PANS-OPS Flight Procedure Design Training for CAAs

23 August – 03 September 2021

14 – ILS missed approach

(Doc. 8168, Vol. 2, Part II, section 1, § 1.5)

Outlines

1. General
2. Final missed approach
3. Straight missed approach
4. Turning missed approach
5. Turn at a TP
6. Turn at an altitude
7. Turn as soon as practicable

General

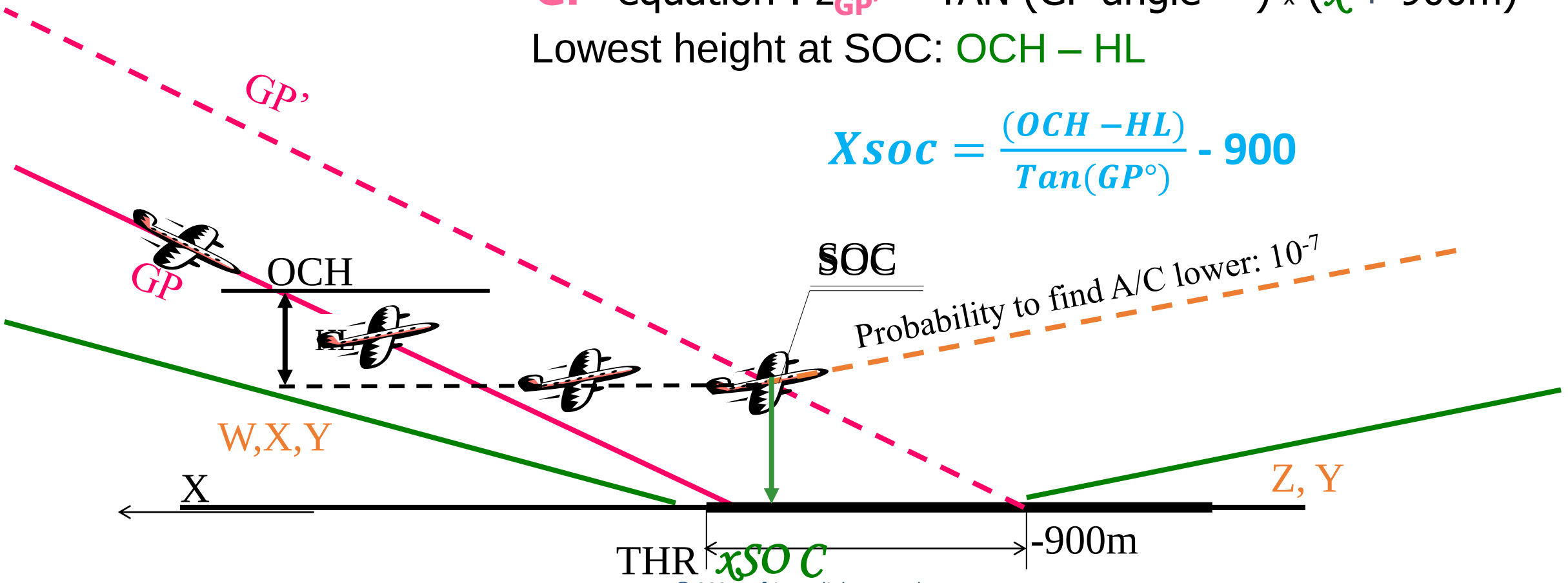
- Initial and intermediate M.A.:
  - Included in precision segment;
  - Computation of OCHps includes obstacles in initial and intermediate phases of missed approach;
  - No MAPt but a,
- SOC:
  - Unique for all categories of A/C
  - Location of SOC in OAS coordinate system ?
  - Minimum Height at SOC ?

Start of Climb

GP' equation : $z_{GP'}$ = TAN (GP angle °) x (x + 900m)

Lowest height at SOC: OCH – HL

$$Xsoc = \frac{(OCH - HL)}{Tan(GP°)} - 900$$



Final missed approach

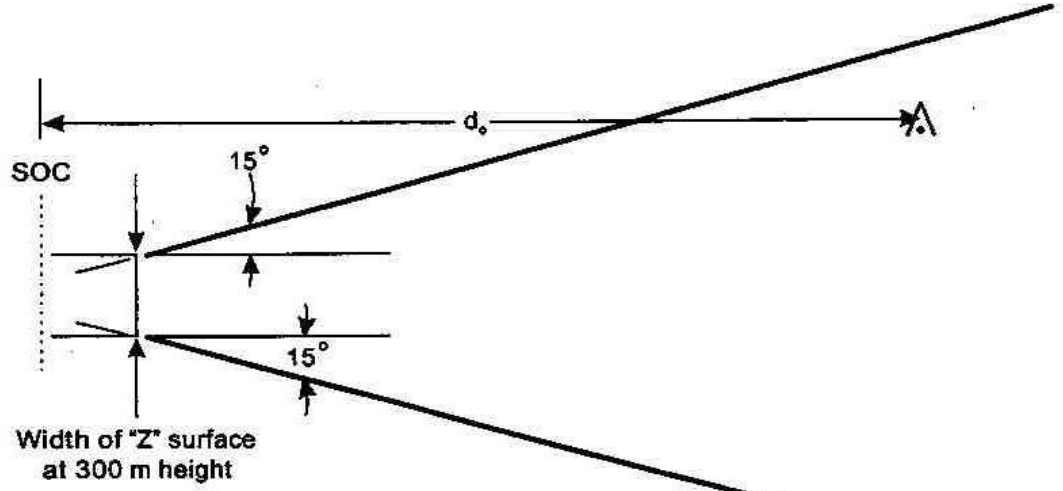
- Two types of missed approach:
  - Straight missed approach;
  - Turning missed approaches.
- From the turn up to next phase of flight (holding, initial, etc.);
- Climb gradient: nominal 3% up to 5%:
  - Gradient more than standard 3% shall be published on IACs.

