Don-Jacques OULD FERHAT
VP Airspace and Airlines Services

Airbus
PBN Safety programs

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Long term cooperation with China

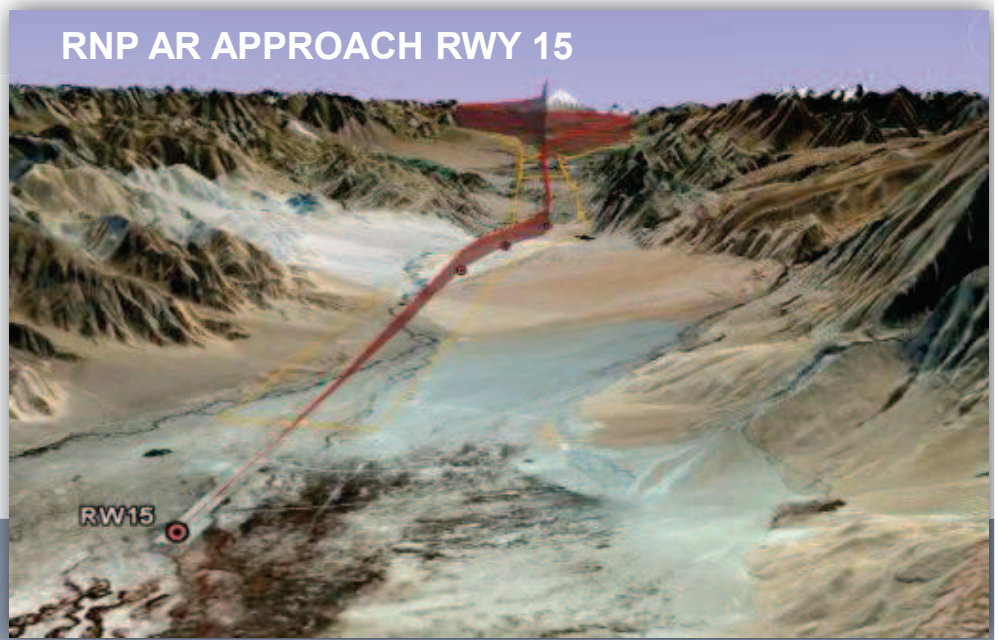
Complex projects in China

RNP AR at Kathmandu airport

Cochin : First RNP APCH in India

Nationwide implementation plan in the Philippines

- RNP AR at Lhasa, Linzhi, Shigatse, Bangda, Ali, Liping and Yan'an airports
- **High elevation and terrain challenging airports**
- RNP network between the different airports
  - **From departure to arrival**
- RNP APCH in Sanya
- RNP to ILS at Xian and Zhangjiajie

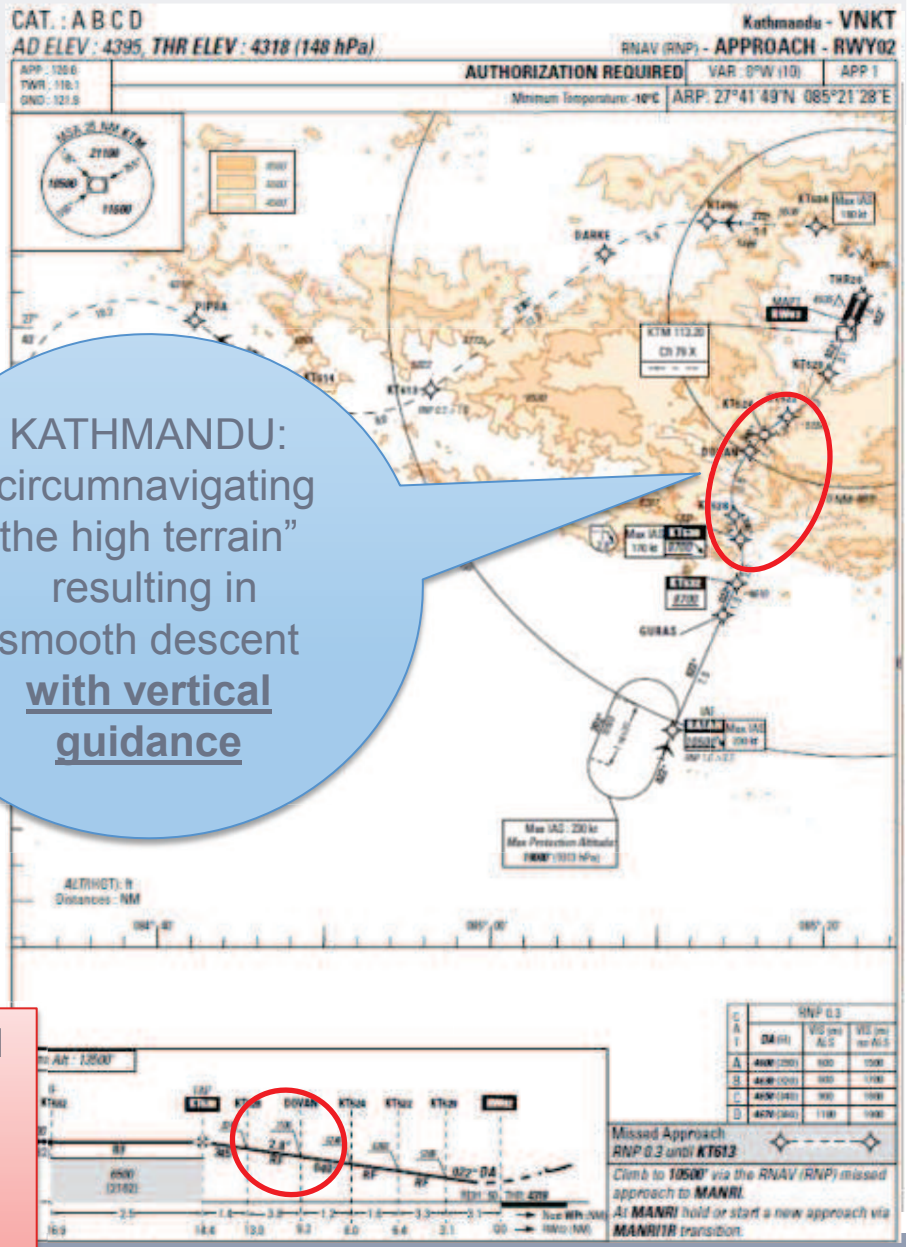


Challenging airport operations

Complex projects in China

RNP AR at Kathmandu airport

KATHMANDU: "circumnavigating the high terrain" resulting in smooth descent **with vertical guidance**



- **RNP-1 STARs and RNP AR approach and missed approach**
- **Fully Managed Approach and Missed Approach**
- **Smooth 2.8° descent slope / Stabilized approaches**
- **Lower minima : 340ft DH vs. 635 ft MDH**

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Tutoring initiatives worldwide

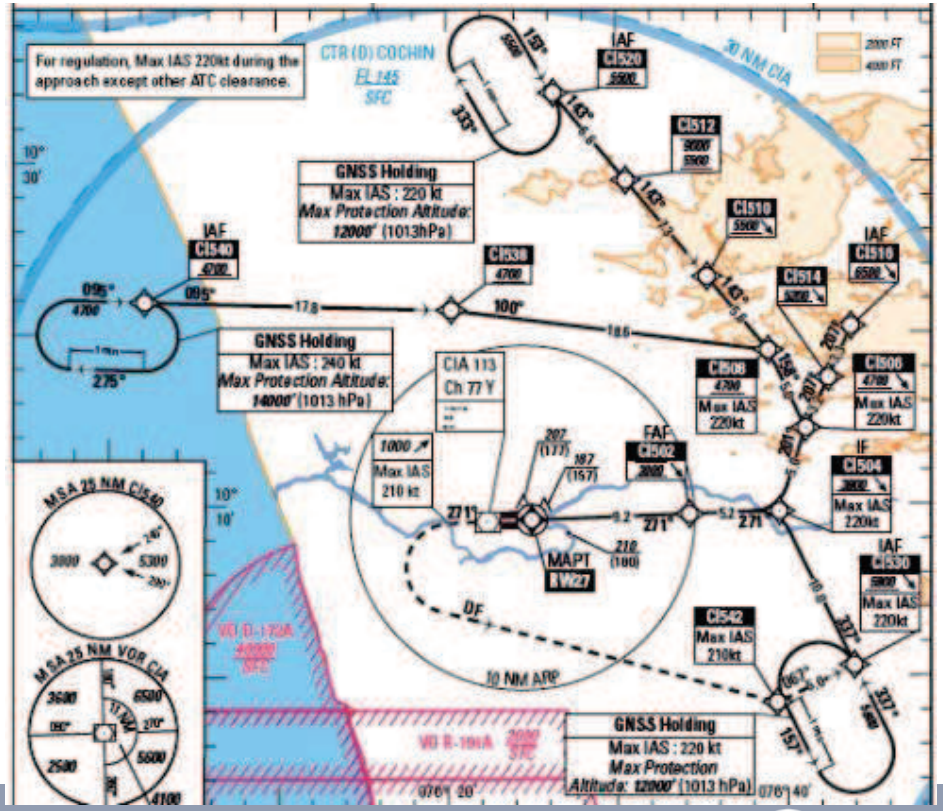
Complex projects in China

RNP AR at Kathmandu airport

Cochin : First RNP APCH in India

Nationwide implementation plan in the Philippines

- Support to Airport Authority of India
- RNP-1 STARs and RNP APCH approach to RWY 27
- Seventh Busiest airport in India
- 40nm shorter flight path compared to conventional VOR



