Tentative Agenda

	9:00-10:30 (90mins)	10:45-12:00 (90mins)	Lunch	13:20-14:50 (90mins)	15:00-16:30 (90mins)
Day1 Monday	Registration & Introduction	Review of Pre-course Assignment		General Overview -Aircraft Classification -MOC	Speed Conversion* & Turn Calculation*
Day2 Tuesday	Wind Effect & Turn Parameters	Wind Effect* & Turn Parameters*		Fix Tolerance	Fix Tolerance
Day3 Wednesday	NPA -General Criteria Initial Segment	NPA Initial Segment*		NPA Intermediate Segment	NPA Intermediate Segment*
Day4 Thursday	NPA Final Segment	NPA Final Segment* OCA/H*		NPA Final Segment* OCA/H* NPA VSS	NPA Final Segment* OCA/H* NPA VSS
Day5 Friday	Missed Approach -Initial Phase	Missed Approach -Intermediate Phase -Turning MAP		Missed Approach -Intermediate Phase -Turning MAP	Missed Approach -Intermediate Phase* -Turning MAP

Notes:

1. All scheduling is in Beijing time(UTC+8).
2. Topics with * will be followed by a short practical exercise.
3. Each presentation is followed by a 10-minute Q&A session.

Pans-Ops
Procedure Design Initial Course

ICAO APAC FPP Office – Beijing, China

(15 June ~ 10 July 2026)

FIX TOLERANCE

CONTENTS

- Facility & Fix
- Fix Tolerance

FACILITY & FIX

- Facilities may include
  - VOR
  - NDB
  - DME
  - LOC

- E.g. VOR provides radials (based on Magnetic North) that can be identified by the aircraft for tracking or crossing
- Aircraft can fly along a radial 'to' or 'from' the facility (Tracking Radial)

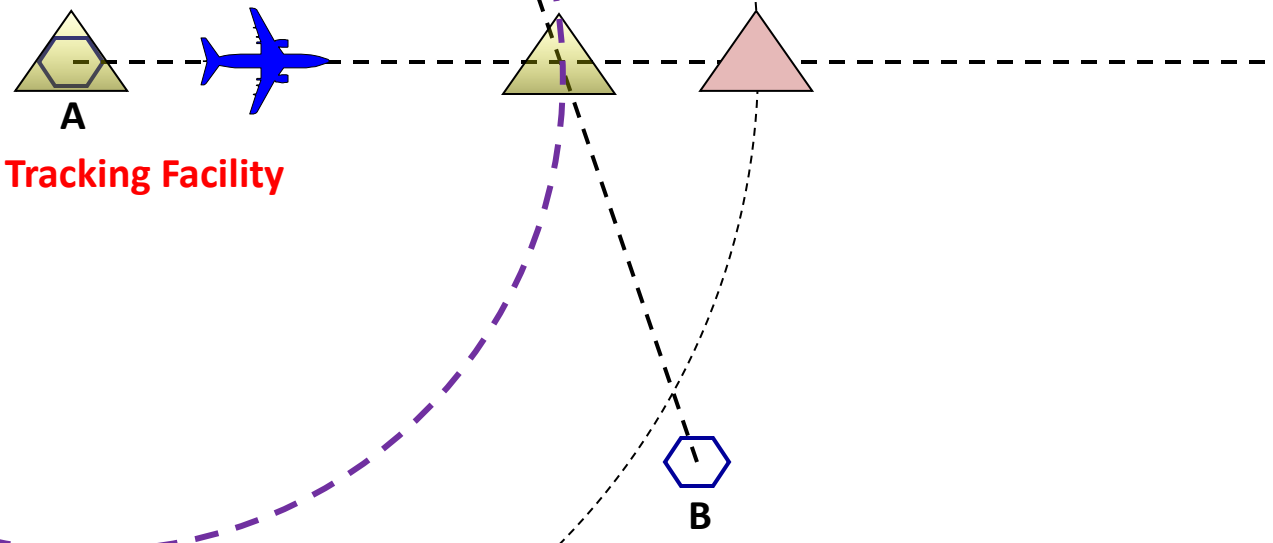
FACILITY & FIX

- Fixes are geographical points identified by navigation by the aircraft

- Fixes can be identified by
  - Facility (Fly-over a facility)
  - Intersection of 2 radials or bearings
  - VOR/DME etc...

FACILITY & FIX

- Intersection of 2 radials or bearings or combo
- Facility (Fly-over a facility)



