PANS-OPS Flight Procedure Design Training for CAAs

23 August – 03 September 2021

12 – RNAV ILS connexion

(Doc. 8168, Vol. 2, Part II, Section 1, Chap. 1)

Outlines

1. General
2. Initial approach segment
3. Intermediate approach segment
4. Missed approach
5. Obstacles assessment
6. Promulgation

General

- Transition form RNAV to ILS:
  - Switch from RNAV mode to ILS mode at IF;
  - Laterally : capture of LOC:
    - With auto Pilot, anticipation is taken by system even with big turn angle at IF;
    - For Flight Director, flight overshoot risk increase with 2 problems:
      - No Anticipation made due to early LOC mode activation (No RNAV turn);
      - LOC display sensitivity high => very late movement of LOC needle on the display.
    - The Intermediate distance shall be long enough to intercept LOC then glide:
      - With short distance => Glide interception by above.

General

- PBN relevant applications:
  - RNAV or RNP route with only systems capable of navigation accuracy of 1 NM or lower.;
  - RNAV or RNP route shall terminate at an IF located on the LOC course;
  - RNAV/RNP turn construction is applicable for turns within the initial segment and at the IF on the LOC course;
  - PBN Applications:
    - A-RNP (TSE ≤1);
    - RNAV1;
    - RNP1;
    - RNP APCH (for initial, final and missed).

General

- RNAV ILS vs conventional ILS:
  - New:
    - Missed approach OAS limit;
    - Connection intermediate / OAS;
    - RNAV guidance in missed approach (lead to different obstacle assessment).
  - Unchanged:
    - Standard conditions;
    - Height Loss;
    - Obstacles classification (approach or missed approach);
    - Equivalent height if missed approach obstacle.

Initial approach segment

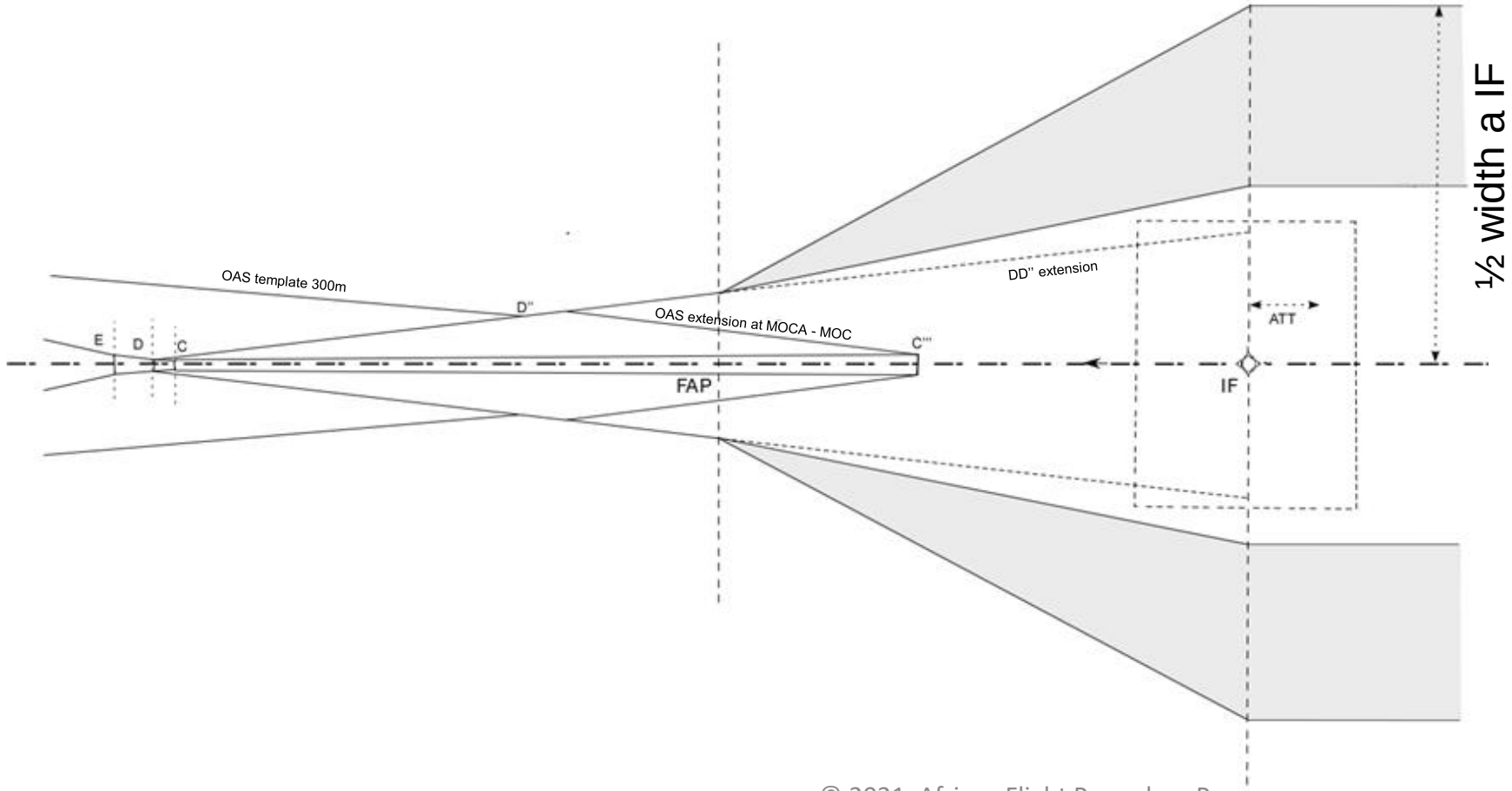
- Guidance: RNAV or RNP route;
- Racetrack possible:
  - ☞ Fix and inbound = LOC guidance;
  - ☞ Protection as holding.
- End at IF with IF in the LOC Axis:
  - ☞ When IF/LOC ≥ 25 NM ➡ Control flight;
  - ☞ IF define as Fly By Waypoint (anticipation):
    - Max turn angle : 90°;
    - Optimum : 30° (auto-pilot / LOC coupling issue).