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PBN network and transfer of knowledge at 12 airports in the Philippines

Complex projects in China

RNP AR at Kathmandu airport

Cochin : First RNP APCH in India

Nationwide implementation plan in the Philippines

- **Tutoring : CAAP procedure designers benefit from Quovadis / ENAC advice and validation at 6 airports**
- **Training : ATC, data survey, procedure design, flight Inspectors, safety assessment**
- **Efficient : CAAP will be fully autonomous at the end of the project**
- **Quovadis design at 6 airports to speed up the implementation**

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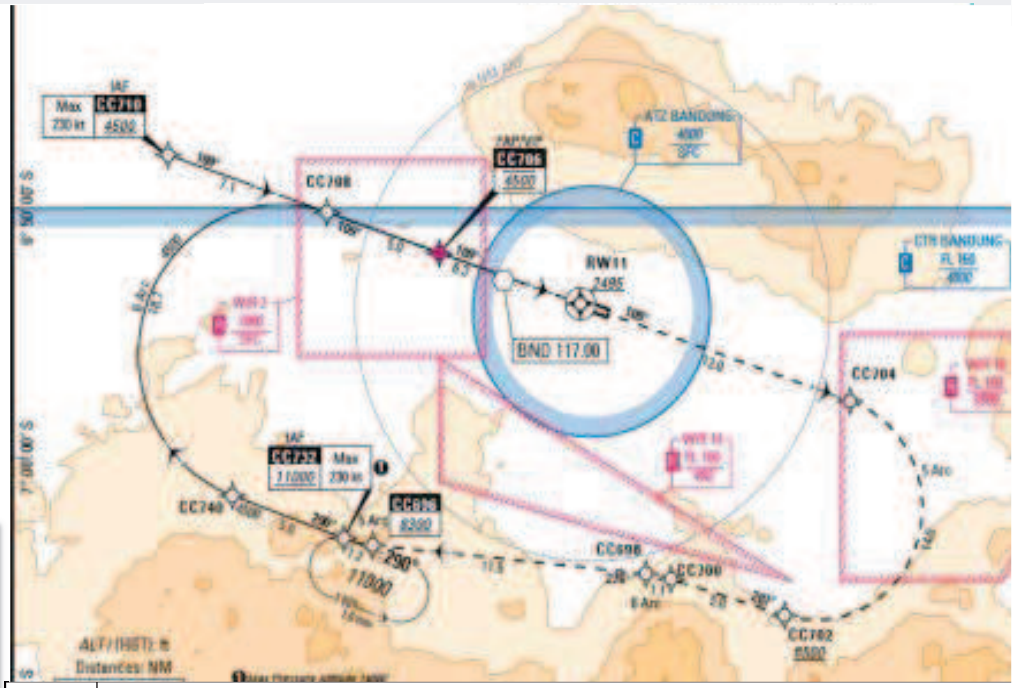
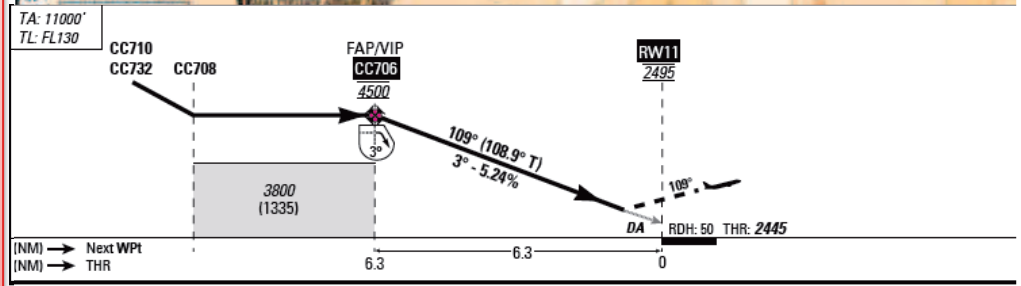
Removal of visual and circle-to-land procedures

- **Drawbacks of Circling:**
  - Challenging flying procedure in marginal visual conditions
  - “Disliked” by most pilots
  - Identified as a major cause of several fatal accidents
  - Needs specific training

- **Removal of circling and visual procedures without need for additional ground infrastructure**
- **Reduction of tailwind landings on short runways to avoid the circling**
- **Might require flexibility in terms of trajectories (curved path) depending on surrounding terrain**





AD minima: Altitude and Height in feet. VIS and RVR in meters. REF HGT: *THR ELI*

M.A. Climb Gradient : **2.5%** 152 ft/NM

RNP **0.3**

CAT	*DA*(H)	Vis (m) ALS	Vis (m) no ALS
CAT A	***2820'*** (370')	**1000**	**1700**
CAT B	***2830'*** (380')	**1000**	**1700**
CAT C	***2840'*** (390')	**1100**	**1800**
CAT D	***2850'*** (400')	**1100**	**1800**

Missed Approach

Climb to ***8300'*** (5855') via the **RNAV(RNP) missed approach** to **CC732**. At **CC732** hold or start a new app via **CC732**.

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ASBU Block Upgrades

CCO and CDO implementation listed as near term (now thru 2018) steps in the ICAO Aviation System Block Upgrades and Global Air Navigation Capacity & Efficiency Plan

Module	Performance Improvement Area	Module Title	Module Description
B0-05	Efficient Flight Path	Improved Flexibility and Efficiency in Descent Profiles **(CDO)**	To use performance-based airspace and arrival procedures allowing aircraft to fly their optimum profile using continuous descent operations (CDOs). This will optimize throughput, allow fuel efficient descent profiles and increase capacity in terminal areas.
B0-20	Efficient Flight Path	Improved Flexibility and Efficiency in Departure Profiles - Continuous Climb Operations **(CCO)**	To implement continuous climb operations in conjunction with performance-based navigation (PBN) to provide opportunities to optimize throughput, improve flexibility, enable fuel-efficient climb profiles and increase capacity at congested terminal areas.

