Example of CCO and CDO Implementation for Red Sea Airport – KSA, During Conceptual Design Phase

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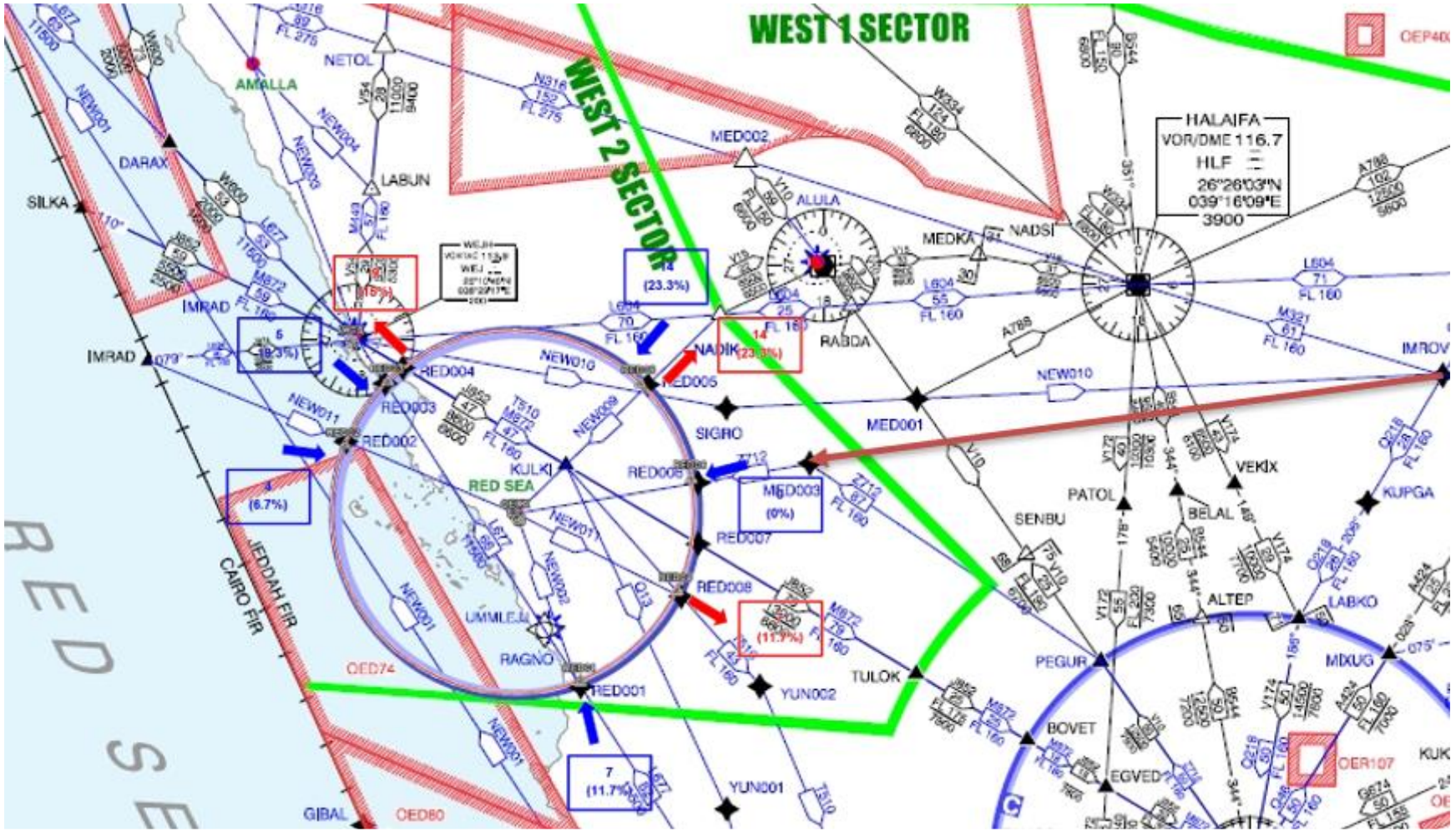
References for CCO and CDO Implementation