Straight missed approach

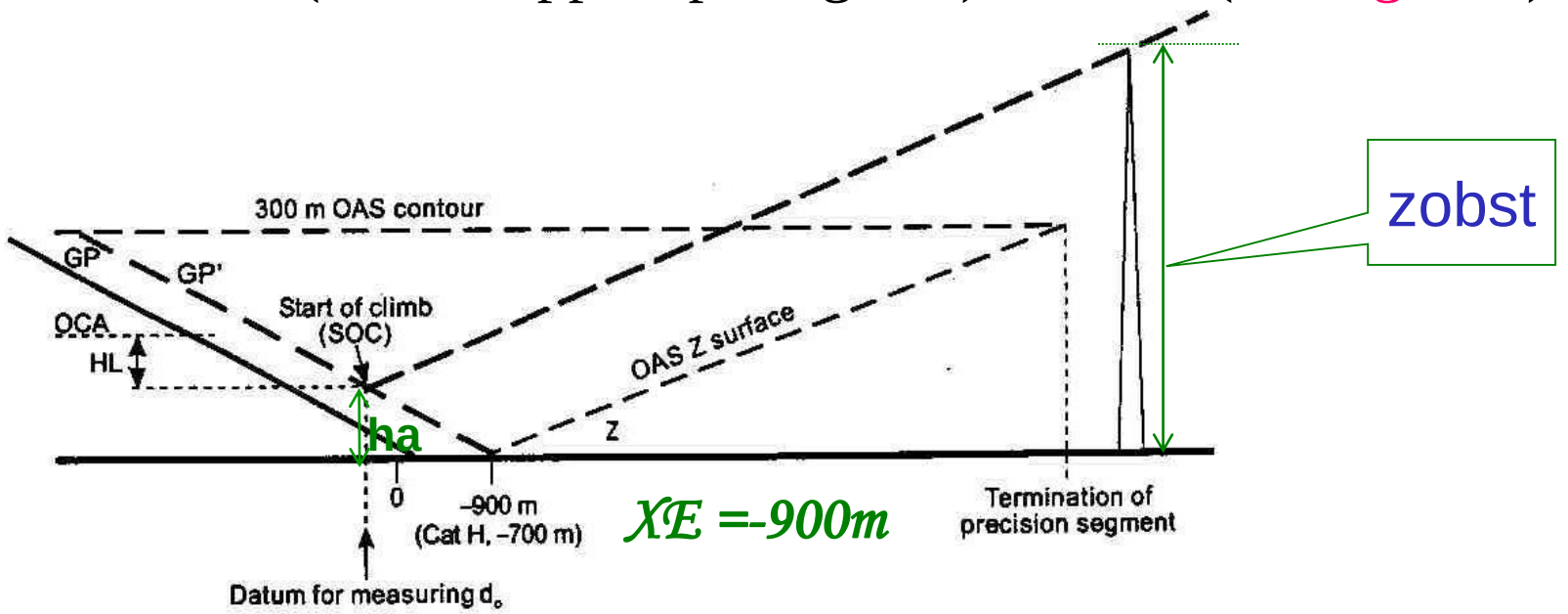
- Very seldom used:
  - No guidance;
  - Dead reckoning track.
- Protection area based on
  - OAS width at the end of precision segment;
  - Splay angle of 15° / path;
  - No secondary area;
  - No MOC.
- OCH ?
  - From precision segment : OCHps;
  - From straight missed approach: OCHma;
  - OCHma = Max (ha +HL)
  - **OCH = max (OCHps, OCHma)**

Missed Approach

Straight missed approach



$$h_a = \frac{zobst \text{ x Cotan (missed app slope angle}^\circ\text{)} + (xobst - XE)}{\text{Cotan (missed app slope angle}^\circ\text{)} + \text{Cotan (GPangle}^\circ\text{)}}$$



Turning missed approach

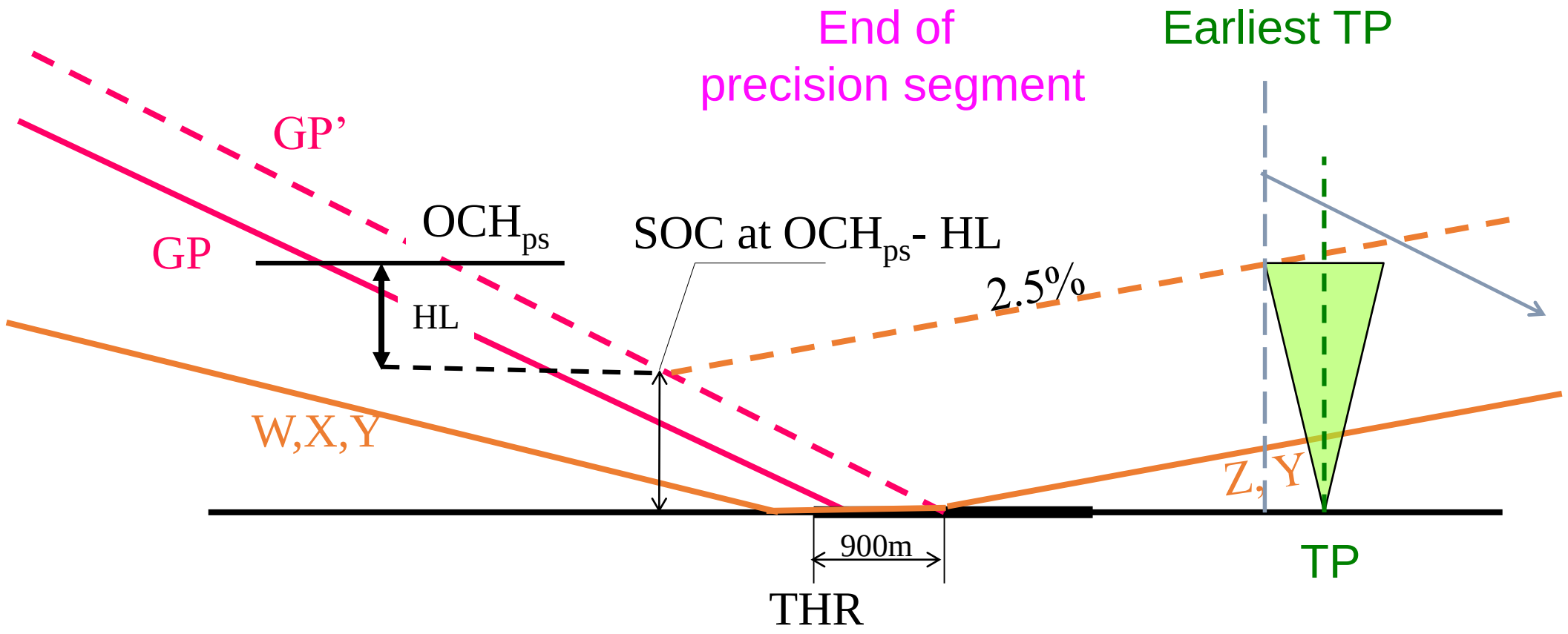
- Three types of turns:
  - Turn at a designated turning point (turn at TP);
  - Turning at a designated Altitude/Height : TNA/H;
  - As soon as practicable.

