

MIDANPIRG PBN SG/3 Meeting Cairo, Egypt, 11-13 February 2018

Saudi Arabia

Presented by

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Presentation Outline

- **Brief of the State National PBN Implementation Plan**
- **Status of Implementation**
- **Post assessment results of the PBN Implementation**
- **Lessons Learned**
- **Challenges**
- **Thoughts/Recommendations**

National PBN Implementation Plan

International airports	Regional airports	Domestic airports	Other Airports
6	6	15	31 airports
Dammam Jeddah Madinah Riyadh Taif Hail	Abha Jazan Gassim Hail Tabuk Taif Nejran Yenbo	Al Ahsa Al Baha Al Jouf Arar Bisha Al Dawadmi Guriat Qaisumah Rabigh Rafha Sharura Turaif Wadi Al Dawasir Wejh Alula	



National PBN Implementation Plan

2018



- New international airports: Taif & Hail
- New TMAs: Gassim & Hail
- New RWYs (Al Baha, turaif, Quaisumah) and rehabilitation of existing RWYs
- Restructure of ATS routes at empty quarter in coordination with Adjacent FIRs

National PBN Implementation Plan

Restructure of ATS routes at empty quarter:

- ✓ 25 May 2017, the Empty Quarter Airspace Project – Phase I, 3 new RNAV 5 ATS Routes as follows:
 - Y511
 - Q322
 - UM550
- ✓ May 2018 New ATS RNAV 5 Routes :
 - Z515
 - Q21
 - Q541



National PBN Implementation Plan

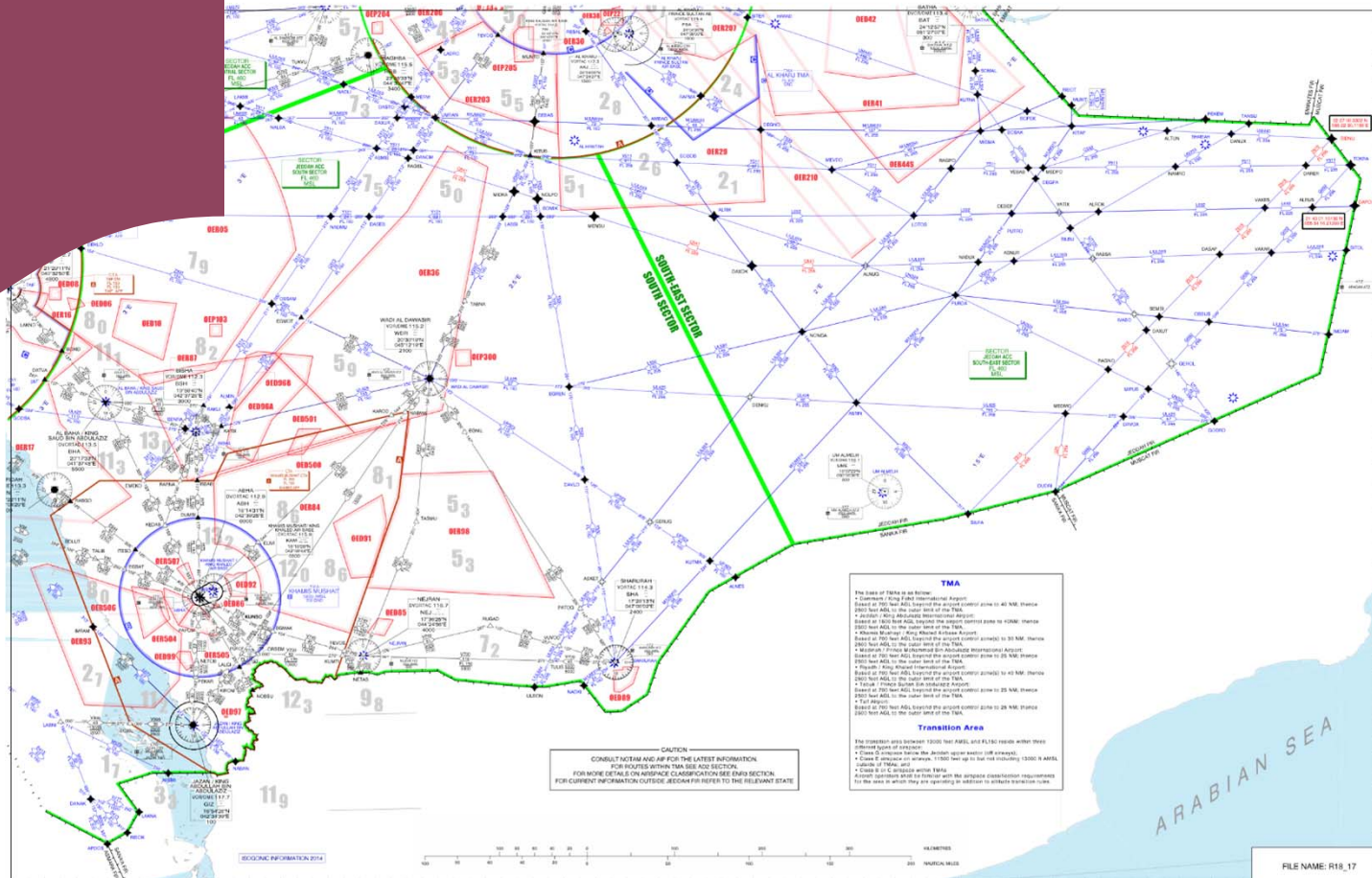
Restructure of ATS routes at empty quarter:

- ✓ May 2018 Realignment of ATS RNAV 5 Routes:
 - UM440
 - N569
 - Y511
 - L/UL883
 - Extends T533



National PBN Implementation Plan

Restructure of ATS routes at empty quarter



National PBN Implementation Plan

✓ 2018:


- Certification of Saudi Air Navigation Services (SANS) by General Authority of Civil Aviation (GACA) based on GACA Regulations
- Update National PBN Plan
- Obstacle Survey and eTOD
- Design and publish New PBN IFPs for international airports including LNAV/VNAV

✓ 2019 - 2020:

- Redesign new conventional and PBN IFPs based on ICAO / PANS – OPS for 18 airports
- Rename RNAV (GNSS) Approaches
- Training (Designer, chief designer, ATCO, AIM)


Status of Implementation

International airports

International airport	PBN status
OEMA-PRINCE MOHAMMAD BIN ABDULAZIZ INTL-MADINAH	<ul style="list-style-type: none">- 4 RWY Ends- 2 RWY Ends ILS CAT II- 1 RWY END ILS CAT I- RNP APCH- LNAV- RNAV 1 SID- RNAV 1 STAR  <p>PUBLISHED 2014</p>

Status of Implementation

International airports

International airport	PBN status
OEJN-KING ABDULAZIZ INTL-JEDDAH	<ul style="list-style-type: none">- 6 RWY Ends- 4 RWY Ends ILS CAT II- 2 RWY ENDS ILS CAT III- RNP APCH- LNAV/VNAV- RNAV 1 SID- RNAV 1 STAR  <p>WILL BE PUBLISHED 2018</p>

Status of Implementation

International airports

International airport	PBN status
OERK-KING KHALED INTL-RIYADH	<ul style="list-style-type: none"> - 4 RWY Ends - 4 RWY Ends ILS CAT II - RNP APCH - LNAV/VNAV - RNAV 1 SID - RNAV 1 STAR <div style="display: flex; justify-content: flex-end; align-items: center; margin-top: 10px;"> <div style="margin-right: 10px;"> } </div> <div style="text-align: right;"> <p>TO BE PUBLISHED MAY 2018</p> </div> </div> <div style="display: flex; justify-content: flex-end; align-items: center; margin-top: 10px;"> <div style="margin-right: 10px;"> } </div> <div style="text-align: right;"> <p>TO BE PUBLISHED OCT 2018</p> </div> </div>

Status of Implementation

International airports

International airport	PBN status
OEDF-KING FAHD INTL-DAMMAM	<ul style="list-style-type: none">- 4 RWY Ends- 4 RWY Ends ILS CAT II- RNP APCH- LNAV/VNAV- RNAV 1 SID- RNAV 1 STAR <p style="text-align: right;">} Planned end of 2018</p>