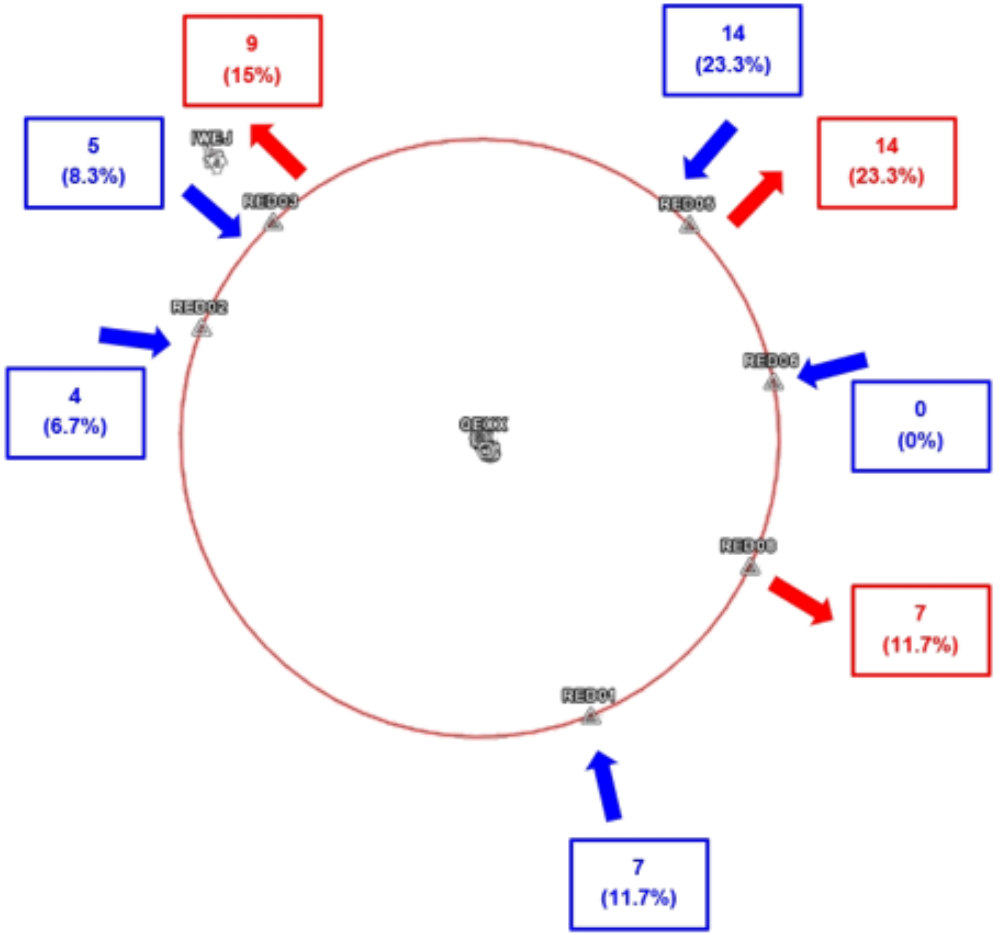
Primary Reference Documents

- ICAO DOC 9931 (CDO)
- ICAO DOC 9993 (CCO)
- ICAO DOC 9992 (PBN Airspace Design)

Secondary Reference Documents

- GACAR PART 172 (IFP Design Local Regulations)
- ICAO DOC 8168 (IFP Design Criteria)
- ARINC 424 (Navigation Data base Coding)
- Red Sea Airport Master Plan


WEST 1 SECTOR
WEST 2 SECTOR
HALAIFA
VOR/DME 116.7
HLF
26°26'03"N
039°16'09"E
3900
NETOL
AMALLA
DARAX
SILKA
LABUN
IMRAD
MED002
ALULA
MEDKA
NADSI
RABDA
NADIK
RED004
RED005
RED003
RED002
NEW010
NEW011
SIGRO
MED001
KULKI
RED SEA
RED006
MED003
RED007
RED008
UMMLEJ
RAGNO
RED001
YUN002
YUN001
TULOK
PEGUR
BOVET
EGVED
SENBU
PATOL
BELAL
VEKIX
KUPGA
ALTEP
LABKO
MIXUG
IMROV
CAIRO FIR
JEDDAH FIR
GIBAL
OED74
OED80
OER107
RED SEA