- Turns include:
  - Turn initiation area and
  - Turn area.

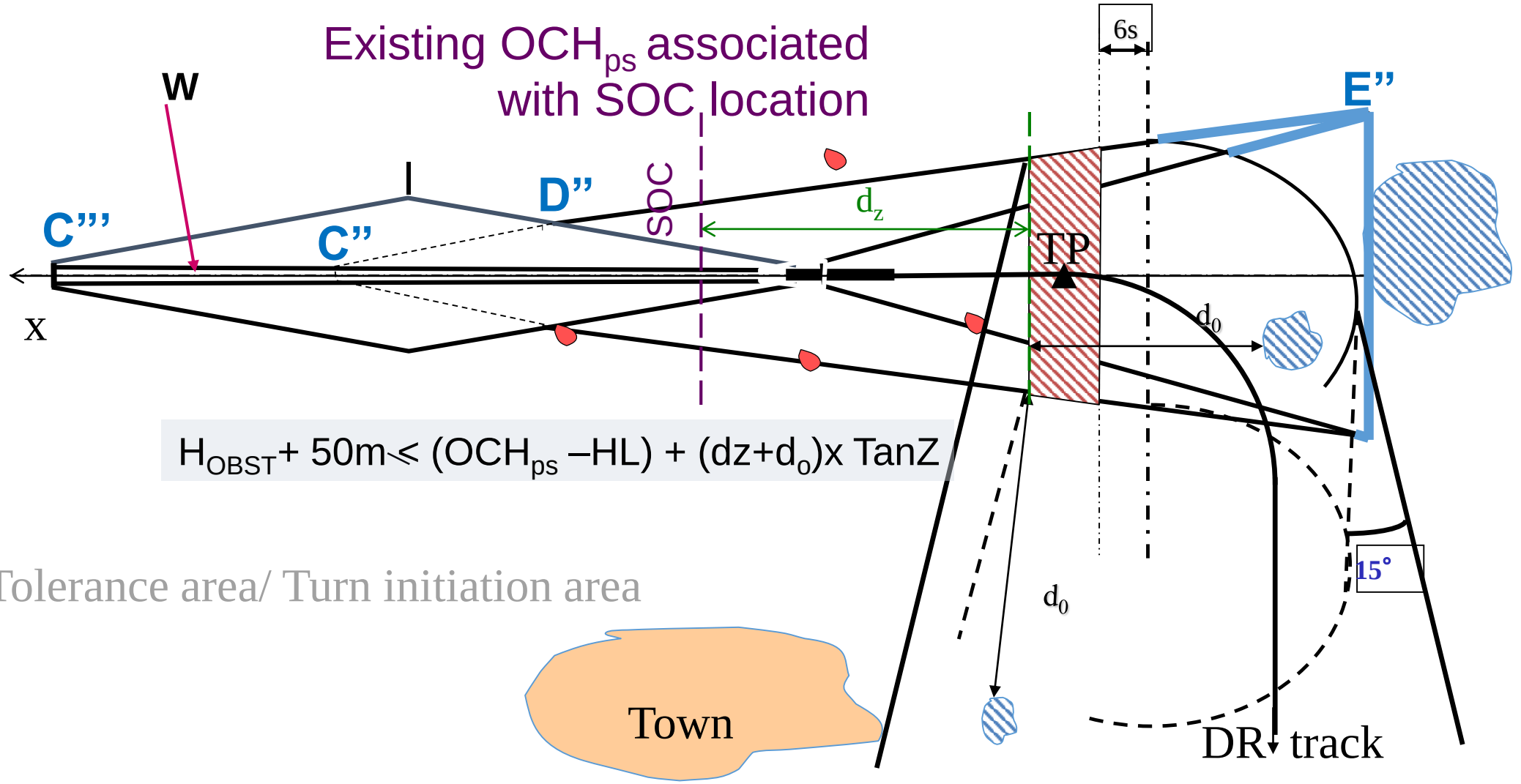
Turn at a TP

- All A/C shall turn at the same fix;
- Type of fix:
  - Overhead a facility;
  - At DME distance.
- Final missed approach:
  - Turn initiation area and turn area:
    - MOC = 50 m if turn angle > 15°;
    - MOC = 30 m if turn angle ≤ 15°.

End of precision segment



Turn protection areas

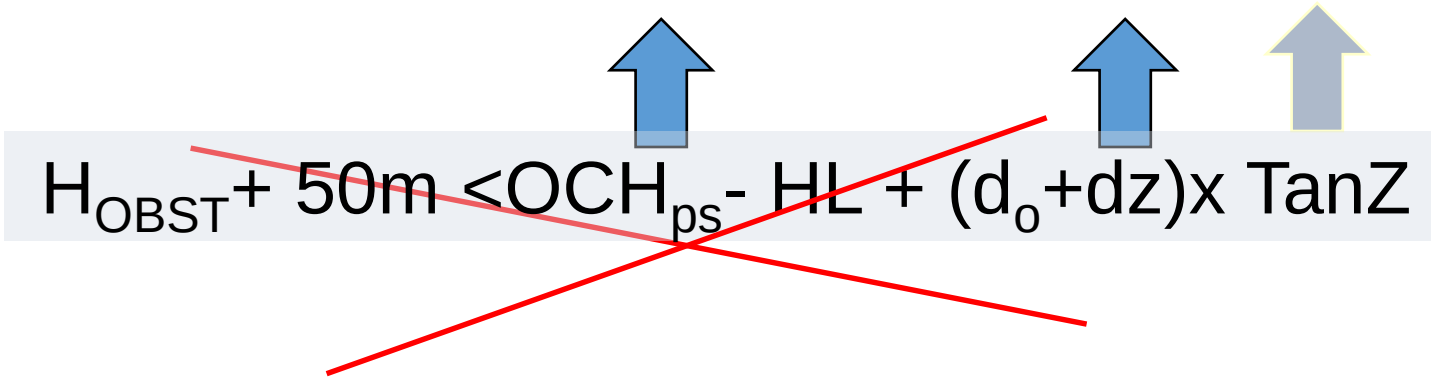


H_{OBST} + 50m ⩽ (OCH_{ps} – HL) + ($dz+d_o$) x TanZ

Tolerance area/ Turn initiation area

Obstacle clearance in turn area

- If criteria not met :



