# PANS-OPS Flight Procedure Design Training for CAAs

**23 August – 03 September 2021**

# 6 – Initial approach segment

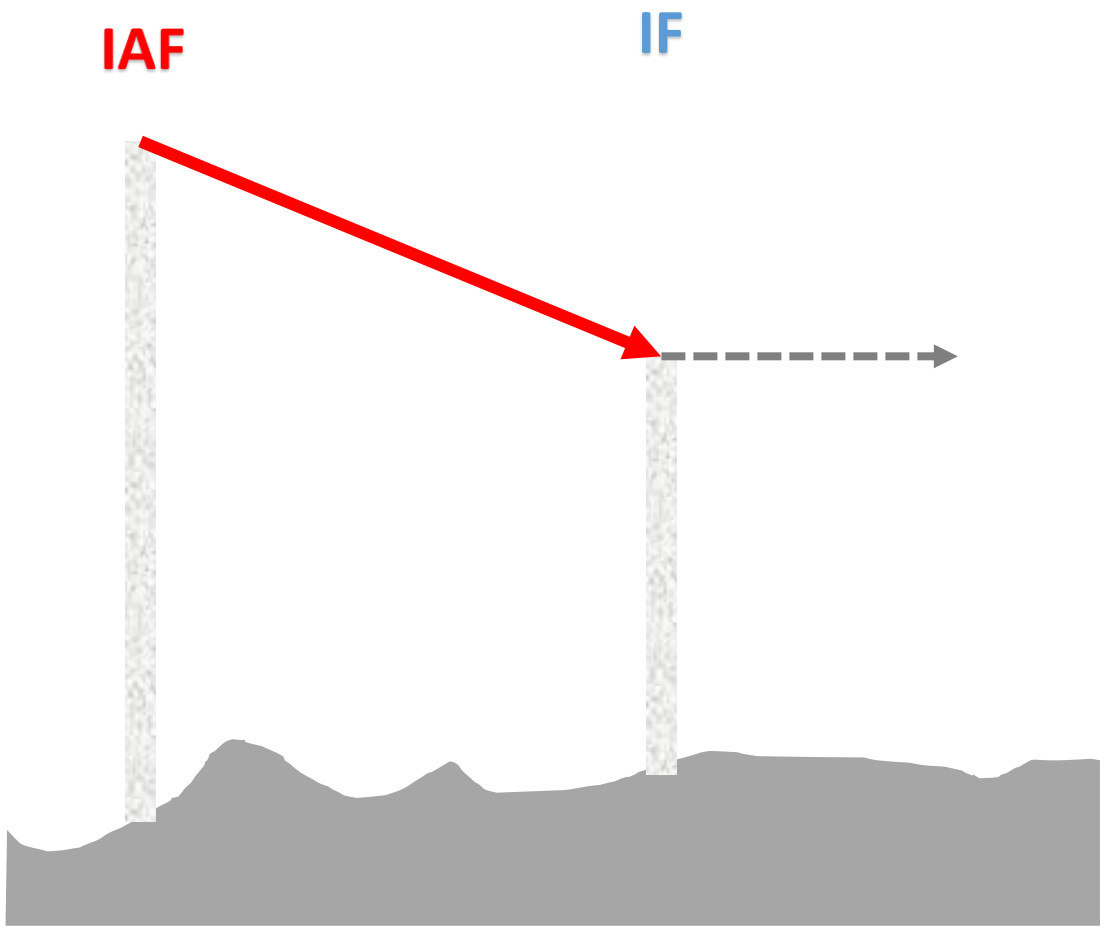
## (Doc. 8168, Vol. 2, Part I, section 4, Chap. 3)

# Outlines

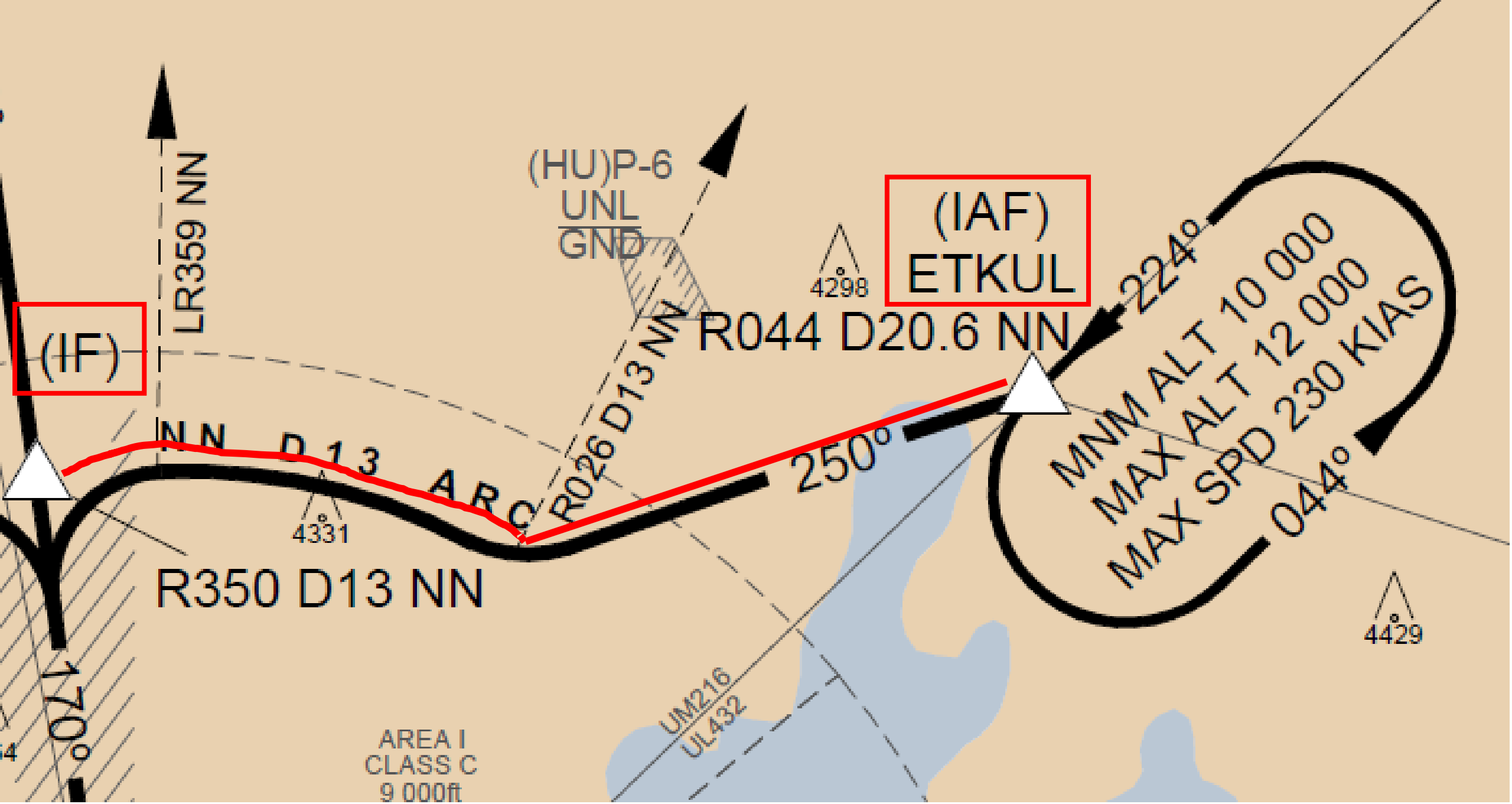


1. General
2. General criteria
3. Guided segments
4. Dead reckoning segments
5. Racetrack procedure
6. Reversal procedures

# General




- Goal:
  - Segment along which aircraft is maneuvering to enter the intermediate segment,
- Guided:
  - Radial (VOR) or bearing (NDB);
  - DME arc;
  - PBN;
  - Radar vector.
- Non-guided: DR
- Specific trajectories:
  - Racetrack procedure;
  - Reversal procedure;
  - Holding pattern descents.
- Can be combination of the above.

