PANS-OPS Flight Procedure Design Training for CAAs

23 August – 03 September 2021

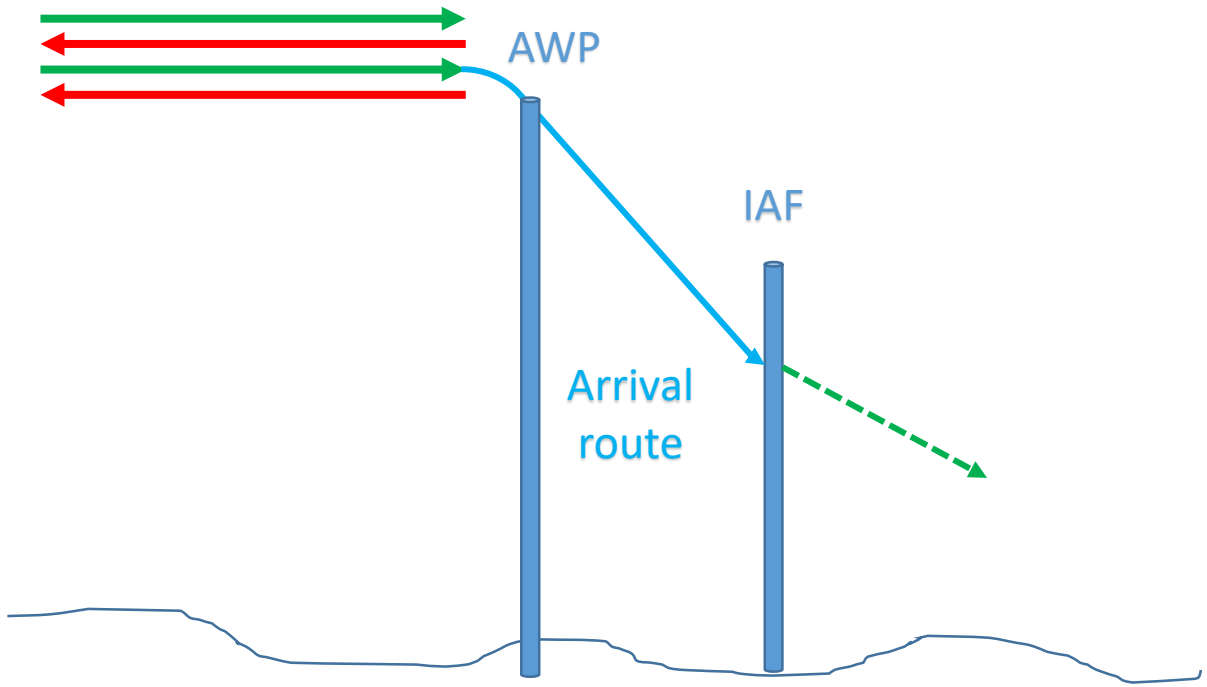
4 – Arrival segment

(Doc. 8168, Vol. 2, Part I, section 4, Chap. 2 & 8)