Move TP forward (increase dz)

Or

Increase OCH - HL

Obstacle clearance in turn area

- If criteria is not met and TP can be moved

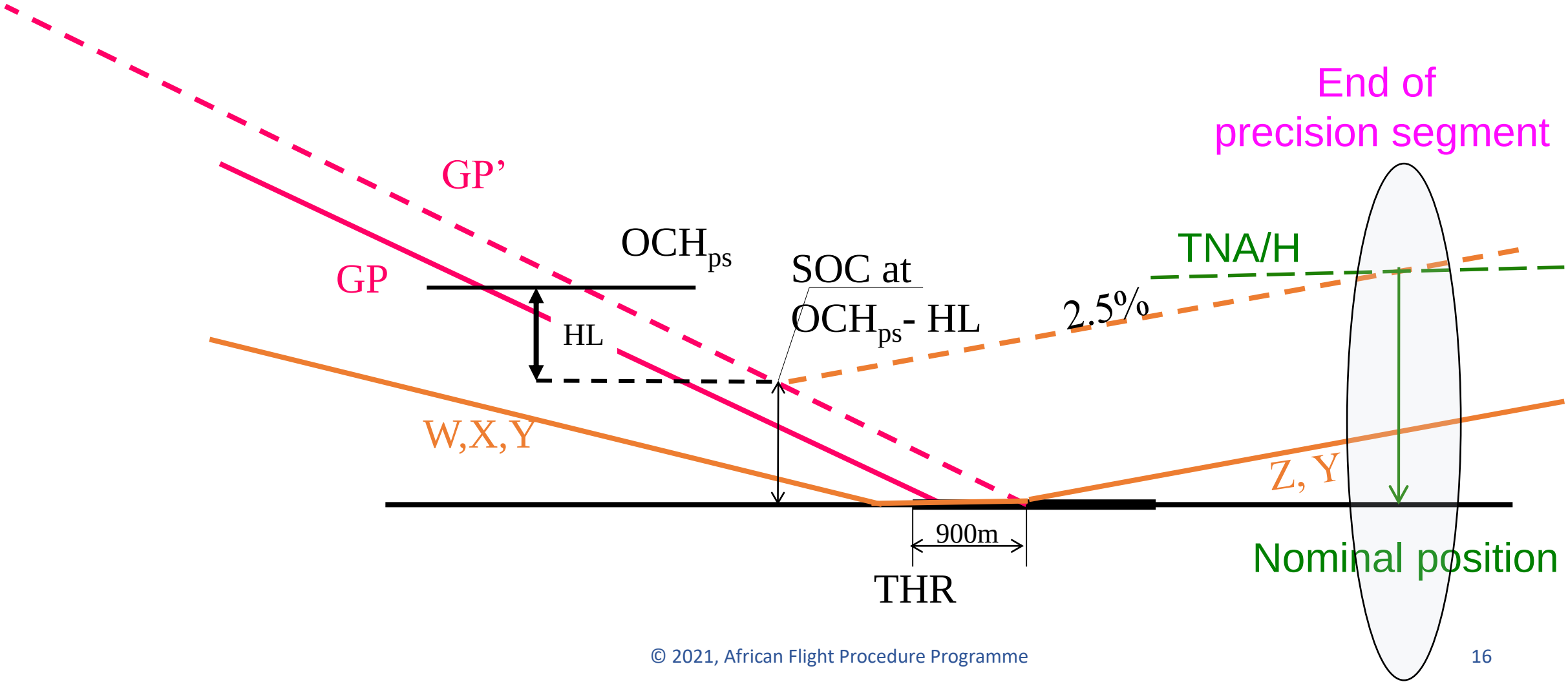
$$H_{OBST} + 50m < OCH_{ps} - HL + (d_o + dz) \times Tan Z$$

1. Find ultimate position of earliest TP;
2. Compute expected height at earliest TP;
3. Use formula of equivalent height;
4. Find corresponding OCH – HL.