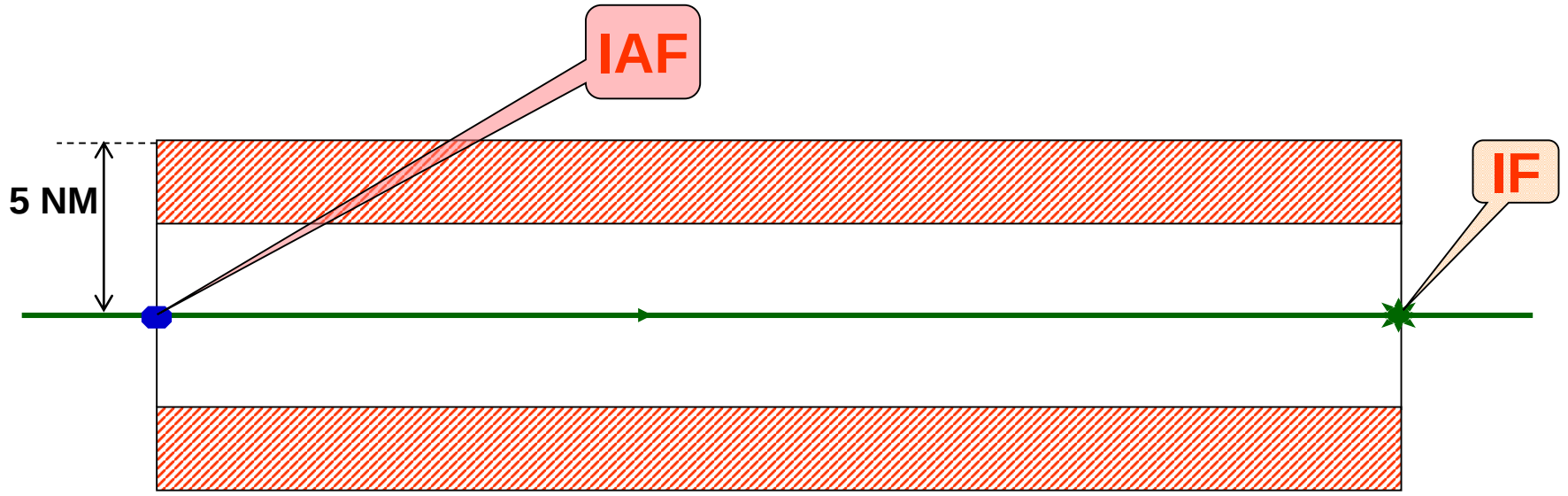


# General criteria

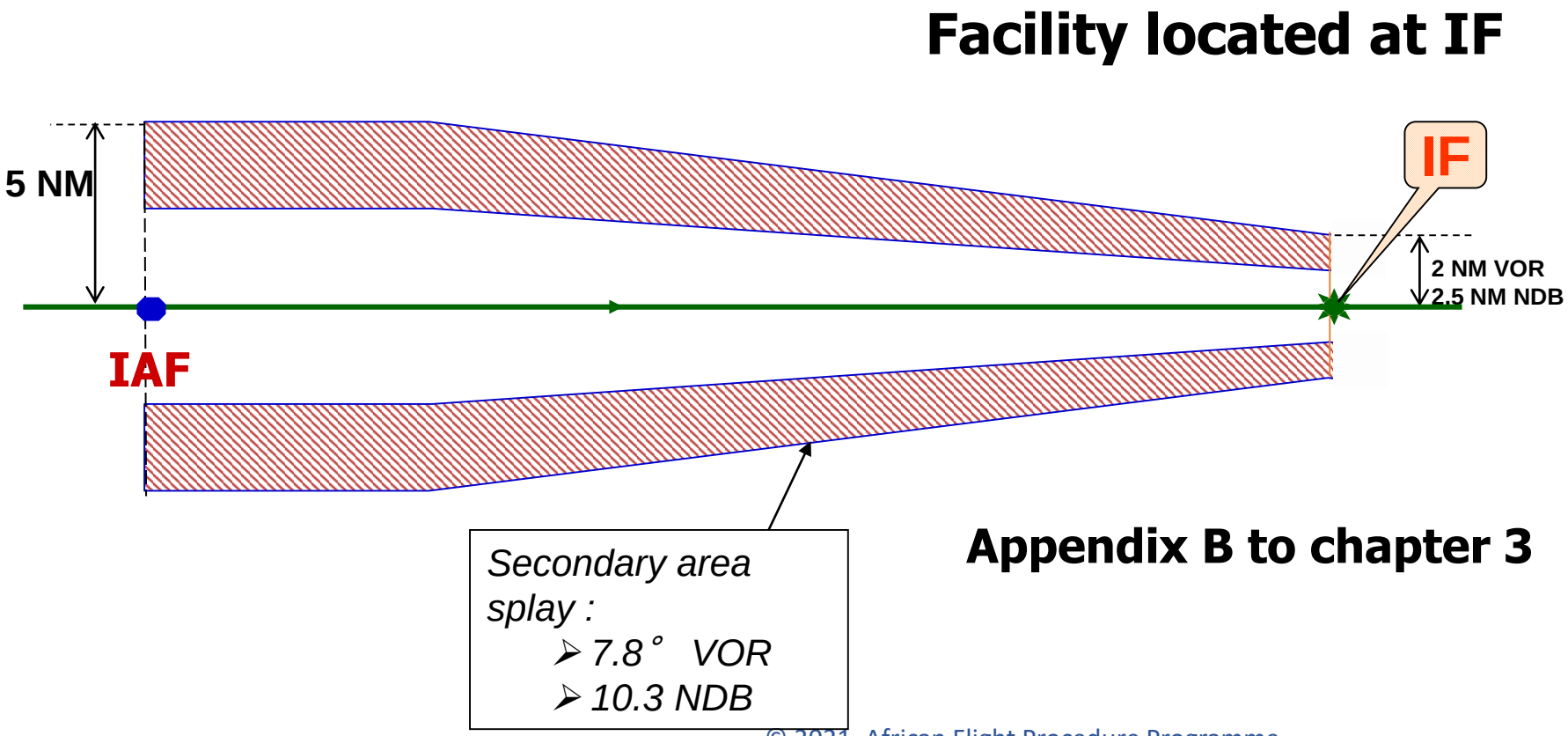


- Maximum turn angle: 120°
  - ☞Turns more then 70°: leading fix or radial for turn anticipation.
- MOC: 300 m
- MOCA and PA: rounded up in hundred of feet;
- Length of each segment: no restriction
- Descent gradient:
  - ☞ Optimum: 4°
  - ☞ Maximum: 8°
- For racetrack and reversal procedures:
  - ☞ Descent rate provided instead.

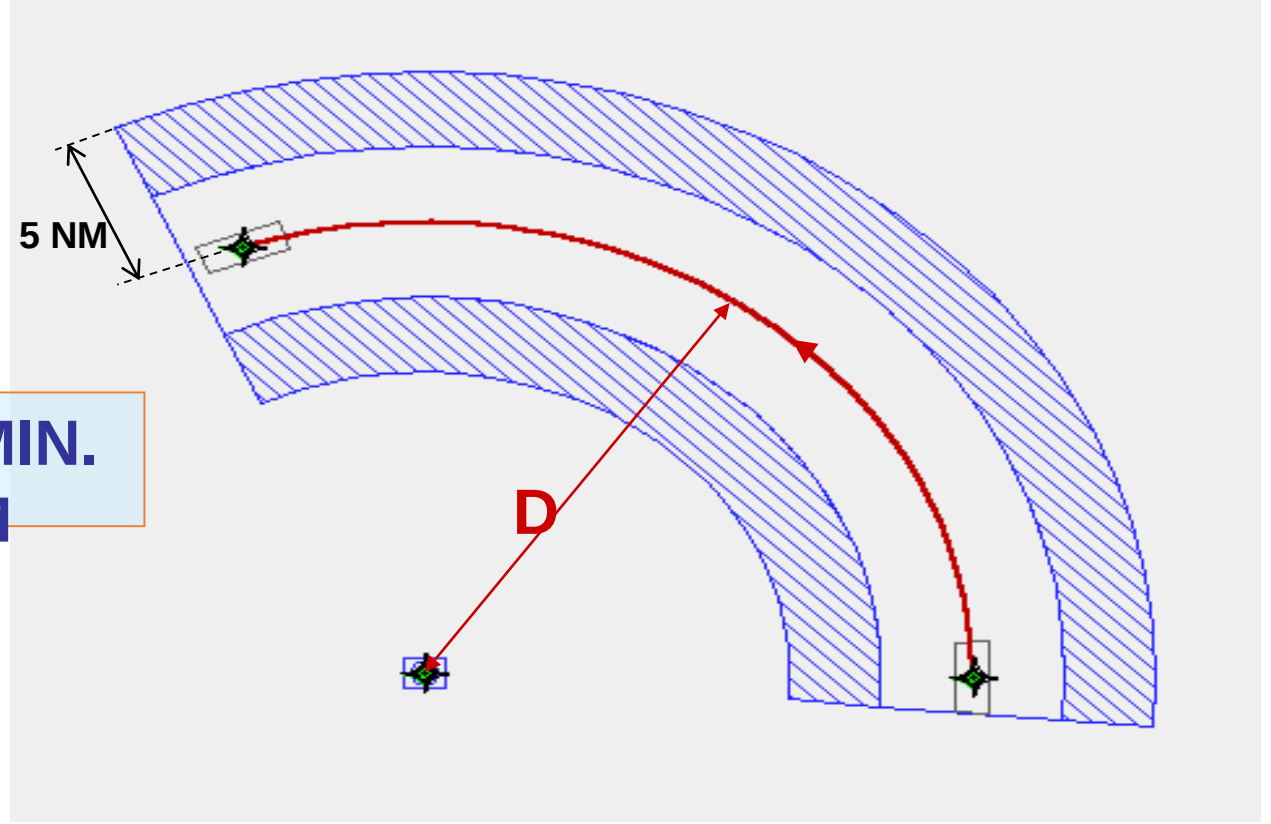
## Standard straight segments protection



