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PANS-OPS Flight Procedure Design Training for CAAs

23 August – 03 September 2021





09 – Missed approach

(Doc. 8168, Vol. 2, Part I, section 4, Chap. 6)





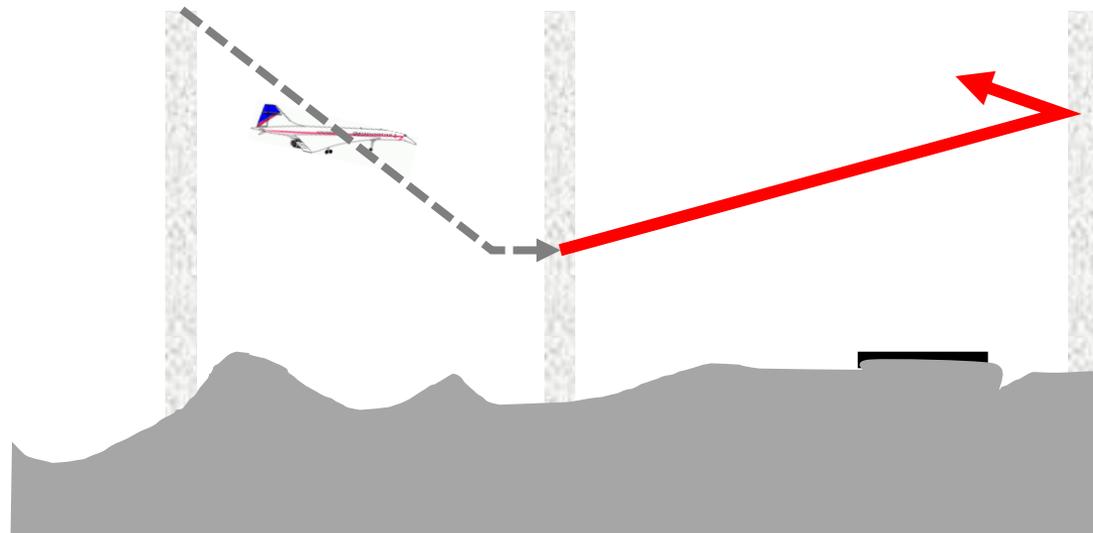
- 1. General**
- 2. Phases of missed approach segment**
- 3. Initial missed approach**
- 4. Intermediate missed approach**
- 5. Final missed approach**
- 6. Turning missed approach**
- 7. Obstacle assessment**
- 8. Protection areas**

FAP/FAF

Or in-bound track
Or no FAP/FAF

MAPt/DA

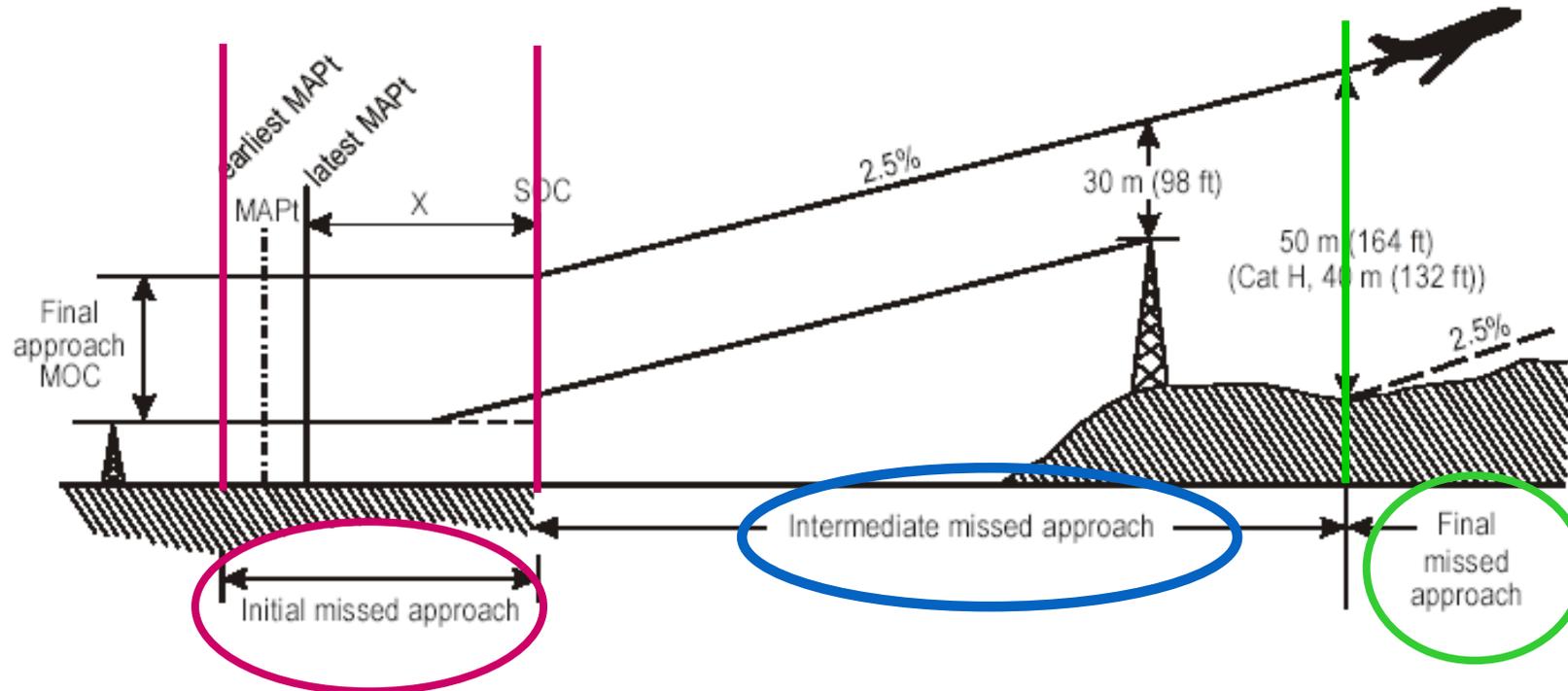
TA/TP/HF



- Track guidance recommended;
- Three phases in missed approach:
 - ☞ Initial missed approach
 - ☞ Intermediate missed approach;
 - ☞ Final missed approach.
- Two types of missed approach:
 - ☞ Straight missed approach;
 - ☞ Turning missed approach.
- Minimum climb gradient: 2.5%
- Mandatory segment!

Missed approach phases

African Flight Procedure Programme (AFPP)

