Airbus Prosky
Thomas Bernstein

ICAO Workshop

Study Case: Kalibo airport

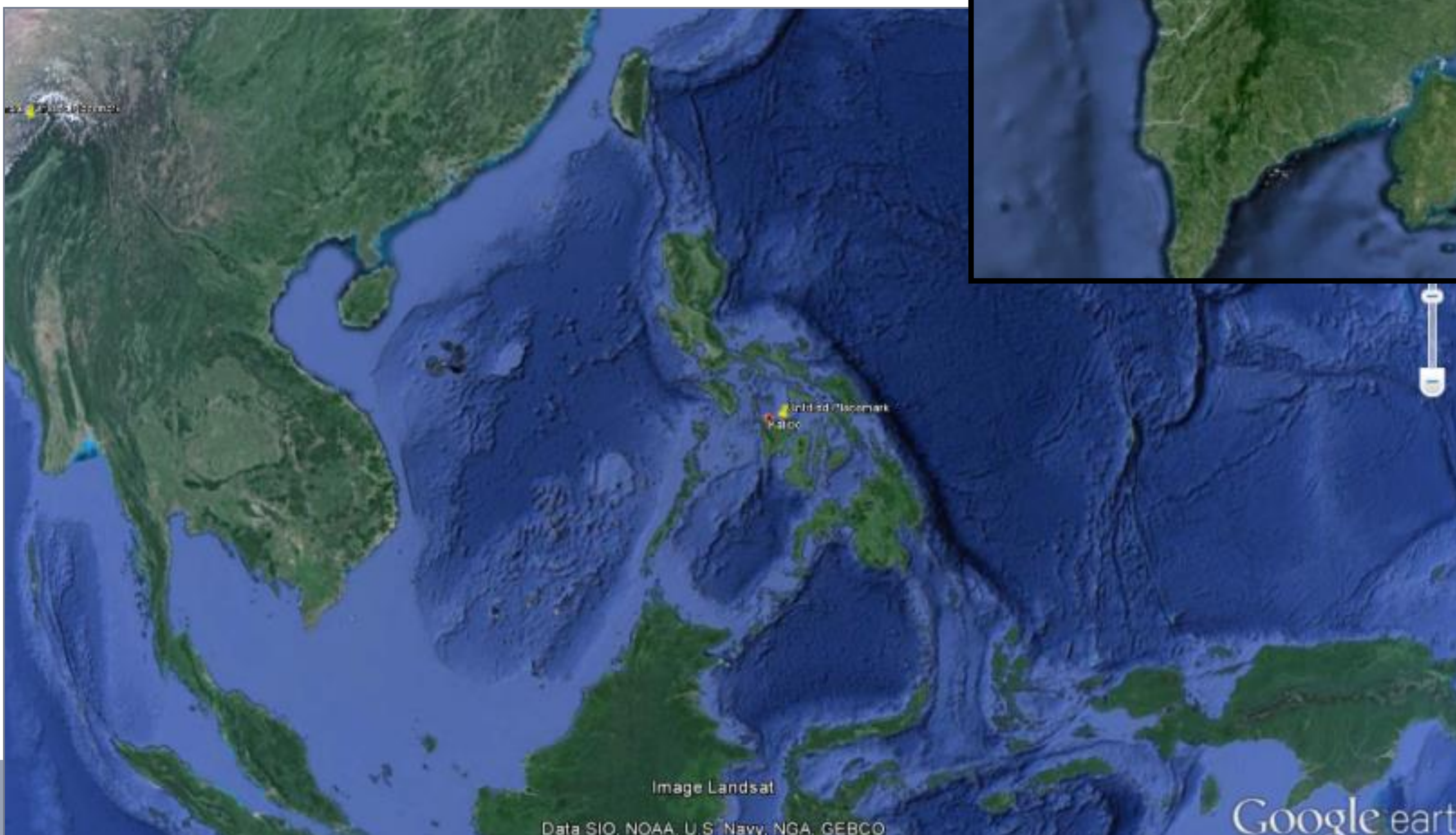
ICAO AFPP Workshop
3rd – 6th November 2015
Nairobi

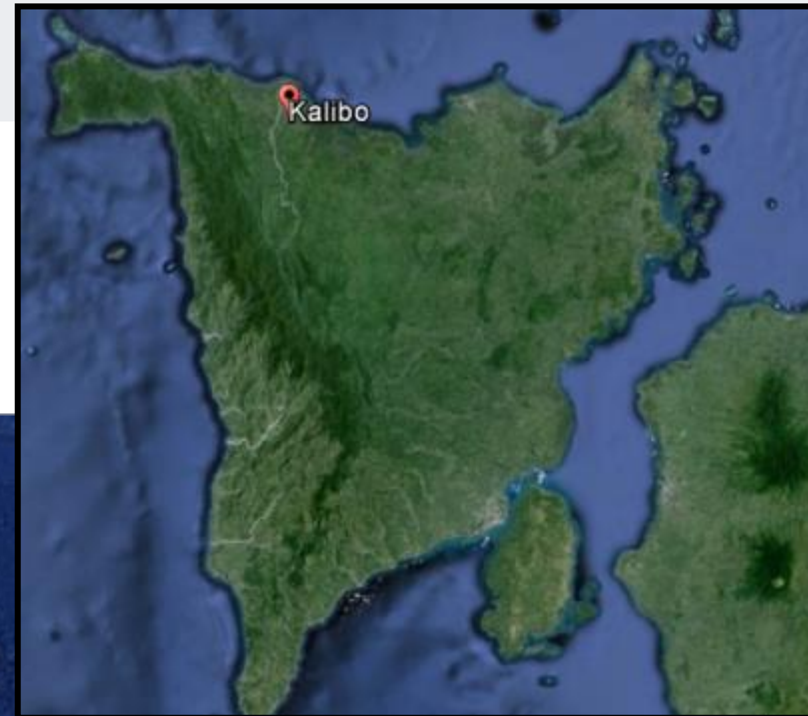
Objective

- Objective of the Study Case:
  - To apply the ICAO 9906 steps and Methodology to a concrete case
  - To go deeper in a concrete case, by analyzing & identifying:
    - ✓ The existing airport procedures – Potential issues and ways of improvement
    - ✓ *Which PBN Nav Spec may be used to improve the existing procedures*
    - ✓ Stakeholders Roles & Responsibilities

Study Case – Kalibo airport

Kalibo airport is located in Philippines





Study Case – Kalibo airport

Airport surrounded by:

- North/North East: Sea
- West/South West: Mountains

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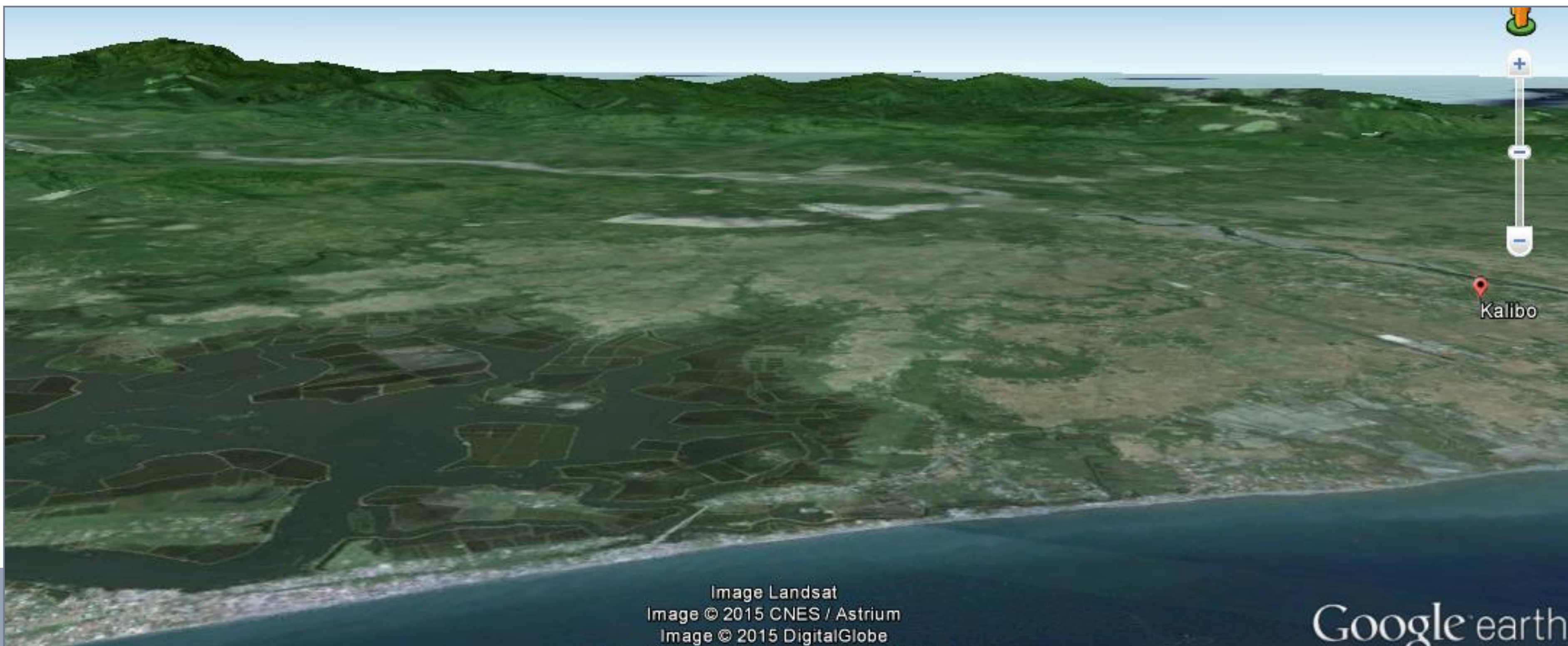


Kalibo airport – Main features

- VFR/IFR traffic
- Non Radar Environment
- Traffic flow:
  - About 25-30 aircraft per day
  - Mostly Airbus A320 aircraft (80%) and 737-800 (from Russia and Taipei), ATR and Dash Q400
- Existing procedures *(see AIP)* :
  - VOR/DME RW23
  - *LOC RW23 : Not in service*
  - Circling RW05

Kalibo airport – Study case

ATC

- Kalibo: TWR + APP + Coordinator
- Mainly flights from Manila, Taipei, Russia *(North, North West of Kalibo)*
- Coordination between:
  - Manila ACC
  - Mactan ACC
  - Kalibo ATC

Step 1 - Initiation

- Starting point of the “Future Project”

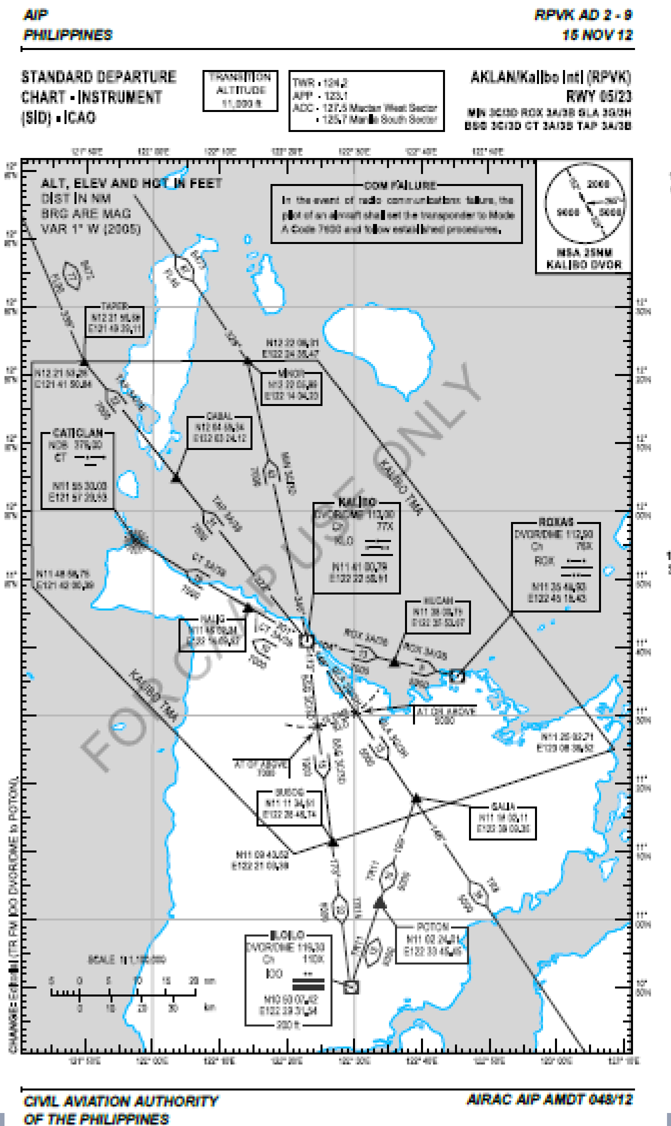
→ Why looking at this airport?