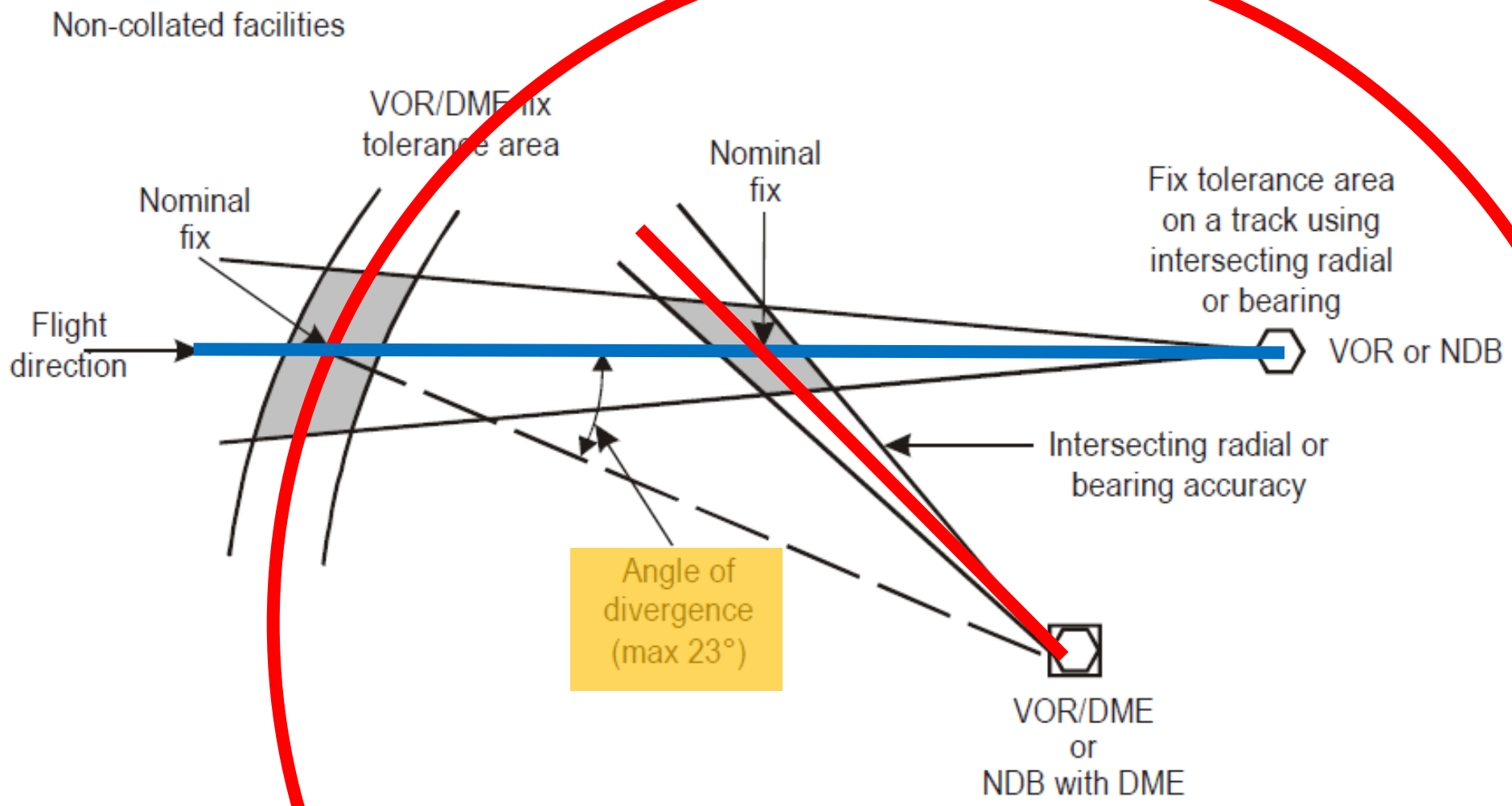
Facility A: **Tracking Facility**

Facility B: **Intersecting (Crossing) Facility**

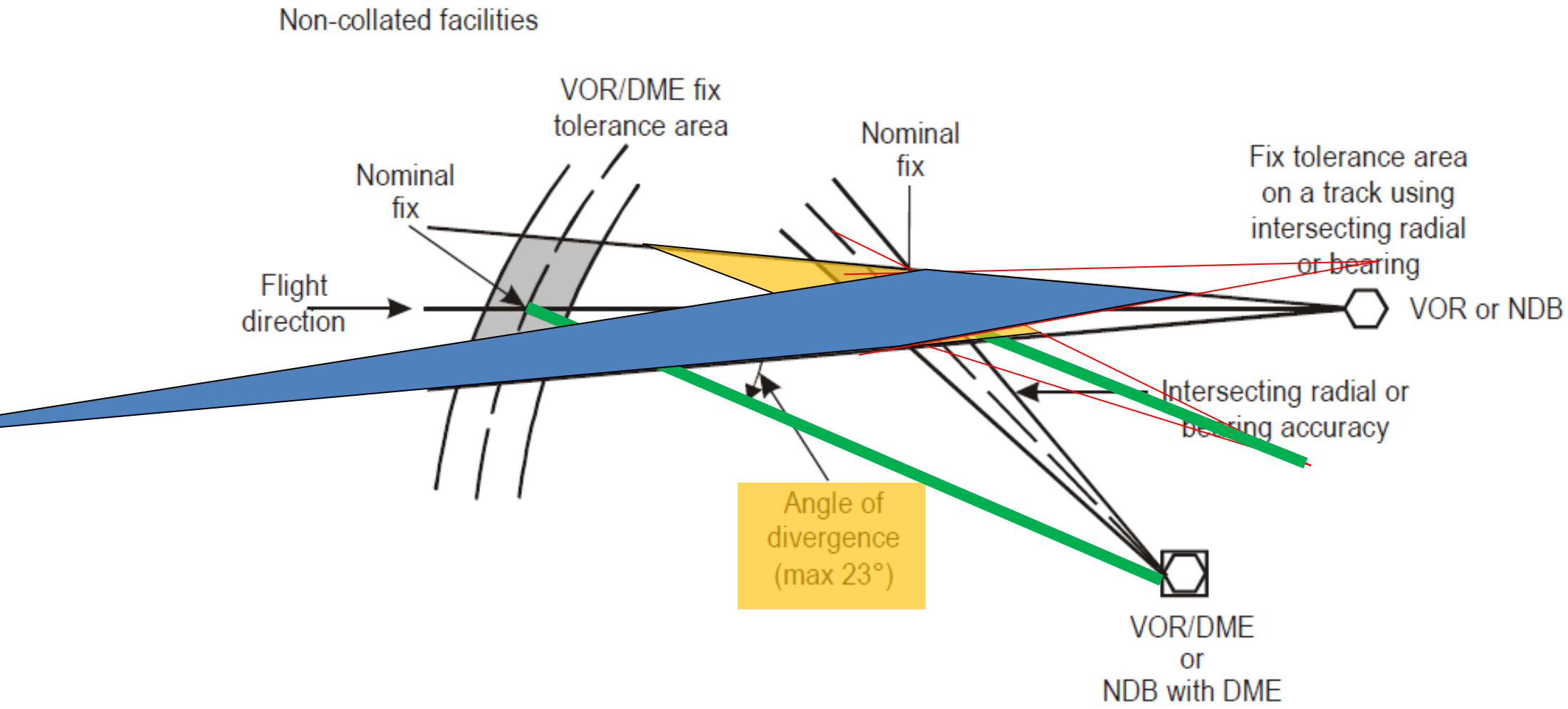
FIX TOLERANCE AREA

- The fix tolerance areas are formed by the boundaries obtained from system use accuracies of the homing and intersecting radials (or arcs as appropriate) with respect to the nominal fix position.
- The size of the fix tolerance area is dependent on the distance of the fix to navigation aids.