## Width reduction for straight segments protection



## Protection along a DME arc




**ARC MIN. 7 NM**

# PBN initial approach segment

- No Reversal nor DR;
- No rate of descent;
- Same MOC as conventional;
- Turn protection using wind spiral;
- Protection Area width depends on RNP value.

# Dead reckoning segments



- Appendix A to Chapter 3;
- To reduce time and save airspace (main goal);
- Guidance and fixes based on:
  - Two VORs;
  - One VOR-DME.
- Two types:
  - U-Type;
  - S-Type.
- Maximum length: 10 NM
- Angle with the FAT: 45°

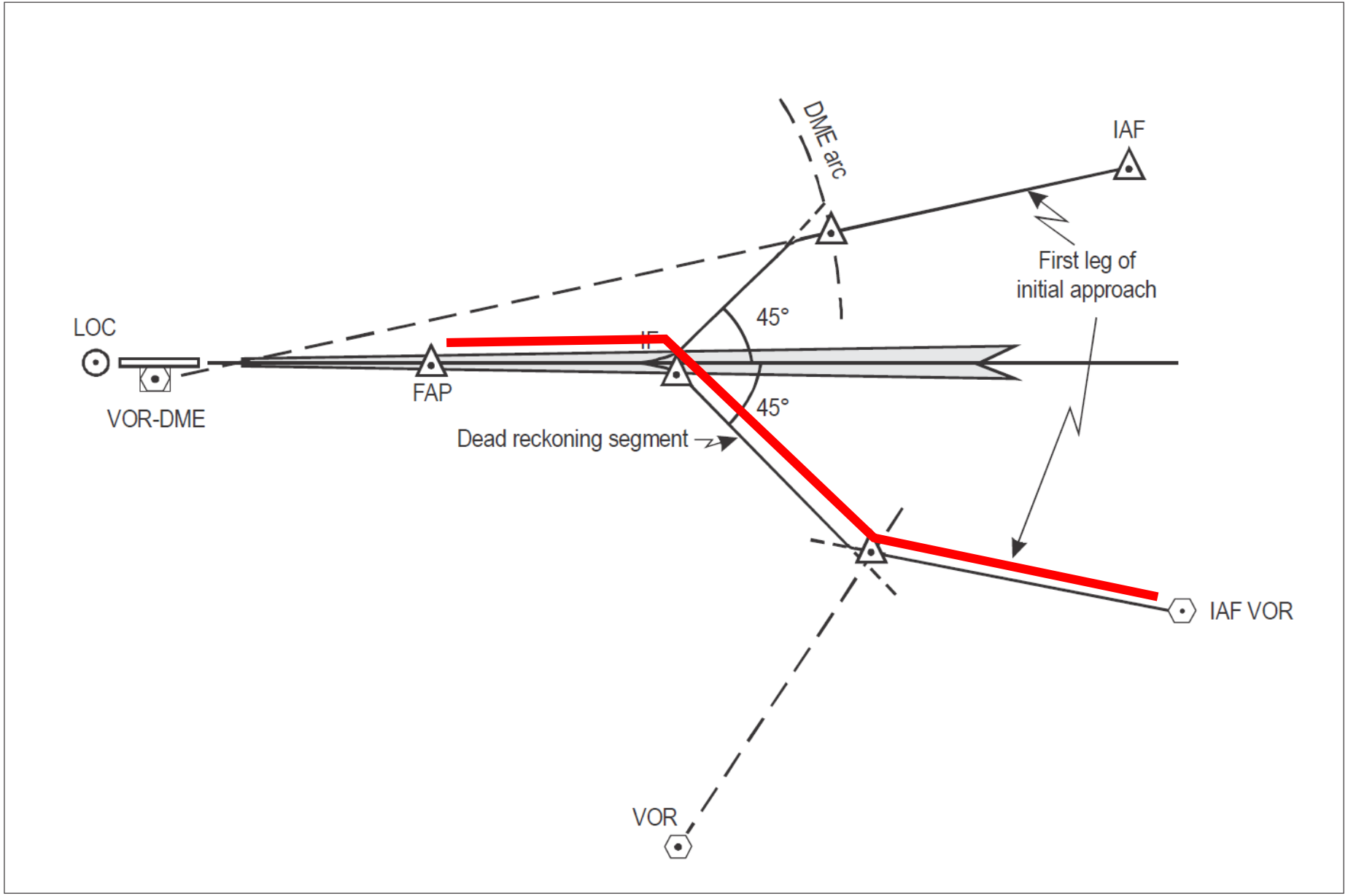
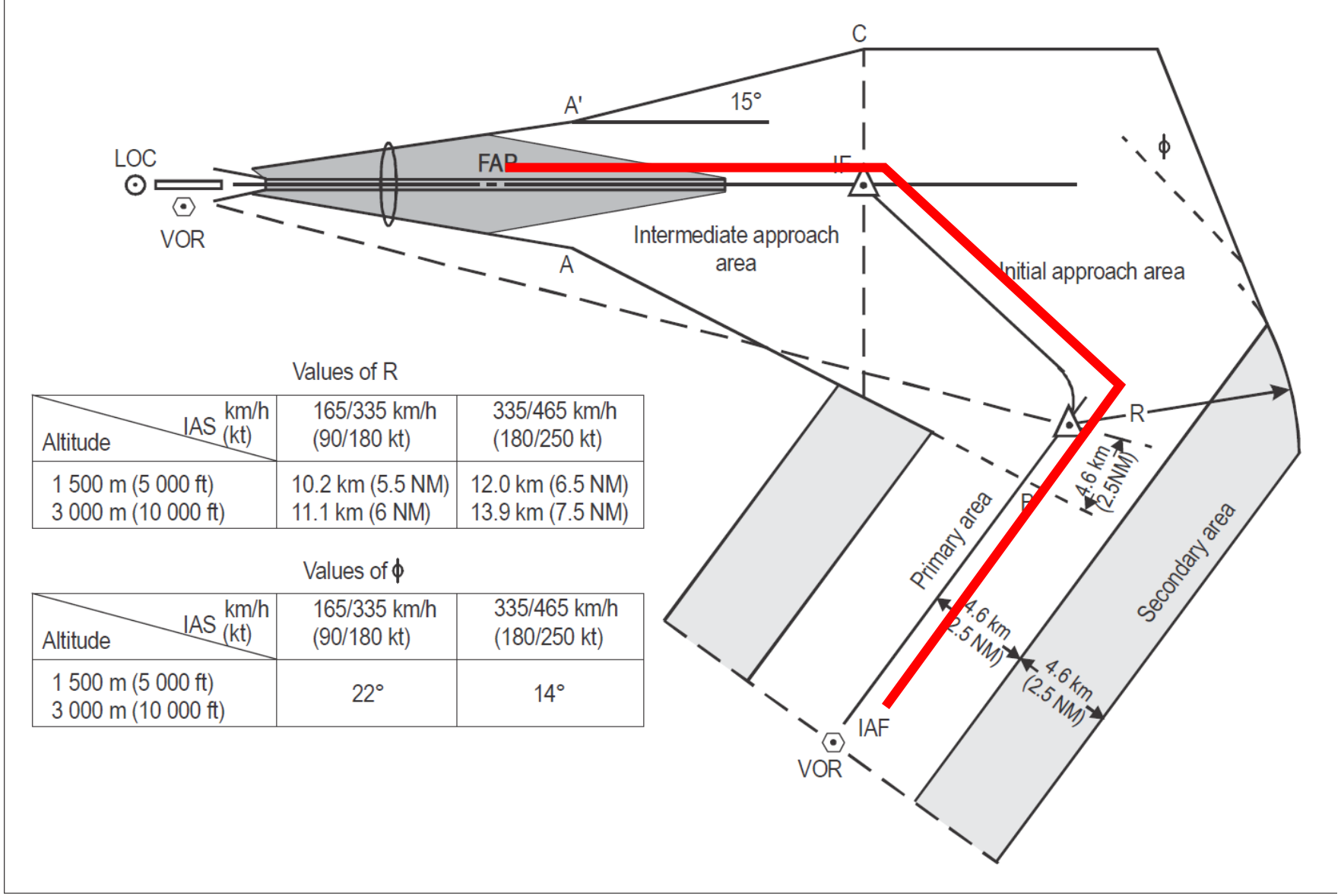