Status of Implementation

International airports

International airport	PBN status
OEHL-HAIL AIRPORT	<ul style="list-style-type: none">- 2 RWY Ends- 1 RWY End ILS CAT I- RNP APCH- LNAV/VNAV- RNAV 1 SID- RNAV 1 STAR <p style="margin-left: 150px;">} Planned mid of 2018</p> <p style="margin-left: 150px;">} Planned end of 2018</p>

Status of Implementation

International airports

International airports	PBN status
OETF-TAIF AIRPORT	<ul style="list-style-type: none">- 4 RWY Ends- 2 RWY End ILS CAT I- RNP APCH- LNAV/VNAV- RNAV 1 SID- RNAV 1 STAR <p style="text-align: right;">} TO BE PUBLISHED IN 2019</p>

Status of Implementation

Airports	PBN status
<ul style="list-style-type: none">• Yenbo/Prince Abdulmohsin Bin Abdulaziz Airport• Jubail airport	<ul style="list-style-type: none">- 4 RWY Ends- RNP APCH- LNAV <p>} UNDER PROCESS OF VALIDATION -2018</p>

Status of Implementation

2018 -2019

Redesign IFPs from TERPS to PANS-OPS Project


13 Airports	PBN status
<ul style="list-style-type: none"> Gassim/Prince Nayef bin Abdulaziz Airport 	<ul style="list-style-type: none"> - 28 RWY Ends
<ul style="list-style-type: none"> Al-Ahsa Airport 	<ul style="list-style-type: none"> - Redesign from FAA-TERPS to ICAO PANS-OPS
<ul style="list-style-type: none"> Bisha Airport 	<ul style="list-style-type: none"> - RNP APCH
<ul style="list-style-type: none"> Nejran Airport 	<ul style="list-style-type: none"> - LNAV/VNAV
<ul style="list-style-type: none"> Wadi Al-Dawasir Airport 	<ul style="list-style-type: none"> - RNAV 1 SID
<ul style="list-style-type: none"> Alula/Prince Abdulmajeed Bin Abdulaziz Airport 	<ul style="list-style-type: none"> - RNAV 1 STAR
<ul style="list-style-type: none"> Al-Dawadmi/King Salman Bin Abdulaziz Airport 	
<ul style="list-style-type: none"> Arar Airport 	
<ul style="list-style-type: none"> Tabuk Airport 	
<ul style="list-style-type: none"> Al-Jouf Airport 	
<ul style="list-style-type: none"> Guriat Airport 	
<ul style="list-style-type: none"> Rafha Airport 	
<ul style="list-style-type: none"> Sharurah Airport 	

TO BE PUBLISHED
BETWEEN 2018 - 2019

Status of Implementation

2018 -2019

Redesign IFPs from TERPS to PANS-OPS and development of PBN IFPs Project

6 Airports	PBN status
<ul style="list-style-type: none"> • Abha Airport • Jazan/King Abdullah bin Abdulaziz Airport • Al-Baha Airport • Wejh Airport • Al-Qaisumah Airport • Turaif Airport 	<ul style="list-style-type: none"> - 12 RWY Ends - Redesign from FAA-TERPS to ICAO PANS-OPS - RNP APCH - LNAV/VNAV - RNAV 1 SID - RNAV 1 STAR <div style="text-align: right; margin-top: 10px;">  <p>TO BE PUBLISHED BETWEEN 2018-2019</p> </div>

Status of Implementation

TMA PROCEDURES Implementation Status (2018)

Int'l Aerodrome	RWY	Approach							SID		STAR		Provided PBN Plan Update date	Remarks
		precision		VOR or NDB	LNAV	LNAV/VNAV	RNP AR	LPV	Conventional	RNAV	Conventional	RNAV		
		ILS	CAT											
OEDF	16L	ILS	I	VORDME					Y					
	16R	ILS	I	VORDME					Y					
	34L	ILS	I	VORDME					Y					
	34R	ILS	I	VORDME					Y					
OEJN	16L	ILS	I		Y	Y			Y	Y	Y	Y		
	16C	ILS	I		Y	Y			Y	Y	Y	Y		
	16R	ILS	I	VORDME	Y	Y			Y	Y	Y	Y		
	34L	ILS	I	VORDME	Y	Y			Y	Y	Y	Y		
	34C	ILS	I	VORDME	Y	Y			Y	Y	Y	Y		
	34R	ILS	I		Y	Y			Y	Y	Y	Y		
OEMA	17	ILS	I	VORDME	Y				Y	Y		Y		
	18			VORDME	Y				Y	Y		Y		
	35	ILS	I	VORDME	Y				Y	Y		Y		
	36	ILS	I	VORDME	Y				Y	Y		Y		
OERK	15L	ILS	I	VORDME	Y	Y			Y	Y	Y	Y		
	15R	ILS	I	VORDME	Y	Y			Y	Y	Y	Y		
	33L	ILS	I	VORDME	Y	Y			Y	Y	Y	Y		
	33R	ILS	I	VORDME	Y	Y			Y	Y	Y	Y		
TOTAL	18	17		15	14	10	0	0	18	14	10	14	y	
%		94		83	77	55	0	0	100	77	55	77		