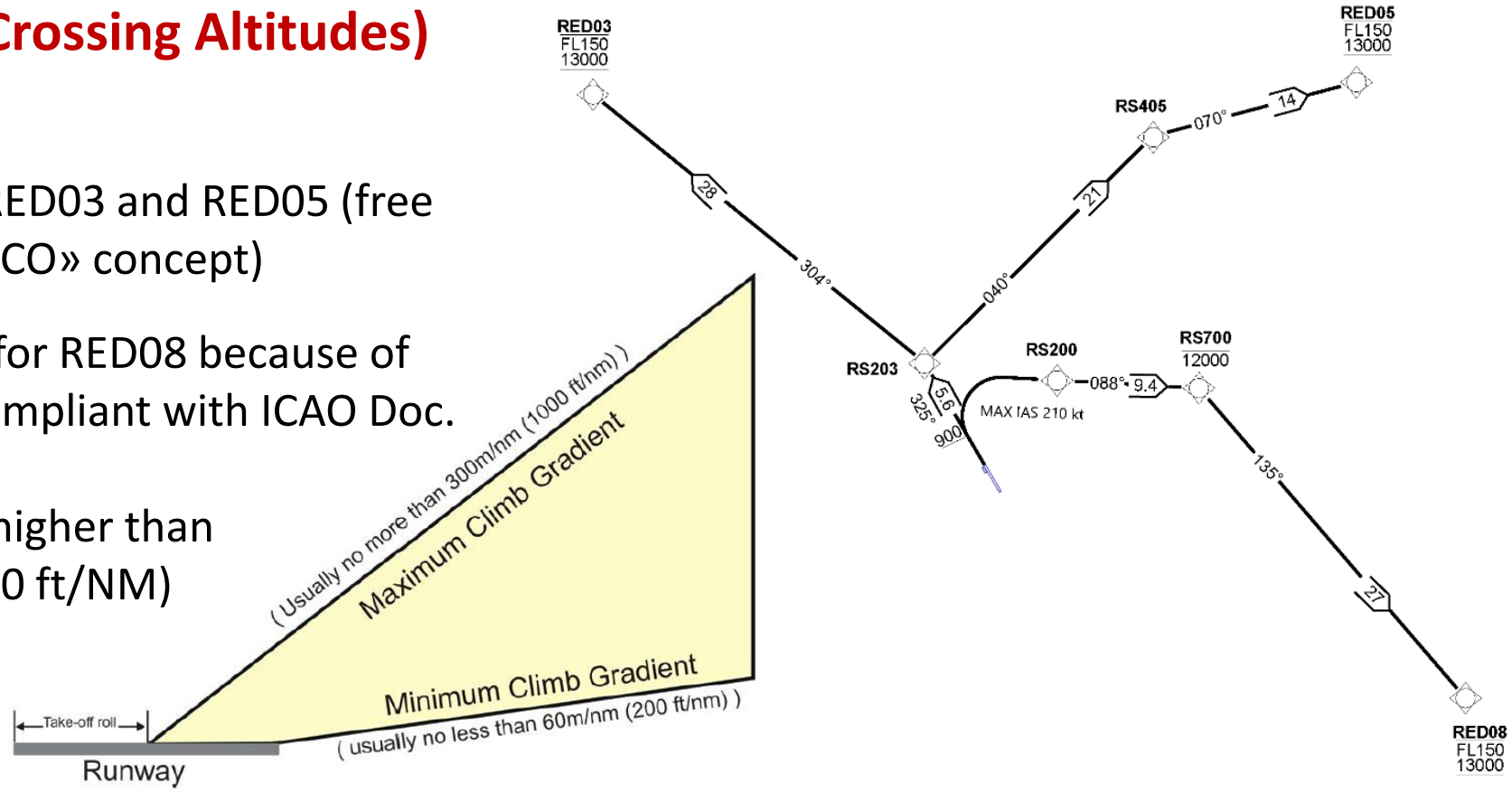

9
(15%)
14
(23.3%)
5
(8.3%)
14
(23.3%)
WEJ
RED03
RED04
RED02
RED05
4
(6.7%)
0
(0%)
OEMK
RED06
7
(11.7%)
RED01
7
(11.7%)

Example of CCO Implementation

CCO implementation

IMPLEMENTED (Minimum Crossing Altitudes) MCAs

- No MCAs implemented along RED03 and RED05 (free climb profile based on «Basic CCO» concept)
- MCA (-12000 ft) implemented for RED08 because of Arrival interaction is anyway compliant with ICAO Doc. 9993 Figure 1.1
  (as the upper limitation is Still higher than after RS200 and 9.4 NM * 1000 ft/NM)



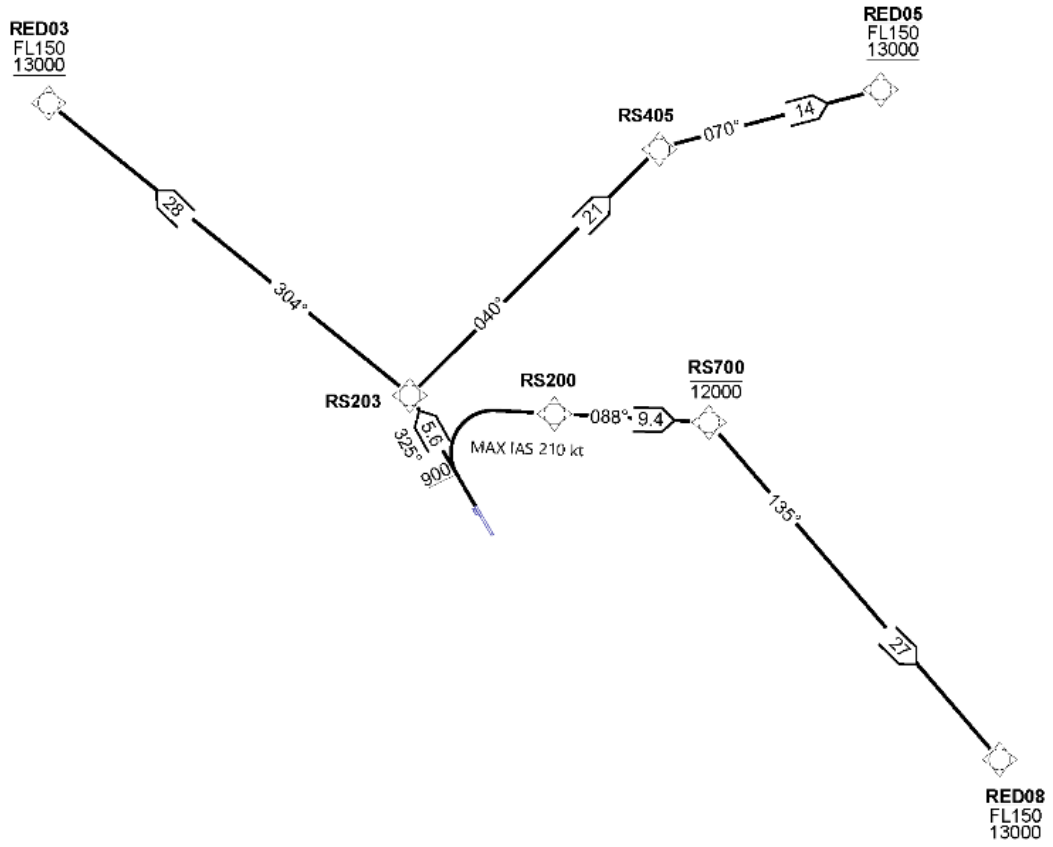
CCO implementation

SPEED RESTRICTIONS

- Speed restriction compliant with Average Flight Path criteria (ICAO Doc. 8168 Vol. II)
- Speed limit (at 900 ft) does not penalize the flight profile and do not increase the cockpit workload

TURNS CONSIDERATIONS

- Number of turns is reduced as much as possible to lower the number of required waypoints and the cockpit workload