**Figure I-4-3-App A-2. S-type procedure**




Values of R

| Altitude \ IAS km/h (kt) | 165/335 km/h (90/180 kt) | 335/465 km/h (180/250 kt) |
|---|---|---|
| 1 500 m (5 000 ft)<br>3 000 m (10 000 ft) | 10.2 km (5.5 NM)<br>11.1 km (6 NM) | 12.0 km (6.5 NM)<br>13.9 km (7.5 NM) |

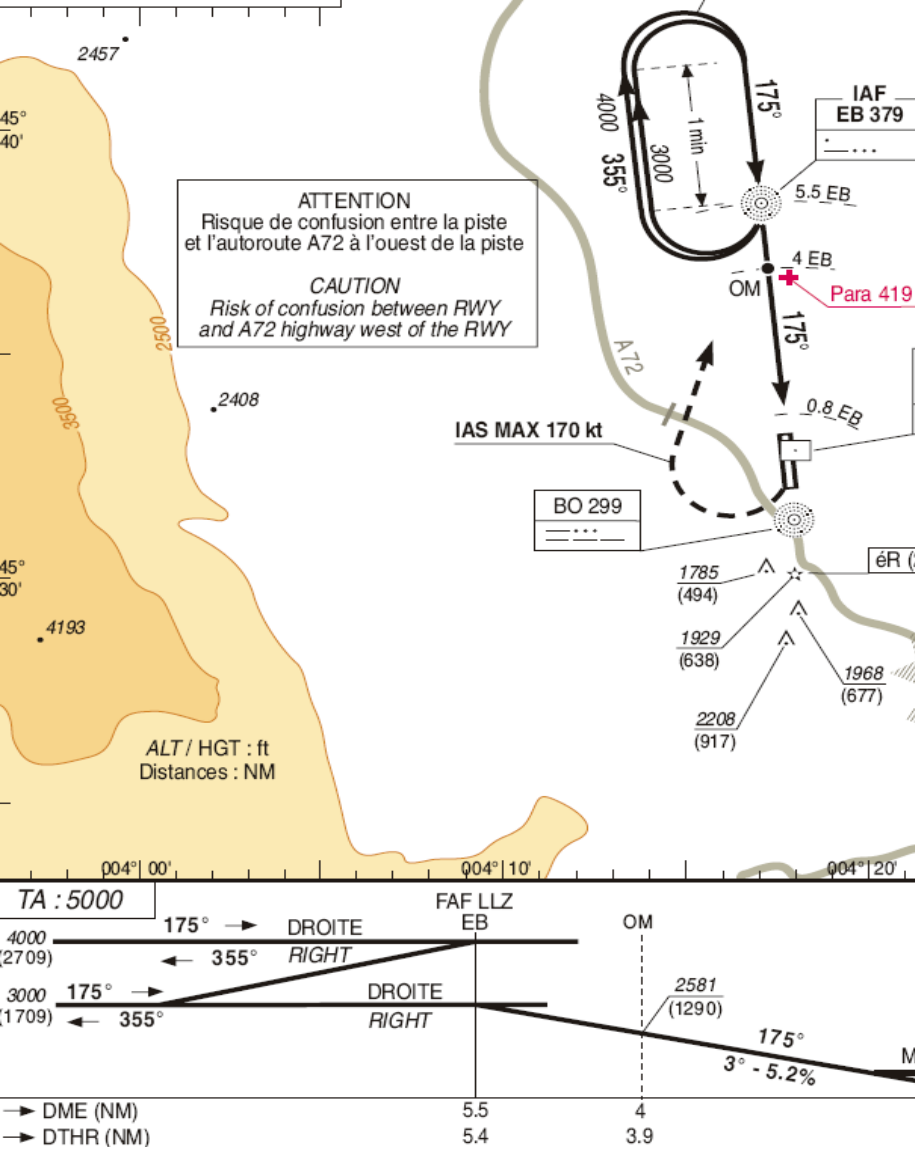
Values of ϕ

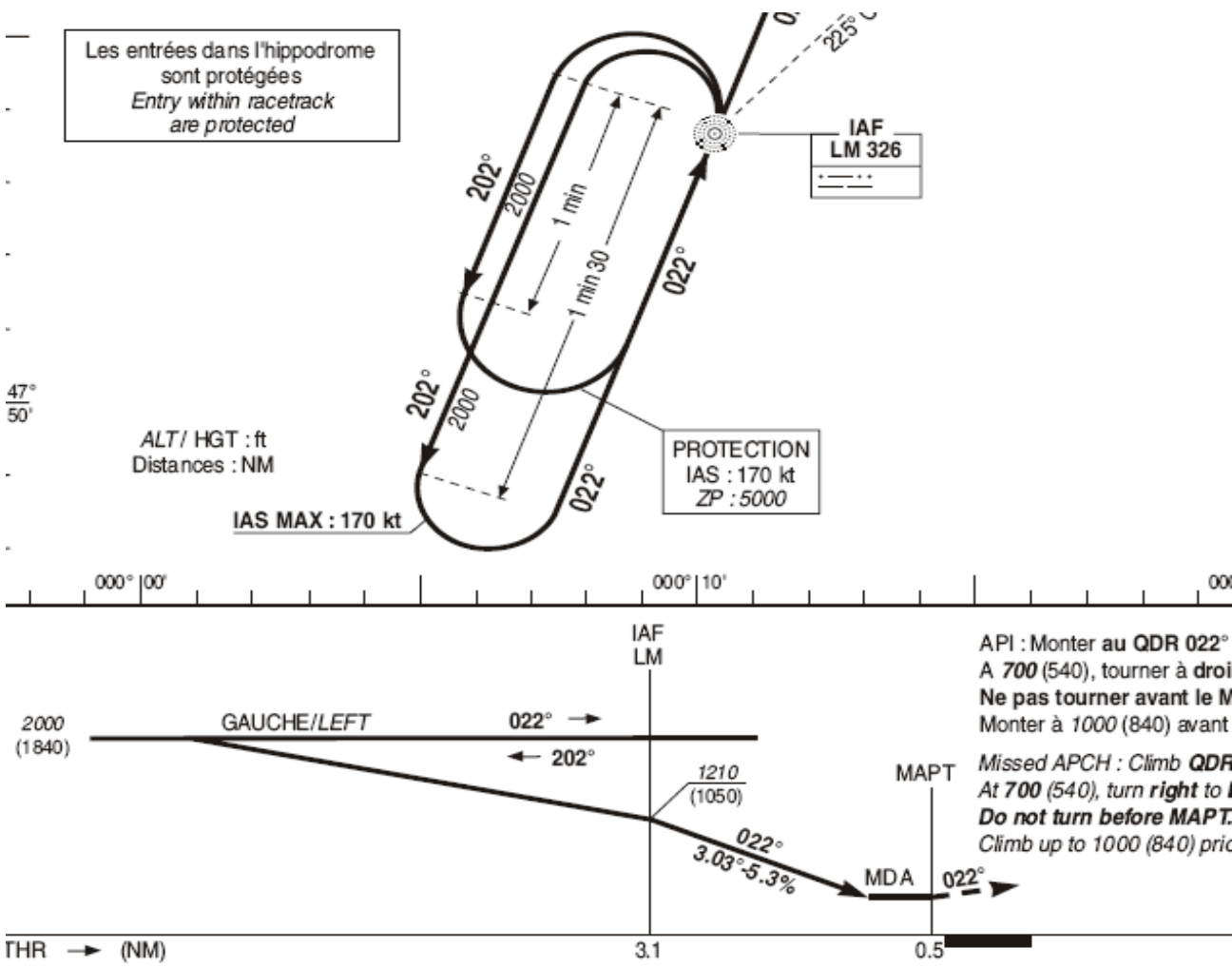
| Altitude \ IAS km/h (kt) | 165/335 km/h (90/180 kt) | 335/465 km/h (180/250 kt) |
|---|---|---|
| 1 500 m (5 000 ft)<br>3 000 m (10 000 ft) | 22° | 14° |