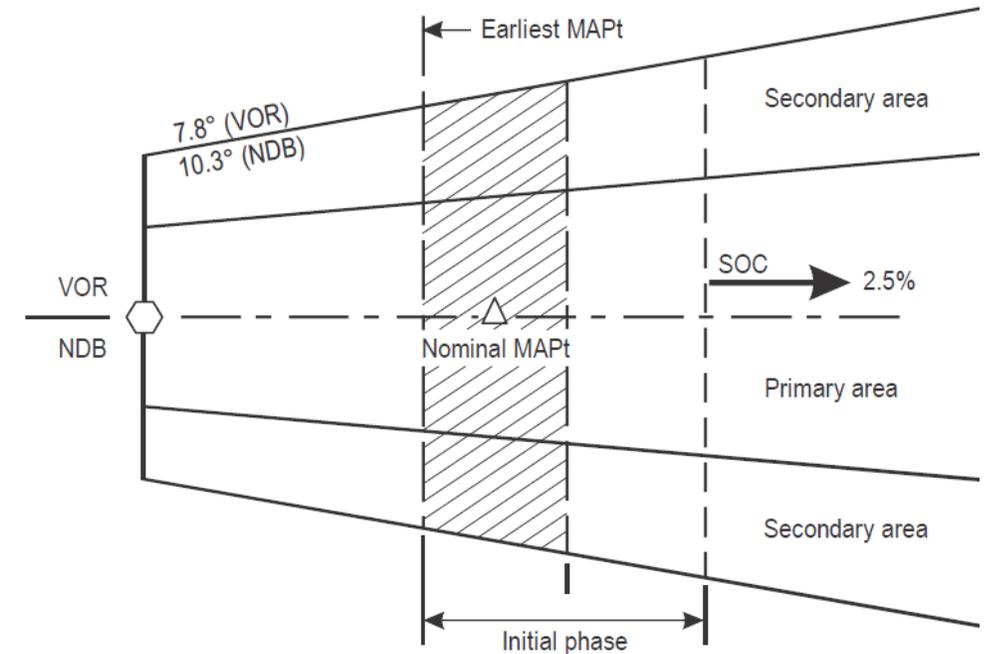


Turn always occurs in final phase of missed approach

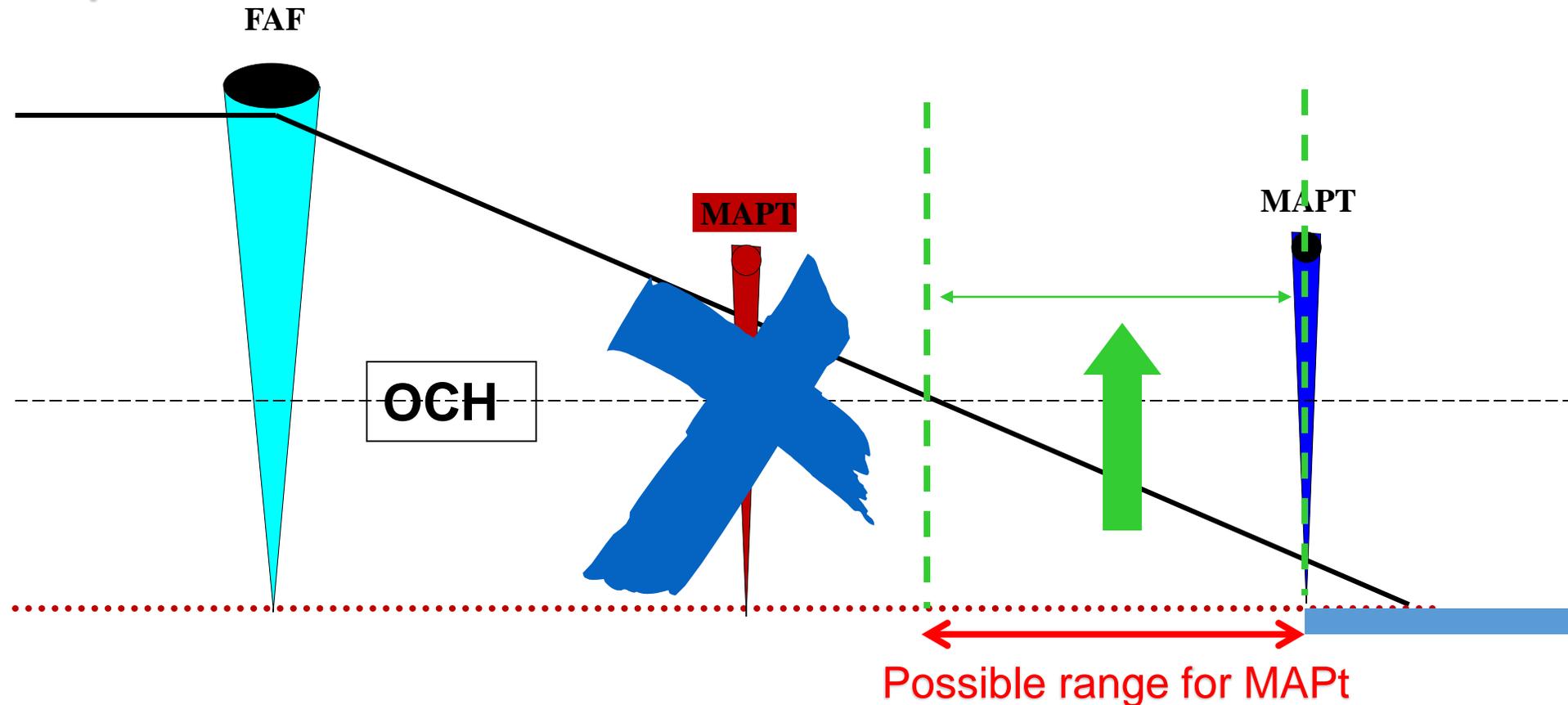
Initial missed approach (NPA)

African Flight Procedure Programme (AFPP)

- ❑ Starting point: earliest MAPt (may start before MAPt);
- ❑ End: SOC (Start Of Climb);
- ❑ Includes:
 - 👉 MAPt tolerance;
 - 👉 Transition tolerance (X).
- ❑ MAPt can be defined by:
 - 👉 Procedures without FAF :A navaid, or a fix;
 - 👉 Procedures with FAF:
 - Timing from the FAF;
 - Facility or fix (Timing not authorized);
 - Timing, distance and Fix.
- ❑ No track change allowed.



MAPt optimum location





Initial missed approach (NPA)

African Flight Procedure Programme (AFPP)

MAPt tolerance area: Defined by a facility (NDB, VOR, Marker)

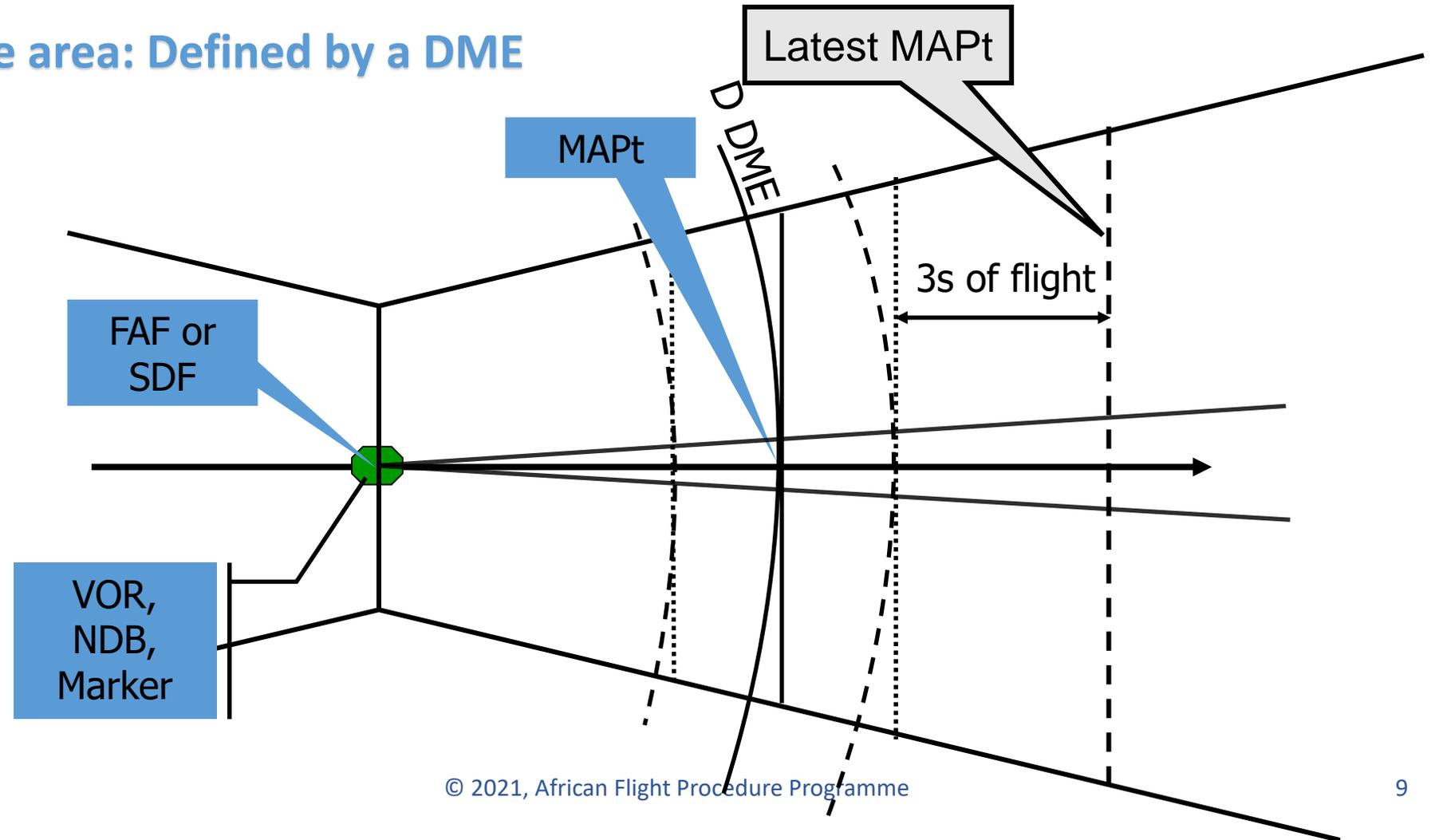
- ❑ Fix tolerance: 0;
- ❑ Latest MAPt:
 - 👉 3s of flight at TAS + 10 kt
 - 👉 Speed: Maximum final approach IAS;
 - 👉 Temperature deviation: ISA + 15° (or computed);
 - 👉 Altitude: Aerodrome elevation.