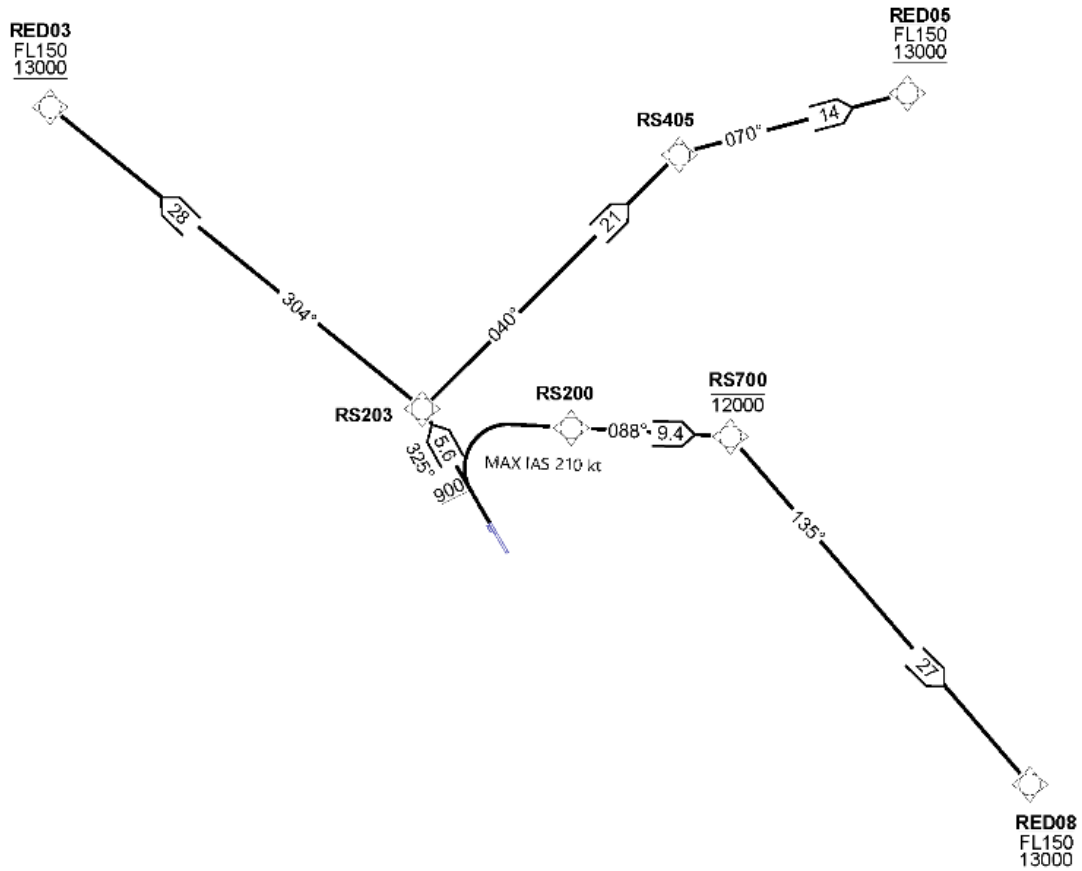
CCO implementation

INTERSECTIONS WITH ARRIVALS

- Avoided, except for RED08 (minor gate) where we have only a single intersection

MILEAGE CONSIDERATIONS

- Mileage reduced as much as possible because of RNAV design criteria flexibility, RED05 and RED03 (main gates) is almost a direct connection without any restriction in terms of MCAs