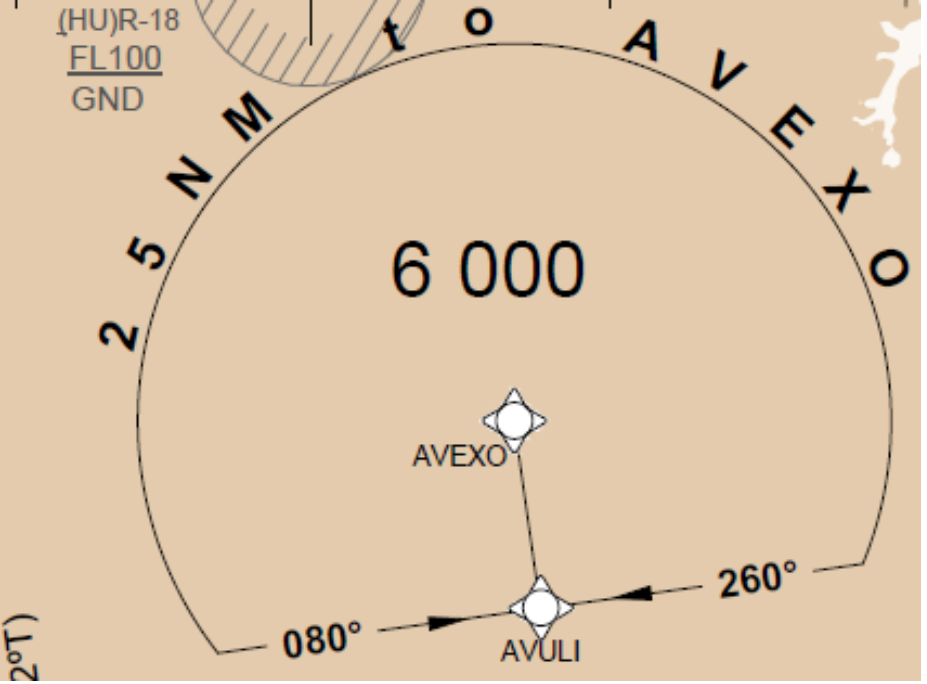
Outlines

1. Definition
2. Arrival criteria
3. Protection
4. Publication

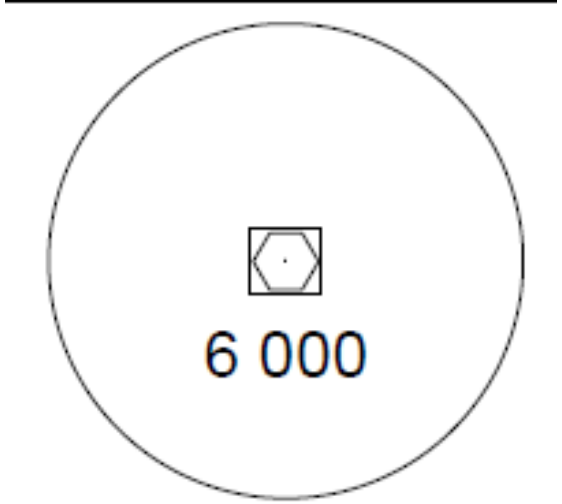
Definition and types



- Arrival:
  - Transition between the en-route structure and the Approach.
- Two types or arrival:
  - Omnidirectional arrivals:
    - Minimum Sector Altitude (MSA);
    - Terminal Arrival Altitude (TAA) for PBN.
  - Specified arrivals routes:
    - Standard instrument Arrival (STAR);
    - Not mandatory.