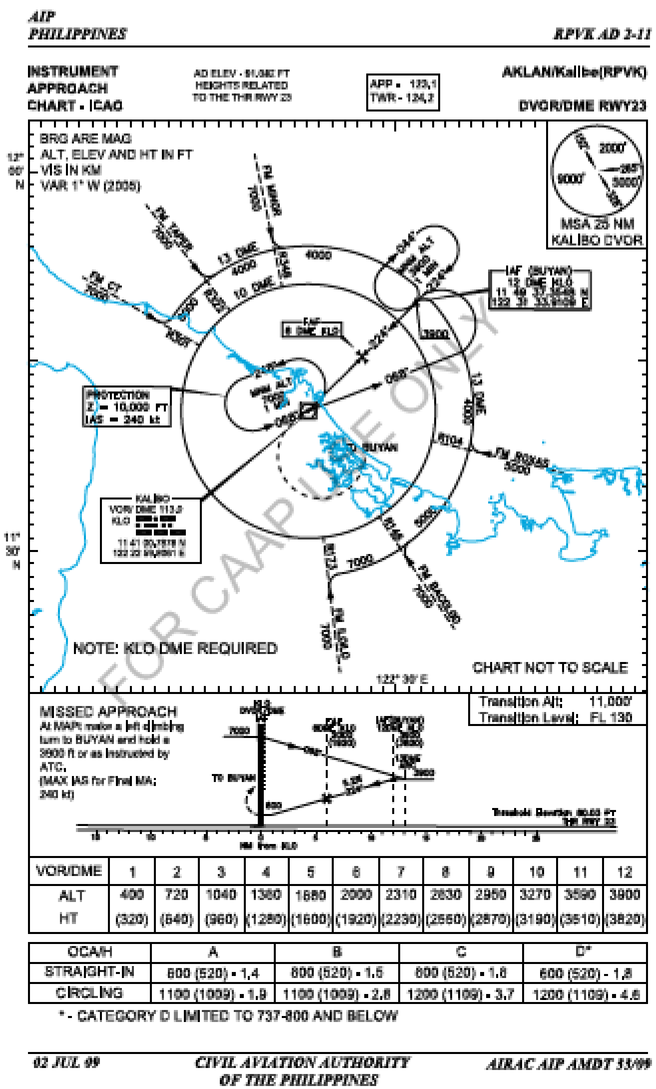
Authorized material:

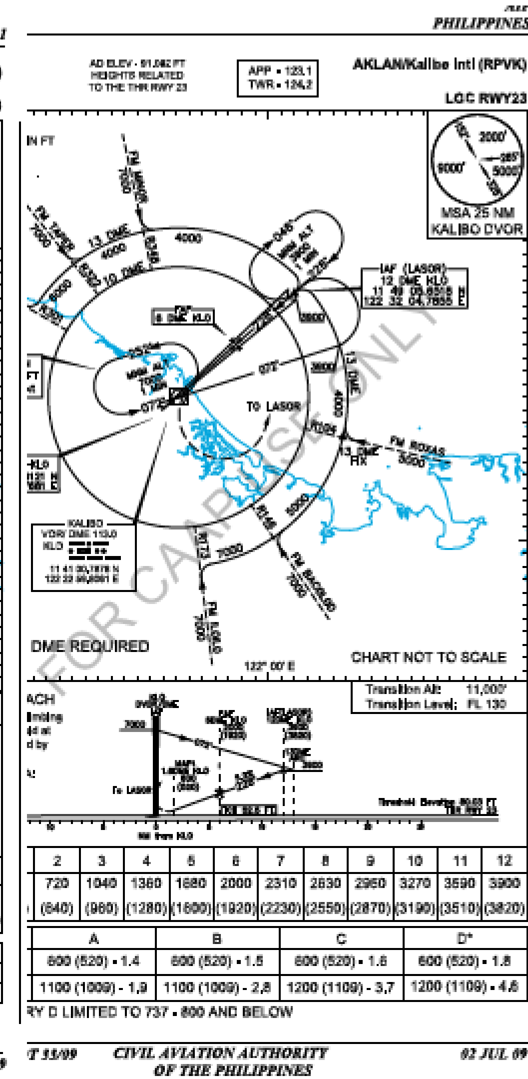
✓ AIP

✓ Weather data

AIP


AIP
PHILIPPINES
RPVK AD 2 - 9
15 NOV 12
STANDARD DEPARTURE CHART - INSTRUMENT (SID) - ICAO
AKLAN/Kalibo Intl (RPVK)
RWY 05/23
ALT, ELEV AND HGT IN FEET
DIST IN NM
BRG ARE MAG
VAR 1° W (2005)
COM FAILURE
MSA 25NM KALIBO DVOR
CATICLAN
KALIBO
ROXAS
ILOILO
FOR CAAP USE ONLY
CIVIL AVIATION AUTHORITY OF THE PHILIPPINES
AIRAC AIP AMDT 048/12


AIP
PHILIPPINES
RPVK AD 2-11
INSTRUMENT APPROACH CHART - ICAO
AKLAN/Kalibo(RPVK)
DVOR/DME RWY23
BRG ARE MAG
ALT, ELEV AND HT IN FT
VIS IN KM
VAR 1° W (2005)
MSA 25 NM KALIBO DVOR
NOTE: KLO DME REQUIRED
CHART NOT TO SCALE
FOR CAAP USE ONLY
MISSED APPROACH
Transition Alt: 11,000'
Transition Level: FL 130
VOR/DME 1 2 3 4 5 6 7 8 9 10 11 12
ALT 400 720 1040 1360 1680 2000 2310 2630 2950 3270 3590 3900
HT (320) (640) (960) (1280) (1600) (1920) (2230) (2550) (2870) (3190) (3510) (3820)
OCA/H A B C D*
STRAIGHT-IN 600 (520) - 1.4 600 (520) - 1.5 600 (520) - 1.6 600 (520) - 1.8
CIRCLING 1100 (1009) - 1.9 1100 (1009) - 2.8 1200 (1109) - 3.7 1200 (1109) - 4.6
* - CATEGORY D LIMITED TO 737-800 AND BELOW
02 JUL 09
CIVIL AVIATION AUTHORITY OF THE PHILIPPINES
AIRAC AIP AMDT 33/09


PHILIPPINES
AKLAN/Kalibo Intl (RPVK)
LOC RWY23
MSA 25 NM KALIBO DVOR
DME REQUIRED
CHART NOT TO SCALE
FOR CAAP USE ONLY
Transition Alt: 11,000'
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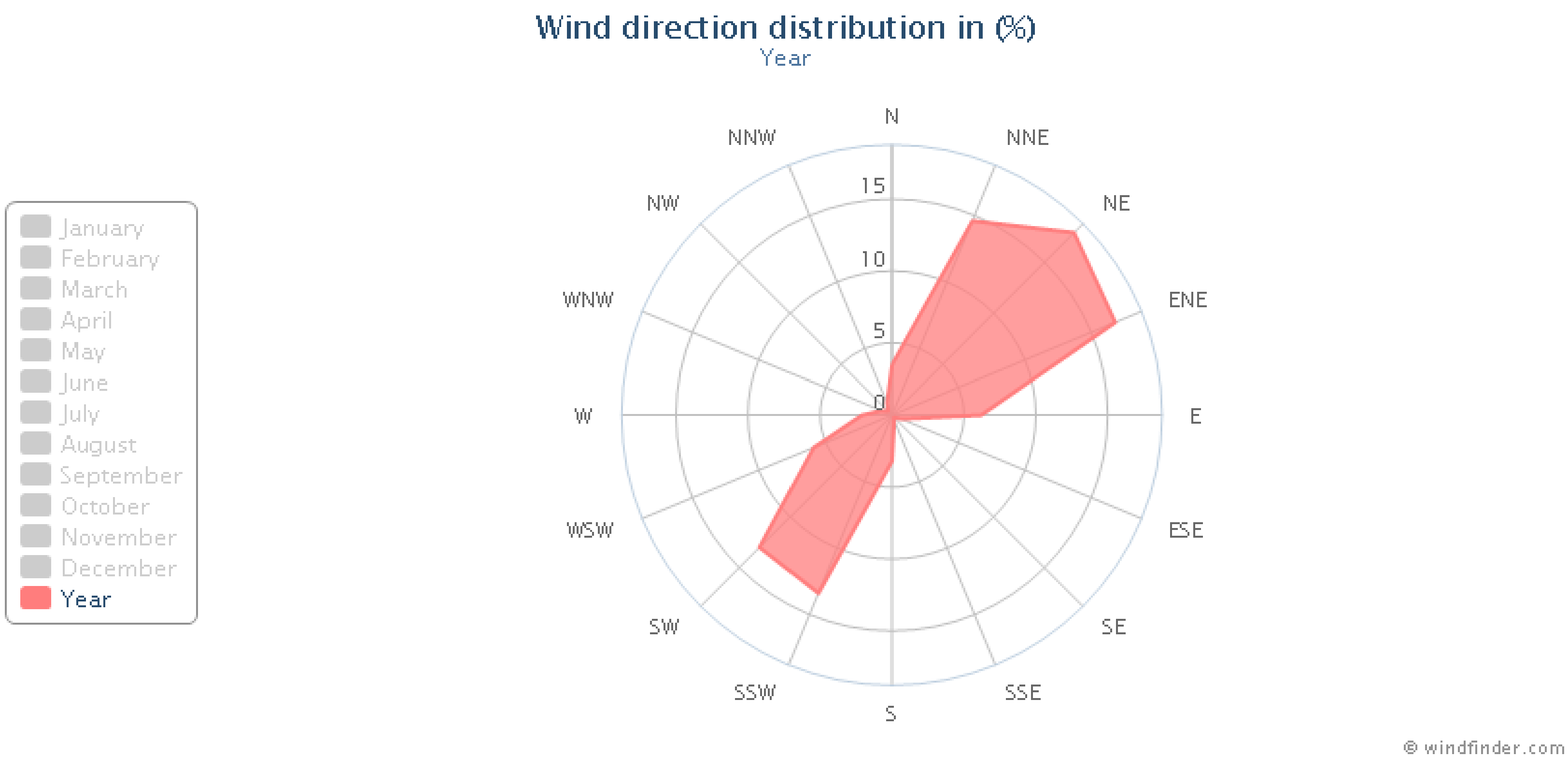
CIVIL AVIATION AUTHORITY OF THE PHILIPPINES
02 JUL 09

Weather data

Month of year	Jan 01	Feb 02	Mar 03	Apr 04	May 05	Jun 06	Jul 07	Aug 08	Sep 09	Oct 10	Nov 11	Dec 12	Year 1-12
Dominant Wind dir.													
Wind probability >= 4 Beaufort (%)	63	49	45	22	6	18	26	35	27	19	31	56	33
Average Wind speed (kts)	13	11	11	9	6	8	9	10	9	8	8	12	9
Average air temp. (°C)	27	27	28	29	30	29	29	28	28	29	29	28	28



Step 1 - Initiation

- Identification of potential :
  - Operational issues (on both runways)
  - Safety issues

- AIP and existing procedure:

  Give your analyse and feedback?