Status of Implementation

B0 – APTA: Optimization of Approach Procedures including vertical guidance

Saudi Arabia

B0 – APTA: Optimization of Approach Procedures including vertical guidance			
Elements	Applicability	Targets	Status
States' PBN Implementation Plan	All	80 % by Dec. 2014 100% by Dec. 2015	Done
LNAV	All RWYs Ends at International Aerodromes	All runway ends at Int'l Aerodromes, either as the primary approach or as a back-up for precision approaches	<ul style="list-style-type: none"> • OEMA: 2014 • OEJN & OERK: 2018 • OEDF: 2018-19
LNAV/VNAV	All RWYs ENDS at International Aerodromes	All runway ends at Int'l Aerodromes, either as the primary approach or as a backup for precision approaches	<ul style="list-style-type: none"> • OEMA: 2018 • OEJN & OERK: 2018 • OEDF: 2018-19

Status of Implementation

B0 – CDO: Improved Flexibility and Efficiency in Descent Profiles (CDO)

Saudi Arabia

B0 – CDO: Improved Flexibility and Efficiency in Descent Profiles (CDO)			
Elements	Applicability	Targets	Status
PBN STARS	In accordance with States' implementation Plans	100% by Dec. 2016 for the identified Aerodromes/TMAs 100% by Dec. 2018 for all the International Aerodromes/TMAs	<ul style="list-style-type: none"> • OEMA: 2014 • OEJN & OERK: 2018 • OEDF: 2018-2019
International aerodromes/TMAs with CDO	In accordance with States' implementation Plans	100% by Dec. 2018 for the identified Aerodromes/TMAs	

Status of Implementation

MIDANPIRG/15

B0 – CCO: Improved Flexibility and Efficiency Departure Profiles - Continuous Climb Operations (CCO)

Saudi Arabia

Elements	Applicability	Targets	Status
B0 – CCO: Improved Flexibility and Efficiency Departure Profiles - Continuous Climb Operations (CCO)			
PBN SIDs	in accordance with States' implementation Plans	100% by Dec. 2016 for the identified Aerodromes/TMAs 100% by Dec. 2018 for all the International Aerodromes/TMAs	<ul style="list-style-type: none"> • OEMA: 2014 • OEJN & OERK: 2018 • OEDF: 2018-19
International aerodromes/TMAs with CCO	in accordance with States' implementation Plans	100% by Dec. 2018 for the identified Aerodromes/TMAs	

