MIDANPIRG PBN SG/6 Meeting (virtual), 10-11 November 2021

Kingdom of Saudi Arabia

Presented by

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GACA
الهيئة العامة للطيران المدني
General Authority of Civil Aviation

VISION رؤية 2030
المملكة العربية السعودية
KINGDOM OF SAUDI ARABIA

Outline

1. Status of Implementation
2. Continuous Descent Operation (CDO)
3. Continuous Climb Operation (CCO)
4. Next steps
5. Recommendations

Status of Implementation

OERK — RIYADH / KING KHALED INTERNATIONAL

RWY Ends	LNAV	LNAV/ VNAV	LPV	RNP AR	RNAV SID	RNAV STAR
15L	Y	Y			Y	Y
15R	Y	Y			Y	Y
33L	Y	Y			Y	Y
33R	Y	Y			Y	Y

Status of Implementation

OEJN — JEDDAH / KING ABDULAZIZ INTERNATIONAL

RWY Ends	LNAV	LNAV/ VNAV	LPV	RNP AR	RNAV SID	RNAV STAR
34R	Y	Y			Y	Y
34C	Y	Y			Y	Y
34L	NA	NA			Y	Y
16R	Y	Y			Y	Y
16C	Y	Y			Y	Y
16L	Y	Y			Y	Y

Status of Implementation

OEMA — MADINAH / PRINCE MOHAMMAD BIN ABDULAZIZ INTERNATIONAL

RWY Ends	LNAV	LNAV/ VNAV	LPV	RNP AR	RNAV SID	RNAV STAR
35	Y	Y			Y	Y
17	Y	Y			Y	Y
36	Y	Y			Y	Y
18	Y	Y			Y	Y

Status of Implementation

OEDF — DAMMAM / KING FAHD INTERNATIONAL

RWY Ends	LNAV	LNAV/ VNAV	LPV	RNP AR	RNAV SID	RNAV STAR
34L	Y	Y			Y	Y
34R	Y	Y			Y	Y
16L	Y	Y			Y	Y
16R	Y	Y			Y	Y

Status of Implementation

Aerodrome	CDO	CCO
OERK — RIYADH / KING KHALED INTERNATIONAL	Implemented	Implemented
OEJN — JEDDAH / KING ABDULAZIZ INTERNATIONAL	Implemented	Implemented
OEMA — MADINAH / PRINCE MOHAMMAD BIN ABDULAZIZ INTERNATIONAL	Implemented	Implemented
OEDF — DAMMAM / KING FAHD INTERNATIONAL	Implemented	Implemented

Status of Implementation

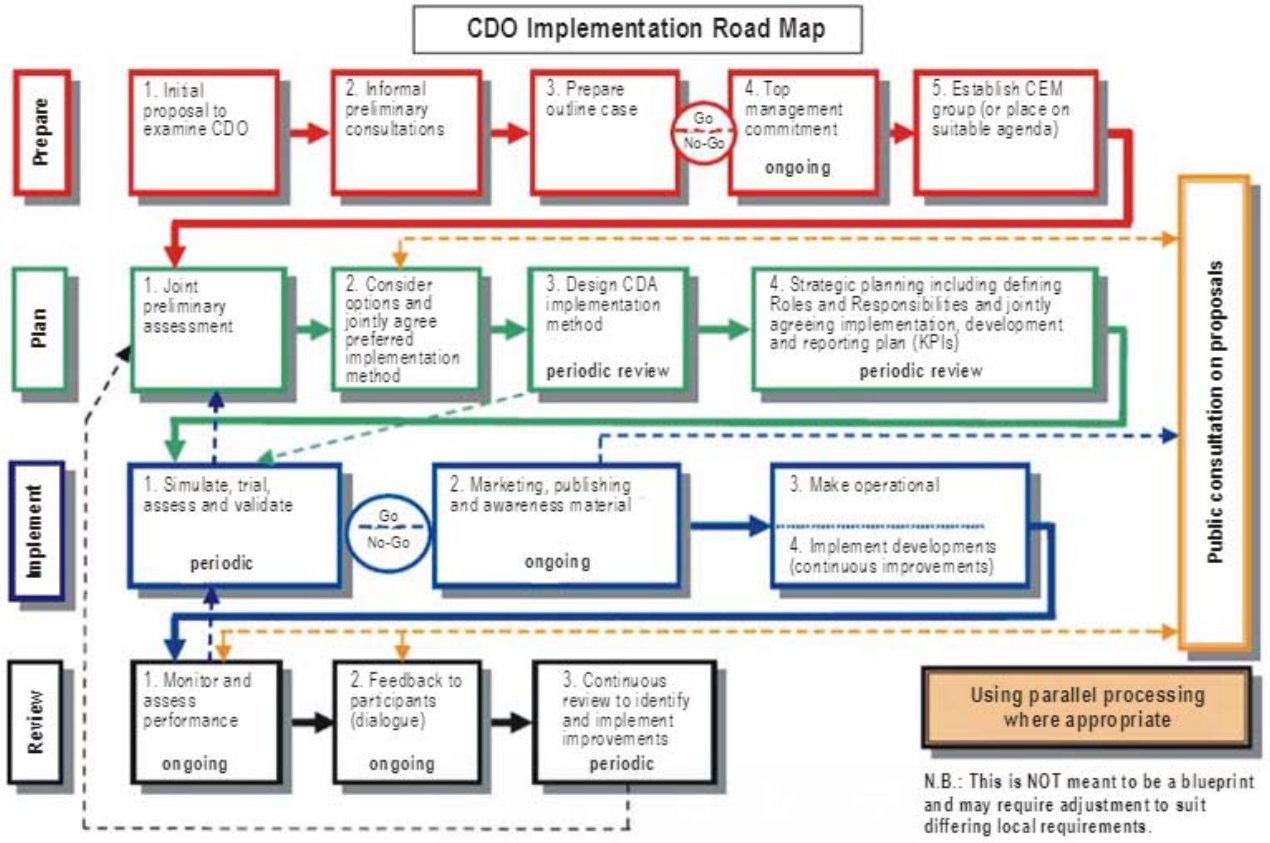
- **Rename RNAV (GNSS) Approaches to RNP**
  - Implemented

- **In progress**
  - Restructure of Saudi Airspace based on Saudi Air Navigation Plan (SNAP)

- **Procedure Design**
  - 2 organizations certified by GACA.
  - 2 chief designers accepted by GACA.
  - Multiple IFP designers trained conventional and PBN IFPs.
  - Static aeronautical data within AIS.
  - AIS automation system (to be updated on 2022)
  - IFPs organizations and AIS are ISO certified.
  - Design Automation tools is updated to the latest amendment of ICAO Doc 8168