- **No track is specified**
- **Aircraft can come from all azimuts**

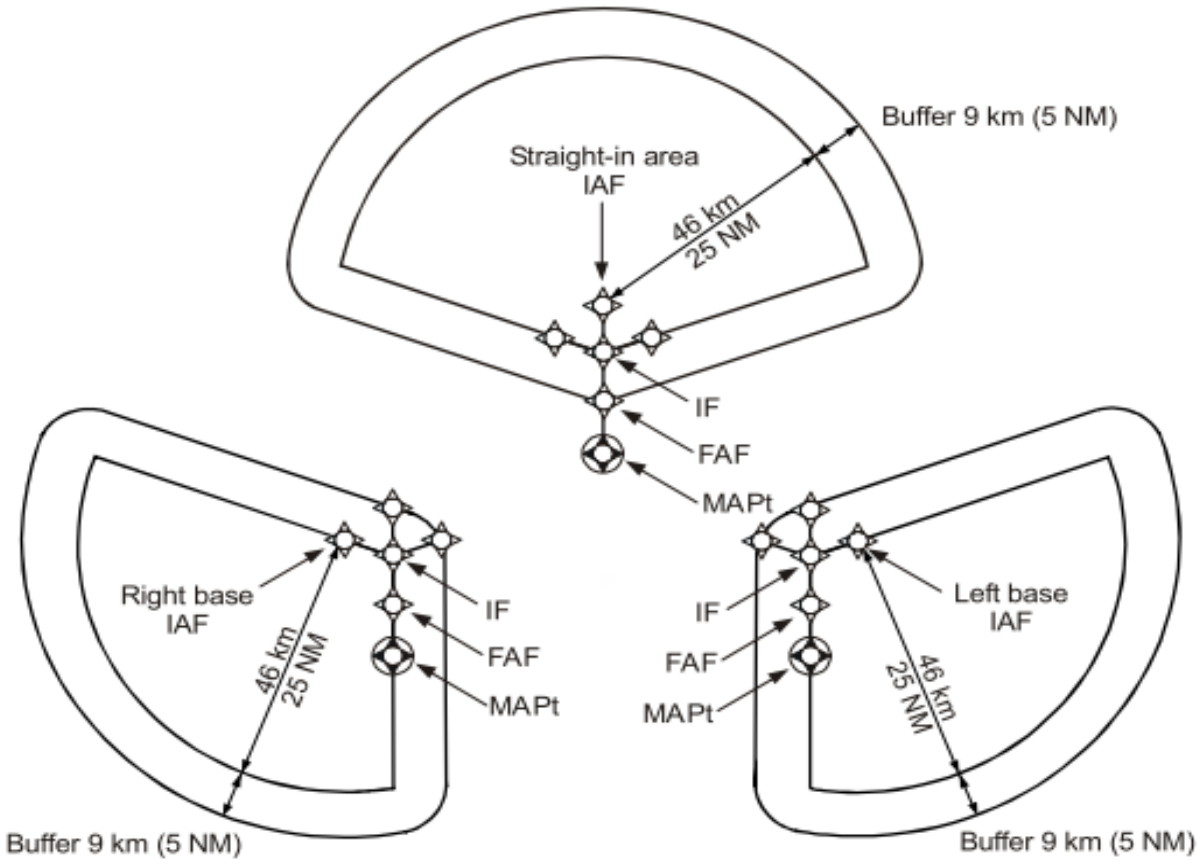


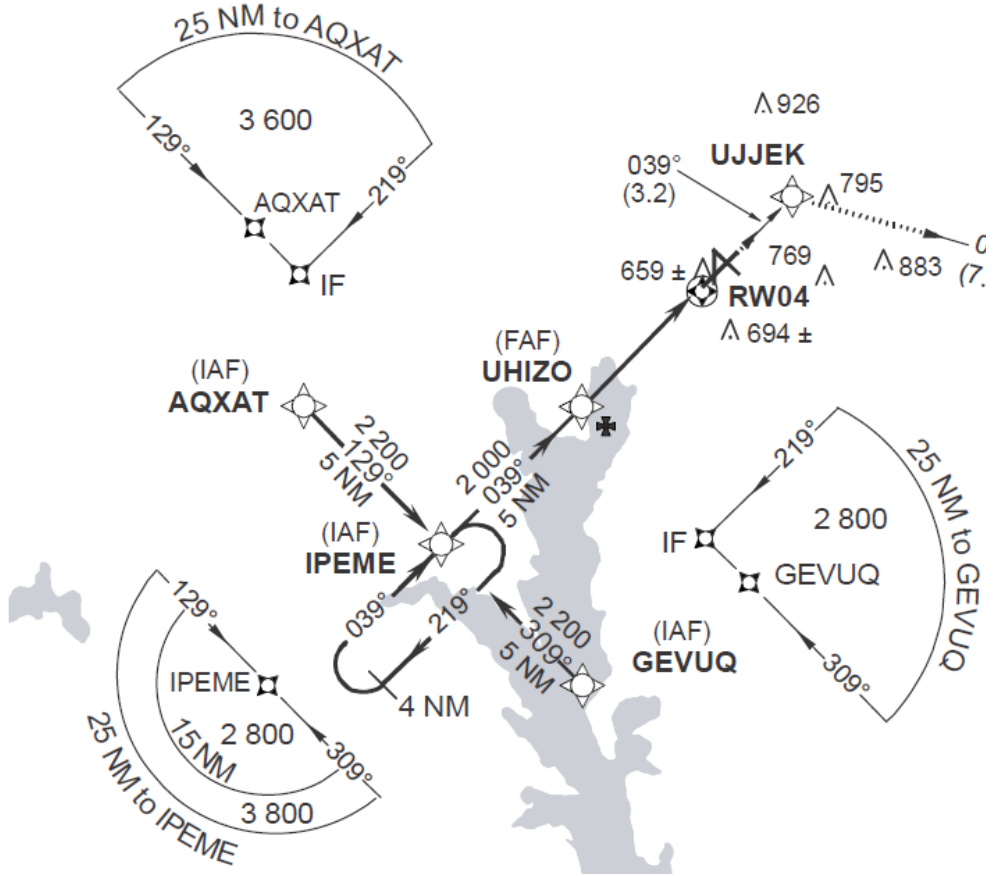
MSA 25NM
NN VOR/DME

Track clearly defined:

- **Route named: EREKA 1B;**
- **Bearing: 265°;**
- **Length: 33.0** NM

TAAs: Tbar or Y bar





Arrival criteria

- Track guidance:
  - Generally guided:
    - Starting point: Fix;
    - Ending point: Fix (IAF).
- Shape:
  - Straight;
  - Curved:
    - Minimum DME radius, 10 NM.
  - Mix of straight and curved.
- Number of segments: No restriction;
- Length: No restriction;

Arrival criteria

- Flight Technical Tolerances (FTT):
  - En-route FTTs used for Arrivals:
    - Pilot reaction time : 10s;
    - Bank angle value : 15°
    - Bank angle delay : 5s
    - Longitudinal limits :
      - Fix tolerance:
      - General criteria apply;
      - Highest expected altitude;
      - IAS: 315 kt;
      - ISA deviation: +15s.