  Ways of potential :
  - Operational improvement
  - Safety improvement

Step 1 - Initiation

- Identification of potential :
  - **Operational issues :**
    - ✓ Minima ?
    - ✓ Traffic separation ?
    - ✓ Payload ?
    - ✓ Terrain Awareness triggered ?
    - ✓ Fuel consumption ?
    - ✓ Navaids not reliable / Failure ?
  - **Safety issues :**
    - ✓ Procedure not coded, higher crew workload
    - ✓ Circling: Visual Approach and manual flying – Does not facilitate fully stabilized approach

Step 1 - Initiation

- ❑ Who should be involved?
- ❑ Who may provide operational feedback and recommendations?

Step 1 - Initiation

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CAA to establish FORMS for stakeholder for send a request

→ Outputs

- GO / NO GO?
- Preliminary Design/Proposal of procedure type
- CAA/ANSP Project Managers identified / Focal Point in stakeholders identified
- Tentative planning / Resources / Validation means *(if required)* identified

→ Stakeholders

- CAA, ANSP, ATC, Airport Authority, Operators, local communities etc

Step 2 – Data Collection

- Which data?

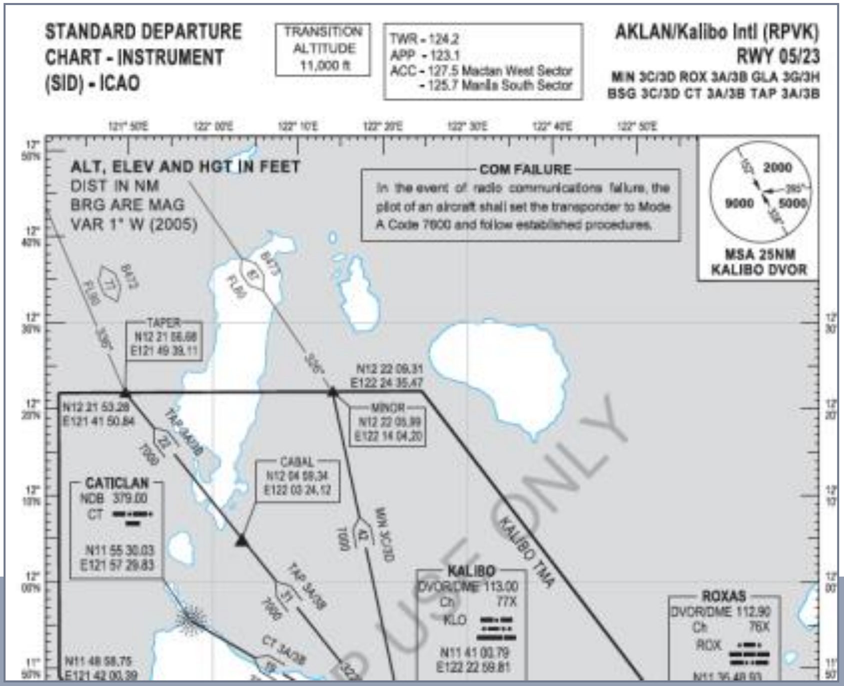
Step 2 – Data Collection

- Which data?
  - ✓ Data collected in the Step 1 – Initiation
    - Operational / Safety Feedback
      - Operators
      - ATC

RPVK AD 2.12 RUNWAY PHYSICAL CHARACTERISTICS

Designations RWY NR	TRUE BRG	Dimensions of RWY	Strength (PCN) and surface of RWY and SWY	THR coordinates RWY end coordinates THR geoid undulation	THR elevation and highest elevation of TDZ of precision APP RWY
1	2	3	4	5	6
05	049º GEO 050º MAG	2187M X 45M	PCN 47 R/B/W/U ASPH	114025.8953N 1222208.1095E	09.039M/29.655FT
23	229º GEO 230º MAG	2187M X 45M	PCN 47 R/B/W/U ASPH	114110.1550N 1222259.5220E	05.771M/18.934FT

- ✓ In addition, all relevant data for Procedure Design purpose should be gathered:
  - Runway, obstacles / Data Survey
  - Controlled airspace
  - Restricted airspace
  - Airways
  - Existing procedure
  - Entry/Exit points
  - Noise sensitive area
  - Radar/Non Radar
  - Atmospheric conditions / Turbulence area



Step 3 – Conceptual Design

- Using all previous gathered data, a Conceptual Design maybe drafted

  - ✓ RW23
  - ✓ RW05

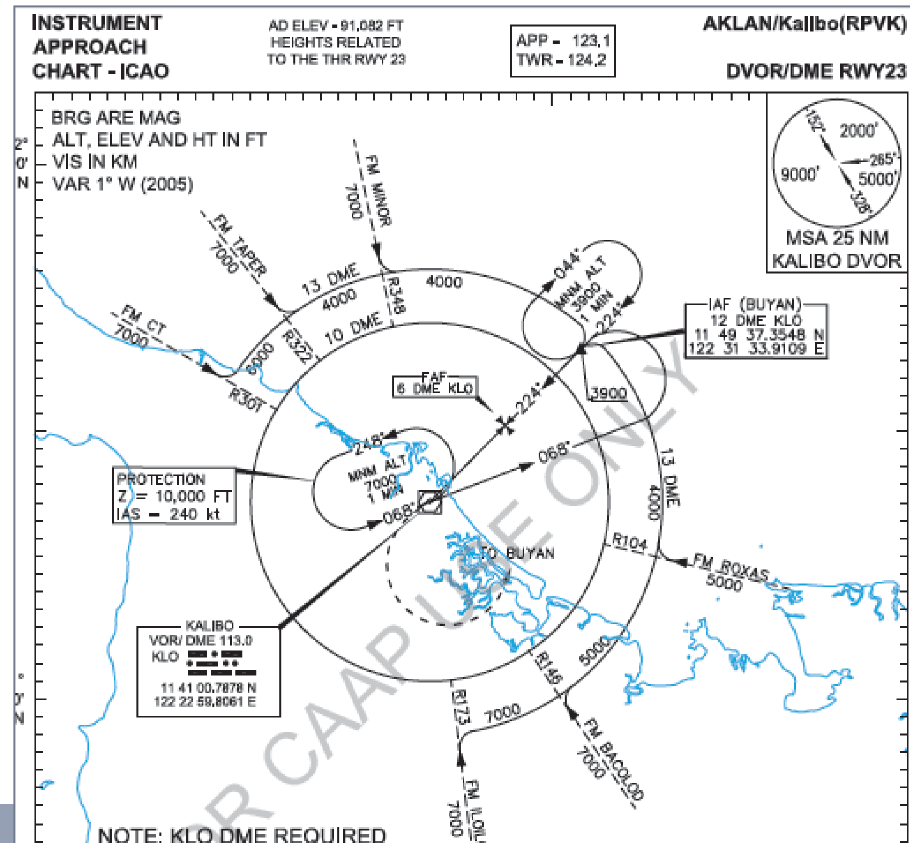
Step 3 – Conceptual Design – RW23

- Using all previous gathered data, a Conceptual Design maybe drafted

  - ✓ **RW23**
  - ✓ **Proposed solution ?**
  - ✓ **Nav Spec?**
  - ✓ **Proposed Design?**

Step 3 – Conceptual Design – RW23

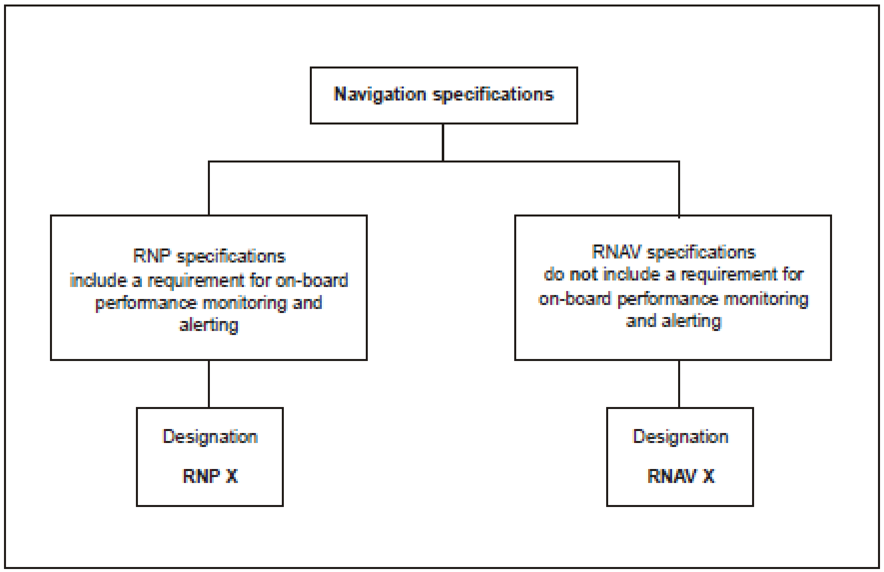
- Reminder of RW23 Existing procedures
  - ✓ **VOR/DME**
    - **Reliability of Ground Navaid?**
    - **NDB coding?**
  - ✓ **RNP procedure**
    - **No Ground Navaid**
    - **Coded in NDB *(ARINC424)***
  - ✓ **Which Nav Spec? Which Design?**

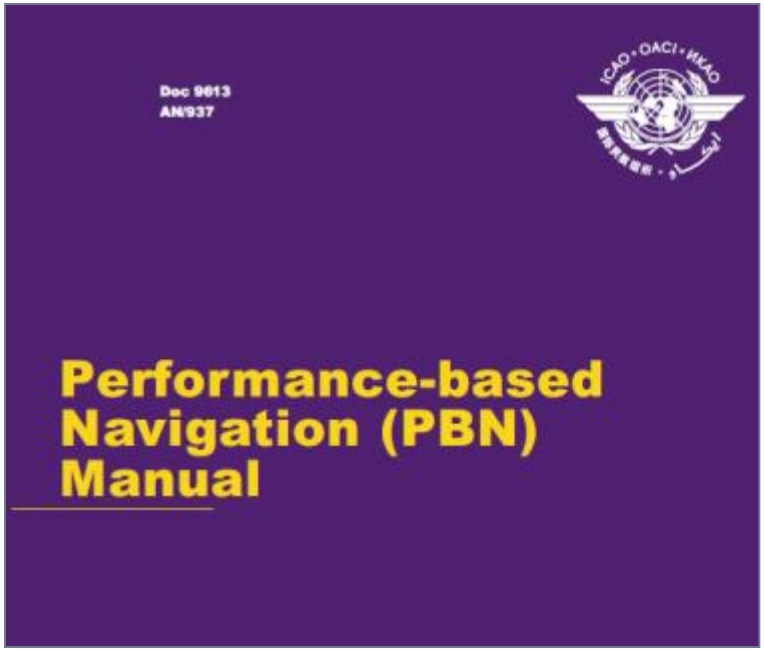


Step 3 – Conceptual Design – RW23

- Non Radar Environment

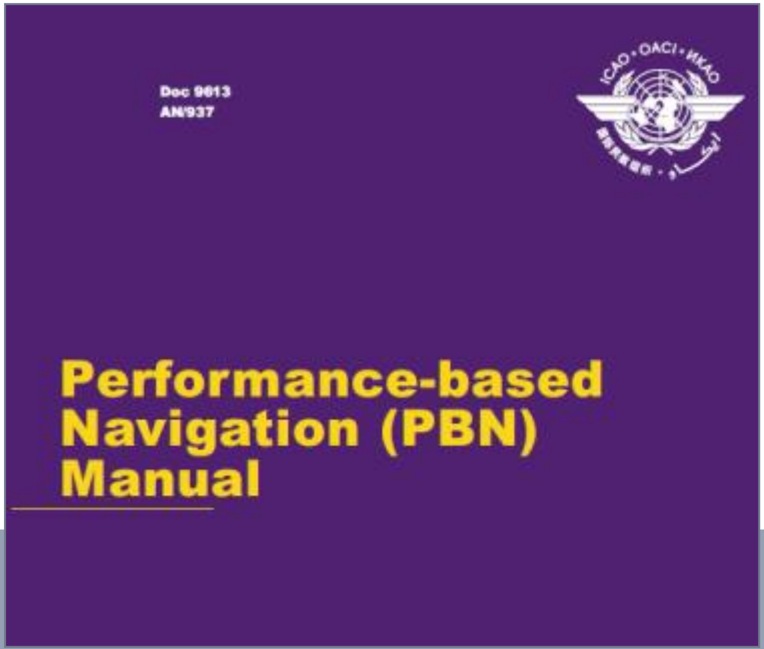
RNP Procedure required (No RNAV)