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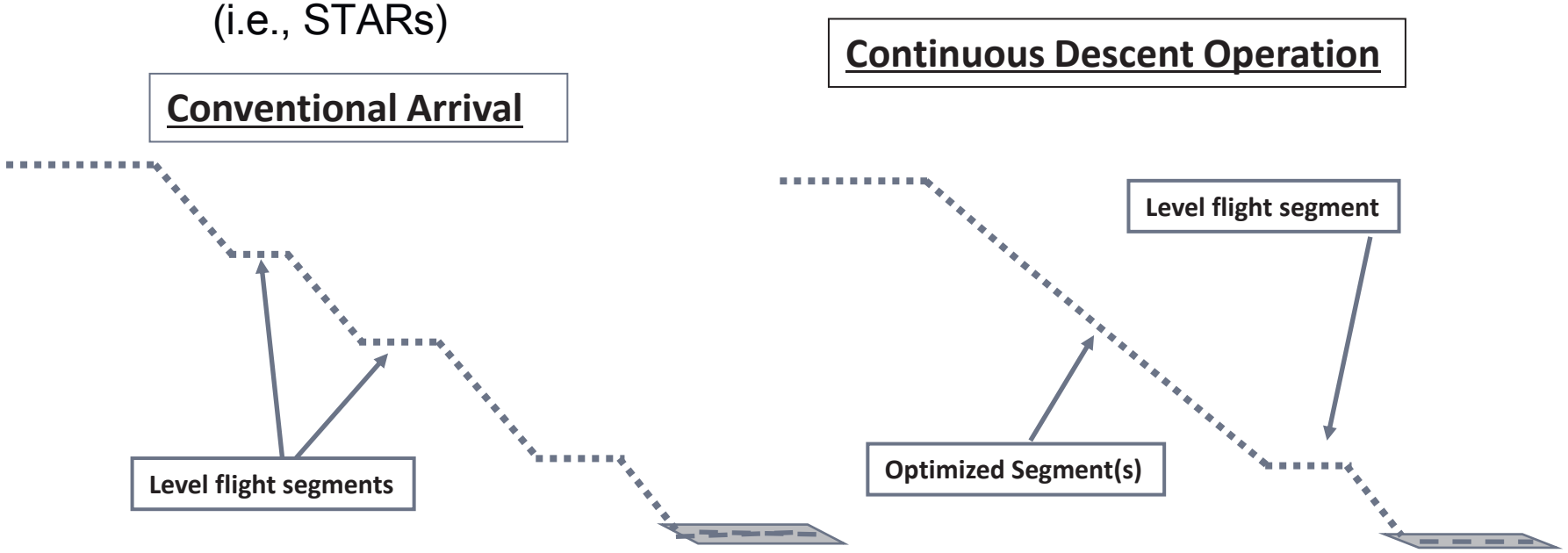
CDO Side View

Continuous Descent Operations (CDO) vs Conventional Arrival

- Leverages RNAV STAR implementations
- Reduce the amount of time spent in level flight on published arrival procedures (i.e., STARs)



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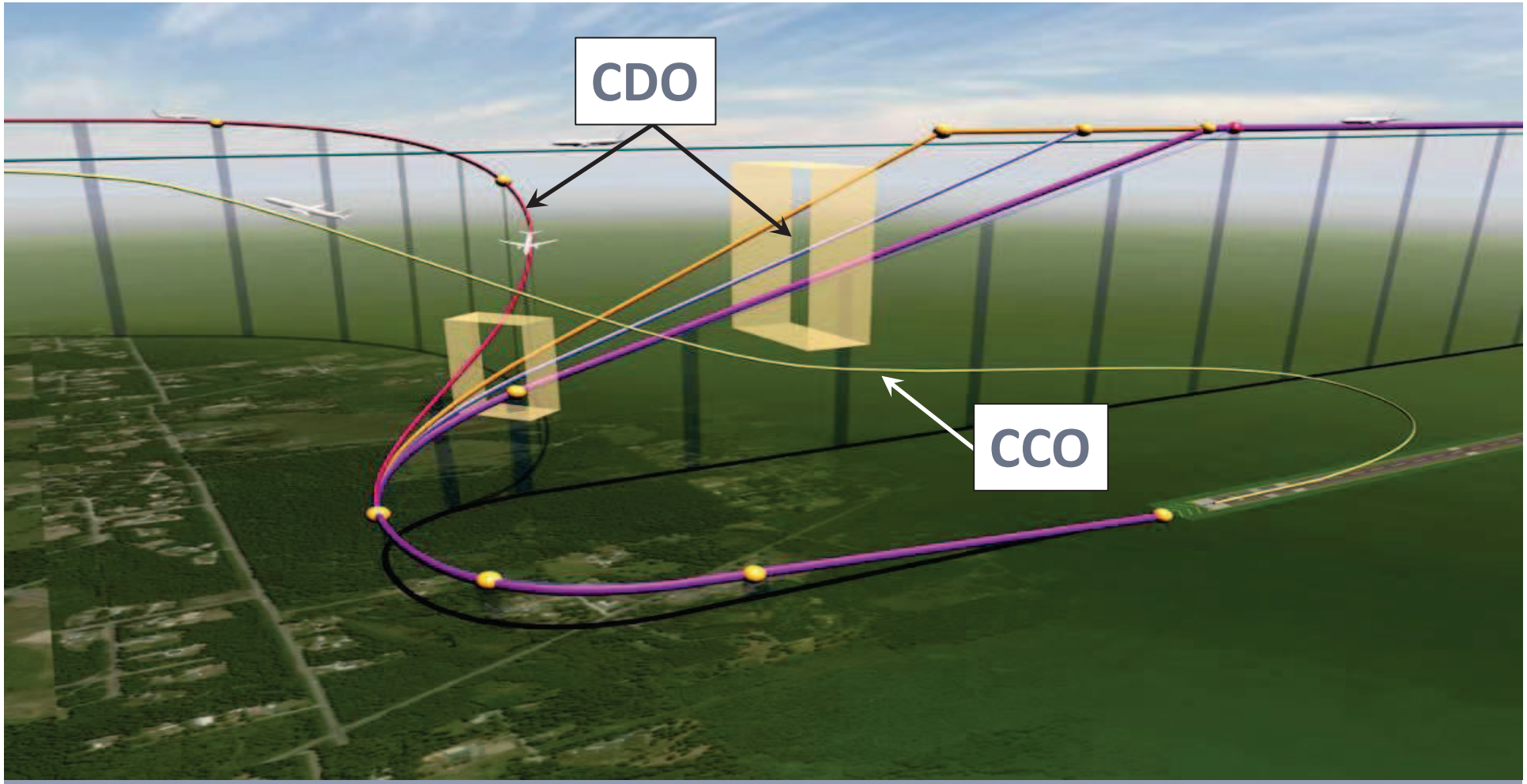
Closed Path Design

Altitude windows safely separate aircraft and allow predictable flight performance



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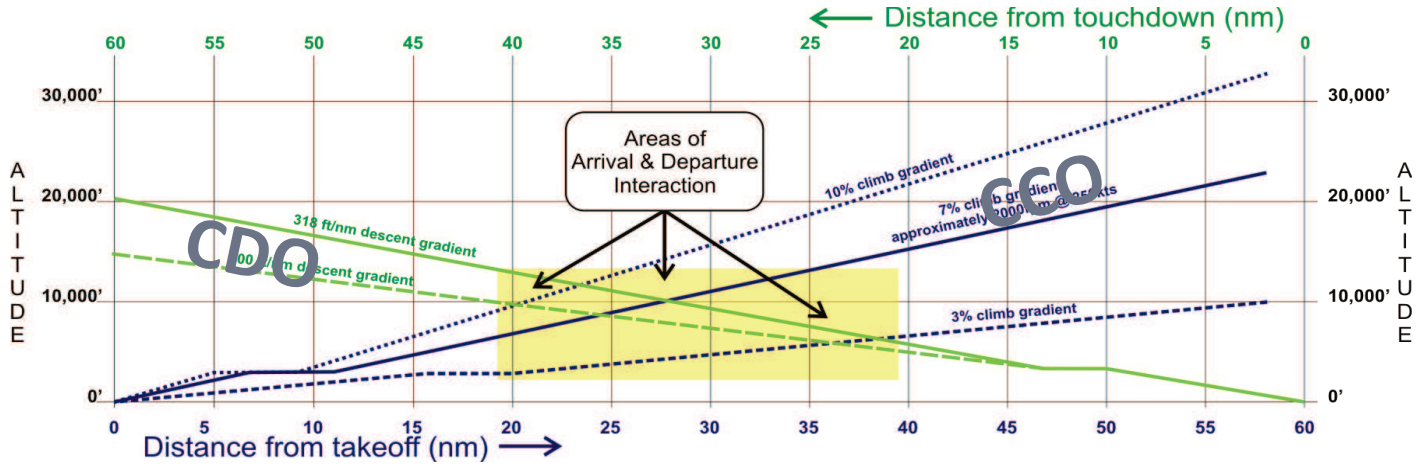
ATC Integration

