



WORKING PAPER

ASSEMBLY — 39TH SESSION

TECHNICAL COMMISSION

Agenda Item 33: Aviation safety and air navigation monitoring and analysis

IMPLEMENTING PBN FOR AIRPORTS IN REMOTE AND MOUNTAINOUS AREAS

(Presented by Indonesia)

EXECUTIVE SUMMARY

This paper presents a case study of the application of the available performance-based navigation (PBN) specifications to fit with the specific conditions of an airport in Papua Island (Indonesia) as an illustration of the very particular conditions of air navigation in airports in remote and mountainous areas.

Similar challenges could be identified in other Member States with similar conditions and thus Indonesia wishes to promote technical work in ICAO and information exchanges among Member States in order to solve such air navigation challenges including the development of specifications for Guided Visual Approaches.

Action: The Assembly is invited to:

- a) note the case study presented by Indonesia;
- b) support the development of ICAO technical work for the development of navigation specifications suitable for remote mountainous areas, including Guided Visual Approach; and
- c) encourage Member States with areas with similar conditions to share information and contribute to find local solutions while supporting global harmonization.

<i>Strategic Objectives:</i>	This working paper relates to the Safety and Air Navigation Capacity and Efficiency Strategic Objective.
<i>Financial implications:</i>	The activities referred to in this paper will be undertaken subject to the resources available in the 2017–2019 Regular Programme Budget and/or from extra budgetary contributions.
<i>References:</i>	Resolution A 37-11, Performance-based navigation global goals

1. INTRODUCTION

1.1 Implementation of performance-based navigation (PBN) has been included in the DGCA Indonesia's policy priorities as was shown in its PBN action plan issued in 2011 and submitted to ICAO. DGCA Indonesia realizes the importance of PBN implementation for enhancing safety, increasing airspace capacity, as well as for achieving fuel efficiency and reducing emissions from the aviation sector.

1.2 Indonesia has 237 airports throughout the country. 159 of them are equipped with Nav-aid, 78 airports without Nav-aid, 52 airports have conventional approach procedure and 38 airports have PBN approach procedures.

1.3 For busy airports, besides improving safety the implementation of PBN is key for increasing airspace capacity and airport efficiency. On the other hand, for many airports the need of PBN is merely for safety reasons due to their terrain difficulty, such as most airports in Papua Island.

1.4 In addition to the implementation of PBN in all International airports as requested by ICAO Resolution A 37-11, for Indonesia has become as well a national priority the implementation of PBN in domestic airports to enhance operational safety. Special focus has been put by DGCA Indonesia on finding safe air navigation solutions for remote airports located in mountainous areas with very difficult access and airfield characteristics.

1.5 Indonesia is searching cooperation with other Member States, such as the United States, with areas with similar conditions such as Alaska in order to develop local solutions while searching to support global harmonization.

2. CASE STUDY

2.1 As an illustrative example Indonesia presents the case of Enarotali Airport (Elev. 5.800 ft) in a remote mountainous area of Papua (Indonesia).

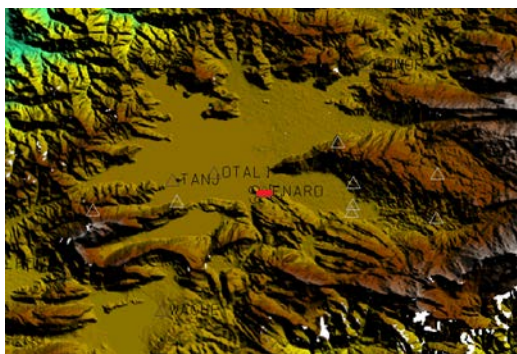


Figure 1. Enarotali airport (red strip) surround by the mountain

2.2 At a first assessment DGCA Indonesia tried to implemented RNP APCH navspec as approach procedure, but the terrain in the protection area makes that the aerodrome minima's (obstacle clearance height (OCH) and visibility) are too high, even higher than with visual procedure.

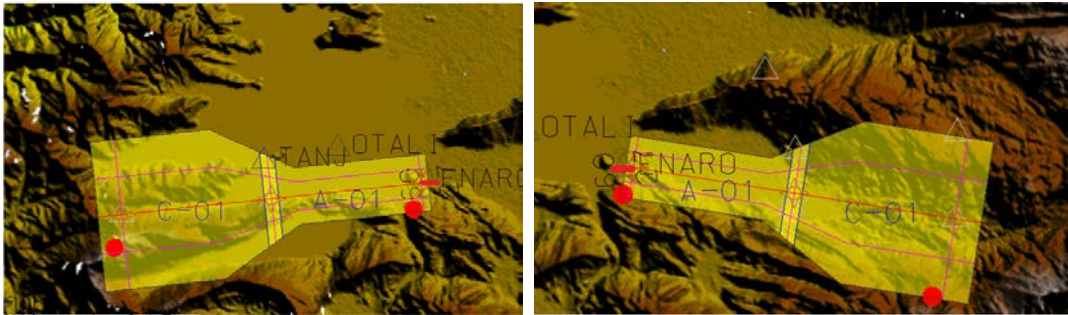
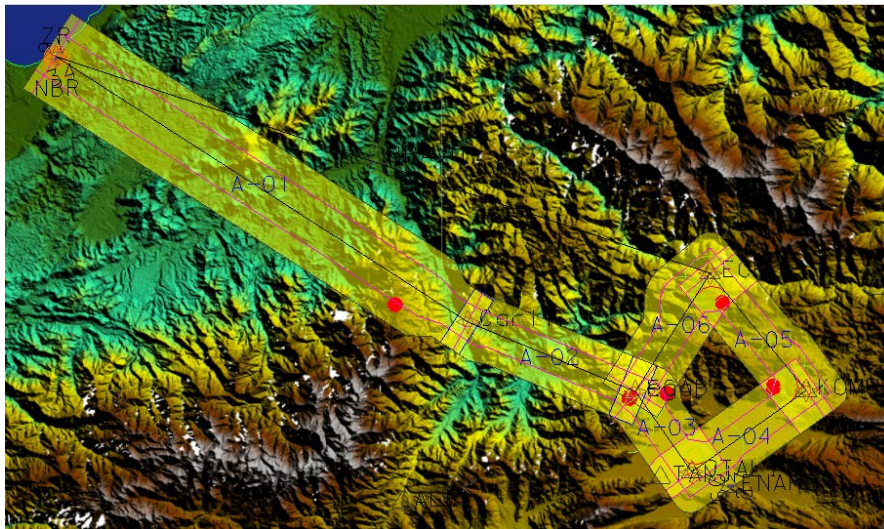