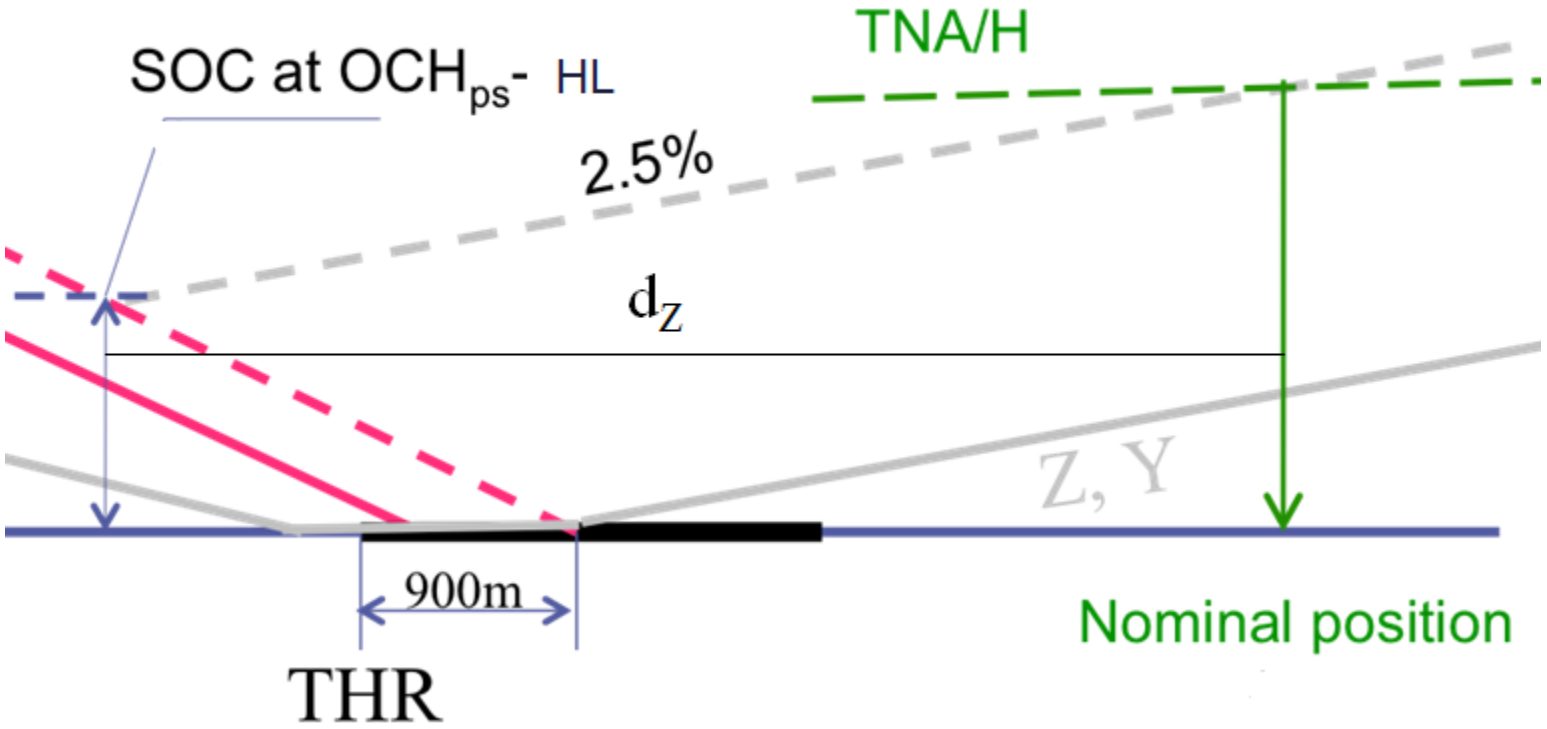
Turn at an altitude (TNA/H)

- No possibility to define a TP;
- Environmental constraints:
  - ☞No obstacle constraint along RWY extended track;
  - ☞Constraining obstacles after turn.
- Aircraft performances:
  - ☞Shorter trajectories for A/C with good climbing performances.
- Mostly before normal termination of precision segment:
  - ☞TNH lower than 1 000 ft.
- Turn initiation area and turn area.