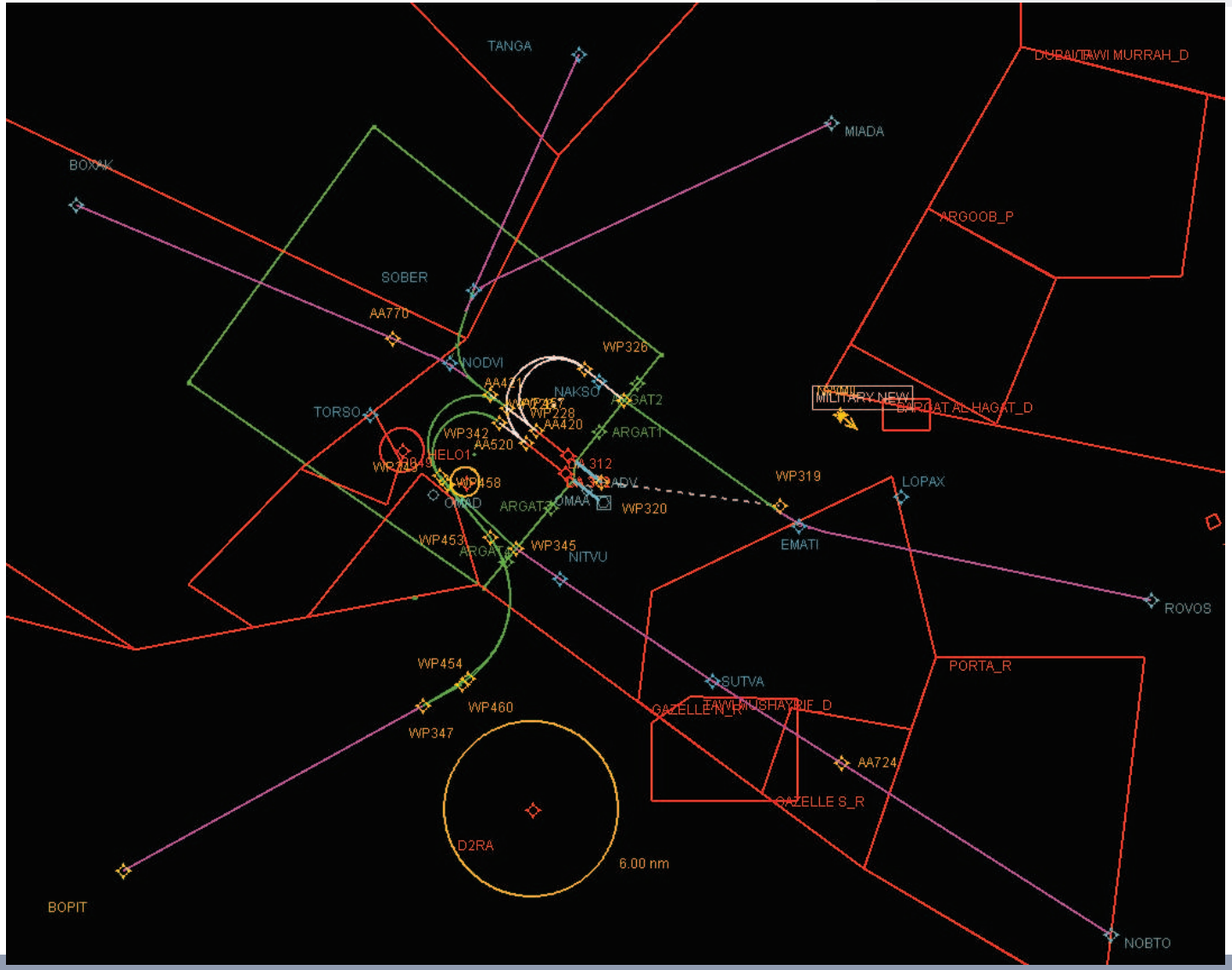
ATC operating procedures to accommodate PBN.

- Design using updated techniques to minimize interaction
  - CDO
  - CCO

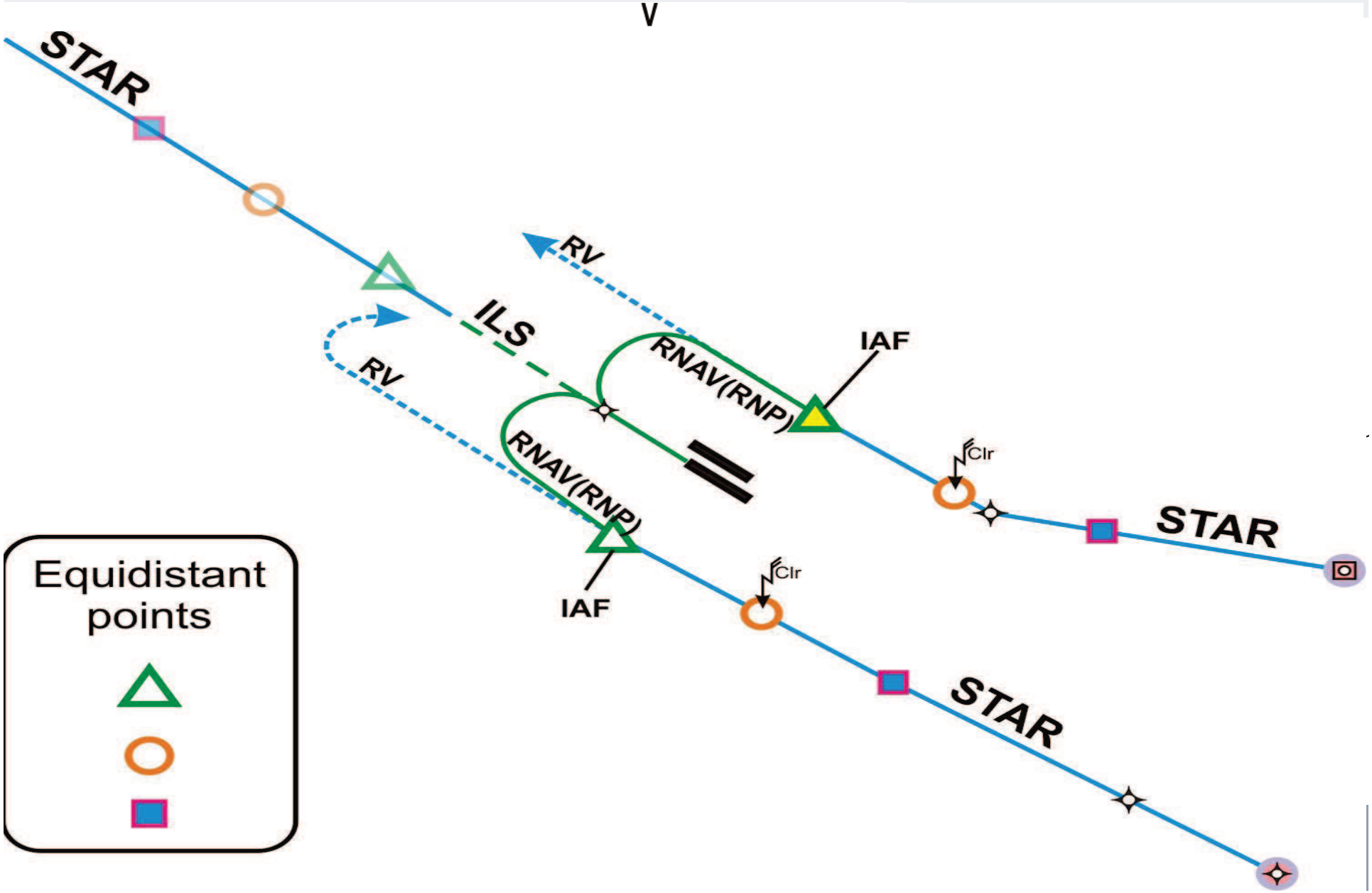


- Education is critical
  - Concept of operations
  - ATC benefits
  - Clear responsibilities defined
  - Structured Decision Points give ATC ability to judge control actions early.

