

# ZRH TMA Redesign 2.0

based on FOCA & ICAO requirements

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# Intro

1. Overview of the development of the ZRH CTR and TMA:
  - IFPs protected
  - Reduction of complexity of basis TMA structure (in number and shapes)
  - ICAO and FOCA Design criteria applied
  - SIL2 Procedures (62 IFPs: 17 APCH, 14 Final & Missed APCH, 31 SID) More details on this number later in PPT.
  - Dübendorf Airspace integrated in concept
2. Presentation only
3. Design Technical question only, may be asked at the end of the presentation.

# Requirements (ICAO & FOCA) explanation on following slides

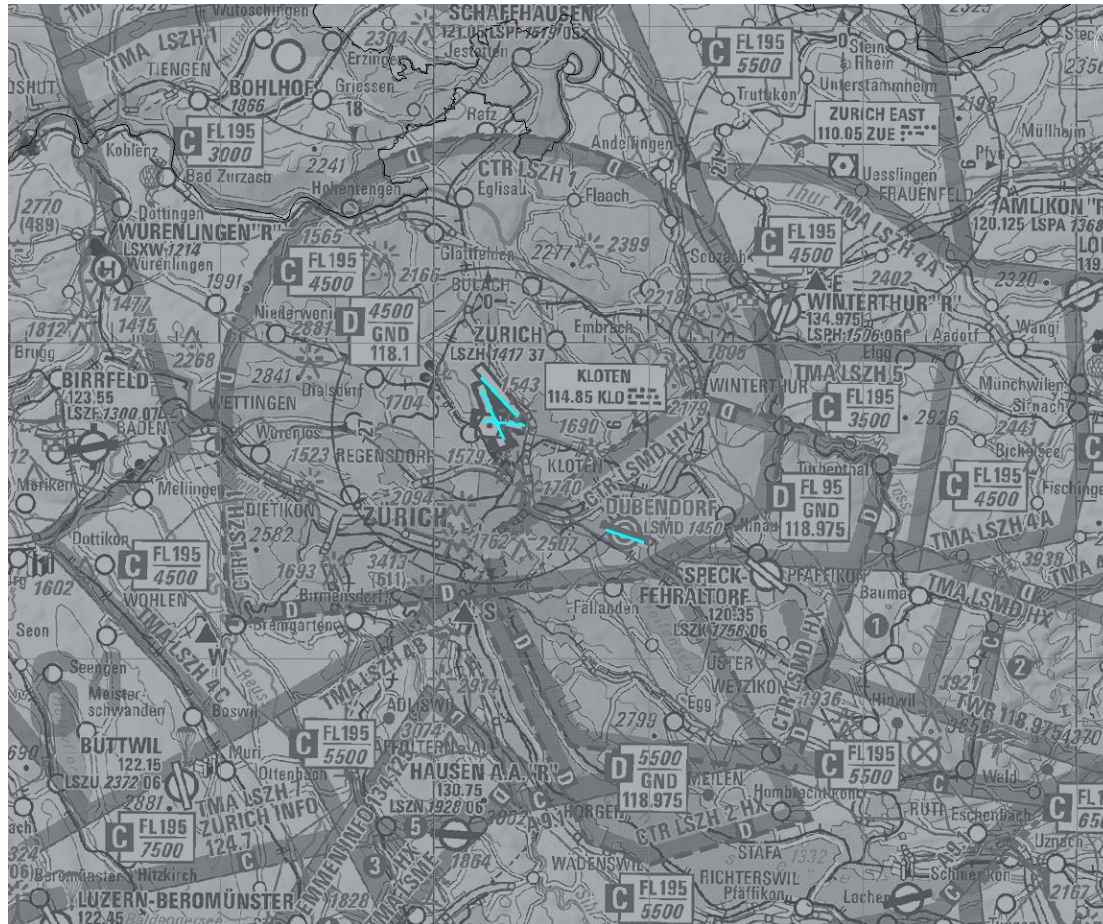
- › ICAO Annex 11 §2.9.3.2 A lower limit of a control area shall be established at a height above the ground or water of not less than 200 m (700 ft).
- › ICAO Annex 11 § 2.11.5.2 The lateral limits of a control zone shall extend to at least 9.3 km (5 NM) from the centre of the aerodrome or aerodromes concerned in the directions from which approaches may be made.  
*Note.— A control zone may include two or more aerodromes situated close together.*
- › Vertical protection IFPs 500ft towards lower floor of the airspace.  
(ICAO Annex 11, §2.6 for the service class and §2.11.3 for the VFR division level)
- › Lateral protection IFP procedure 3NM  
(ref. Buffer Table, 1NM NAV. Performance +1NM +1NM for collision avoidance.)
- › Lateral protection towards airspace boundary in climb/descent profile 2NM for collision avoidance.
- › Airspace Design Principles Document CH

# Airspace Design Principles CH

- › FOCA project to publish the legal binding ADP-CH.
- › Buffertable will be integrated part of the ADP-CH (as Annex).
- › Previous principles (Design of 28-03-2019) mainly based on IFP (more conservative).
- › New principles closer to average TFC performance (real life).
- › ADP-CH will be legally binding (also for 3<sup>rd</sup> party AD) over Switzerland.



# RWYs considered



ICAO Annex 11 § 2.11.5.2 The lateral limits of a control zone shall extend to at least 9.3 km (5 NM) from the centre of the aerodrome or aerodromes concerned in the directions from which approaches may be made.  
*Note.— A control zone may include two or more aerodromes situated close together.*



5nm from each RWY end was taken to cover the intent of this ICAO article (as the 5nm around ARP does not provide equal protection for all RWYs).

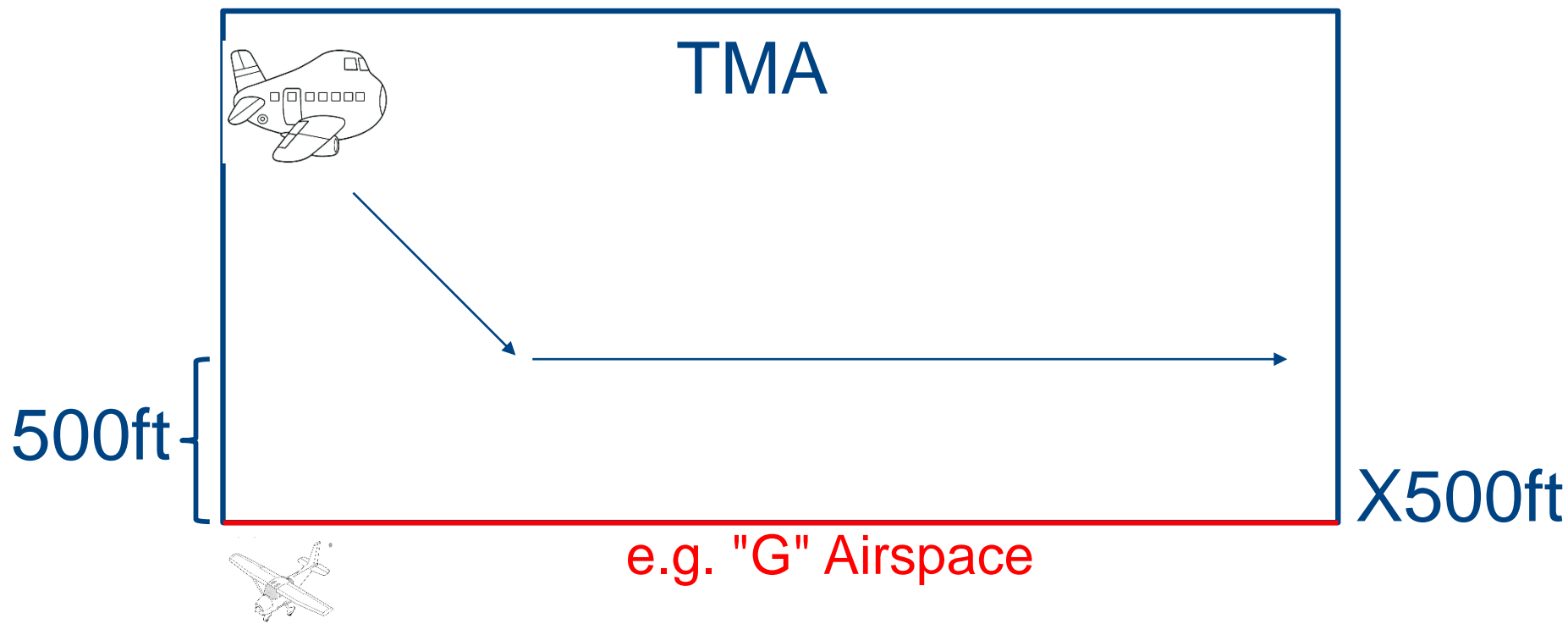
This will also be covered in EU IR currently proposed 2017/373, opinion 2/2018 (ODD foreseen 2020: Annex 1-11, part Flight Procedures design)



# Minimum CTR size



# ICAO Annex 11 § 2.11, 2.6.3 (VFR DL & Service class)



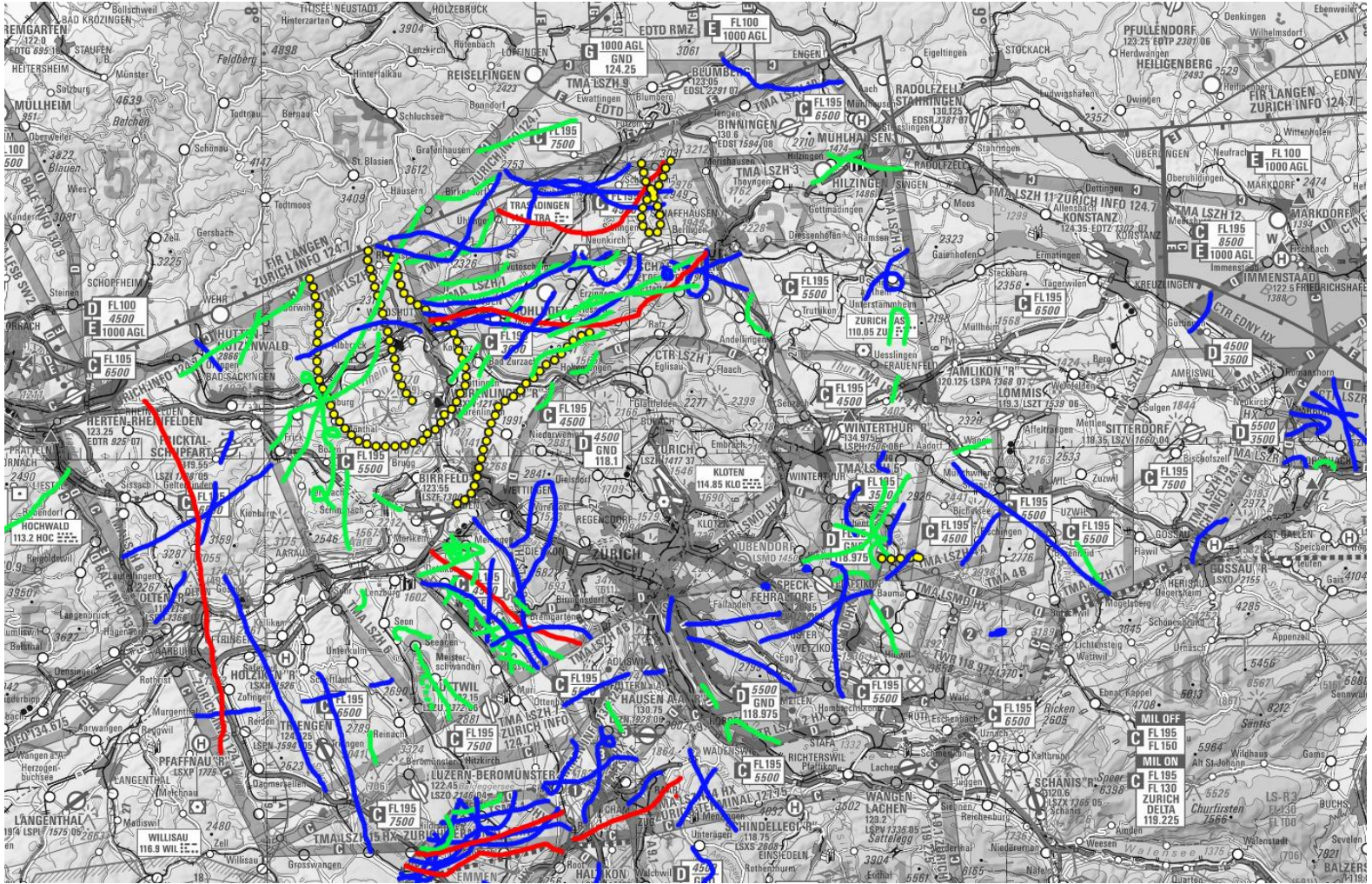
*Note.— Where the ATS airspaces adjoin vertically, i.e. one above the other, flights at a common level would comply with requirements of, and be given services applicable to, the less restrictive class of airspace. In applying these criteria, Class B airspace is therefore considered less restrictive than Class A airspace; Class C airspace less restrictive than Class B airspace, etc.*





# FOCA overview Airspace Infringements

## Zürich / Dübendorf 2017

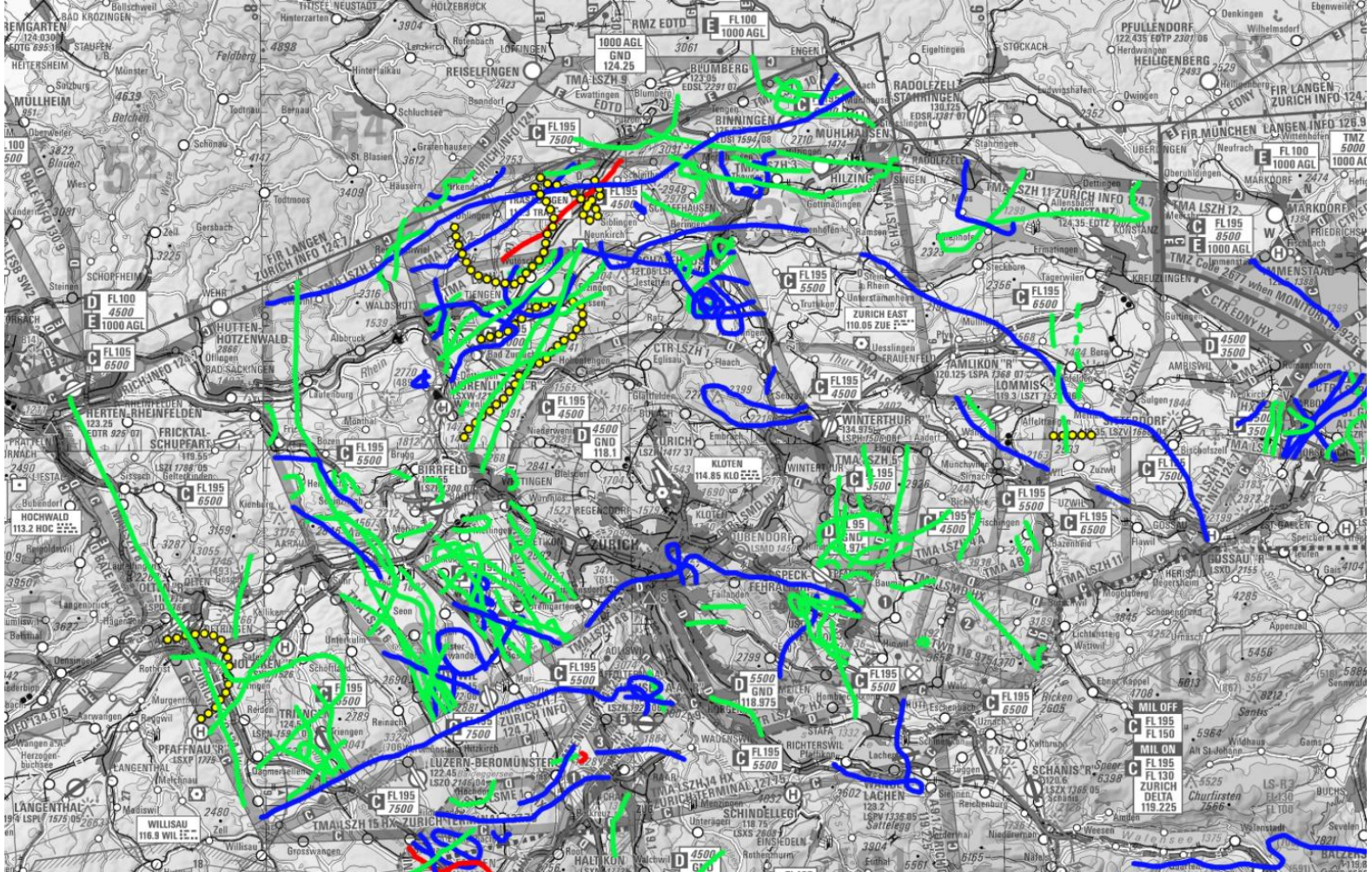






# FOCA overview Airspace Infringements

## Zürich / Dübendorf 2018





# New ATS Buffer Table CH

- 3 Air Traffic Service Buffers:
  - **Independent of airspace class**
  - **Collision Avoidance only, no separation provided**
- SMALL – 2NM/500ft
- MEDIUM – 2NM/1000ft
- LARGE – 5NM/2000ft

Airspace Structure	Buffer required	Type
- LS-R GND/GND - LS-R Anti Hail Firing	No	Firing and other activities
- LS-T Gliders (in 2019 LS-R Gliders in TMA) - LS-R GND/Air	SMALL	Rules of the Air
- LS-R Gliders (small cloud distance) - LS-R Air/GND - LS-R Air Display	MEDIUM	Not adhering to Rules of the Air
- TRA/TSA - LS-R Air/Air	LARGE	High Performance Activities



# Buffertable explanation 3NM AD

*(Only Applicable over CH)*

- › Nav Performance **RNP1** is covered with **1NM** lateral protection
- › **2NM** is collision avoidance
  - **1NM** Nav performance for ACFT outside of the airspace (rationale based on infringements observations)
  - **1 NM** Safety Buffer to cater for collision avoidance.

