also operates one Hawker 900XP aircraft.

The aircraft operated by the Flight Inspection Unit are adequately equipped and suitable for the flight validation role. There is sufficient pilot and aircraft capacity to complete the expected flight procedure validation workload.

Pilots in the Flight Inspection Unit who are to be tasked with flight procedure validation need experience in the conduct of PBN operations in order to effectively evaluate the flyability of PBN procedures. Some pilots have experience in the conduct of PBN flight operations, although experience is limited. No pilots in the flight inspection unit have experience in PBN approach operations using basic stand-alone equipment

Training in PBN flight operations is readily available and as the Flight Inspection Unit has a BE-200/350 simulator, training can be completed locally by employing a PBN qualified instructor who is current on the BE-200/350 and familiar with the installed avionics. Pilots in the unit routinely attend simulator recurrent training and, on completion, initial PBN training could be included. Future recurrent training sessions should include PBN approach training as part of the normal curriculum.

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 are operated by the STPI flight training division. (PA28-151 equipped with Garmin 430 receivers).

Some pilots and engineers in the unit have completed training under a Japan International Cooperation Agency (JICA) program which included limited flight procedure design and basic principles of IFP validation. IFP Validation training conforming to ICAO Doc 9906 Volume 6 has not been completed.

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

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

b) Action

DGCA to review and amend CASR Part 173 to implement validation and flight validation requirements in accordance with ICAO Doc 9906

DGCA to review and amend AC 171-5 to implement validation and flight validation procedures and processes in accordance with ICAO Doc 9906

Pilots in the DGCA Flight Inspection Unit (BKFP) to complete PBN Flight Operations Training

Recurrent training for Pilots in the DGCA BKFP to include PBN operations

Pilots in the DGCA BKFP to complete a FVP Course in accordance with ICAO Doc 9906 Vol 6

Pilots in the DGCA BKFP to complete supervised OJT after completion of an initial FVP Course.

Action Element 7: DGCA Review and Amend CASR Part 173: Quality Assurance

Action Element 12: DGCA Review and Amend AC 171-5 to implement validation

procedures in accordance with Doc 9906

Action Element 13: DGCA BKFP PBN Operations Training for Pilots: Initial

Action Element 13a: DGCA BKFP PBN Operations Training for Pilots: Recurrent

Action Element 14: Flight Validation Pilot Course for Flight Inspection Pilots

Action Element 14a: Flight Validation Pilot Supervised OJT

c) Recommendation

Pilots in the DGCA BKFP to complete familiarisation training in aircraft equipped with stand-alone GNSS receivers.

Procedure designers attend the validation portion of the FVP course.

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

a) Analysis

Although AirNav 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 AirNav Indonesia 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 Indonesia 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, 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 DGCA, 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.

b) Action

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

Action Element 15: AIRNAV Concept of Operations

3.21. Air Traffic Management (ATM) - Airways

a) Analysis

Some routes serving international overflying traffic are designated RNP 10 but PBN navigation specifications have not been assigned to the domestic route structure.

The applicable options for domestic route specifications are RNAV 5 and RNP 2. With the publication of new separation standards in ICAO Doc 4444 Air Traffic Management, opportunities now exist to modernise and improve efficiency in the Indonesian 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.

Any aircraft that is not RNP 2 capable will be able to navigate on RNP 2 or RNP 1 routes but will be 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.

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.

ICAO Cir 341-AN/184 *Guidelines for the Implementation of Lateral Separation Minima* has additional guidance for planning purposes.

b) Action

AirNav develop comprehensive plan for transition to a PBN domestic enroute structure

AirNav to assign RNP 2 Navigation Specification to domestic air routes

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

Action Element 16: AirNav ATM: Assign PBN Navigation Specifications

Action Element 16a: AirNav ATM: Transition to PBN Enroute Structure

3.22. 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 STARs have been published for three airports but those procedures are inefficient due to extensive application of speed and attitude restrictions, and excessive track miles. SIDs and STARs need to be redesigned with fewer restrictions and reductions in track miles to obtain any benefit from PBN. Where possible, STARs should be designed for continuous descent operations (CDO) and SIDs should be designed for continuous climb operations (CCO).

A key element in achieving PBN operational efficiency is a reduction in the dependence by ATC on radar vectoring and the use of efficient PBN SIDs and STARs. Currently maximum runway usage is achieved by sequencing aircraft in trail by radar vectoring which results in inefficiency. For maximum efficiency aircraft should be retained on well-designed PBN routes with minimum level/speed restrictions permitting the aircraft FMS to manage the climb/descent and consequently burn less fuel. However, runway occupancy must also be managed and traffic must be sequenced. The use of an Arrivals Manager System (AMAN) in conjunction with speed control and other techniques permits greater dependence on aircraft managed profiles, a reduction in vectoring and improvement in efficiency. AirNav reports that an AMAN is planned to be implemented early in 2017. Combined with good PBN STAR design this can be expected to reduce radar vectoring and begin to achieve measurable PBN efficiency improvement.

AirNav reports a reluctance by ATC to change from existing practice which typically depends on radar vectoring to achieve in-trail spacing. This is a common problem and it is necessary to effect a fundamental change in controller attitude. This can be achieved through education and training but will take some time and effort. AirNav is encouraged to persevere and to expect that change needs to occur in small steps. Initially AirNav intends to remove as many altitude and speed restrictions as possible and to trial track shortening where possible. (Refer to Cultural Change above and Action Element 2b)

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. Other ICAO members in the region already mandate RNP 1 capability.

b) Action

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

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

AirNav to designate all SID/STAR procedures RNP 1

Action Element 1i: Prepare PBN Plan: AirNav/DGCA Develop Priority List

Action Element 16: AirNav ATM: Assign PBN Navigation Specifications

c) Recommendation

AirNav to complete the commissioning of an Arrivals Manager (AMAN) system, as a matter of high priority.

AirNav to develop techniques for more efficient traffic management using PBN STARs supported by AMAN sequencing and reductions in procedural restrictions and radar vectoring.

AirNav to manage the ATC cultural and attitude changes associated with PBN SID/STAR implementation.

3.23. Air Traffic Management (ATM) - Instrument Approaches

a) Analysis

There are approximately 270 airports in Indonesia that are capable of supporting some PBN procedures, typically RNP APCH LNAV or LNAV/VNAV approaches.

Airports in Indonesia are provided varying levels of air traffic services as follows:

•	Radar controlled primary airports	20
•	Non-radar controlled (radar monitoring available)	20
•	Non-radar controlled (no radar monitoring)	40
•	Airports with AFIS	150
•	Other airports	40

Note: Numbers are approximate only

Of these airports 25 are international airports and, therefore, are a priority for PBN services consistent with ICAO resolution A37-11. In addition, there are about 240 or more domestic airports that will benefit from PBN implementation on efficiency and safety grounds and, therefore, should be included in the Indonesian PBN Implementation Plan. Over 50 of these airports are in eastern Indonesia (West Papua) and are already considered a safety priority. The PBN Implementation Plan also needs to consider the changes to CNS/ATM required as the reliance upon conventional navigation aids is replaced by satellite based navigation.

Approximately 39 PBN approach procedures have been published at about 20 or more airports. Most of these appear to have been designed under a JICA project that ran from 2010 to 2015. Of the 39 procedures, 6 are RNP AR APCH procedures designed by either Airbus/Prosky or Jeppesen but are currently not being flown as no operator has yet been given operational approval. Several of the published PBN approach procedures require revision to meet current ICAO guidelines.

Of the total 270+ airports in Indonesia, it is estimated that at least 150 to 200 will be suitable for PBN approach and/or departure procedures. The remaining airports may not be suitable due to terrain or other factors, or have insufficient traffic to require an instrument procedure.

AirNav has commenced work on determining requirements for each airport (approach/SID/STAR) and establishing an implementation schedule. AirNav should consult with stakeholders in determining the order of priority for implementation.

The support for PBN operations by Air Traffic Services (ATS) staff has been identified as an issue and an impediment to implementation. ATS personnel have been reluctant to authorise PBN operations due to lack of knowledge and/or confidence in PBN operations. Although some training had been completed there was concern by DGCA that training needed to be certified. Most of these issues have now been resolved. DGCA has agreed to AirNav conducting "PBN Familiarisation Training" for ATC. AirNav commenced PBN Familiarisation Training on an "as needed" basis from September 2016.

Special training for ATC associated with RNP AR APCH operations is also required. There has been reluctance by ATC to allow RNP AR APCH operations due to concerns about integration with conventional (ILS or VOR) operations as well as a lack of understanding of RNP AR APCH. The result is that aircraft operators applying for DGCA RNP AR APCH operational approval who are required to conduct a number of operations to demonstrate their competence cannot meet the DGCA requirements due to the low ATC clearance rate. Techniques for managing simultaneous PBN and conventional operations need to be developed and AirNav needs to promulgate local instructions for ATCs where RNP AR APCH operations are conducted. The DGCA indicated just prior to publication of this report that PBN familiarisation training had been provided to ATCs at twenty international airports in November and December 2016.

AirNav needs to consult with DGCA and operators on the phasing in of RNP AR APCH operations by initially requiring operations in visual conditions, until ATC is comfortable with managing these types of operations. AirNav has agreed to actively support operators in the implementation of RNP AR APCH operations and to ensure that aircraft are permitted to conduct RNP AR APCH procedures whenever possible.

b) Action

AirNav to complete a schedule for the implementation of PBN approaches, APV where possible, at all airports

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

AirNav to provide additional training for ATCs where RNP AR APCH operations are implemented.

AirNav to develop techniques and issue local instructions for the management of RNP AR APCH operations

AirNav to consult with DGCA and operators on the phasing in of RNP AR APCH operations

Action Element 1i: Prepare PBN Plan: AirNav/DGCA Develop Priority List

Action Element 16b: AirNav ATM: Training and Instructions for ATCs involved in RNP AR APCH operations

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

a) Analysis

AirNav 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 not required as a back-up to PBN navigation.

In Indonesia 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.

Instrument Landing Systems (ILS) and GNSS Landing Systems (GLS) are not replaced by PBN and should be retained/installed where needed. (ICAO PBN Plan Template Chapter 2)

The industry should be kept well-informed of the details and schedule of decommissioning.

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

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

b) Action

AirNav to conduct a CNS/ATM Study to apply to PBN-based airspace system

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

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

a) Analysis

Indonesia should consider and include in the PBN Plan a timeframe for mandating PBN capability (i.e. GNSS equipage) in Indonesian 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 Indonesian airspace are modern and GNSS equipped and, therefore, able to comply with a mandate without significant expense.

b) Action

DGCA in consultation with AirNav and the industry to mandate PBN capability on a schedule consistent with the new Indonesia PBN Implementation Plan

Action Element 17: DGCA to Mandate PBN Capability

3.26. Airlines

a) Analysis

Although some operators have obtained all relevant PBN operational approvals, most operators have only applied for limited approvals.

Operators should be encouraged to apply to DGCA for PBN operational approvals as soon as possible, given that the AirNav proposal is to commence the rollout of PBN procedures in the immediate future.

Operators are reluctant to apply for approvals due to the cost of obtaining an approval and, in particular, the system of charging per tail number. As most operators will require operational approval for six or more PBN Specifications (typically RNAV 10, RNAV 5, RNAV 1 and 2, RNP 2, RNP 1, RNP APCH), with each approval costing approximately USD 500, an operator with 100 aircraft will incur a DGCA charge of USD 300,000 in addition to the costs associated with preparing an application and crew training. Given that the DGCA workload is the same for one aircraft as for 100 aircraft, these charges are regarded by operators as excessive.

Charges are determined by the Ministry of Finance and are outside DGCA's control. DGCA recognises that the current charging system is unreasonable and a disincentive to progress, and has undertaken to raise the matter with the relevant agencies to seek a more equitable charging arrangement.

Lion Air, Batik Air and Citilink intend to implement RNP AR APCH operations at selected airports. Lion Air was issued a temporary approval for the purpose of gaining experience in visual conditions, but this approval has now lapsed. It was reported that Lion Air had only completed six approaches of a required 100 approaches during the six months of their initial temporary approval.

b) Action

DGCA to investigate and find solution to the charging system for PBN Operational Approvals

Action Element 18: PBN Operational Approval Charging System

c) Recommendation

DGCA to encourage operators to submit applications for Operational Approval

3.27. Military

a) Analysis

The Indonesian Military has a fleet of aircraft that includes a number of aircraft that are capable of PBN operations, but has little knowledge and no experience in PBN.

As PBN operations will provide capability to operate in circumstances where ground-based navigation aids may be unavailable, due to natural disasters or major systems failures, military operations wherever possible should be PBN capable.

The military should be encouraged to participate in Indonesian PBN implementation and to seek assistance from civilian authorities and operators to assist in gaining PBN knowledge and experience.

b) Recommendation

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

3.28. Airports

a) Analysis

Angkasa Pura (AP) 1 and II together manage 26 of the major airports in Indonesia.

Airport authorities are familiar with ICAO Annex 4 and 14 requirements and are generally fulfilling their responsibilities.

Responsibility for the control of obstacles in the vicinity of airports (Annex 14) and the compilation of Electronic Terrain and Obstacle Data (eTOD) as required by Annex 15 needs to be established.

The responsibility for eTOD belongs to DGCA, with the Directorate of Air Navigation having responsibility for Annex 15. Some eTOD is available at a limited number of airports.

It is important that eTOD is available for use by procedure designers and avionics manufacturers and that the revised PBN Implementation Plan addresses the priorities and timeline for collection of eTOD to support PBN implementation. DGCA should adopt a strategy allowing for initially limiting the collection of data to the most important aspects of PBN implementation. For example, collection of Areas 2a, 2b and 2c data out to 10km will cover the most important areas of the final approach, missed approach and departure for procedure design purposes.

Notwithstanding the availability of eTOD, the importance to the procedure designer of surveyed WGS-84 coordinates for the runway ends is emphasized. DGCA obtains electronic terrain data for the entire economy (Area 1) from Indonesia's mapping agency. DGCA is advised to evaluate the suitability of that data for use in procedure design, even if it does not meet all the requirements of Annex 15. DGCA should also check with Indonesia's mapping agency to obtain whatever obstacle data they may have that would meet or partially meet the electronic obstacle data requirements, particularly for Areas 1 and 2d. DGCA requires an application from builders wishing to build or erect structures in the vicinity of airports. The data for each of those approved structures should be included in an electronic database available to the procedure designers.

Responsibility for area 2, 3 and 4 data should be transferred to the Airports Directorate. The Airports Directorate needs to amend regulations to require airports to provide eTOD Area 2, 3 and 4 data in accordance with Annex 15 as a condition of airport 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.

The Directorate of Air Navigation should retain responsibility for Area 1 data and work with Indonesia'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 (SARPs).

DGCA'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, DGCA needs to work with AirNav to include the electronic database of all approved and known obstacles, as well as all available eTOD, in the AirNav AIXM 5.1 database project.

b) Action

DGCA 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

DGCA 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

c) Recommendation

DGCA should adopt a strategy allowing for initially limiting the collection of eTOD to the most important aspects for PBN implementation

DGCA to coordinate with Indonesia's mapping agency to obtain whatever obstacle data they may have that would meet or partially meet the electronic obstacle data requirements, particularly for Areas 1 and 2d.

3.29. 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 Indonesia will become redundant and can be decommissioned with consequent significant cost savings.