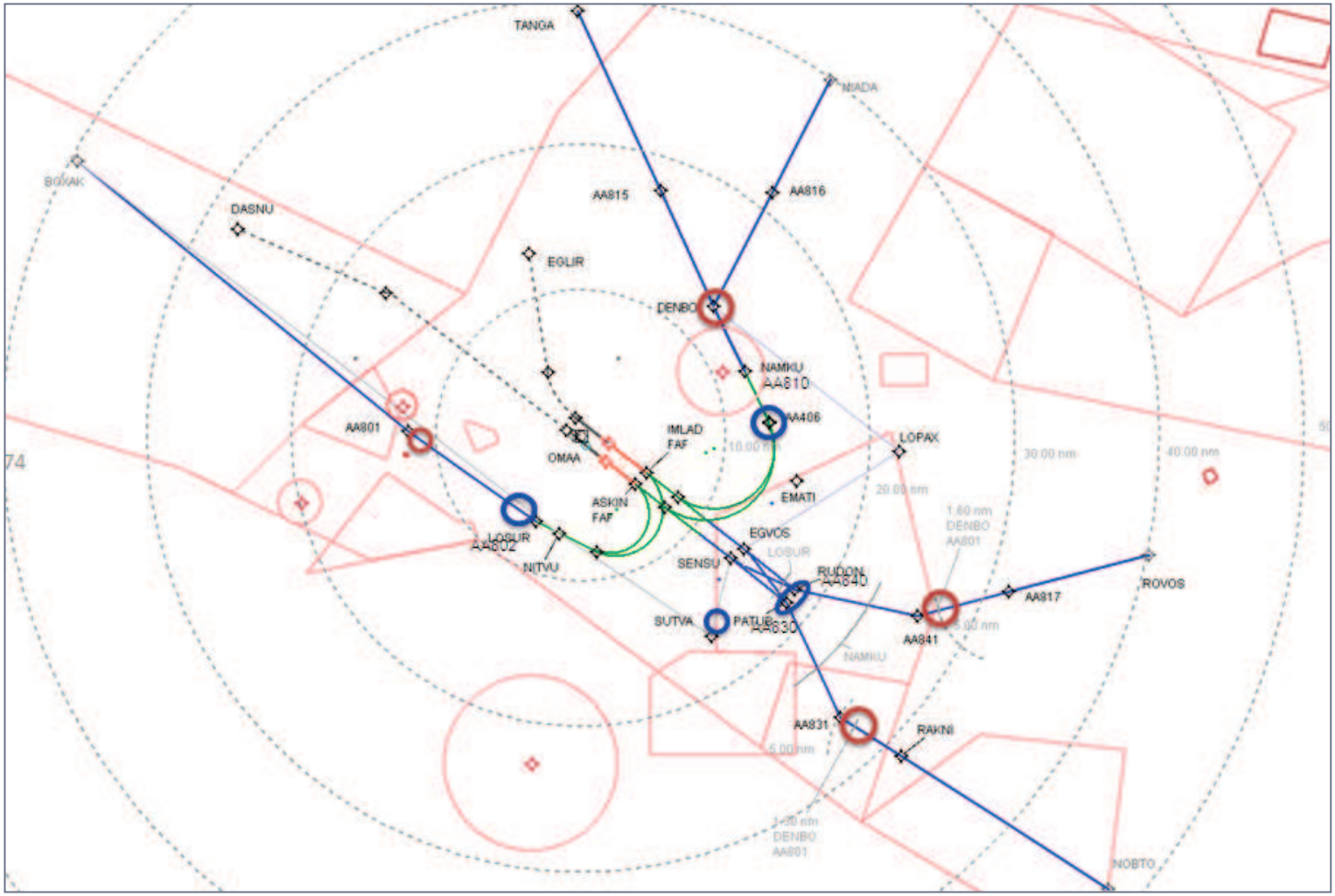
OMAA: RWY 13R/L



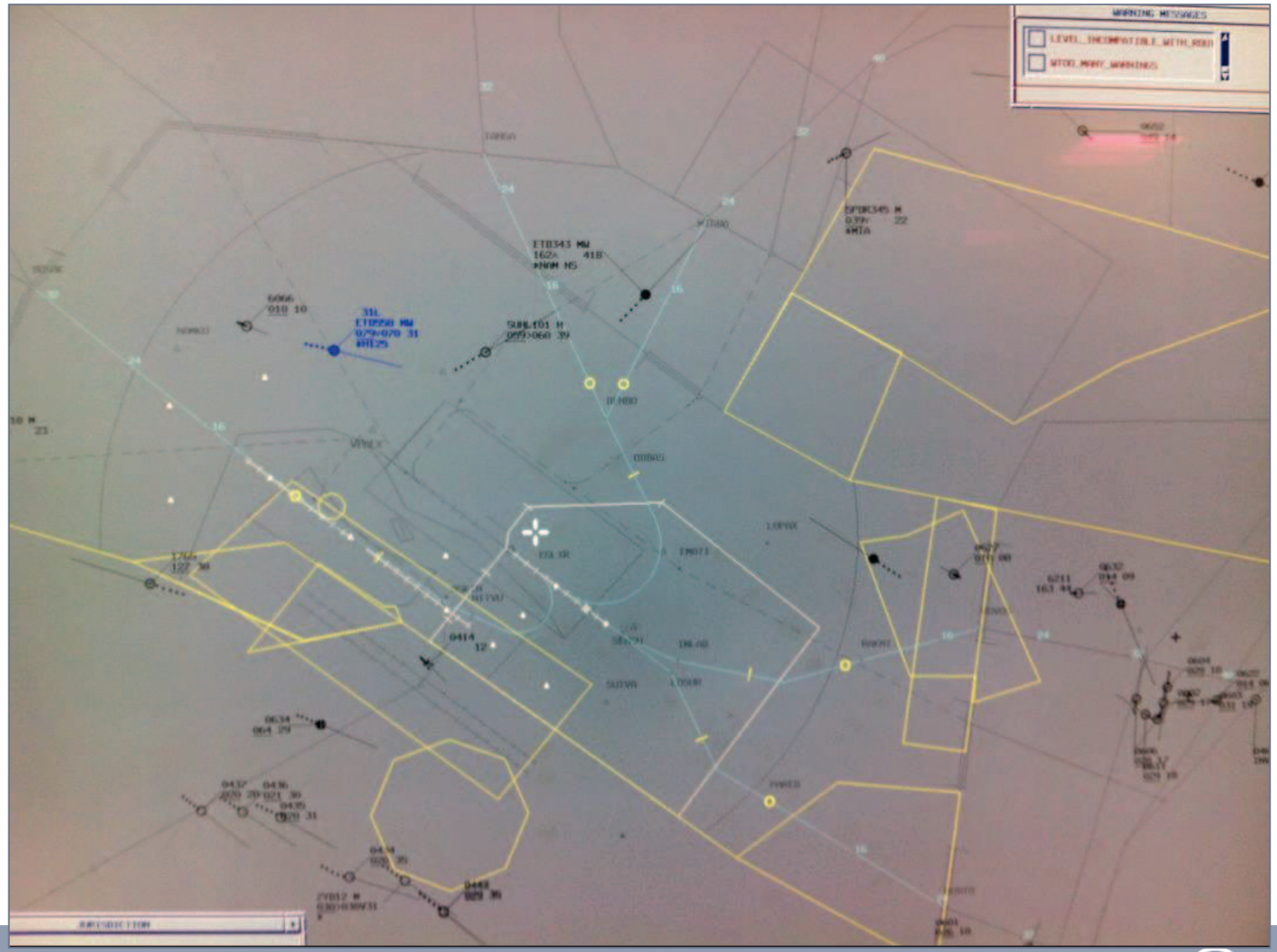
PBN CCO/CDO Sequencing Methods



Integration of traffic from various arrival routes

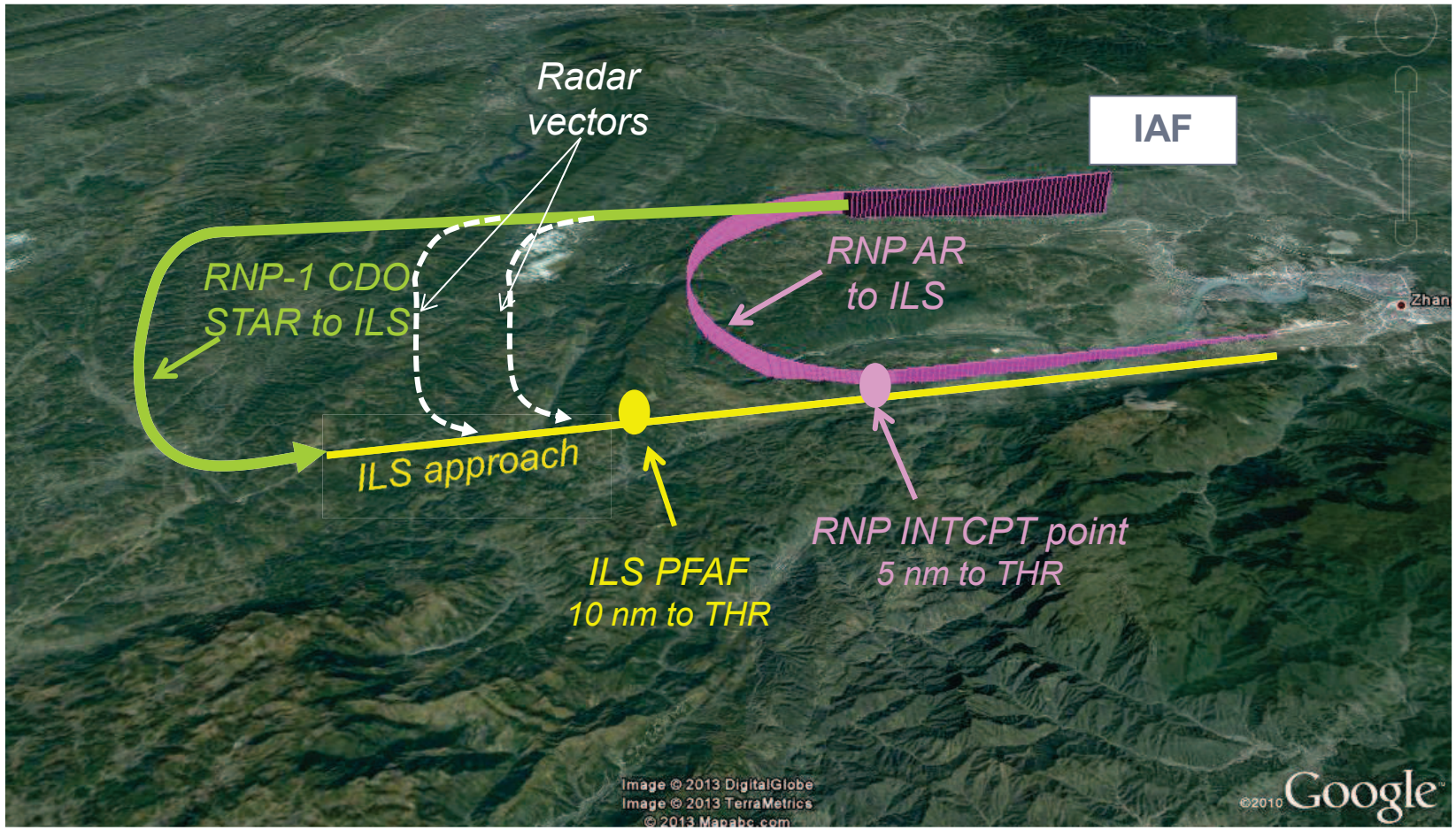


Display of RNP tracks on the ATC radar screen



CDO Integration Techniques