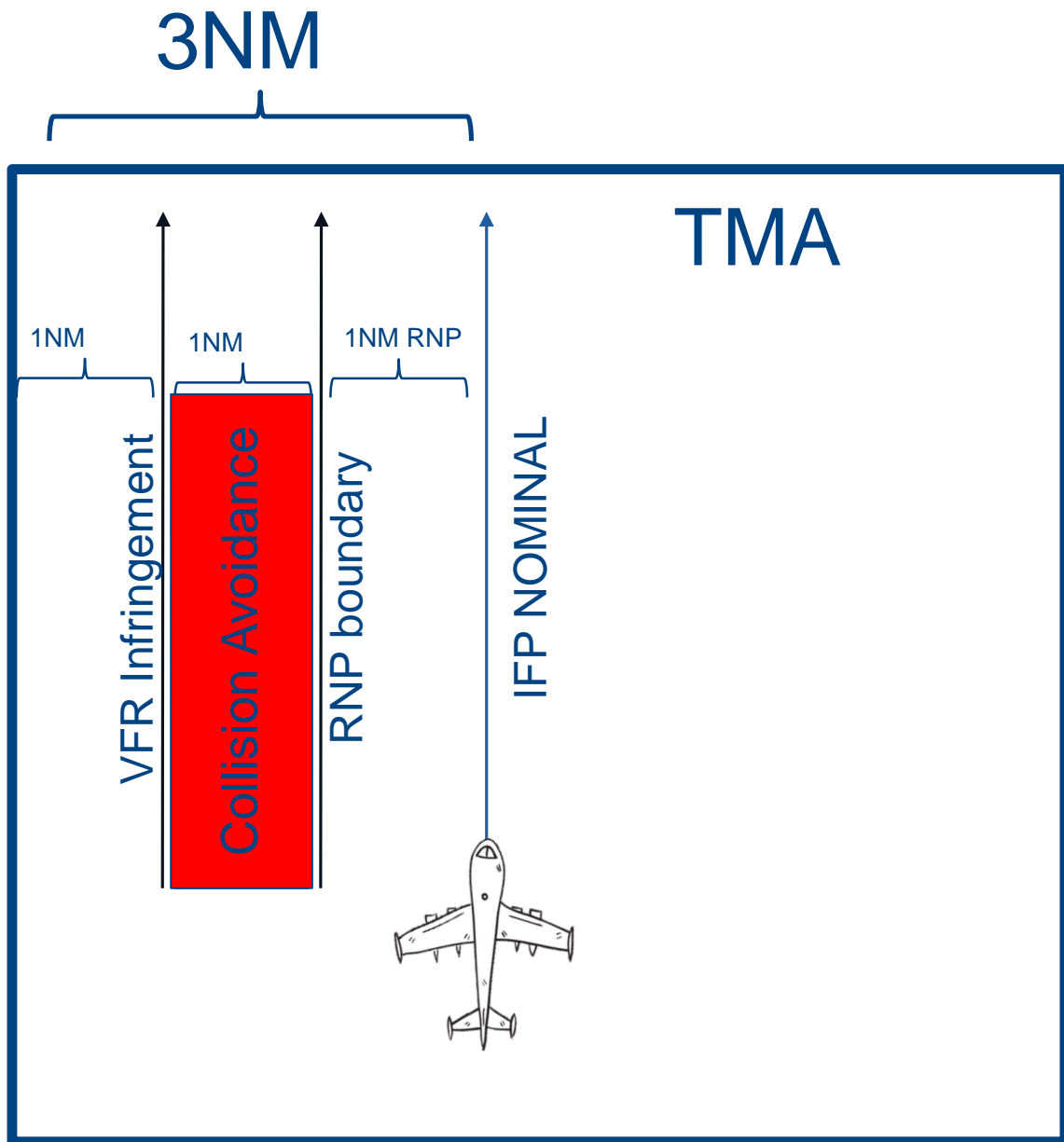
1+1+1= 3NM

3NM = Design Basis on Procedures.

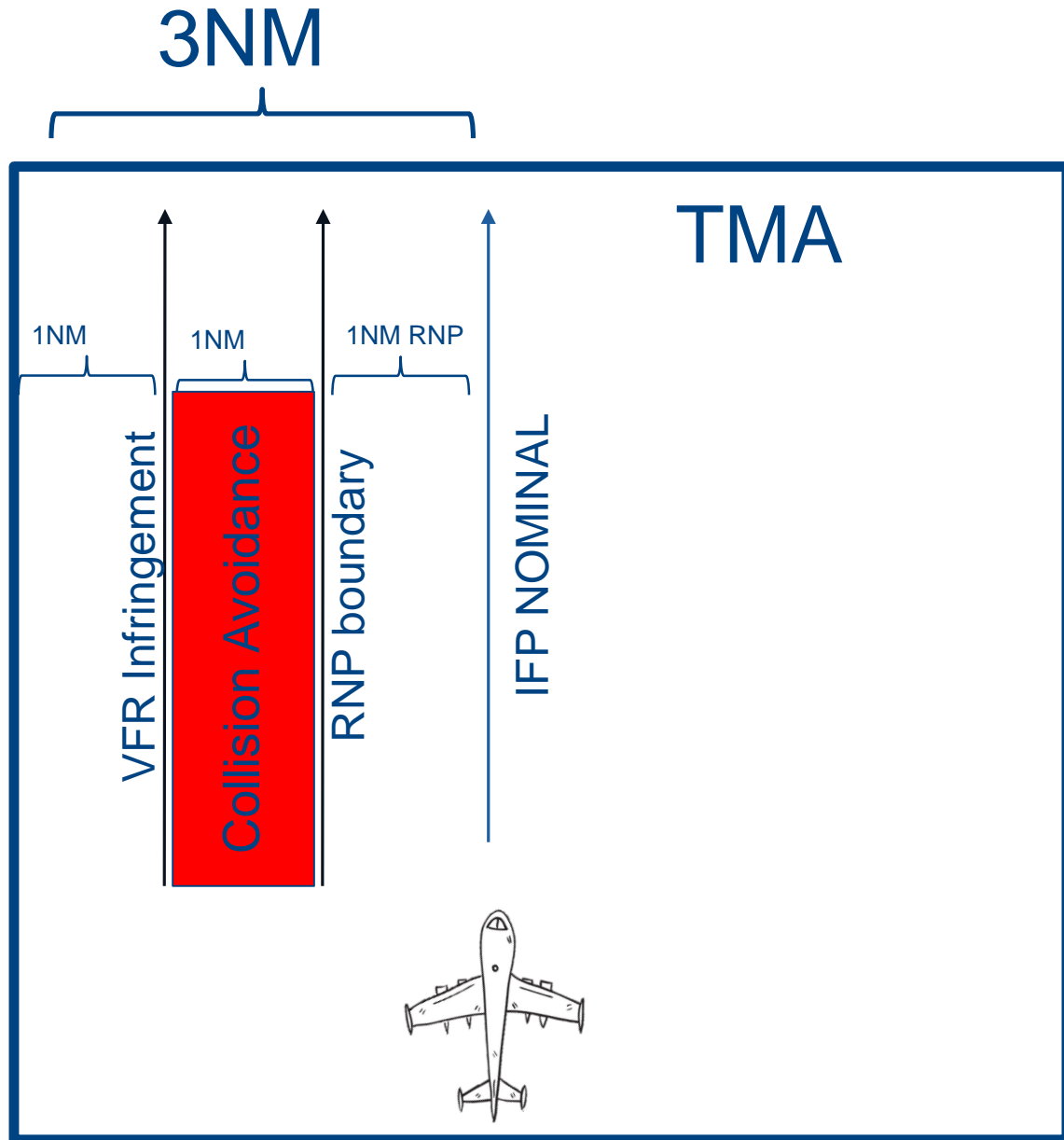
FAF = 2NM as NAV Performance RNP1 is excluded (no lateral tolerances required)



# E/G Airspace



# E/G Airspace





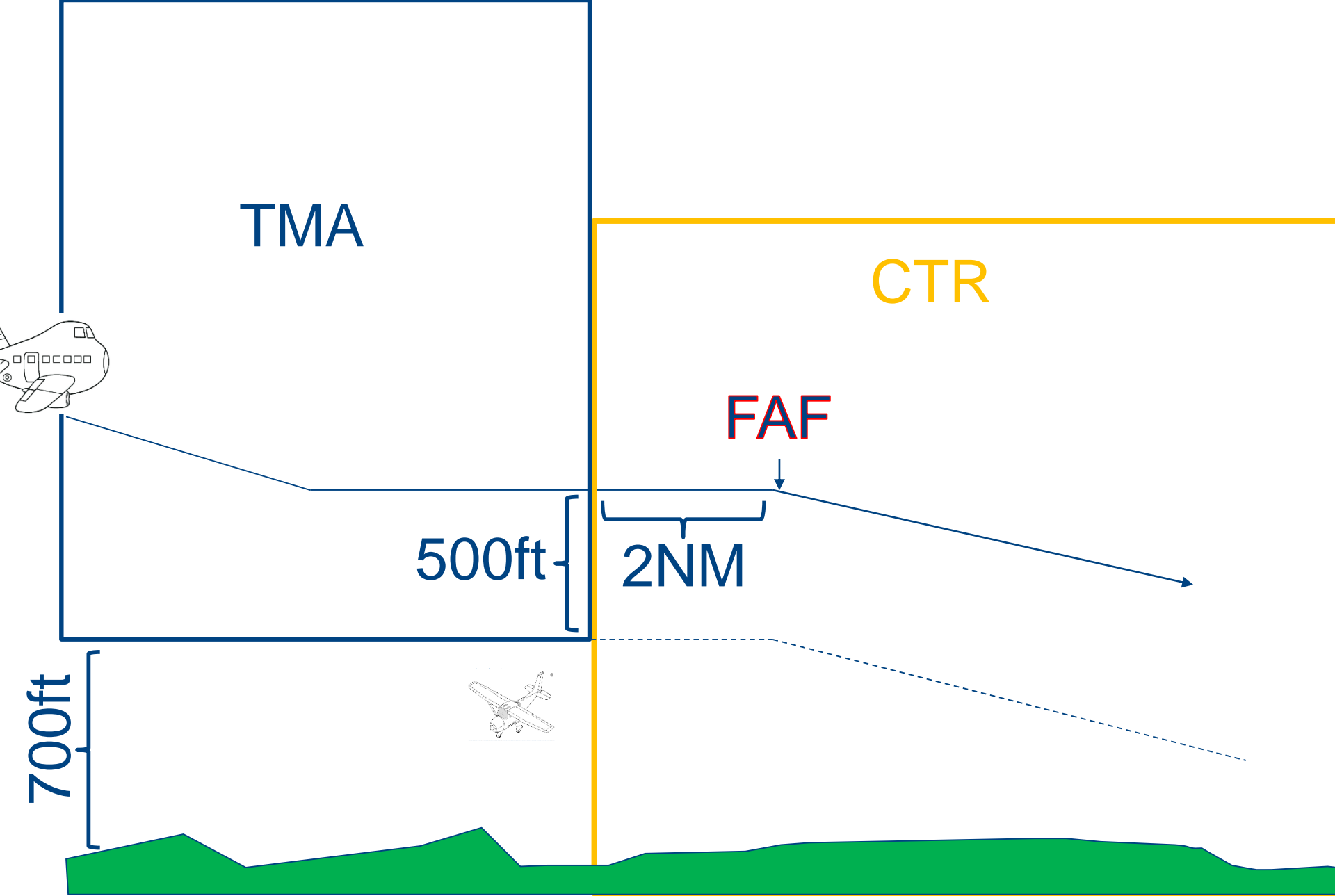
# Buffertable explanation 3NM AD

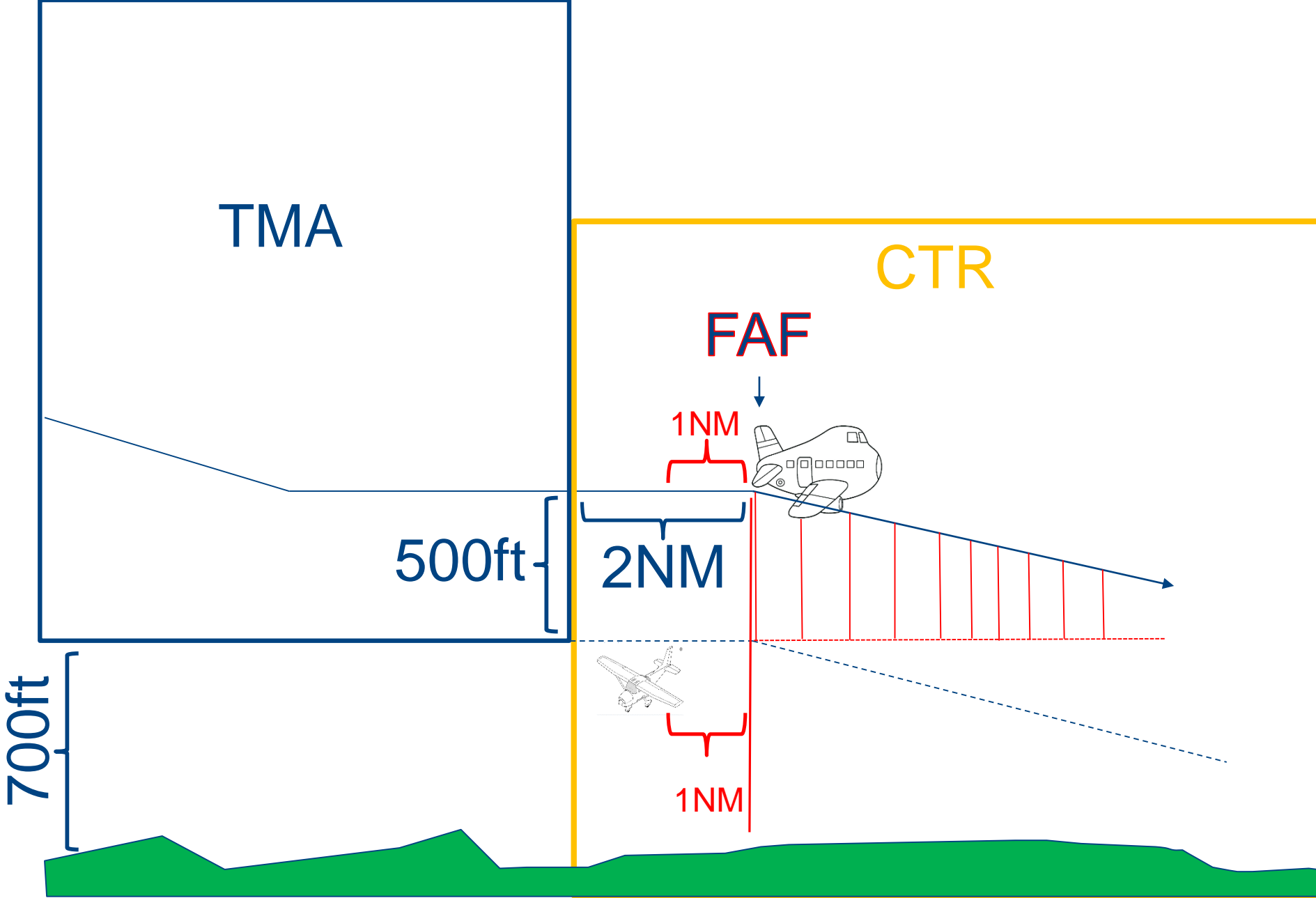
- › Nav Performance *RNP1* is covered with *1NM* lateral protection
- › *1NM* assumed Nav performance for ACFT outside of the airspace (rationale based on infringements observations)
- › *1 NM* Safety Buffer to cater for collision avoidance.