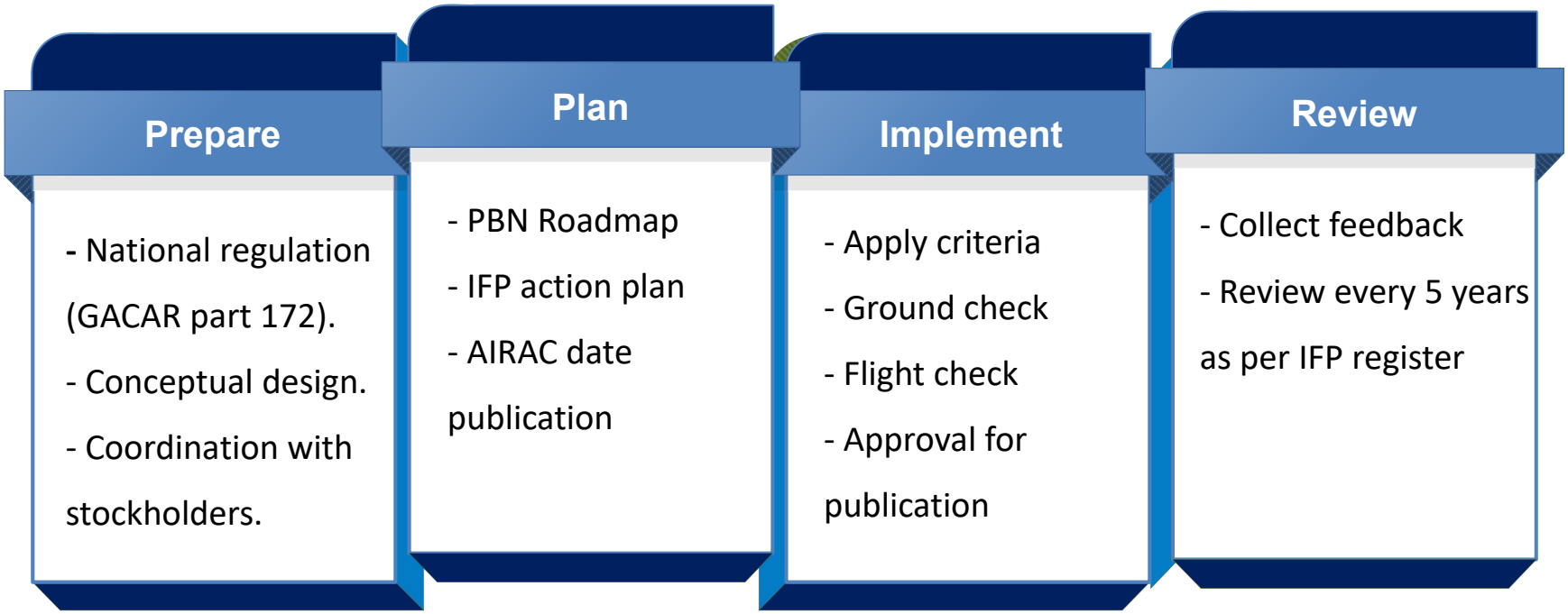
Continuous Descent Operation (CDO)

IMPLEMENTATION PROCESS DIAGRAM (ICAO Doc 9931)



Continuous Descent Operation (CDO)

IMPLEMENTATION PROCESS DIAGRAM (ICAO Doc 9931)

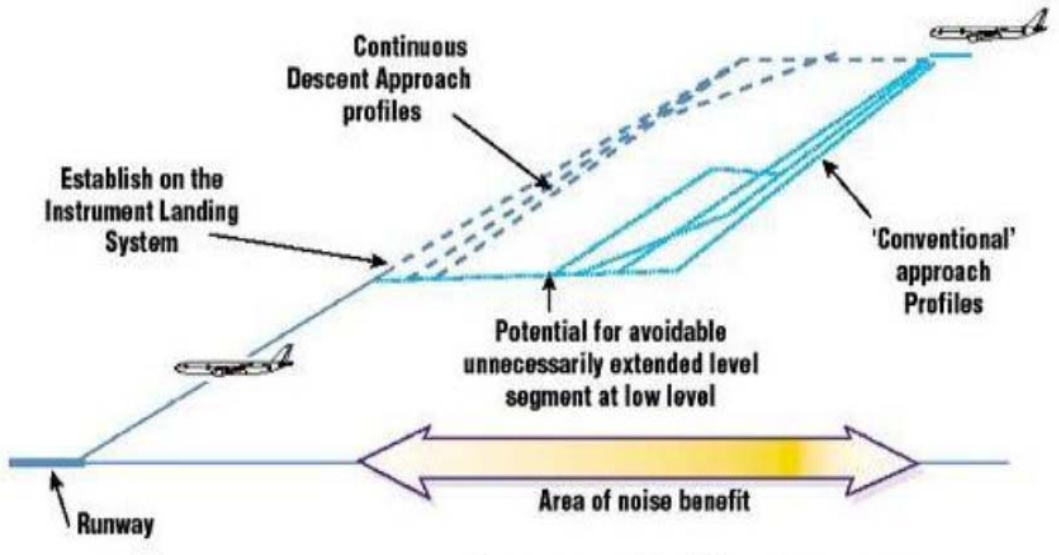


Continuous Descent Operation (CDO)

Continuous descent operation (CDO)

An operation, enabled by airspace design, procedure design and ATC facilitation, in which an arriving aircraft descends continuously, to the greatest possible extent, by employing minimum engine thrust, ideally in a low drag configuration, prior to the final approach fix /final approach point

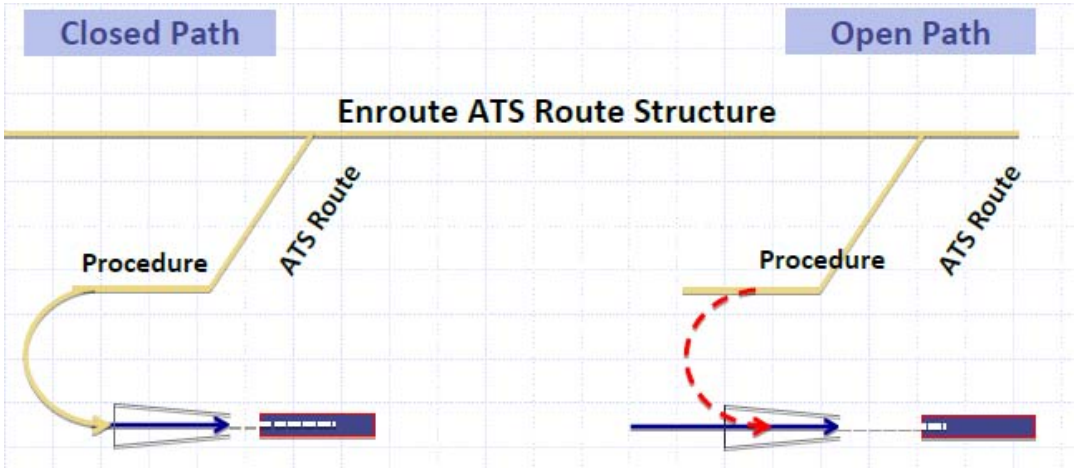
ICAO DOC 9931



Where an arriving aircraft descends continuously

Continuous Descent Operation (CDO)