Initial missed approach (NPA)

African Flight Procedure Programme (AFPP)

MAPt tolerance area: Defined by a DME





Initial missed approach (NPA)

African Flight Procedure Programme (AFPP)

MAPt tolerance area: Defined by an intersection

- ❑ Fix tolerance: tolerance of the intersection;
- ❑ Latest MAPt:
 - ☞ 3s of flight at TAS + 10 kt after the latest tolerance area;
 - ☞ Speed: Maximum final approach IAS;
 - ☞ Temperature deviation: ISA + 15° (or computed);
 - ☞ Altitude: Aerodrome elevation.



Initial missed approach (NPA)

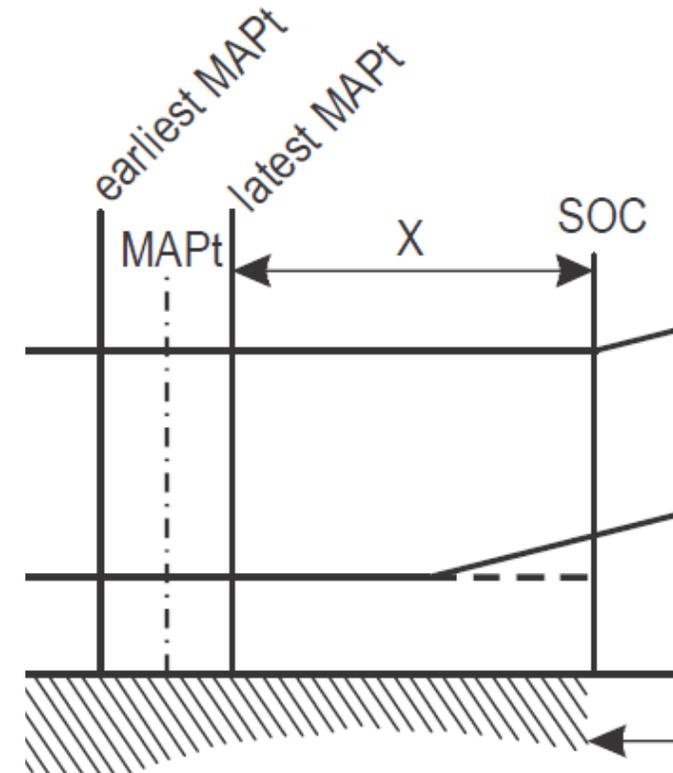
African Flight Procedure Programme (AFPP)

MAPt tolerance area: Timing over a distance from FAF

- Earliest (D1) and latest (D2) tolerances computed with the following parameters:
 - ☞ Tolerances of FAF (a, b);
 - ☞ Distance between FAF and MAPt (D);
 - ☞ Maximum TAS;
 - ☞ Minimum TAS;
 - ☞ Statistical Wind velocity V_w (30kt);
 - ☞ FTT.

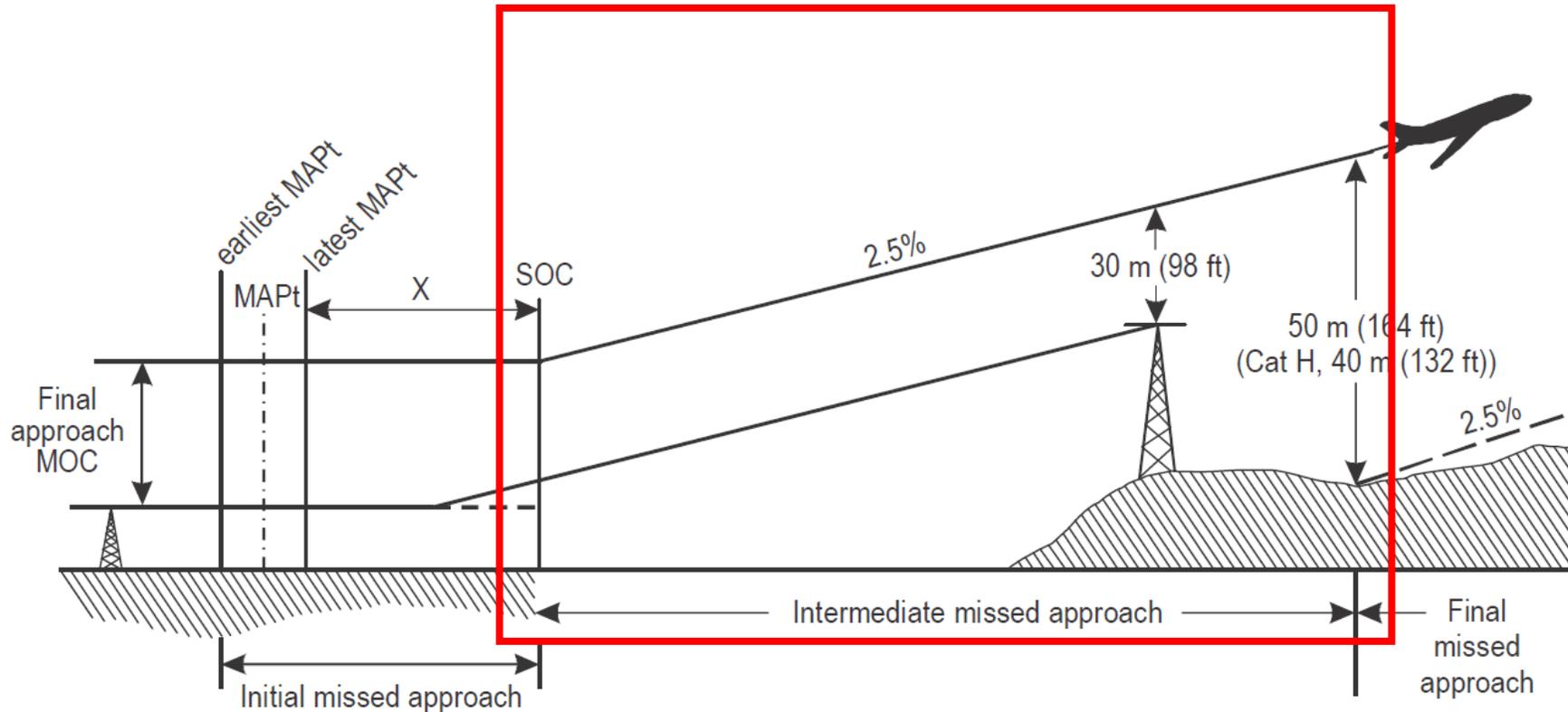
Start Of Climb (SOC)

- ❑ Goal:
 - ☞ Allow the aircraft to change configuration.
- ❑ Parameters:
 - ☞ Origin: Latest MAPt;
 - ☞ Transitional distance X: 15s of flight at
 - ☞ TAS + 10 kt;
 - ☞ Altitude: aerodrome elevation;
 - ☞ Temperature deviation: ISA + 15° (or computed one).
- ❑ Specific computation if MAPt defined by a distance from FAF or SDF;
- ❑ SOC never displayed on a chart.