$$1+1+1= 3NM$$

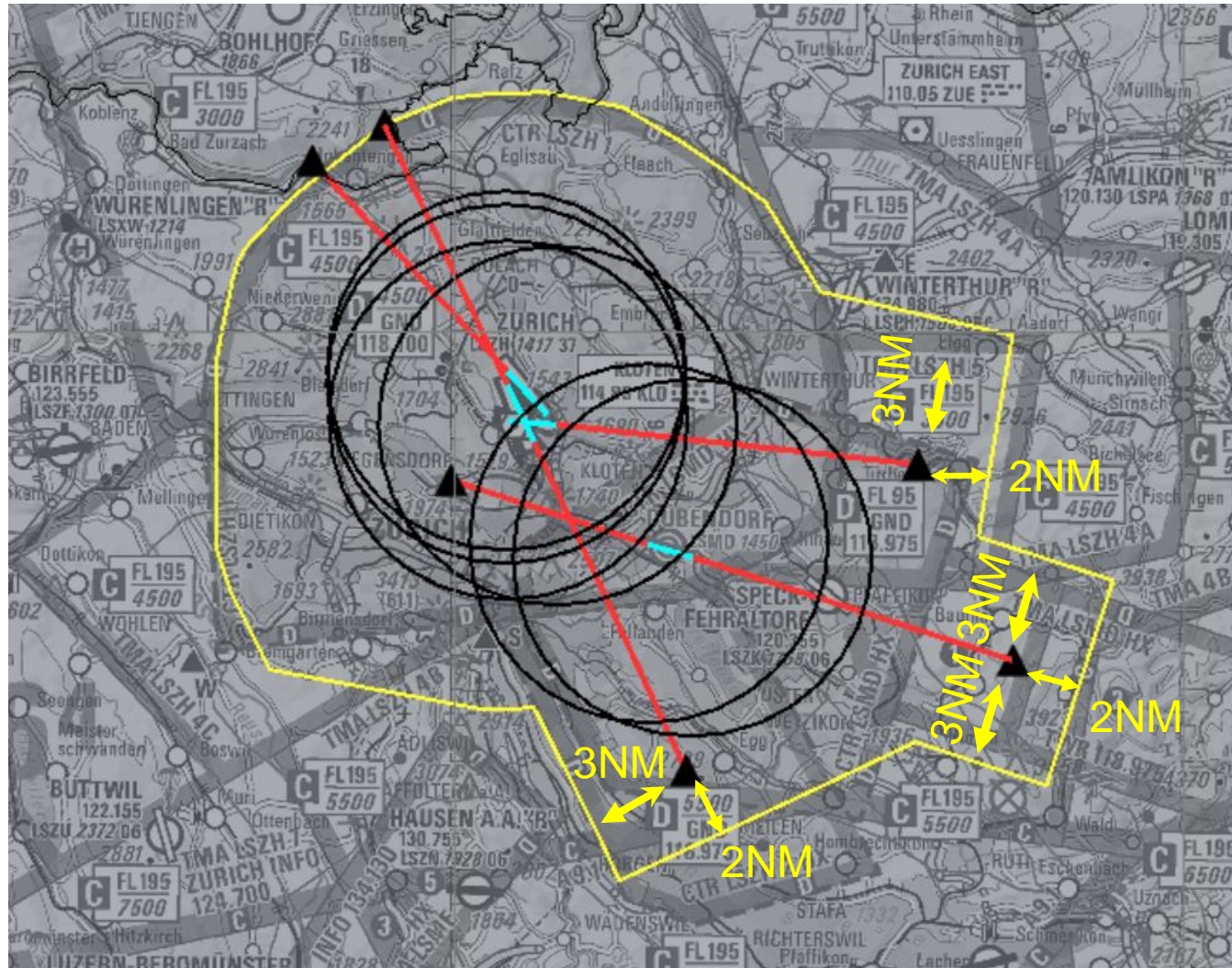
*3NM = Design Basis on Procedures.*

**FAF = 2NM as NAV Performance RNP1 is excluded (no lateral tolerances required)**





# FAFs included



# Masterclass Airspace Design

## › Goal:

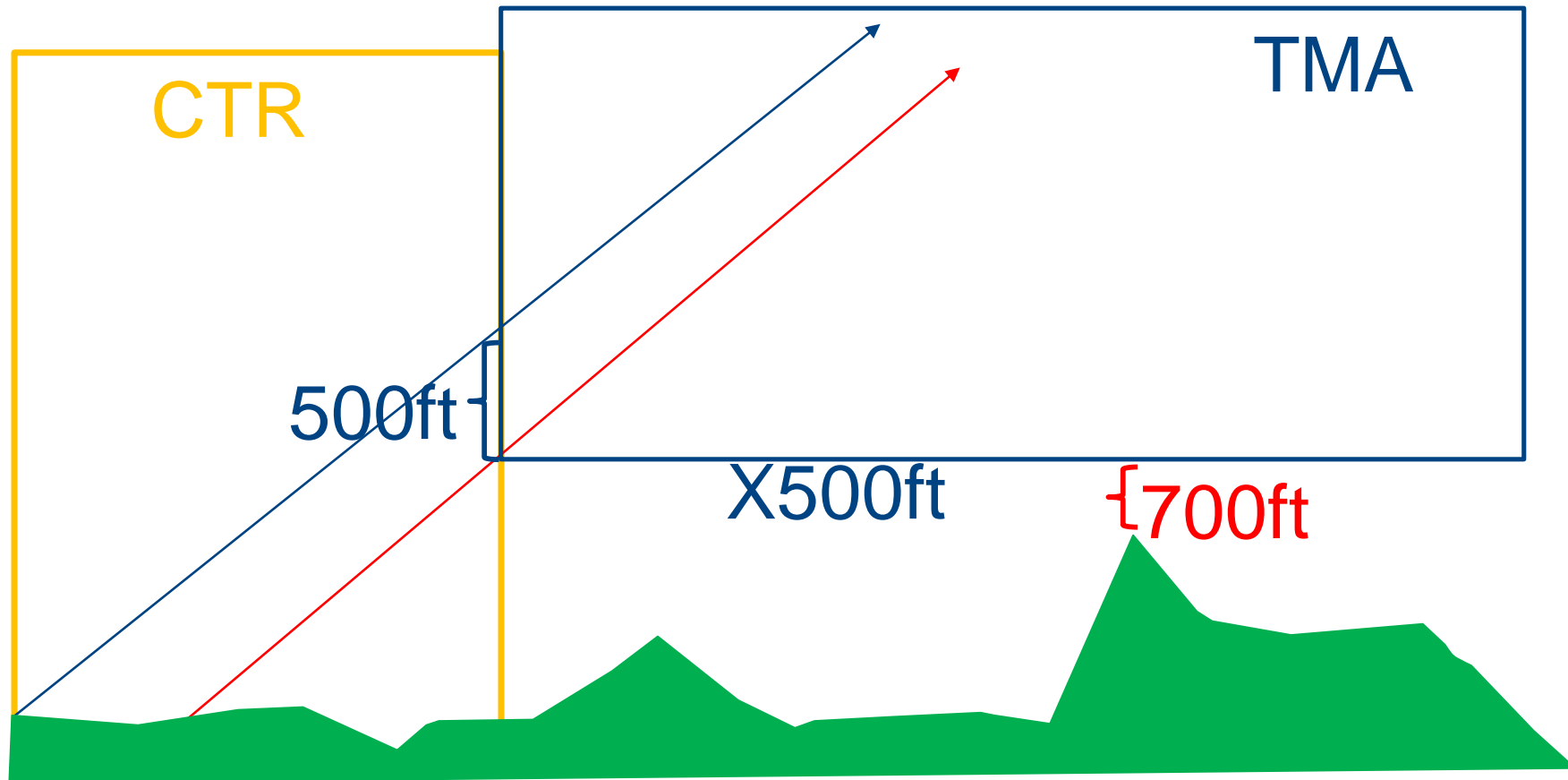
- Everybody understands the basic design steps
- Transparency for all stakeholders on the how's

## › Note:

- Specific Airspace Design Tool used (Luciad™ 1.4.4) including CH Terrainmodel

# TMA Design

- › ICAO Annex 11 §2.9.3.2 (700ft)
- › ICAO Annex 11, §2.6 (service class) and §2.11.3 (VFR DL)

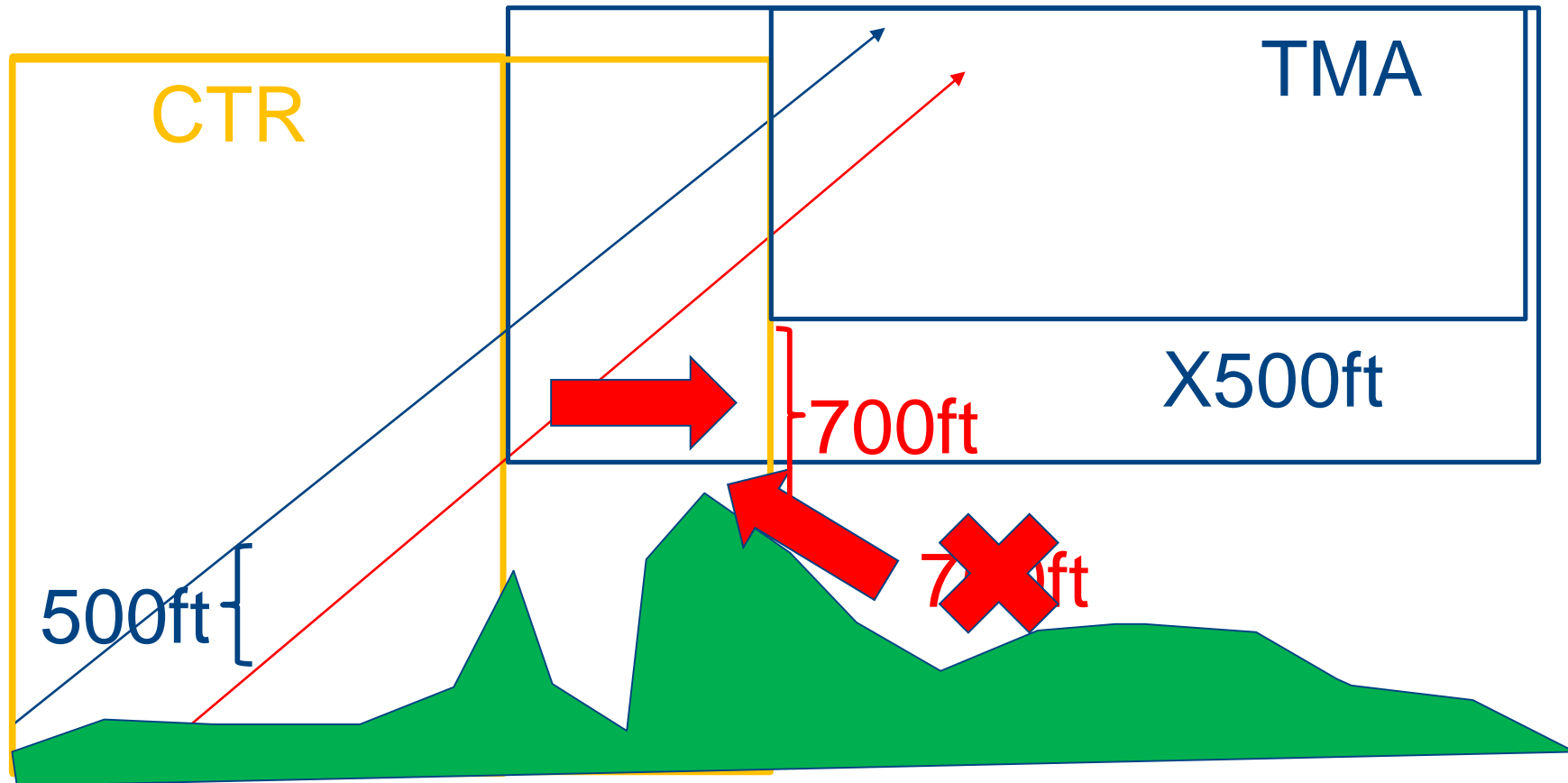






# CTR Design

- › ICAO Annex 11 §2.9.3.2 (700ft)
- › ICAO Annex 11, §2.6 (service class) and §2.11.3 (VFR DL)



# IFP NOMINAL Track

- › IFP PDG till first constrain
- › Then 7% (was 3.3%)
- › **MACG 5%** (was 2.5%)

## 4.1.2.2 P P P P P 1 V

PDG 8.5% to 2900 ft.