Arrival criteria

- Turns:
  - Maximum turn angle: 120°
  - For turns over 70°:
    - Lead radial d to be published:
    - $d = r * \tan(\frac{Turn\ angle}{2})$
    - With:
      - d: Distance from leading fix to intersection
      - r: Turn radius computed at the maximum True Airspeed (TAS)

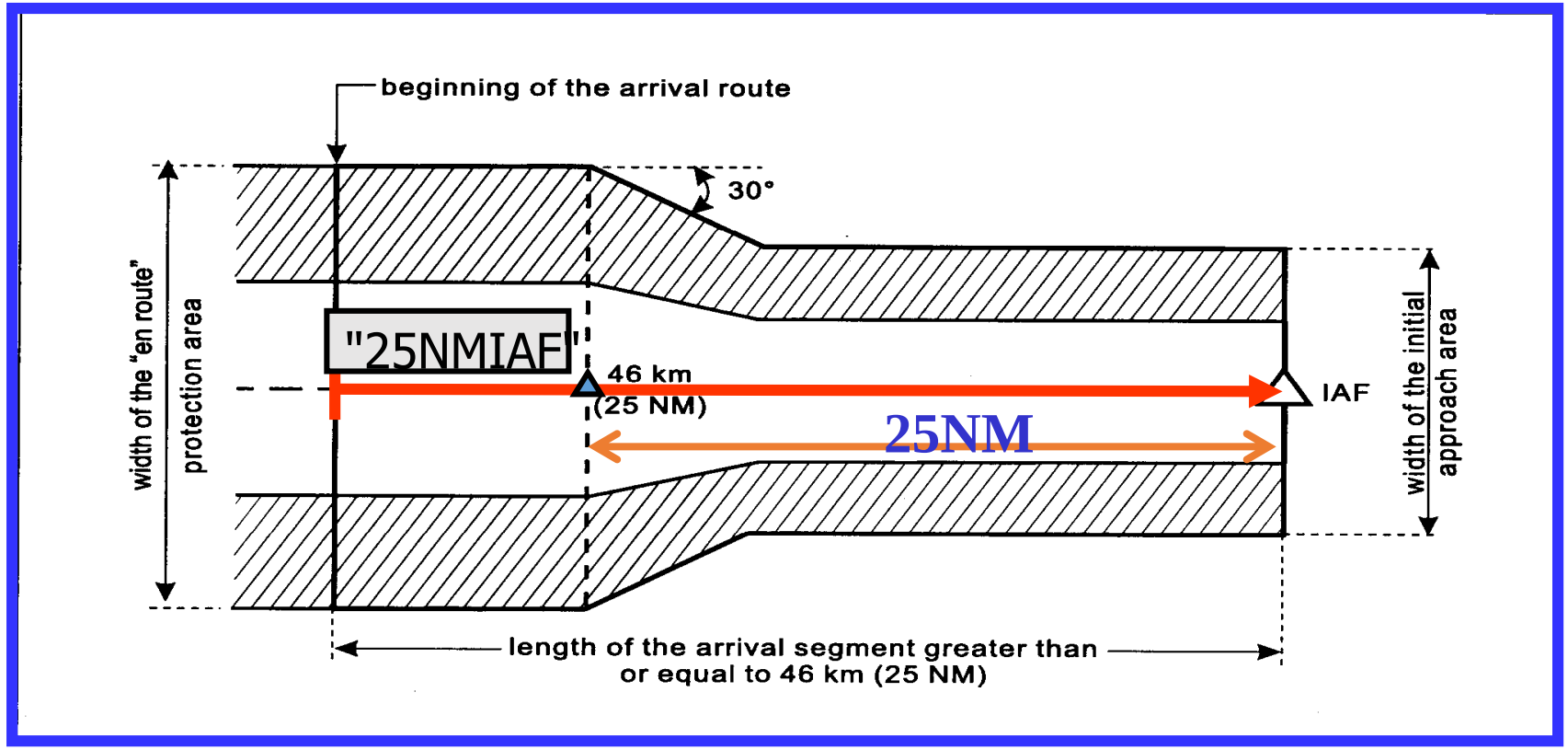
Horizontal protection methodologies

½ Area Width	VOR (m)	NDB (m)	DME (m)
En-route-like	± 10	± 10	± 8
Initial-like	± 5	± 5	± 5

- Notes:
  - For straight segments only;
  - ± 8 NM can be used (Refined method, PANS-OPS, Vol 2, Part II, section 3, App A)

Horizontal protection methodologies

Straight long STARs (> 25 NM)