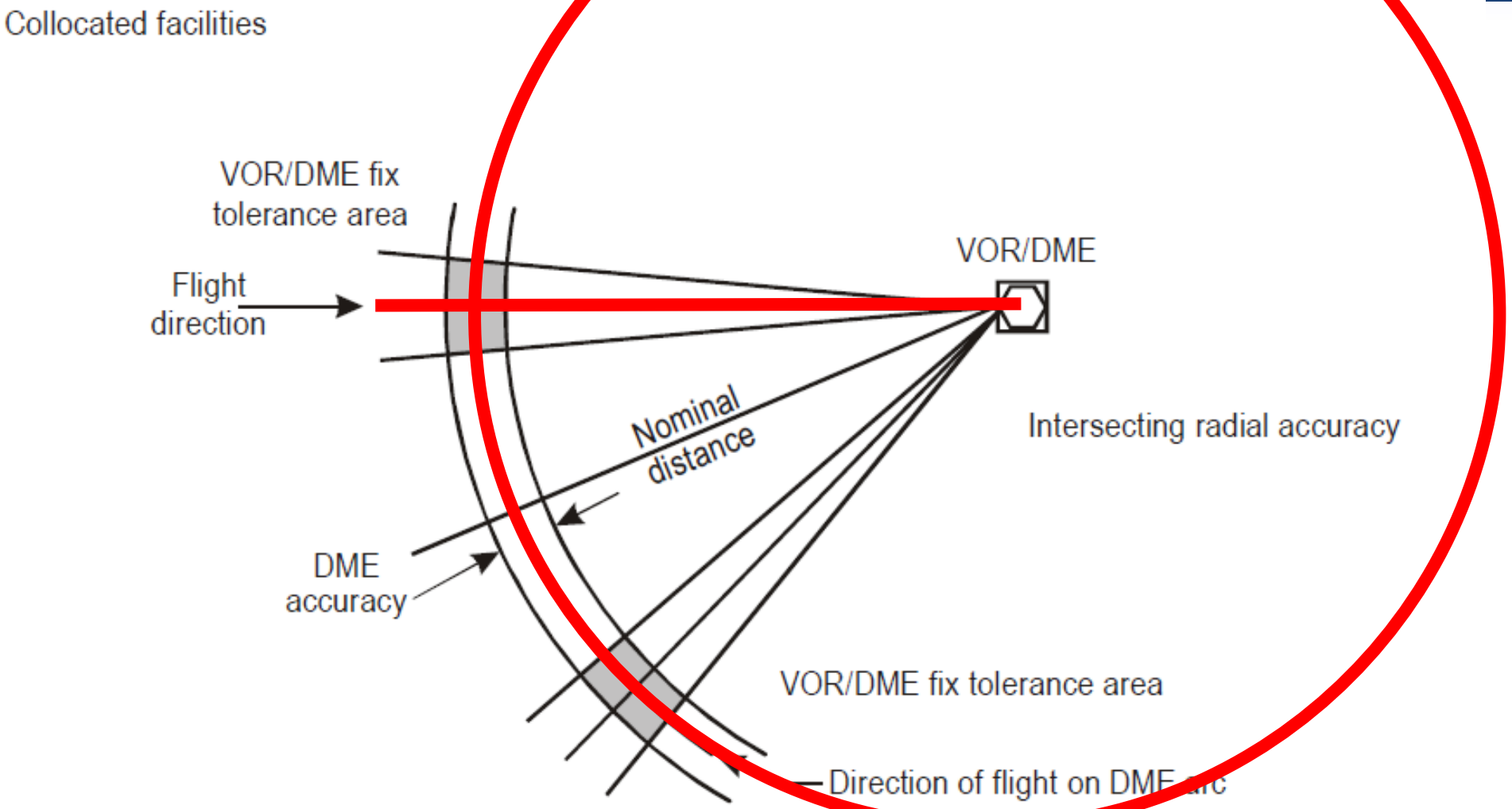
FACILITY & FIX



FACILITY & FIX



FACILITY & FIX

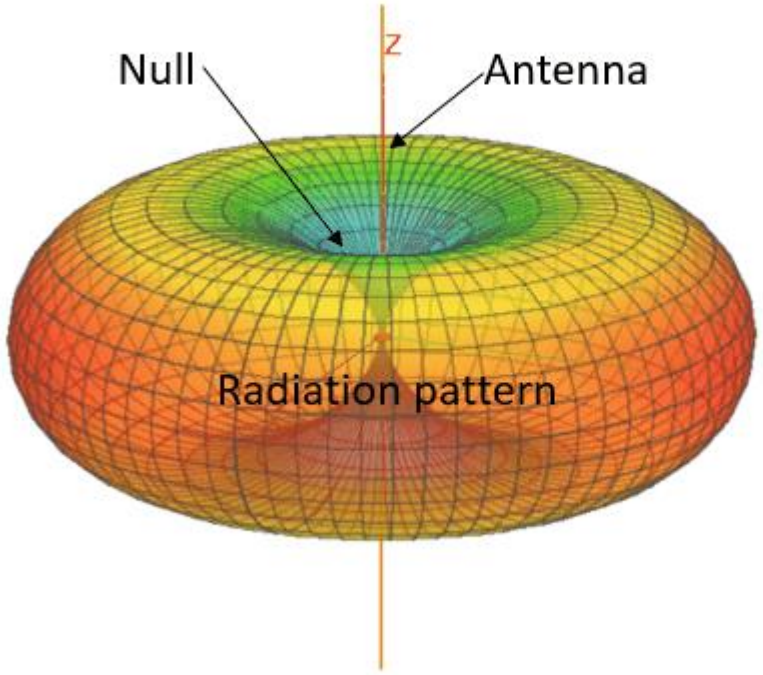


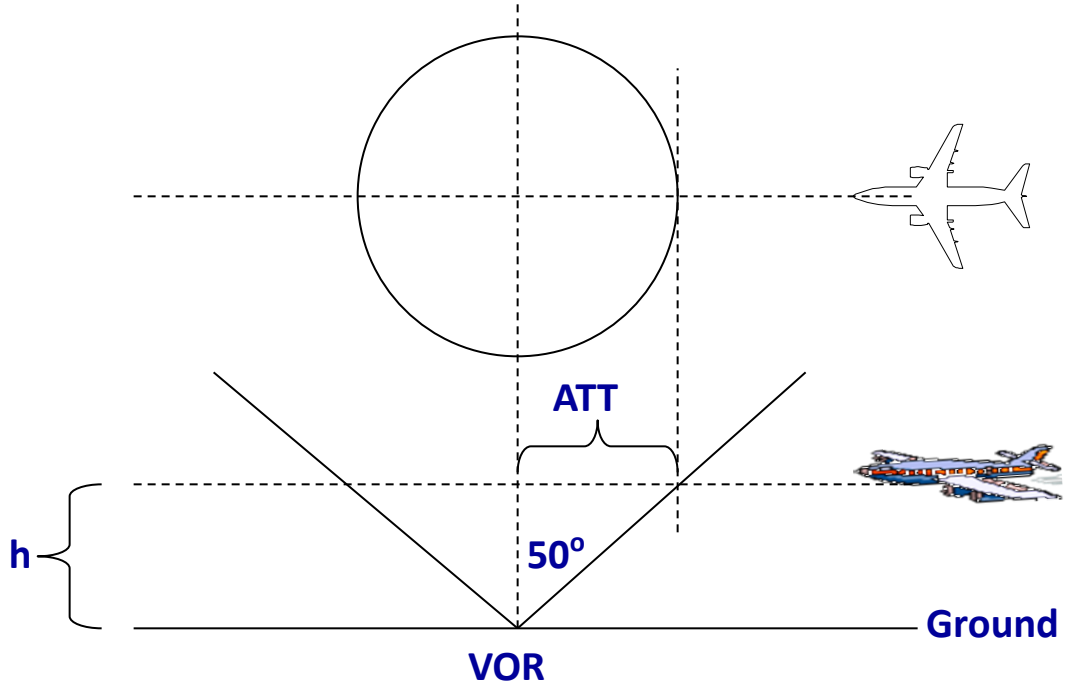
FIX TOLERANCE

- Fix tolerance is a distance measured along the nominal track and relative to the nominal fix position. It is defined by the intersections of the nominal track with the earliest and latest limits of the fix tolerance area, measured along the nominal track.
- The tolerance is expressed as a plus or minus value around the nominal fix.