Intermediate missed approach

African Flight Procedure Programme (AFPP)



- Climb gradients:
 - Minimum: 2.5% (mandatory);
 - Maximum: 5%
 - Track change allowed up to 15°
- MOC: 30 m



Turning missed approach

African Flight Procedure Programme (AFPP)

General

□ Goal:

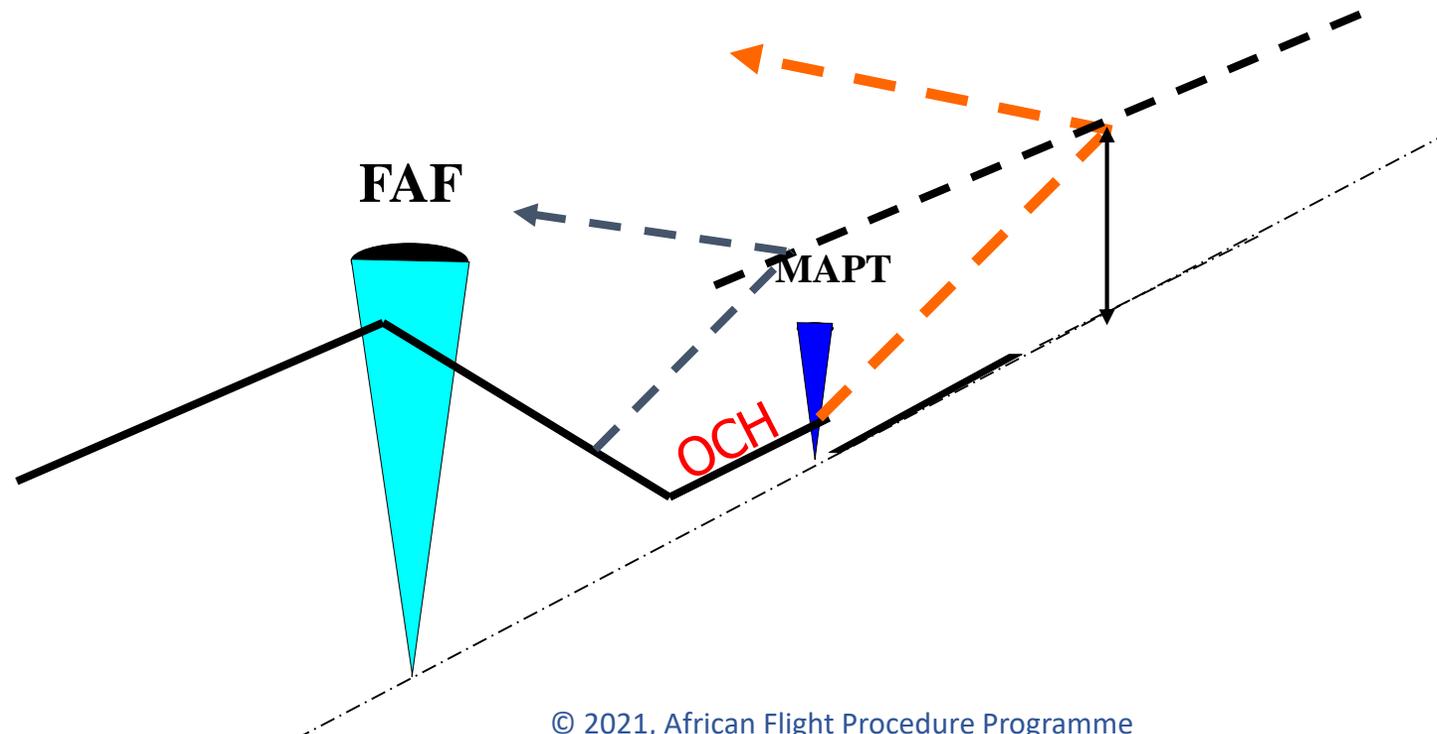
- ☞ Avoid an obstacle or a constraint straight ahead;
- ☞ Rejoin another segment (missed approach holding).

□ Three types of turning missed approach:

- ☞ Turn at an designated altitude (TNA);
- ☞ Turn a designated turning point (TP);
- ☞ Turn over the MAPt.

□ MOC: 50 m.

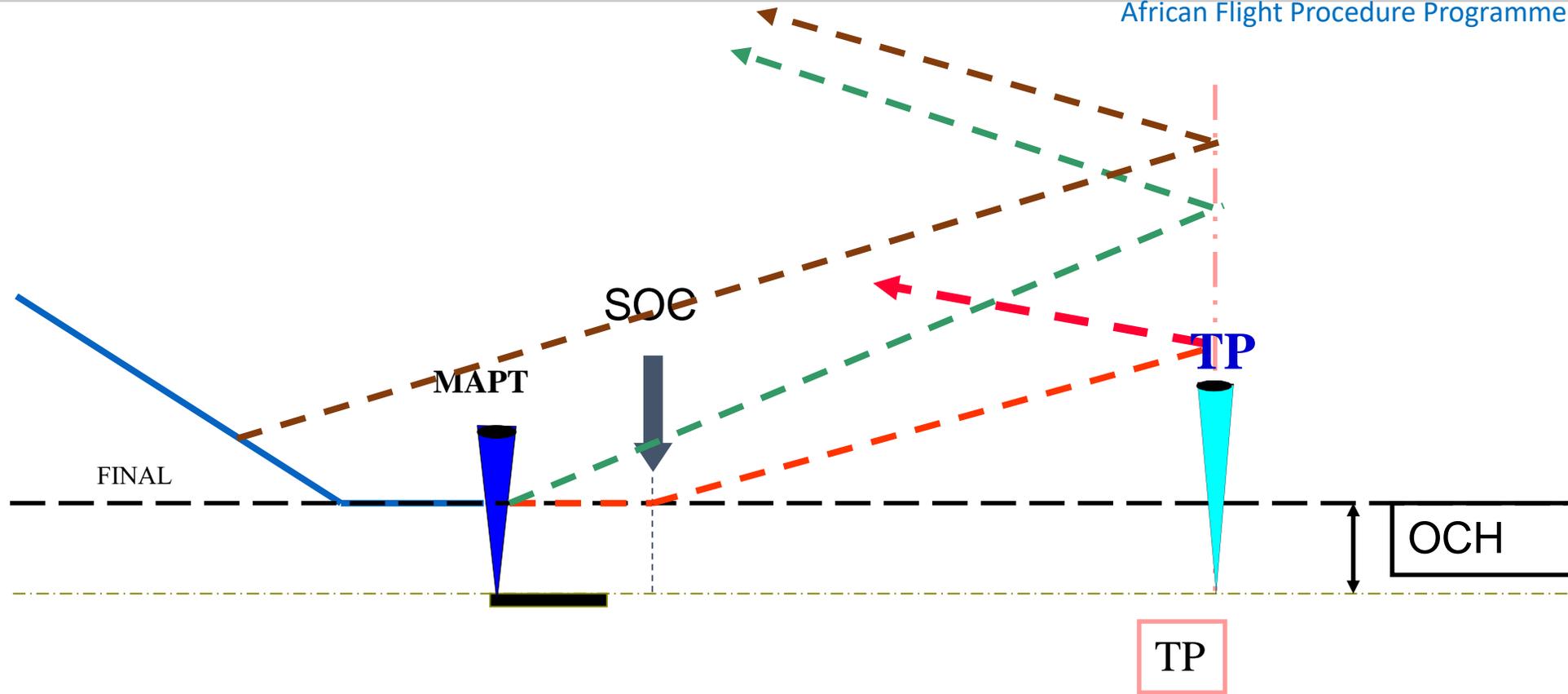
Aircraft are turning when reaching a designated altitude (TNA/H)





Turn at a turning point

African Flight Procedure Programme (AFPP)



Turn Initiation Area starts at earliest TP



Turn parameters

- Altitude:
 - ☞ Turn at TP : aerodrome elevation + 1 000 ft;
 - ☞ Turn at a TA: TNA (if TA > 1000 ft).
- Temperature: ISA + 15 (or computed value);
- Wind : 30 kt;
- Bank angle : 15°
- FTT :
 - ☞ Pilot reaction time: 3s;
 - ☞ Bank establishment: 3 sec.
- IAS: Tabulated values (IAS limitation possible)!