**Figure I-4-3-App A-3. U-type VOR/VOR procedure construction of protection areas**

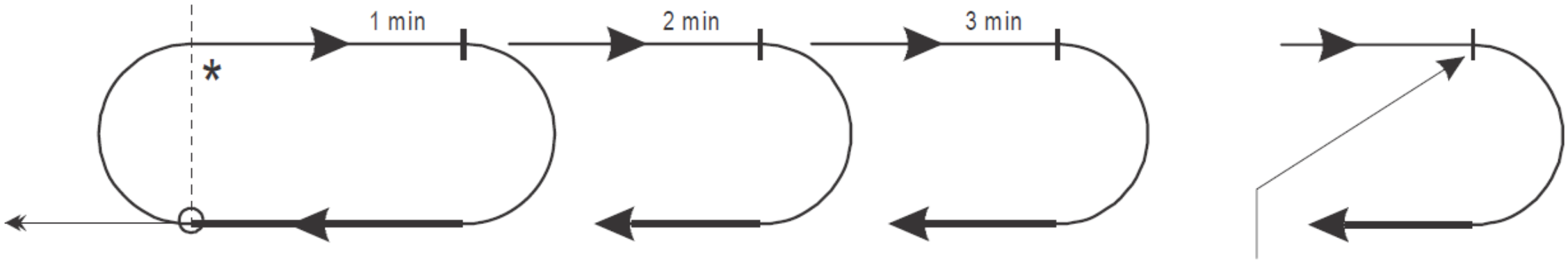
# Racetrack procedure

- General use:
  - To descend below minimum holding altitude:
    - No modification of outbound leg (vs holding);
    - Mostly used when high minimum holding altitude.
  - To extend outbound leg :
    - Mostly used with ILS;
    - Without loss of altitude.




# Protection: Same methodology than for holding pattern




End of outbound leg limited by a radial or DME distance from a suitably located facility (see Section 2, Chapter 2, 2.4.3, "Fixes for VOR or NDB with DME".)

track guidance

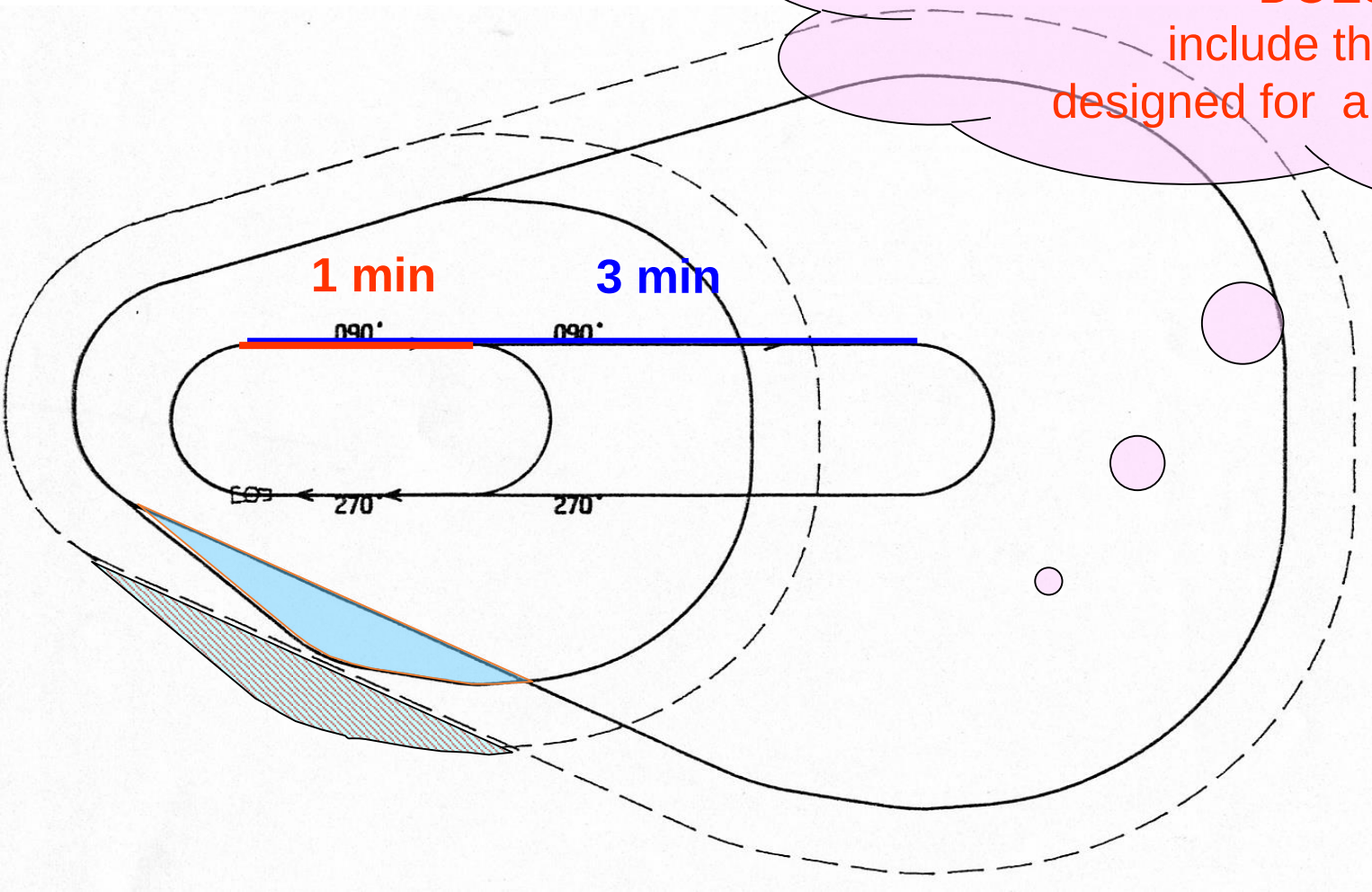
no track guidance

* For the start of timing in a racetrack procedure based on a facility, see 3.6.3 a).