Step 3 – Conceptual Design – RW23

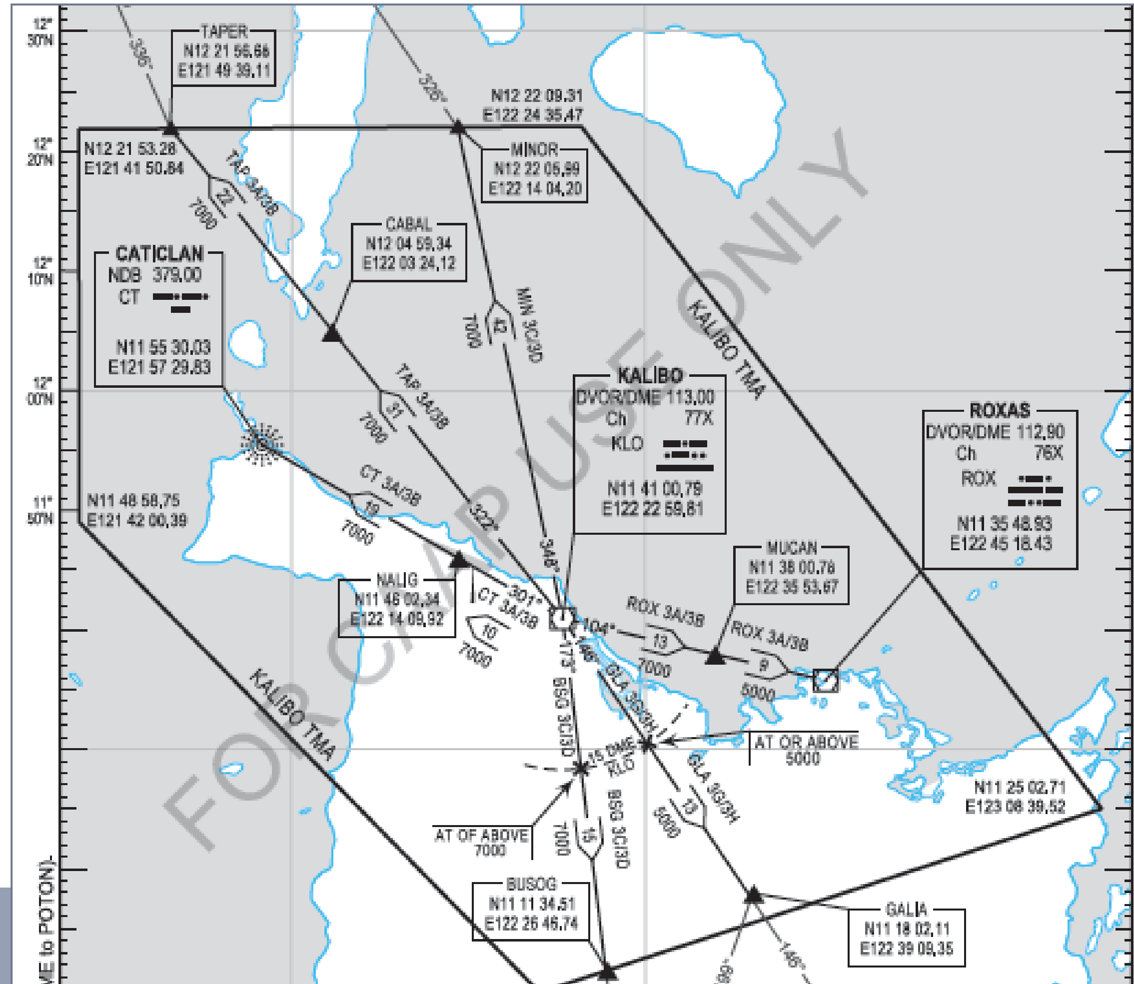
- Non Radar Environment
  - ✓ RNP Procedure required (No RNAV)
  - ✓ RNP-APCH approach
    - Basic capability for most aircraft type
    - Basic crew training
    - Fully coded procedure in NDB
    - LNAV & LNAV/VNAV minima



Step 3 – Conceptual Design – RW23

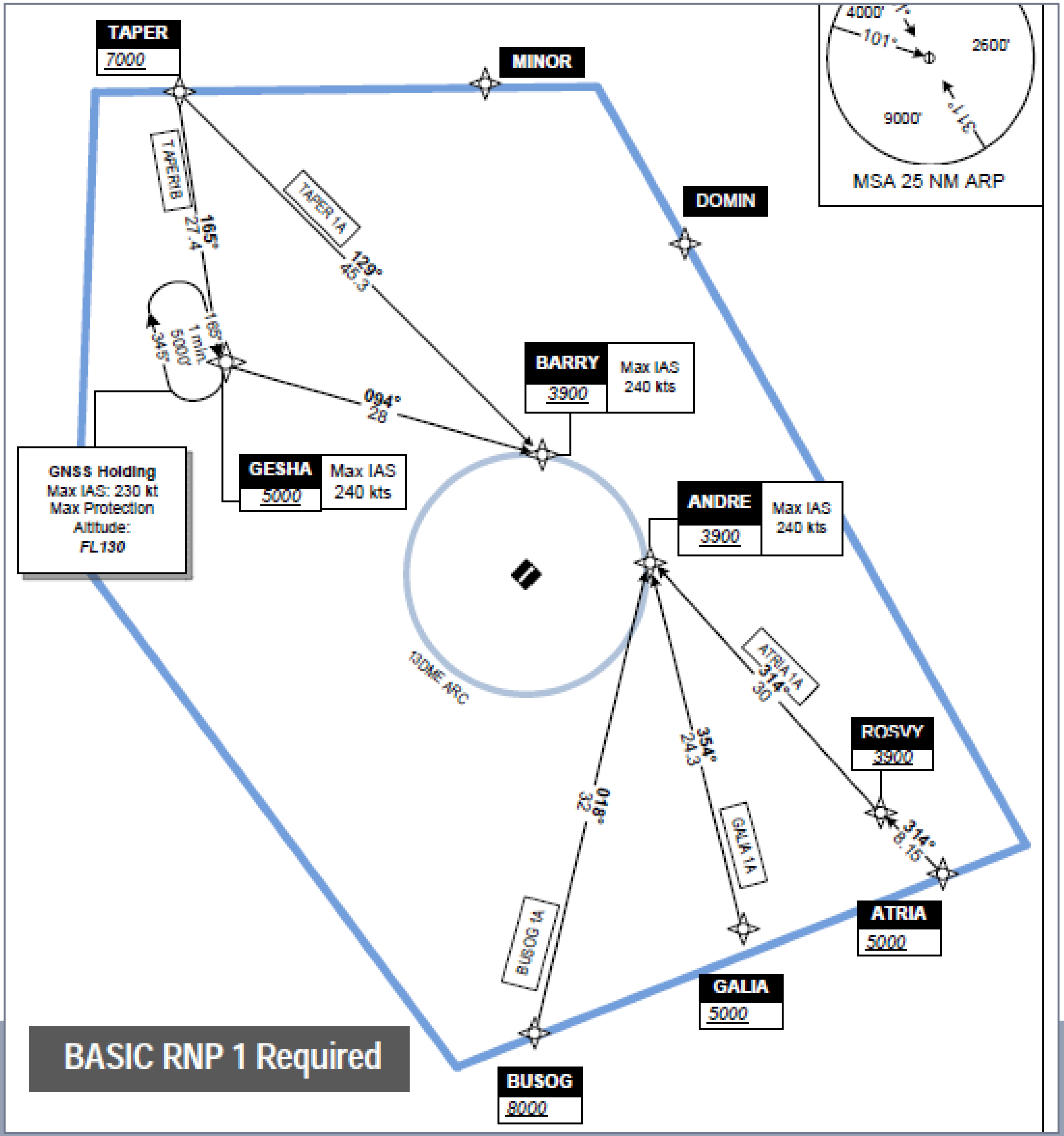
- TMA with several Entry Points
- STARs design to connect Entry Points to IAFs

T-Bar approach



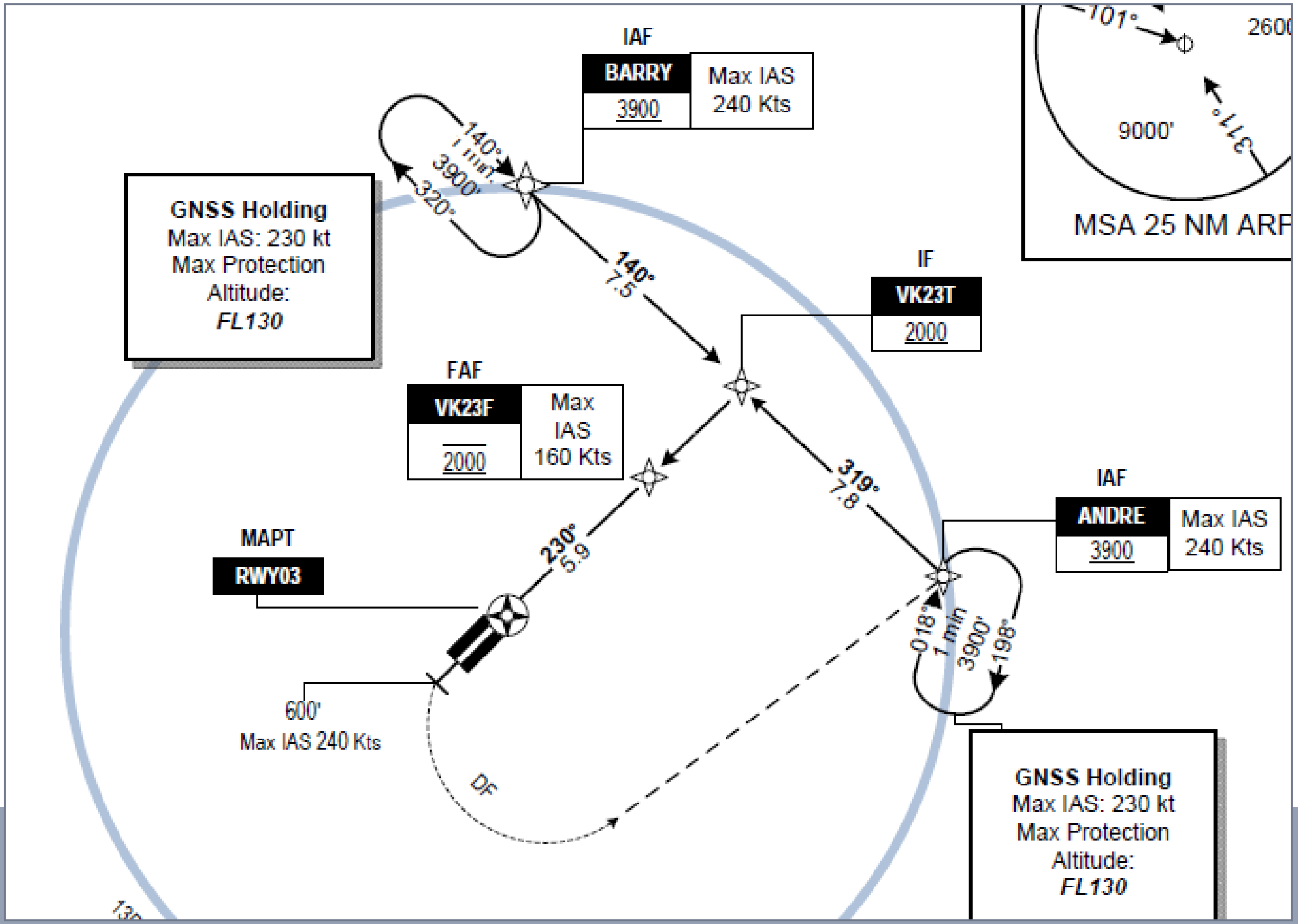
Step 3 – Conceptual Design – RW23 - STARs