Status of Implementation

Riyadh / King Khaled International airport

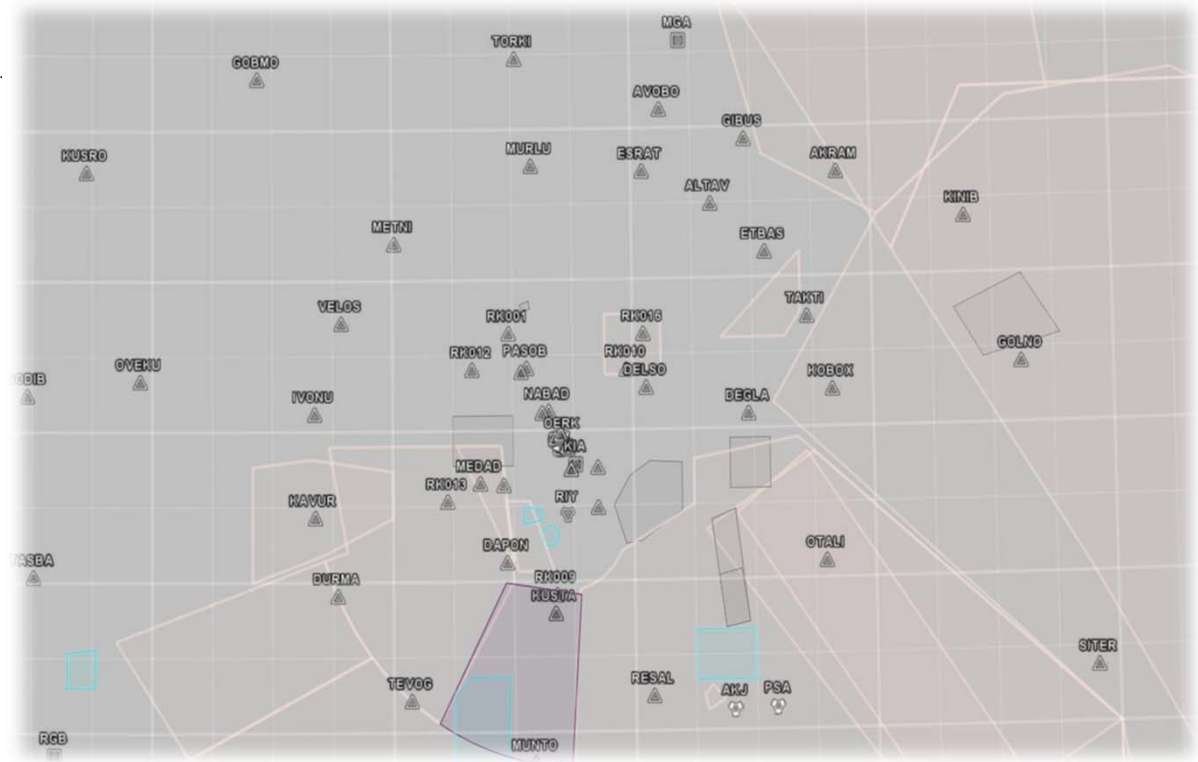
PBN Implementation Mid 2018

Status of Implementation

Static Scenario – Before first conceptual design

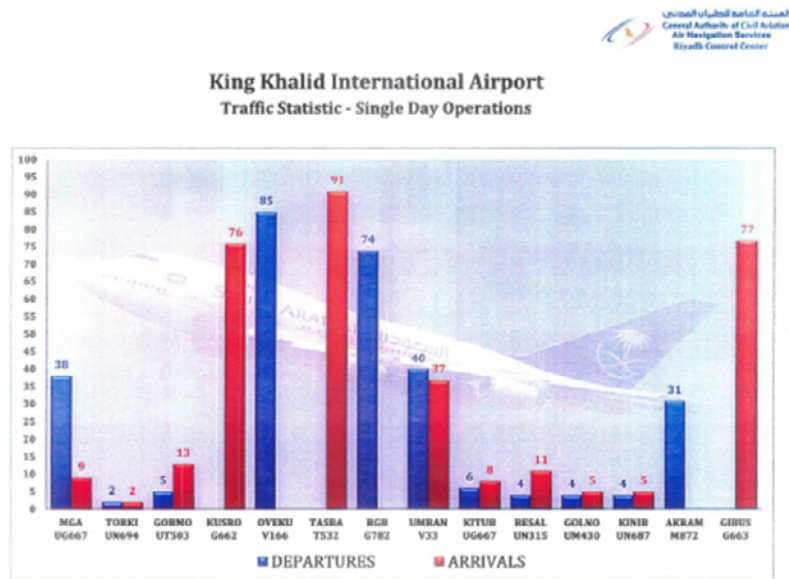
2016: Departures and Arrival Gates:

- a. RESAL Remains on AWY or Flag out of the Area Arrival /Departure.
- b. Arrival and Departure at KOBOX are time restricted.
- c. TAKTI Bidirectional.
- d. ETBAS Departure Only.
- e. ALTAV Arrival Only.
- f. ESRAT Departure Only.
- g. MURLU Bidirectional.
- h. METNI Bidirectional.
- i. VELOS Arrival Only.
- j. IVONU Departure Only.
- k. KAVUR Arrival Only.
- l. DURMA Departure Only.
- m. TEVOG Bidirectional.
- n. MUNTO Bidirectional.