**Parameters:**

- ❑ **IAS: Speed table;**
- ❑ **Maximum protection altitude: at least minimum holding altitude**
- ❑ **Outbound limit:**
  - ☞ **Time: 1 – 3 min with 30 second step**
  - ☞ **DME distance**
- ❑ **Protection:**
  - ☞ **Depends on aircraft category;**
  - ☞ **But only one is published**

**WARNING !**
Protection area corresponding to
racetrack with the greatest outbound time
DOES NOT always
include the protection area
designed for  a shorter outbound time



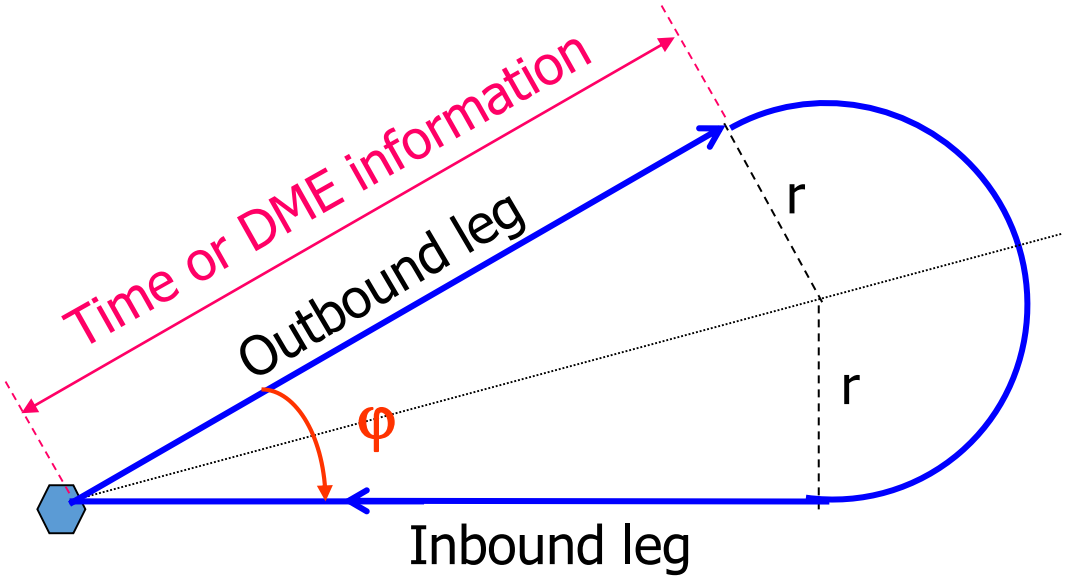
# Reversal procedures



- Two types of reversal procedures:
  - Base turn
  - Procedure turn.
- All consist in an outbound leg followed by an inbound leg.
- Outbound limitation:
  - Time;
  - DME distance;
  - Radial.
- Outbound may be determined for different aircraft categories (AB & CD e.g.):
  - Separate charts to be published in this case.

# Base turn






φ depends on TAS

**Starting point is always a facility or a fix (3 minutes max)**

**For TAS ≤ 170 kt :**

**φ ° = 36 / outbound time (min)**

**For TAS > 170 kt :**

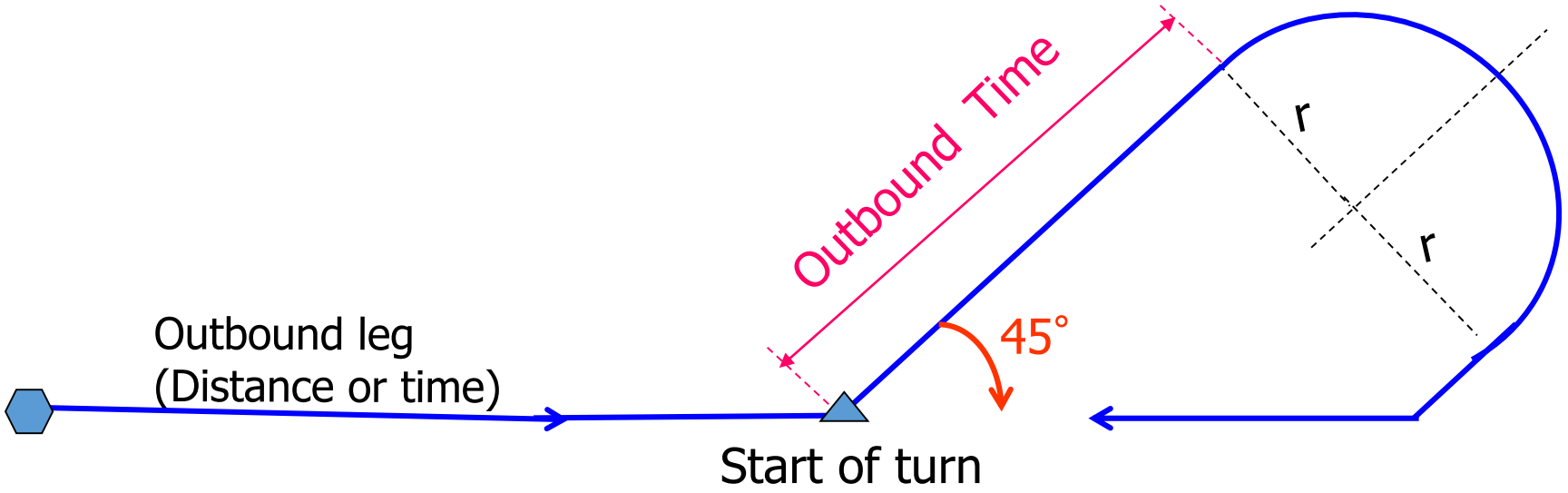
**φ ° = (0.215 xTAS (kt))/ outbound time (min)**

# Procedure turns

- Two types:
  - 45°/180° procedure turn;
  - 080°/260° procedure turn
- Main parameters:
  - Starting point: Facility:
  - Outbound leg:
  - Outbound time not published;
  - Maximum and minimum IAS:
    - Cat. A, B
    - Cat. C, D.

# 45°/180° procedure turn



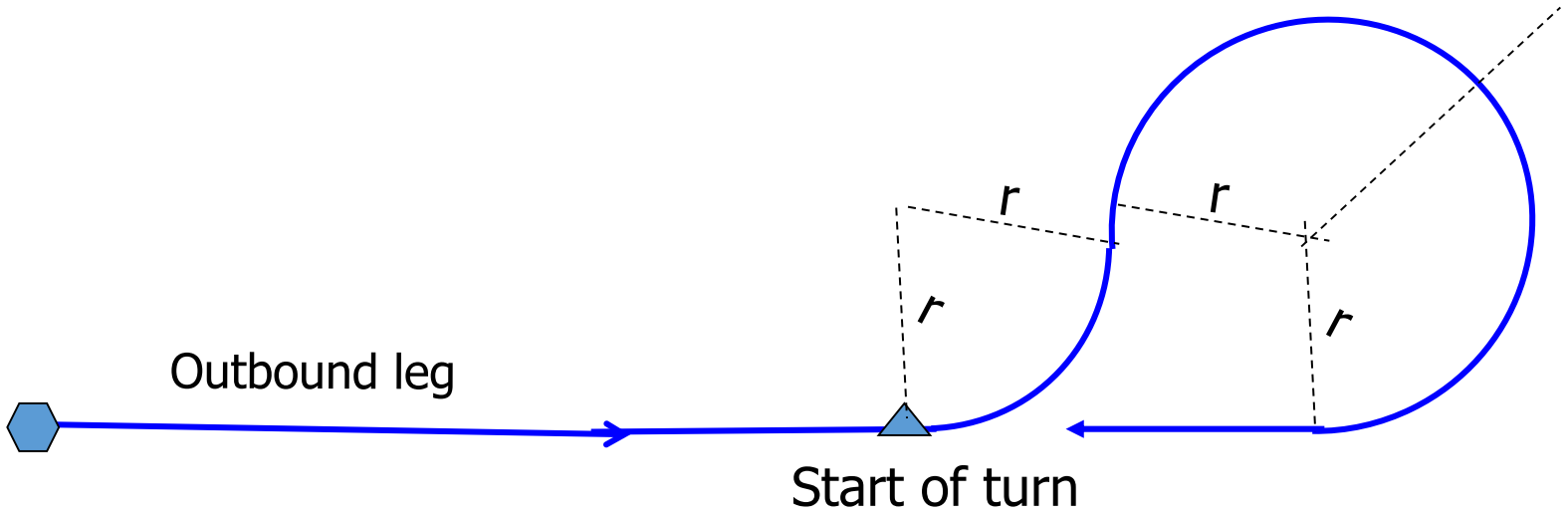



| Start of turn |
|---|
| Time : 1 min to 3 min |
| Fix |

| Outbound time | **NOT PUBLISHED** |
|---|---|
| Cat A and B | 1 min |
| Cat C and D | 1 min 15 s |