Intermediate approach segment

- Length:
  - Refer to minimum localizer and glide path interception.
- Intermediate area : link between IF and FAF:
  - At IF : ½ width RNAV at the end of initial RNAV segment;
  - At FAP : width of surface X extension.

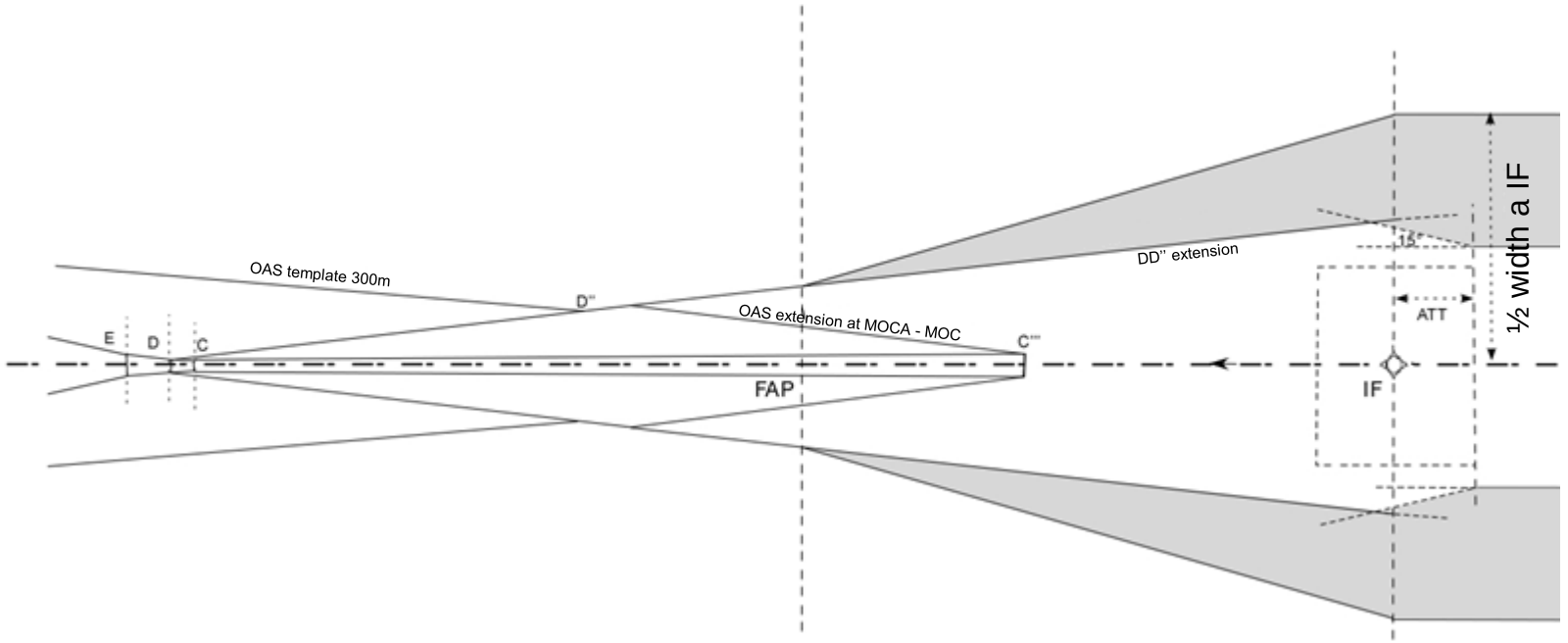
Intermediate approach segment

1st case : X extension (DD”) is smaller than primary area at IF