Status of Implementation

Static Scenario – Before first conceptual design



Traffic Statistics Single Day

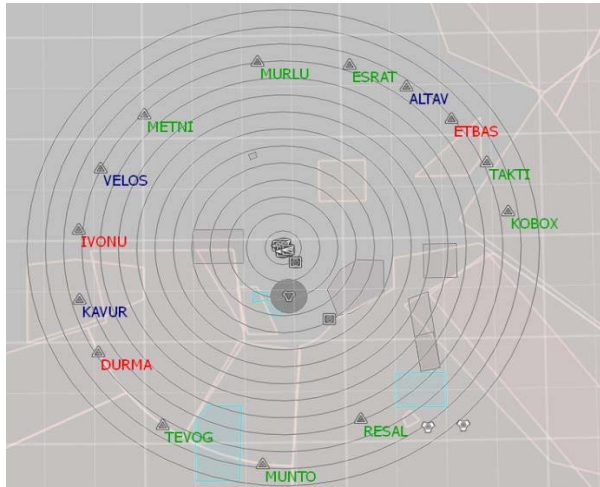


Arrival And Departure Traffic for one day

Traffic Flown analysis has been considered in order to optimize the fuel consumption for SID and STARs and increase the capacity of Riyadh TMA

Status of Implementation

Merge Point Solution – First Conceptual Design Proposal



Traffic Flow analysis has been done in order to design Merge Point solution for Riyadh TMA (see below).

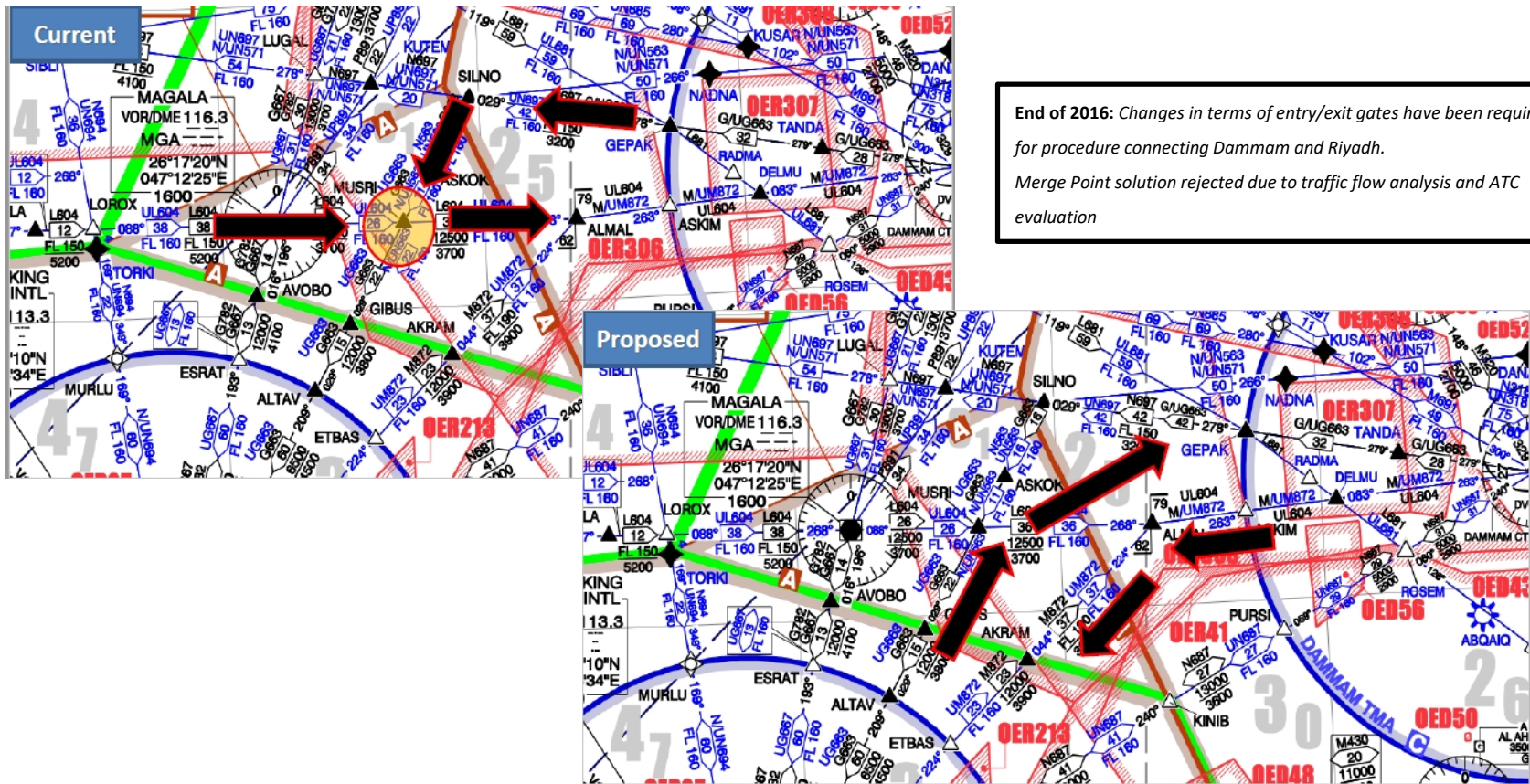
TMA has been modified in according to the picture reported on the left side (green points are low traffic gates, red points are high traffic flow, blue points are considered as critical)