- RNP1 STARs
- 2 IAFs
  - BARRY
  - ANDRE



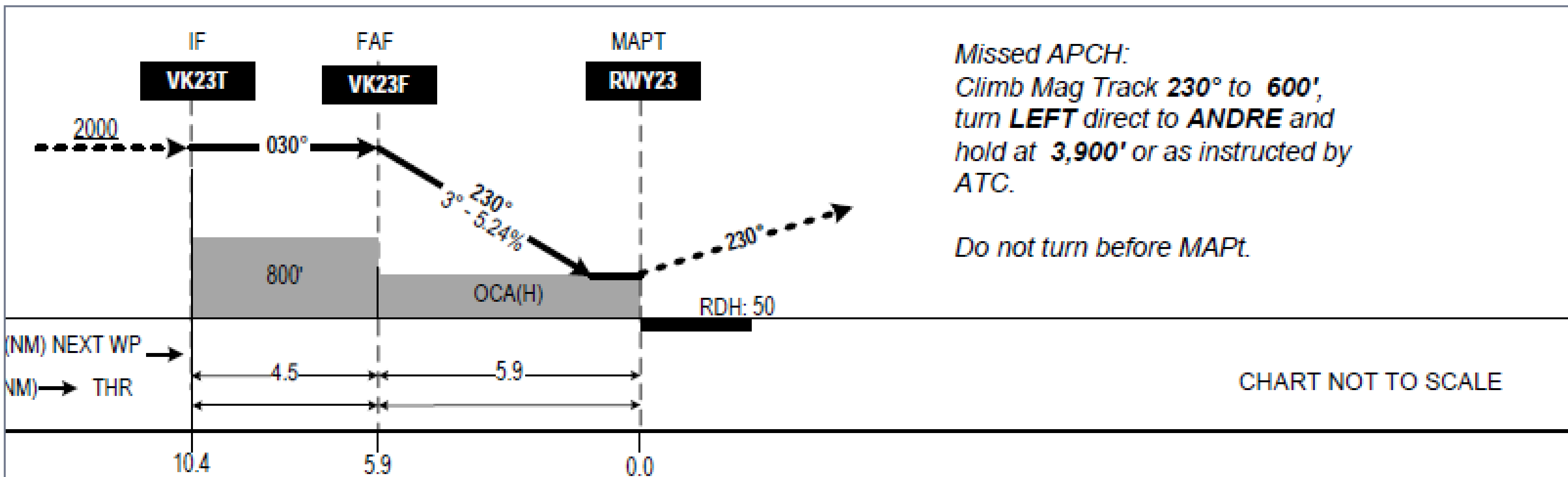
Step 3 – Conceptual Design – RW23 - Approach

- RNP-APCH
- T-bar concept – Approach over the sea (No limiting obstacles for design)
- 2 IAFs
  - BARRY
  - ANDRE
- ICAO 8168 compliant
  - TF-TF legs
  - Straight Final segment (Aligned with the runway)
  - Missed Approach to IAF ANDRE & Holding



Step 3 – Conceptual Design – RW23 - Approach

- Straight Final segment aligned with the runway
- Final segment: 3° VPA *(Baro-VNAV approach – Not temperature compensated)*
- MAPT collocated with RWY Threshold
- Missed approach to IAF ANDRE
- LNAV & LNAV/VNAV minima



		CAT A		CAT B		CAT C	
CIRCLING NOT AUTHORIZED		OCA(H)	VIS	OCA(H)	VIS	OCA(H)	VIS
	LNAV/VNAV	411(332)	1700	411(332)	1700	411(332)	1700
	LNAV	422(342)	1700	422(342)	1700	422(342)	1700

Step 3 – Conceptual Design – RW23 - Approach

- Fully coded STARs & Approach in NDB
- Lateral & Vertical Guidance

Step 3 – Conceptual Design

- Using all previous gathered data, a Conceptual Design maybe drafted

  - ✓ RW23
  - ✓ RW05

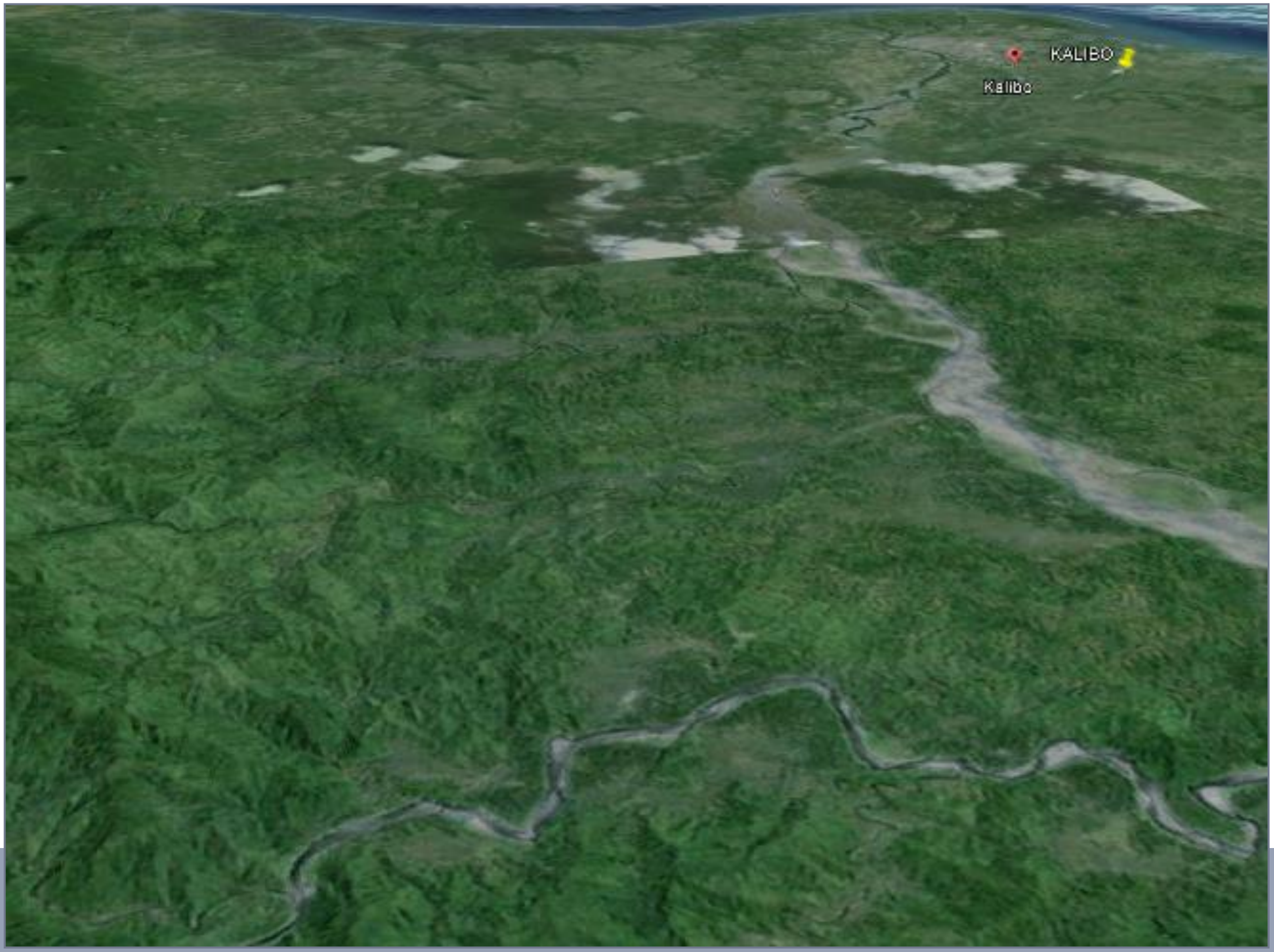
Step 3 – Conceptual Design – RW05

- Using all previous gathered data, a Conceptual Design maybe drafted

  - ✓ **RW05**
  - ✓ **Proposed solution ?**
  - ✓ **Nav Spec?**
  - ✓ **Proposed Design?**

Step 3 – Conceptual Design – RW05

- RW05
- High Terrain located West /South West of Kalibo



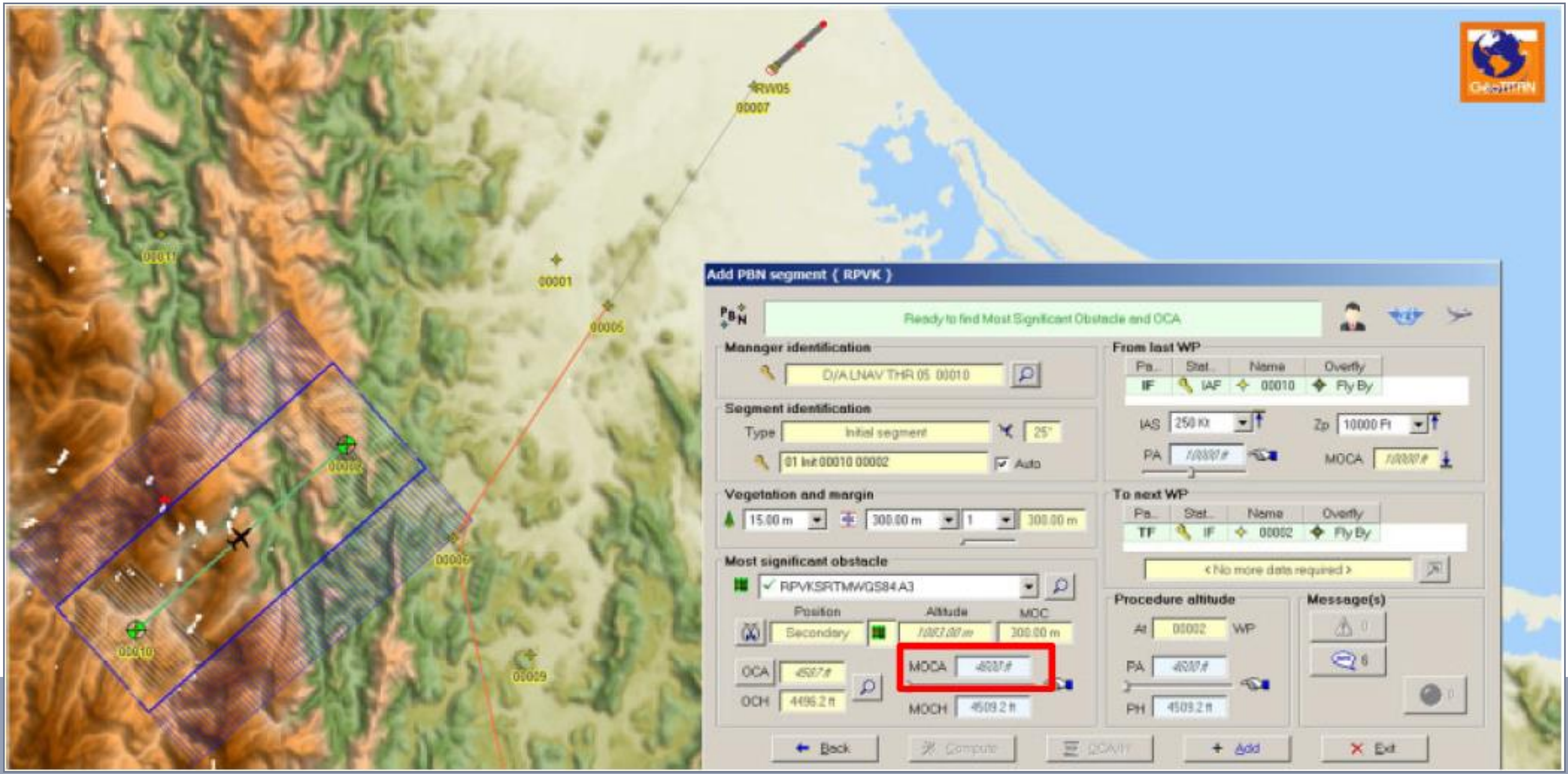
Study Case – Kalibo airport

Airport surrounded by:

- North/North East: Sea
- West/South West: Mountains

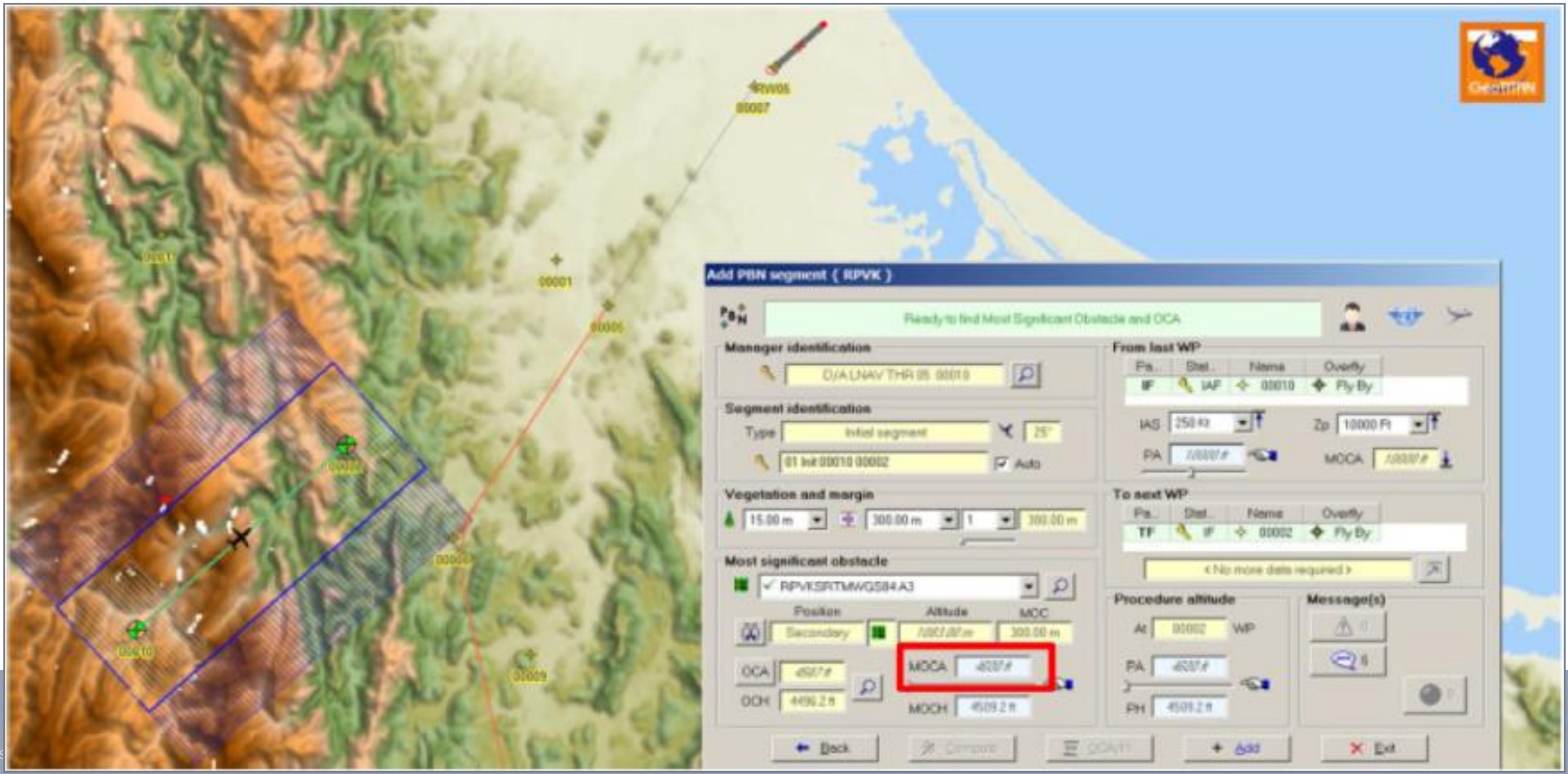
Step 3 – Conceptual Design – RW05 – *Proposal 1*

- Straight Initial / Intermediate segment aligned with the runway
- Initial / Intermediate segment over high terrain



Step 3 – Conceptual Design – RW05 – *Proposal 1*

- Initial segment MOCA = 5100ft
- FAF at 1800ft
- 3300ft to descend in Intermediate segment (3.5NM), i.e. 15% Descent Gradient…



Step 3 – Conceptual Design – RW05 – *Proposal 1*

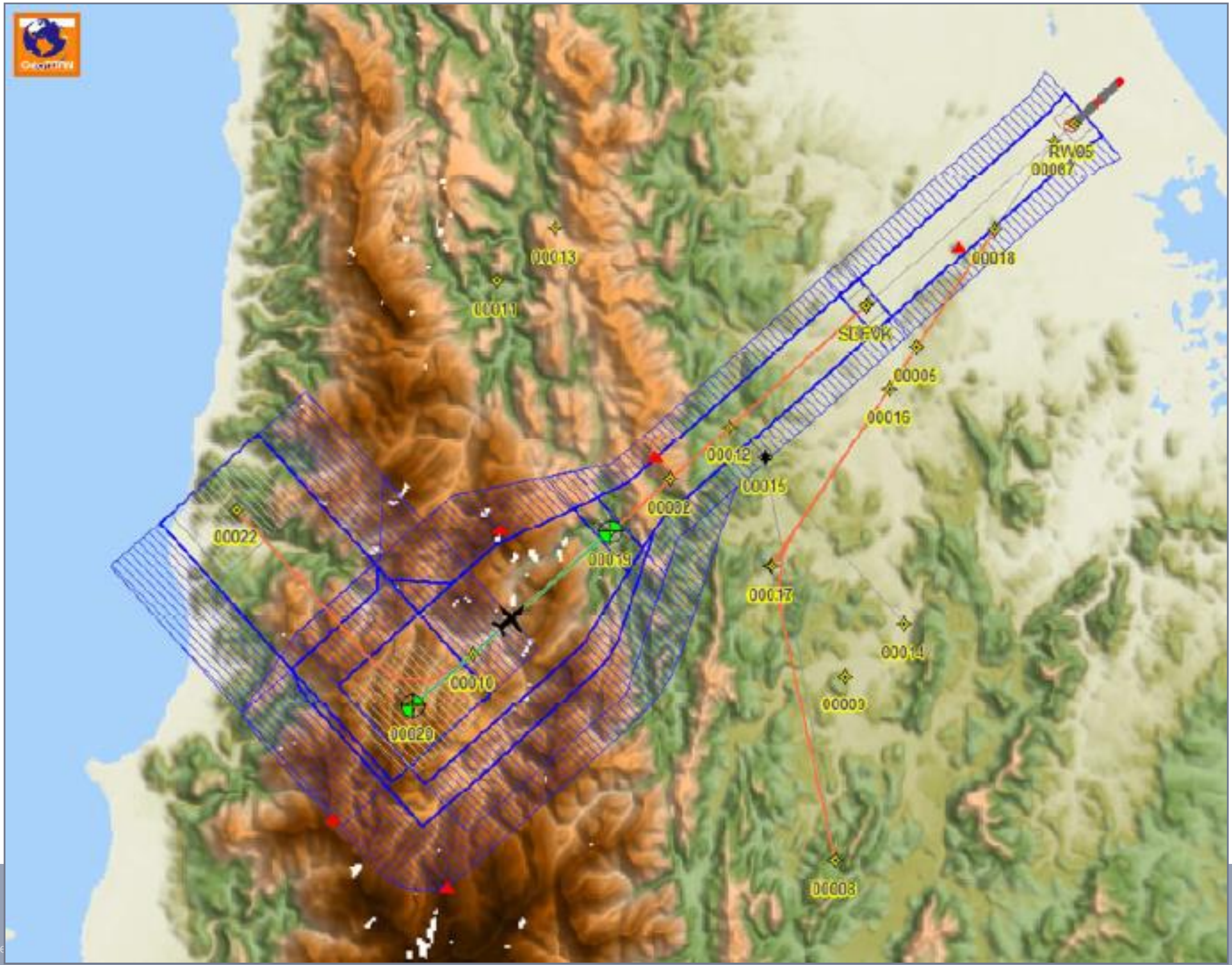
- Initial segment MOCA = 5100ft
- FAF at 1800ft
- 3300ft to descend in Intermediate segment (3.5NM), i.e. 15% Descent Gradient…

  - ✓ Smooth descent gradient managed by Airbus/Boeing aircraft # 4% (250ft/NM) in clean configuration
  - ✓ 15% Descent Gradient is not acceptable

Proposal 1 not adequate

Step 3 – Conceptual Design – RW05 – *Proposal 2*

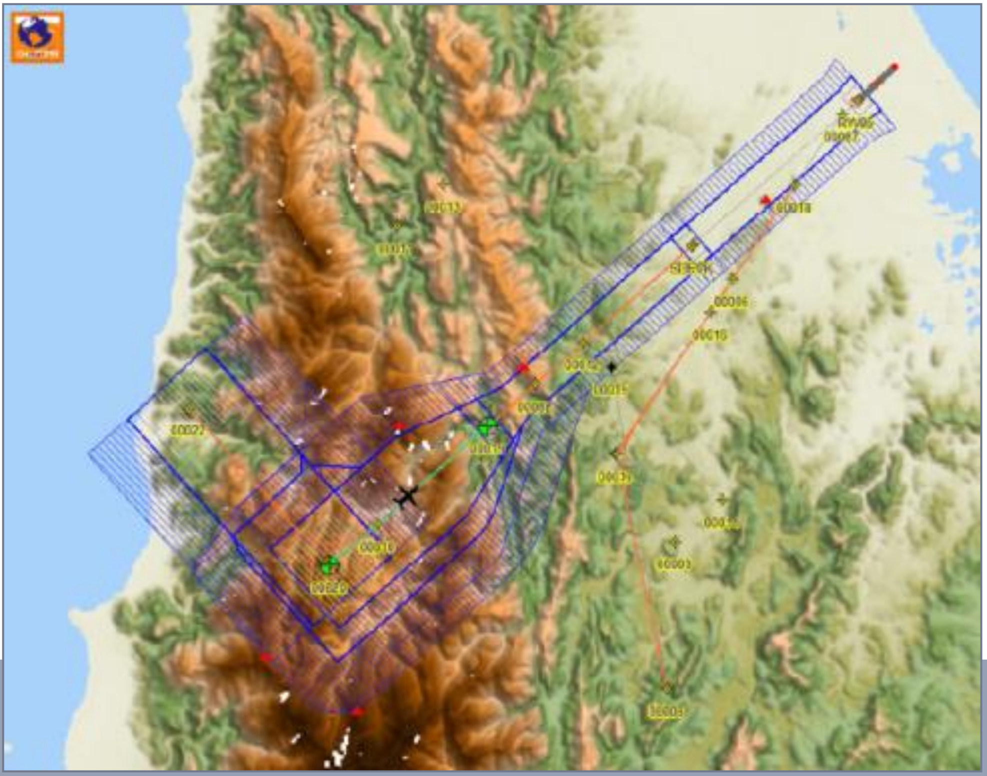
- Long Final Segment (12NM)
- FAF at 4500ft
- VPA 3.5°
- SDF 2150ft



Step 3 – Conceptual Design – RW05 – *Proposal 2*

- VPA 3.5°
- Baro-VNAV approach – Not temperature compensated
- Temperature may be high in Philippines and resulting VPA may reach 4°!