Turn areas

□ Two types of turn areas:

☞ Turn initiation area:

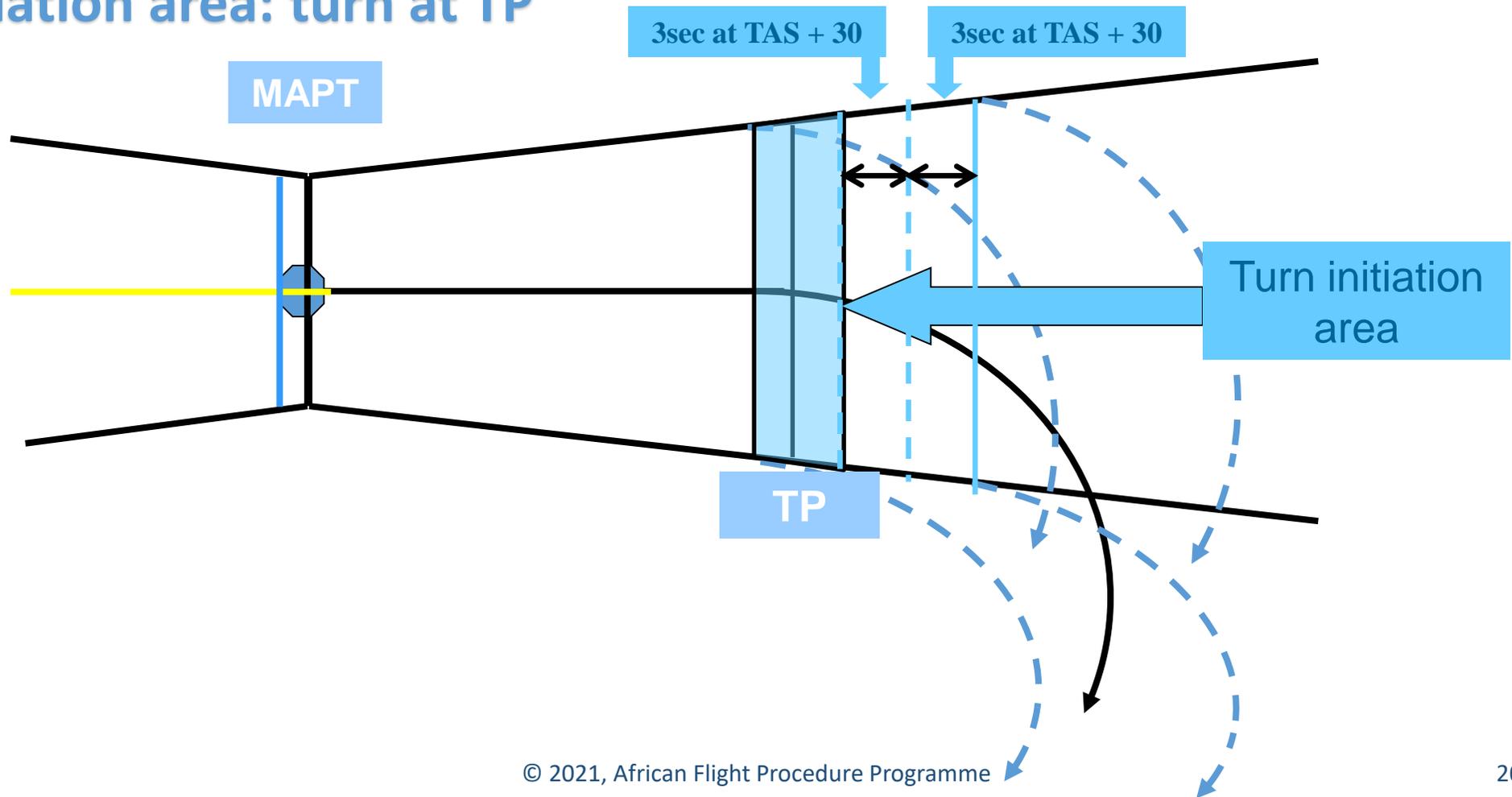
- All points where turns can be initiated.

☞ Turn area:

- For protection of actual turns and following trajectories.

☞ Turn initiation area included in the turn area.

Turn initiation area: turn at TP

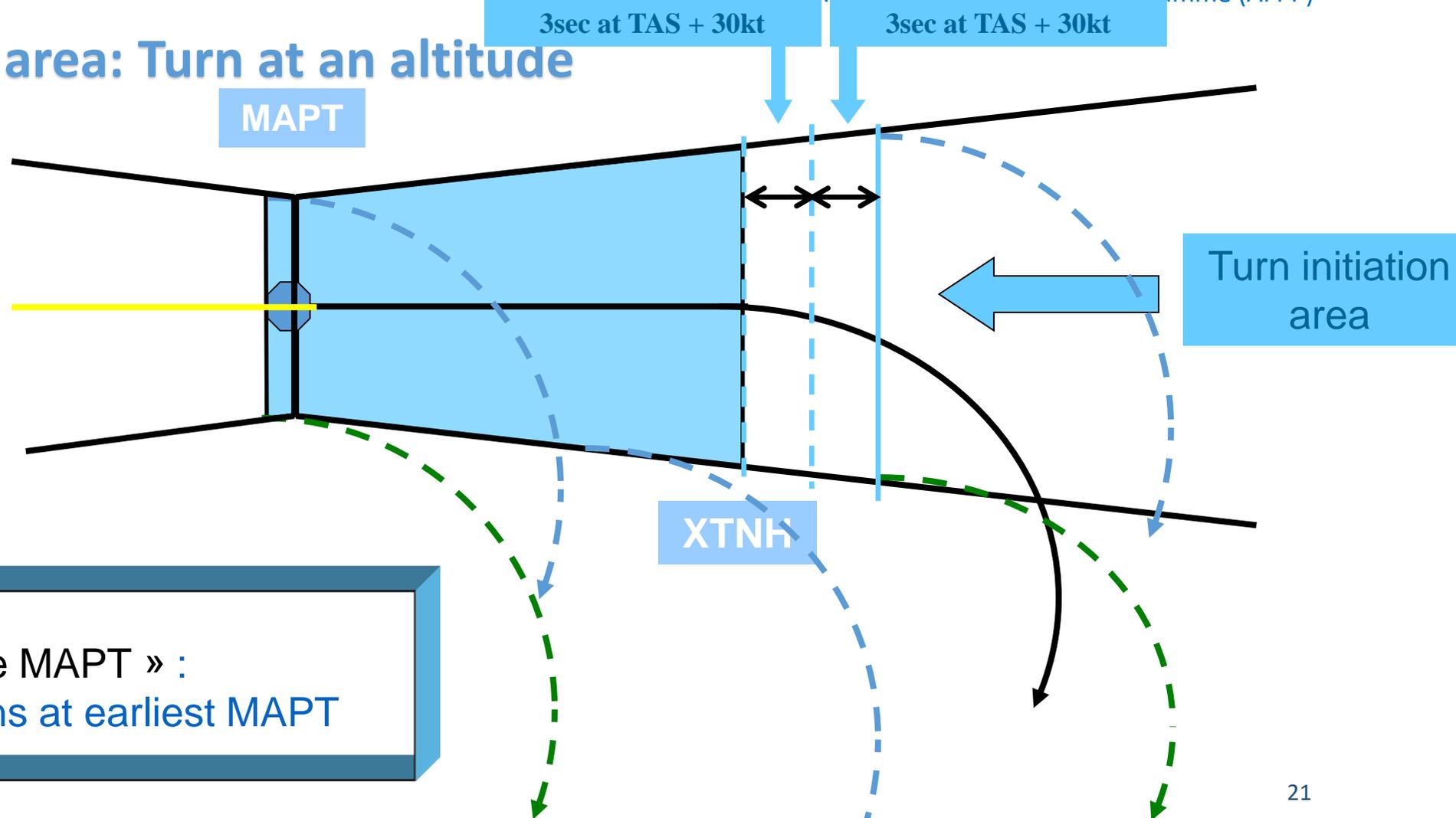




Turning missed approach

African Flight Procedure Programme (AFPP)