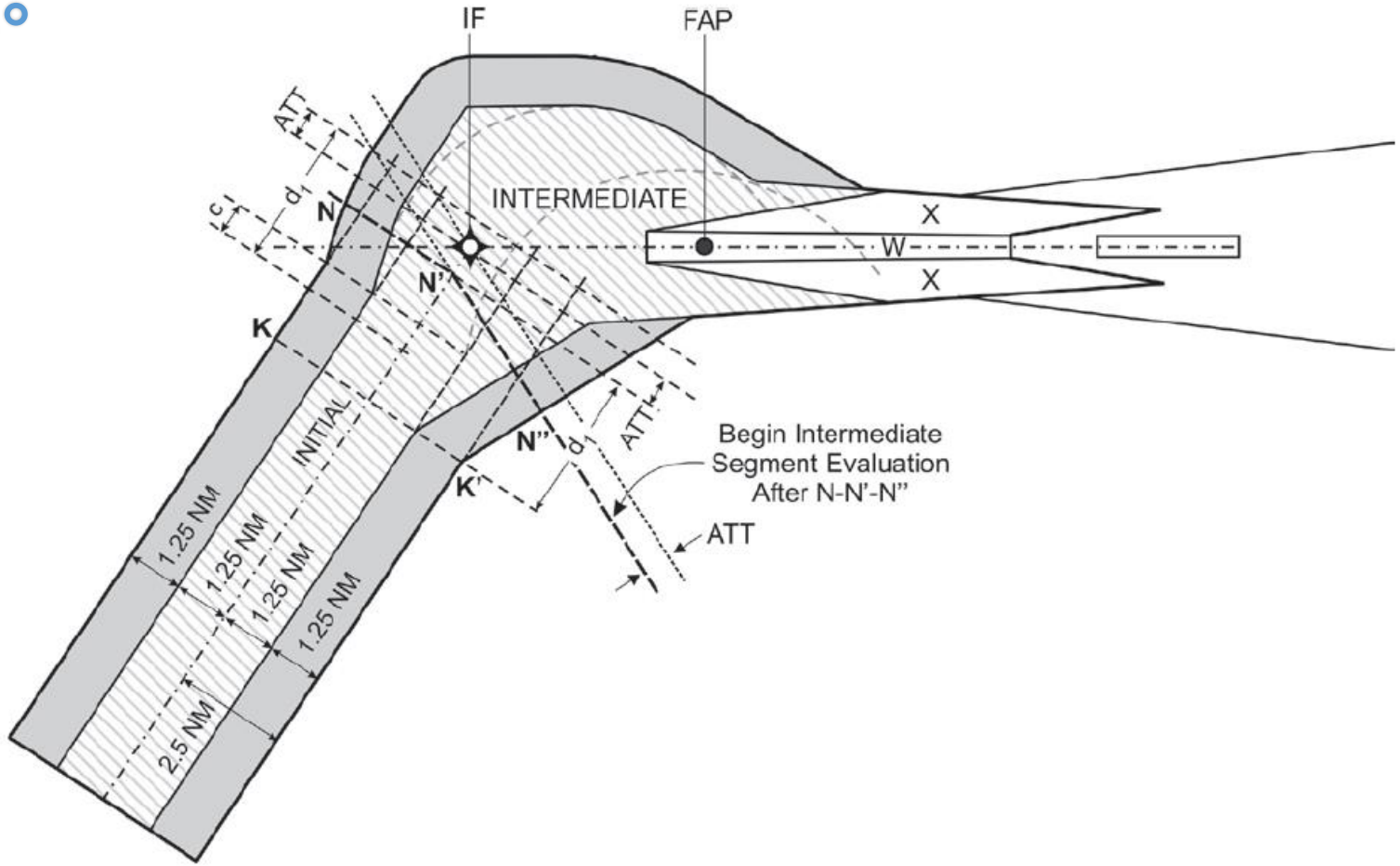
Intermediate approach segment

2nd case : X extension (DD”) is bigger than primary area at IF



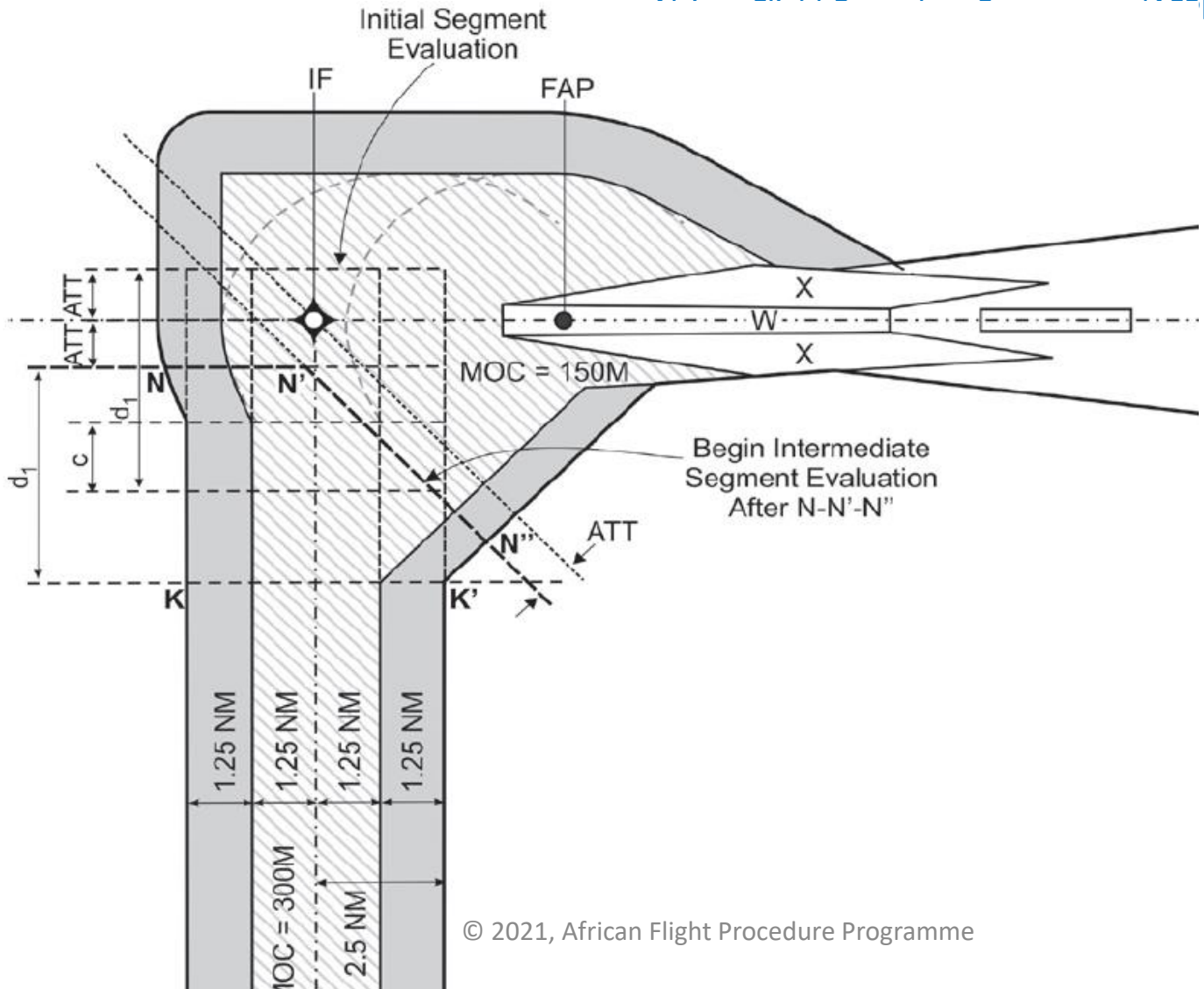
Intermediate approach segment

Turn at IF: 60°



Intermediate approach segment

Turn at IF: 90°



Missed approach

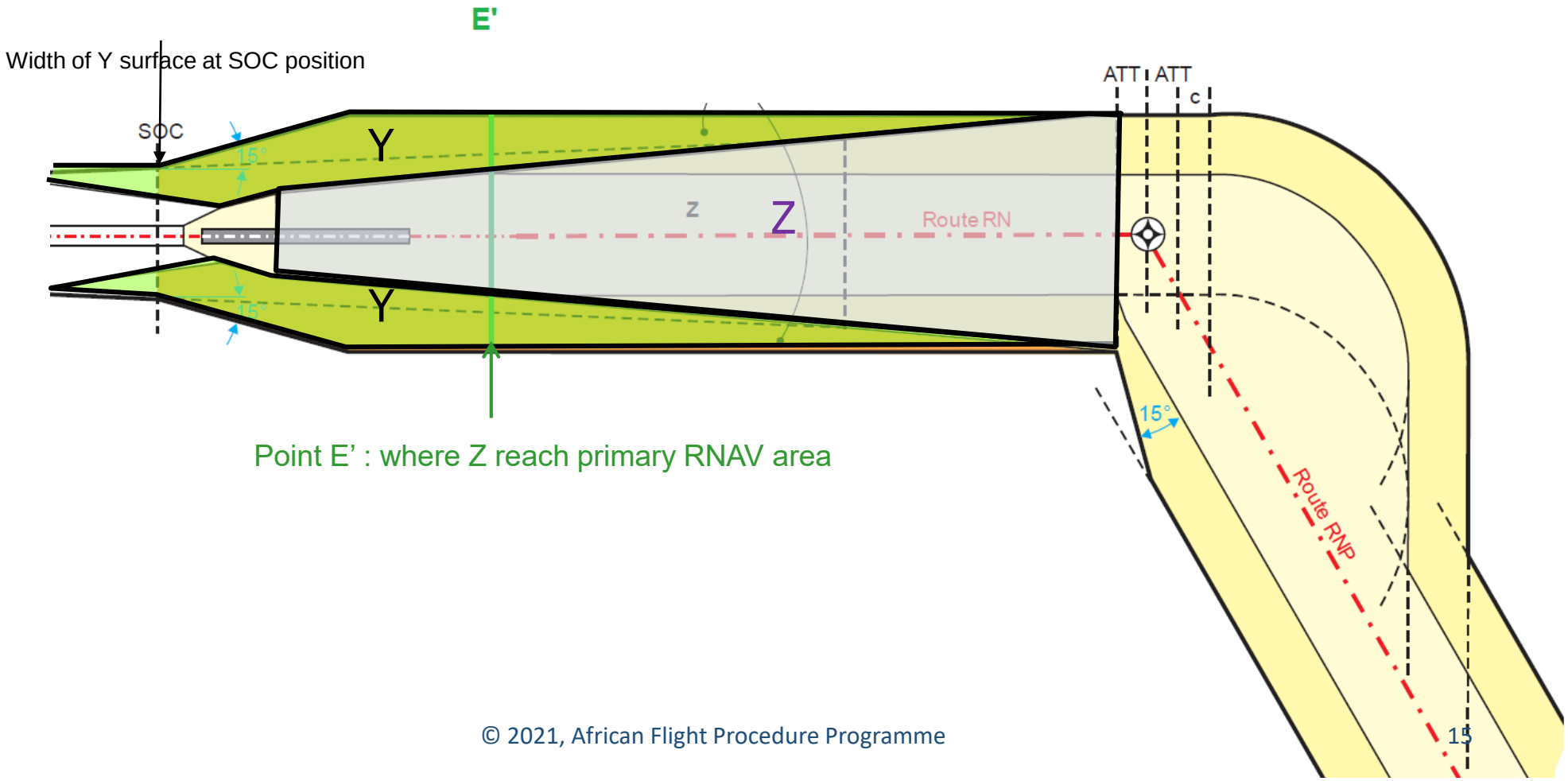
- Transition from ILS to PBN missed approach:
  - RNAV or RNP route with only systems capable of navigation accuracy of 1 NM or lower;
  - Turn at TP or turn at Altitude possible;
  - RNAV guidance considered from SOC;
  - From accurate guidance to less accurate :
    - Needle will remain centred even if the aircraft diverge laterally from the trajectory.