- Such high VPA should require specific test depending on the aircraft type :
  - Energy management
  - TAWS reactive mode - High descent rate in Final segment



Step 3 – Conceptual Design – RW05 – *Proposal 2*

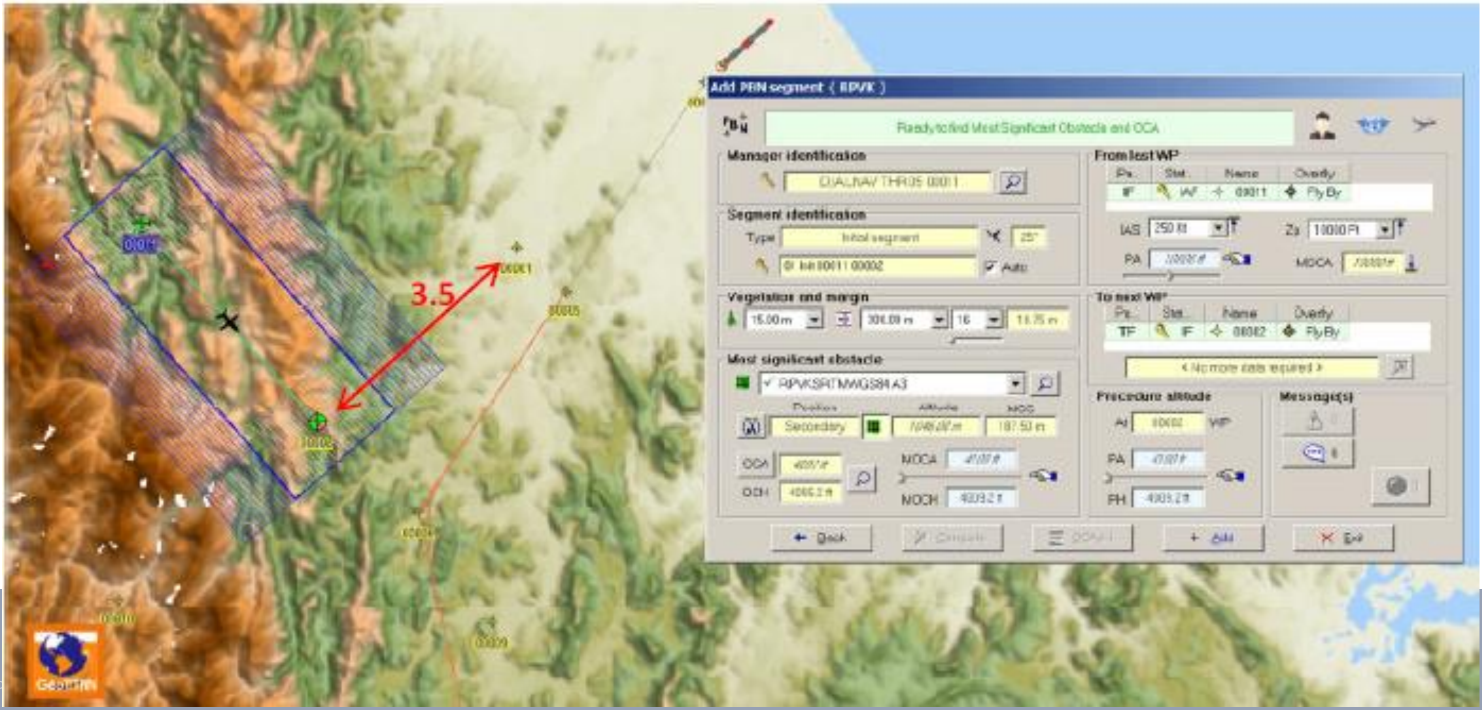
- VPA 3.5°
- Baro-VNAV approach – Not temperature compensated
- Temperature may be high in Philippines and resulting VPA may reach 4°!

Proposal 2 not adequate

Step 3 – Conceptual Design – RW05 – *Proposal 3*

- Initial Segment from North direction
- Minimum Intermediate segment length = 3.5NM *(stabilization distance)*
- MOCA of Initial segment too high, does not permit smooth descent gradient

North Arrival



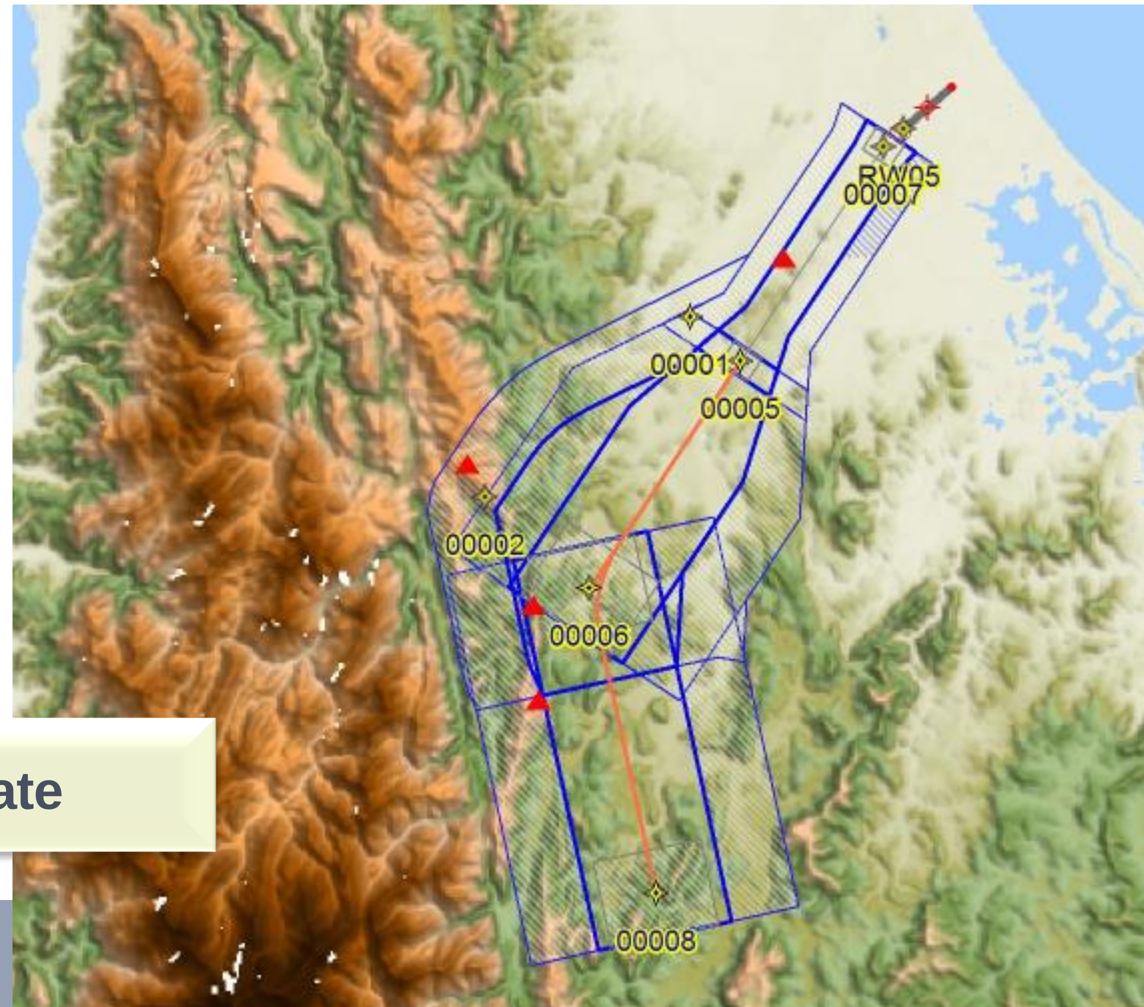
Step 3 – Conceptual Design – RW05 – *Proposal 3*

- Initial Segment from North direction
- Minimum Intermediate segment length = 3.5NM *(stabilization distance)*
- MOCA of Initial segment too high, does not permit smooth descent gradient

Proposal 3 not adequate

Step 3 – Conceptual Design – RW05 – *Proposal 4*

- Final segment with 15° offset (only authorized for LNAV, not applicable to Baro-VNAV)
- Does not permit to collocate MAPT and Runway Threshold
- Final not align with the runway
- Does not permit fully stabilized approach
- Not applicable to Baro-VNAV approach
- Not recommended



Proposal 4 not adequate

Step 3 – Conceptual Design – RW05 – *Proposal 5*

- Straight Final segment
- Intermediate segment:

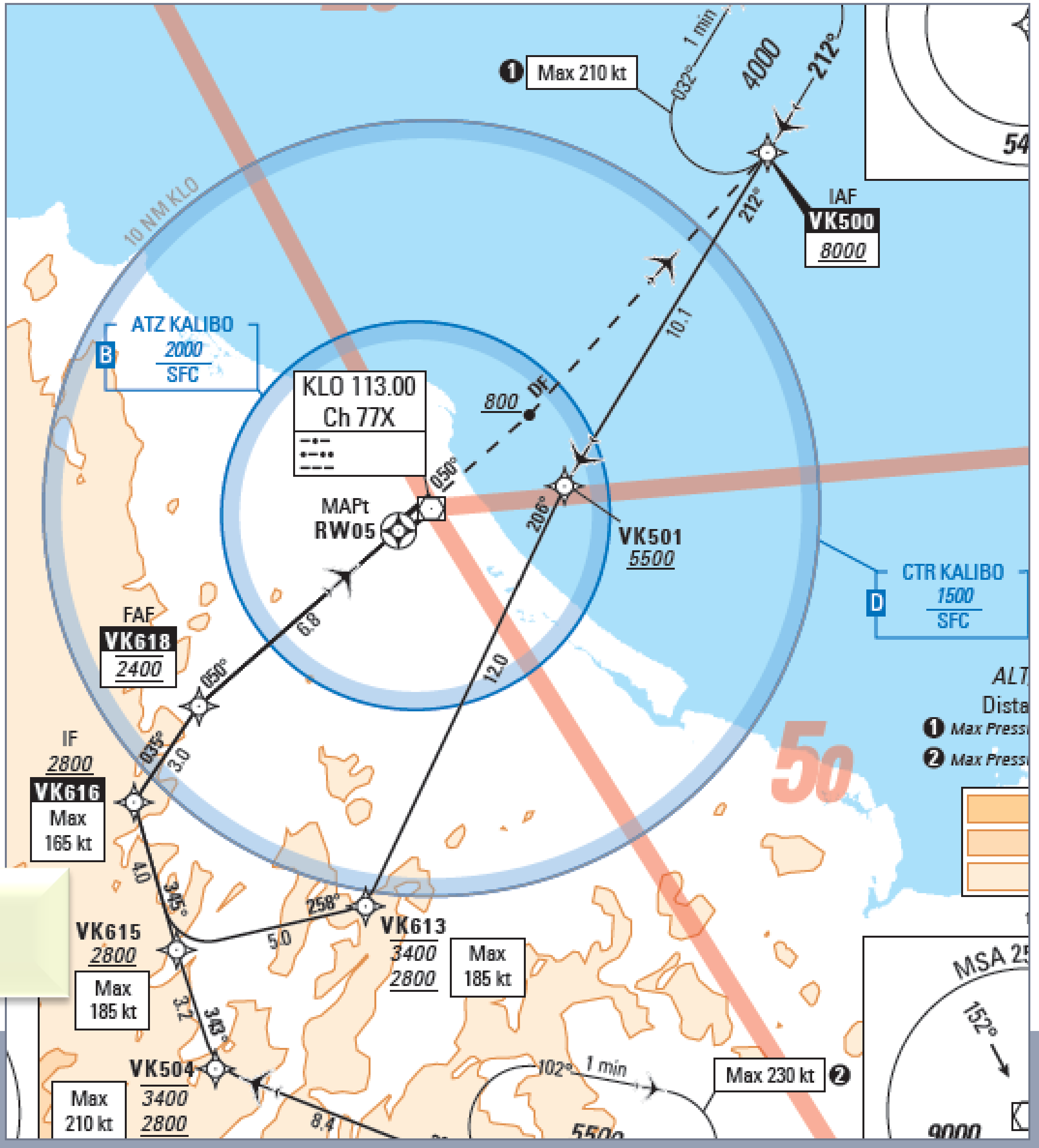
Offset at FAF

(Baro-VNAV: 15° max

LNAV only: 30° max)