Horizontal protection methodologies

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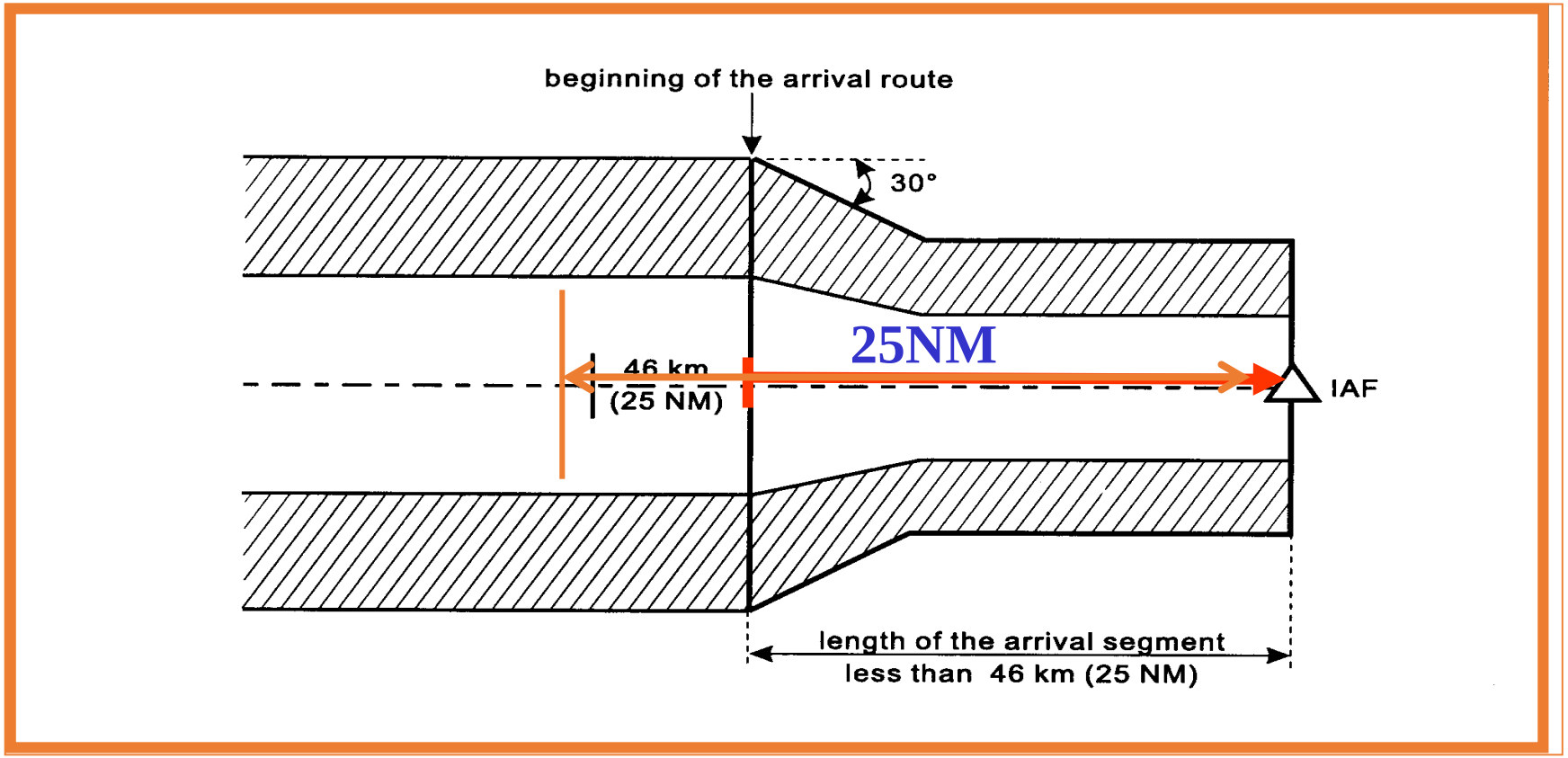
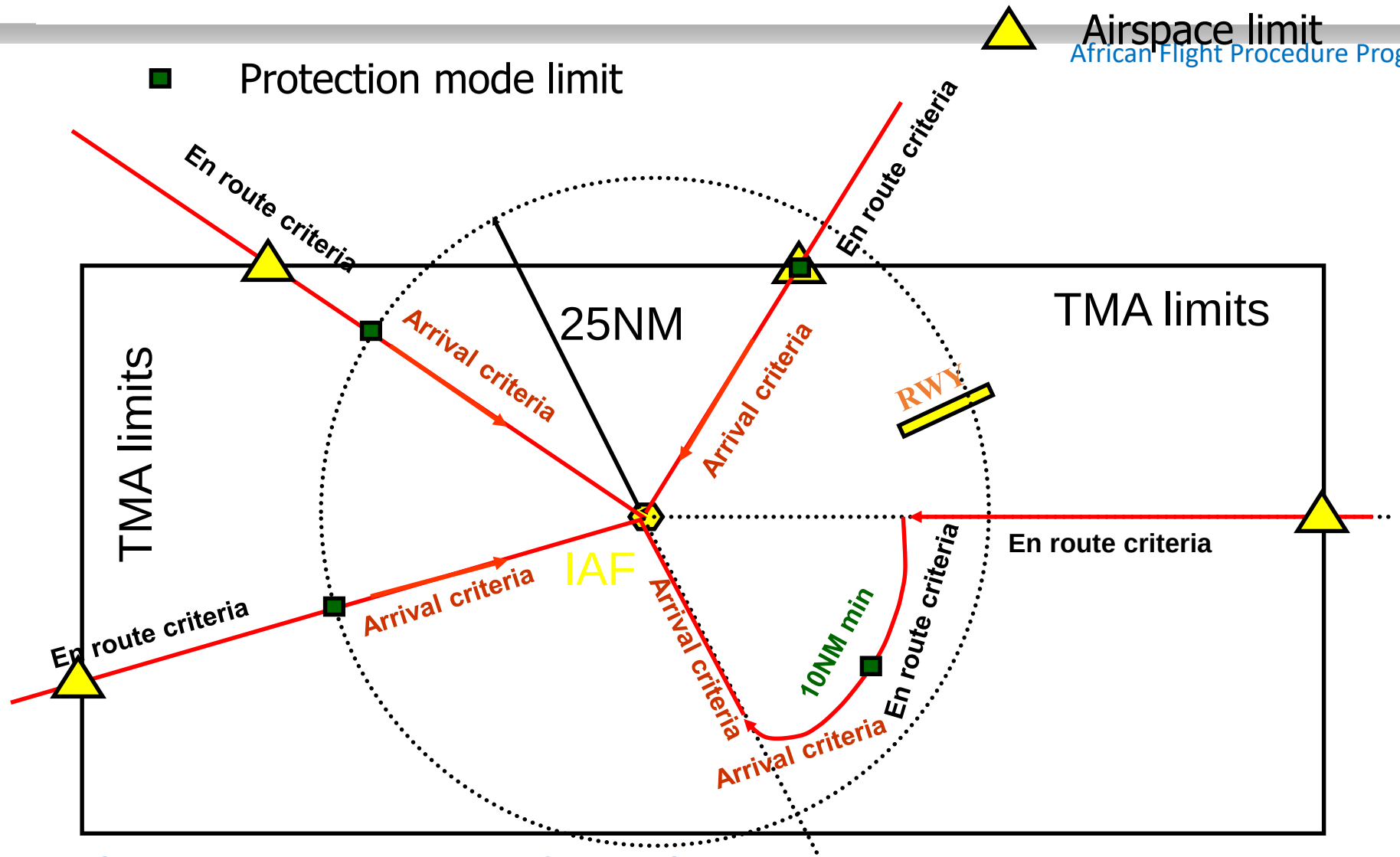