CDO Options (STARs)



- **Open Path Design:**
  - **Vectored CDO Procedure**
  - **Open CDO Procedure to Down-wind**
- **Closed Path Design: Distance is known**

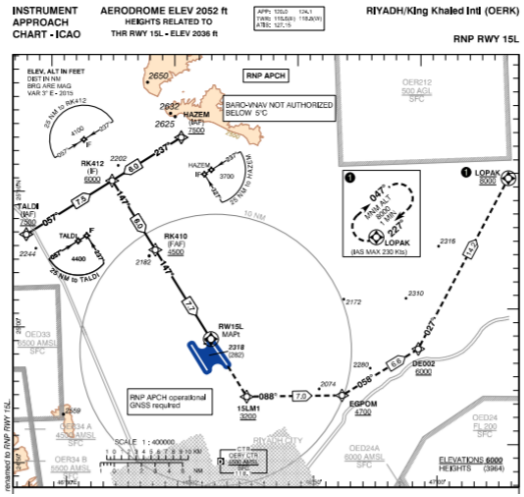
Continuous Descent Operation (CDO)

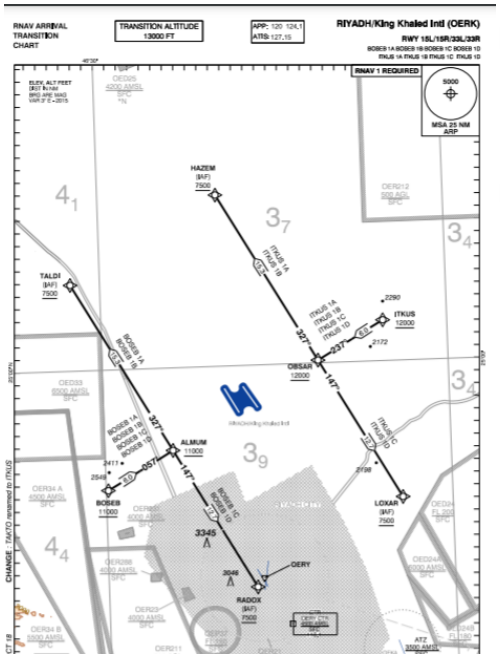
King Khaled International Airport (OERK)

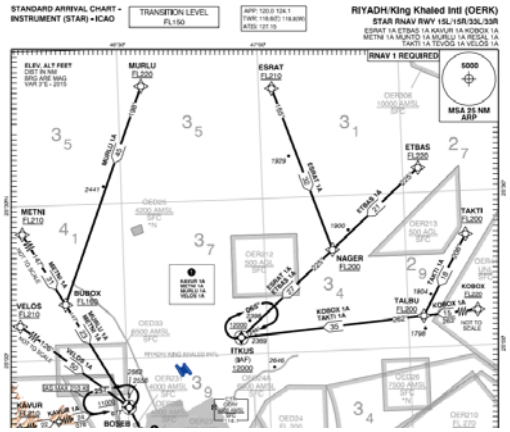
- Entry/exit points have been evaluated for procedure connecting OERK and OEDF
- Merge point solution rejected due to traffic analysis and ATC evaluation
- Direct connection (shortest distance) for mane gates. Trajectories designed with respect to the minimum length, optimal descent.
- Avoid interference with arrival procedures of near aerodromes (one STAR for 3 aerodromes).
- T-Bar concept RNP Approach implemented for OERK .
- RNAV transition implemented in order to link RNAV SATR with RNP Approach procedure.
- Procedure separation within SID and STAR and CCO has been granted.
- Designed as closed STARS → Procedures end at FAF/FAP.
- Entry points in OERK TMA are used

Continuous Descent Operation (CDO)

King Khaled International Airport (OERK)

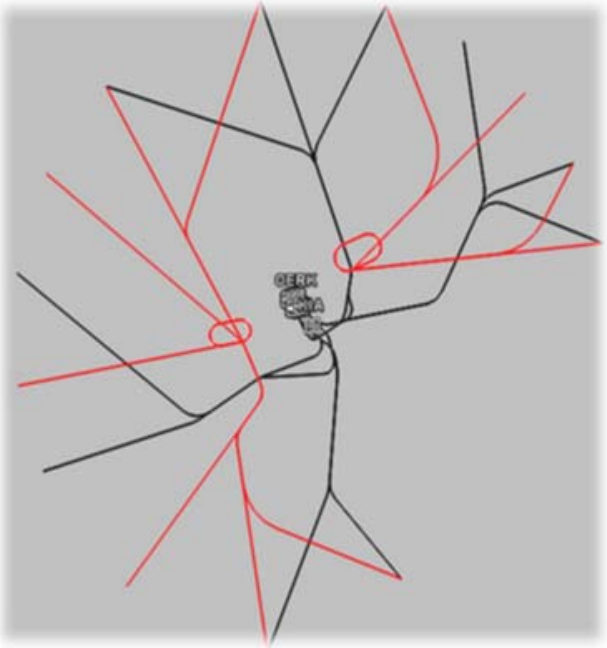




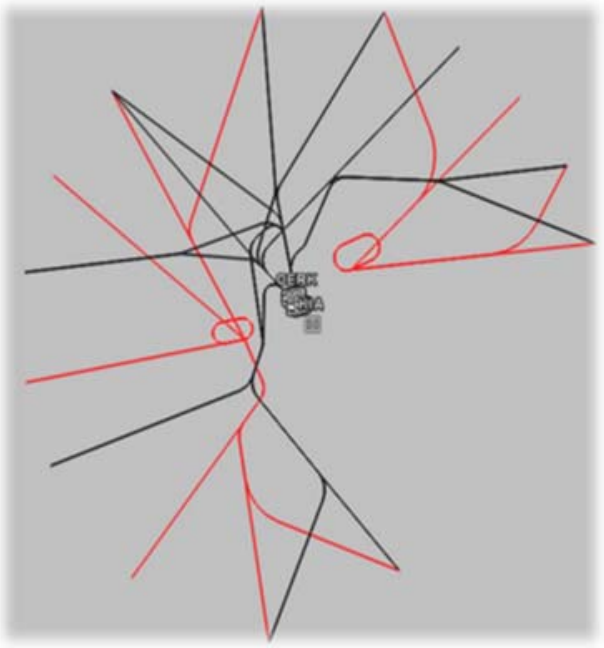


Continuous Descent Operation (CDO)