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. AirNav has a plan to provide this service at 100 towered airports, either by installation of Automated Weather Stations or training of local personnel. This requirement can be met similarly 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

DGCA and AirNav 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. 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 DGCA 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 DGCA 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 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 & DGCA 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 & DGCA guidance	

Regulatory			
Position	Type of Training	Training Subject	
Flight Operations Inspector	OJT	PBN Operational Approval	
Airworthiness Inspector (selected)	Initial	PBN Operational Approval	
Airworthiness Inspector (selected)	Recurrent	PBN, Operational Approval, new or amended ICAO & DGCA 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 & DGCA guidance	
Flight Validation Pilot	ОЈТ	Flight Validation Pilot	

Procedure Design			
Position		Type of Training	Training Subject
Procedure Designer	Ini	tial	PANS OPS Procedure Design, PBN & Conventional
Procedure Designer	OJ	Т	PANS OPS Procedure Design, PBN & Conventional
Procedure Designer	Re	current	PANS OPS Procedure Design, PBN & Conventional
Procedure Designer	Ini	tial	Validation segment of FVP Training
Procedure Designer	Re	current	PBN, new or amended ICAO & DGCA guidance
Procedure Designer	Ini	tial	PANS OPS/Doc 9905, RNP AR Procedure Design

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

4.2. PBN Operations Flight Training

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

PBN flight training is required for the following persons:

- Selected DGCA FOIs who are responsible for evaluation of applications for PBN operational approval;
- Pilots in the DGCA Flight Inspection Unit who are to be tasked with Flight Validation duties;
 and
- STPI/ICAI flight instructors who will give training to FOIs and FVPs.

Two classes of PBN systems are relevant, namely:

- 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 local 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 "standalone" receivers installed in this class of aircraft.

The flight training division of ICAI/STPI was visited to determine the availability of PBN training for GA Inspectors. Suitably equipped aircraft with stand-alone receivers are available for training (Piper PA28-151 equipped with dual Garmin 430 TSO 146 receivers). This type of equipment is in common use in light aircraft and ideally suited to initial PBN training.

Also inspected were three PA34 Piper Seneca twin engine aircraft fitted with Garmin 1000 avionics. This type of installation represents more modern large glass-screen displays and is becoming more common in late model aircraft. STPI advised that a large fleet of new Cessna 172 training aircraft are on order and although the type of avionics is not known, it is likely that these aircraft will also be fitted with Garmin 1000 systems.

Although excellent systems, this type of installation is not representative of the basic type of receiver (e.g., Garmin 430) and is not the preferred type of receiver for basic training. While inspectors should be familiar with the Garmin 1000 system, basic training should be conducted in the Piper Warrior with Garmin 430 system.

Several STPI senior flight instructor pilots were interviewed but none was familiar with the Garmin 430 receiver or the Garmin 1000 system. None of the instructors employed by STPI is believed to be trained or experienced in PBN operations with stand-alone receivers.

It is recommended that at least two senior STPI instructors obtain flight training in the operation of basic stand-alone receivers such as the Garmin 430. Training of this type is not available in Indonesia, but is commonly available in neighbouring economies such as Australia or New Zealand.

Following completion of training, STPI would be equipped to train DGCA general aviation FOIs who would then be qualified to oversight general aviation PBN operations.

Similarly, pilots from the BKFP Flight Inspection Unit would be able to gain experience on stand-alone GNSS systems at STPI, which will better qualify them to validate PBN procedures.

4.3. PBN Operational Approval Training

PBN Operational Approval training is required for the following personnel:

- a) Selected persons in the Department of Airworthiness and Aircraft Operations (DAAO) responsible for developing and maintaining PBN operating rules (2 estimated);
- b) Selected persons in the DAAO responsible for administering PBN Operational Approvals (8 estimated);
- c) FOIs (pilots) in the DAAO responsible for evaluating applications for operational approvals (20 estimated).

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

ICAO conducts PBN Operational Approval courses on request. 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.

It is recommended that DGCA contact the ICAO COSCAP-SEA CTA to arrange a course as soon as practical.

4.4. Flight Validation Pilot Training

The following personnel require FVP training:

- a) Pilots in the DGCA Flight Inspection Unit (BKFP);
- b) Selected DGCA FOIs (pilots) who are responsible for the oversight of PBN operations and IFPs, especially RNP AR.

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 DGCA pilot inspectors without the requisite

PBN experience seek the cooperation of Indonesian 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 two weeks' classroom training.

A second classroom module, typically of about five to six days' duration covers the conduct of validation (including flight validation). Material to be covered is detailed in ICAO Doc 9906, Volumes 5 and 6. This portion of the training should also be made available to the AirNav and DGCA procedure designers so that they have a full understanding of the validation process.

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 who will mentor and advise 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 one to two 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 BKFP.

As there are a large number of pilots who require training, it is suggested that DGCA arranges for a course to be conducted in Indonesia. It is recommended that at least one FOI (pilot) from DGCA also attend. This is in order that the regulator is informed and familiar with validation procedures.

Occasionally, ICAO conducts FVP courses based on demand. It is recommended that DGCA contact the ICAO COSCAP-SEA CTA as soon as practical to arrange a course. DGCA should consider hosting a course in Indonesia, inviting participants from other Asia-Pacific economies, as it can be expected that other authorities in the region are also in need of FVP training. Convening a course in Indonesia is likely to be less expensive than sending individual pilots overseas for training.

The Ambidji team has informally advised the ICAO COSCAP-SEA CTA to expect a request from the DGCA 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 Indonesia.

An *Action Plan* (see below) provides a chronological order for implementation of 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 identify which elements are relevant to their organisation 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.

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 <u>at the time of discussion during the second site visit</u>. To the credit of the stakeholders concerned, action on some items was to commence immediately and, consequently, several target dates predate the publication date of this report.

- 1. Actions to be undertaken with immediate effect: DG of the DGCA takes charge of PBN implementation:
 - Meet directly with President-Director, AirNav Indonesia, on the subject of working together to achieve PBN implementation:
 - Jointly with President-Director AirNav appoint a PBN Task Force, reporting regularly to him, and responsible to develop and execute the PBN Implementation Plan;
 - Jointly with President-Director establish management structure making Directors responsible and accountable for their organisations' roles in PBN implementation; and
 - Make required resources available.

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

- Revise and publish Indonesia PBN Implementation Plan including supporting tasks;
 - Identify strategic objectives
 - List assumptions & constraints
 - Fleet capability review;
 - o CNS/ATM capability review;
 - Determine implementation targets
 - Assess expected benefits of PBN
 - Safety assessment;
 - AirNav Concept of Operations.
 - Develop priority list.
- Issue Aeronautical Information Circular informing aviation community of major future events in the revised plan;
 - o 30/06/2017: Implement RNP 1 replacing RNAV 1, RNP 2 domestic enroute;
 - o 30/06/2017: Implement RNP naming in lieu of RNAV(GNSS) for approach;
 - o By 31/12/2017: Commence publishing RNP 2 routes between city pairs;
 - 31/12/2018: Implement RNP 2 to replace RNAV 10 on oceanic routes;
 - 2017-2021: Publish PBN approaches to 40 or more airports per year, see AirNav website for schedule:
 - 2017-2020: Publish RNP 1 SIDs and STARs at 22 airports at a rate of 5-6 per year, see AirNav website for schedule;
 - 31/12/2019: Mandate RNP 1;
 - o 31/12/2021: Mandate RNP 2 for all enroute, and mandate RNP APCH;
- Update SI 8900 4.1 to latest edition of PBN Manual;
- Organise recommended pilot training for 1st quarter, 2017. Includes PBN operations, FVP, Operational Approval, STPI/ICAI;
- Begin enforcement of CASR 173. Require full compliance of procedure design organisations;
- AirNav to address requirement for additional fulltime procedure designers;
- AirNav to ensure completion of procurement for procedure design automation tool;
- Develop website, accessible by the public, on AirNav site with information on progress against the PBN procedure goals and schedule of airports to get new PBN procedures;

- Temporary RNP AR APCH approval for Lion Air to be reinstated;
- Nominate Indonesian procedure design expert to become member of the ICAO IFPP
- 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 DAAO within 60 days;
 - Procedures received for validation by BKFP 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, CASR 173
 amendments such as periodic review of procedures, waivers to procedure design
 criteria;
- Permanent RNP AR APCH approval for Lion Air completed;
- Coordinate with data houses (Jeppesen, Lido) on exact AIRAC cycle to publish name change for RNAV 1 and RNAV(GNSS) procedures;
- Publish first revisions to existing RNAV 1 STARs/SIDs with changes to increase efficiency;
- 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;
- 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;

- Implement RNP 1 SID and STAR at high traffic international airports;
- 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;
- 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)
- 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);
- Complete all elements of 2016 PBN Implementation Plan;
- 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;
- Mandate RNP 2 for all enroute operations;
- Mandate RNP APCH for all IFR aircraft;
- Annual review of progress against PBN Plan targets.

5.3. Action Elements Index (refer Appendix H)

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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: DGCA Conduct Fleet Study	3.4
1d	Prepare PBN Plan: AirNav CNS/ATM Study	3.4, 3.24
1e	Prepare PBN Plan: Determine Implementation Targets	3.4
1f	Prepare PBN Plan: DGCA Assess Expected Benefits of PBN	3.4
1g	Prepare PBN Plan: DGCA & AirNav to Assign Responsibility	3.4
1h	Prepare PBN Plan: DGCA/AirNav to Conduct Safety Study	3.4
1i	Prepare PBN Plan: AirNav/DGCA Develop Priority List	3.4, 3.22, 3.23
2	DGCA/AirNav Leadership Initiatives: Implement Management Structure	3.4, 3.6
2a	DGCA/AirNav Leadership Initiatives: Establish PBN Task Force Structure	3.4, 3.6
2b	DGCA/AirNav Leadership Initiatives: Manage Cultural Change	3.4, 3,7

Action No	Topic	Paragraph No.
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4	DGCA to Review Operational Approval Guidelines	3.4, 3.9
5	PBN Training for FOIs: GA Inspectors	3.4, 3.10
5a	PBN Training for FOIs: all DGCA FOIs	3.10
6	PBN Operational Approval Training	3.4, 3.10
6a	PBN Operational Approval Training: Incorporate in Initial FOI Training	3.10
7	DGCA Review and Amend CASR Part 173: Quality Assurance	3.4, 3.11, 3.16, 3.19
7a	DGCA Review and Amend CASR Part 173: Exemptions to Criteria	3.12
7b	DGCA Review and Amend CASR Part 173: Periodic Review of IFP	3.4, 3.13
8	DGCA/AirNav RNP AR Procedure Design Training	3.4, 3.11, 3.17
9	All PBN Procedures to be extracted from approved Nav Database	3.4, 3.14
10	AirNav Procedure Design Productivity: Ensure Sufficient Design Staff	3.4, 3.17
10a	AirNav Procedure Design Productivity: Procedure Design Automation Tool Procurement	3.4, 3.17
11	Adopt new ICAO RNP APCH Titling Convention	3.18
12	DGCA Review and Amend AC 171-5 to implement validation procedures in accordance with Doc 9906	3.4, 3.19
13	DGCA BKFP PBN Operations Training for Pilots: Initial	3., 3.19
13a	DGCA BKFP PBN Operations Training for Pilots: Recurrent	3.19
14	Flight Validation Pilot Course for Flight Inspection pilots	3.4, 3.19
14a	Flight Validation Pilot Supervised OJT	3.4, 3.19

Action No	Торіс	Paragraph No.
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16	AirNav ATM: Assign PBN Navigation Specifications	3.4, 3.21, 3,22
16a	AirNav ATM: Transition to PBN Enroute Structure	3.4, 3.21
16b	AirNav ATM: Training and Instructions for ATCs involved in RNP AR APCH operations	3.4, 3.23
17	DGCA to Mandate PBN Capability	3.4, 3.25
18	PBN Operational Approval Charging System	3.4, 3.26
19	Annex 15 eTOD	3.4, 3.28
19a	Airports Directorate responsibility for eTOD	3.4, 3.28
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20	Convert Indonesia's obstacle data base to AIXM format	3.28
21	Provision of Local Barometric Pressure for PBN Instrument Approach Operations	3.4, 3.29
22	PBN Training for STPI/ICAI Flight Instructors	3.4, 3.10
23	DGCA/AirNav/Garuda Ensure Procedure Designer Familiarity with ICAO QA Provisions	3.4, 3.16
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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 approach procedures with vertical guidance (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:

 Urges all States to implement RNAV and RNP 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 enroute 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
- 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;

- 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
			1
			P.

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)]

Executive Summary

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- 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 Term	Definition			
[Insert Term]	<provide acronyms="" and="" definition="" document.="" in="" of="" term="" this="" used=""></provide>			
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 efficiencyInfrastructure and equipment
- AirspaceAircraft 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 INFRASTUCTURE

[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

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:
 - 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
RNAV 10			
RNAV 5		8	
RNAV 2			
RNAV 1			
RNP 4			
RNP 2			
RNP 1			
Advanced RNP			
RNP APCH		1	
RNP AR APCH		×.	
RNP 0.3		.9	

[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
<document and<br="" name="">Version Number></document>	<document description=""></document>	<url document="" is="" located="" location="" or="" where=""></url>

[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].

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

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)

INDONESIA 2016



15 July 2016



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PROPOSED TERMS OF REFERENCE TPT 05/2015A Indonesia

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 Indonesia to take the current PBN implementation plan to the next level of implementation maturity so that Indonesia 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 states 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 Indonesia.

Indonesia 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 Indonesia'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 Indonesia 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:

- Questionnaire. In order to assist the Ambidji Project Team to be familiar with the current PBN implementation status and experience in Indonesia 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 Indonesia'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 Indonesia 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 Indonesia to conduct the first of two site visits, 29 August-2 September 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 Indonesia for the second site visit 10-14 October 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 rising from the Gap Analysis;
 - b. A summary of the best practices shared with Indonesia 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 Indonesia 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 Indonesia 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 Jakarta, Indonesia from 29 August-2 September 2016.

The primary purpose of the first visit is to evaluate the current PBN status in Indonesia 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
- Mr Pongabha Abhakara (Aeronautical Radio of Thailand Ltd) Subject Matter Expert
- Mr Shoei Oida (All Nippon Airways Co. Ltd) Subject Matter Expert

7. PROPOSED TOPICS

Taking into account the considerable amount of PBN development work already completed in Indonesia, feedback from the questionnaire, and Indonesia's participation in recent ICAO Asia-Pacific Region PBN conferences, the following topics are proposed:

- ALL STAKEHOLDERS: Review the role of the recently established (26 Jan 2016)
 PBN Task Force in progressing plans and priorities for PBN implementation in Indonesia.
- DGCA: Review PBN operational regulatory documentation with regard to the adequacy of legislation and regulations to support the implementation of PBN. Discuss the regulatory criteria for approving "certified" PBN training courses needed by various stakeholders in order to fulfil their role in PBN implementation and ongoing PBN flight operations.
- 3. DGCA: 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 DGCA 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 and cost to air operators for administration of PBN approvals and surveillance of operators. Discuss very low rate of RNP APCH approvals. Discuss DGCA policy of individual tail number approvals vs. fleet approvals.
- 4. **DGCA:** 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.
- 5. **DGCA:** 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).