Horizontal protection methodologies

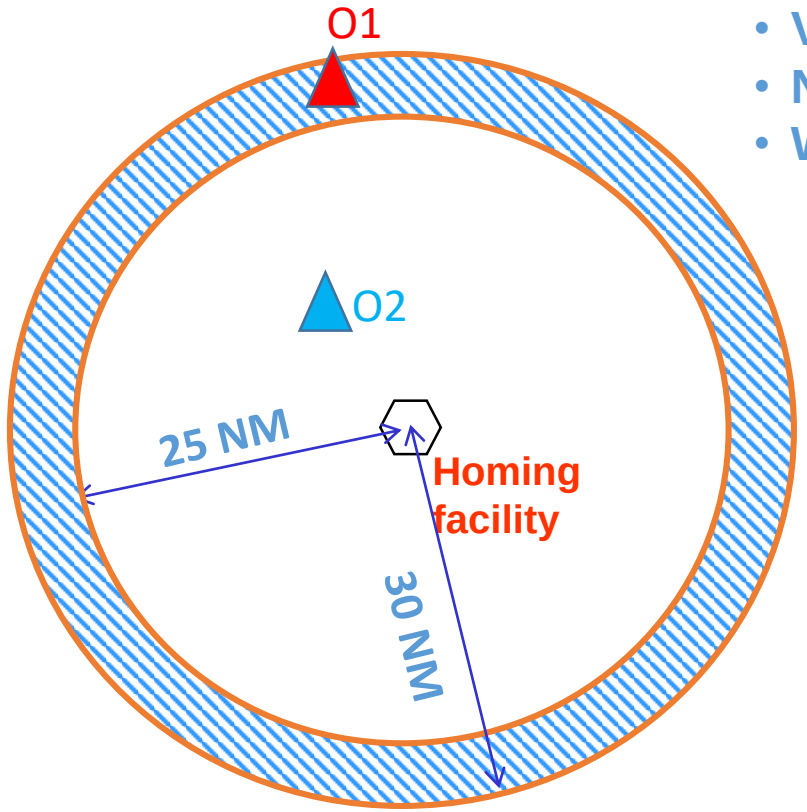


Transition between en-route and initial

Horizontal protection methodologies

MSAs and TAAs

Sectorization possible:
- VOR radials, NDB bearings
- DME arcs: between 10 and 15 NM



Homing facility:
- **VOR;**
- **VOR-DME;**
- **NDB;**
- **Waypoint.**

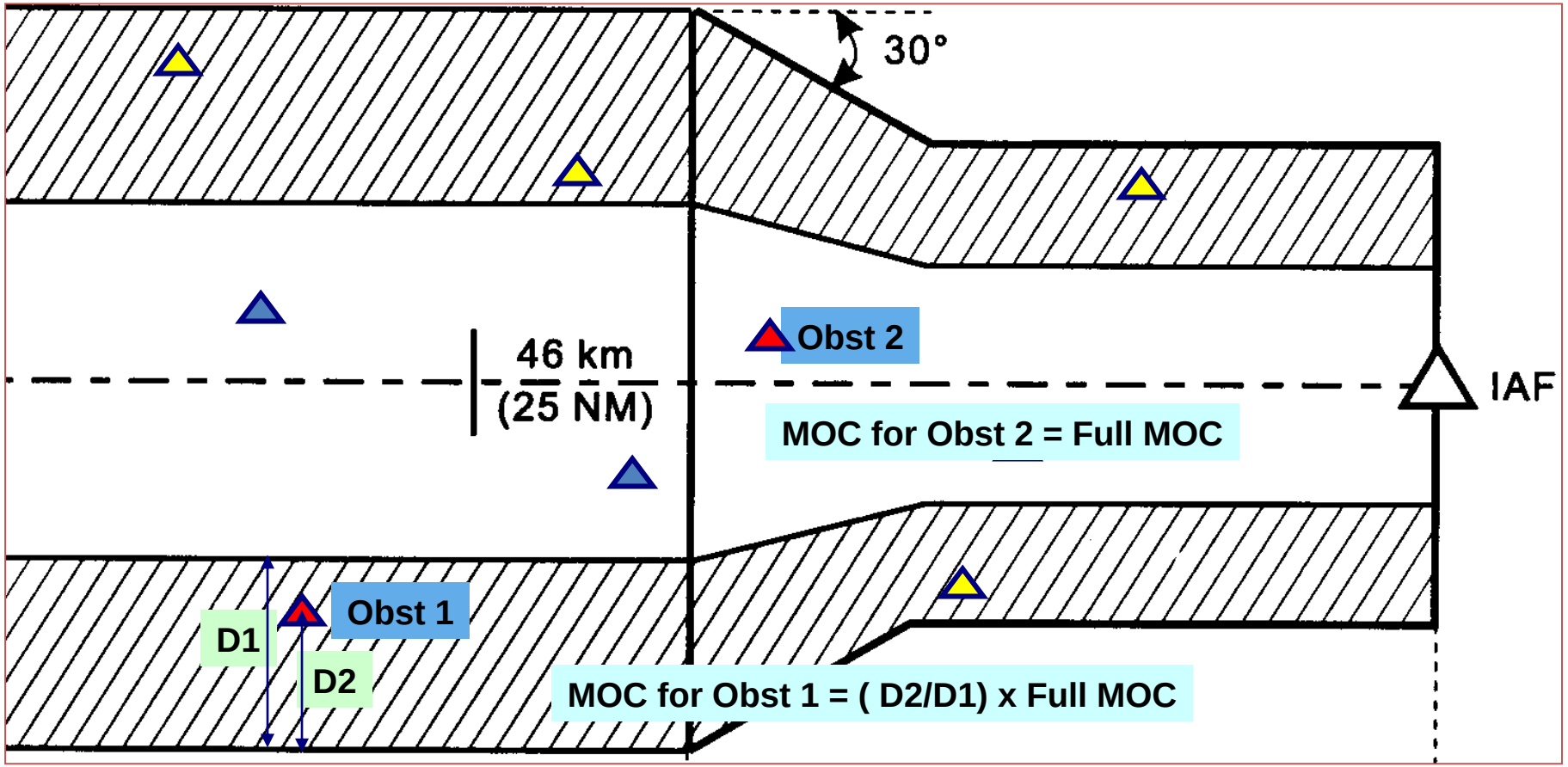
MOCA(O1) : Alt(O1) + Vegetation + Full MOC
MOCA(O2) : Alt(O2) + Vegetation + Full MOC
MOCA = Max (MOCA(O1),MOCA(O2))