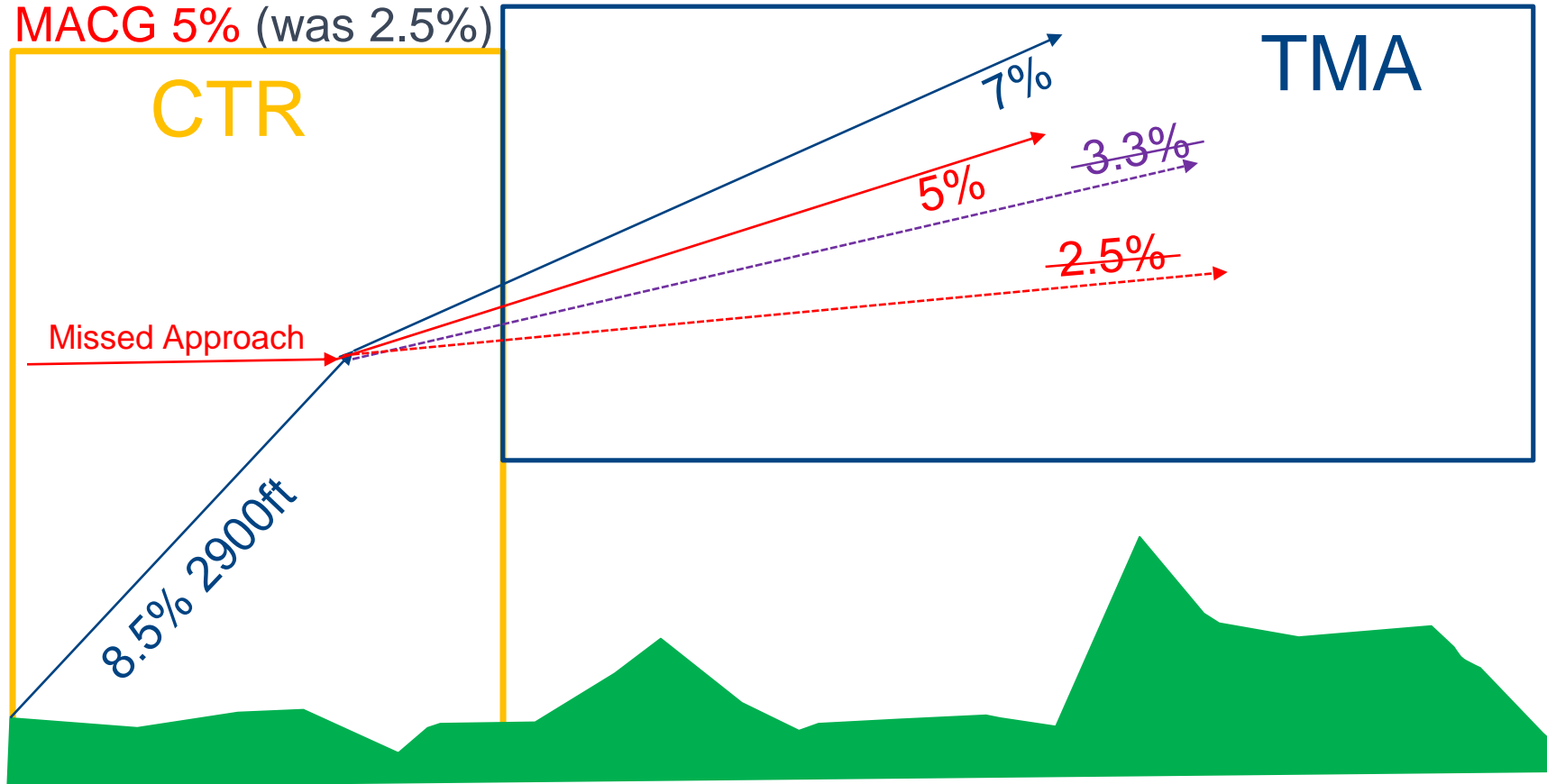
Proceed via ZHffg, ZHaaf, QQQQQ to P P P P P.

MAX IAS 210 kt until QQQQQ.

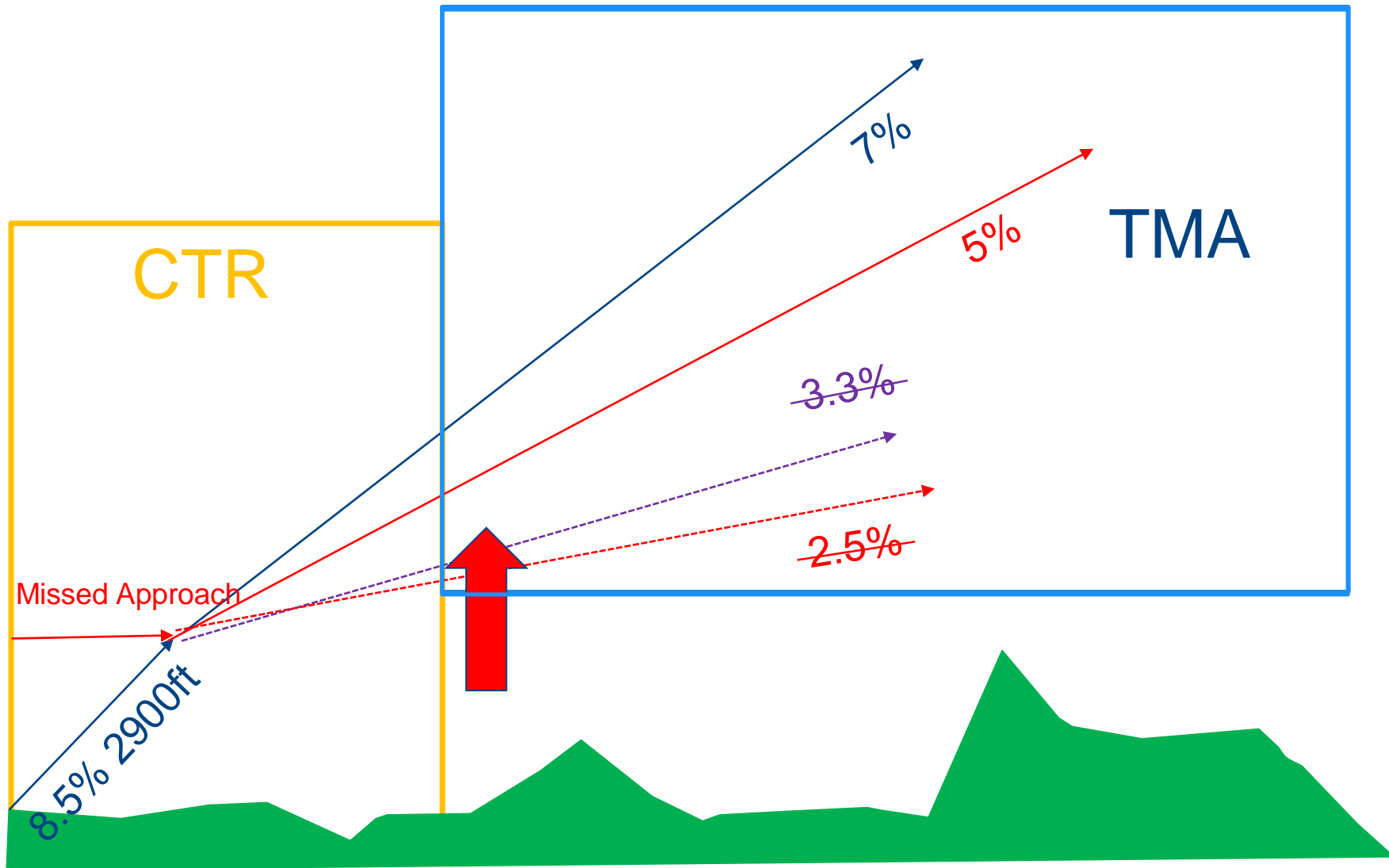
Cross QQQQQ at 7000 ft or above, P P P P P at 8000 ft or above.

Initial climb clearance 5000 ft.

Close-in obstacles left and right of track up to 1550 ft.

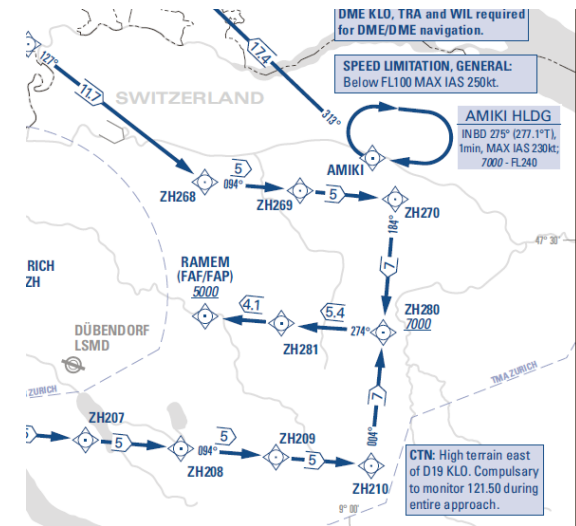


# IFP NOMINAL Track Design Impact on TMA



# Drawing Particularities

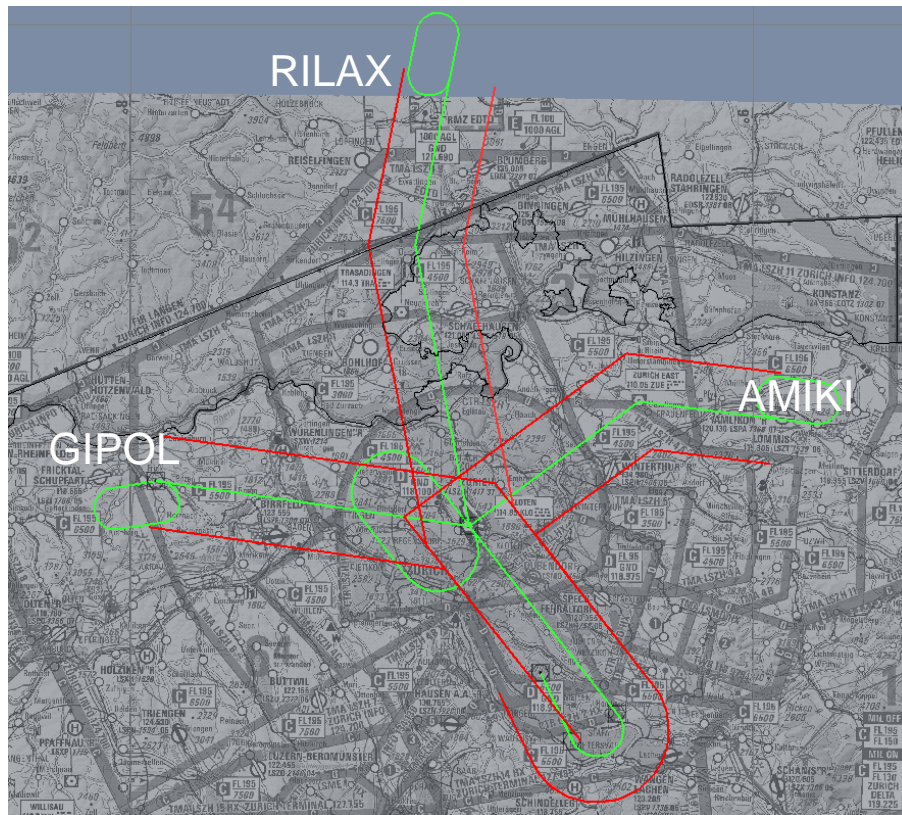
- › Drawing particularity: Fly By procedures, Anticipated Turn applied to reduce Protective Airspace Dimensions



- › MVA ( considered where applicable for ATCO Radar Vectoring, IFPs can be and legally are below a MVA)

# The Procedures

SIL2 Procedures (62 IFPs: 17 APCH, 14 Final & Missed APCH, 31 SID)



62 IFPs: all the APCH procedures are actually 3 in 1 so in total **96** Procedures

# TMA Zürich Re-Design 2.0

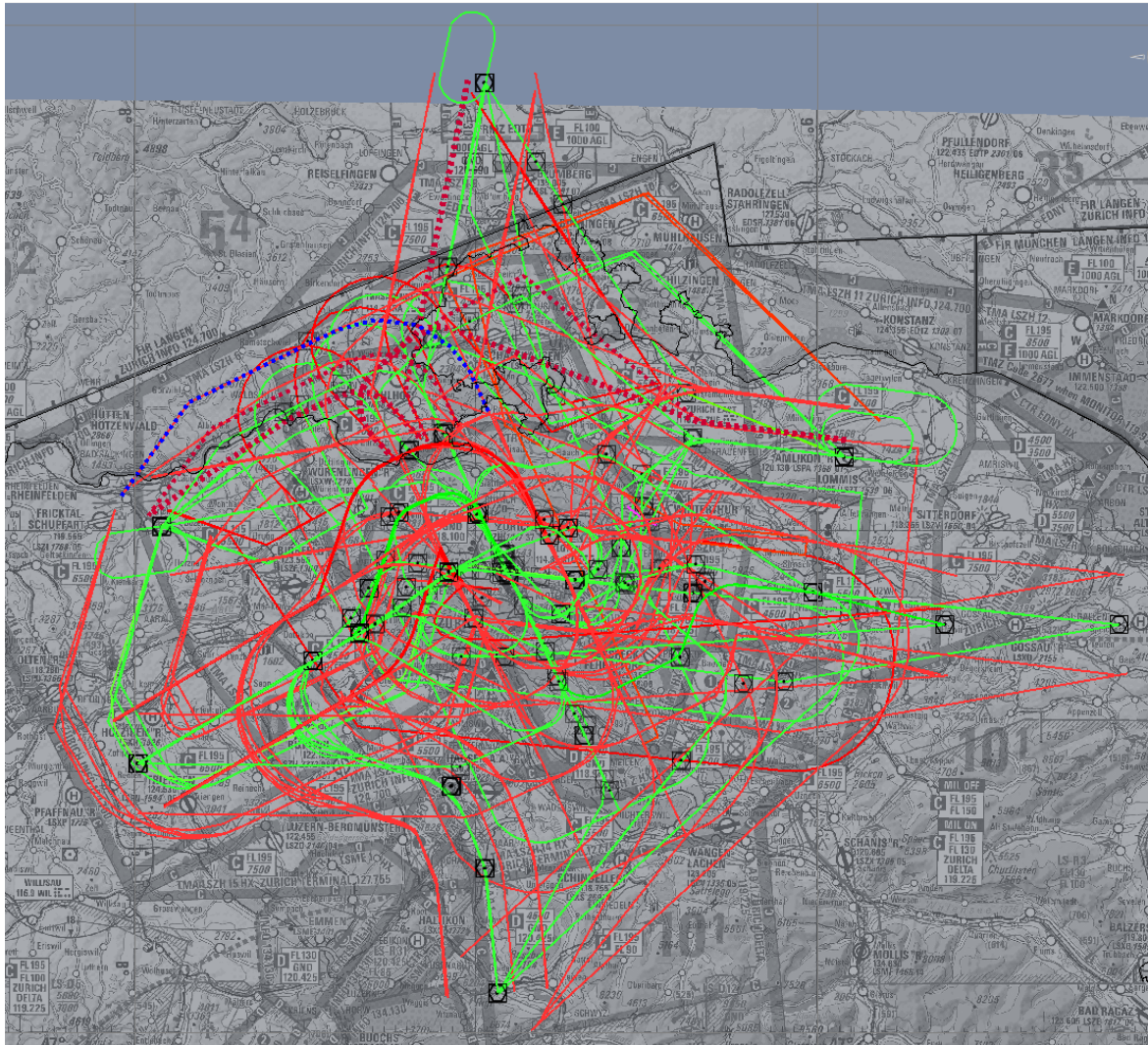
All **96** procedures are analyzed individually according previous slides, in particular slide 20 till 25 .