FIX TOLERANCE

- Facility (Fly-over a facility)





Along Track Tolerance (ATT) of the Fix = h * Tan50° (↑)

Calculate ATT (in NM) if h=4000ft

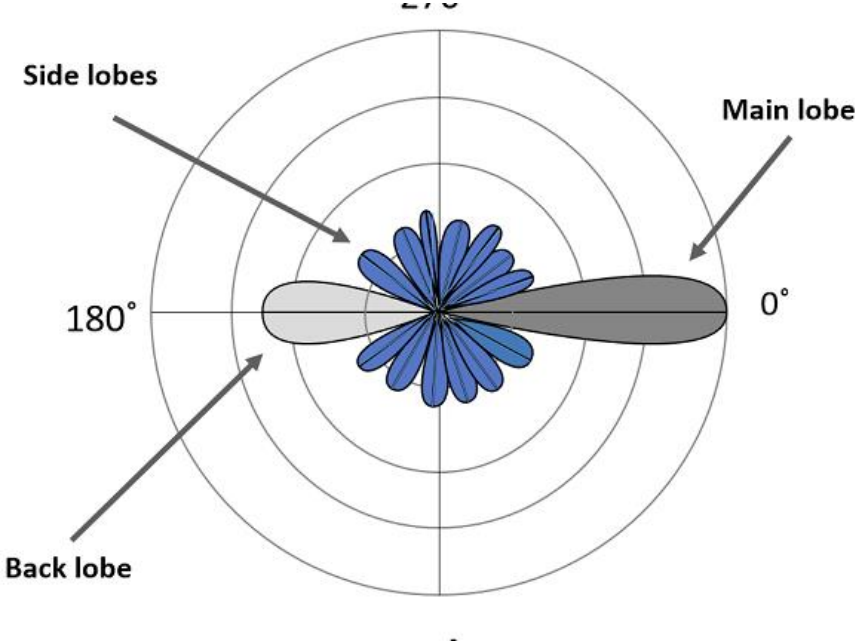
FIX TOLERANCE

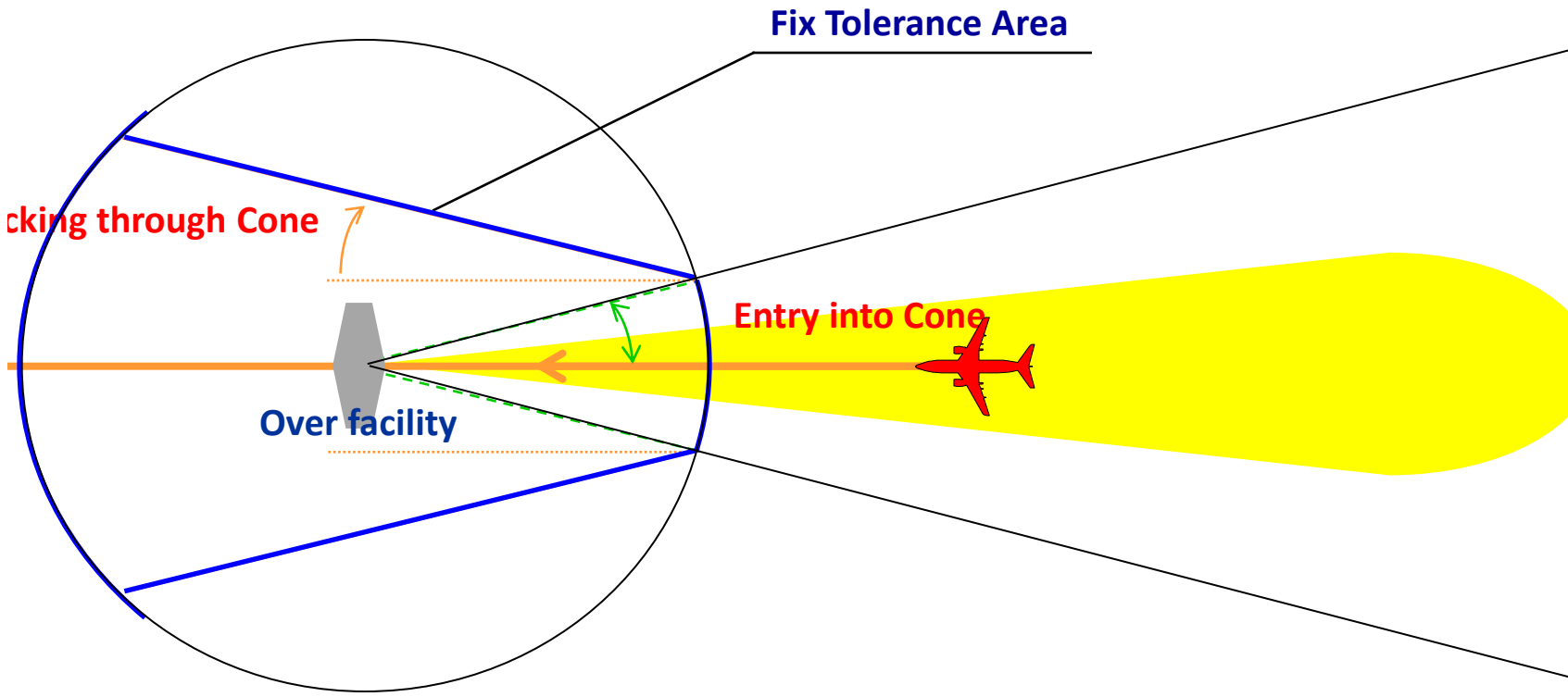
- Overhead Facility Tolerances:

	VOR	NDB
Cone Effect Angle	50°	40°
Entry into Cone	+/-5°	+/-15°
Tracking through Cone	+/-5°	+/-5°

FIX TOLERANCE

- Overhead Facility Tolerances:





FIX TOLERANCE

VOR position fix tolerance area construction.

- 1) draw a circle with centre on the VOR and a radius of zV: zV = h tan α (zV and h in km)

  where α is 50° (NDB:40 °); and h the height above the facility;
- 2) draw the parallel lines at a distance qV = zV sin 5° on each side of the inbound track;
- 3) draw two lines making an angle of 5° with the preceding lines 2) on the points “V2” and “V4”; and
- 4) locate points “Vl” and “V3” at the intersections of the lines 3) and the circle 1).