King Khaled International Airport (OERK)



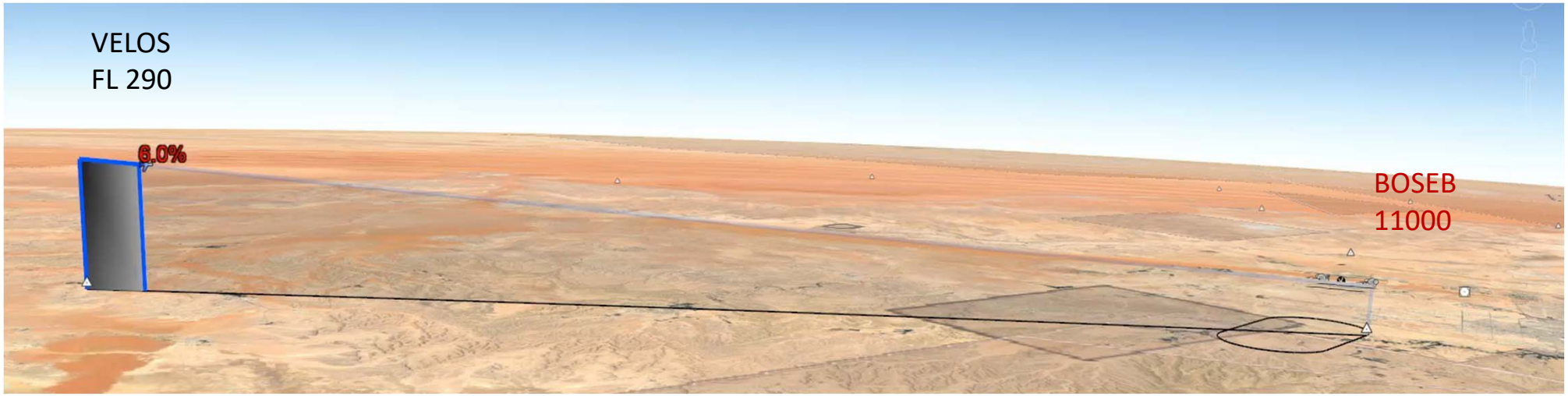
Runway 15L and 15 R Departure and Arrival operations



Runway 33L and 33R Departure and Arrival operations

Continuous Descent Operation (CDO)

King Khaled International Airport (OERK)



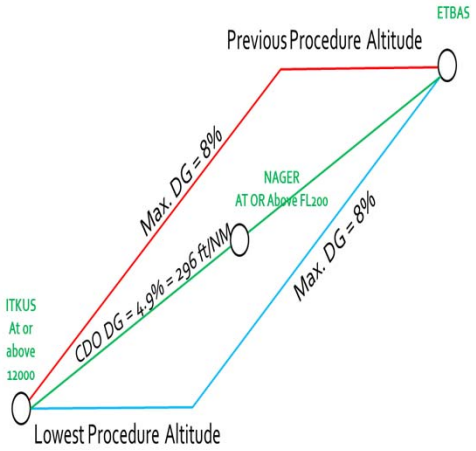
TOTAL Distance 50 NM

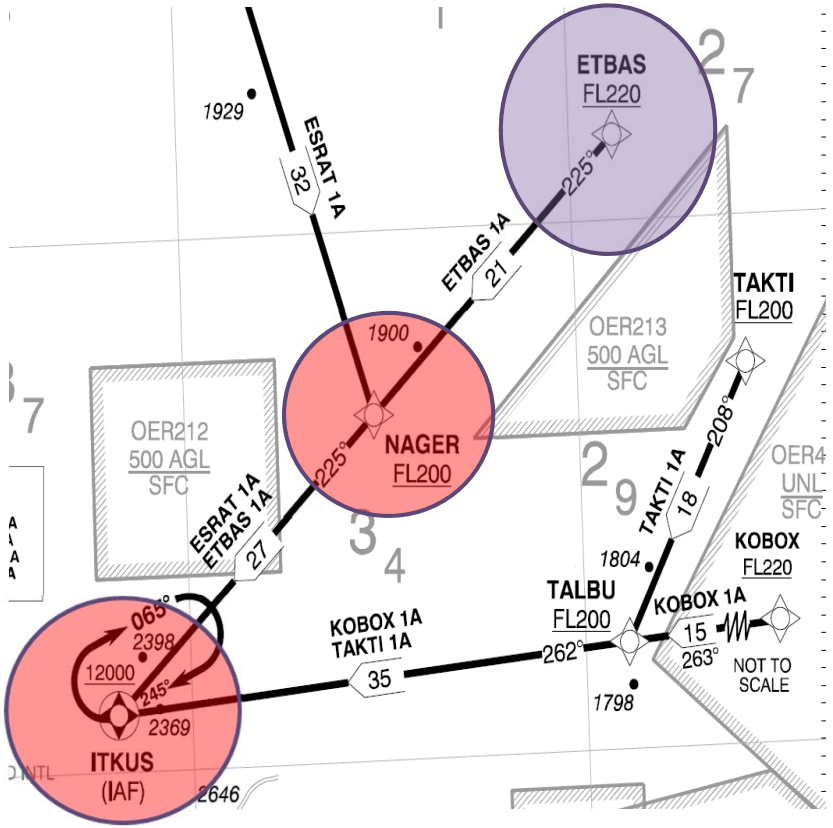
STAR RNAV All Runways
STAR VELOS 1A
No Altitude Restrictions,
CDO is Achieved with 6.0% = 364 Ft/NM Rate of Descend is 1500 Ft/Min@250 KT
Total Distance is 50 NM.
Start Descend Altitude at VELOS is FL 290 and the Final Altitude at BOSEB is 11000 Feet.