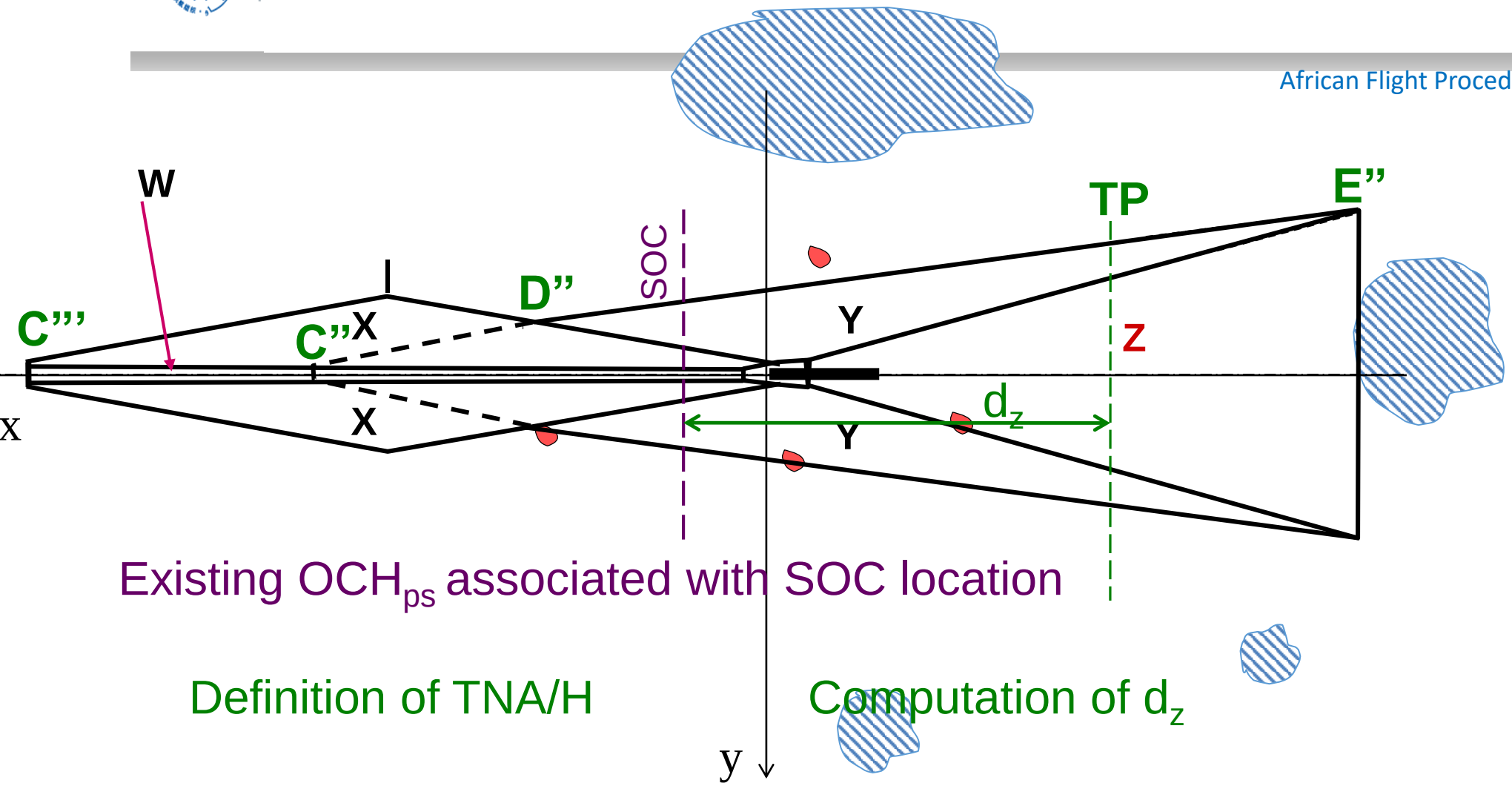
End of precision segment



Computing TNA/H



$$TNH = (OCH_{ps} - HL) + d_Z \times \text{Missed approach slope}$$



Existing OCH_{ps} associated with SOC location

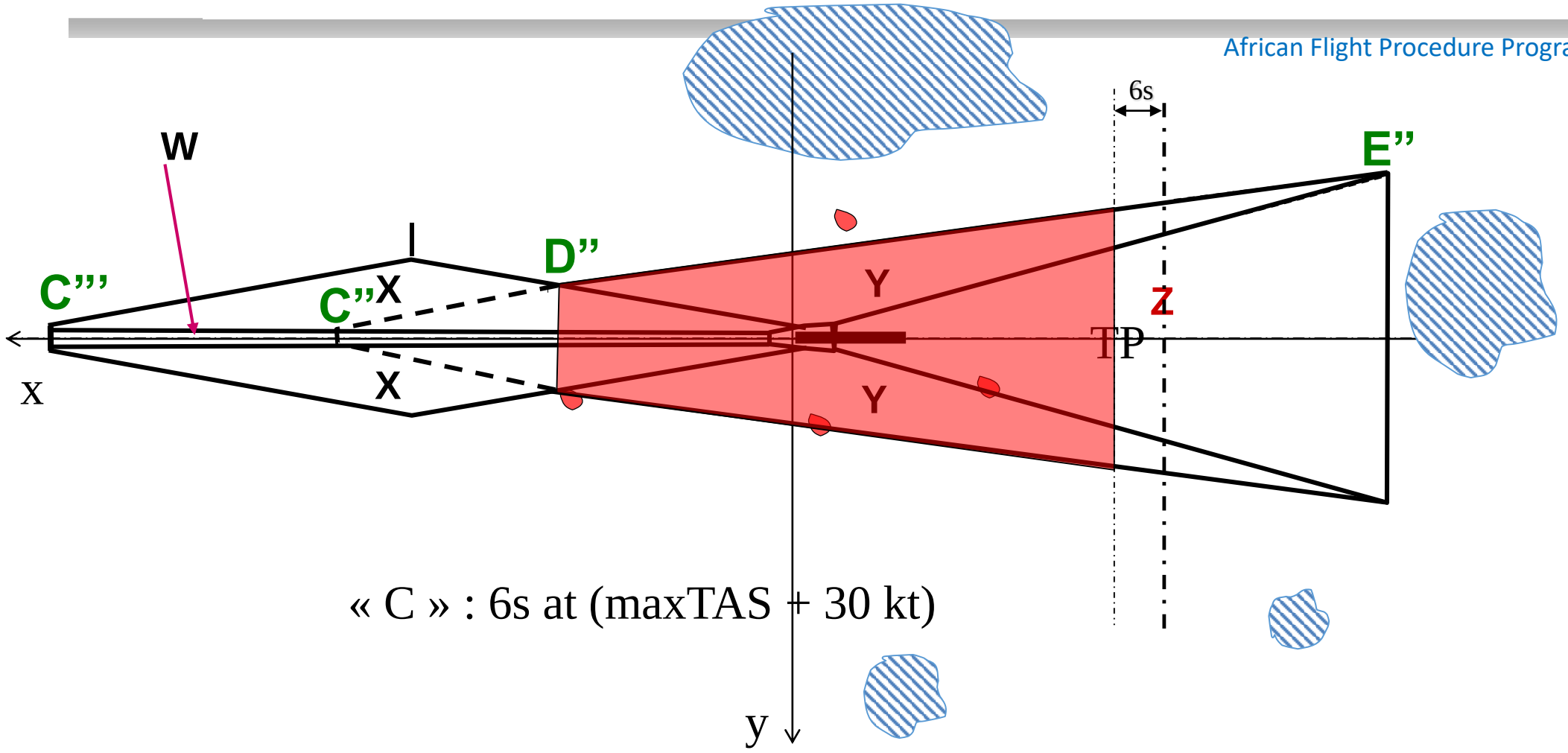
Definition of TNA/H

Computation of d_z

Turn initiation area

- Limited by Y contours at 300 m;
- Earliest limit : line D’’D’’;
- Latest limit : nominal position (TP);
- Obstacles to be checked : ALL;
  - ☞Except obstacles under Y surface on outer side of turn.
- No secondary area;
- Hobst less or equal (TNH – MOC).