Example of CDO Implementation

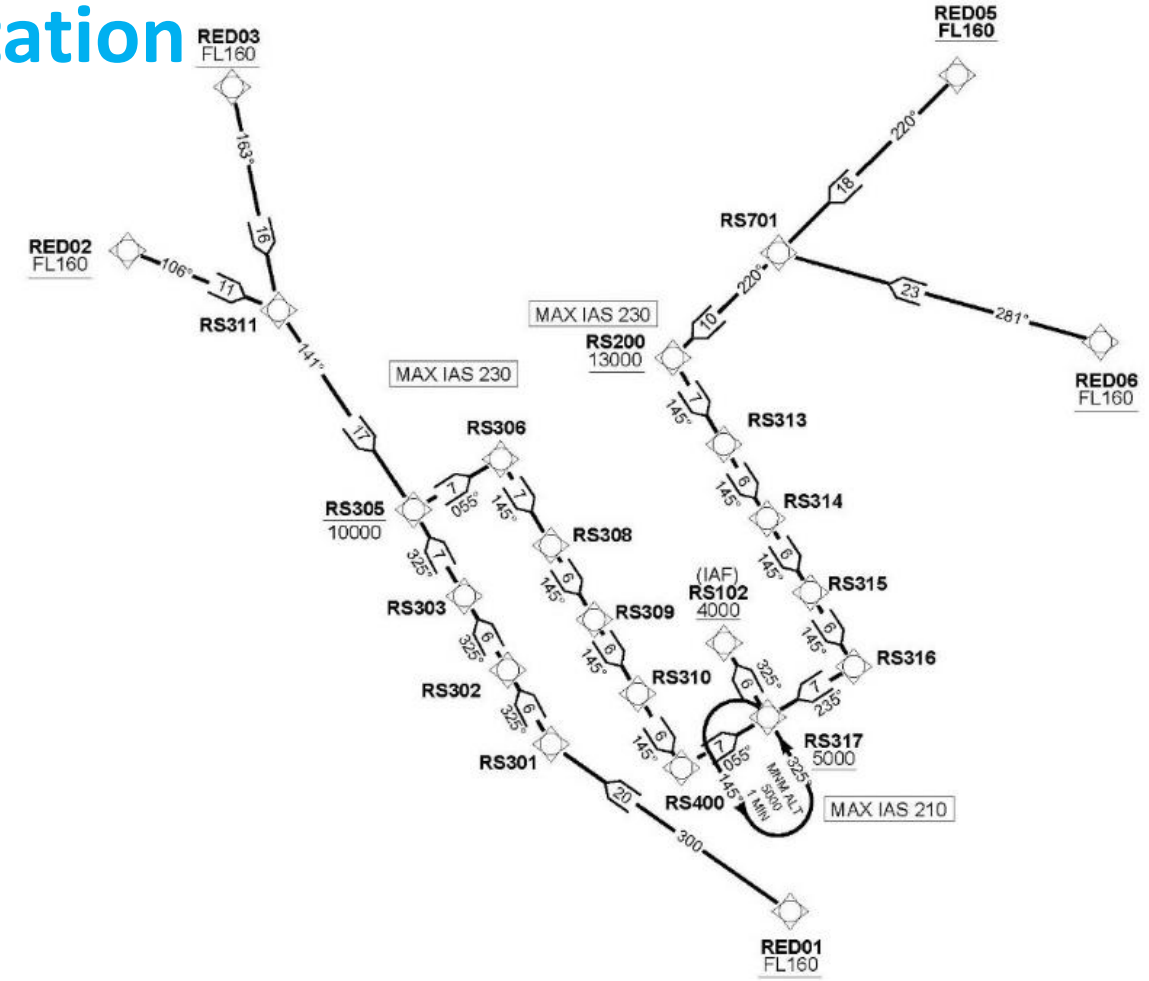
CDO implementation

TROMBONE SOLUTION

- Trombone solution has been used to better absorb/manage traffic
- RED01 and RED05 are the main gates and they have almost a «direct» routing
- Fuel burn is predictable because of closed path (known distance from IAF)

HORIZONTAL PROFILE

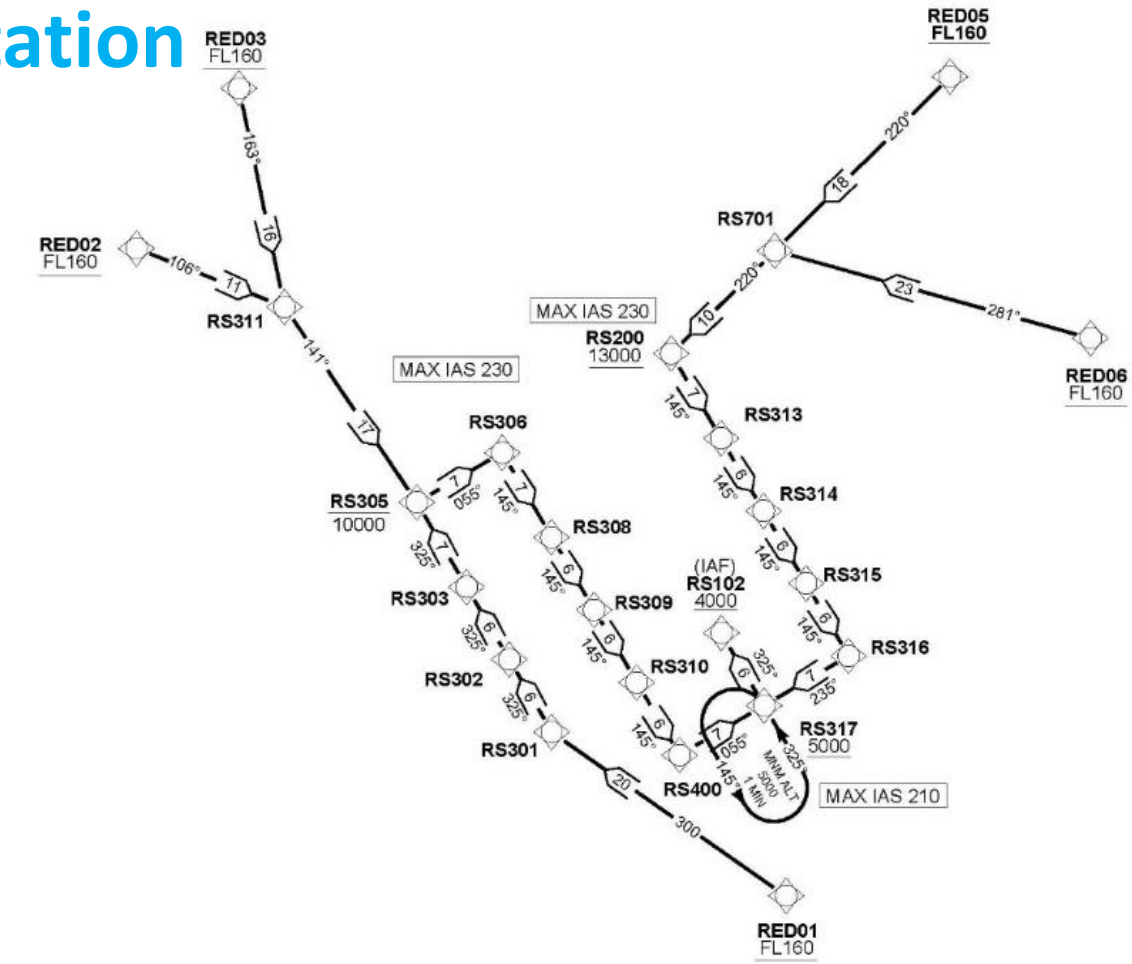
- S-shape allow for shorter routes when the traffic amount is low



CDO implementation

SPEED RESTRICTIONS

- Used to keep sequencing
- Used to have the same segment length along the trombone proposal.
- ATCo Can Clear the Traffic with no Speed Restriction when traffic is Less Dense.