Airspace minimalized to the maximum

MVA ( considered where applicable for ATCO Radar Vectoring,  
IFPs can be and legally are below a MVA)

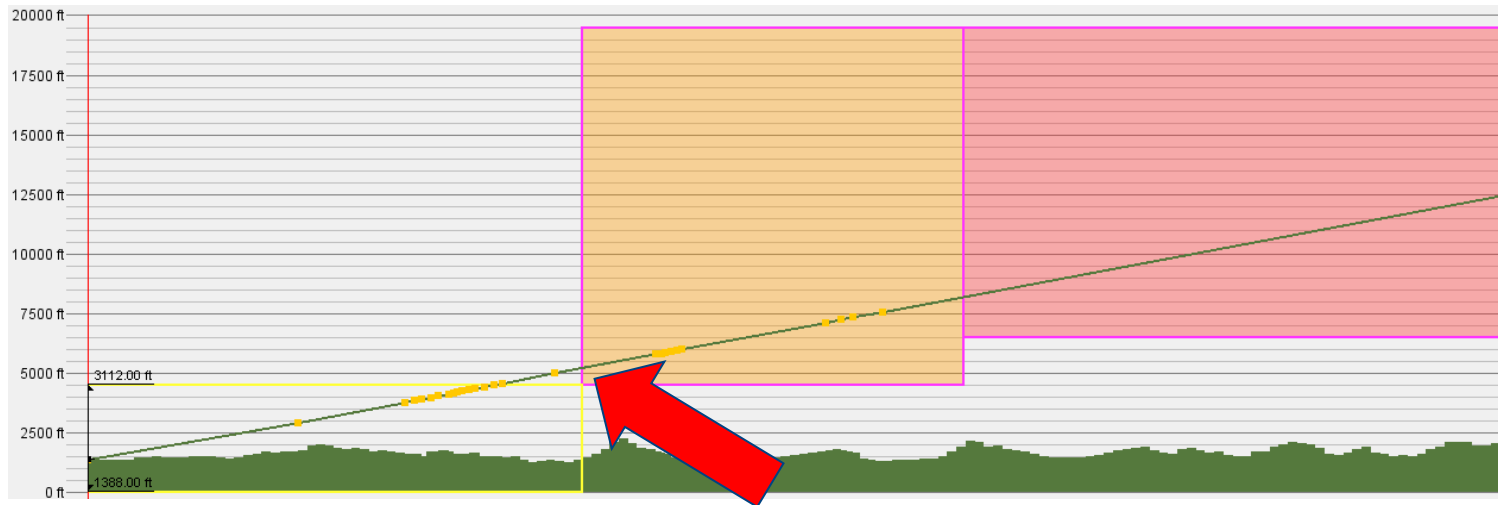
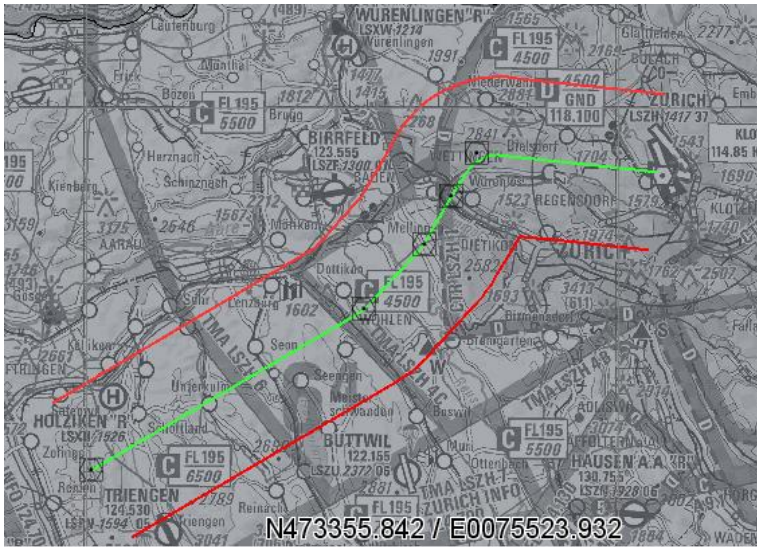


# All Procedures

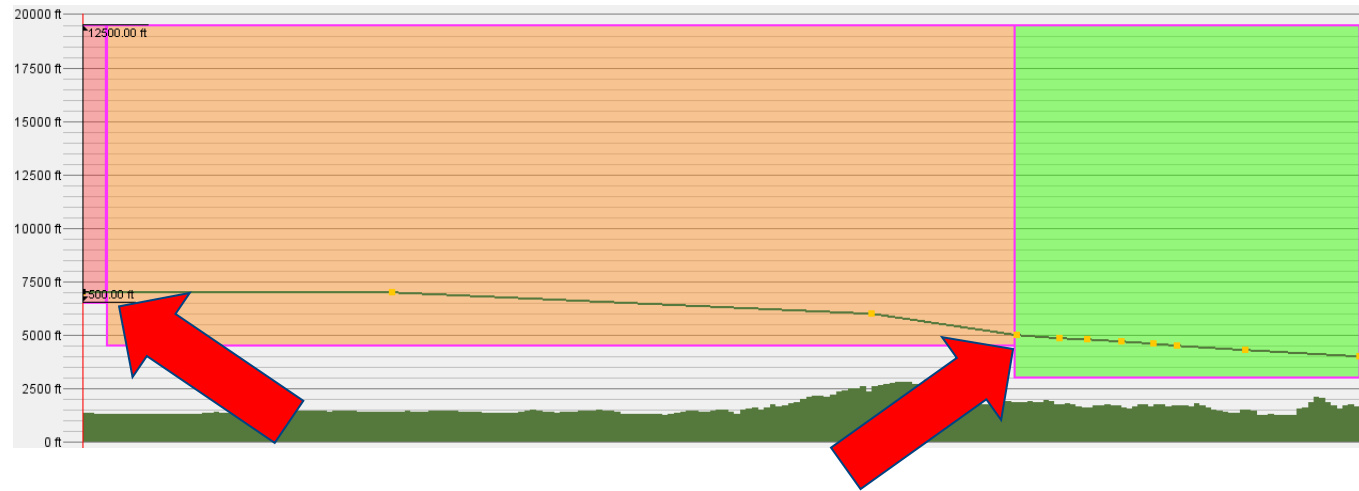
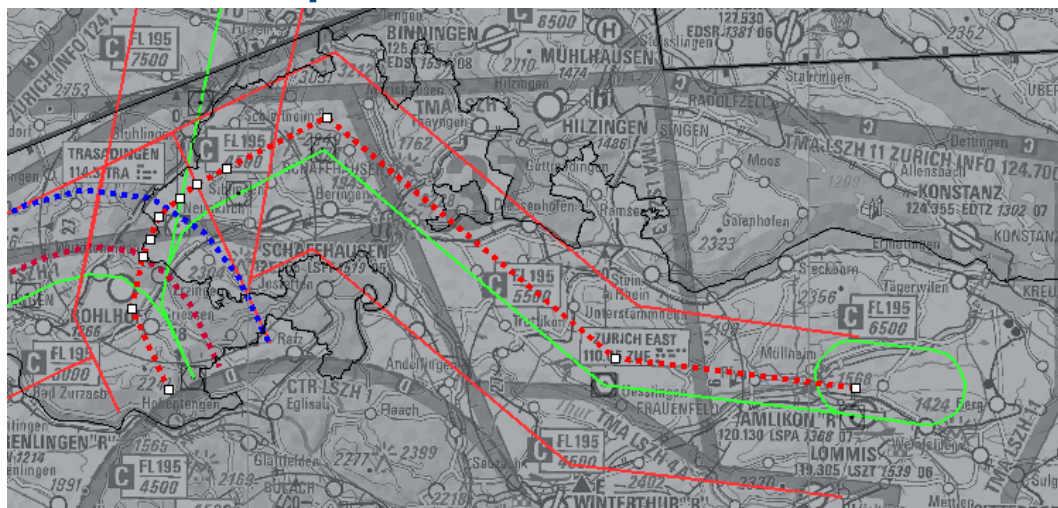




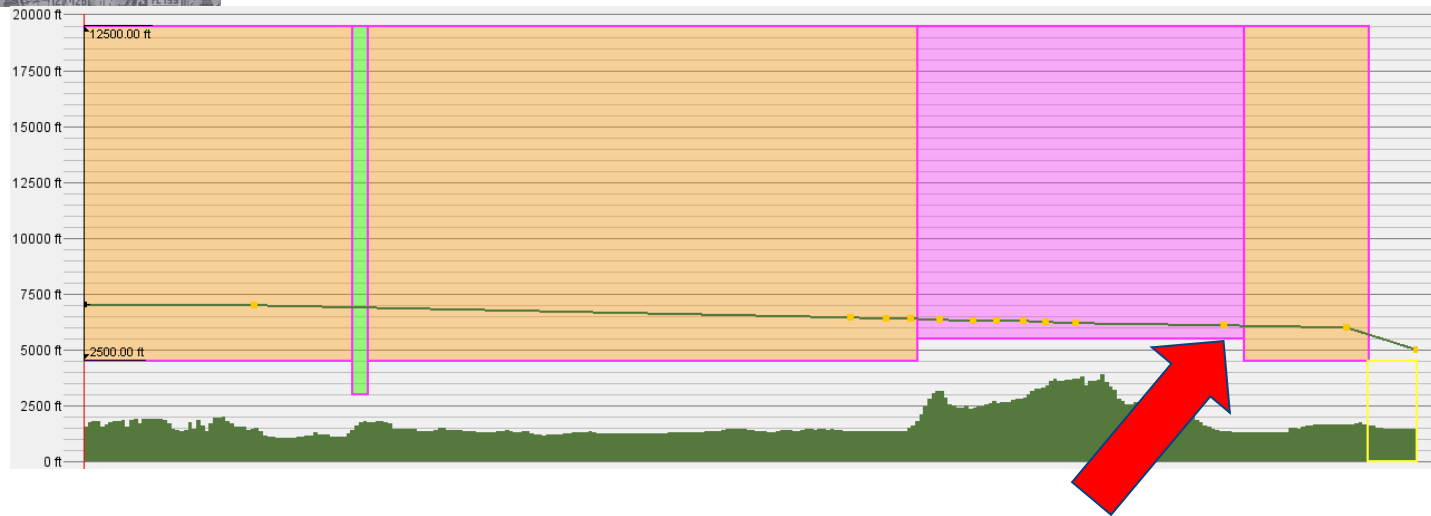
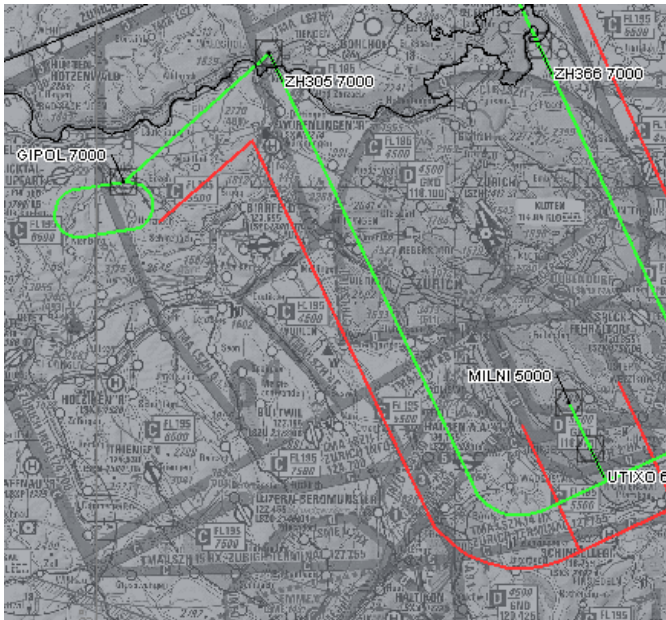
# Example SID