- DGCA/AIRNAV INDONESIA: Review plans and goals for a minimum operational network of DME's and other ground infrastructure subsequent to PBN implementation. Review plans for decommissioning of navigation aids. Discuss PBN route harmonization with neighbouring economies, e.g. Australia; Malaysia; and Singapore.
- 7. AIRNAV INDONESIA 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 options for increasing capacity to develop PBN IFPs, such as procedure design automation tools. Discuss plans to meet ICAO goals.
- 8. **AIRNAV INDONESIA 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.
- 9. AIRNAV INDONESIA ATS: Review the PBN standard operating procedures and training provided to ATS staff. Discuss the availability of "certified" training courses and AIRNAV Indonesia proposals for training course development and delivery. 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 arrival and approach procedures, and ATC acceptance and support for PBN. Discuss ATC access to aircraft PBN equipage/capability information on the flight plan. Discuss coordination between ATS and Procedure Design.
- 10. AIR OPERATORS: Review operator training, experience, capability and operational approval status for PBN IFPs. Discuss operator demand for PBN procedures and ATC response to requests for PBN procedure clearances. 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, LNAV/VNAV 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. Discuss impediments and barriers to PBN implementation. Discuss operators' priorities for PBN implementation.
- 11. **AERODROME OPERATORS**: Discuss airport operator participation in PBN implementation. Discuss role of PBN in aerodrome safety, environmental and

capacity planning. Discuss proliferation of obstacles, adequacy of survey, terrain and elevation data. Discuss challenges to PBN implementation at airports,

12. **MILITARY**: Discuss military role in PBN implementation as an air operator, an aerodrome operator and with respect to airspace restricted for military use.

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 DGCA 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:

AirNav Indonesia/ATS senior staff

Flight Operations inspectors

DGCA regulatory personnel

DGCA 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

Military ATC and Flight Operations

DAY 2: DGCA Regulatory personnel - General

DGCA Oversight personnel-Procedure Design & Validation

Flight Operations Inspectors

Flight validation manager/pilots/crew located at DGCA (if any)

DAY 3: Flight Procedure Design manager/staff

Aerodrome management/planning staff

Flight calibration and validation manager/pilots/crew

DAY 4: ATS senior operational and training staff

AirNav Indonesia Safety Inspectors

Airline operator senior pilots/training and flight operations staff

(pilots)

Military air operators (if applicable)

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)
0930 1030	Registration and Opening Ceremony	DGCA General Regulatory	AIRNAV INDONESIA Procedure Design Organization	At AIRNAV INDONESIA Aerodrome Operators Angkasa Pura 1 & 2	Conclusion and Debriefing Presentation of preliminary findings
1045 1200	Program Outline Briefing	DGCA Flight Operations Standards		BKFP (DGCA) Flight Calibration & Validation Organization	
1200 1300	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
1300 1415	Review of PBN Implementation Plan General Discussion	DGCA Flight Operations Standards	AIRNAV INDONESIA Air Traffic	At AIRNAV INDONESIA Air Operators	Spare
1430 1530	and Input from Stakeholders	DGCA Procedure Design and Validation Oversight	Services		APEC Team Departs

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 Jakarta, Indonesia from 10-14 October 2016.

The primary purpose of the second visit is to present the draft Gap Analysis, share best practices and finalize the 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 coordination 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 DGCA

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 DGCA 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 DGCA/Stakeholder participants.

On Days 1 and 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)
0930 1030	Registration and Opening Ceremony	DGCA General Regulatory	AIRNAV INDONESIA Procedure Design Organization	At AIRNAV INDONESIA Aerodrome Operators Angkasa Pura 1 & 2	Conclusion and Debriefing Presentation of preliminary findings
1045 1200	Program Outline Briefing	DGCA Flight Operations Standards		BKFP (DGCA) Flight Calibration & Validation Organization	
1200 1300	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
1300 1415	Review of PBN Implementation Plan General Discussion	DGCA Flight Operations Standards	AIRNAV INDONESIA Air Traffic	At AIRNAV INDONESIA Air Operators	Spare
1430 1530	and Input from Stakeholders	DGCA Procedure Design and Validation Oversight	Services		APEC Team Departs

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

APPENDIX D

Questionnaire



TPT 05/2015A - Enhancing Aviation Connectivity and Emissions Reductionvia 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 you 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 revior your PBN implementatio, 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 review 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 41432680 (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
PI	If so please provide copy of latest version in English.	attached
P2	Has the PBN Plan been submitted to ICAO for assessment?	yes, PBN Plan has been submitted to ICAO, as National PBN Plan
FΖ	If so please provide the outcome of that assessment.	not yet for the assessment
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?	Our target is provide RNP APCH LNAV or LNAV/VNAV in international airpor and domestic airport.

PBN Implementation Questionnaire-Regulator			
Filled out by:		Organization:	
	Is there a PBN Implementation Working Group for your economy?	Yes, we have PBN Task Force starting 2011, this year PBN Task Forcebased of Director of Air Navigation Decree no: KP 20 Tahun 2016, January 26, 201	
R1	If so please list stakeholders that are represented?	Directorate of Air Navigation, Airnav Indonesia, Airlnes (Garuda Indonesia, Sriwijaya Air, Batik Air Indonesia)	
	How often does it meet and when was last meeting?	every 3 month, last meeting early June 2016	
R2	Are implementing civil aviation regulations in place to allow for PBN operations and regulatory oversight of those operations?	Yes, the civil aviation regulations are in place	
R3	Is there a timeline for mandating ADS/B and/or PBN equipage?	ADSB we have mandating for fleet equipage before 31 December 2016 (AI Sup 08/15), but for PBN we don't have any mandating for fleet to equipage (just Information implemented in some airspace SID/STAR and Enroute)	
R4	How many carriers have applied for or obtained PBN operating approval? Please provide a summary.	Some airlines have PBN operating approval like Garuda Indonesia, Lion Air, Air Asia Indonesia, Air Asia X, Sriwijaya, Citilink, Air Fast. (the detail in the attachment file)	
R5	Does the Regulator have flight operations and/or airworthiness inspectors qualified to issue PBN operating approvals?	yes, it does	
R6	Does the regulator possess sufficient trained inspectors to administer PBN approvals, including RNP APCH and/or RNP AR APCH?	yes, it does	
R7	What impediments to PBN Implementation is the regulator experiencing?	Training for ATC and Pilot	

	PBN Implementation Question	onnaire-Air Navigation Service Provider(s)	
Filled out by:		Organization:	
Number	QUESTION	RESPONSE	
A1	Have any RNAV routes been published? If so please provide a summary.	yes, I have	
A2	Are any RNAV routes (if implemented) PBN compliant, e.g. RNAV5, RNP4, RNP2, RNAV(RNP)10?	Yes, we have RNAV (RNP) 10 in some enroute	
А3	Have any RNAV SID/STAR been published? If so please provide a summary.	yes, there are on three international airport At Soekarno Hatta Jakarta, Bali Ngurah Rai and Juanda Surabaya with RNAV 1 and RNP AR for the three airport there are Manado, Ambon and Bandung	
A4	Are any RNAV SID/STAR PBN compliant, e.g. RNAV1, RNAV2, RNP1?	RNAV 1 SID/STAR and RNP AR APCH	
A5	Has carriage of GNSS or PBN capability been mandated in your airspace.	Mandated in some airspace where PBN procedure implemented	
A6	Does any adjoining airspace mandate PBN capability?	yes, australia airspace.	
A7	Does ATC have ready access to the ICAO flight plan PBN equipage/capability codes filed by each aircraft?	Yes, ATC can assess PBN equipage from the flight plans or by check the list sent by airworthines directorate	
A8	Do you have any plans to mandate PBN capability?	Yes, plan for mandated PBN equipage on all controlled airspace	
40	Are there airports that routinely experience ATC Delays?	Yes, for same mayor international airport	
A9	Arrivals?	Yes, there are	
	Departures?	Yes, there are	
A10	Have Continuous Climb and Descent procedures been implemented?	Not yet fully implemented, but partially in some airport	
A11	Is an arrivals management program in operation?	on trial AMAN system for same congestion airports	
A12	Are there Plans/Requirements for a Minimum Operation Network (DME and VOR)?	Yes, we have planning to change to PBN procedure and reduce NDB installation also maintain for VOR/DME as ground nav aids	
A13	What impediments to PBN Implementation is the ANSP experiencing?	lack of flight procedure designer, FUA (Flexible Use of Airspace)	

	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?	not yet, the data available only for PBN Approval Airlines		
F2	Is data available on foreign carrier PBN equipage/readiness?	not yet, the data available only for PBN Approval Airlines		
F3	Is data available on domestic carrrier PBN equipage/readiness?	not yet, the data available only for PBN Approval Airlines		
	Approximately what proportion of your IFR aircraft operations are:			
	Overflying	95%		
F4	International	100%		
	Domestic jet	95%		
	Domestic commuter	50%		
	Domestic private	40%		
	IFR Helicopter	15%		
F5	Do operators routinely include the correct ICAO flight plan PBN equipage/capability codes on each flight plan?	yes, they do.		
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, specially for remote airport with limitation of ground navaids and sometimes for special terrain. Like in Sibolga Airport, Nagan Raya Airport.		
F7	Has industry consultation on PBN implementation been conducted?	Yes, like Jeppesen (project in Ambon Airport and Manado Airport), Airbus Prosl (Bandung Airport)		
F8	What impediments to PBN Implementation are air operators experiencing?	cost to get PBN approval certification.		

PBN Implementation Questionnaire-Procedure Design Organization(s)			
Filled out by:		Organization:	
Number	QUESTION	RESPONSE	
PD1	What procedure design capability is available?	conventional and PBN capability	
	In house?	yes, in house	
	Contract?	no	
	For each PD organization please advise:		
	Is the procedure design organization qualified to design PBN procedures?	yes, it is	
PD2	PBN SIDs/ STARs	yes, it is	
	RNP APCH LNAV and LNAV/VNAV	yes, it is	
	RNP APCH LP and LPV	yes, it is	
	RNP AR APCH	no, it isn't	
PD3	For each PD organization please advise:		
	Does the PD use an automation tool?	no, it isn't	
	Is a Quality Assurance Process in place for:		
	Initial design	yes, it is	
	Periodic review of existing procedures?	no, it isn't	
PD4	Is digital terrain data available to Procedure Design organizations? ICAO ETOD compliant?	yes we have but only partially, no compliant with ICAO ETOD, but we also support woobstacle survey.	
PD5	Is there an obstacle database covering the economy's area of responsibility?	no, it isn't	
PD6	Is there regulatory oversight of procedure design providers and organizations?	yes, it is	
PD7	What organization provides oversight?	DGCA	
PD8	Does oversight organization have the necessary training, resources and experience to fulfill it's responsibilities?	yes, it does	
PD9	Is validation of PBN Instrument Flight Procedures conducted?	yes, it is by regulator	
	What organization(s) conduct validation?	regulator (directorate of general civil aviation)	
	What training has been conducted in validation techniques?	Air Navigation Safety Audit Training, PANS - Ops Training	
	How is flight validation accomplished?	with flight procedure design tool, Fllght Simulator and Calibration aircraft	
	Has training of Flight Validation Pilots been conducted.	yes it has	
PD10	What impediments to PBN Implementation is the Procedure design organization experiencing?	no FPD tool, lack FPD personel, need more training and experience	

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?	Aerodrome operator consist of Angkasa Pura I , Angkasa Pura II and Airnav Indonesia. Airnav Indonesia play a role in PBN implementation.	
AD2	What role do they play?	Angkasa Pura I and Angkasa Pura II is responsible to operate of ground side of airport. Airnav Indonesia is responsible to operate or air side/ air navigation.	
AD3	Does the aerodrome operator develop or contract for development and validation of instrument Flight Procedures?	Airnav Indonesia develop and validate of instrument flight procedures	
AD4	Does the aerodrome operator install or contract for installation of ground navigation aids?	Airnav Indonesia install and contract for installation of ground navigation aids	
	Approximately what proportion of your IFR aircraft operations are:		
	Overflying	95%	
AD5	International	100%	
AUS	Domestic jet	95%	
	Domestic commuter	50%	
	Domestic private	40%	
	IFR Helicopter	15%	
AD6	Has consultation on PBN implementation been conducted with the aerodrome operators?	we have forum/group consist of stakeholder from Airlines, Airnav Indonesia and DGCA (Directorate of Air Navigation)	
AD7	What impediments to PBN Implementation are aerodrome operators experiencing?	training for ATC, limitation of obstacle limitation surface (OLS)	

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

APPENDIX E

Site Visit 1 Report

(TPT 05/2015A)

SITE VISIT 1 - INDONESIA

(29 AUGUST – 2 SEPTEMBER 2016)



9 September 2016



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Site Visit 1 - Indonesia

(29 August – 2 September 2016)

1. INTRODUCTION

The first of two site visits to Indonesia was conducted between 29 August and 2 September 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 Jakarta from 29 August to 2 September.

The primary purpose of the first visit was to evaluate the existing PBN status in Indonesia 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 Project 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;
- Mr David VanNess (Ambidji Group), PBN Flight Procedure Specialist;
- Mr Pongabha Abhakara (AeroThai), Subject Matter Expert;
- Mr Shoei Oida (All Nippon Airways), Subject Matter Expert.

4. FAA

The FAA was represented by:

Mr Braks Etta, FAA Air Traffic Representative, Asia-Pacific.

Mr Jim Spillane, Sr. FAA Representative, South East Asia, attended on Day 1 and formally introduced the Program and Team Members.

5. ATTENDANCE

The list of attendees at the workshop is included 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 29 August 2016

A meeting of all stakeholders was conducted at the offices of the DGCA in Jakarta.

Representatives from the following organisations attended:

- DGCA;
- AirNav Indonesia;
- Air Operators;
- Angkasa Pura 1 & II (Airports);
- ICAO.

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

Mr Cesar Velarde presented a summary of the recent activity of the DGCA/ICAO INS13801 PROJECT *ENVIRONMENTAL MEASURES IN CIVIL AVIATION* and the Working Group on Operations and PBN (OPS-PBN WG).

A useful discussion involving all stakeholders followed. This discussion enabled the Ambidj 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 30 August 2016

DGCA: Review of PBN Operational Approval Procedures

The general procedures for issuing an Operating Specification (OPSPEC) authorising PBN operations are sound and working reasonably well. The DGCA staff have a good working knowledge of PBN and ICAO guidance relating to the approval of PBN operations in accordance with ICAO Doc 9613 *PBN Manual*. Good use is made of PBN Job Aids. It was noted that the relevant instruction SI 8900-4.1 needs to be updated based on the latest edition of the ICAO PBN Manual (Doc 9613). The present instruction does not include new navigation specifications such as RNP 2, Advanced RNP, and RNP 0.3 that are included in the latest edition.

Selected examples of OPS SPECS were examined with regard to PBN annotation and although those inspected were generally correct, some errors were noted. It was also noted that an approval for RNP APCH should also include a note indicating which specific types of approach are authorised i.e. LNAV, LNAV /VNAV, LPV.

It was noted that flight testing is being required to obtain operational approval for some basic operations such as RNAV1/RNP1 SID and STAR. A "validation" form relating to these flights was examined. The evaluation of RNAV1/RNP1 aircraft capability or flight procedures either in actual flight or in a full flight simulator is not a normal requirement for issue of the relevant OPSPEC. Many of the items listed on the "validation" form are items which would normally be for the attention of the aircraft manufacturer and compliance is demonstrated by reference to manufacturer documentation. Compliance with remaining items is normally identified by desktop examination of operator supplied documentation. Only in exceptional cases, such as an aircraft where after-market GNSS or FMS modifications have been installed, would a flight in the aircraft or simulator be warranted.

It is recommended that this requirement be removed, or at the very least, conducted in a simulator rather than the aircraft.

Some discussion of the approval procedure for RNP AR APCH operations identified that DGCA is following guidance material which is unduly conservative. RNP AR APCH has now become more widely accepted worldwide and much operational experience has been gained over the last 10 years. Consequently, the very conservative approach to RNP AR APCH approvals that was adopted in the developmental phase (circa 2004-2008) is no longer warranted. For example, DGCA requires LionAir to demonstrate 100 operations in visual conditions to qualify for approval, which can be (and has proven to be) difficult to achieve in a reasonable period.