Turn initiation area

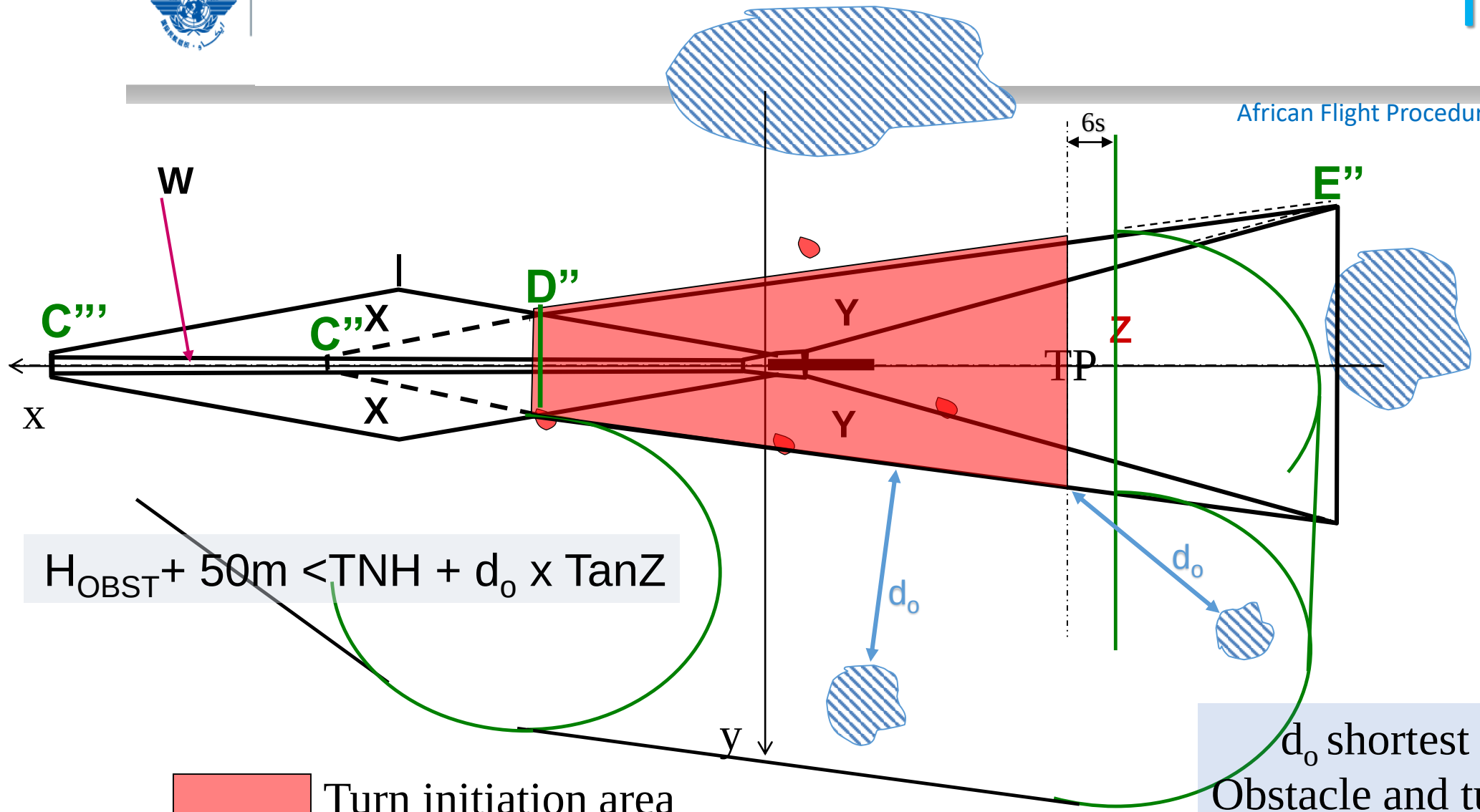


Turn initiation area

Turn area

- includes turn initiation area;
- Protect turning trajectories;
- Protect trajectories after turn;
- Secondary area can be found based on guidance after the turn.

Turn area



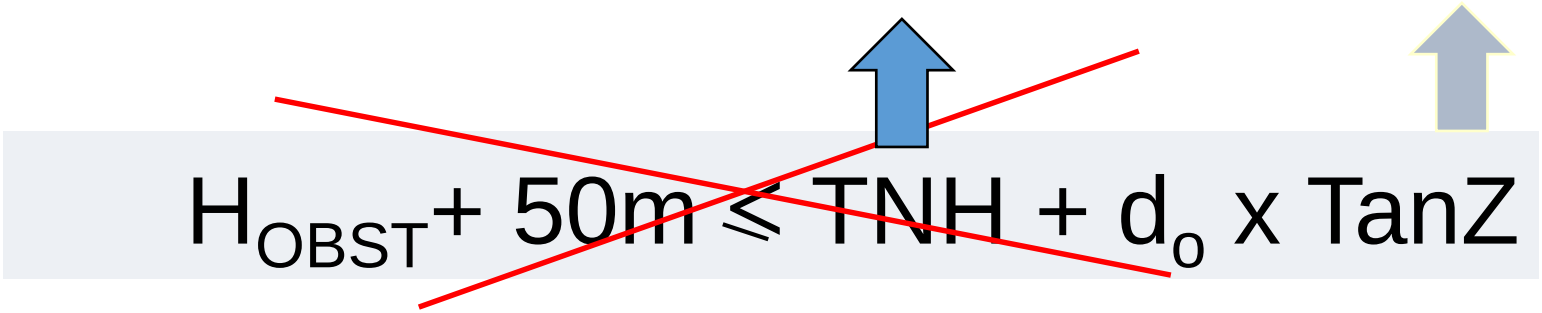
H_{OBST} + 50m < TNH + d_o x TanZ

Turn initiation area

d_o shortest distance between Obstacle and turn initiation area

Obstacle clearance in turn area

- If criteria are not met:



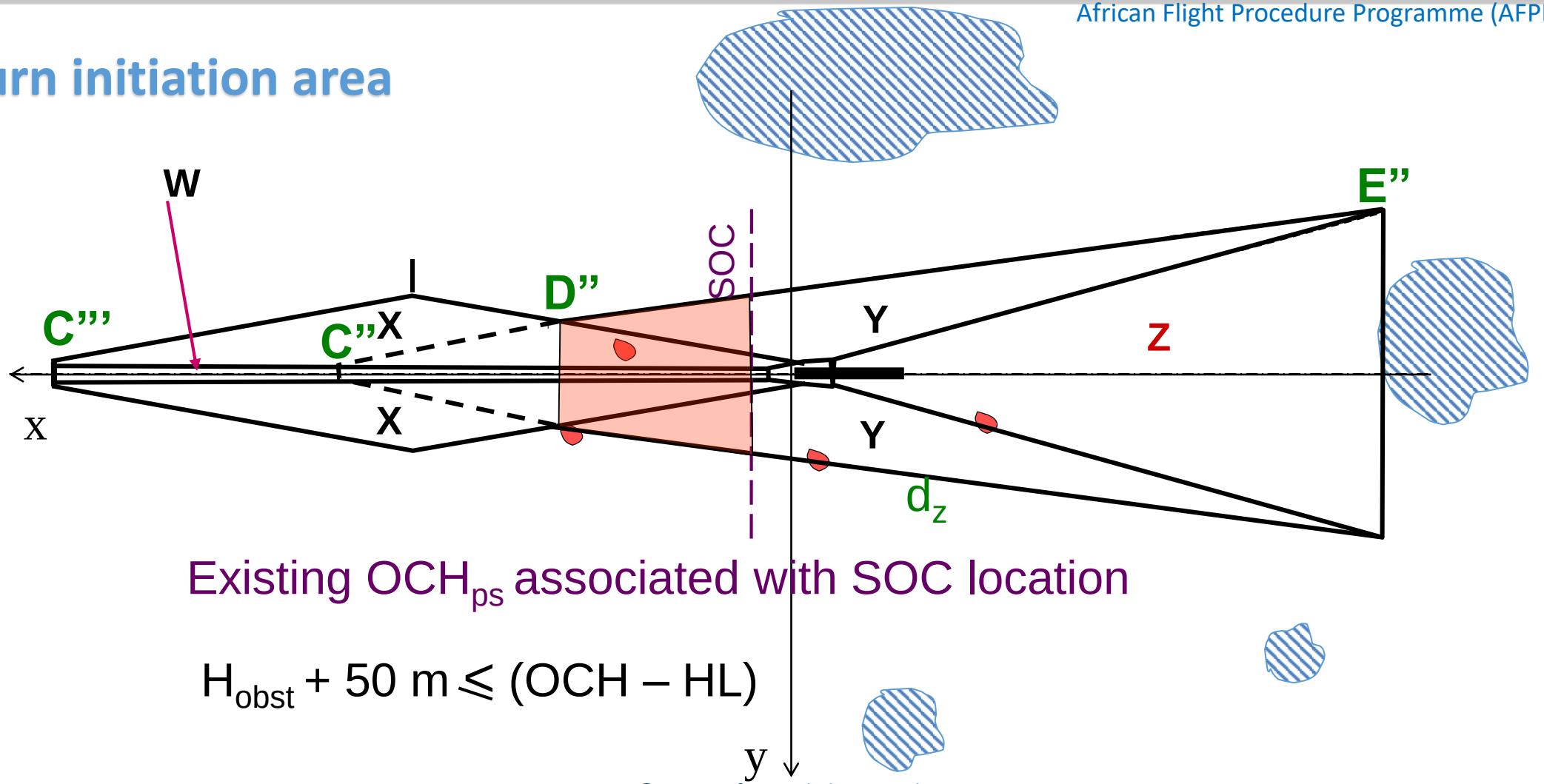
- Increase TNH is always possible;
- But might induce increase of OCH.