Turn initiation area: Turn at an altitude



« No turn before MAPT » :
turn initiation area begins at earliest MAPT

Initial missed approach

$$MOC_{O2} = 30 + \Delta moc$$

$$\Delta moc = MAslope * d_{SOC-O2}$$

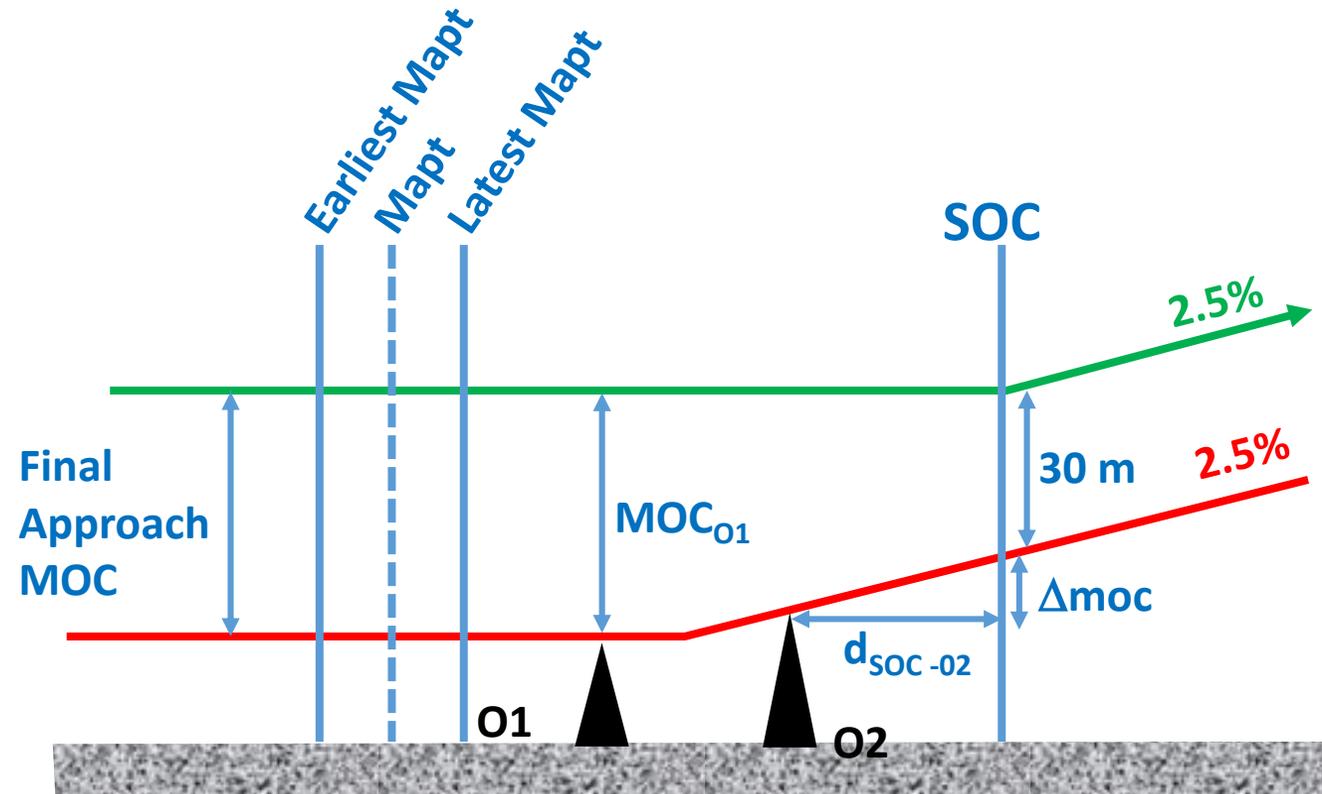
$$OCH_{O1} = H_{O1} + MOC_{O1}$$

$$OCH_{O2} = H_{O2} + MOC_{O2}$$

$$OCH = \text{Max} (OCH_{O1}; OCH_{O2})$$

With:

- **MAslope** : Missed Approach slope (2.5% or more)





Intermediate missed approach

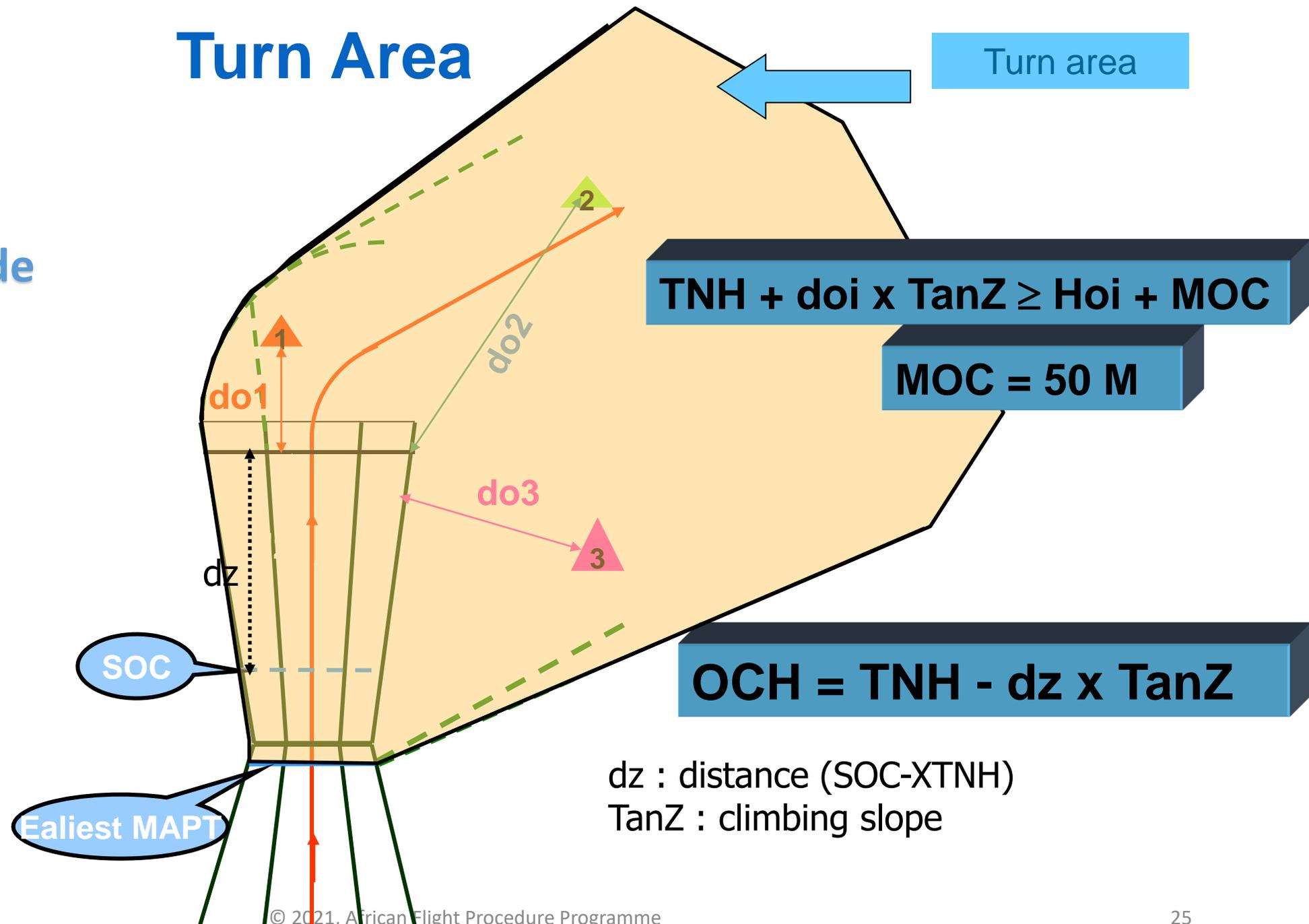
- ❑ MOC: 30 m;
- ❑ Specific concept for OCH computation:
 - ☞ $OCH \neq Ho + MOC$;
 - ☞ OCH_{MA} shall grant the overflight of obstacle + MOC:
 - Height a/c above obstacle $\geq OCH_F + \text{height gain (HG)}$
HG = distance(SOC-Obstacle)*Climb gradient