It is recommended that the requirements for RNP AR APCH approvals be reviewed and, rather than the specification of an arbitrary number of operations, that approval be issued when the Flight Operations Inspector and other stakeholders (ATC) are satisfied that all relevant conditions are met.

The qualifications and experience of Flight Operations Inspector pilots was examined. It was noted that DGCA employs both staff (27) and contract (72) pilot inspectors and that

a number of new inspectors (45) have been, or are being, recruited from ab initio flight training programs.

Senior staff inspectors are suitably qualified and experienced with regard to approval of PBN operations in FMS equipped aircraft, e.g. B737NG/A320.

However, although all contract inspectors receive basic inspector training, it is not clear if any or all of the contract inspectors have PBN operational experience and if they are suitably trained to process applications for PBN Operational Approval.

Flight Operations Inspectors responsible for smaller aircraft were also interviewed. There are approximately 15 permanent general aviation and helicopter FOIs. Smaller aircraft, including twin turboprop aircraft such as DHC6 Twin Otter as well as general aviation aircraft (e.g. B55/B300/C421/C208 Caravan) and helicopters are typically fitted with stand-alone panel mounted basic GNSS receivers. This type of receiver is generic and capable of RNP APCH LNAV approach operations as well as RNAV1/RNP1/RNP 2/RNAV5 operations. GNSS operations were in fact based on this class of equipment and it has only been in more recent years that GNSS operations have been extended to include FMS aircraft such as the B737NG and Airbus A320.

The operation of stand-alone equipment is quite different to operations in aircraft fitted with an FMS. It is evident that inspectors do not have operational experience with this type of equipment and will require training. Once qualified to fly PBN operations using stand-alone receivers, Inspectors will require specialist training in PBN Operational Approval.

The general aviation Flight Operations Inspectors interviewed undertook to research the availability of suitable training and to report back during Site Visit 2.

Although most PBN operations can be flown in aircraft equipped with stand-alone GNSS receivers and, considering that RNP APCH LNAV approach operations are designed to be flown using this type of equipment, it is understood that current DGCA regulations and/or policy may not permit this type of operation. If this situation exists, then it constitutes a serious limitation to PBN implementation in Indonesia. Small and remote airports will depend almost entirely on the ability to operate aircraft with stand-alone receivers. Clarification of the Indonesian regulations regarding PBN operations in smaller aircraft was requested to be provided for Site Visit 2.

It was noted that the regulations in Indonesia may not allow GNSS as the primary means of navigation. There was no reference available to confirm that. DGCA will research this prior to Site Visit 2.

DGCA: Procedure Validation

Personnel representing the DGCA Flight Inspection Unit were interviewed with regard to arrangements for the Validation, (including Flight Validation) of PBN Instrument Flight Procedures (IFPs). Research subsequent to the site visit revealed that the flight inspection unit operates in accordance with Indonesia AC 171-5 that includes requirements for flight inspection and flight validation.

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).

Pilots in the Flight Inspection Unit have experience in PBN operations relevant to the aircraft that the unit operates.

Two issues were identified:

- 1. Pilots in the DGCA Flight Inspection Unit have no training or experience in PBN operations in aircraft fitted with stand-alone receivers; and
- 2. Pilots in the DGCA Flight Inspection Unit have not been trained as Flight Validation Pilots in accordance with ICAO Doc 9906 *Quality Assurance Manual for Instrument Flight Procedure Design* Volume 6.

Training in PBN operations using stand-alone receivers is highly desirable for flight validation pilots in order that they are competent to assess the "flyability" of a procedure by pilots with a range of experience flying the most basic to advanced equipment.

It was noted that some pilots had completed JICA training related to flight validation. Although the extent of that training could not be determined it appeared, based on discussion with those present at the meeting, that it was not conducted with regard to ICAO Doc 9906.

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 of 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 DGCA makes enquiries regarding course availability as soon as possible.

It is suggested that DGCA consider hosting a course in Indonesia, inviting participants from other Asian economies, as it can be expected that other authorities in the region are also in need of FVP training. Convening a course in Indonesia is likely to be less expensive than sending individual pilots overseas for training.

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

The DGCA Flight Inspection Unit is equipped with suitable aircraft and 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 Indonesia.

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

To obtain greater clarity on this issue, the team has arranged to visit the DGCA Flight Inspection Unit during Site Visit 2.

DGCA: 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 Indonesia, by both domestic and foreign operators. Currently there is little recorded information available, although it is clear that Indonesia has a modern and generally PBN-capable fleet.

As this task falls under the scope of the DGCA, 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 Indonesia airspace.

6.3. Day 3: Wednesday 31 August 2016

AIRNAV: ATS

A meeting was held with AIRNAV Air Traffic Control staff and Management. A number of topics were discussed and the Ambidji Team was provided with an overview of the current PBN implementation status in Indonesia. It was noted that the planned implementation based on the 2011 PBN Implementation Plan had not been achieved and that implementation was well behind the target dates recommended by ICAO in Resolution A37-11.

It was observed that while efforts are being made to accelerate PBN implementation, AirNav did not have a written concept of operations. A concept document should set out the objectives related to PBN Implementation, such as the achievement of efficiency in traffic management, safety of operations etc., as well as a timeline, order of priority, CNS/ATM infrastructure planning and other related matters. The concept of operations and associated strategic objectives should also be included in the revised Indonesia PBN Implementation Plan.

It is recommended that a Concept of Operations statement be drafted as a matter of high priority.

The Indonesian airway system was examined. Currently there are some RNP 10 airways serving international overflying traffic, but PBN navigation specifications have not been assigned to the domestic route structure. The applicable options are RNAV 5 and RNP 2. The AMBIDJI Team explained that the RNP 2 specification is now available in the PBN Manual, replacing RNAV 5, and that RNP 2 is the most appropriate specification for domestic air routes. Also, ICAO has now published separation criteria for RNAV 5, RNP 2 and GNSS equipped aircraft. AlrNav advised their intent to consult with operators

before deciding whether to proceed with RNAV 5 or RNP 2, primarily due to concerns about RNP 2 capability and the role of ATC if RNP 2 is implemented.

A discussion followed with regard to the design of air routes, including the selection of a suitable Navigation Specification, and the application of new standards for route separation which are becoming available in ICAO Doc 4444. Opportunities now exist to modernise and improve efficiency in the Indonesian airspace, by separation of routes by 15NM in cruise and 7NM in climb/descent by use of the RNP 2 specification or alternatively using RNAV 5 with a requirement for carriage of GNSS.

It was recommended that Indonesia consider and include in the PBN Plan a timeframe for mandating RNP capability (i.e. GNSS equipage) in Indonesian Airspace. It was noted that aircraft not RNP capable would still be able to navigate on RNP 2 or RNP 1 routes but would not be eligible for separation based on route spacing. As non-RNP 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.

Information was provided that there are approximately 270 airports in Indonesia that are capable of supporting some PBN procedures, typically RNP APCH LNAV or LNAV/VNAV approaches.

Airports in Indonesia are provided varying levels of air traffic services as follows:

•	Radar controlled primary airports	20
•	Non-radar controlled (radar monitoring available)	20
•	Non-radar controlled (no radar monitoring)	40
•	Airports with AFIS	150
	Other airports	40

Note: Numbers are approximate and the information is provided only to permit estimation of workload.

Of these airports 25 are international airports and, therefore, are a priority for PBN services consistent with ICAO resolution A37-11. In addition, there are about 240 or more domestic airports which will benefit from PBN implementations on efficiency and particularly safety grounds and, therefore, should be included in the Indonesian PBN Implementation Plan. Over 50 of these airports are in eastern Indonesia (West Papua) and are already considered a safety priority. The PBN Implementation Plan also needs to consider the changes to CNS/ATM required as the reliance upon conventional navigation aids is replaced by satellite based navigation.

The support for PBN operations by ATS staff has previously been identified as an issue and an impediment to implementation. ATS personnel have been reluctant to authorise PBN operations due to lack of knowledge and/or confidence in PBN operations. Although some training had been completed there was concern by DGCA that training needed to be certified.

It is pleasing to note that most of these issues have now been resolved. DGCA has agreed to AirNav conducting "PBN Familiarisation Training" for ATCs. AirNav will provide training on an "as needed" basis commencing September 2016.

Special training for ATCs associated with RNP AR APCH operations was also discussed. There has been reluctance by ATC to allow RNP AR APCH operations due to concerns about integration with conventional (ILS or VOR) operations as well as a lack of understanding of RNP AR APCH. The result is that Operators applying for DGCA RNP AR APCH operational approval who are required to conduct a number of operations to demonstrate their competence cannot meet the DGCA requirements due to the low ATC clearance rate. Techniques for managing simultaneous PBN and conventional operations were discussed and demonstrated. As a result, AirNav agreed that local instructions for ATCs will be developed where RNP AR APCH operations are to be conducted. It was recommended that AirNav consult with DGCA and operators on phasing in of RNP AR APCH operations at an airport by initially requiring VMC conditions, based on the particular approach (e.g. 5000 foot ceiling) until ATC is comfortable with the operations conducted under the Letter of Instruction. AirNav also agreed to actively support operators in the implementation of RNP AR APCH operations and to ensure that aircraft were permitted to conduct RNP AR APCH procedures whenever possible.

The Ambidji Team examined current and proposed samples of arrival and departure procedures (SIDs and STARs) and discussed proposed implementation strategies and techniques.

It is recommended that AirNav 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.

AirNav 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 not required as a back-up to PBN navigation. In Indonesia 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.

AirNav: Flight Procedure Design

AirNav is responsible for the bulk of the flight procedures to be designed in Indonesia. Garuda has some designers, who work on procedures of particular interest to the company, and DGCA has a number of designers primarily responsible for checking and oversight. DGCA has automated procedure design tools, although they are not currently being tasked to design new procedures. AirNav presently has no procedure design automation tool, although purchase of a tool is in the procurement process. It was noted

that as the design of flight procedures will constitute a major task, that sharing of valuable resources between AirNav and DGCA should be considered.

AlrNav employs about 20 qualified flight procedure designers, of which about 8 have received PBN design training. But as the 20 qualified designers are active air traffic controllers and are not assigned to flight procedure design on a full time basis, it is estimated that insufficient designers are currently available and qualified to meet the requirements for PBN implementation in the short to medium term. It was also not clear the amount and recency of experience of all the AirNav procedure designers. It is recommended that AirNav evaluate its PBN design capability as a matter of high priority and take action to increase design capacity. As a general guide the AMBIDJI Team estimates that Indonesia will require a team of 10-15 full time qualified procedure designers for the next 4 to 5 years to enable flight procedures to be provided at all domestic and international airports within a five-year timeframe. In addition, Indonesia will require other designers to handle routine non-PBN tasks. It was noted that as DGCA, Garuda and AirNav all employ procedure designers that there should be some consideration given to sharing the design workload.

DGCA reported that when Garuda submits a procedure for publication, and DGCA approves the procedure, they issue a letter of authorization to the airline allowing them to start using the procedure immediately, before publication. The Ambidji team informed DGCA that this practice should be stopped immediately, especially with respect to PBN procedures, which must be accessed from the aircraft database. Procedures do not appear in the database until they are published.

A number of flight procedure design examples were inspected, and some technical suggestions for improvement were made. AirNav (and DGCA oversight) procedure designers are competent and well trained. However, the conduct of flight procedure design, while technically sound, is not carried out in accordance with ICAO Doc 9906 *Quality Assurance Manual for Flight Procedure Design*. As a consequence, flight procedure designers are also untrained in their role in procedure validation, including the requirements for flight validation contained in Volume 5 of that Manual. Quality assurance processes of the various procedure design organizations should be in writing, and the requirement for a written quality assurance process should be included in CASR Part 173.

In order to implement PBN in Indonesia in accordance with ICAO guidelines, all design organisations (AirNav, Garuda and DGCA) should take immediate steps to familiarise themselves with Doc 9906 and to implement appropriate quality assurance procedures.

6.4. Day 4: Wednesday 1 September 2016

Air Operators

A meeting attended by a good representation of Indonesian air operators, including Garuda, Batik Air, Citilink and the Military.

Air operator experience with the process of obtaining operational approval was reviewed.

Although some operators have obtained all relevant PBN operational approvals, most operators have only applied for limited approvals. Operators reported that they have not applied for approvals due to cost of obtaining an approval, and in particular the system of charging per tail number.

It was recommended that operators apply to DGCA for PBN operational approvals as soon as possible.

Particular issues associated with operational approvals for RNP AR APCH operations were discussed. LionAir (not in attendance, but represented by associate company Batik Air) and Citilink have intentions to implement RNP AR APCH operations at selected airports. LionAir had obtained a temporary approval for the purpose of gaining experience in visual conditions, but this approval has lapsed. It was reported that LionAir had only completed six approaches of a required 100 approaches during the six months of their initial temporary approval. The AMBIDJI Team reported on earlier discussions with DGCA regarding the approval process and with AirNav regarding ATC training and support for RNP AR APCH and suggested that operators pursue or renew efforts to obtain approval.

The Ambidji Team recommended that operators involve DGCA inspectors, especially flight operations inspectors, in development of their PBN capability and applications at an early stage.

The Indonesian Military has a fleet of aircraft that includes a number of aircraft that are capable of PBN operations, but has little knowledge and no experience in PBN. As PBN operations will provide capability to operate in circumstances where ground-based navigation aids may be unavailable, due to natural disasters or major systems failures, military operations wherever possible should be PBN capable. The military is encouraged to participate in Indonesian PBN implementation and to seek assistance from civilian authorities and operators to assist in gaining PBN knowledge and experience.

Airports

A meeting was held with representatives of Angkasa Pura 1 and II. Together AP I and II manage 26 of the major airports in Indonesia.

The responsibility of airports for the control of obstacles in the vicinity of airports (Annex 14) and the compilation of Electronic Terrain and Obstacle Data (eTOD) (Annex 15) was discussed.

The airport authorities are familiar with Annex 14 requirements and are fulfilling their responsibilities.

The responsibility for collection of eTOD data belongs to DGCA. DGCA personnel indicated that some eTOD data was available for some airports. The importance of this data was emphasized with respect to its use by procedure designers and avionics manufacturers and that the revised PBN implementation Plan should address the priorities and timeline for collection of eTOD in support of PBN implementation.

6.5. Day 5: Friday 2 September 2016

A meeting of all stakeholders was reconvened at DGCA Indonesia 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, Indonesia is well placed to achieve full PBN implementation in the short to medium term.
- Serious impediments to progress were identified including:
 - Training required for DGCA flight inspection pilots to enable validation of PBN flight procedures in accordance with ICAO guidelines;
 - Training of DGCA Flight Operations Inspectors;
 - DGCA charges for operational approvals; and
 - Procedure design staffing

Although a PBN OPS Working Group has been established, it is recommended that this group be formally appointed by joint authority of the DGCA and the CEO of AirNav 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 CEO AirNav 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 10 to 14 October.

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 Indonesia PBN Plan.

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 Mr Fajar Sunarjanto is acknowledged with thanks.

ATTACHMENT A

PROJECT OVERVIEW

19 August 2016 Attachment A



PROJECT OVERVIEW









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 Jakarta 29 Aug 2 Sep
- Develop PBN Action Plan with Timelines
 - Site Visit 2 Jakarta 10-14 Oct

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 Indonesia
- Identify impediments to full implementation
- Provide technical advice to stakeholders



FACILITATORS

AMBIDJI

Robert (Bob) Kennedy

Ambidji

Project Coordinator and PBN Operations Specialist

Dave VanNess

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PBN Flight Procedures Specialist

Pongabha Abhakara

Aeronautical Radio of Thailand Ltd.