Missed approach

❑ Area :

- ☞15° splay from width at SOC position until ½ width of RNAV area. ***(Iterative process as SOC is OCH dependant)***
- ☞Extrapolation of Y and Z surface.
  - Z surface continue to splay until ½ width of RNAV area;
  - Identify point E' where Z reach primary RNAV area.
- ☞Earliest location of Fix :
  - *Fly over : ATT from SOC;*
  - *Fly By : ATT + (rtan A/2 + 3s)*
- ☞Max turn angle : 90°;
- ☞*RF Not Permitted for first leg but can be used after a TF (defined on the LOC course).*

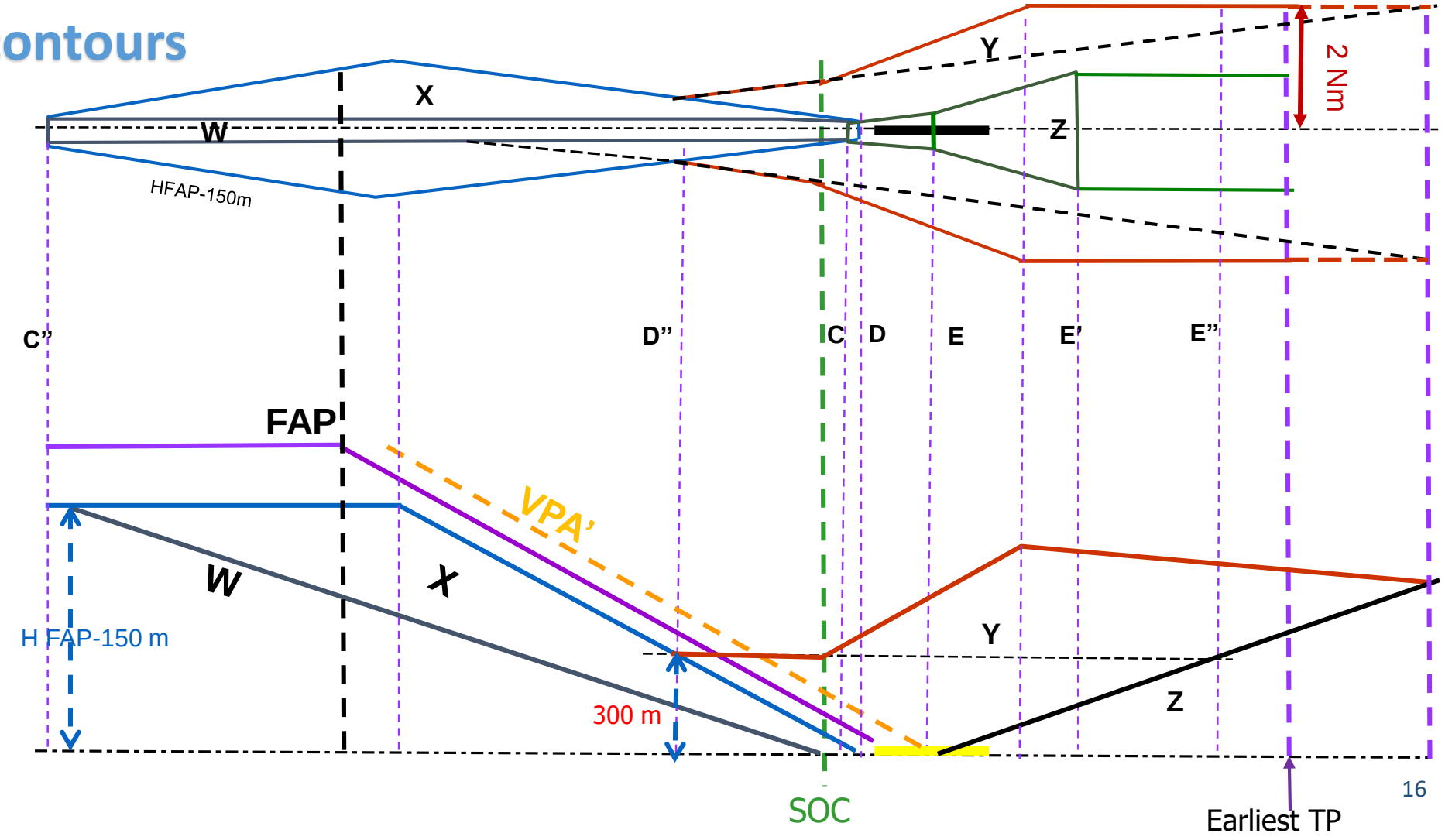
Missed approach with FO waypoint



Point E' : where Z reach primary RNAV area

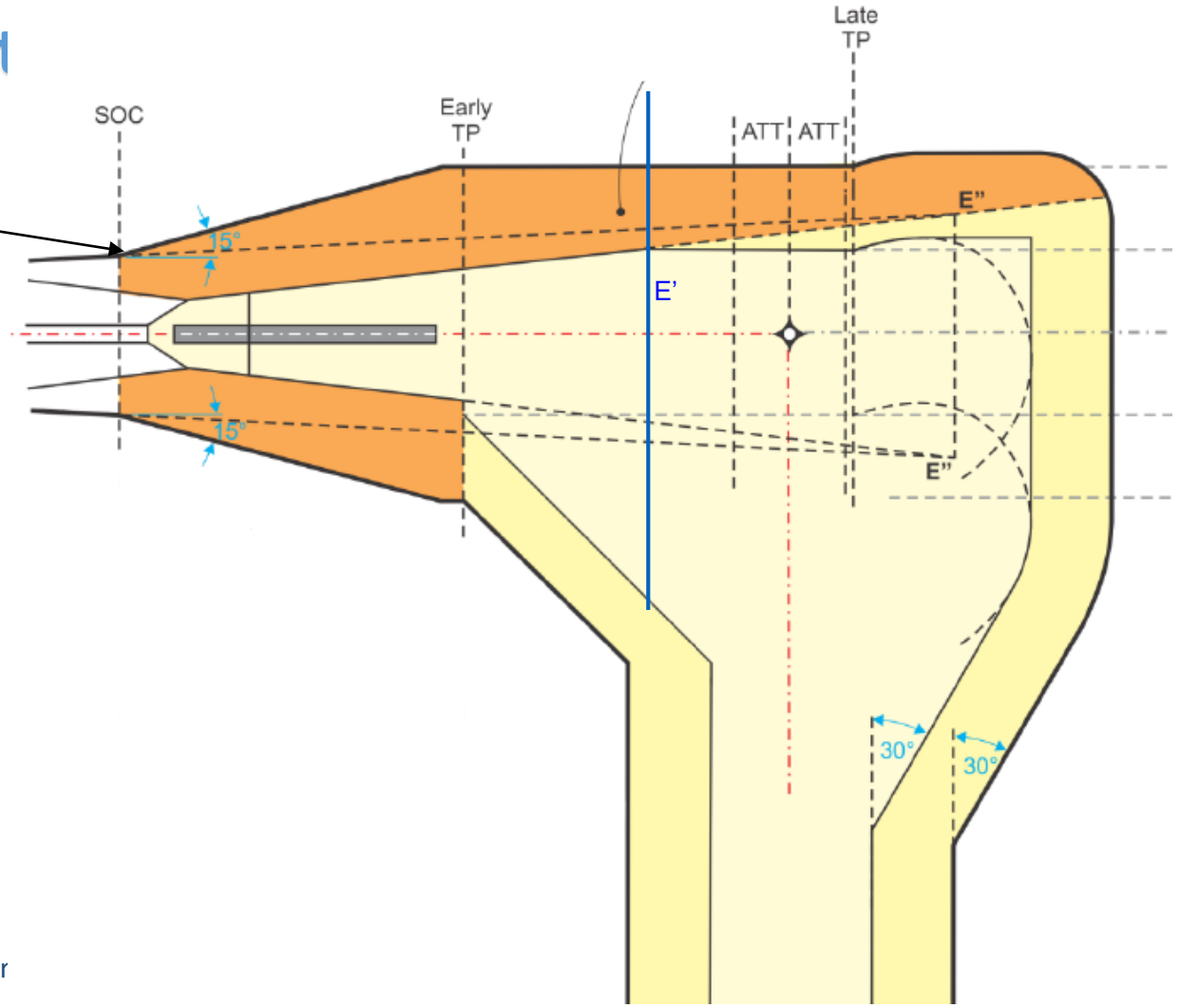
Missed approach

RNAV ILS contours



Missed approach with FB waypoint

Width of Y surface at SOC position



OCH computation

- Until the Point E' :
  - ☞Use of OAS surface to compute OCH for penetrating obstacles as ILS:
    - No secondary area and No MOC to use!