- ❑ Finally:
 - ☞ $OCH_{MA} + HG = Ho + MOC_{30}$ and then,
 - ☞ $OCH_{MA} = (Ho + MOC_{30}) - HG$

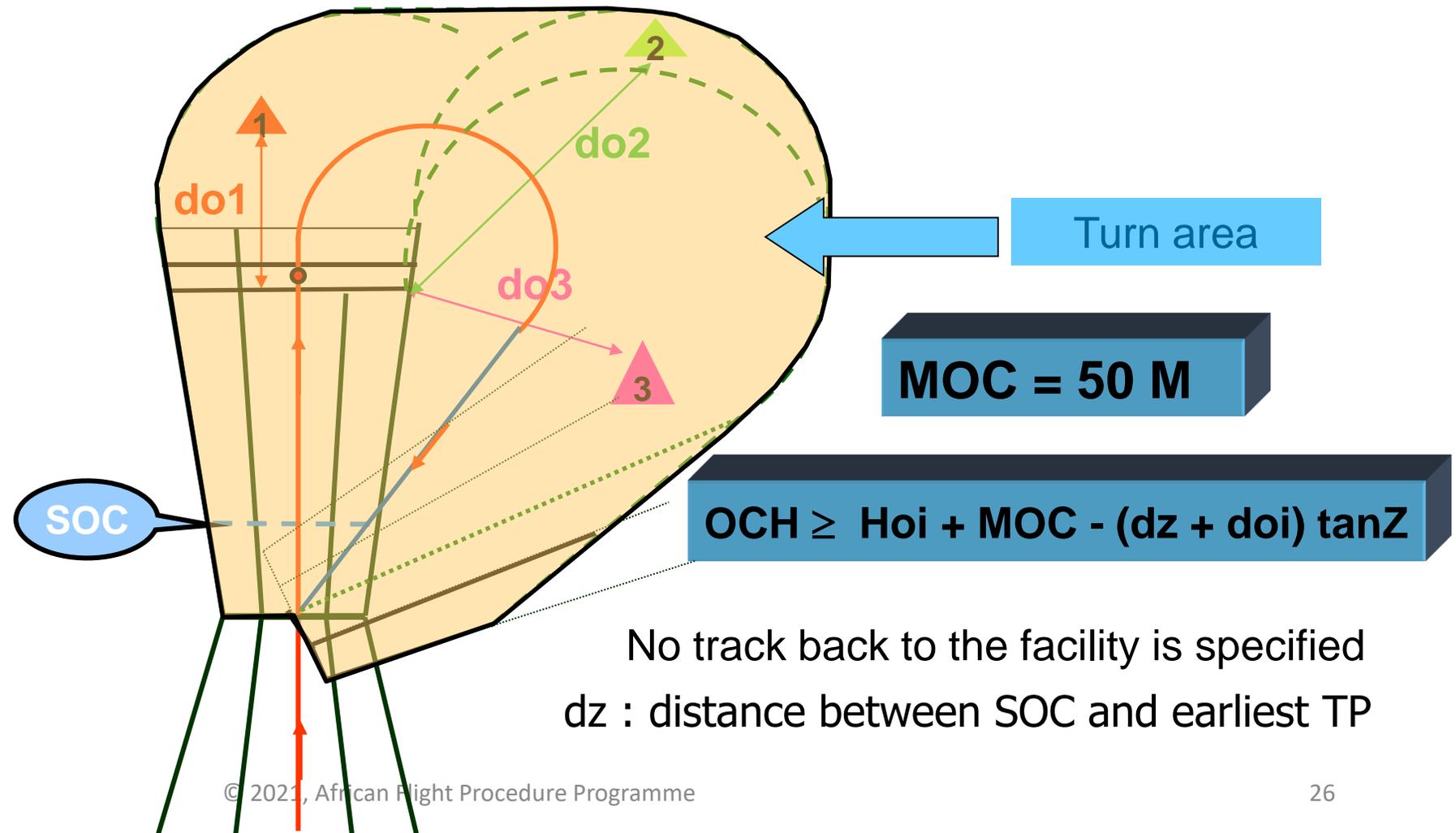
Turn Area

Turn area

Turn at an altitude

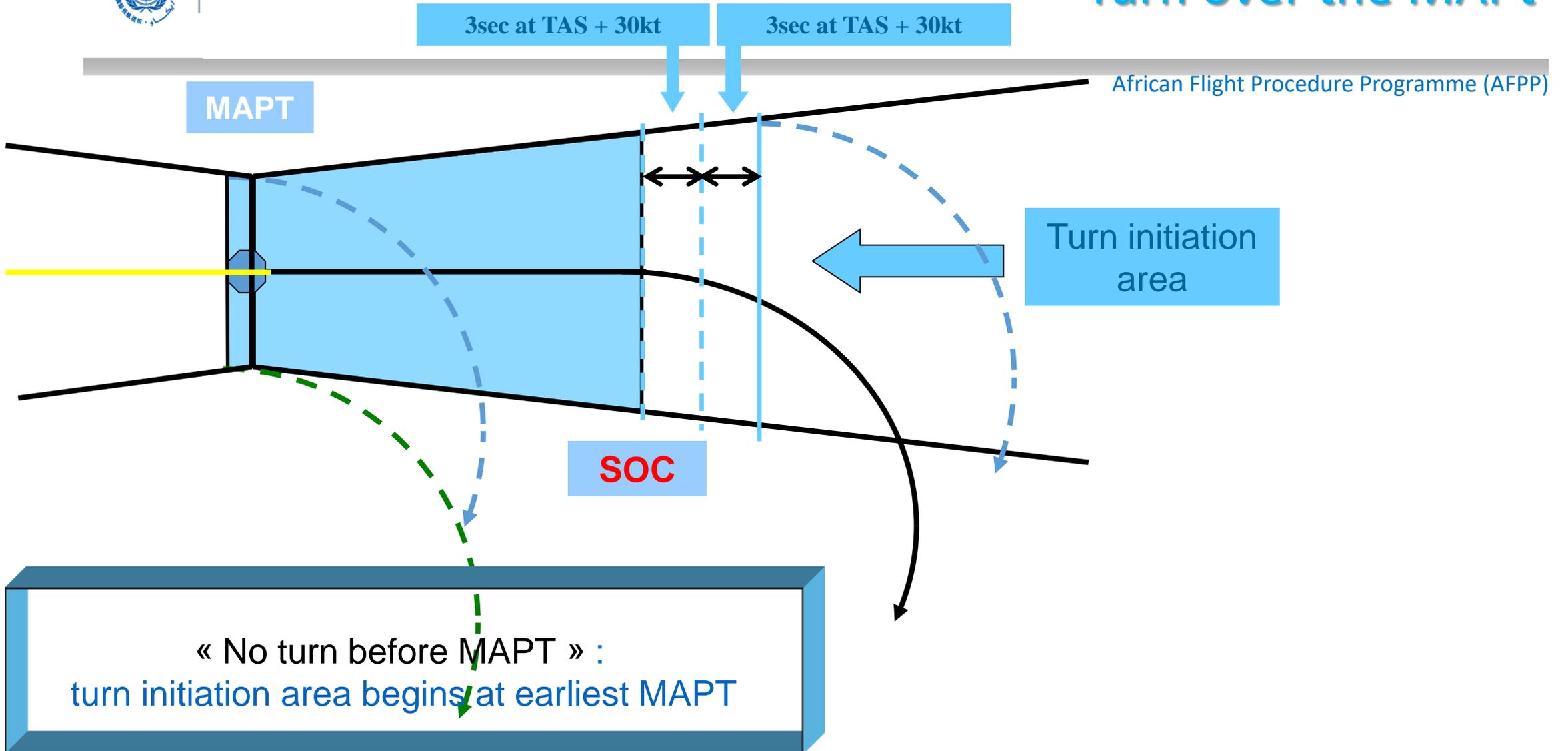


$$\text{Alt at}_{\text{earliest TP}} + (\text{Dist Obst} / \text{earliest TP}) \tan Z \geq \text{Alt Obst} + \text{MOC}$$





Turn over the MAPt





Turn over the MAPt