- FAF 2400ft
- Final VPA 3.2°

Proposal 5 adequate

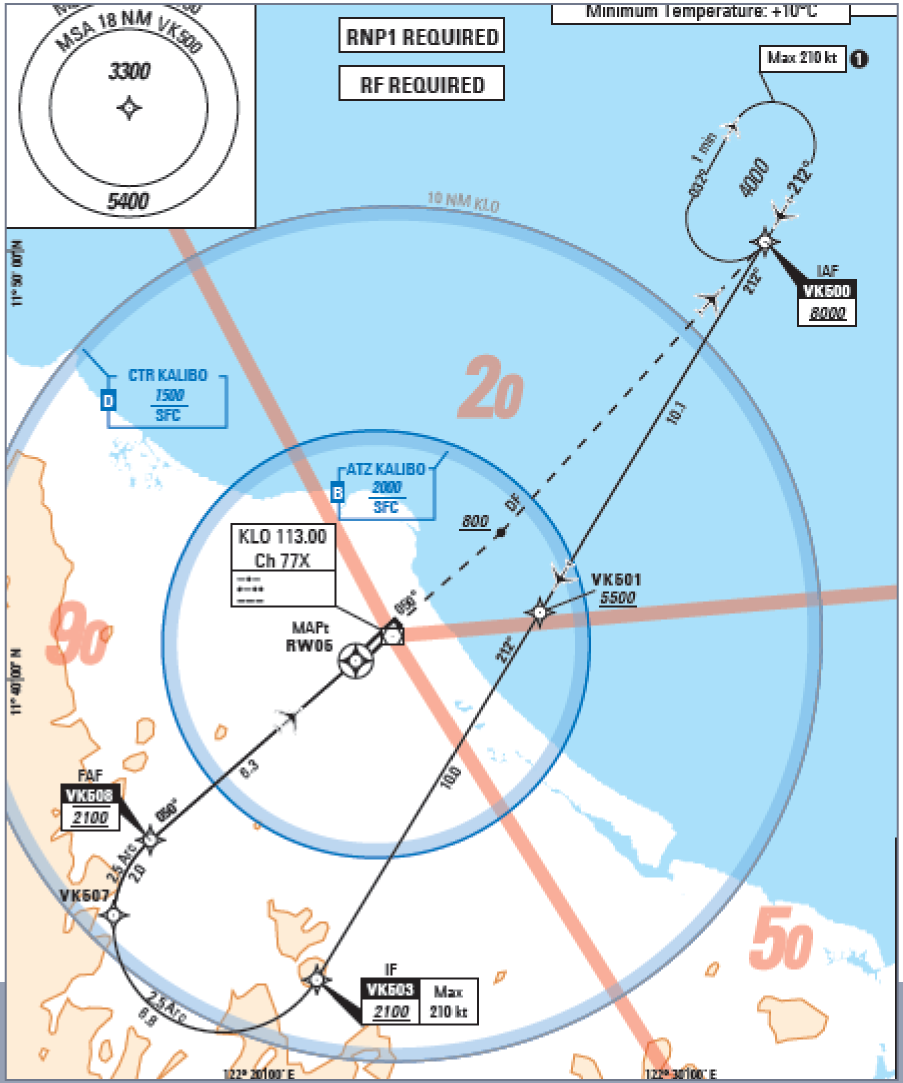


Step 3 – Conceptual Design – RW05 – *Proposal 6*

- Straight Final segment
- Intermediate segment:

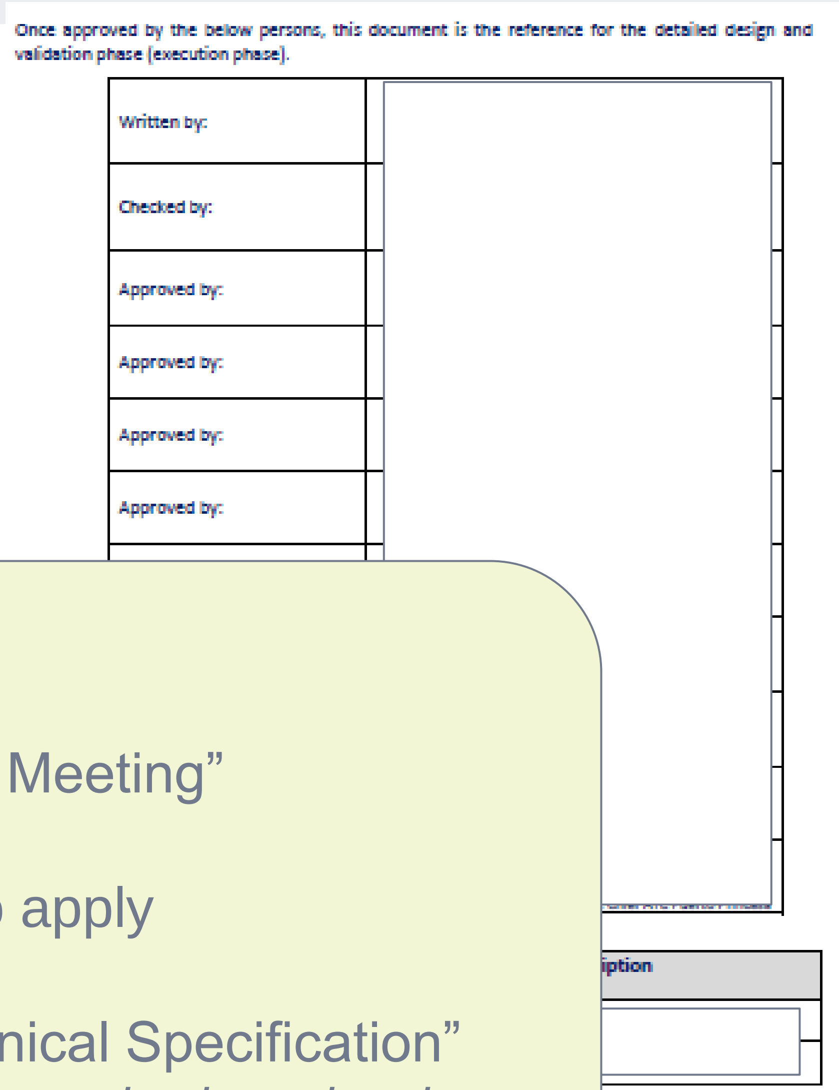
Including RF turn connected to FAF

- FAF 2100ft
- Final VPA 3.1°



Proposal 6 adequate

Step 4: Stakeholders review



Once approved by the below persons, this document is the reference for the detailed design and validation phase (execution phase).

Written by:	
Checked by:	
Approved by:	
Approved by:	
Approved by:	
Approved by:	

Role / Responsibilities

- ❑ CAA/ANSP to organize “Kick Off Meeting”
- ❑ CAA to provide the Regulation to apply
- ❑ CAA/ANSP to produce the “Technical Specification” *(Document gathering all assumptions, organization, planning, conceptual design etc)*

Step 5 to 6 – Apply Criteria & Documentation

Role / Responsibilities

❑ Procedure Designer to perform the Detailed Design
As per Technical Specification document and regulation

❑ CAA to provide the Regulation to apply

❑ It is the State's responsibility to define the minimum period of time during which this documentation must remain available

Step 7 – Safety Assessment

Role / Responsibilities of CAA/ANSP

- ❑ Provide the Safety Assessment responsible/Organisation
- ❑ Severity/Likelihood/Risk Matrix published by the State
- ❑ Validate/Approve the Safety Assessment
- ❑ Audits (all mitigation means should be stated and followed-up)

Step 8 & 9 – Validation & Consult Stakeholders

Role / Responsibilities of CAA/ANSP

- CAA to define the minimum requirements for Procedure Validation & Documentation
- CAA to organize the "Detailed Design Review" *(DDR)* meeting with Stakeholders *(if required)*
- CAA/ANSP/… to send outputs of DDR to all stakeholders for agreement

Step 10 - Approval

Role / Responsibilities of CAA/ANSP

- CAA to define the minimum requirements for Procedure Approval & Documentation, e.g.:
  - *Data Survey report*
  - *Technical report*
  - *Validation report*
  - *Safety Assessment report*
  - *etc*
- CAA to specify the entity to “Approve” the IFP (*DG, ANSP, other?)*

Step 11 to 13 - Publication

Role / Responsibilities of CAA/ANSP

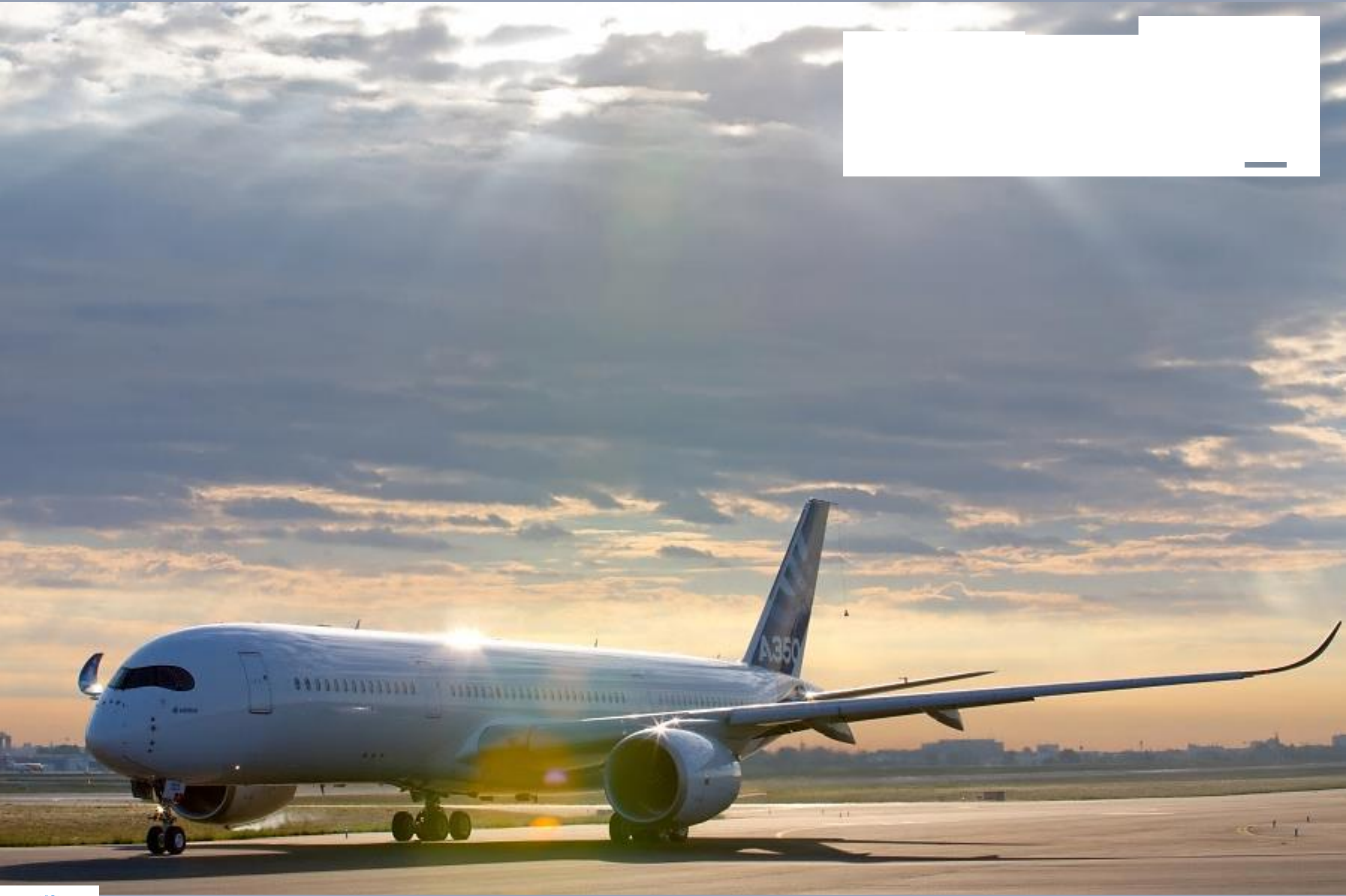
- ❑ ANSP/AIS to produce draft charts
- ❑ The publication of the IFP and supporting data is normally a State responsibility.

In some situations, it is possible that the publication may be delegated to another entity

Step 14 to 16 – After Publication

Role / Responsibilities of CAA/ANSP

- ❑ Questionnaire/Forms to be put in place for airspace users feedback & Process to post treat data
- ❑ Maintenance is achieved all along the procedure life, each time any new data may impact the procedure
- ❑ CAA to define the periodic basis to perform Procedure Review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Quality Assurance Introduction

ICAO AFPP

Any Questions?