FIX TOLERANCE

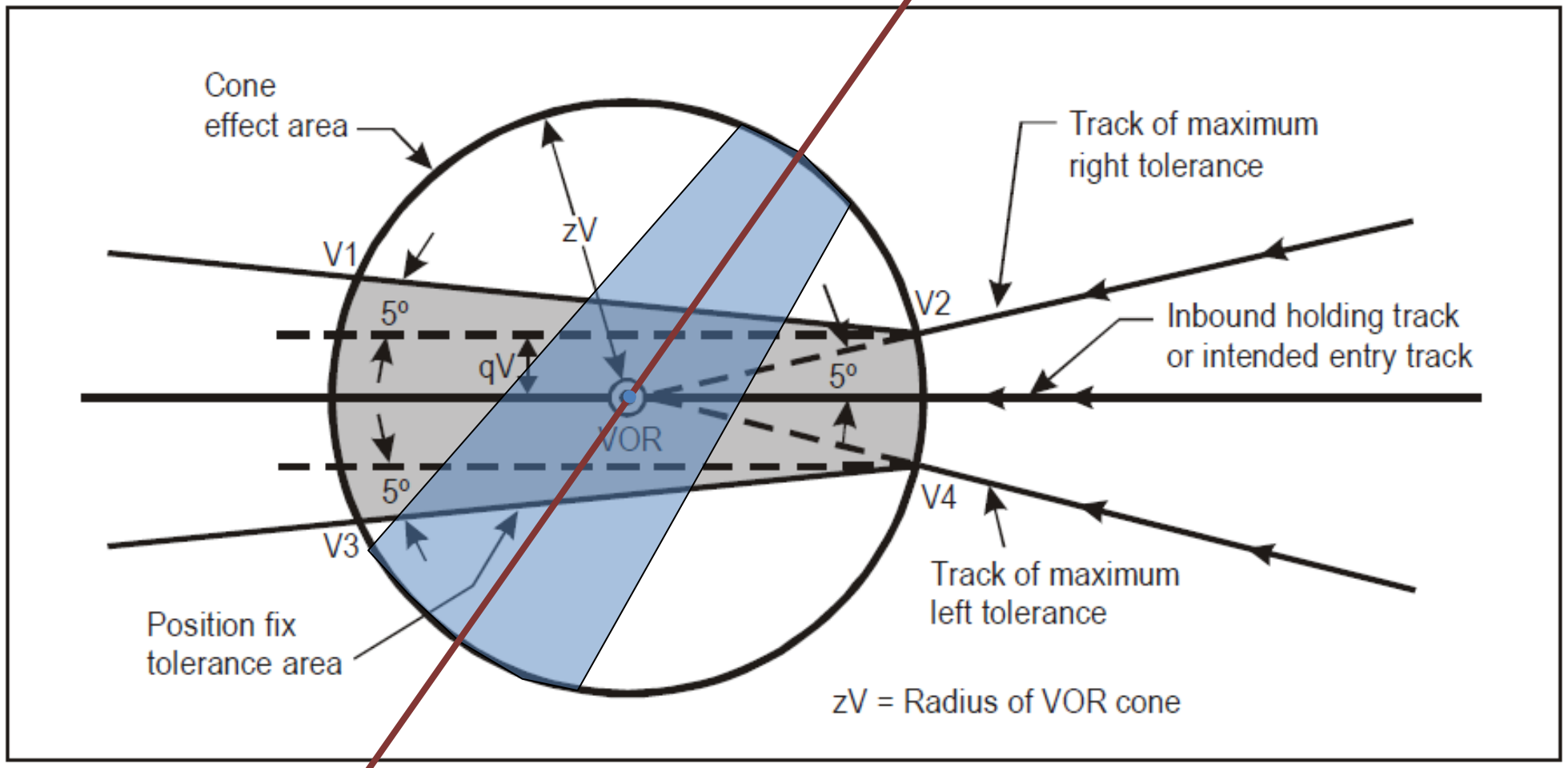
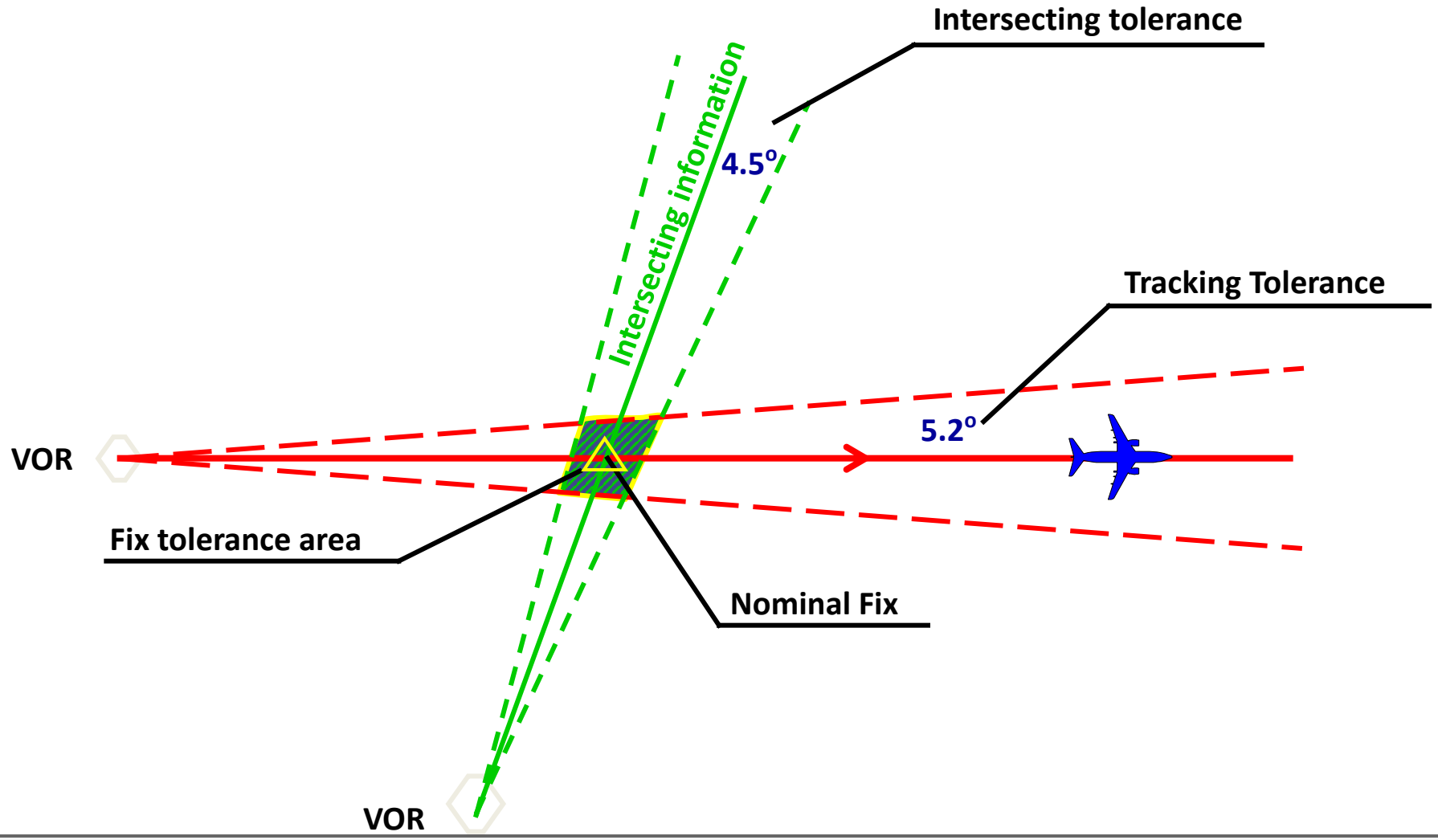


Figure I-2-2-3. Fix tolerance area overhead a VOR

FIX TOLERANCE



FIX TOLERANCE

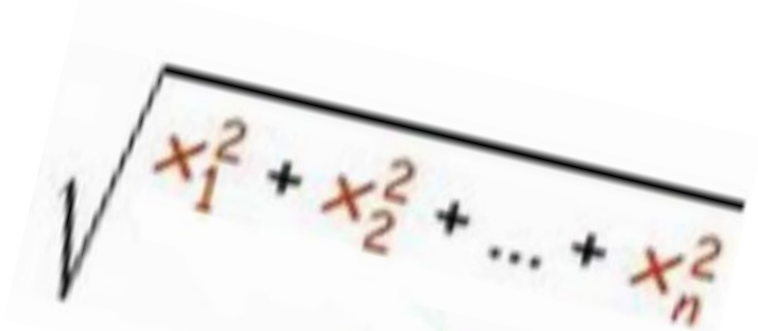
- Tracking & Intersecting Fix Tolerances:

	VOR	NDB
Tracking Tolerance	5.2°	6.9°
Intersecting Tolerance	4.5°	6.2°

Reference: Table I-2-2-1

FIX TOLERANCE

- System use accuracy is formed by considering the components of each navigation system's tolerance at 95% values and combining them by the root sum square (RSS) technique.
- Eg. VOR