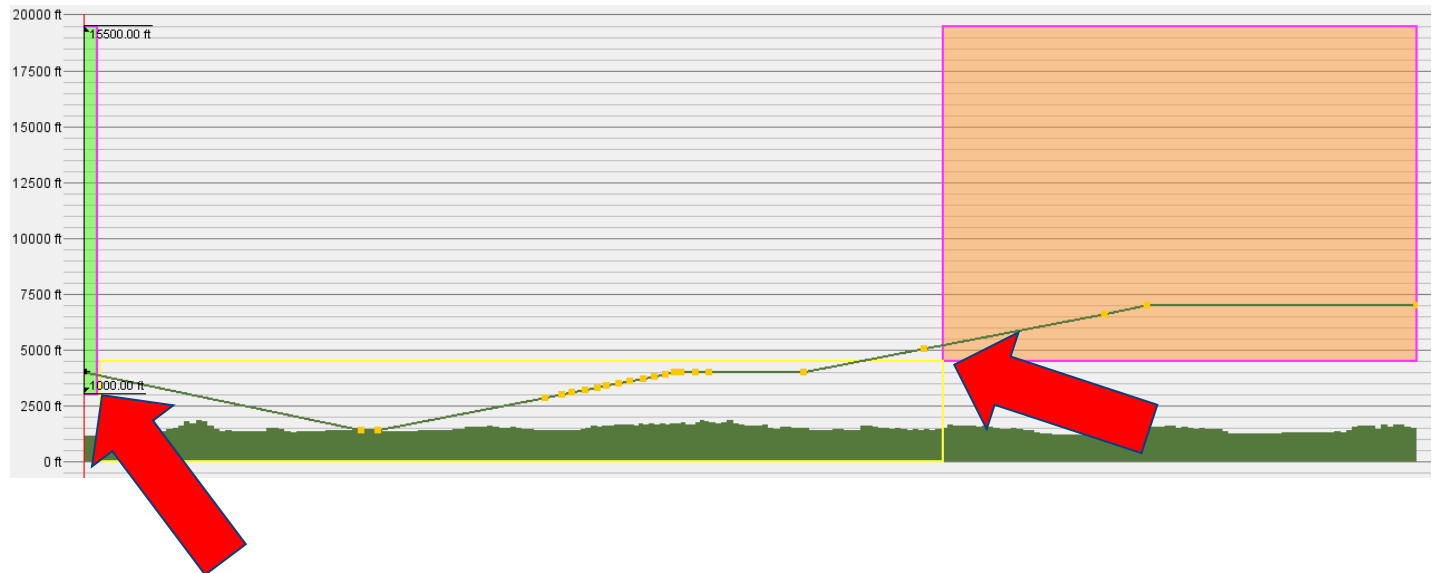
# Example APCH



# Example Transition

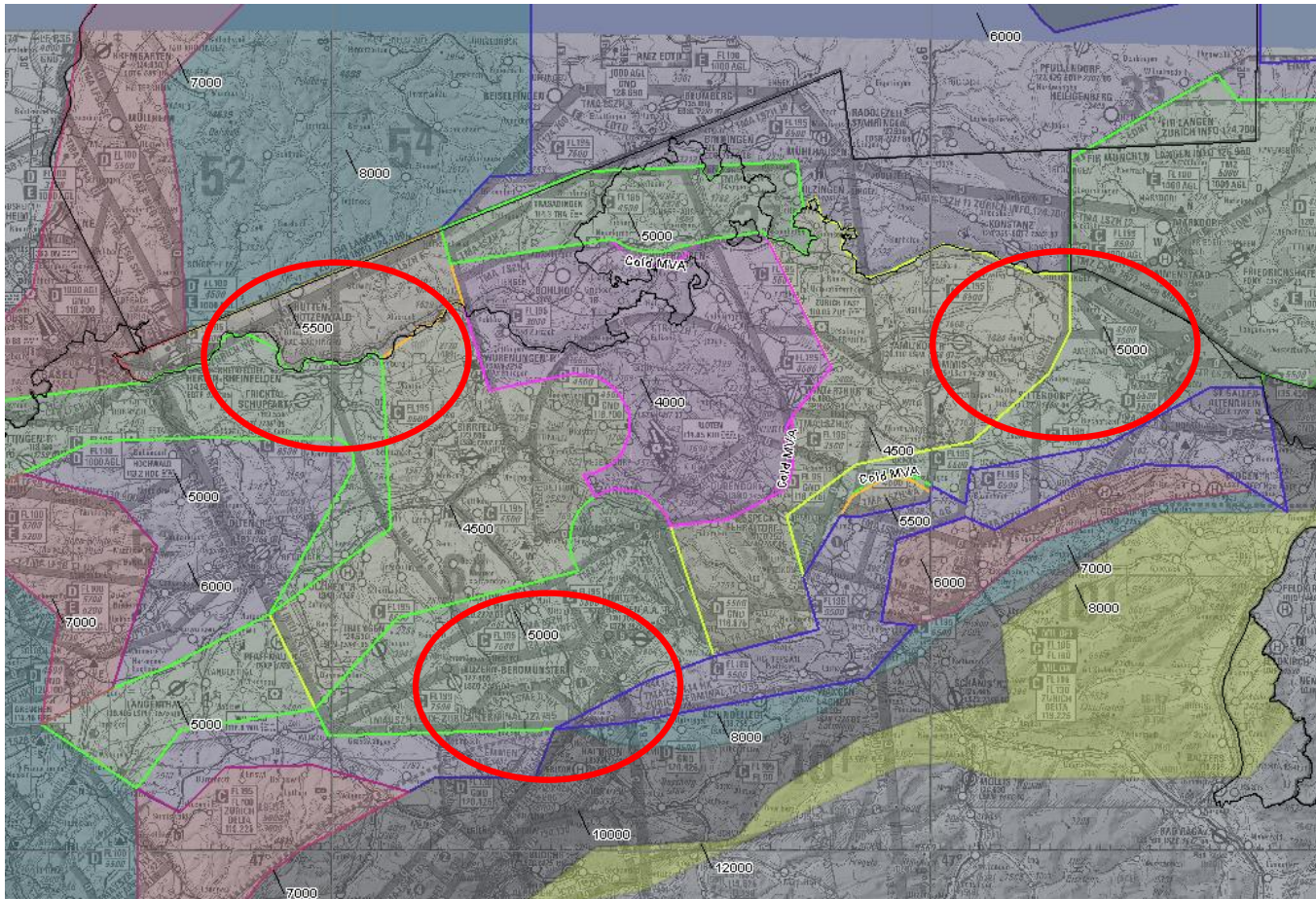


# Example APCH & Missed APCH





# MVA



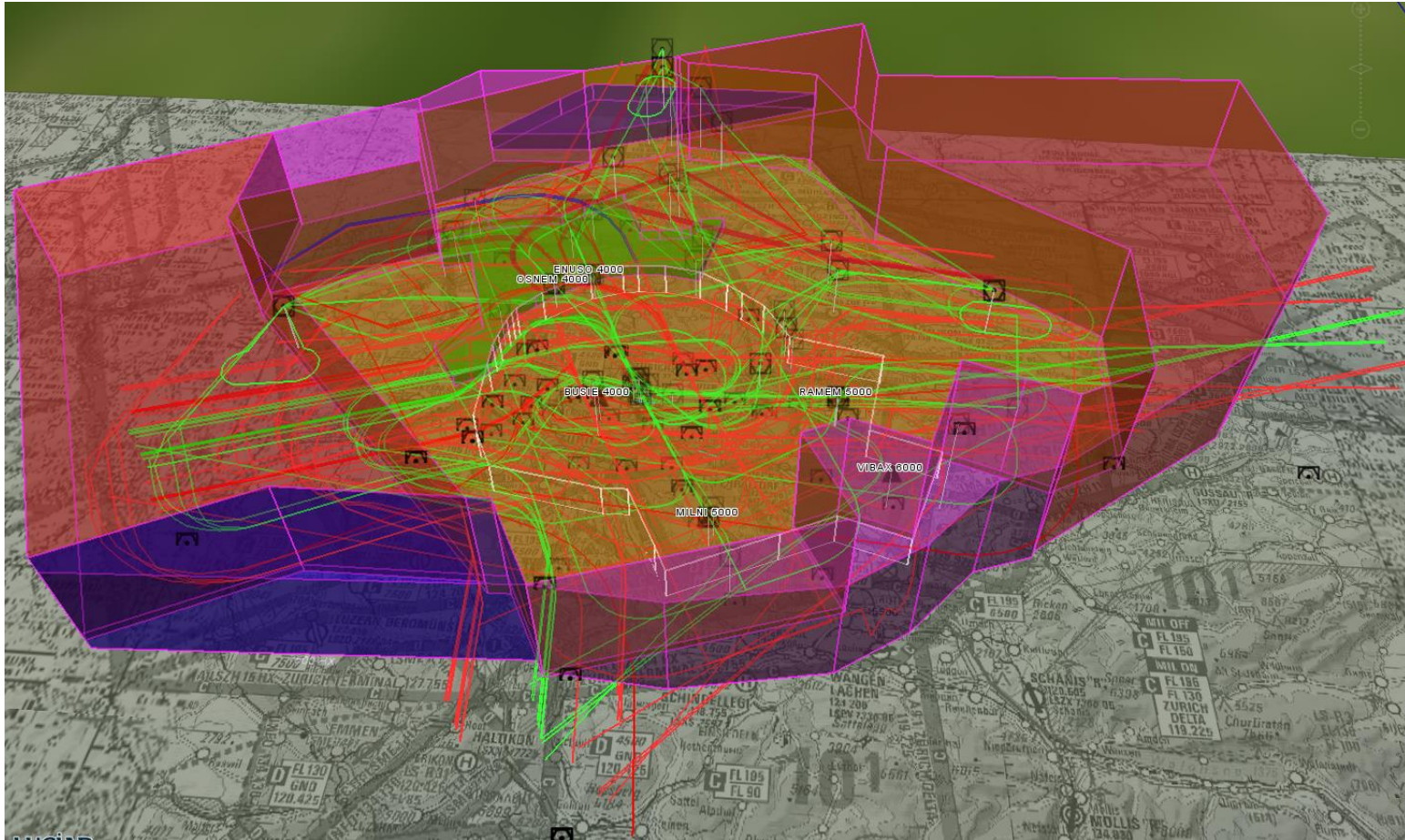
Vectoring areas considered where needed

# TMA ZRH Design 2.0

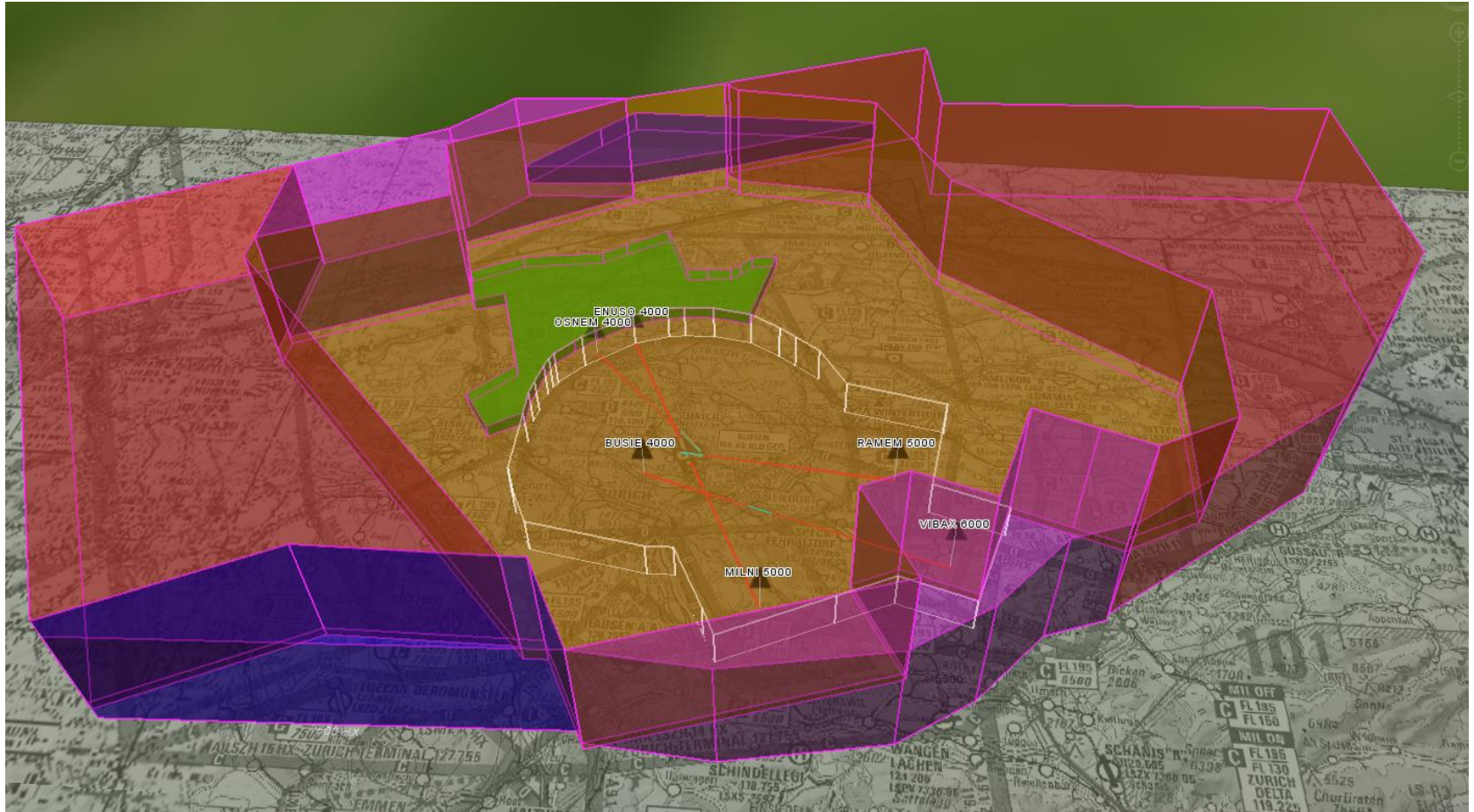
- › 3D Views
- › Per Procedure Group
- › Clean Picture