Subject Matter Expert

Shoei Oida

All Nippon Airways Co. Ltd.

Subject Matter Expert

Fajar Sunarjanto

Directorate of Air Navigation, DGCA Project Liaison Officer



DAILY SCHEDULE



Day 1

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

Day 2

Meetings with DGCA stakeholders (at DGCA)

Day 3

Meetings with AirNav Indonesia and aerodrome stakeholders (at AirNav Indonesia)

Day 4

 Meetings with AirNav Indonesia and air operator stakeholders (at AirNav Indonesia) and with BKFP Flight Calibration and Validation organization

Day 5

Debriefing, presentation of preliminary findings (at DGCA)



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 Indonesia



DAILY SCHEDULE



0930 Start

1030 Break

1200-1300 Lunch

1415 Break

1530 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



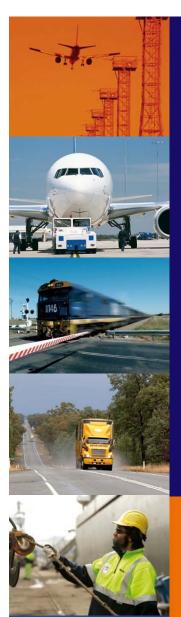


QUESTIONS?

ATTACHMENT B

PBN PLAN ESSENTIALS

19 August 2016 Attachment B



PBN PLAN ESSENTIALS





Jakarta 29th August 2016



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Melbourne, Australia



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
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GOALS



The goals of the 1st Site Visit are to:

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



PBN IMPLEMENTATION: 1st STEP

- Develop a good plan
- •Follow the plan



THE PBN IMPLEMENTATION PLAN IN THE REPUBLIC OF INDONESIA APRIL 25, 2011

Review and update the plan as needed



PLAN CONTENTS



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



OVERVIEW



- Background
- Purpose
- Strategic Objectives
- Assumptions & Constraints

Your vision of the future of PBN in Indonesia



PBN CURRENT STATE



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

Performance-based NavigationThe Primary Air Navigation Priority

HLSC emphasises the importance of effective regulatory oversight



Where is Indonesia now with PBN??

REDUCTION via IMPLEMENTATION of PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM

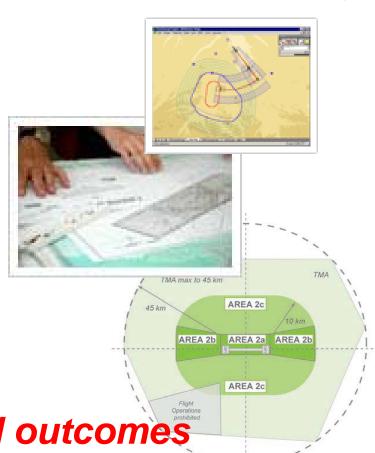


IMPLEMENTATION CHALLENGES



AMBIDJI

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



Objective is to achieve real outcomes



IMPLEMENTATION TARGETS



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



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 Indonesia's PBN implementation



SAFETY



- Preliminary Safety Assessment
- Post-implementation Safety Assessment

Objective: Implement PBN, but do it safely



APPENDICES



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

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





QUESTIONS?

The Ambidji Group

ATTACHMENT C

SITE VISIT 1 SUMMARY

19 August 2016 Attachment C



SITE VISIT 1 SUMMARY





Jakarta 2 September 2016



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Melbourne, Australia



GOALS



The goals of the 1st Site Visit are to:

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



INDONESIA PBN STATUS



GOOD POSITION TO ACHIEVE IMPLEMENTATION

PROVIDED

SOME ROADBLOCKS ARE REMOVED



PBN TASK FORCE



WORKING WELL

REPRESENTATION FROM MAJOR STAKEHOLDERS

SEEK HIGH LEVEL MANDATE

ADOPT A MISSION STATEMENT

DRIVE PBN IMPLEMENTATION

REVIEW PROGRESS vs PLAN

TAKE ACTION TO KEEP ON TRACK



DGCA OPS APPROVALS



PBN RULES AVAILABLE

GOOD PBN KNOWLEDGE

CHARGES PER TAIL NUMBER COSTLY

Loa ISSUE: NOT REQUIRED

RNP 2 RULES NOT PUBLISHED



DGCA OPS INSPECTORS



QUALIFIED FLIGHT OPS INSPECTORS

GOOD PBN KNOWLEDGE

SUFFICIENT STAFF

SOME REQUIREMENTS UNNECESSARY

NO FLIGHT CHECK RQD RNAV 1/RNP 1 SID/STAR

GA INSPECTORS NEED PBN OPS TRAINING

OPERATIONS WITH STAND-ALONE RECEIVERS



DGCA FLIGHT VALIDATION



ENOUGH CREWS

ADEQUATE AIRCRAFT AVAILABILITY

AIRCRAFT AVIONICS SUITABLE

PILOTS NEED STAND-ALONE GPS TRAINING

PILOTS NEED FLIGHT VALIDATION TRAINING



PROCEDURE DESIGN



AIRNAV/GARUDA/DGCA

CAPABLE DESIGN STAFF

GOOD KNOWLEDGE OF PBN

INSUFFICIENT STAFF (270 airports)

QUALITY ASSURANCE PROCEDURES

TRAINING IN VALIDATION

RNP AR TRAINING

TRAIN MORE PD STAFF IN PBN DESIGN



AIRNAV- AIR TRAFFIC



SOME PBN PROCEDURES PUBLISHED
PBN TRAINING FOR ATC IN PIPELINE
SUPPORT FOR RNP AR OPS DEVELOPMENT
CONCEPT OF PBN OPS REQUIRED
REDESIGN SID/STARs for MAX EFFICIENCY
DECIDE ON RNP 2 or RNAV 5 for ROUTES



AIRPORTS



RESPONSIBLE FOR OLS DATA

WHO IS RESPONSIBE FOR ANNEX 15 DATA?

Electronic Terrain and Obstacle Data (eTOD)

Up to 45km from airport



AIR OPERATORS



SUPPORTERS OF PBN

WILLING TO WORK WITH DGCA/AIRNAV

SHOULD PARTICIPATE IN SETTING GOALS

NEED TO APPLY FOR PBN APPROVALS

COST OF APPROVALS

ISSUES WITH RNP AR APPROVALS



FLEET STATISTICS



MOST AIRCRAFT PBN CAPABLE

MODERN FLEET

BUT NO DATA AVAILABLE

CONDUCT SURVEY

Domestic and International

Sample operations at selected airports



IMPLEMENTATION TIMING



ALL STAKEHOLDERS NEED TO COLLABORATE
SET A COMPLETION DATE FOR IMPLEMENTATION

FOR ALL INDONESIAN AIRPORTS

PRIORITISE AIRPORTS

DETERMINE A SCHEDULE FOR IMPLEMENTATION



NEXT STEPS - AMBIDJI



Prepare an Action Plan

Site Visit #2 October 10 -14

Present Action Plan for review by Stakeholders



NEXT STEPS - STAKEHOLDERS



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



SOME HOMEWORK



DGCA: Investigate ops approval/LOA charging

AirNav: ATC to support RNP AR implementation

DGCA: LionAir RNP AR temporary approval status?

DGCA: Investigate GA OPS Inspector Training

AirNav: RNP 2 or RNAV 5?

Air Nav: Study of CNS/ATM capabilities



NEXT TIME:PBN PLAN



Prepare your input to the PBN Plan

Be ready to discuss the timeline for implementation

Determine your priorities and be ready to contribute





THANK YOU

The Ambidji Group

ATTACHMENT D

WORKSHOP ATTENDANCE LIST

19 August 2016 Attachment D

DIREKTORAT JENDERAL PERHUBUNGAN UDARA DIREKTORAT NAVIGASI PENERBANGAN

DAFTAR HADIR

Hari / Tanggal

: Senin, 29 Agustus 2016

Jam

: 09.30 s/d 15.30 WIB

Tempat

: RR. Mulawarman Gd. Karsa Lt. 5

Acara

: APEC PBN VISIT

NO	NAMA	INSTANS	I TELP	EMAIL	TANDA TANGAN
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3.	SAMSU POHMAT	BBKFP		szamsv rohmat @ yaho.	V V
4.	DIAN YUSUF A	BBKFP		deandgac@ gmail.com	-8
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26	Ryan H.	DEPTH	+6287789004780		
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DIREKTORAT JENDERAL PERHUBUNGAN UDARA DIREKTORAT NAVIGASI PENERBANGAN

DAFTAR HADIR

Hari / Tanggal

: 10 -10 - 2016

Jam

: 09.30 s/d ANISH.

Tempat

: RR Mubwarman, Gd. Karsa Lt. S

Acara

: APEC PIBN VISIT I

NO.	NAMA	INSTANSI	TELP	EMAIL	TANDA TANGAN
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10	FADAR S	DNP	081226334925	tojar.ssnp@gnall.com	tajar
11	ETHTU	DKPPU	100 100 100 100 100 100 100 100 100 100		A
12	Erdah Purnamasari	pur-onp	085718200960	endah sopornamale yahoo . Co. 19	ALM.
13	Andreas Pallo	DUPPY	30501700180	andreas_pallo @ deph.b.g	o.id 5
14	Surya Putra	PEPPU	085920603963	i_gustioso39dephub.go	id 86
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26	ADE JULIZAR	BATIKAIR	085252492010	ade juliear - floe@ batikair.com	10
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B	YOMFTA A.K.	SKD17.	081329700911	Yodifta 27@ gwail.com	B.
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ENHANCING AVIATION CONNECTIVITY AND EMISSIONS REDUCTION VIA IMPLEMENTATION OF PERFORMANCE BASED NAVIGATION (PBN) ASSISTANCE PROGRAM (TPT 05/2015A)

APPENDIX F

Site Visit 2 Report

(TPT 05/2015A)

SITE VISIT 2 - INDONESIA

(10 OCTOBER - 14 OCTOBER 2016)



October 2016



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	Day 4: Thursday 13 October 2016	
	Day 5: Friday 15 October 2016	

Site Visit 2 - Indonesia

(10 October – 14 October 2016)

1. INTRODUCTION

The second of two site visits to Indonesia was conducted between 10 October and 14 October 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 second of two site visits by the Ambidji Team took place in Jakarta from 10 October to 14 October 2016.

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 Indonesia 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: The Ambidji Team visited STPI/ICAI to evaluate the PBN pilot training capability. A meeting was held with DGCA Flight Inspection Unit (BKFP) to discuss the training requirements for pilots who are to fulfil the Flight Validation Pilot Role.
- Days 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 Project 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;
- Mr David VanNess (Ambidji Group), PBN Flight Procedure Specialist;

Mr Pongabha Abhakara (AeroThai), Subject Matter Expert;

4. FAA

The FAA was represented by:

Mr Braks Etta, FAA Air Traffic Representative, Asia-Pacific

Mr Robert Trent Bigler, FAA Aviation Safety Inspector

5. SUMMARY OF DAILY ACTIVITIES

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

5.1. Day 1: Monday 10 October 2016

A meeting of all stakeholders was conducted at the offices of the DGCA in Jakarta.

Representatives from the following organisations attended:

- DGCA;
- AirNav Indonesia;
- Air Operators;
- Angkasa Pura I & II (Airports);
- ICAO

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

Mr VanNess reviewed the ICAO PBN Plan Implementation Template. The use of the template and each section was explained.

5.2. Day 2: Tuesday 11 October 2016

ICAI/STPI: Evaluation of PBN Pilot Training Capability

Site Visit 1 identified that PBN pilot training is required for DGCA Flight Operations Inspectors and DGCA Flight Inspection Unit pilots.

In order to identify if there is capability to meet the pilot training requirements locally, the Ambidji Team met with senior officers and flight instructors of ICAI/STPI at the ICAI Budiarto Airport campus.

The flight training division of STPI does not have any experience or knowledge of PBN operations. None of the flight instructors employed by STPI is trained in PBN operations.

The Ambidji Team inspected aircraft on the flight line and examined a number of aircraft that are PBN capable. These aircraft are:

Piper PA28-151 Warrior. Three aircraft were inspected equipped with dual Garmin 430 GNSS multi-mode receivers. This type of receiver is very common in general aviation aircraft and therefore typical of the type that will be in widespread use in Indonesia. This aircraft and avionics is ideal for ab initio PBN training, particularly for GA Flight Operations Inspectors who will be responsible for oversight of operators using this class of GNSS receiver.

Piper PA34 Seneca. Three new Seneca light twin-engine aircraft were inspected. These aircraft are equipped with modern Garmin 1000 large screen multi-function displays similar to those seen in commercial airline aircraft. This type of equipment is excellent and capable of RNP 1 and RNP APCH LNAV operations and provides a much improved pilot interface, compared to basic GNSS receivers such as the Garmin 430, which is much easier to use, providing better situational awareness and ease of manipulation. DGCA Flight Operations Inspectors and Flight Validation Pilots would be well advised to gain experience using this type of equipment to broaden their experience.

STPI advised that a number of C172 aircraft had been ordered but were unable to advise the type of avionics that will be installed. However, as these aircraft are new aircraft, the standard avionics package installed by Cessna will be PBN capable (RNP 1, RNP APCH). It is likely that the C172 fleet will also be equipped with Garmin 1000 type multi-function displays.

A Beechcraft BE58 Baron twin-engine aircraft was also inspected. This aircraft is to be replaced by PA34 Seneca aircraft and is equipped with an earlier version of a large screen display GNSS system, the Garmin G600.

The PBN capability of the various STPI aircraft was explained to STPI staff and senior instructors. It was explained that there is a requirement for DGCA general aviation Flight Operations Inspectors to be trained in PBN operations using stand-alone GNSS receivers in order to approve and oversee general aviation PBN operations.

It was also explained that pilots in the DGCA Flight Inspection Unit who are to undertake the evaluation of instrument flight procedures as Flight Validation Pilots will need some familiarisation training in general aviation GNSS installations in order to be able to assess flyability.

As STPI has suitable aircraft, DGCA pilots' training might be provided locally. As none of the STPI instructors is trained in PBN it was suggested that STPI arrange for an initial cadre of instructors to be trained in PBN operations using the Garmin 430 receiver. Options discussed included sending instructors to Australia or New Zealand where this type of training is readily available or contracting a suitably experienced instructor to come to Indonesia to train instructor pilots on

PBN operations in the STPI Pa28 aircraft with Garmin 430 receivers. STPI Instructors could then train DGCA FOIs and FVPs, as well as initiate PBN pilot training as part of the STPI Instrument Rating curriculum.

STPI was advised to have DGCA airworthiness inspectors examine the Garmin 430 installation in the PA28 aircraft to confirm that the equipment is correctly installed.

STPI: Flight Procedure Designer Training

STPI advised that ab initio and advanced flight procedure design training is available. Courses are conducted to meet the demand.

BKFP: Flight Validation

The manager and staff pilots in the DGCA Flight Inspection Unit were interviewed with regard to the validation of instrument flight procedures.

The DGCA Flight Inspection Unit, BKFP, is responsible for validation, (including flight validation) of PBN instrument flight procedures. The Flight Inspection Unit employs 31 pilots (nine captains and 22 co-pilots) in addition to engineering and support staff. The unit operates six Beechcraft King Air aircraft (four BE200 and two BE350) in the flight calibration role. These aircraft are equipped with Collins ProLine 21 avionics and Collins FMS. The unit also operates one Hawker 900XP aircraft.