Good Design Integrates PBN, CDO, & Conventional Capabilities



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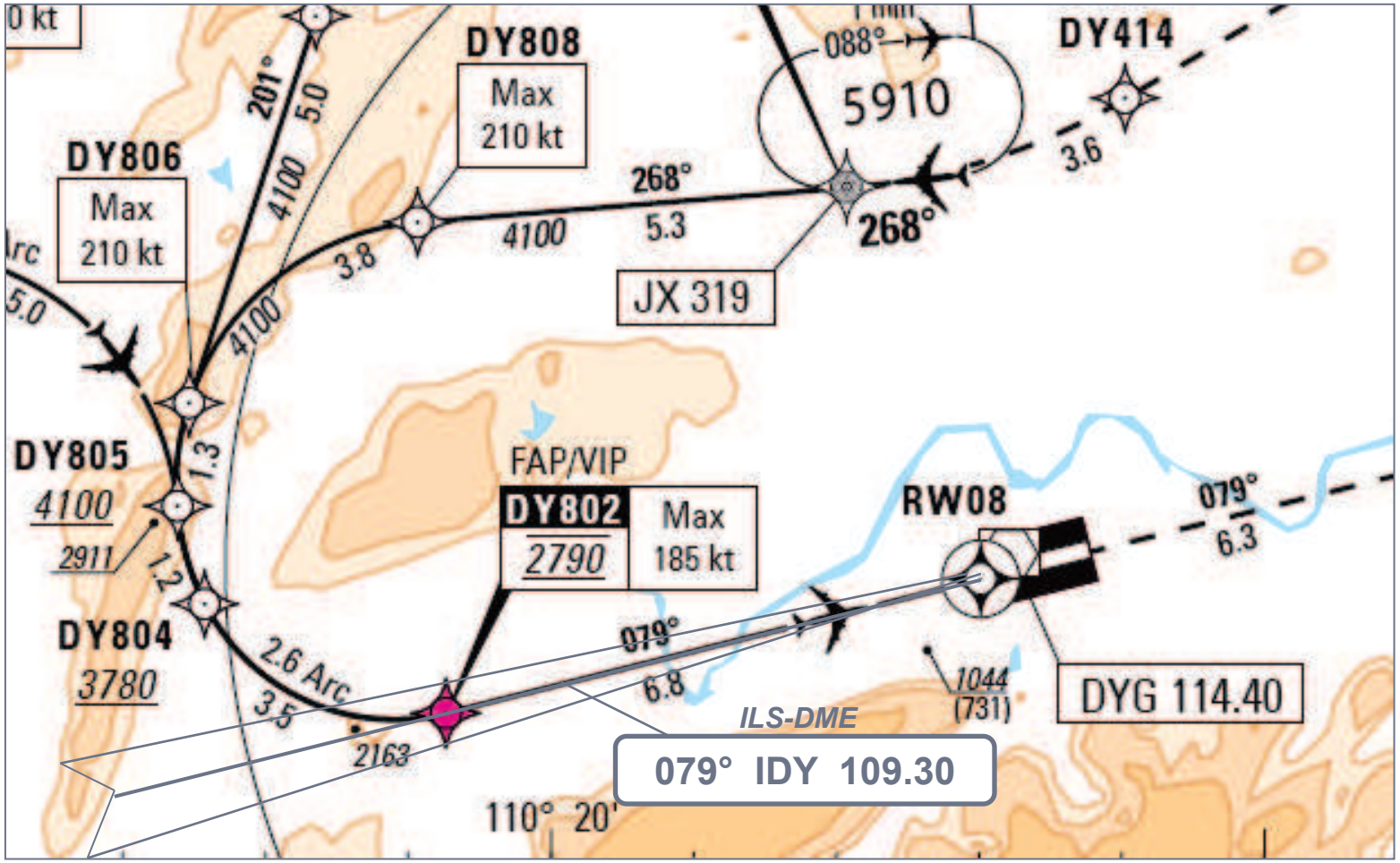
Example of RNP AR to ILS track – Lateral profile



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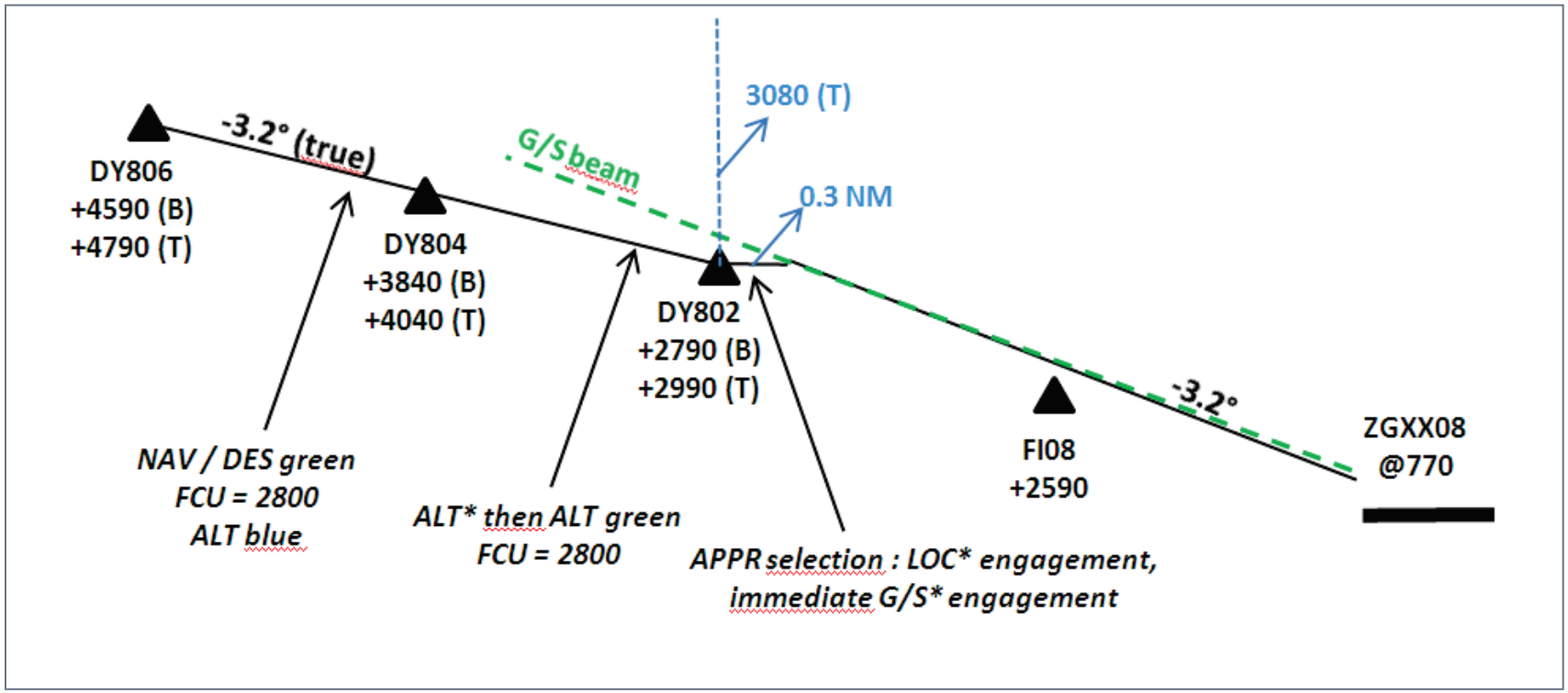
Example of RNP AR to ILS track – Vertical profile