# 080°/260° procedure turn



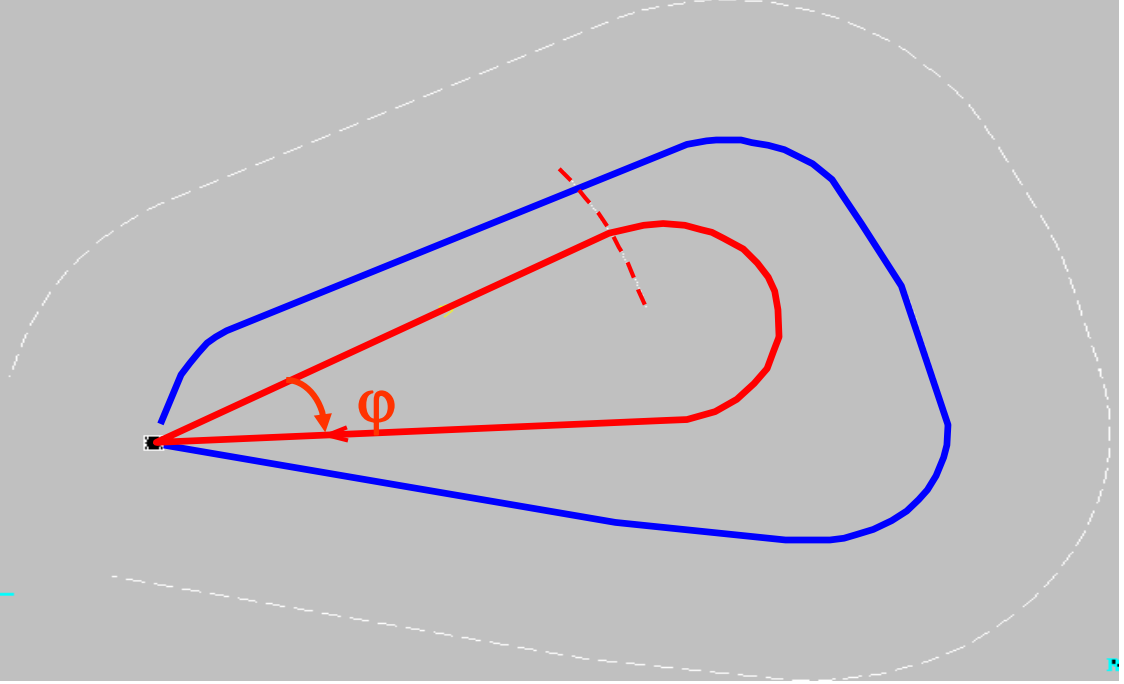


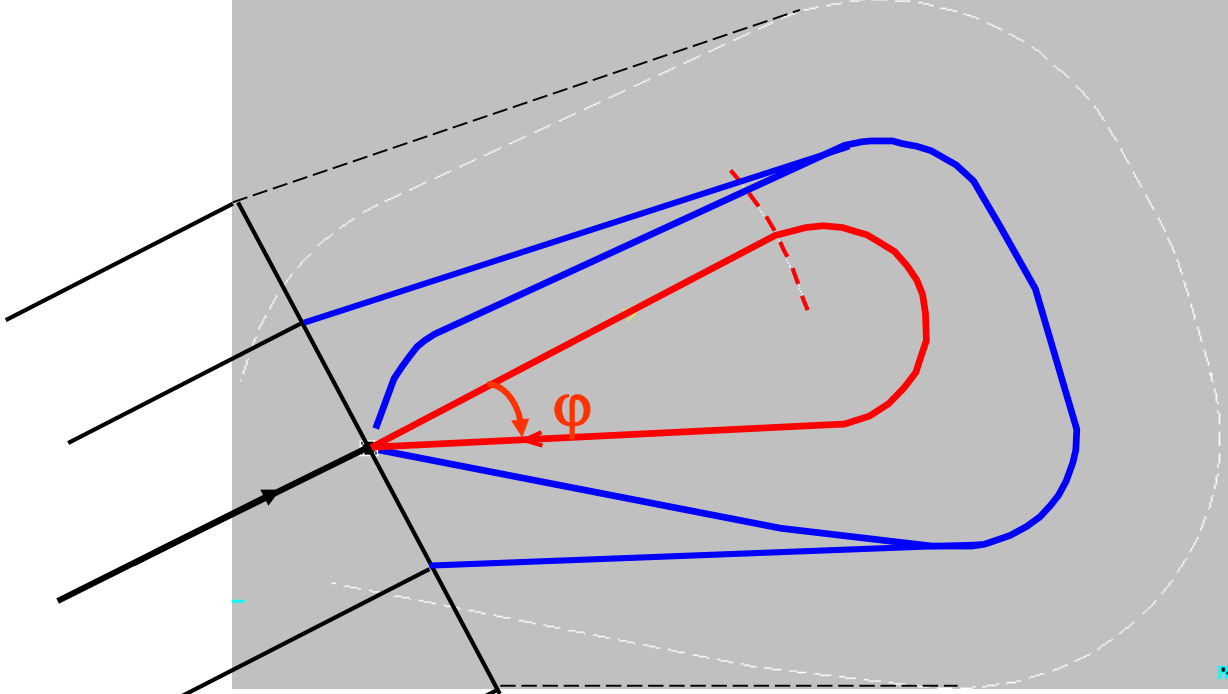

| Start of turn |
| --- |
| Time : 1 min to 3 min |
| Fix |

# Reversal procedures protection



- Protection parameters:
  - Type of reversal procedure;
  - Maximum altitude;
  - Highest and lowest IAS:
    - Design two different protections for each speed;
    - Blend into one protection area;
  - Secondary area: 2.5 NM all around;
  - Full area blended with the protection area of the previous segment;
  - In case of procedure turn, protect both 045°/180° and 080°/260° (Except if mention is made on the map).