The flight inspection unit operates in accordance with Indonesia Advisory Circular (AC) 171-5 that includes requirements for flight inspection and flight validation.

Some pilots and engineers in the unit have completed training under a Japan International Cooperation Agency (JICA) program that included very limited flight procedure design and basic principles of instrument flight procedure validation. Some pilots have experience in the conduct of PBN flight operations although experience is limited. No pilots in the flight inspection unit have experience in PBN approach operations using basic stand-alone equipment.

The flight hours operated by the unit are relatively low and there is sufficient capacity available to fulfil the flight validation role.

Pilots in the unit have limited PBN experience but as the unit's aircraft are PBN capable there is opportunity for pilots to obtain the necessary training. Training in PBN flight operations is readily available and as the Flight Inspection Unit has a BE-200/350 simulator, training can be completed locally by employing a PBN qualified instructor who is current on the BE-200/350 and familiar with the installed avionics. Pilots in the unit routinely attend simulator recurrent training and initial PBN training could be added to that training. Future recurrent training sessions should include PBN approach training as part of the normal curriculum.

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 are operated by the STPI flight training division. (PA28-151 equipped with Garmin 430 receivers).

Flight Validation Pilot Training in accordance with ICAO Doc 9906 Volume 5 was discussed. As publication of PBN approach procedures should not occur unless validated by qualified FVPs, immediate action to provide training for pilots of the DGCA Flight Inspection Unit is necessary.

The BKFP manager was advised to contact ICAO COSCAP SEA to arrange FVP pilot training. It was explained that courses are conducted infrequently and only when requested. As there are a large number of pilots in the BKFP who will require FVP training it was suggested that Indonesia offer to host a course in Jakarta.

5.3. Day 3: Wednesday 12 October 2016

A meeting was held with AirNav Indonesia procedure design and ATS organizations at the AirNav headquarters. AirNav provided additional information on current capabilities and future plans. Also reviewed and discussed a number of published terminal and approach procedures.

There are presently approximately 88 airports that have instrument flight procedures (IFPs). There are 270 registered or certified airports at which IFPs are planned. AirNav stated that they plan to design 10 procedures per month at about 40 airports per year.

They have 10 PBN-trained procedure designers in Jakarta, of which only two are presently full time. There are eight more trained procedure designers from other regions of Indonesia that do not have PBN training. Garuda has two procedure designers.

The AirNav Procedure Design section is not certified by the DGCA, however individual designers are certified by the DGCA. The section has a draft Procedure Design Operations Manual that has not yet been submitted to the DGCA for acceptance. It was noted that CASR Part 173 was translated to Bahasa Indonesia and updated to address Indonesia's situation in 2015.

A number of the published PBN approach procedures were reviewed. It was noted that most procedures with LNAV/VNAV minima had a published angle of 3.0°. Discussed the fact that since Indonesia has a relatively constant temperature of about ISA +15° C, a published angle of 3° will result in an effective angle of about 3.2° at those temperatures. To achieve an effective angle of 3° would require a published angle of approximately 2.8°. Guidance on temperature differential is in PANS OPS Volume 2. Several arrivals were reviewed and suggestions made for improvements that will reduce track miles. Briefed on some techniques for increasing efficiency with PBN SIDs and STARs in order to realize benefits.

AirNav is in the procurement process for an Arrivals Management Tool, to be available by April 2017.

The need for local altimeter setting to be available for Baro-VNAV was discussed. AirNav is in the process of installing AWOS or training local staff for this purpose at 100 airports with towers.

AirNav is still in a transition period with regard to transferring ground navigation aids to AirNav control.

5.4. Day 4: Thursday 13 October 2016

A meeting with operators was held, attended by Batik, Garuda and the military. Briefed the operators on what the DGCA and AirNav were planning and asked them to do their part by applying for the required approvals. Batik noted that they had already applied for RNP APCH and RNP AR APCH. The operators were asked to work with the DGCA on the LOA charging issue and to continue to provide their input on priorities for approach implementation.

Following the individual stakeholder sessions, a meeting was conducted with the DGCA Director of Air Navigation.

A briefing on the outcomes of the Program was provided and the Director indicated enthusiastic 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 PBN Task Force is formally established by the DG and tasked
 with oversight of PBN Implementation. It is suggested members be formally appointed,
 that the Task Force operates in accordance with a Terms of Reference and is required to
 report regularly to the DG.
- 2. Several training requirements that are urgently required will require some allocation of funding. The costs are not considered high, but currently there may be no budget for this expenditure. Training includes:
 - Flight Inspection/Flight Validation Pilot training; and
 - Flight Operations Inspector (Pilot) training

5.5. Day 5: Friday 15 October 2016

A meeting of stakeholders was conducted at the DGCA offices in Jakarta. A general overview of the outcomes of the Program was provided.

The Ambidji Team advised that a Report would be prepared and shared with the Project LO for comment.

The Ambidji Team and Mr Braks Etta (FAA) thanked the meeting for the cooperation and support received during the program, with particular thanks to the Liaison Officer Mr Fajar Sunarjanto for his excellent co-ordination work.

There was considerable additional individual discussion after the wrap-up. Subjects included use of the RNP 0.3 navigation specification, airport surveys, and eTOD

APPENDIX G

Summary of Best Practice

SUMMARY OF BEST PRACTICE

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

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

Regulatory

- Regulation of IFP design should:
 - Require all flight procedures design organisations (including 3rd party designers) to be properly authorized;
 - Ensure that all flight procedure design organisations (including 3rd party designers) are fully compliant with the relevant regulation;
 - Require that all flight procedure design organisations implement documented quality assurance processes conforming to ICAO Doc 9906;
 - Require that procedure design organisations (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;
 - o Include provision for the approval of variations to ICAO design criteria;
 - o 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;
- OPS SPECs approving RNP APCH operations should include a note indicating which specific types of approach are authorized i.e. LNAV, LNAV /VNAV;
- DGCA 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 naming 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).

Air Traffic Management

- ATC should be primarily responsible for the design of SIDs and STARs with the assistance of qualified procedure designers;
- SID and STAR procedures should be regarded as Air Traffic Management tools and utilised to develop more efficient routes and vertical profiles;
- SID and STAR procedures should be designed to work in harmony to minimise level and speed restrictions;
- Air Traffic Management should direct that the policy is to leave aircraft on the SID/STAR path in order to permit on-board FMS to manage climb/descent. Vectoring and track changes should be kept to a minimum.

APPENDIX H

Action Element Task Sheets

		□ Required	□ Urgent
ACTION No.	1	Recommended	☐ Important
			Routine
		Prepare PBN Plan	
ACTION		DGCA, in consultation with all stakeholders, and in close co- operation with AirNav Indonesia, to prepare a new PBN Implementation Plan using the ICAO PBN State Implementation Plan Standard Template.	
Issue		Indonesia has a basic PBN implementation plan in place that was prepared in 2011. The plan is very brief and 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)		a PBN Implementation Plan. prepared an Implementation Plavaries greatly. In an effort to comprehensive and useful planand a PBN State Implementation has requested by State Letter to	7-11 urges all members to develop While most economies have an, the content and quality of plans assist members in developing a n ICAO has developed guidelines on Plan Standard Template. ICAO that all members review their PBN espect to the new ICAO Plan plan using that template.
Organisation		DGCA and AirNav	
Responsible Person/Department		DG and President-Director	
Target Date		December 31, 2016	

ACTION No.	1a	☑ Required☐ Recommended	☐ Urgent☐ Important☐ Routine
ACTION		Prepare PBN Plan: Identify Strategic Objectives Identify the strategic objectives to be achieved by PBN implementation in Indonesia.	
Issue		A robust PBN Implementation Plan requires that the economy identify the objectives they seek to achieve by implementing PBN.	
Comment (or Background)			accident rate in Indonesia, reduced icreased efficiency and continuity of s, etc. (Chapter 1 of template)
Organisation		DGCA and AirNav	
Responsible Person/Department		DG and President-Director	
Target Date		December 31, 2016	

ACTION No.	1b	☑ Required☐ Recommended	☐ Urgent☑ Important☐ 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)			en identifying assumptions and O Standard Template (Chapter 1).
Organisation		DGCA Directorate of Air Navigation	
Responsible Person/Department		Director of Air Navigation	
Target Date		December 31, 2016	

ACTION No.	1c	☑ Required☐ Recommended	☑ Urgent☐ Important☐ Routine
ACTION		Prepare PBN Plan: DGCA to Conduct Fleet Study DGCA to conduct a study of the current and future planned PBN	
			nd international fleets operating in
Issue		There is no fleet capability study available. This is required for the PBN Plan.	
Comment (or Background)		which to base PBN Implemental little recorded information availed Indonesia has a modern fleet of To move forward with devimplementation Plan, up-to-date with operators on future fleet deciding when to implement an task is the responsibility of the E (Direktorat Jenderal Perhubit	in order to inform decisions about
Organisation		DGCA Directorate of Air Navigation	
Responsible Person/Department		Director of Air Navigation	
Target Date		December 31, 2016	

		□ Required	□ Urgent
ACTION No.	1d	Recommended	☐ Important
			Routine
ACTION		Prepare PBN Plan: AirNav CNS/ATM Study	
		AirNav 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 s the PBN Plan.	tudy available. This is required for
Comment (or Background)		selection of the most suitable na priorities for implementation ba CNS/ATM capability. It is remaining navigation aids requirements, and ADS-B surveillance capacontroller communications capabe used to facilitate various as as route spacing and design of	lanning with recent data enabling avigation specifications and setting sed on current and planned future ecommended to include data on current and planned future radar pabilities, and VHF direct pilotabilities. Data from this study will pects of PBN implementation such terminal and approach procedures. Under plans for decommissioning BN implementation proceeds.
Organisation		AirNav	
Responsible Person/Department		AirNav	
Target Date		December 31, 2016	

ACTION No.	1e	☑ Required☐ Recommended	☐ Urgent☑ Important☐ Routine
ACTION		Prepare PBN Plan: Determine Implementation Targets DGCA and AirNav, 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)		targets for short and medium te years) including mandates for various types of PBN operation helicopter and military. As the implementation by the end of 20	olders determine implementation arm, and end state (no more than 5 PBN equipage/approval, for the cons; enroute, terminal, approach, ICAO goal for completion of PBN 016 is no longer achievable, further and efficiency benefits of PBN e. (Chapter 4);
Organisation		DGCA and AirNav	
Responsible Person/Department		DGCA and AirNav	
Target Date		December 31, 2016	

ACTION No.	1f	☑ Required☐ Recommended	☑ Urgent☐ Important☐ Routine
ACTION		Prepare PBN Plan: DGCA Assess Expected Benefits of PBN DGCA, with input from AirNav, 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)		should be assessed in reacultural/environmental) resultir emissions, improvement in samore efficient operations. It is plenefits assessment in the Indo	ne end state PBN implementation al terms (financial as well as ng from expected reduction in fety (reduced accident rate), and particularly important to include the onesian PBN plan in order to inform t and other stakeholders. (Chapter
Organisation		DGCA Directorate of Air Navigation	
Responsible Person/Department		Director of Air Navigation	
Target Date		December 31, 2016	

ACTION No.	1g	☒ Required☐ Recommended	☑ Urgent☐ Important☐ Routine
ACTION		Prepare PBN Plan: DGCA & AirNav to Assign Responsibility DG of DGCA and President-Director AlrNav 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)		be taken to ensure that every a and coordinated. Both DGCA a essential roles in PBN impleid Director-General of DGCA and essential for success. Joint actions are successed in the success of the success	cceed in Indonesia action needs to spect of PBN is carefully managed nd AirNav Indonesia (AirNav) have mentation and leadership by the the President-Director of AirNav is tion by DGCA and AlrNav to make countable for meeting PBN Plan is
Organisation		DGCA and AirNav	
Responsible Person/Department		DG and President-Director	
Target Date		December 31, 2016	

ACTION No.	1h	☒ Required☐ Recommended	☑ Urgent☐ Important☐ Routine
ACTION		Prepare PBN Plan: DGCA/AirNav to Conduct Safety Study AirNav, with input from DGCA and stakeholders to conduct a	
		associated with executing the ne	e risks, hazards and mitigations ew PBN Implementation Plan.
Issue		A pre-implementation safety assessment is required	
Comment (or Background)		and as PBN implementation cor Indonesian airspace system, ar risks is essential. AirNav show the preliminary safety assessm	ation planning is risk management nstitutes a significant change to the n assessment of the consequential all have primary responsibility for nent to be included in the revised s well as post implementation rgets are met. (Chapter 6)
Organisation		AirNav	
Responsible Person/Department		Air Nav	
Target Date		December 31, 2016	

ACTION No.	1i	☑ Required☐ Recommended	☐ Urgent☑ Important☐ Routine
ACTION		Prepare PBN Plan: AirNav/DGCA Develop Priority List AirNav, with input from DGCA 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		Priority list of approaches and terminal procedures to be implemented is required.	
Comment (or Background)			rs to plan their future operations, they are needed the most, and
Organisation		DGCA and AirNav	
Responsible Person/Department		DG and President-Director	
Target Date		December 31, 2016	

	1	T	
		☐ Required	☐ Urgent
ACTION No.	2	□ Recommended	
			Routine
	•	DGCA/AirNav leadership li Structure	nitiatives: Implement Management
ACTION		DG of the DGCA to take charge of PBN implementation and in cooperation with the President-Director, AirNav Indonesia, 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 ensestablished.	sure PBN implementation is not clearly
		involving numerous agencies, so disciplines and thousands of inceffective management and co-oresources in an orderly and tin management that is the most implementation worldwide. Lac failure to recognize that all com	the co-ordination of many activities ervice providers, operators, professional dividuals. Success is dependent on the rdination of the various participants and nely fashion. It is the task of effective commonly overlooked aspect of PBN ck of progress is commonly due to the ponents of PBN must exist concurrently flown, and without continuous active success is not achieved.
Comment (or Background)		has been expended in recent development and many PBN minimal and well behind ICAO individual elements involved in procedures, to approval and o crews, despatchers and air tr procedures, management of da	ifferent to many economies. Much effort years on training, design, regulation assistance activities, yet progress is targets. Because there are so many PBN, from the design and validation of versight of operators, training of flight affic controllers, development of ATC ata, redesign of airspace, mandating of implementation does not happen unless agement.
		This Program has identified that, for the most part, Indonesian agencies and airlines have the capability to achieve full PBN implementation in the short to medium term. For PBN implementation to succeed in Indonesia action needs to be taken to ensure that every aspect of PBN is carefully managed and coordinated.	
Organisation		DGCA and AirNav	
Responsible Person/Department		DG and President-Director	
Target Date		December 31, 2016	

ACTION No.	2a	☐ Required ☐ Recommended	☐ Urgent☑ Important☐ Routine
ACTION		DGCA/AirNav leadership In Force Structure	itiatives: Establish PBN Task
		DG Civil Aviation and President-Director AirNav jointly formally create Task Force, appoint members, and establish responsibilities	
Issue		Leadership, membership and responsibilities of Indonesia's PBN Implementation Task Force are not clearly established.	
Comment (or Background)		and DGCA play the key rol- unequivocal statement of comm clear delineation of responsibility	nitment to PBN implementation and illities and accountability by these way toward ensuring that PBN
Organisation		DGCA and AirNav	
Responsible Person/Department		DG and President-Director	
Target Date		December 31, 2016	