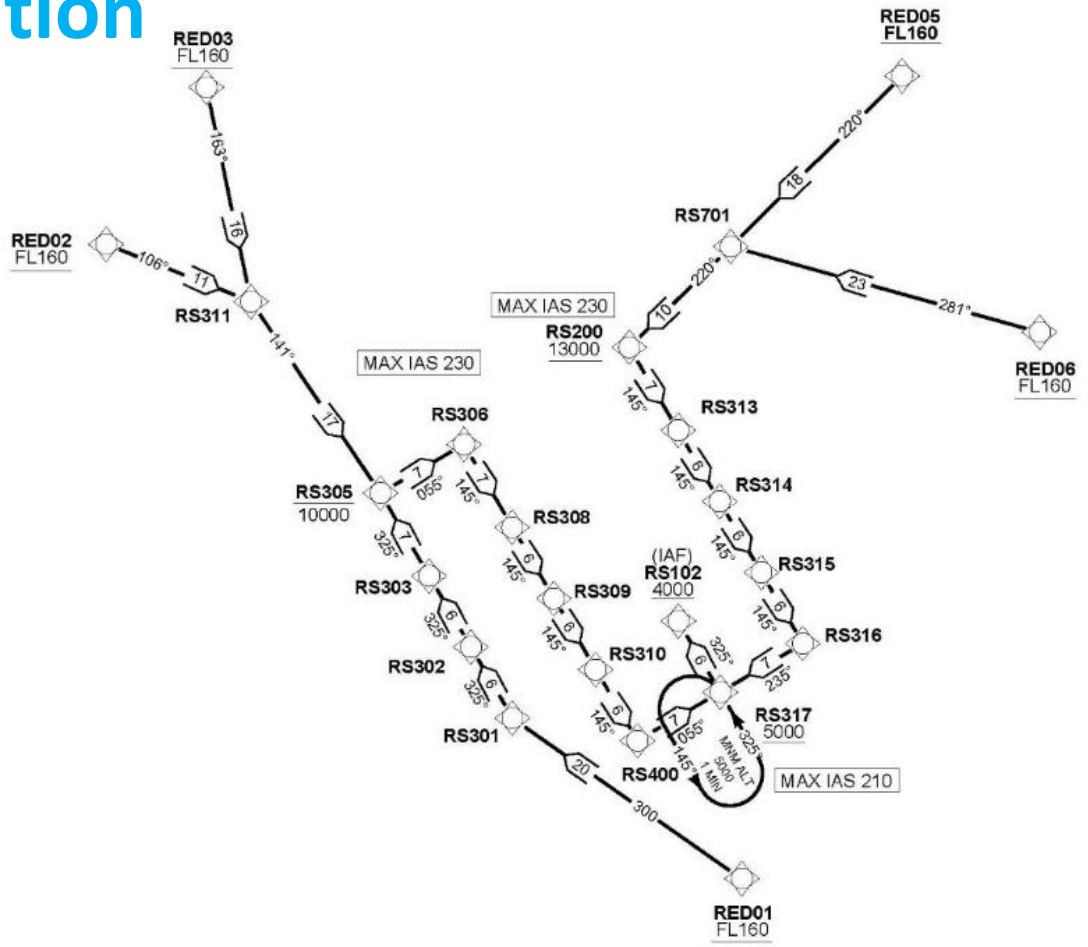
CDO implementation

UPPER LIMIT

No upper limit implemented to leave the maximum flexibility for the TOD calculation

Example:
RED02 should have a window of approximately +FL160/-FL260 (350 ft/NM).

No upper limit has been implemented to allow different configurations.