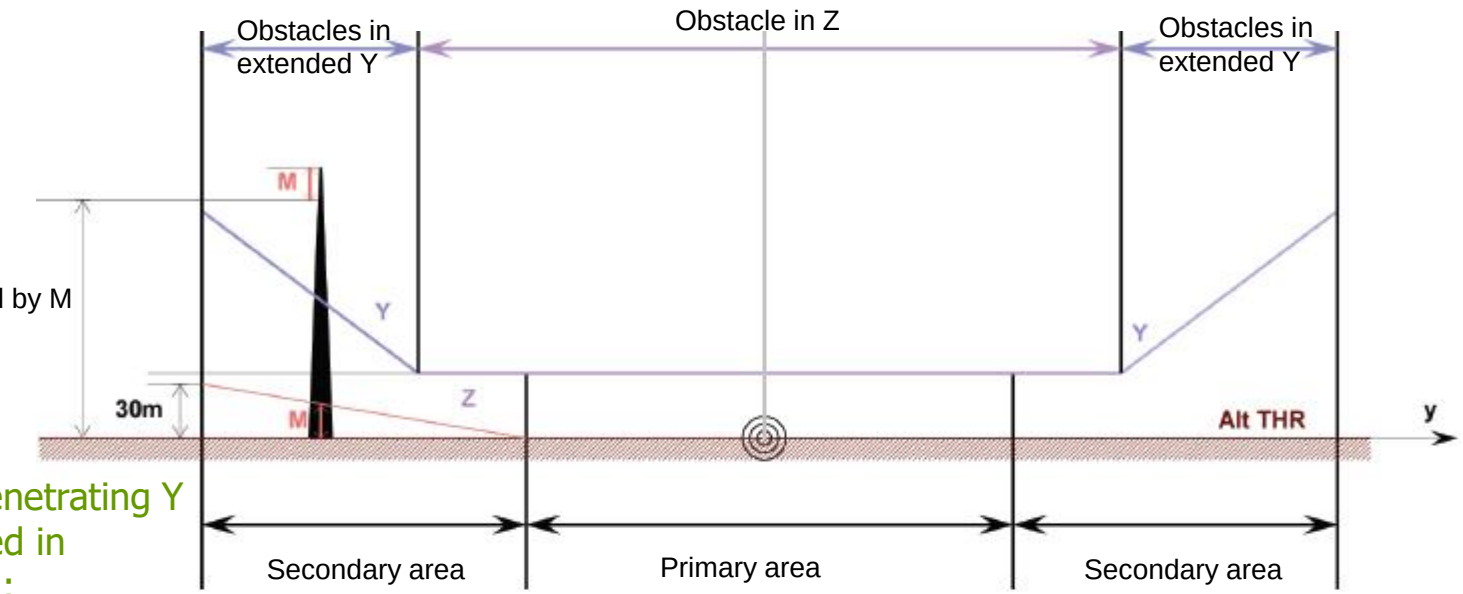
OCH computation

- After the point E' until earliest TP:
  - Primary area :
    - Use of Z surface (no MOC) and OCH computation for penetrating obstacles as in ILS.
  - Secondary area :
    - Identify obstacles penetrating Y, Y extended or Z;
    - Reduce obstacles by M (linearly reduced from 30 m at the edge of secondary area to 0 at the edge of primary area);
    - Compute Heq using Hma=Hobs –M
    - Compute OCH = Heq + HL

OCH computation

- After earliest TP (Turn area):
  - 50 m or 30 m MOC in primary area linearly decreasing in secondary area.
  - Obstacle not penetrating Y (from earliet TP) in the other side of the turn can be ignored for OCH computation.

Sectional view (after point E')



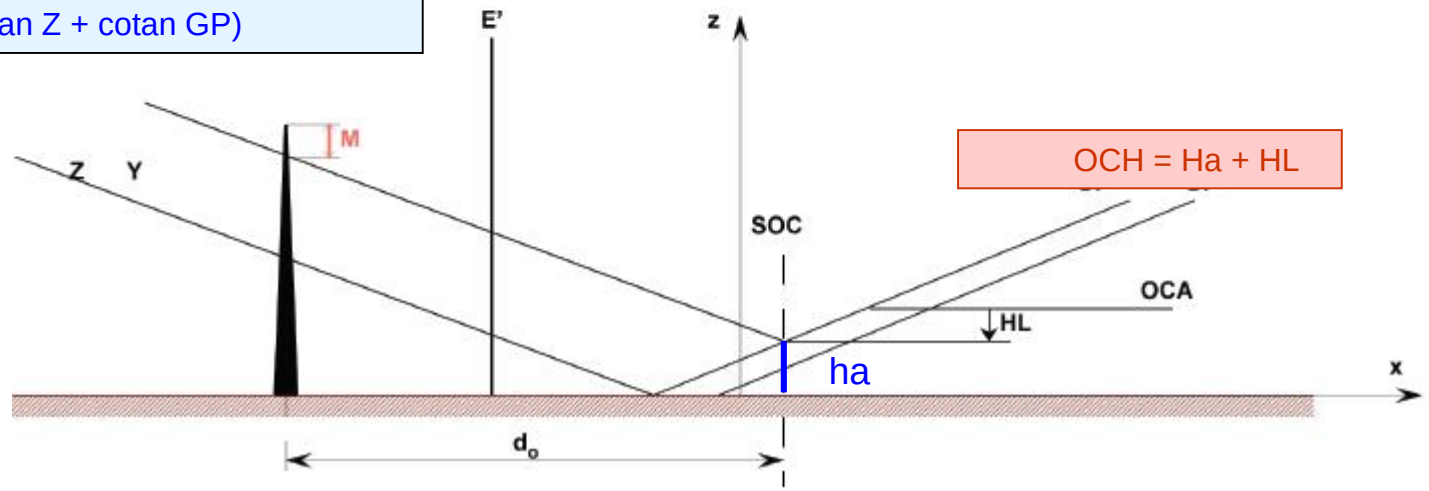
Hma = Obstacle reduced by M

•Obstacle in penetrating Y and it is located in secondary area:

Hma = (hobst – M)

$$ha = \frac{(hobst - M)\ \text{cotan}\ Z + (xobs + 900)}{(\text{cotan}\ Z + \text{cotan}\ GP)}$$