Figure 2. The terrain penetrate the protection area of RNP APCH procedure

2.3 In Enarotali Airport, the advanced PBN navspec such as RNP AR have some difficulties to be applied due to the limited resources and small aircraft without sophisticated avionics population.

3. SOLUTION CONCEPT

3.1 First solution, continue provide the guidance to fly in Instrument Flight Rule (IFR) until the closest distance to the airport using STAR RNP1 concept, this concept guide the aircraft until certain point called Visual Decision Point (VDP), at this point the pilot must see the runway to continue fly to land in visual, if the pilot do not see the runway than pilot must continue fly following the track for go-around.



Segment	NBR – Carlie	Carlie – E-Gap	E-Gap – Otali	Otali – Komopa	Komopa – Echo	Echo – E-Gap
Min. Altitude	9.900 ft	8.100 ft	9000 ft	9.700 ft	9.700 ft	8.700 ft

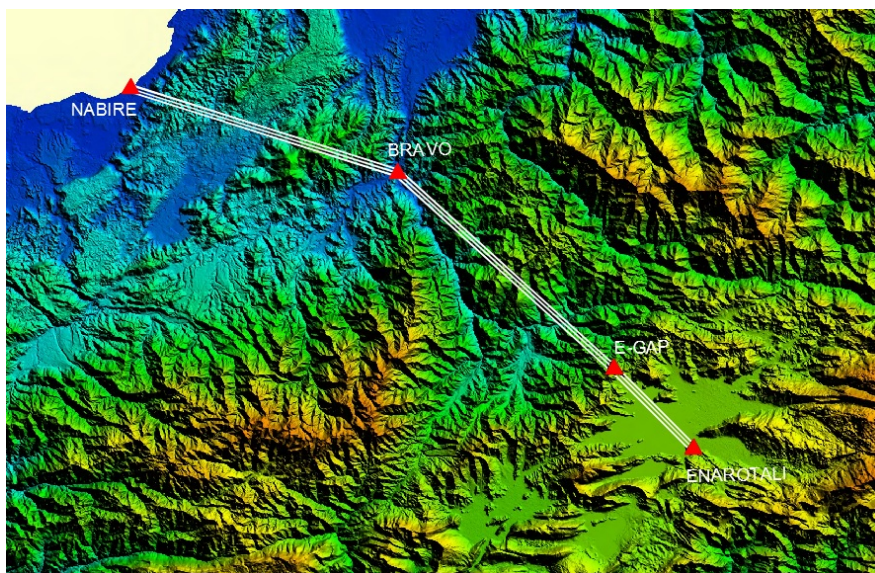
Figure 3. The profile of STAR RNP1 concept

3.2 The problem with this concept is the height at Visual Decision Point (VDP) is still high around 3.200 ft above airport elevation and yet the distance to the airport is short around 3 NM. Meanwhile the optimum descend gradient for landing the aircraft is 3° or 5,24% or 954 ft / 3 NM.

3.3 A second solution was to make the aircraft fly low between the mountains. It was proposed the pilot to fly in Visual Flight Rule (VFR) using VFR criteria such as:

- a) corridor: 600 m horizontally and 1.000 feet vertically from obstacle; and
- b) visibility: 5.000 m

but using Global Navigation Satellite System (GNSS) coordinate as direction guidance replacing the visual reference on the ground which is mandate in VFR, if we apply the proposed criteria in example case Enarotali Airport the flight procedure design will be like in the figure below.



Segment	Nabire – Bravo	Bravo – E-Gap	E-Gap – Enarotali
Minimum Altitude	5.500 ft	7.900 ft	7.700 ft

Figure 4. The profile of VFR with GNSS Guidance concept

3.4 With this concept the minimum height when arriving at Enarotali Airport is around 1.900 ft above airport elevation with distance 10,5 NM. The second concept resulted better height (lower) and better distance (longer) for landing the aircraft than the first concept.

3.5 This case study was analyzed by Indonesia with support and inputs from the ICAO Bangkok Regional Office experts of the PBN Implementation Coordination Group (PBNICG).

3.6 It is presented here as a case study of possible applicable solutions in remote mountainous areas.

4. CONCLUSION

4.1 Similar challenges could be identified in other Member States with similar conditions and thus Indonesia wishes to promote technical work in ICAO and information exchanges among Member States in order to solve such air navigation challenges including the development of specifications for Guided Visual Approaches.

4.2 Indonesia also wishes to promote the development of ICAO technical work for the development of navigation specifications suitable to be used in remote mountainous areas, including Guided Visual Approach.