Minimum Obstacle Clearance (MOC)

Terrain elevation (m)	Below 900	Between 900 and 1 500	Above 1 500
MOC Value (m)	300	450	600

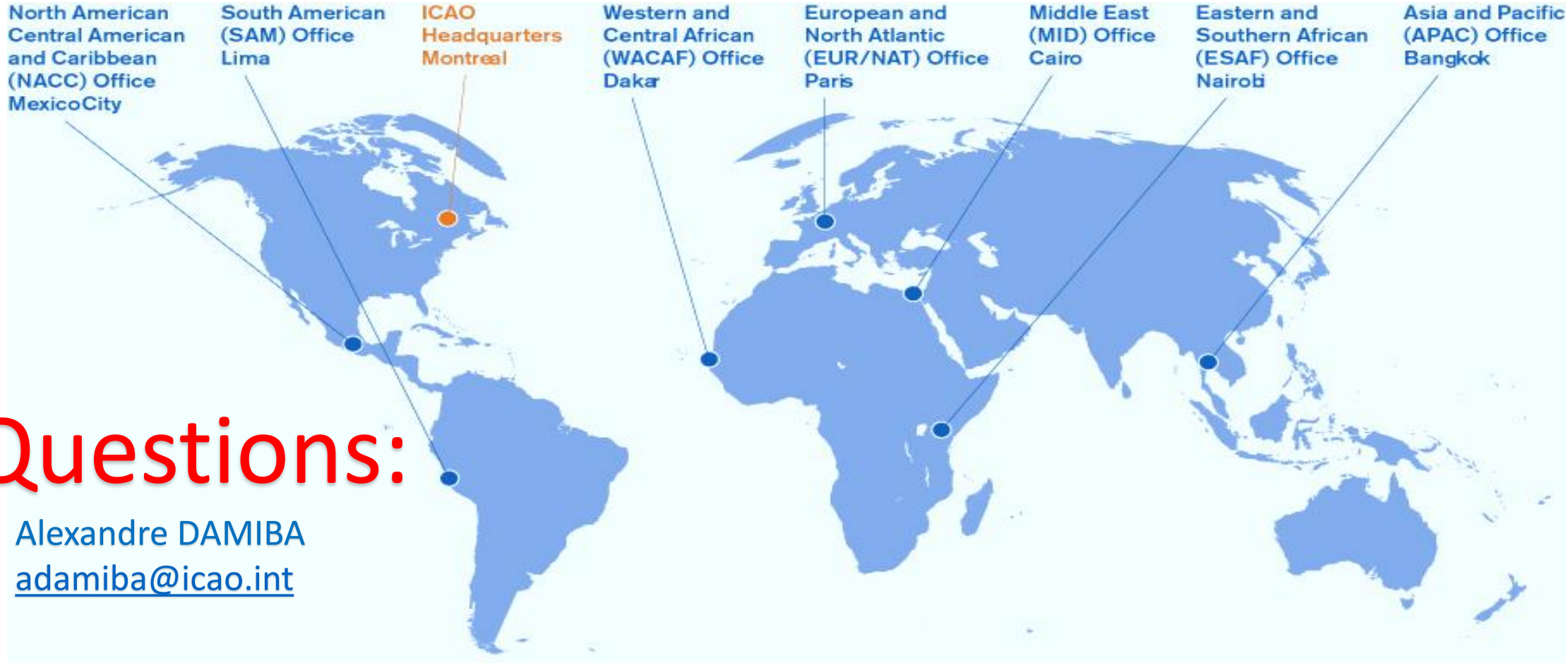
- Notes:
  - National values can be applied;
  - Different values can be used by the procedure designers.

MOCA = Max [AltObst + MOC for Obst]



Publication

- Arrival routes (MSA, TAA, STARs) are published with:
  - MOCAs;
  - MOCA rounded up in hundred of ft;
  - Procedure altitude may be published.
- For STARs:
  - STAR name (naming convention);
  - Segments length;
  - Bearing.



Questions:

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