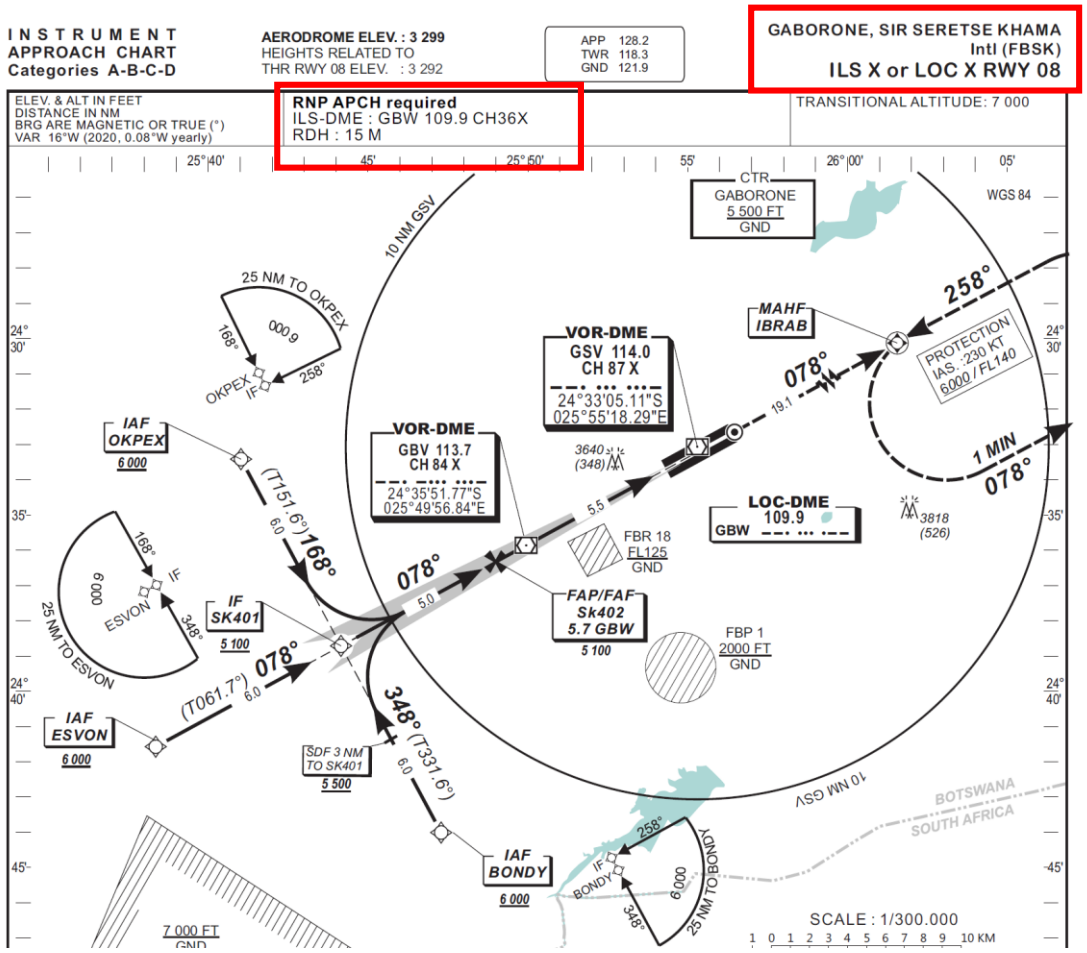
Profile view (after point E')



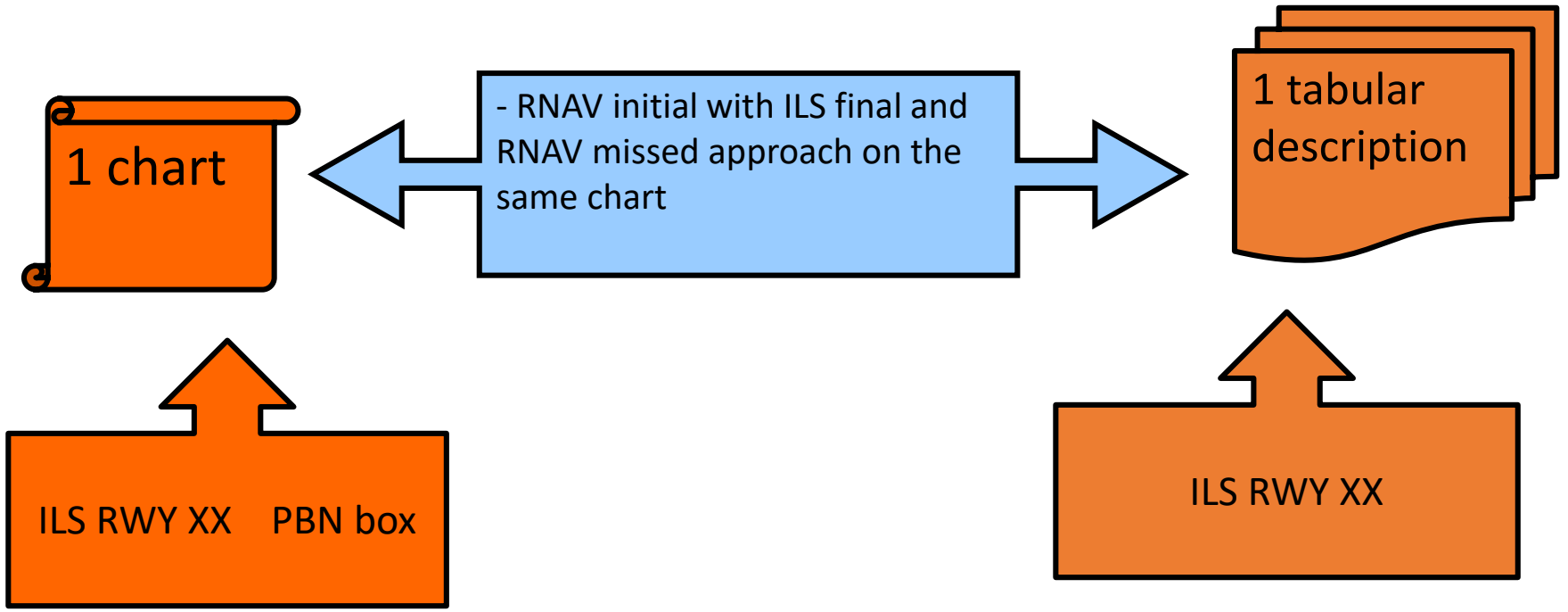
OCH = Ha + HL

Publication

- Title: ILS RWY XX
- PBN requirement box: identification of the relevant PBN navspec:
  - "RNP 1 application" or
  - "RNAV 1 application".



Publication



Questions:

Alexandre DAMIBA
adamiba@icao.int