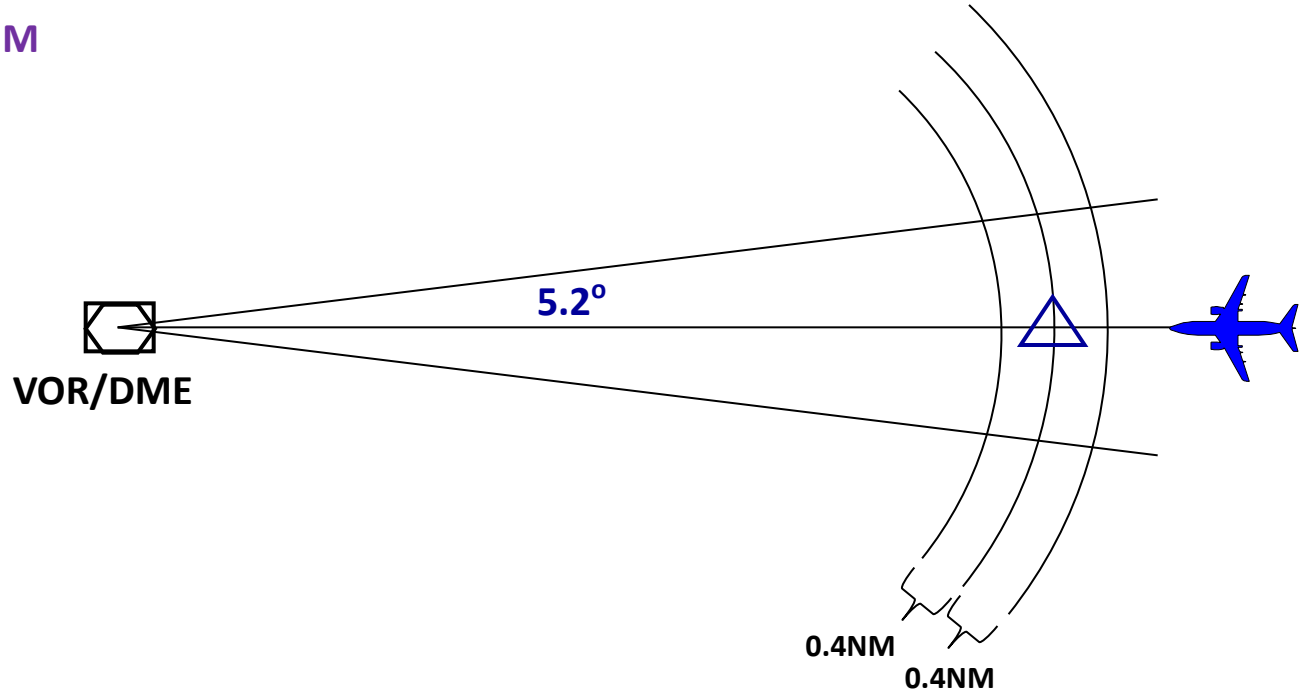
Component	System use accuracy of facility NOT providing track	System use accuracy of facility providing track
Ground System	±3.5	±3.5
Monitor	±1.0	±1.0
Receiver	±2.7	±2.7
FTT		±2.5
Total	±4.5	±5.2

FIX TOLERANCE

- Fix defined by VOR/DME:

DME TOL = 0.25NM + 0.0125*D

If D = 12NM



Note: **When the DME is not co-located with the navigation facility, the maximum angle between the track & a line through the DME facility is 23°**

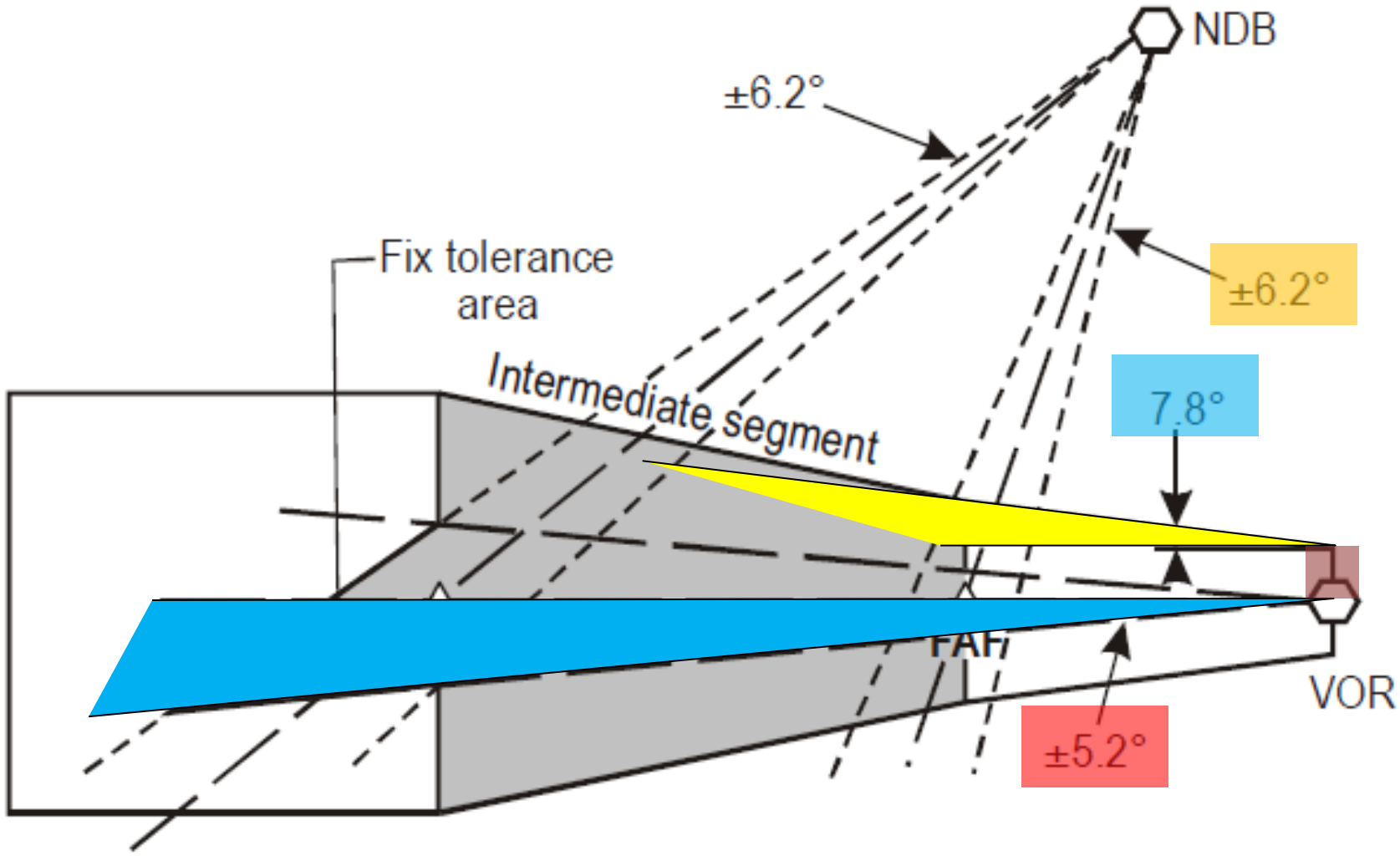
PROTECTION AREA FOR VOR AND NDB

- The values for protection areas are based on the system use accuracies (2 SD) and are extrapolated to a 3 SD value (99.7 per cent probability of containment).