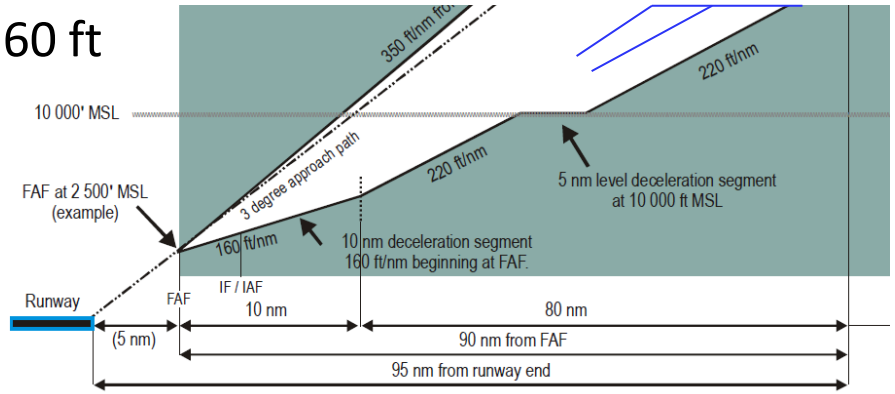


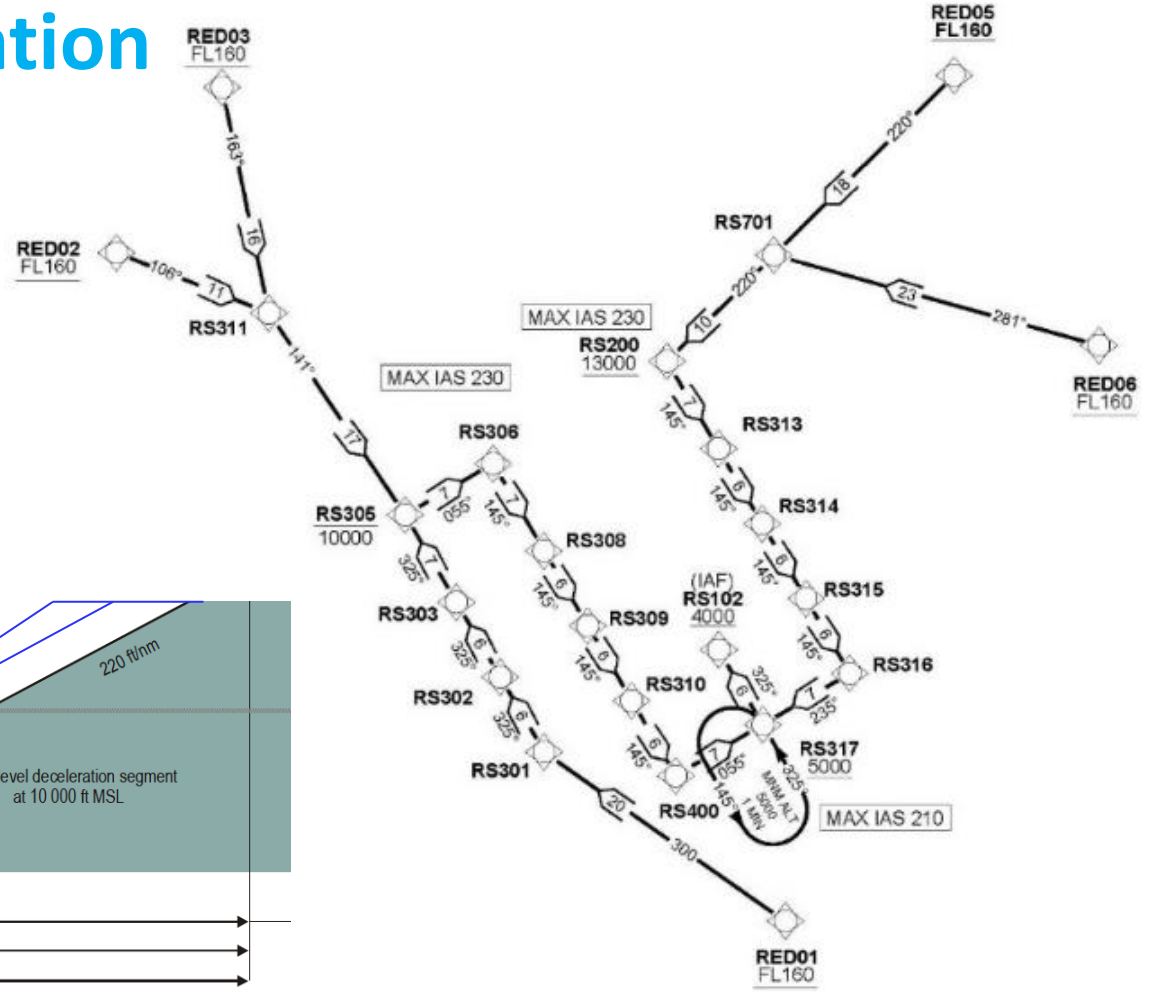
CDO implementation

IMPLEMENTED MCAs (RS200)

- The restriction +13000 ft is placed at 48 NM from FAF (38 NM from IAF), where the minimum altitude should be +10860 ft :

160 ft/NM * 10 NM from FAF = 3600 ft
220 ft/NM * 38 NM from +13000ft
deceleration phase (5 nm) = 7260 ft
3600 ft + 7260 ft = +10860 ft