Continuous Descent Operation (CDO)

King Khaled International Airport (OERK)

Example STAR RNAV RWY 15L/15R/33L/33R ETBAS 1A



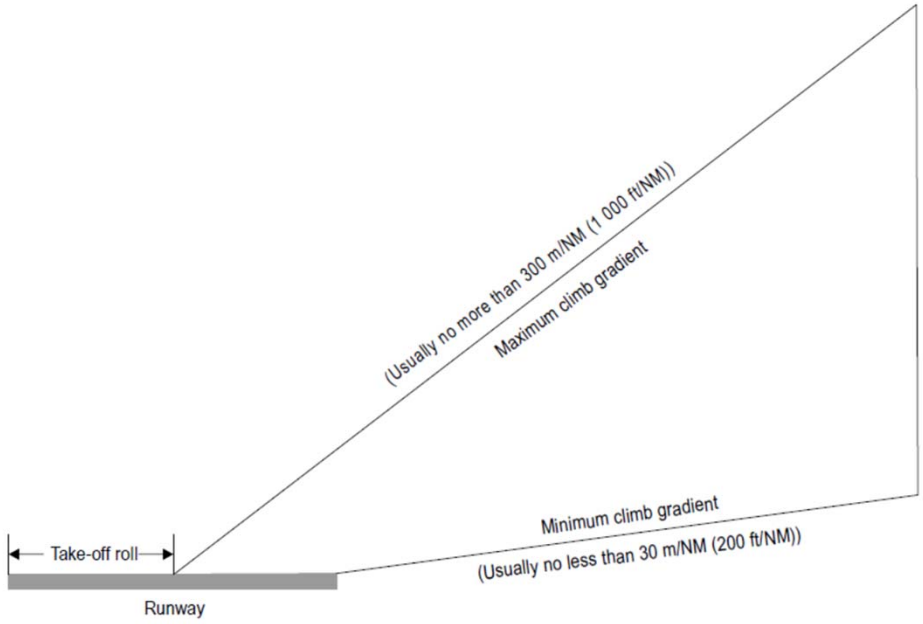


Continuous Climb Operation (CCO)

Continuous Climb Operation (CCO)

An operation, enabled by airspace design, procedure design and ATC , in which a departing aircraft climbs without interruption, to the greatest possible extent, by employing optimum climb engine
thrust, at climb speeds until reaching the cruise flight level

ICAO DOC 9993

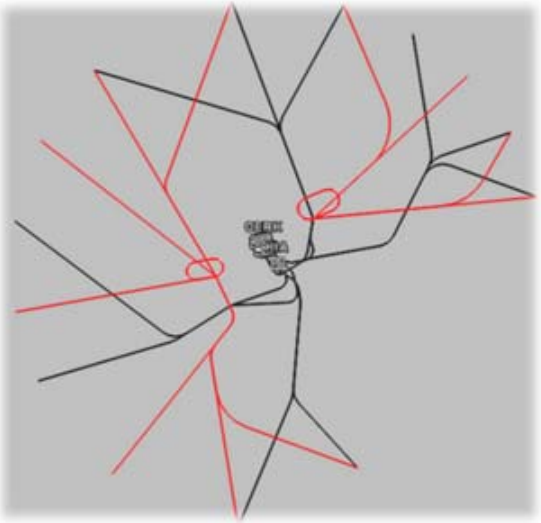


Where departing aircraft climbs without interruption at optimum climb speeds.

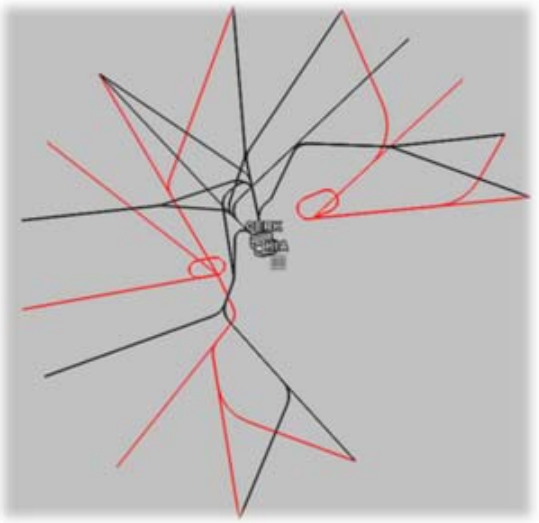
Continuous Climb Operation (CCO)

King Khaled International Airport (OERK)

Traffic Flow analysis has been considered in order to optimize the fuel consumption for SID in direction of RWYs → Procedure separation within SID and STAR ; CCO has been granted.



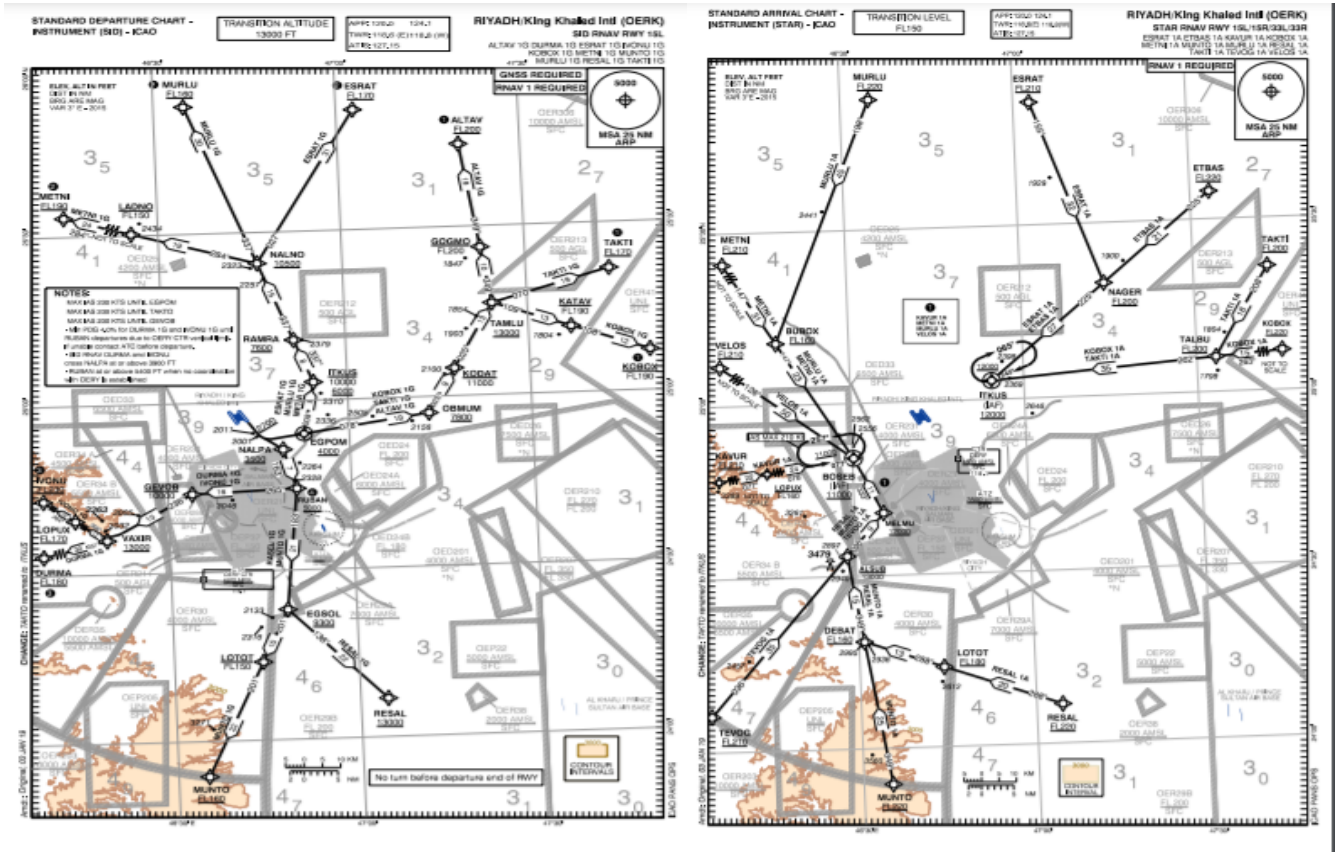
Runway 15L and 15 R Departure and Arrival operations