ACTION No.	2b	☑ Required☐ Recommended	☐ Urgent☑ Important☐ Routine
		DGCA/AirNav leadership Initia	atives: Manage Cultural Change
ACTION		DG of DGCA and President-Director AlrNav Indonesia jointly convene a meeting of all department heads to plan the management of cultural change associated with PBN implementation.	
		DG of DGCA and President-Director AlrNav Indonesia 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)			a common impediment to PBN at all levels to understand and ulture.
Organisation		DGCA and AirNav	
Responsible Person/Department		DG and President-Director	
Target Date		December 31, 2016	

ACTION No.	3	☑ Required☐ Recommended	☐ Urgent☑ Important☐ Routine	
ACTION		DGCA to Update SI 8900 4.1 Include changes in latest edition of the ICAO PBN Manual (Doc 9613) and Operational Approval Manual (Doc 9997)		
Issue		Indonesia's PBN Instruction, SI 89000 4.1, is out of date. Does not reflect changes in the latest edition of the ICAO PBN Manual (Doc 9613)		
Comment (or Background)		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 Indonesia 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.		
Organisation		DGCA, Directorate of Airworthiness and Aircraft Operations		
Responsible Person/Department		DGCA, Director of Airworthiness and Aircraft Operations		
Target Date		December 31, 2016		

			T	
ACTION No.	4	⊠ Required	☐ Urgent ☐ Important	
		Recommended	Routine	
		DGCA to Review Operational Approval Guidelines		
		Issue guidelines for operators detailing operational approval application requirements.		
ACTION		Issue updated staff guidance on the administration of PBN Operational Approvals.		
		Review the requirements for PBN approvals, including RNP AR APCH approvals, to ensure compliance with ICAO PBN Manual without imposing any unnecessary elements;		
		Several comments from operators noted that the process of PBN operational approval is inefficient and is causing significant delays and expense to operators.		
Issue		DGCA has not published guidance material on the content requirements for applications for PBN approval		
		Cases were reported which appear to indicate that DGCA is imposing unnecessary requirements for approval. Complaints were also received that DGCA had made repeated requests for information, causing delays in obtaining approval.		
Comment (or Background)		DGCA is following guidance material for approval of RNP AR APCH operations which in many cases is unduly conservative. RNP AR APCH has now become more widely accepted worldwide and much operational experience has been gained over the last 10 years. Consequently, the very conservative approach to RNP AR APCH approvals that was adopted in the developmental phase (circa 2004-2008) is no longer warranted.		
		Operators applying for RNAV1/RNP1 (SID/STAR) operational approval are unnecessarily required by DGCA to demonstrate capability in flight. DGCA uses a "validation" form for this purpose but many of the items listed on the "validation" form are normally addressed by the aircraft manufacturer and compliance can be determined by reference to manufacturer documentation or operations manuals.		
		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.		
Organisation		DGCA, Directorate of Airworthiness and Aircraft Operations		
Responsible Person/Department		DGCA, Director of Airworthiness and Aircraft Operations		
Target Date		December 31, 2016		

ACTION No.	5	□ Required □ Recommended	☑ Urgent☐ Important☐ Routine
		PBN Training for FOIs: GA Inspectors	
ACTION		Arrange for supplemental PBN ground school and approach training for an initial group of general aviation and helicopter flight operations inspectors at STPI/ICAI	
Issue		General aviation Flight Operations Inspectors (pilots) are not trained in PBN flight operations	
Comment (or Background)		General aviation and operators of smaller aircraft are expected to be major users of PBN procedures once available, including in Eastern Indonesia. In order to evaluate air operators' applications for PBN operational approvals and to conduct oversight of domestic and foreign operators conducting PBN operations the Flight Operations Inspectors (FOI) responsible must first understand the operation as a pilot. In the past and up to the present there have not been a significant number of PBN procedures in Indonesia.	
Organisation D		DGCA, Directorate of Airworthiness and Aircraft Operations	
Responsible Person/Department		DGCA, Director of Airworthiness and Aircraft Operations	
Target Date		March 31, 2017	

ACTION No.	5a	☐ Required ☐ Recommended	☐ Urgent ☐ Important ☐ Routine
		PBN Training for FOIs: All DG	CA FOIs
ACTION		Train all remaining Flight Operations Inspectors in PBN flight operations, including contract inspectors, as needed	
Issue		Flight Operations Inspectors (pilots) are not trained in PBN flight operations	
Comment (or Background)		enroute and terminal operation approach operations. For the inspectors will eventually need to the inspectors will eventually need to the inspectors.	will be the default operation for ons, with ILS/GLS and PBN for this reason, all flight operations to be trained and qualified for PBN. Ol's in the future will already have operations
Organisation		DGCA, Directorate of Airworthiness and Aircraft Operations	
Responsible Person/Department		DGCA, Director of Airworthiness and Aircraft Operations	
Target Date		December 31, 2017	

		⊠ Required	□ Urgent
ACTION No.	6	Recommended	☐ Important
			Routine
		PBN Operational Approval Tr	aining
ACTION		DGCA to ensure that all Flight Operations Inspectors are trained in PBN Operational Approval requirements and DGCA approval processes.	
		DGCA arrange for PBN Operational Approval training course to train initial cadre of general aviation and helicopter Flight Operations Inspectors, as well as contract FOIs.	
Issue		Flight Operations Inspectors (pilots) are not trained in PBN Operational Approval	
Comment (or Background)		helicopter Flight Operations oversight of smaller general averaining schools. Inspectors in PBN experience or training an Operational Approval requirem operational experience of condetermined but, as most are resulted the training but have not been training but ha	permanent general aviation and Inspectors (FOI) responsible for viation aircraft operations and flight this category do not have relevant and have not been trained in PBN pents. The qualifications and PBN contract inspectors could not be ecruited from airlines, it is likely that PBN in FMS equipped aircraft. It is present the permanent of the permanent in PBN operational approval approval qualified in PBN flight operations, the permanent in the past has a from some private organizations.
Organisation		DGCA, Directorate of Airworthiness and Aircraft Operations	
Responsible Person/Department		DGCA, Director of Airworthiness and Aircraft Operations	
Target Date		March 31, 2017	

ACTION No.	6a	☐ Required ☐ Recommended	☐ Urgent☐ Important☑ Routine	
		PBN Operational Approval Training	raining: Incorporate in Initial FOI	
ACTION		DGCA to ensure that all Flight Operations Inspectors are trained in PBN Operational Approval requirements and DGCA approval processes.		
		DGCA 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 [DGCA, Directorate of Airworthiness and Aircraft Operations		
Responsible Person/Department		DGCA, Director of Airworthiness and Aircraft Operations		
Target Date		June 30, 2018		

ACTION No.	7	☑ Required☐ Recommended	☐ Urgent☑ Important☐ Routine
	1	DGCA Review and Amend CA	SR Part 173: Quality Assurance
ACTION		DGCA to ensure all flight procedure design organizations are fully compliant with CASR Part 173	
		DGCA to review and amend CASR Part 173 and include the requirement to conform to the quality assurance provisions of PANS OPS, Volume 2 (ICAO Doc 8168) and ICAO Doc 9906.	
Issue		The DGCA has not fully implemented the written policies or processes relating to their procedure design oversight responsibility under CASR Part 173;	
		CASR Part 173 does not refer to or conform to ICAO Doc 9906 Quality Assurance Manual for Flight Procedure Design.	
Comment (or Background)		At present AirNav Indonesia, Garuda and Airbus/ProSky all have procedure design organizations that should fully comply with provisions of CASR Part 173 and be authorized by the DGCA. It is recommended that DGAC fully implement and enforce the provisions of CASR Part 173 relating to their procedure design oversight responsibilities	
Organisation		DGCA, Directorate of Air Navigation	
Responsible Person/Department		DGCA, Director of Air Navigation	
Target Date		December 31, 2016	

		T	T
		Required	☐ Urgent
ACTION No.	7a	□ Recommended	
			Routine
		DGCA Review and Amend Criteria	CASR Part 173: Exemptions to
		DGCA to publish guidelines for the approval of variations to design criteria.	
ACTION		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 the procedure design and validation oversight regulation. (CASR Part 173).	
Issue		DGCA does not have a process for initiating and processing requests for waivers to procedure design criteria, e.g. RNP AR APCH	
Comment (or Background)		accordance with the criteria in ICAO RNP AR Design Manual (guidance material only and mer rules when necessary. Doc 816 of the basic procedures in this c is permitted for the developmen be needed to satisfy local cond significant and difficult terrain adjustments need to be made requirements for procedure AirNav, to request waivers or e requirements should include the	procedures to be designed in ICAO PANS OPS (Doc 8168) and IDoc 9905). ICAO design criteria is inbers have the right to vary design 8 states "While uniform application document is very desirable, latitude tof detailed procedures which may litions." As Indonesia has areas of in there will be occasions when dee. DGCA should have written design organizations, including exemptions from the criteria. These is specific nature of the exemption, and a full justification showing the
Organisation		DGCA, Directorate of Air Navigation	
Responsible Person/Department		DGCA, Director of Air Navigation	
Target Date		December 31, 2017	

ACTION No.	7b	☑ Required☐ Recommended	☐ Urgent☑ Important☐ Routine	
ACTION		DGCA Review and Amend CASR Part 173: Periodic Review of IFP DGCA to include in CASR Part 173 a requirement for periodic 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. CASR Part 173 does not address periodic reviews.		
		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.		
Comment (or Background)		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		DGCA, Directorate of Air Navigation		
Responsible Person/Department		DGCA, Director of Air Navigation		
Target Date		December 31, 2017		

ACTION No.	8	☐ Required☐ Recommended	☐ Urgent☑ Important☐ Routine	
ACTION		DGCA/AirNav RNP AR Procedure Design Training DGCA to train select procedure designers in RNP AR APCH procedure design. AirNav to train select procedure designers in RNP AR APCH procedure design.		
Issue		DGCA and AirNav procedure designers do not have specific training in RNP AR APCH procedure design		
Comment (or Background)		Procedures for Air Navigation (PANS OPS) procedure design do not have the specific transfer design needed to effectively oversight responsibilities in the to meet future demand for personners.	rsonnel trained and experienced in on Services – Aircraft Operations n, both conventional and PBN. They ining in RNP AR APCH procedure carry out their procedure design at area. AirNav requires the training eriodic review of published RNP AR is meet the anticipated demand for	
Organisation		DGCA, Directorate of Air Navigation AirNav, Directorate of Air Navigation		
Responsible Person/Department		DGCA, Director of Air Navigation AirNav, Director of Air Navigation		
Target Date		December 31, 2017		

ACTION No.	9	☑ Required☐ Recommended	☑ Urgent☐ Important☐ Routine
ACTION		All PBN Procedures to be Extracted from Approved Nav Database	
		DGCA to ensure that regulations prohibit any PBN operation that is not extracted from an approved and current on-board navigation database.	
Issue		When Garuda submits a procedure for publication, and DGCA approves the procedure, a letter of authorization is issued to the airline allowing them to start using the procedure immediately, and prior to publication in the AIP. For PBN procedures this is an unsafe practice.	
Comment (or Background)		DGCA reported that when Garuda submits a procedure for publication, and DGCA approves the procedure, a letter of authorization is issued to the airline allowing them to start using the procedure immediately, and prior to publication in the AIP. This is an unsafe practice and should not be permitted, especially with respect to PBN procedures, which must only be accessed from the aircraft database. Procedures do not appear in the navigation database until they are published by a competent provider (e.g. Jeppesen/Lido).	
		Although subsequent advice from Garuda personnel is that company practice was NOT to operate until procedures were available in the company Navigation Database, it is essential that Indonesian regulations ensure that there is no possibility of operations being permitted unless derived from an approved onboard navigation database.	
Organisation		DGCA, Directorate of Air Navigation	
Responsible Person/Department		DGCA, Director of Air Navigation	
Target Date		December 31, 2016	

ACTION No.	10	☑ Required☐ Recommended	☐ Urgent☑ Important☐ Routine
ACTION		AirNav Procedure Design Productivity: Ensure Sufficient Design Staff AirNav to increase procedure design production capability to meet a proposed 4-5 year implementation target.	
Issue		The current full time procedure design staff (2) is not sufficient to accomplish projected PBN procedure design workload of 40 airports/year	
Comment (or Background)		Procedure design productivity is key to the PBN Implementation Plan timeline. An assessment of the current capability suggests that Indonesia will need approximately 12 full time equivalent procedure designers over the next 4-5 years. AirNav has a sufficient number of trained procedure designers in their employ but these designers are currently employed on other duties.	
Organisation		AirNav, Directorate of Air Navigation	
Responsible Person/Department		AirNav, Director of Air Navigation	
Target Date		December 31, 2016 and ongoing	

ACTION No.	10a	☐ Required☐ Recommended	☐ Urgent ☐ Important
ACTION NO.	10a	Recommended	Routine
ACTION		AirNav Procedure Design Productivity: Procedure Design Automation Tool Procurement AirNav to ensure availability of procedure design automation tool.	
Issue		AirNav's pprocurement of a procedure design automation tool has been underway for some time but is not complete.	
Comment (or Background)		productivity multiplier, as well and consistency of the proce design productivity is key to timeline. An assessment of the Indonesia will need approxiprocedure designers over the sufficient number of trained probut these designers are curr Without a tool the target of 40+ If substantial delays in procure	automation tool is an important as serving to enhance the quality dure design product. Procedure to the PBN Implementation Plan ne current capability suggests that mately 12 full time equivalent next 4-5 years. AirNav has a occedure designers in their employmently employed on other duties. Fairports per year may not be met, ment of the tool are expected, it is ter into an agreement to use the
Organisation		AirNav, Directorate of Air Navigation	
Responsible Person/Department		AirNav, Director of Air Navigation	
Target Date		December 31, 2016 and ongoing	

ACTION No.	11	☑ Required☐ Recommended	☐ Urgent☑ Important☐ Routine	
ACTION		Adopt New ICAO RNP APCH Titling Convention DGCA/AirNav to adopt new ICAO RNP APCH titling convention		
Issue		Indonesia has not yet adopted the new ICAO RNP APCH Chart Titling Convention		
Comment (or Background)		ICAO currently uses the chart title convention RNAV (GNSS) for RNP APCH procedures. Recognizing 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. As Indonesia has published few PBN approaches it would be opportune to adopt the new convention immediately rather than retitle many charts at some future date. When Indonesia 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.		
Organisation		AirNav, Directorate of Air Navigation DGCA, Directorate of Air Navigation		
Responsible Person/Department		AirNav, Directorate of Air Navigation DGCA, Directorate of Air Navigation		
Target Date		June 30, 2017		

ACTION No.	12	☑ Required☐ Recommended	☐ Urgent☑ Important☐ Routine
ACTION		DGCA Review and Amend AC 171-5 to Implement Validation in Accordance with Doc 9906	
Issue		AC 171-5 addresses IFP validation but does not fully conform with ICAO Doc 9906.	
Comment (or Background)		validation, (including flight va procedures. The flight inspect Indonesia Advisory Circular (A for flight inspection and flight v	n Unit, BKFP, is responsible for alidation) of PBN instrument flight ion unit operates in accordance with C) 171-5 that includes requirements ralidation. Procedures for validation updating to conform to ICAO Doc
Organisation		DGCA, BKFP	
Responsible Person/Department		DGCA, BKFP	
Target Date		June 30, 2017	