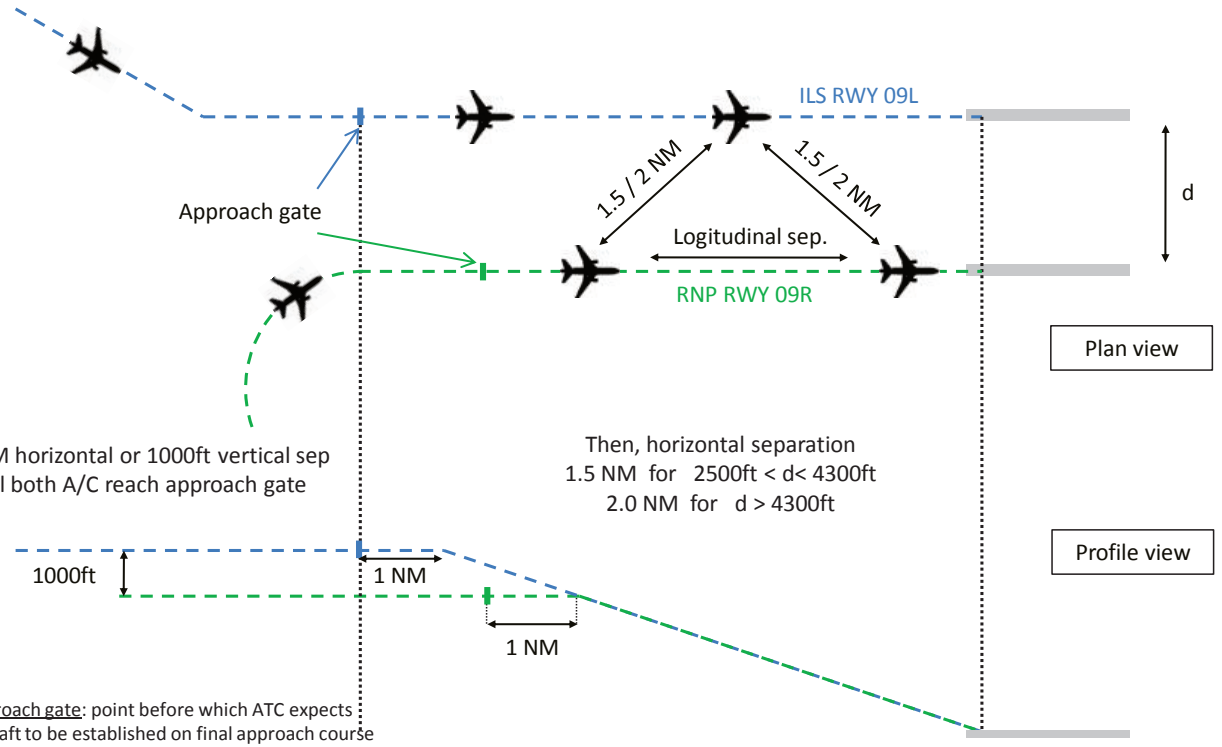


- The RNP AR track should connect from below; to ensure G/S capture from below
- Importance to study the effect of Delta ISA on the barometric profile of the RNP AR track, to ensure correct transition to the ILS

Separations for parallel runways

State of the Art in the U.S.

- ILS / RNP dependent approaches with current FAA criteria



Benefits

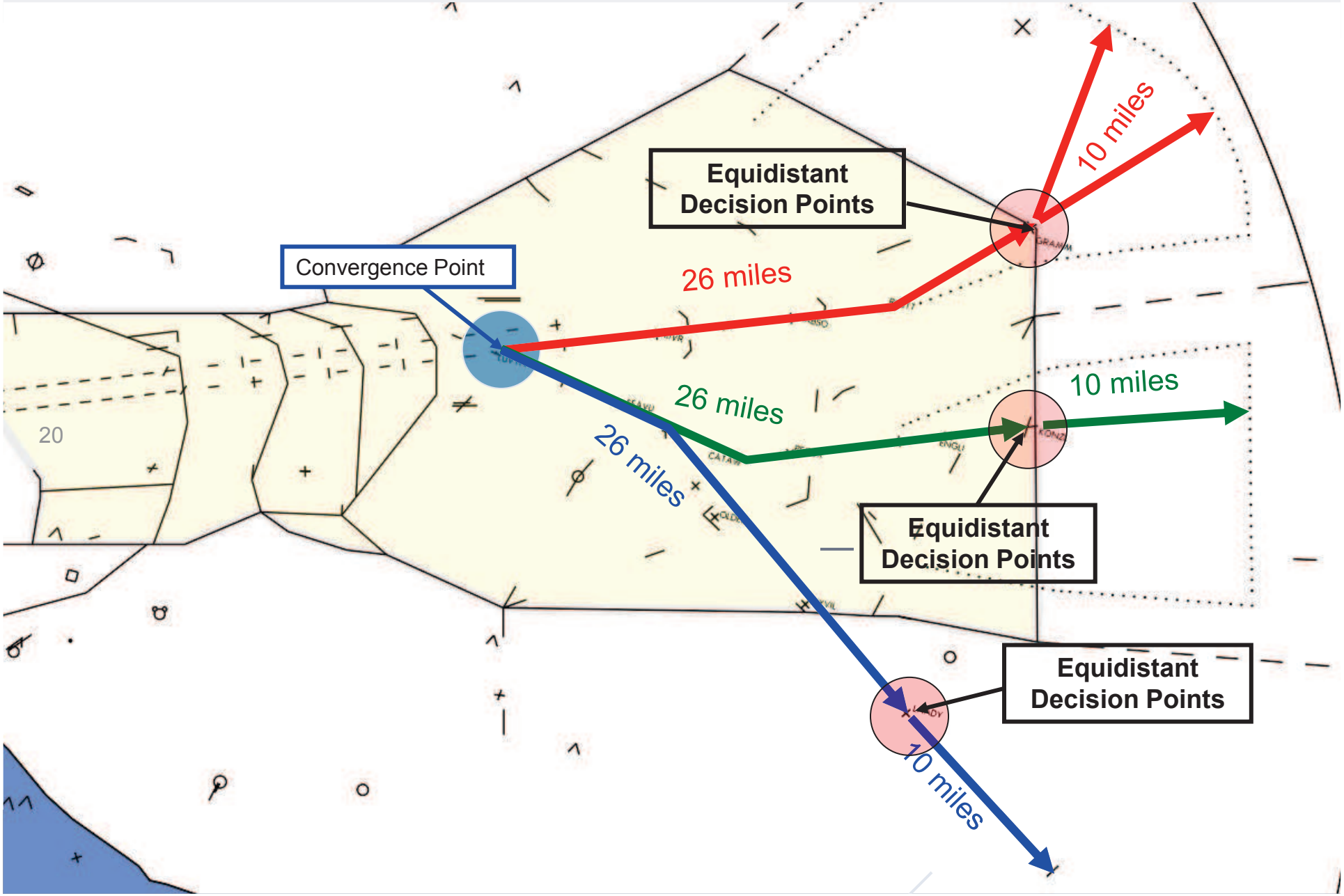
Expected benefits for ATC

•Simplify ATC work and reduce the workload per aircraft
•Increase the traffic flow (reduce average time for approach)
•Reduce separations and optimize airspace use