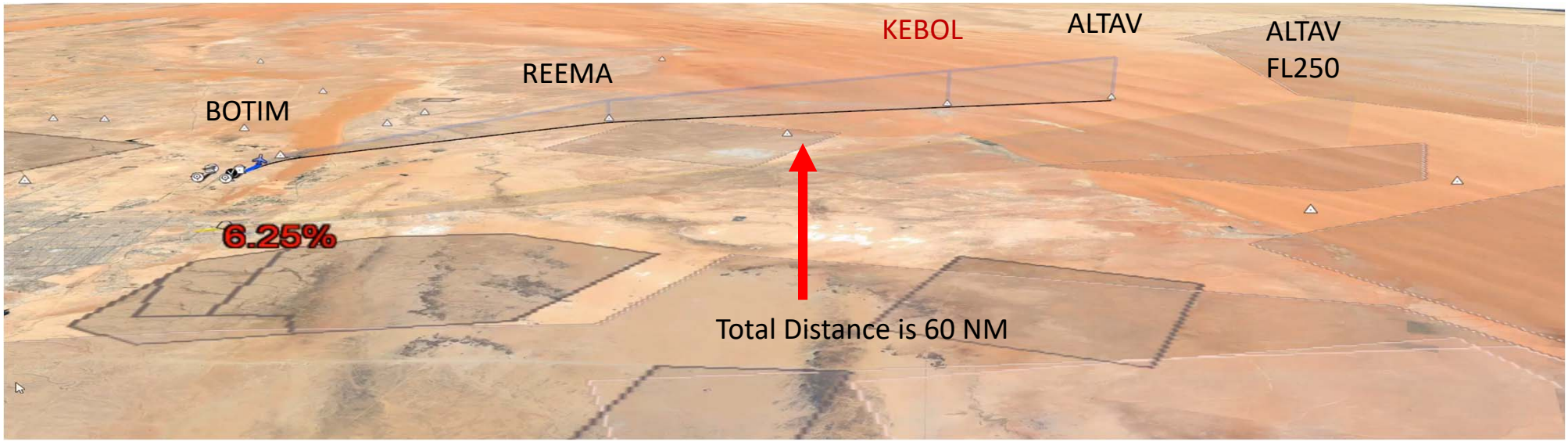
Runway 33L and 33R Departure and Arrival operations

Continuous Climb Operation (CCO)

King Khaled International Airport (OERK)



Continuous Climb Operation (CCO)



SID RNAV RWY 33R

SID ALTAV 1K

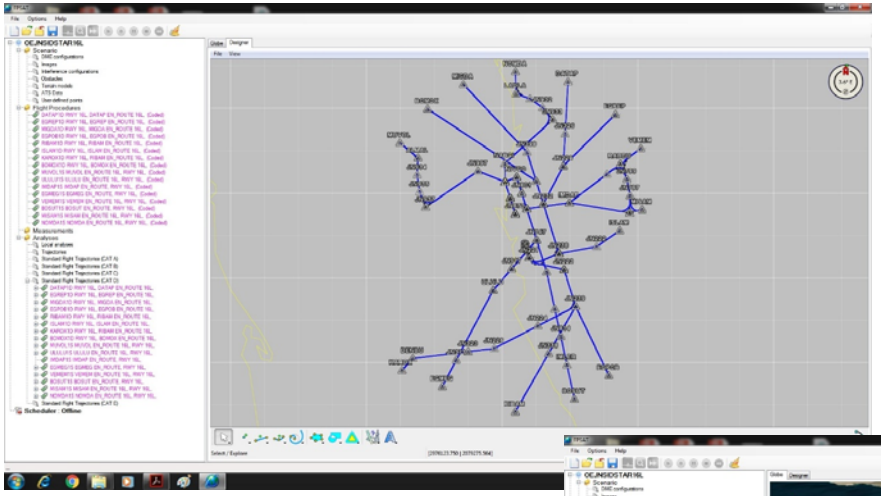
Altitude restriction at Way point KEBOL at or below FL200 it is located after flight distance of 47 NM from DERWAY 33R.

The Total Distance to ALTAV is 60 NM.

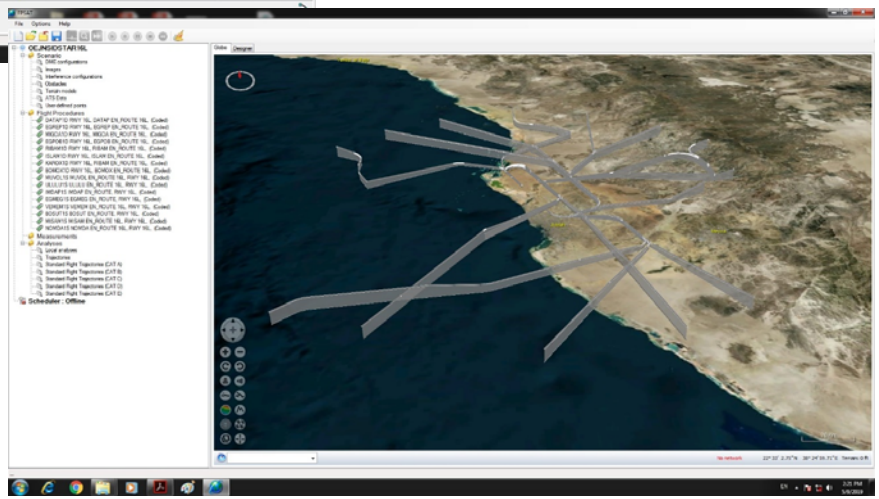
The CCO is Achieved by Climb Gradient 6.25% = 380 Ft/ NM Rate of Climb is 1600 Ft /Min @250KT Reaching ALTAV with CCO at FL250.