		Required	□ Urgent	
ACTION No.	13	Recommended	☐ Important	
			Routine	
		DGCA BKFP PBN Operations	Training for Pilots: Initial	
ACTION		Pilots in the DGCA Flight Inspe Flight Operations Training	ction Unit (BKFP) to complete PBN	
Issue		Flight Inspection/Flight Validation pilots are not trained in PBN flight operations		
Comment (or Background)		PBN instrument flight procedure equipped for the flight portion of however must first be trained Understandably, since Indone number of PBN IFPs, they have training can be completed local simulator. This is a critical stewill need to wait for validation can be published. Additional trusing stand-alone receivers is are competent to assess the fall types of avionics. Suitably	be responsible for validation of all es (IFPs). Their aircraft are suitably of the validation process. The pilots of and qualified to fly PBN IFPs. esia does not have a significant have never received this training. Cally in the BKFP KingAir 200/350 p as PBN IFPs that are completed until FVPs are trained before they raining for FVPs in PBN operations highly desirable in order that pilots flyability" of PBN procedures using equipped aircraft are operated by . (PA28-151 equipped with Garmin	
Organisation		DGCA, BKFP Flight Inspection	Unit	
Responsible Person/Departn	nent	DGCA, Director, BKFP Flight In	spection Unit	
Target Date		December 31, 2016		

ACTION No.	13a	☐ Required ☐ Recommended	☐ Urgent☐ Important☑ Routine
ACTION		DGCA BKFP PBN Operations Training for Pilots: Recurrent Recurrent training for Pilots in the DGCA BKFP 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		DGCA, BKFP Flight Inspection Unit	
Responsible Person/Department		DGCA, Director, BKFP Flight Inspection Unit	
Target Date		March 31, 2017	

ACTION No.	14	☑ Required☐ Recommended	☑ Urgent☐ Important☐ Routine	
ACTION		Flight Validation Pilot Course for Flight Inspection Pilots Pilots in the DGCA BKFP 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)		Inspection Unit must then beco (FVPs). This is a critical step a need to wait for validation until be validated and published. guidance on FVP training. ICA the Asia-Pacific Region over that procedure designers attend Validation Pilot (FVP) course. (Direccion de Control) Inspectors	I operations, the pilots of the Flight me qualified Flight Validation Pilots s PBN IFPs that are completed will FVPs are trained before they can ICAO Doc 9906, Volume 6 has O has conducted 2 FVP courses in e last 4 years. It is recommended the validation portion of the Flight Selected DGAC Flight Operations ors (pilots) who are responsible for s and instrument flight procedures, a attend the full course.	
Organisation		DGCA, BKFP Flight Inspection Unit		
Responsible Person/Department		DGCA, Director, BKFP Flight Inspection Unit		
Target Date March 31, 2017				

ACTION No.	14a	☑ Required☐ Recommended	☐ Urgent☑ Important☐ Routine
ACTION		Flight Validation Pilot Supervised OJT Pilots in the DGCA BKFP to complete supervised OJT after completion of an initial FVP Course.	
Issue		After completing an initial FVP course Flight Inspection/Flight Validation pilots will require practical experience and guidance in procedure validation until fully proficient.	
Comment (or Background)		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.	
Organisation		DGCA, BKFP Flight Inspection Unit	
Responsible Person/Department		DGCA, Director, BKFP Flight Inspection Unit	
Target Date		June 30, 2017	

ACTION No.	15	☒ Required☐ Recommended	☑ Urgent☐ Important☐ Routine
ACTION		AirNav Concept of Operations AirNav Indonesia 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 Indonesia PBN Plan.	
Comment (or Background)		Although AirNav 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 AirNav Indonesia 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 Indonesia PBN Implementation Plan. It is recommended that a Concept of Operations statement be drafted as a matter of high priority.	
Organisation		AirNav, Directorate of Air Navigation	
Responsible Person/Department AirNav, Director of Air Navigation		on	
Target Date		December 31, 2016	

ACTION No.	16	☐ Required☐ Recommended	☐ Urgent ☐ Important	
ACTION NO.	10	Recommended		
		AirNav ATM: Assign PBN Nav	rigation Specifications	
ACTION		AirNav to assign RNP 2 Navig	ation Specification to domestic air	
		AirNav to designate all SID/STA	AR procedures RNP 1	
Issue		AirNav has not selected a na PBN routes.	vigation specification for domestic	
issue		AirNav has designated existing PBN STARs RNAV 1 with GNSS required.		
Comment (or Background)		5 and RNP 2. With the publica ICAO Doc 4444 Air Traffic Manamodernize and improve efficient separation of routes by 15 nauticlimb and descent by use alternatively using RNAV 5 w GNSS. Since RNAV 5 requirements	estic route specifications are RNAV tion of new separation standards in agement, opportunities now exist to ncy in the Indonesian airspace, by ical miles (nm) in cruise and 7nm in of the RNP 2 specification or with a requirement for carriage of res GNSS to receive benefit from a the logical choice for an enroute	
		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. Other economies in the region already mandate RNP 1 capability.		
Organisation		AirNav, Directorate of Air Navigation		
Responsible Person/Department		AirNav, Director of Air Navigation		
Target Date	Target Date December 31, 2016			

ACTION No.	16a	☑ Required☐ Recommended	☐ Urgent☑ Important☐ Routine	
ACTION		AirNav ATM: Transition to PBN Enroute Structure AirNav to develop comprehensive plan for transition to a PBN domestic enroute structure AirNav to develop comprehensive plan for transition to a RNP 2 international and oceanic enroute structure		
Issue		AirNav does not have a plan for transitioning to a PBN enroute structure.		
Comment (or Background)		The applicable options for domestic route specifications are RNAV 5 and RNP 2. With the publication of new separation standards in ICAO Doc 4444 <i>Air Traffic Management</i> , opportunities now exist to modernize and improve efficiency in the Indonesian 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. 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. See ICAO Cir 341-AN/184 Guidelines for the Implementation of Lateral Separation Minima for additional planning guidance.		
Organisation		AirNav, Directorate of Air Naviga	ation	
Responsible Person/Department		AirNav, Director of Air Navigation		
Target Date		December 31, 2016		

ACTION No.	16b	☒ Required☐ Recommended	☐ Urgent☑ Important
			Routine
		AirNav ATM: Training and In RNP AR APCH Operations	structions for ATCs Involved in
ACTION		AirNav to provide additional to APCH operations are implement	raining for ATCs where RNP AR ted.
ACTION		AirNav to develop techniques and issue local instructions for the management of RNP AR APCH operations	
		AirNav to consult with DGCA a RNP AR APCH operations	and operators on the phasing in of
Issue		The support for PBN operations by Air Traffic Services (ATS) staff has been identified as an issue and an impediment to implementation. ATS personnel have been reluctant to authorize PBN operations due to lack of knowledge and/or confidence in PBN operations.	
Comment (or Background)		operations is required. There allow RNP AR APCH operations with conventional (ILS or VOR understanding of RNP AR Al operators applying for DGCA R who are required to condudemonstrate their competer requirements due to the low Amanaging simultaneous PBN and allow RNP Amanaging simultaneous PBN and RNP AMAD RN	TC clearance rate. Techniques for nd conventional operations need to ds to promulgate local instructions
		AirNav needs to consult with DGCA and operators on the phasing in of RNP AR APCH operations by initially requiring operations in visual conditions, until ATC is comfortable with managing these types of operations. AirNav has agreed to actively support operators in the implementation of RNP AR APCH operations and to ensure that aircraft are permitted to conduct RNP AR APCH procedures whenever possible.	
Organisation		AirNav, Directorate of Air Navig	ation
Responsible Person/Department		AirNav, Director of Air Navigation	
Target Date		December 31, 2016	

ACTION No.	17	☒ Required☐ Recommended	☐ Urgent☑ Important☐ Routine
		DGCA to Mandate PBN Capab	•
ACTION		DGCA in consultation with AirNav and the industry to mandate PBN capability on a schedule consistent with the new Indonesia PBN Implementation Plan	
Issue		Indonesia does not currently mandate PBN capability.	
Comment (or Background)		timeframe for mandating PBN Indonesian airspace. A manda maximum PBN participation and clear that the majority of aircraft	t operating in Indonesian airspace ed and, therefore, able to comply
Organisation		DGCA, Directorate of Air Navigation	
Responsible Person/Department		DGCA, Director of Air Navigation	
Target Date		December 31, 2021	

ACTION No.	18	☐ Required☐ Recommended	☑ Urgent☐ Important☐ Routine	
ACTION	•	PBN Operational Approval Ch		
ACTION		DGCA to investigate and find a PBN Operational Approvals	solution to the charging system for	
Issue		Operators are reluctant to apply for PBN approvals due to the cost of obtaining an approval and, in particular, the system of charging per tail number.		
Comment (or Background)		Operators are reluctant to apply for approvals due to the cost of obtaining an approval and, in particular, the system of charging per tail number. As most operators will require operational approval for six or more PBN Specifications (typically RNAV 10, RNAV 5, RNAV 1 and 2, RNP 2, RNP 1, RNP APCH) and each approval is currently being charged separately at approximately USD 500 per approval, an operator with 100 aircraft will incur a DGCA charge of USD 300,000 in addition to the costs associated with preparing an application and crew training. Given that the DGCA workload is basically the same for one aircraft as for 100 aircraft, these charges are regarded by operators as excessive.		
		Charges are determined by the Ministry of Finance and are outside DGCA's control. DGCA recognizes that the current charging system is unreasonable and a disincentive to progress, and has undertaken to raise the matter with the relevant agencies to seek a more equitable charging arrangement.		
Organisation	Organisation DGCA, Directorate of Air Navigation		ation	
Responsible Person/Department		DGCA, Director of Air Navigation		
Target Date December 31, 2016				

ACTION No.	19	☑ Required☐ Recommended	☐ Urgent☑ Important☐ Routine	
ACTION		Annex 15 eTOD DGCA 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)		available certain electronic terr 2015. A major driver of these surge in development of PBN	ments for the members to make rain and obstacle data (eTOD) by e requirements was the expected IFPs as PBN was implemented a is very important to the PBN pproach procedures.	
Organisation		AirNav		
Responsible Person/Department		AirNav, DGCA		
Target Date		December 31, 2016		

ACTION No.	19a	☐ Required ☐ Recommended	☐ Urgent☑ Important☐ Routine
ACTION		Airports Directorate Responsibility for eTOD DGCA 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		DGCA Directorate of Air Navigation DGCA Airports Directorate	
Responsible Person/Department DGCA, Director of Air Navigation		n	
Target Date		December 31, 2016	

		□ Required	☐ Urgent	
ACTION No.	19b	Recommended		
			Routine	
		Airports to be Required to Co	llect eTOD	
ACTION			for the control of obstacles in the and the compilation of Electronic DD) 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 30 airports in Indonesia that are required to be certified, out of the 270+ that may have PBN approach procedures. Further regulatory action to apply this requirement to registered airports with instrument approach procedures should be considered.		
Organisation		DGCA, Airports Directorate		
Responsible Person/Department		DGCA, Airports Director		
Target Date		June 30, 2017		

		□ Required	☐ Urgent	
ACTION No.	19c	Recommended		
			Routine	
		Area 2 and 4 eTOD		
ACTION		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, DGCA 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		DGCA, Airports Directorate		
Responsible Person/Department		DGCA, Director of Airports		
Target Date		December 31, 2019		

ACTION No.	19d	☑ Required☐ Recommended	☐ Urgent☑ Important☐ Routine
ACTION		Area 1 eTOD Obtain Annex 15 eTOD for Area 1, for the entire economy of Indonesia, or confirm compliance and/or adequacy of the economy's 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 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 (SARP).	
Organisation		DGCA, Directorate of Air Navigation	
Responsible Person/Departn	nent	DGCA, Director of Air Navigation	
Target Date	et Date December 31, 2016		

		Required	☐ Urgent	
ACTION No.	19e	□ Recommended		
			Routine	
ACTION		Incorporate eTOD in AIXM Date	tabase	
Issue		AirNav AIXM database does not include eTOD.		
Comment (or Background)		partially met if the data is not r	ortant safety initiative that is only made available to the international standard for sharing this data is	
Organisation		DGCA Airports Directorate		
Responsible		AirNav, Director of Air Navigation		
Person/Departn	nent	DGCA, Director of Airports		
Target Date		To be determined		

ACTION No.	20	☐ Required ☐ Recommended	☐ Urgent☑ Important☐ Routine
		Convert the Obstacle Databas	
ACTION		DGCA to work with AirNav to include the electronic database of all approved and known obstacles in the AirNav 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 AirNav AIXM database	
Comment (or Background)		DGCA'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, DGCA should include the electronic database of all approved and known obstacles, as well as all available eTOD, in the AirNav AIXM 5.1 database project.	
Organisation		DGCA Airports Directorate	
Responsible Person/Department		DGCA Airports Directorate	
Target Date			711

ACTION No.	21	☑ Required☐ Recommended	☐ Urgent ☐ Important
			Routine
ACTION		Provision of Local Barometri Approach Operations	ic Pressure for PBN Instrument
		DGCA and AirNav 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)		the current barometric press (LNAV/VNAV or RNP AR) are barometric pressure is required service at 100 towered airports, Weather Stations or training of can be met similarly at non- automatic weather system with	quire a source from which to obtain sure. Where APV procedures implemented, a local source of AirNav has a plan to provide this either by installation of Automated local personnel. This requirement towered airports by installing an NHF broadcast facility in those edited ground observers to pass aircraft.
Organisation		AirNav, Directorate of Air Navigation	
Responsible Person/Department		AirNav, Director of Air Navigation	
Target Date		December 31, 2019	

ACTION No.	22	☐ Required ☐ Recommended	☐ Urgent☑ Important☐ Routine
ACTION		PBN Training for STPI/ICAI instructors STPI to train flight instructors(2) in PBN flight operations,	
Issue		Flight Operations Inspectors (pilots) are not trained in PBN flight operations STPI flight instructors are not trained in PBN fight operations	
Comment (or Background)		This is a "train the trainer" action. 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. STPI/ICAI is a government owned and operated aviation training school that has small aircraft with Garmin 430 and 1000 PBN systems installed. DGCA should conduct GA FOI PBN Operations training locally with STPI. This has several benefits: eliminate or reduce travel expense for training GA FOIs and FVPs in stand-alone systems, jump start PBN training at the ab initio level in Indonesia since new approaches will be coming available at 40 airports per year. This will require at least 2 STPI instructors to travel outside Indonesia to get training to the instructor level on the Garmin 430.	
Organisation		DGCA, Directorate of Airworthiness and Aircraft Operations	
Responsible Person/Departme	ent	DGCA, Director of Airworthiness and Aircraft Operations DGCA, STPI Pilot Training Department	
Target Date		March 31, 2017	

		□ Required	□ Urgent	
ACTION No.	23	Recommended	☐ Important	
			Routine	
ACTION		DGCA/AirNav/Garuda Ensure with ICAO QA Provisions	Procedure Designer Familiarity	
		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 Indonesia in accordance with ICAO guidelines, all design organizations (AirNav, Garuda and DGCA) should take immediate steps to familiarize 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		DGCA, Directorate of Air Navigation AirNav, Directorate of Air Navigation Garuda		
Responsible		DGCA, Director of Air Navigation		
Person/Departn	nent	AirNav, Director of Air Navigatio	n	
		Garuda		
Target Date		March 31, 2017		

ACTION No.	24	□ Required □ Recommended	☐ Urgent ☐ Important ☐ Routine
ACTION		AirNav to Implement ICAO Procedure Design QA Provisions AirNav to implement the quality assurance provisions of PANS OPS and Doc 9906.	
Issue		AirNav 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 CASR Part 173. AirNav has developed a Procedure Design Operations Manual in draft form (in Bahasa Indonesia) that, when published, should also address the written processes for quality assurance.	
Organisation		AirNav, Directorate of Air Navigation	
Responsible Person/Department		AirNav, Director of Air Navigation	
Target Date		March 31, 2017	

APEC Project: TPT 05/2015A

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APEC#217-TR-01.2