# 3D All Procedures

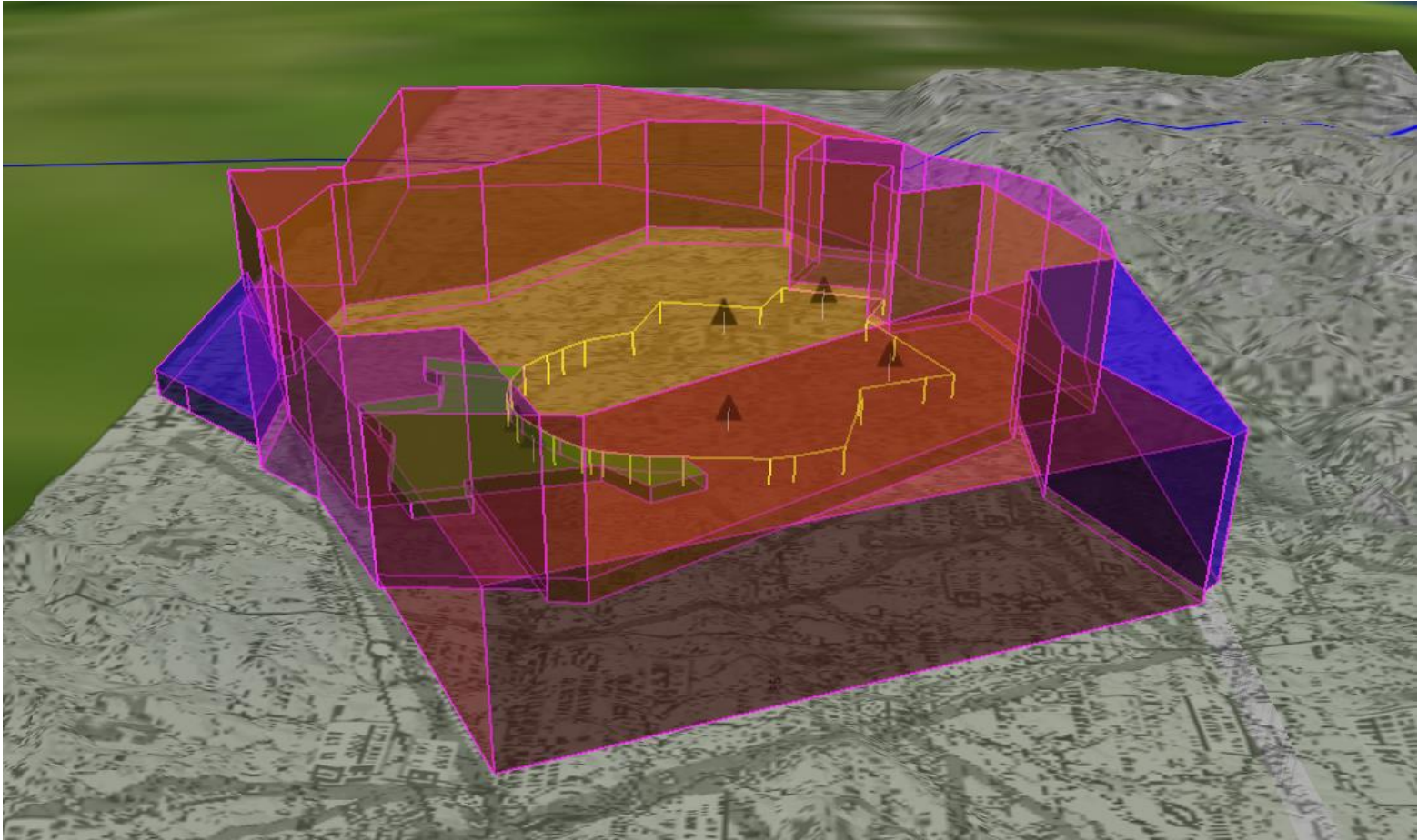


# 3D view N

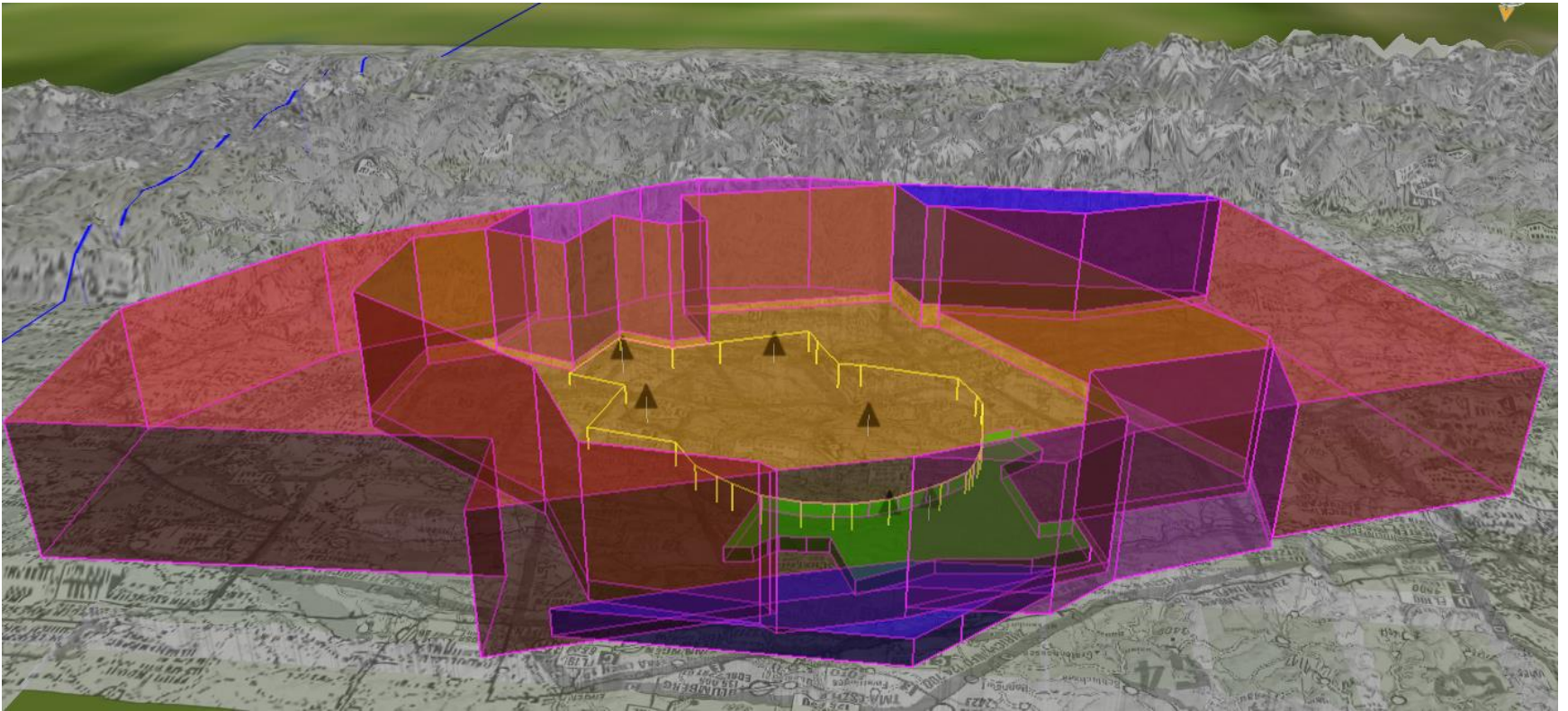




# 3D view E

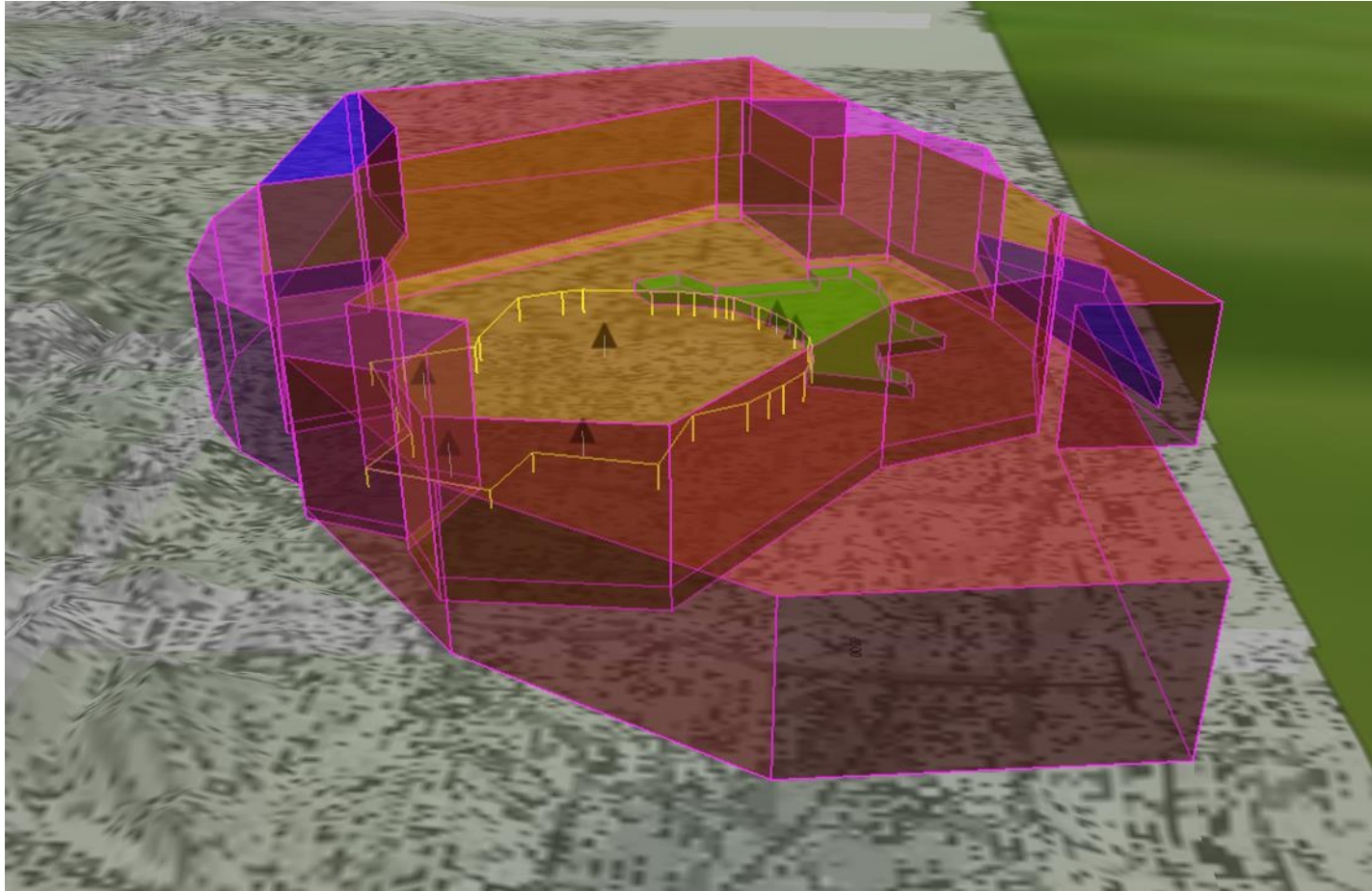


# 3D view S

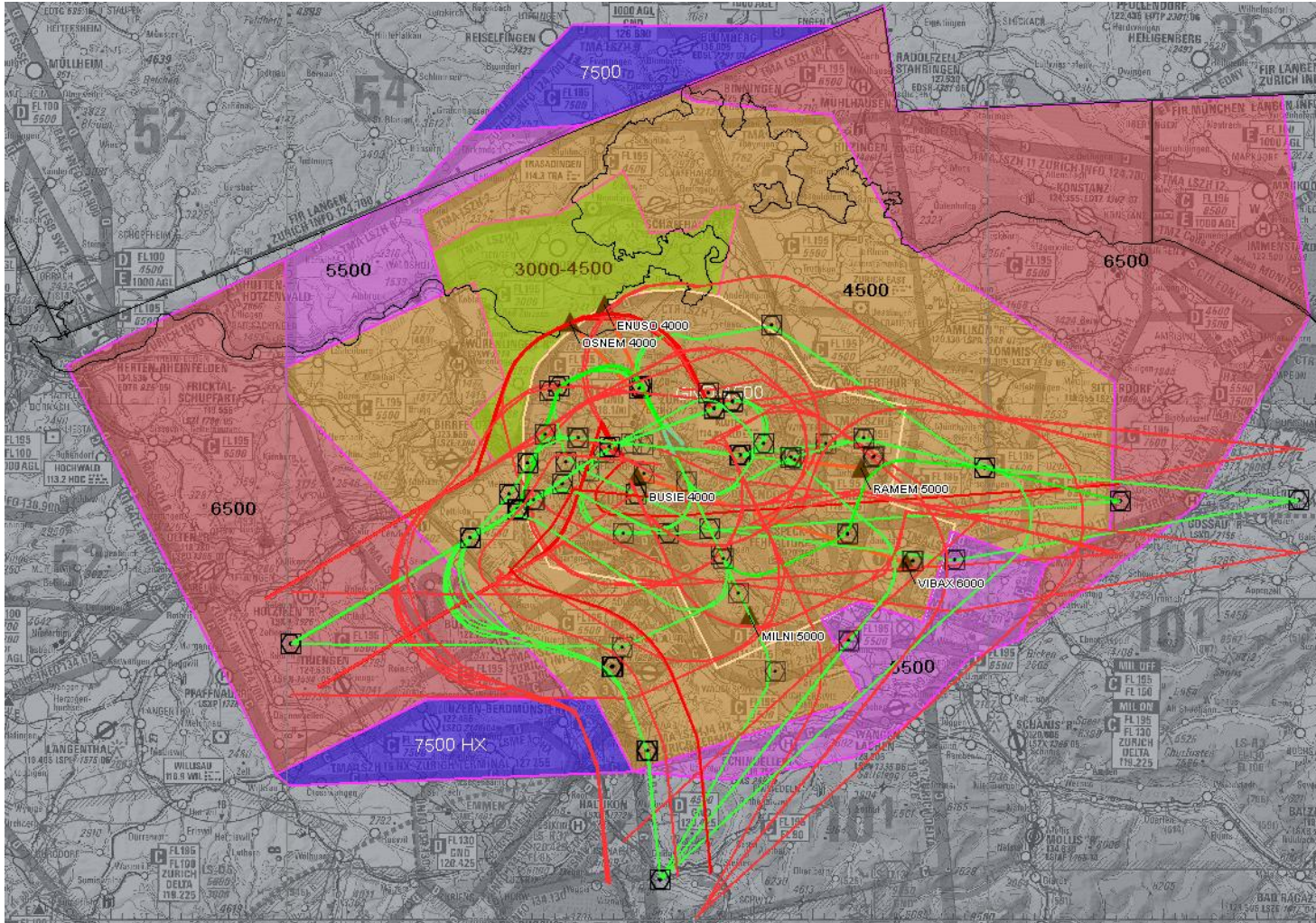




# 3D view W

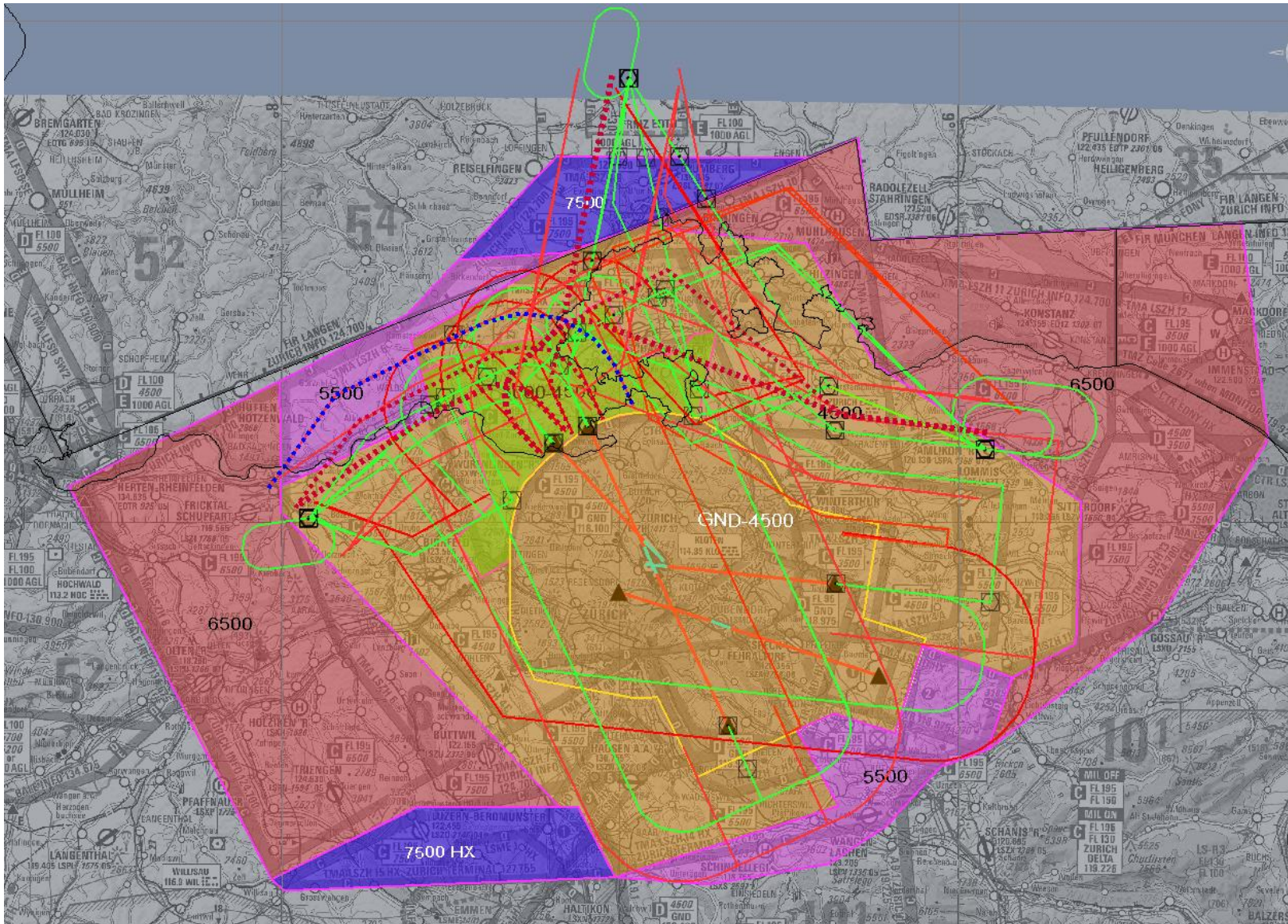


# All SIDs



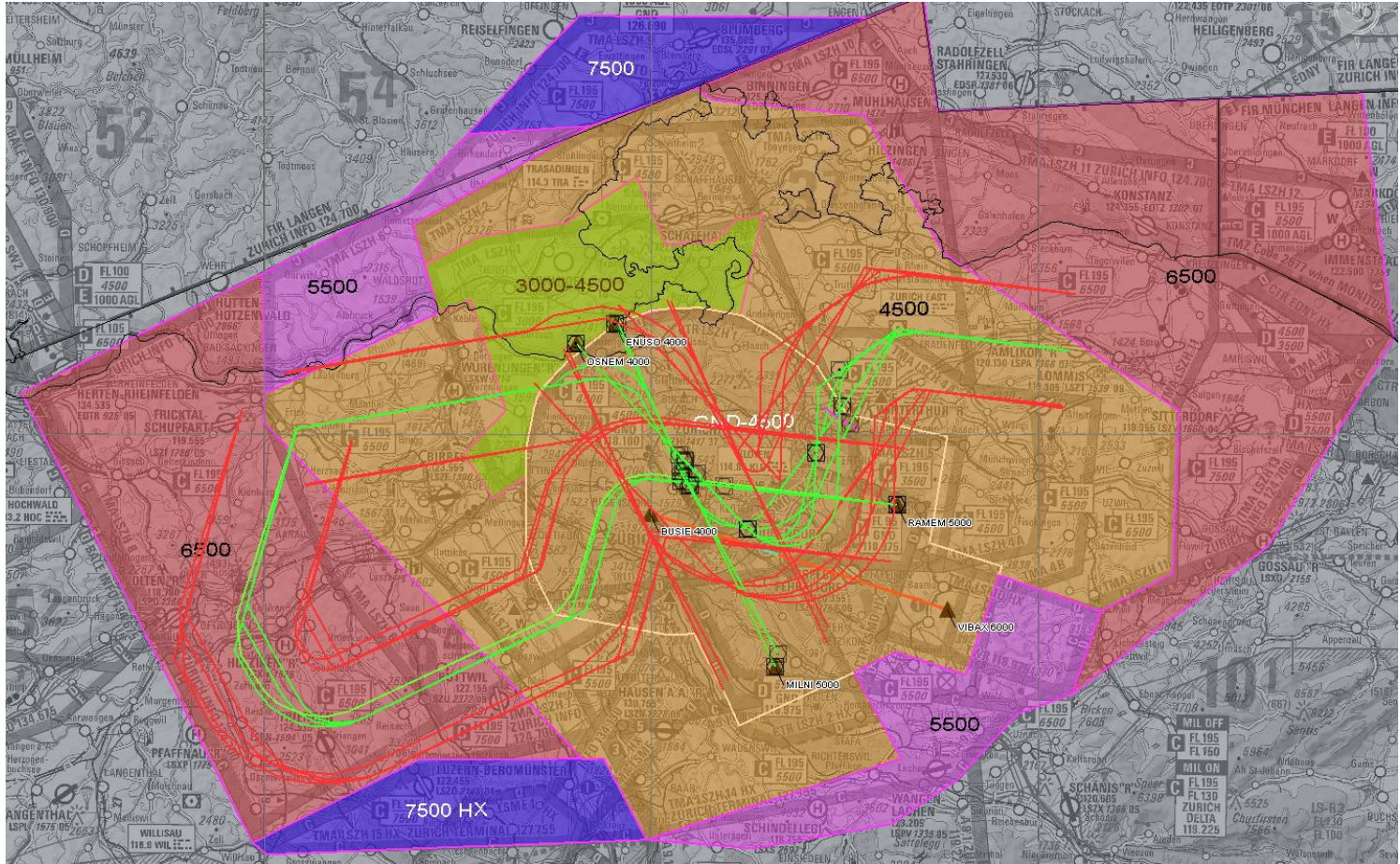


# All APCH and Transitions



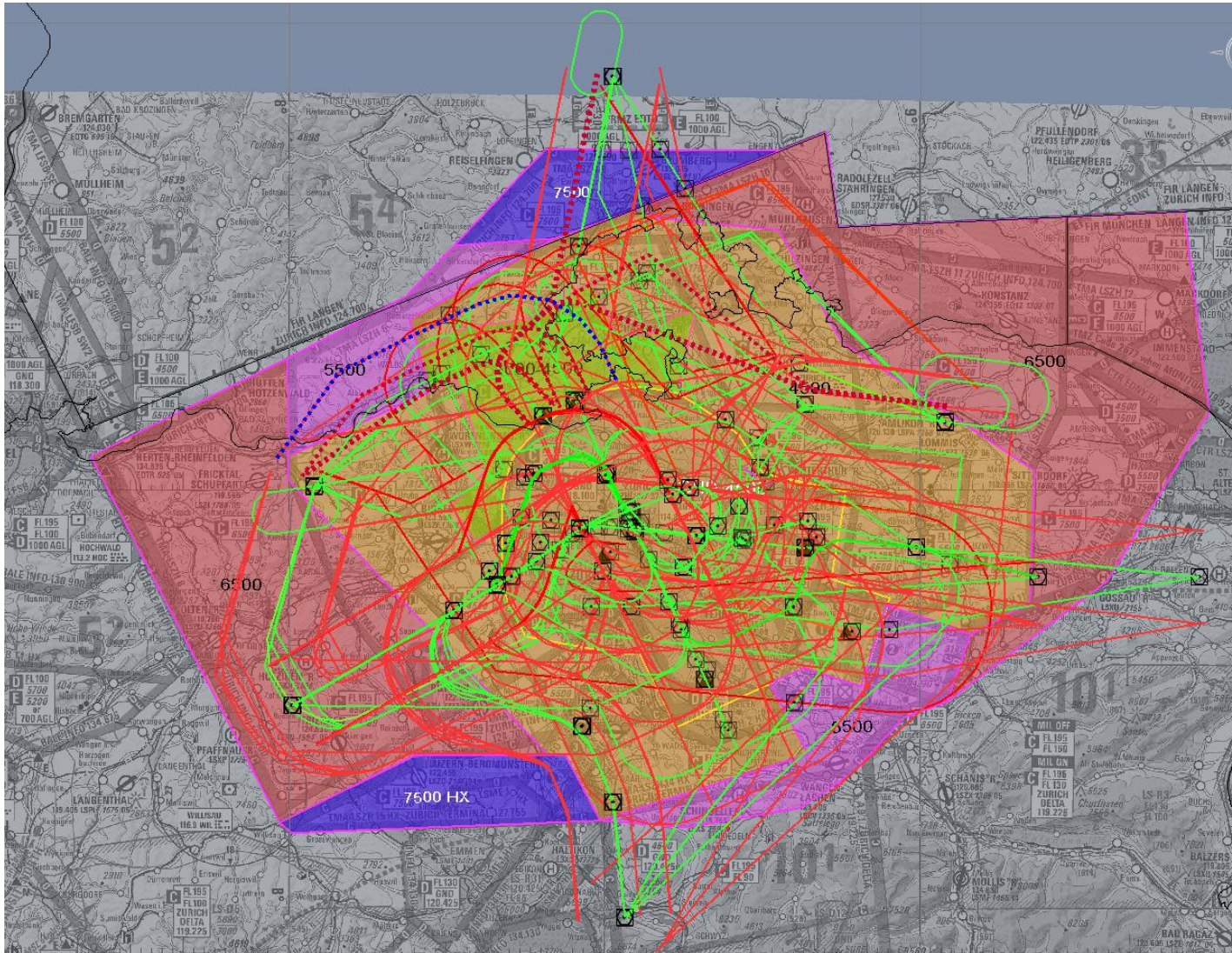


# All Final APCH & Missed APCH



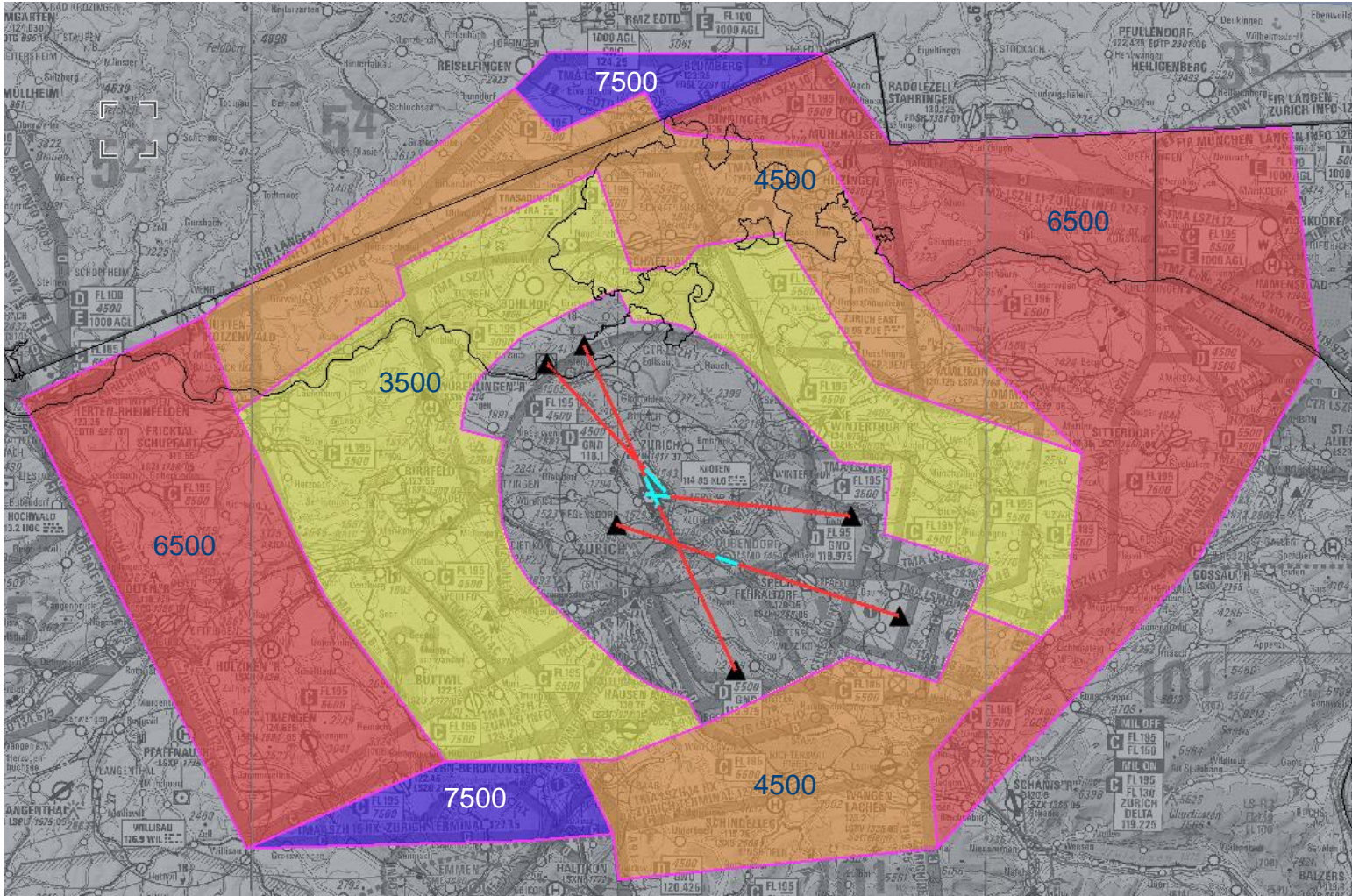


# All Procedures



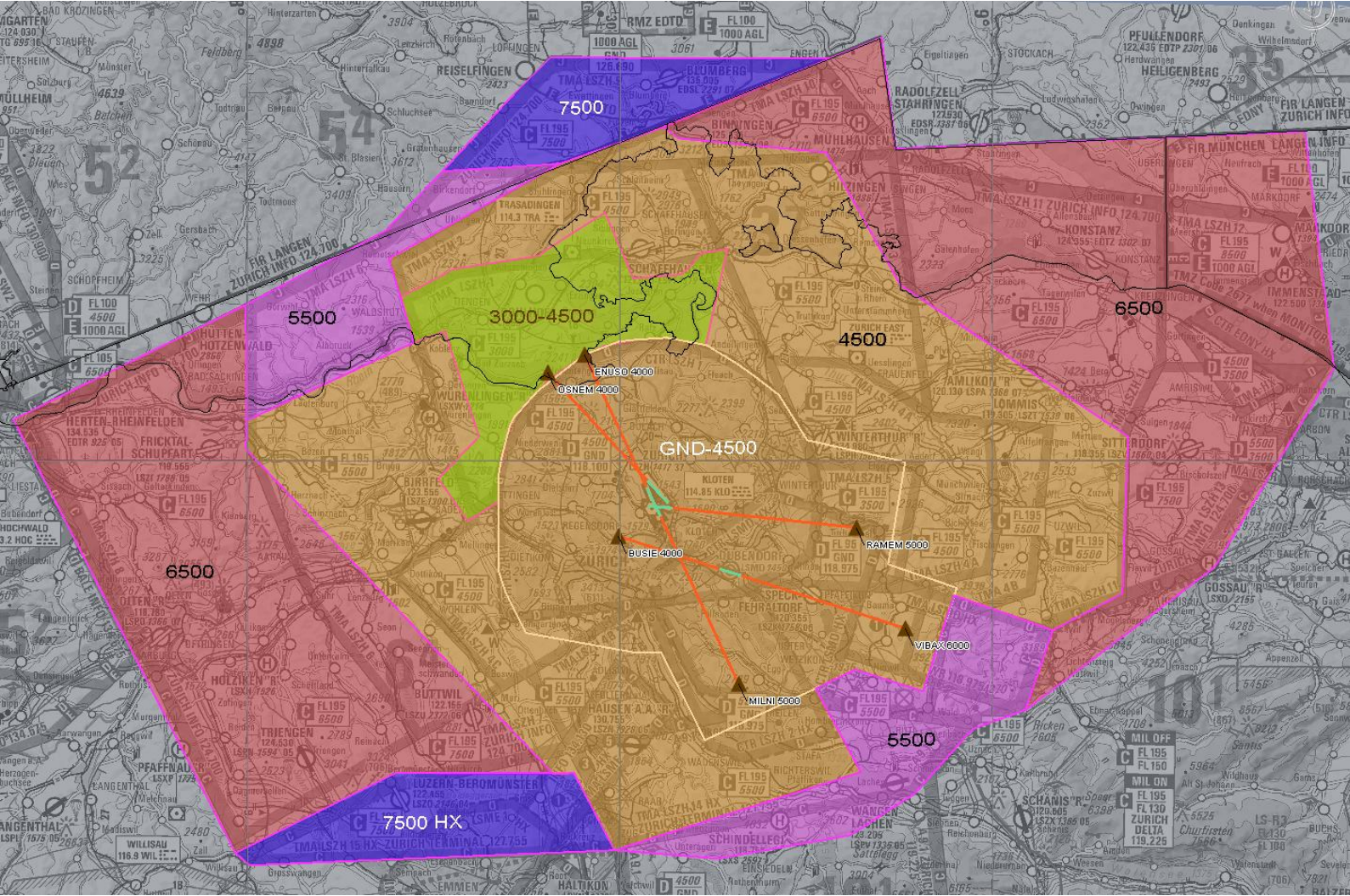


# Proposed Design 1.0



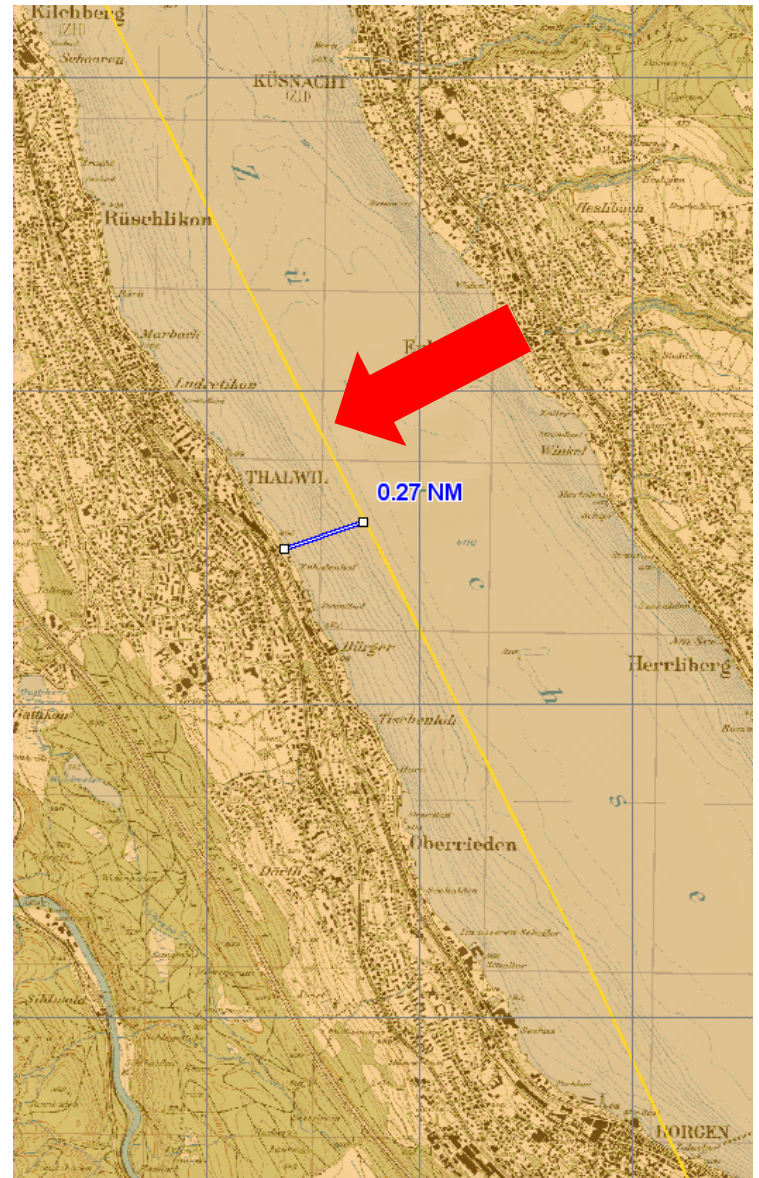
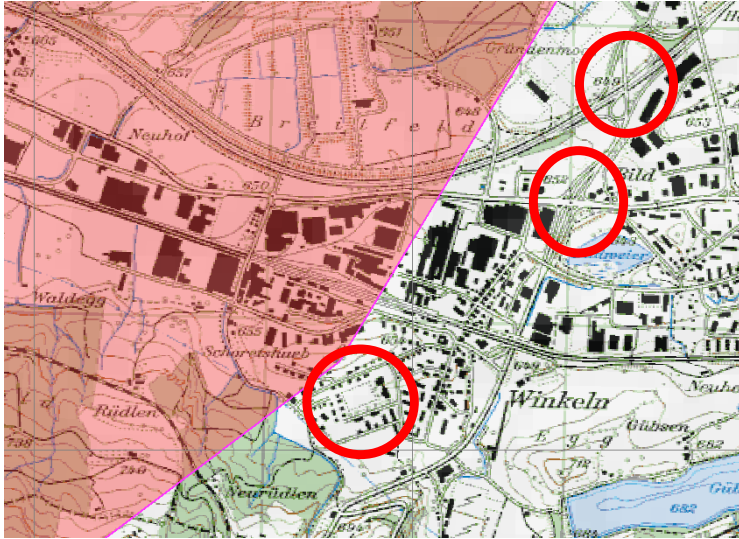


# ZRH TMA 2.0





# Pixel Chart / Geographic Reference



# GA requirements

- › GA requirements were collected during the design 2.0 phase and therefore not considered in this design.
- › The GA requirements and the (im)possibility to integrate them in the design will be tackled in the further process as announced by FOCA and agreed on by the project team including the GA\*.
- › \* for members see ToR §3 Reference: FOCA krj / 371.00-00010/00003/00007

# Airspace Toolbox

- › HX airspaces
  - › LS-R airspaces
  - › LS-RxxT airspaces