CCO & CDO

King Abdulaziz International Airport (OEJN)

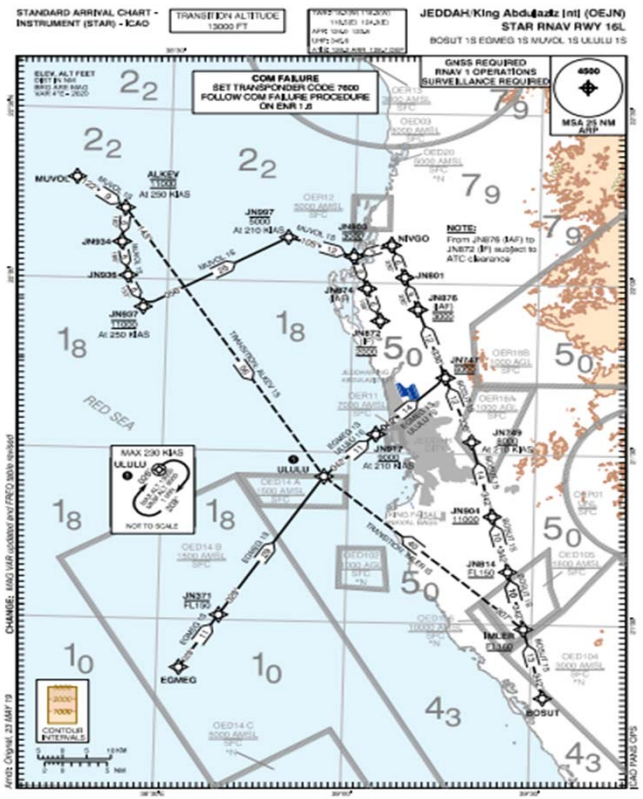


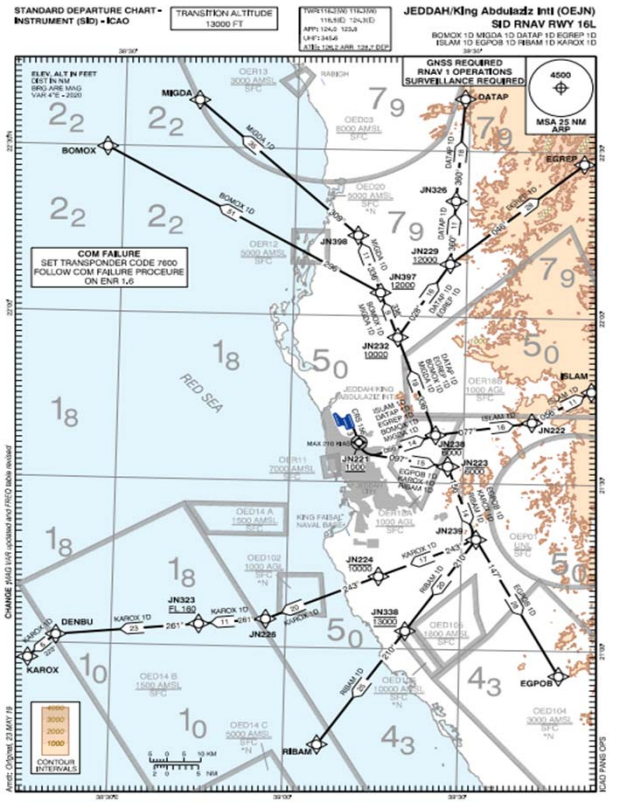
SID & STAR RWY 16L



King Abdulaziz International Airport (OEJN)

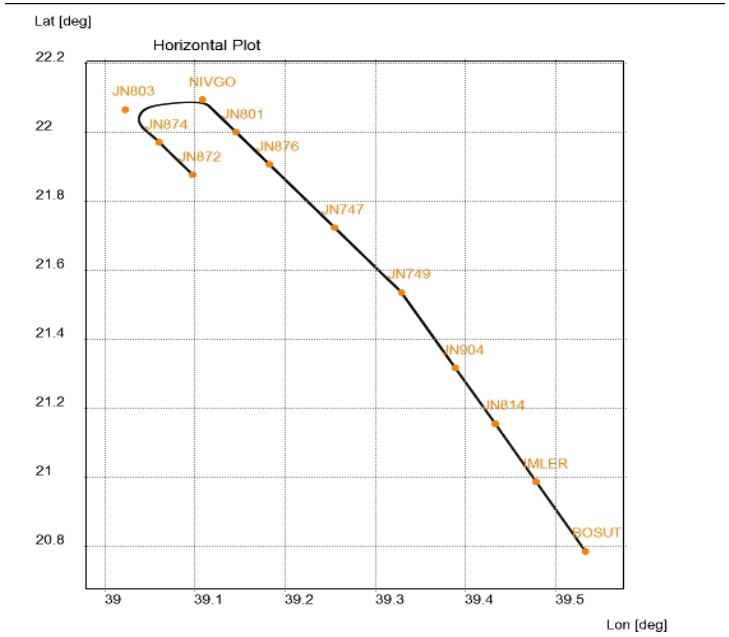
SID & STAR RWY 16L



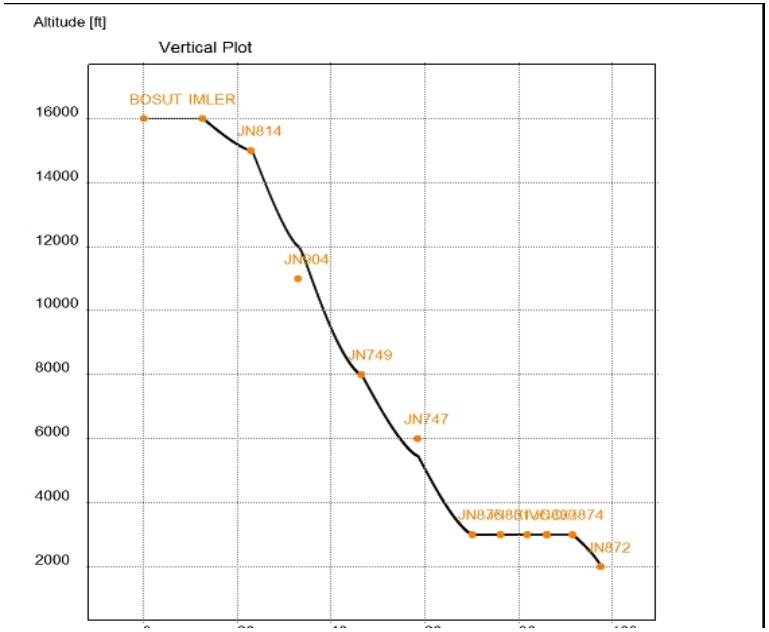


CDO

King Abdulaziz International Airport (OEJN)