African Flight Procedure Programme (AFPP)

MAPt

SOC



$$H_{oi} + 50m \leq OCH + d_{oi} \times \tan Z$$

Protection areas

African Flight Procedure Programme (AFPP)

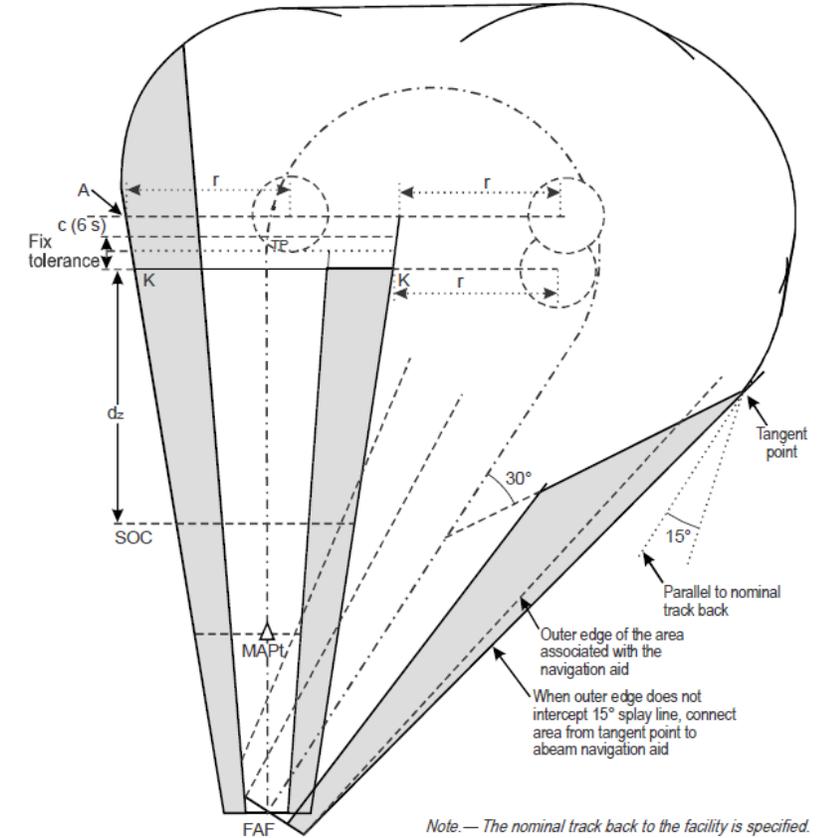
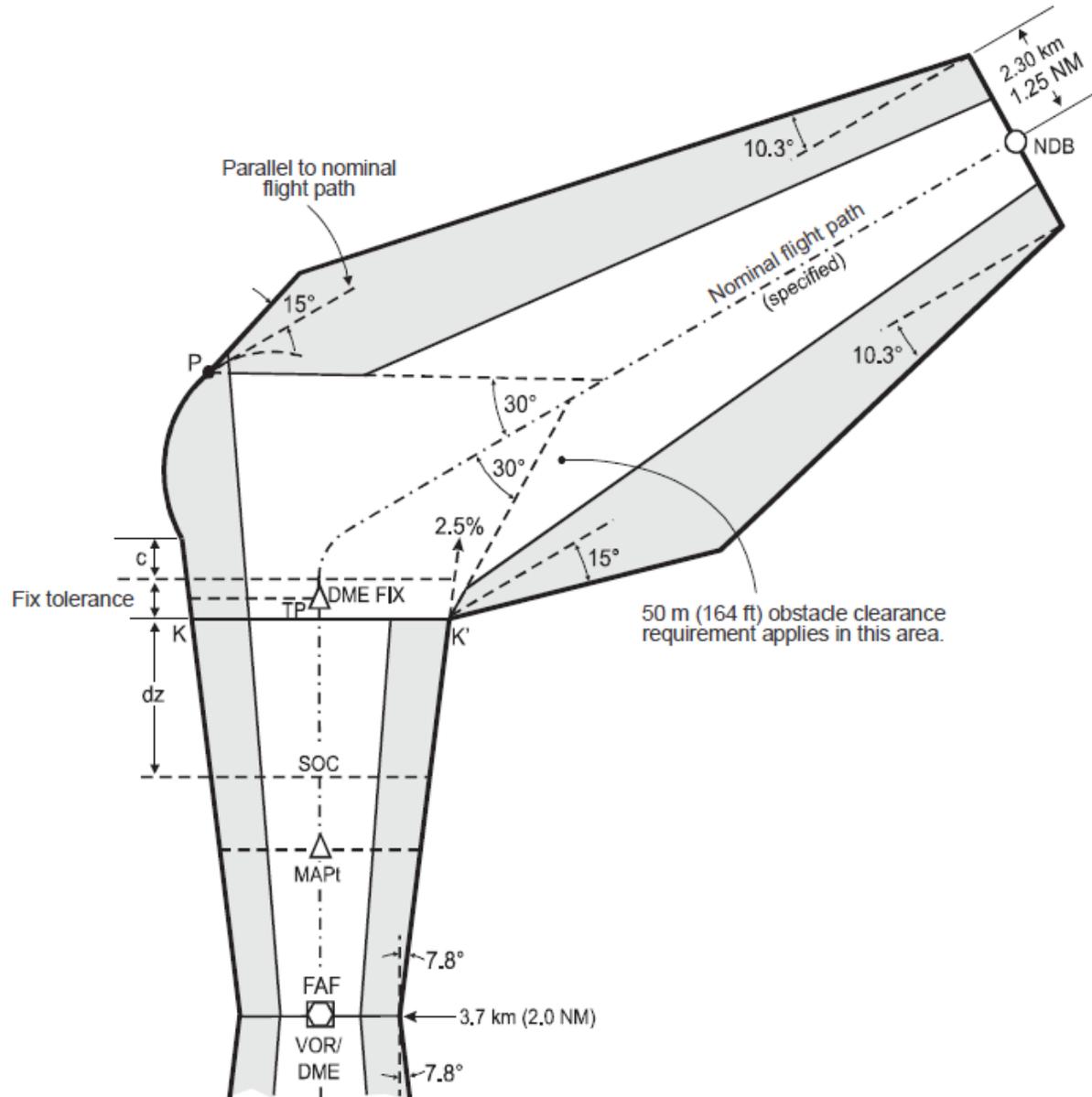


Figure I-4-6-17. Turning missed approach with TP fix and return to the facility with track back



Questions:

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