  - › Additional VFR corridors/transit RTE\*
  - › RMZ/TMZ/Listening squawk
  - › Etc.
- 
- › \* e.g. VFR corridors ZRH (4,5 & 6 as existing today)

# Abbreviations

- › AD:           Airspace Design
- › APCH:       Approach
- › ATCO:       Air Traffic Control Officer
- › ATS:         Air Traffic Service
- › CTR:         Control Zone
- › FAF:         Final Approach Fix
- › FOCA:       Federal Office of Civil Aviation
- › GA:          General Aviation
- › IFP:         Instrument Flight Procedure
- › Nav:         Navigation
- › NM:          Nautical Mile
- › MACG:       Missed Approach Climb Gradient
- › MVA:         Minimum Vectoring Altitude
- › ODD:         Operational Deployment Day
- › PDG:         Procedure Design Gradient
- › RMZ:         Radio Mandatory Zone
- › RNP:         Required Navigation Performance
- › RTE:         Route
- › RWY:         Runway
- › SID:         Standard Instrument Departure
- › SIL:         Sachplan Infrastruktur Luftraum
- › TMA:         Terminal Control Area
- › TMZ:         Transponder Mandatory Zone
- › ToR:         Terms of Reference
- › VFR:         Visual Flight Rules
- › ZRH:         Zürich

# End of Presentation

› Design Technical questions?

End