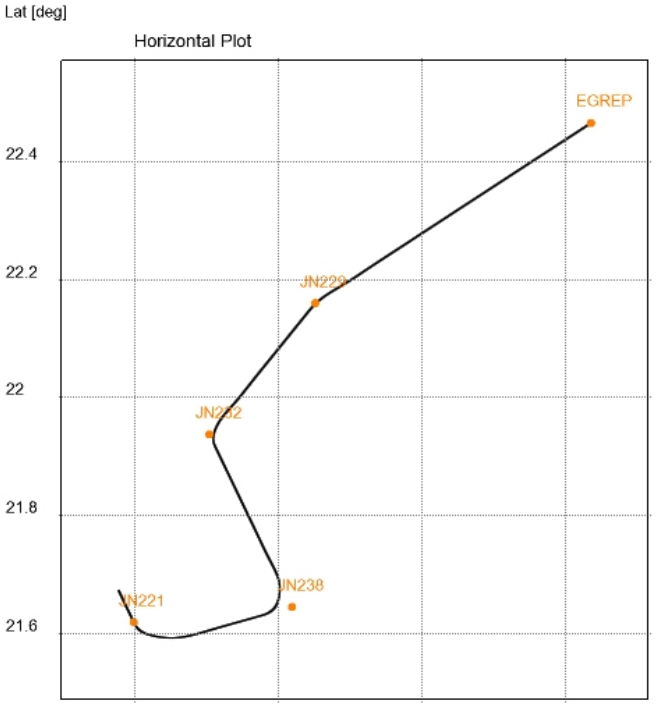
BOSUT 1S STAR RWY 16L Horizontal



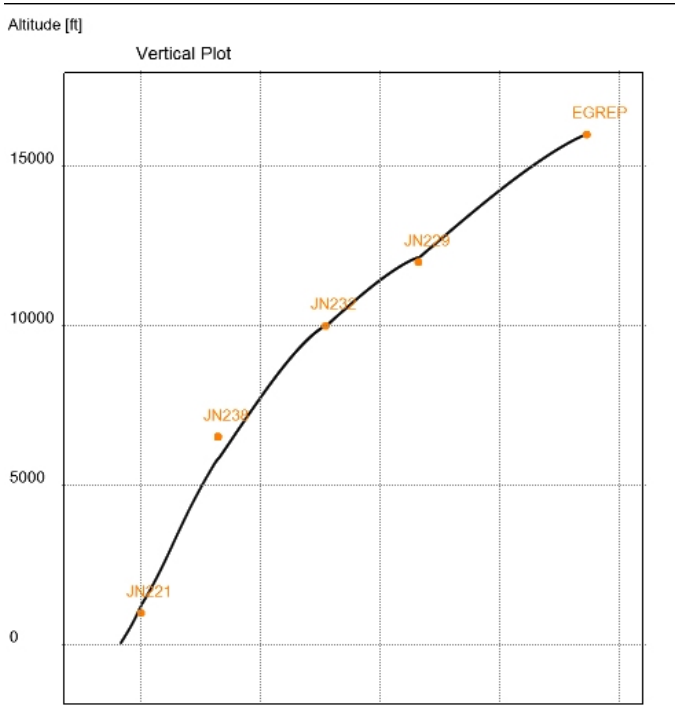
BOSUT 1S STAR RWY 16 L Vertical

CCO

King Abdulaziz International Airport (OEJN)



EGREP 1D SID RWY 16L Horizontal



EGREP 1D SID RWY 16 L Vertical

CCO & CDO

King Abdulaziz International Airport (OEJN)

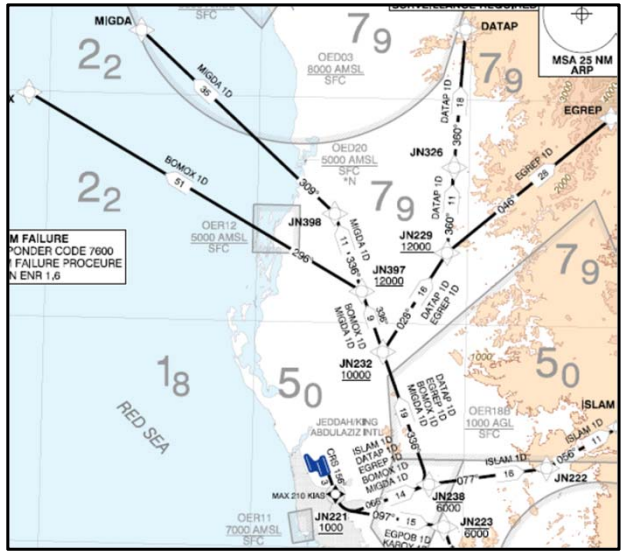
CDO and CCO implementation in Jeddah FIR-Jeddah Airport Analysis

- **RANV 1 SIDs and STARs for RWYs 16L/C/R & 34R/C/L are reviewed and redesigned due to a new the restriction of airspace.**
- **Example for runway 16L as follows:**

STAR RWY 16L

Level at JN747 is provided at 8000 feet to clear restricted area.

SID RWY 16L



CCO & CDO

Benefits from implementation of PBN and CDO/CCO

- CCO and CDO is applied by 80 percent of flights by following STARs and SIDs within OEJN TMA.
- Controller/pilot workload is reduced due to:
  - Reduced VHF transmission in STARs and SIDs
  - Reduce radar vectoring requirements.
  - More Predicted trajectories in SIDs and STARSs.
- Complexity in terminal airspace is reduced by providing strategic separation between STARs and SIDs trajectories, Resulting enhanced Safety.
- Terminal airspace capacity has been increased by introduction of Point merge sequencing method.
- Closed STARs are the best solution for CDO consideration of traffic density.

Next steps

- Continuity review an update of national PBN plan based on Saudi National Air Navigation Plan (SNAP).
- CCO/CDO implementation at new airports within detailed PBN implementation project plan.
- Continuity training of IFP designers and collection of feedback from users.
- Revision of published IFPs when necessary.
- Safety oversight and inspection for the service providers.

Recommendations

- ICAO MID Office organize webinars and training sessions for MID states on CCO/CDO implementation in coordination with MID FPP.
- ICAO MID Office organize workshops for MID states in coordination with other ICAO MID Groups (ATM SG, ASPIG SG etc.)

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Thank you..