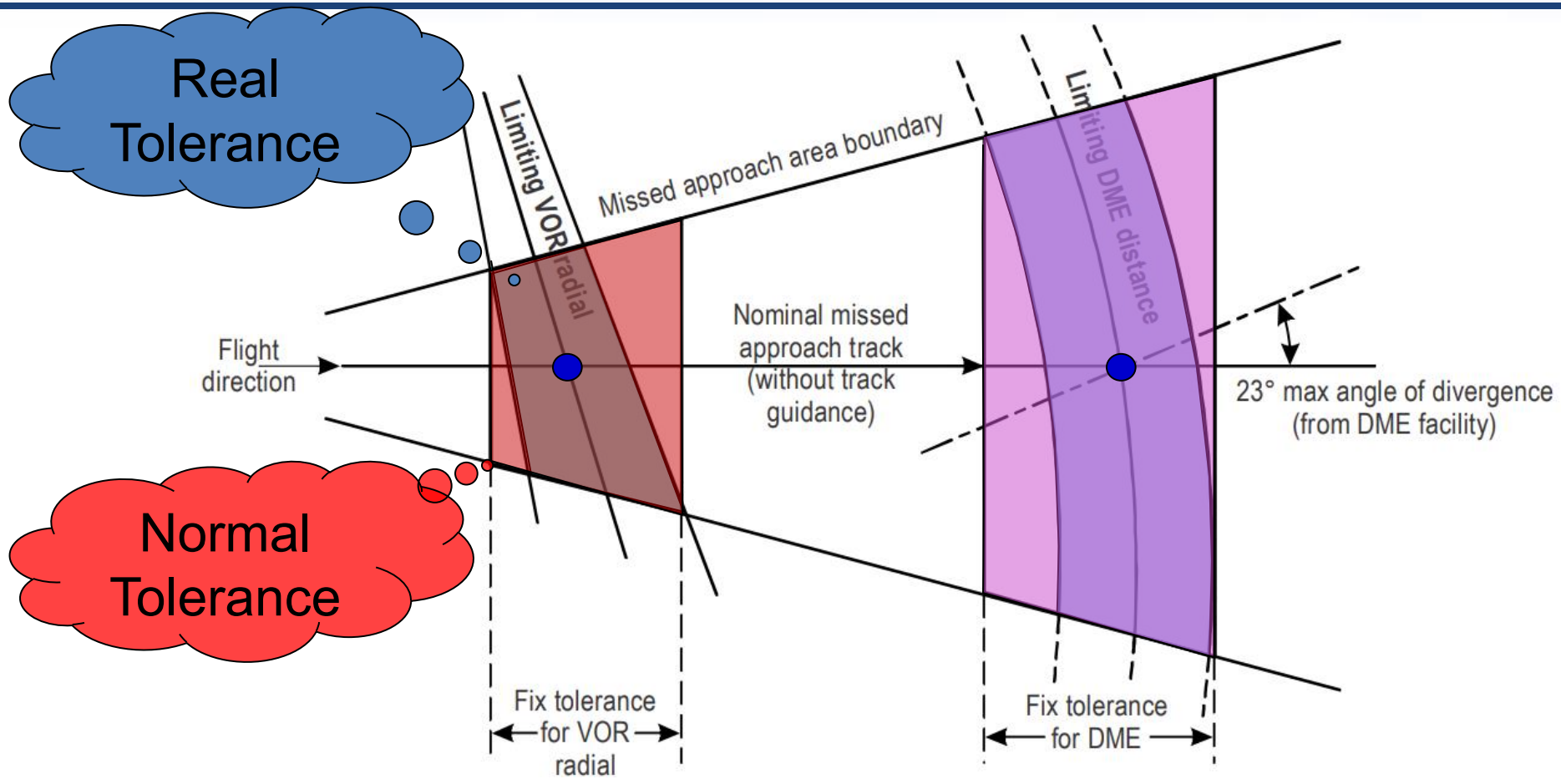
- VOR splay = 7.8°
- NDB splay = 10.3°

2 SD * 1.5 = 3SD
e.g.
VOR : 5.2* 1.5 = 7.8

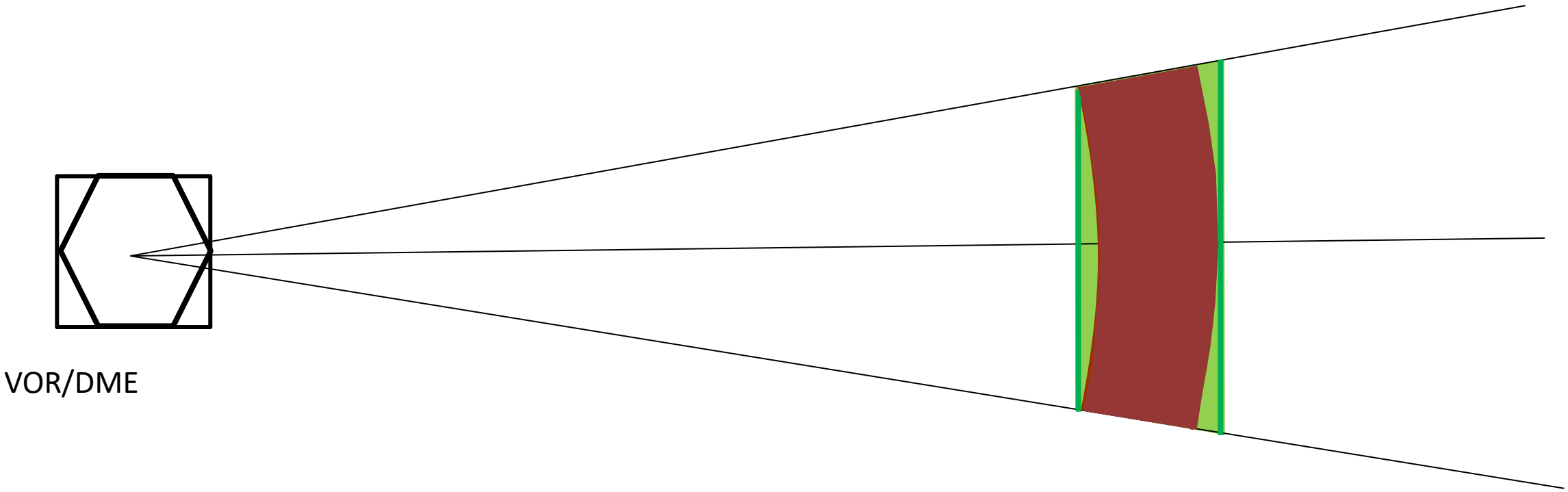
PROTECTION AREA FOR VOR AND NDB