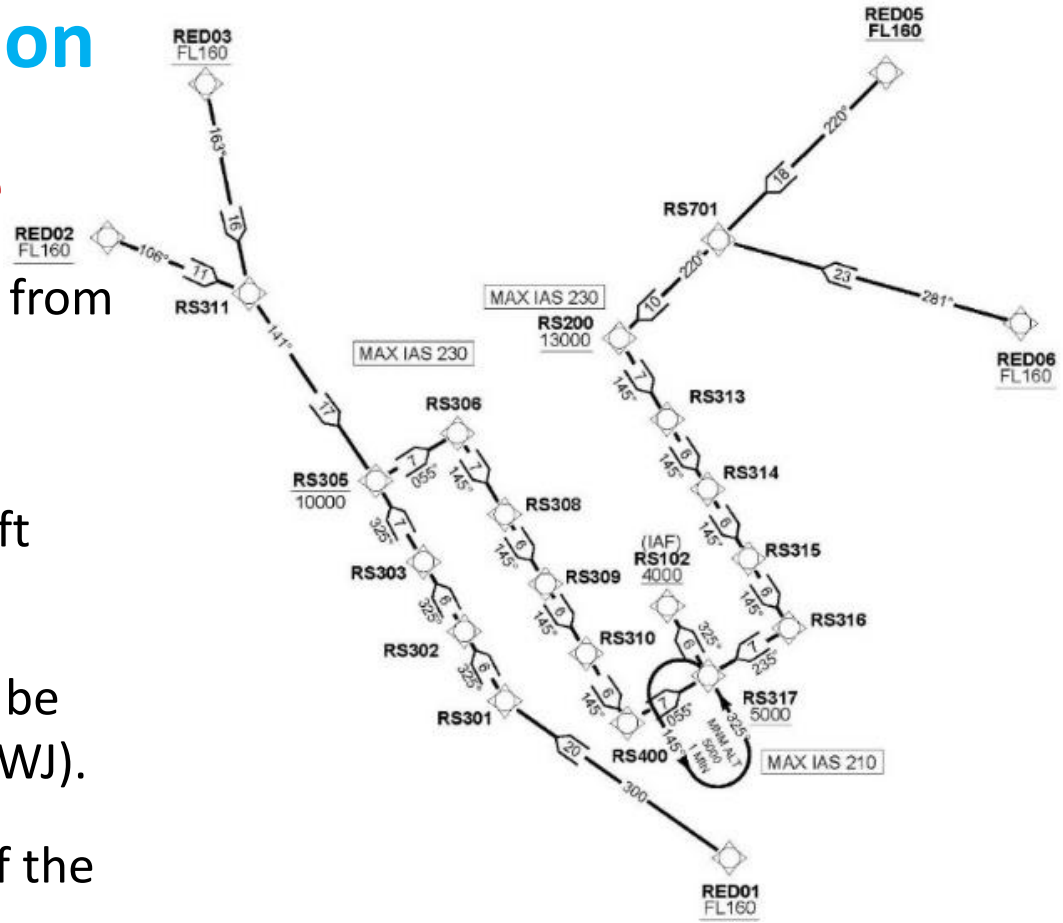




CDO implementation

MCA CONSIDERATIONS (RS305) Non Compliant Case

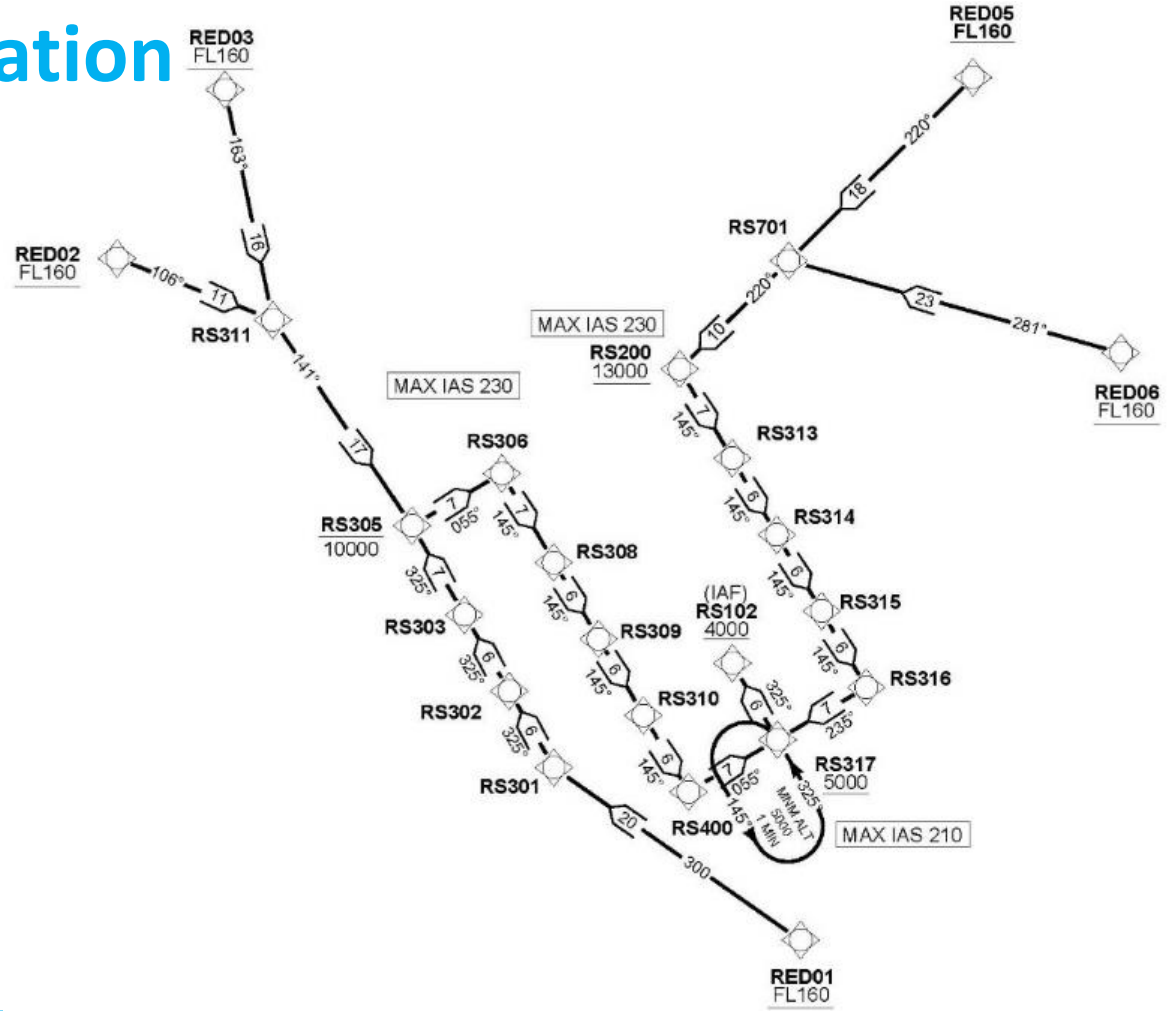
- The restriction -10000 ft is placed at 55 NM from FAF (45 NM from IAF), where the minimum altitude should be +12400 ft :
- 160 ft/NM * 10 NM from FAF = 3600 ft
  220 ft/NM * 40 NM from 10000ft deceleration phase = 8800 ft
  3600 ft + 8800 ft = +12400 ft
- Despite of the calculated lower limit of 12400 ft, the value to be use is 10000 ft because of an existing ATS Route (direct to OEWJ).
- With the given distance from 10000 ft layer, the lower limit of the entry gates is OUTSIDE the margin of CDO criteria.



CDO implementation

IMPLEMENTED MCAs

- The two MCAs at -10000 ft and +13000 ft are needed because of procedure separation (mainly with departure trajectories and Traffic to OEWJ)
- The restriction -10000 ft is placed at 55 NM from FAF (45 NM from IAF) and it's given because of an existing Lower ATS Route
  (MAX gradient shall be lower than 350 ft/NM and **non-Compliant with minimum Altitude for CDO**) Action will be taken During the Stakeholders Meeting.



CCO and CDO future implementation

IMPLEMENTED MCAs

- A future implementation for red Sea might be based on a SIDs and STARs duplication, based on a CCO/CDO profile and a no-CCO/CDO profile
- This will leave the same horizontal trajectory, with different altitude restrictions to allow CCO/CDO operations outside peak time
- A similar case is already used in Qatar (Hamad and Doha Departures) and Switzerland (Zurich)

Thank you !!