Expected benefits for aircraft

•Average reduction in flight time and distance flown for approach (less fuel burn)
•Less Delays
•Possibility to implement CDOs

Approach Integration Using Structured Decision Points



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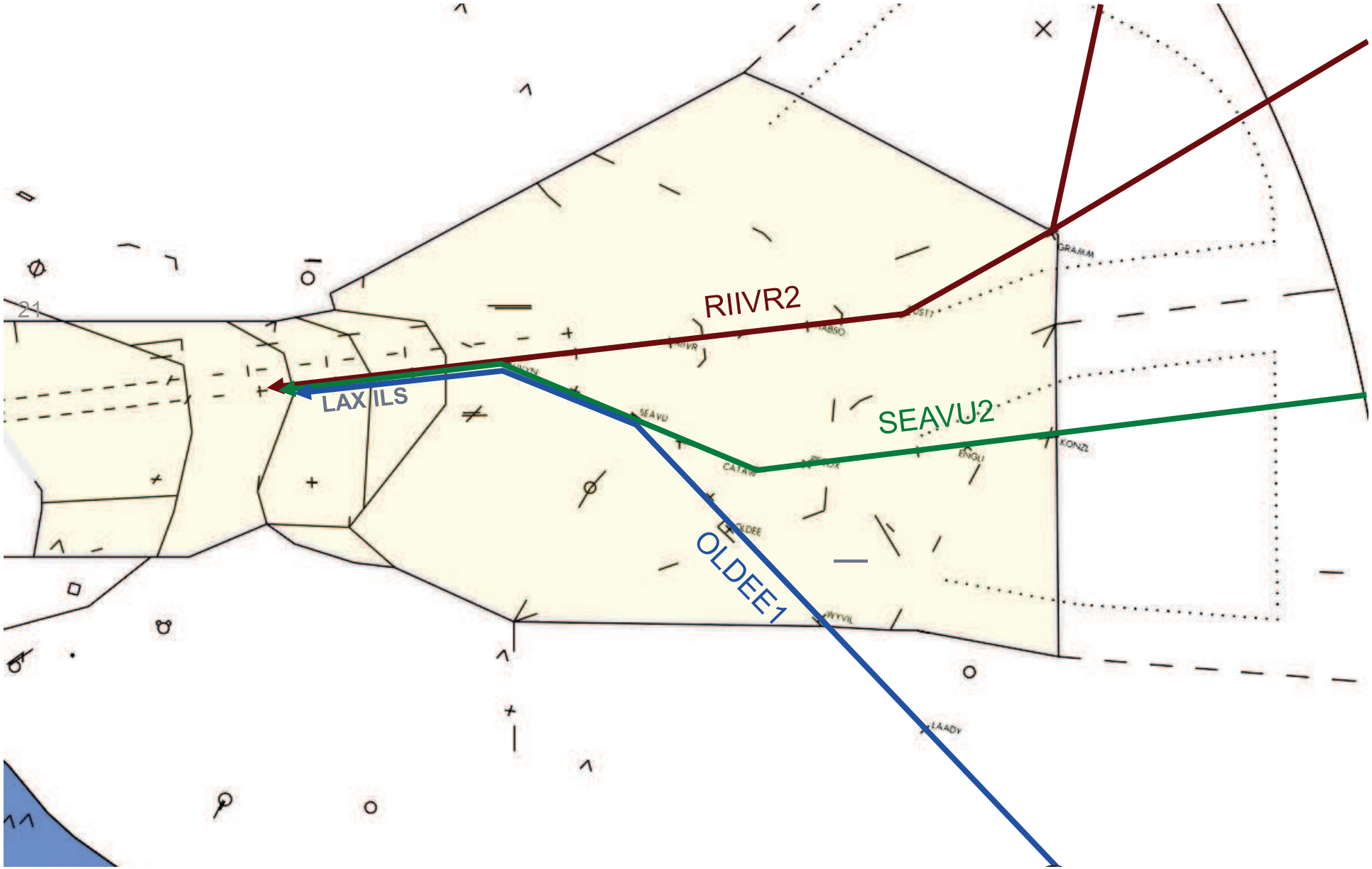
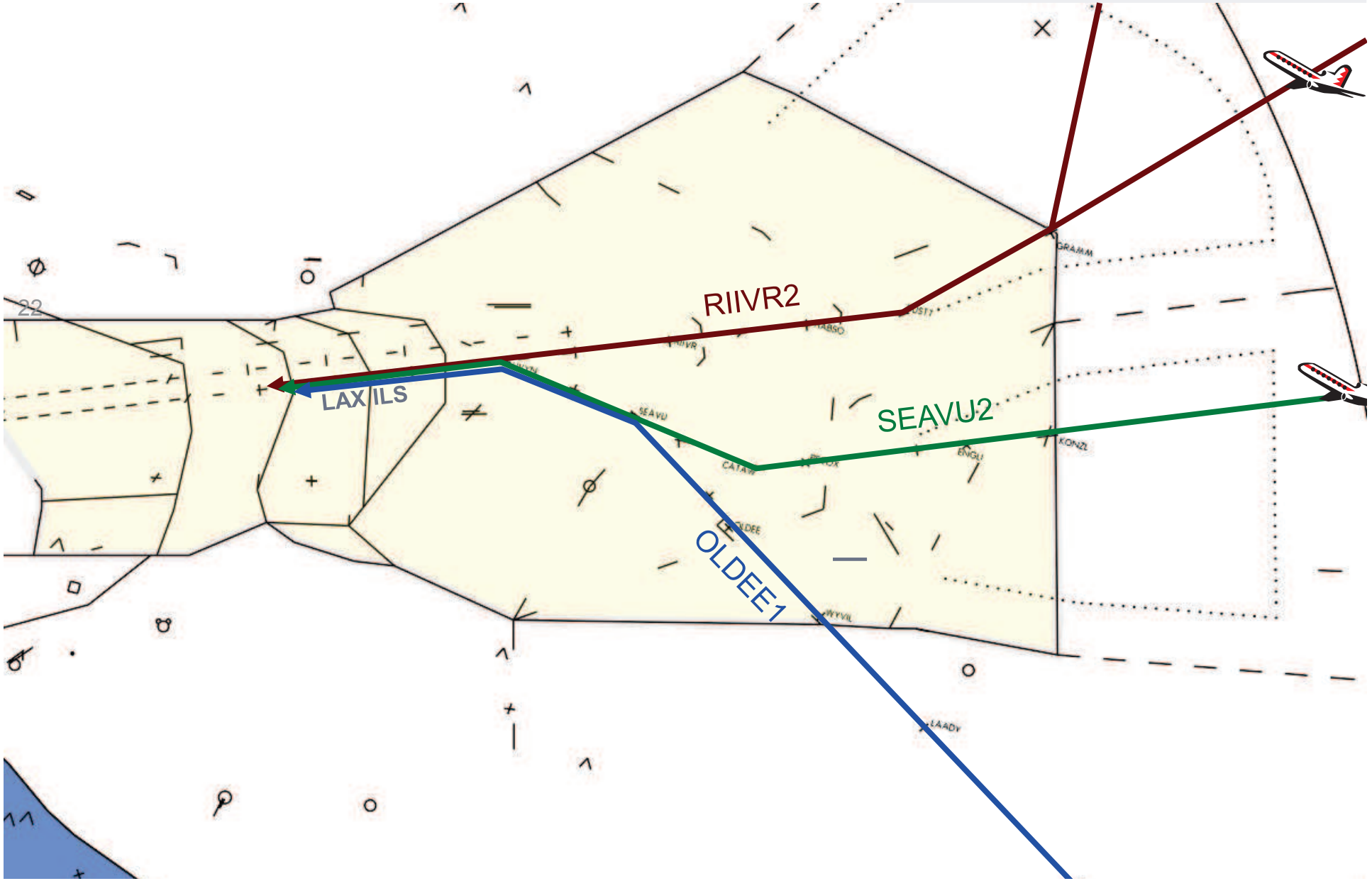


Approach Integration Using Structured Decision Points



Conclusion

- PBN is a great tool
  - to reshape the airspace
  - Enhance the flow
  - Increase capacity
- PBN allows to prepare the future growth of the African traffic
- All the modern aircraft are PBN capable
- Let’s fly the Airbus the most efficient and safest way