φ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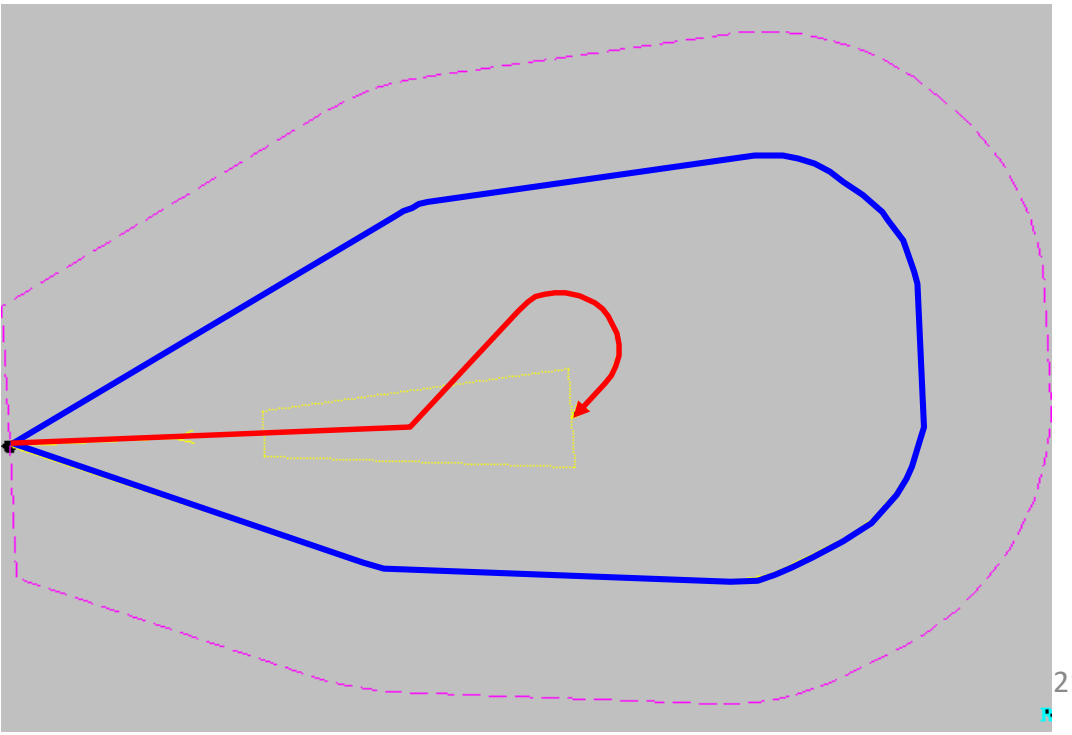
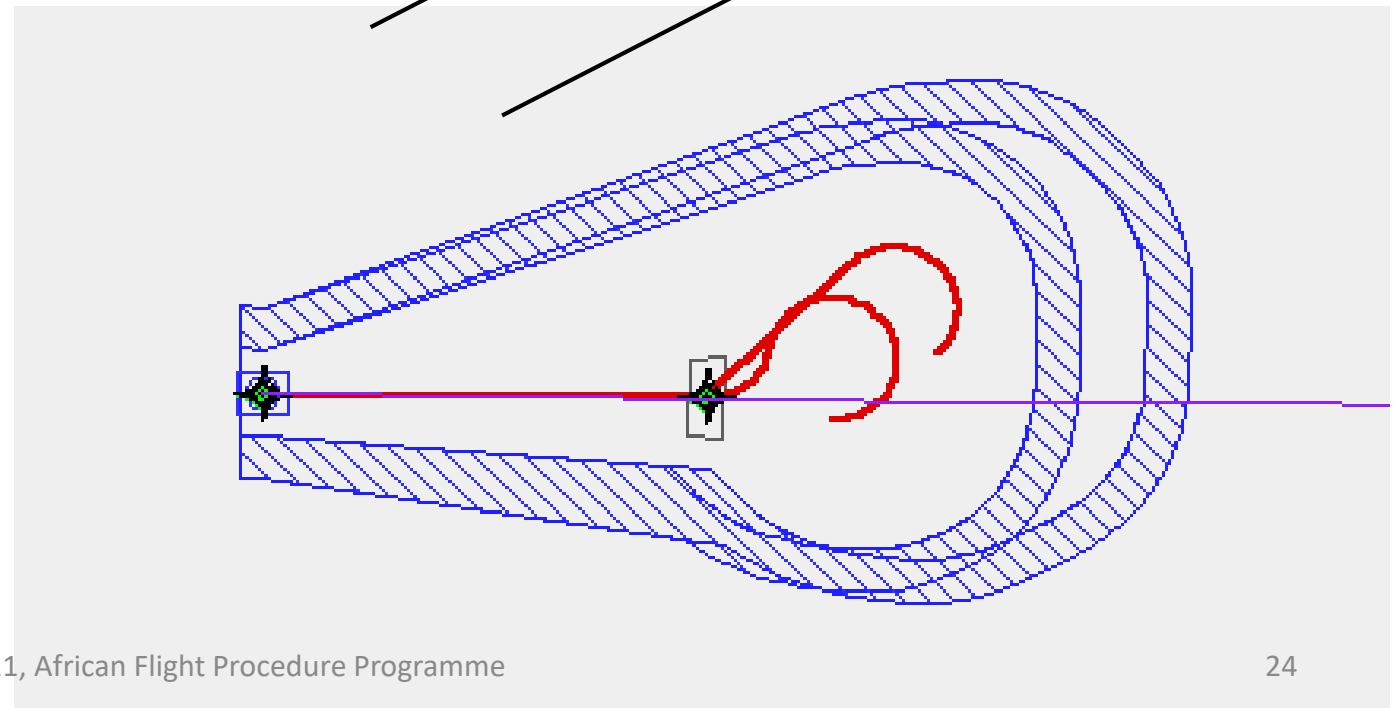




# Descent gradient computation

- No descent considered during turn;
- Maximum height loss calculated along all NOMINAL tracks except turns;
- For procedure turns :
  - ☞1 min added to nominal outbound time.

***Table I-4-3-1.*** **Maximum/minimum descent on a reversal or racetrack procedure**
*(Applicable as of 4 November 2021)*

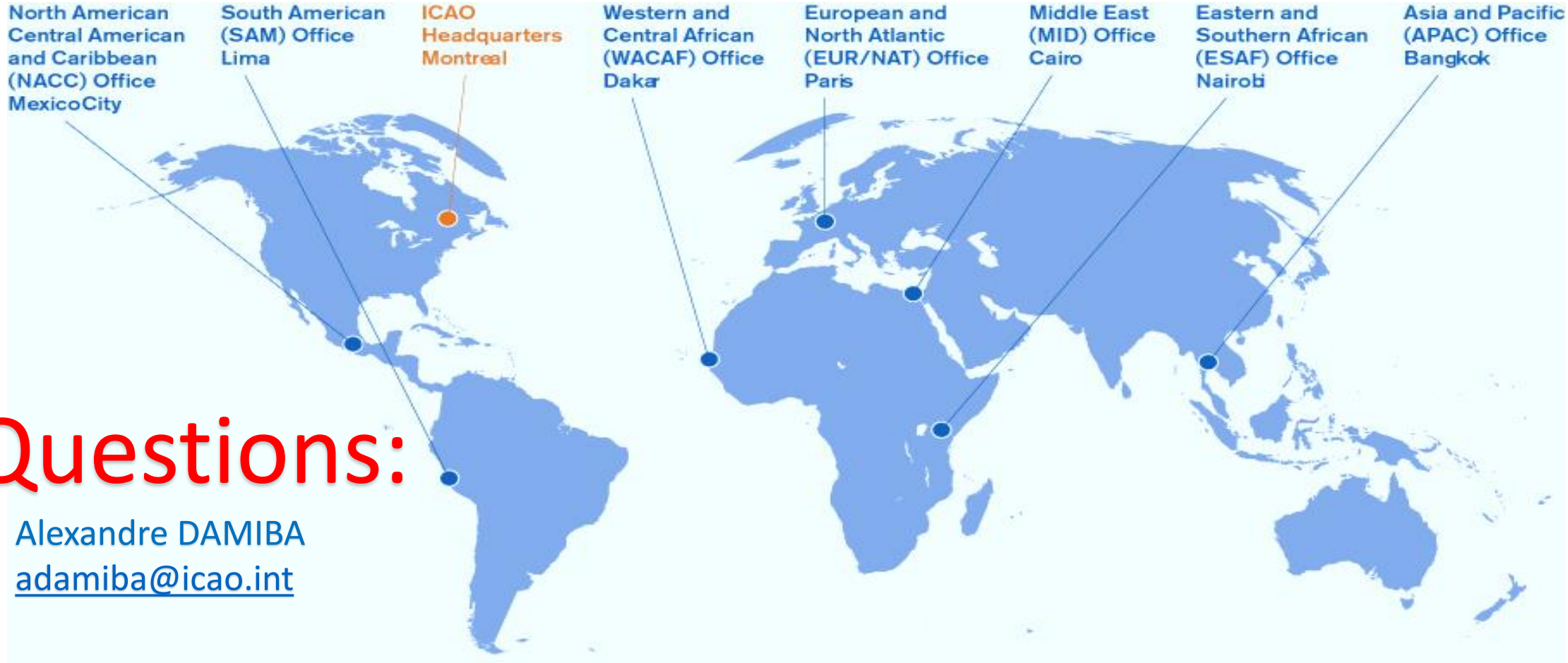
| | | *Maximum** | *Minimum** |
|---|---|---|---|
| Outbound track | Cat A/B | 245 m/min (804 ft/min) | N/A |
| | Cat C/D/E/H | 365 m/min (1 197 ft/min) | N/A |
| Inbound track | Cat A/B | 200 m/min (656 ft/min) | 120 m/min (394 ft/min) |
| | Cat H | 230 m/min (755 ft/min) | N/A |
| | Cat C/D/E | 305 m/min (1 000 ft/min) | 180 m/min (591 ft/min) |

* *Maximum/minimum descent for 1 minute nominal outbound time in m(ft). For maximum descent rates related to a final approach segment, see Chapter 5, 5.3.*

# Summary



- Goal of the initial approach segment;
- Track guidance (guided, no-guided, DR, mix);
- Shape: straight, curved, mix of curved and straight);
- Dr tracks: goal, length (10 NM), Angle with the FAF (45°);
- Racetrack
- Reversal turns (base turn, procedure turn);
- Descent gradient computation for racetrack and procedure turns.




# Questions:

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