Turn as soon as practicable

- Not possible to climb straight:
  - ☞Strong constraints in front:
    - Terrain or high obstacle(s);
    - Prohibited or sensitive area, etc.
- Soc is used at “TP”.
- (OCA/H-HL) is used as “TNA/H”.
- **Very constraining.**

Turn as soon as practicable

Turn initiation area

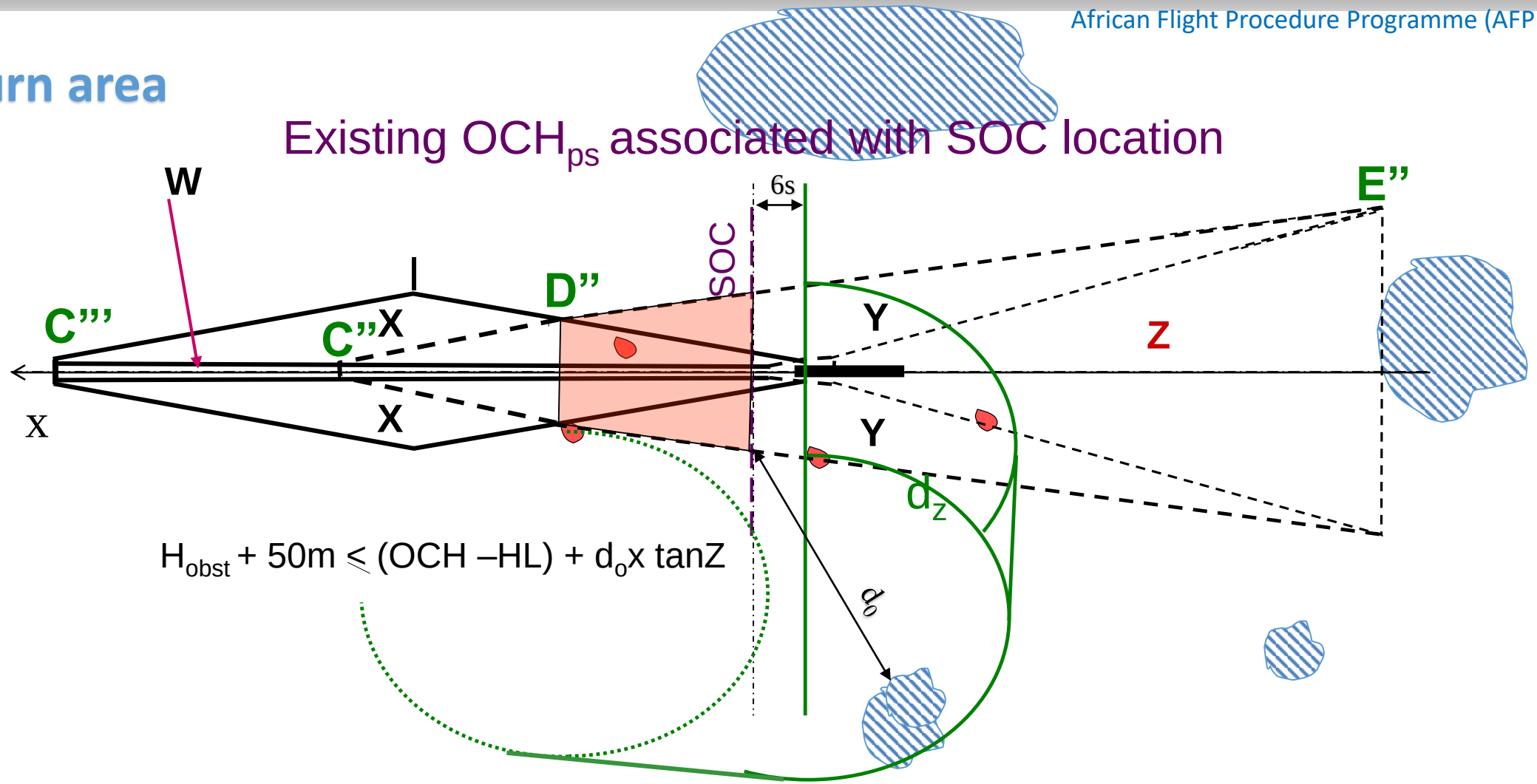


Existing OCH_{ps} associated with SOC location

$$H_{obst} + 50\ m \leqslant (OCH - HL)$$

Turn as soon as practicable

Turn area



Turn as soon as practicable

- If the obstacle clearance criteria are not met :
  - Increase of OCH;
  - Change of SOC location;
  - Change of turn initiation area;
  - Change of turn area.

Questions:

Alexandre DAMIBA
adamiba@icao.int