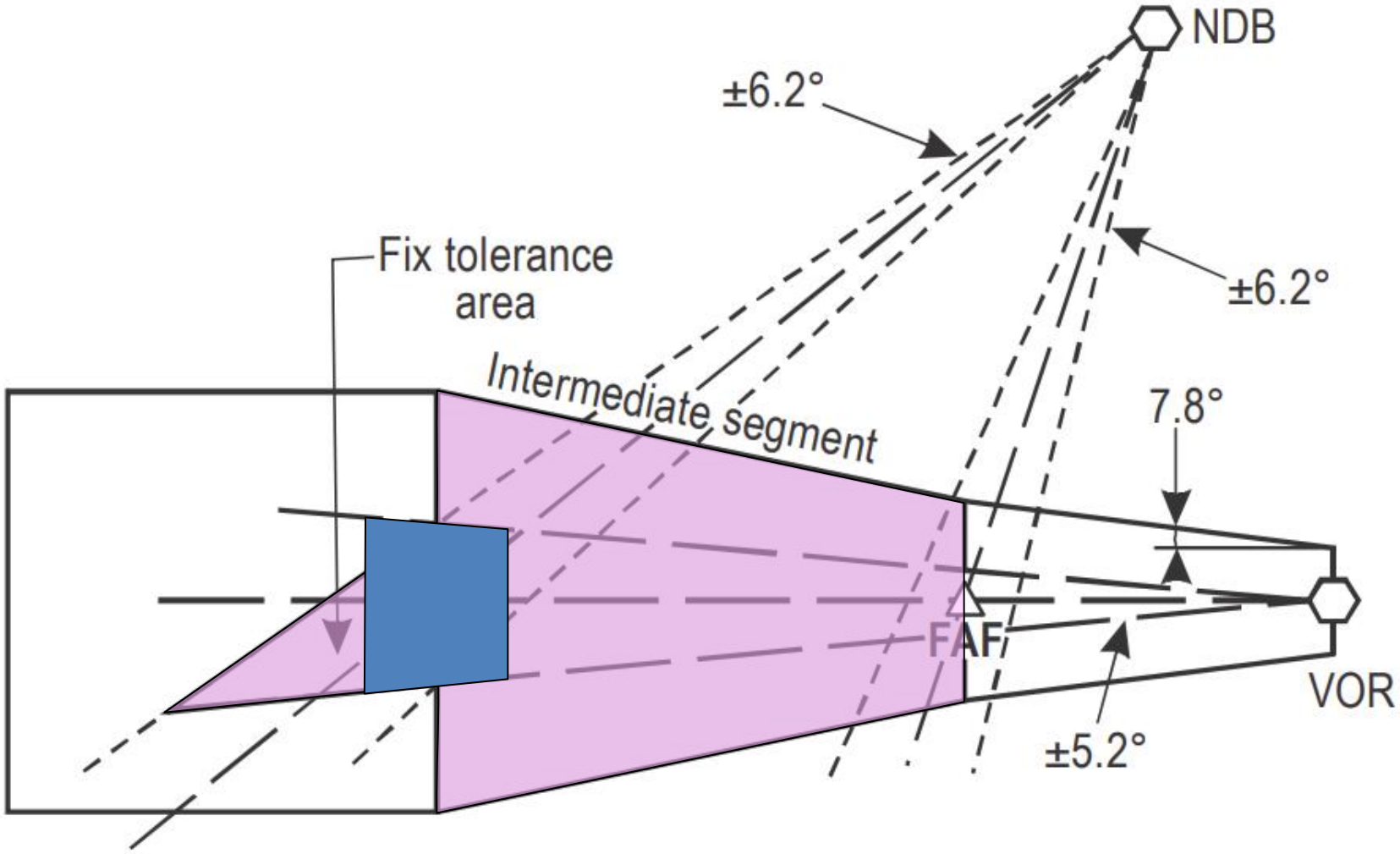
NORMAL FIX TOLERANCE



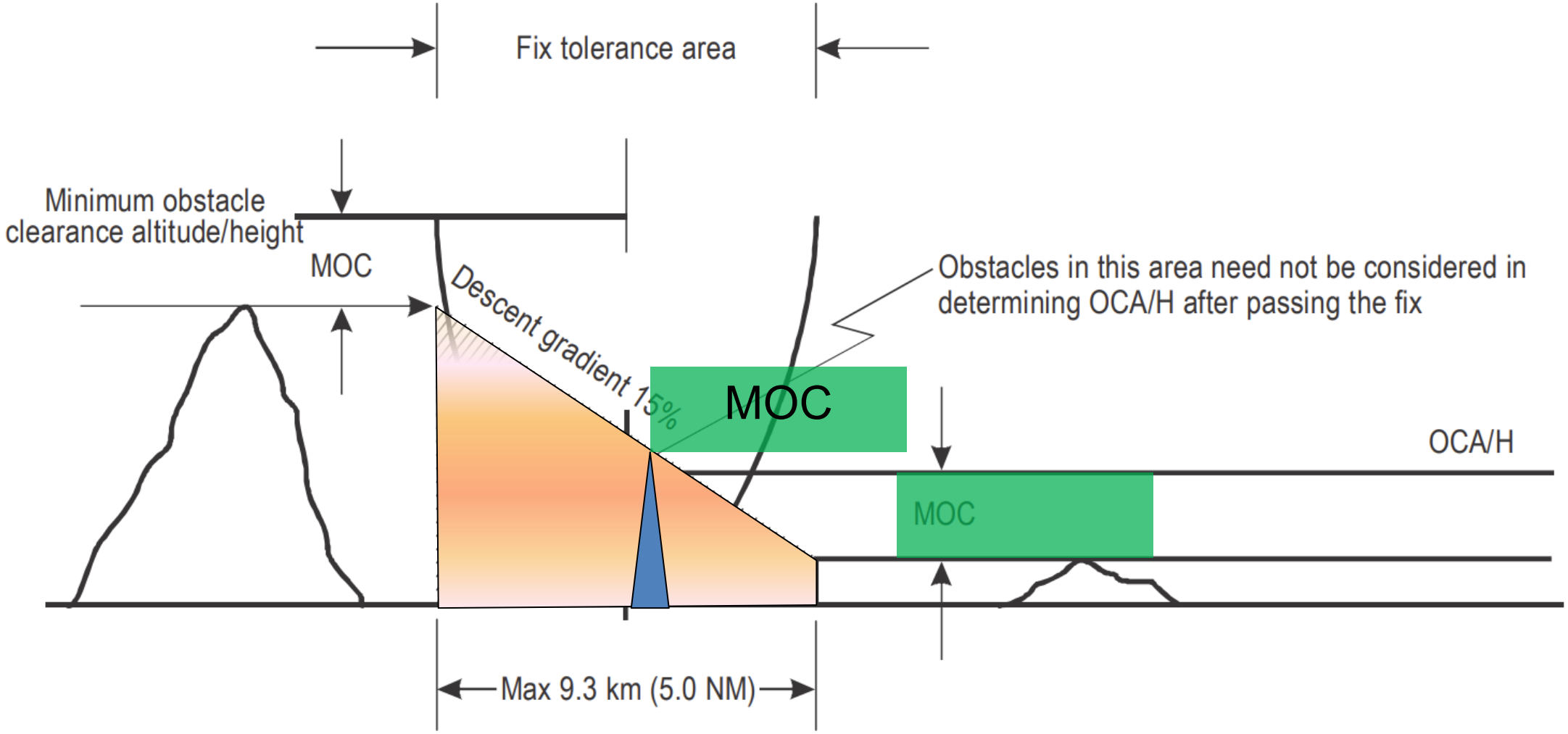
NORMAL FIX TOLERANCE



OBSTACLE CLEARANCE AREA



OBSTACLE CLOSE TO A FAF OR SDF



Questions

Let's Focus/Propose/Plan Together