Direct entry for ALTAV, KAVUR and VELOS due to traffic flow analysis (fuel saving)



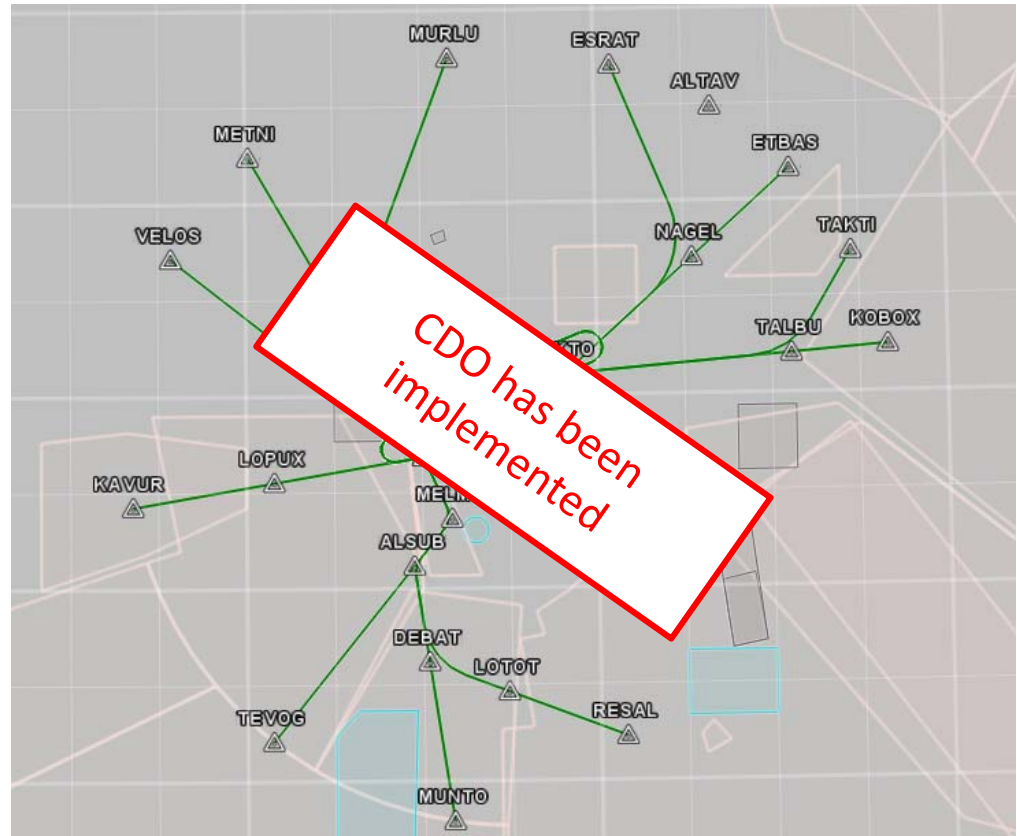
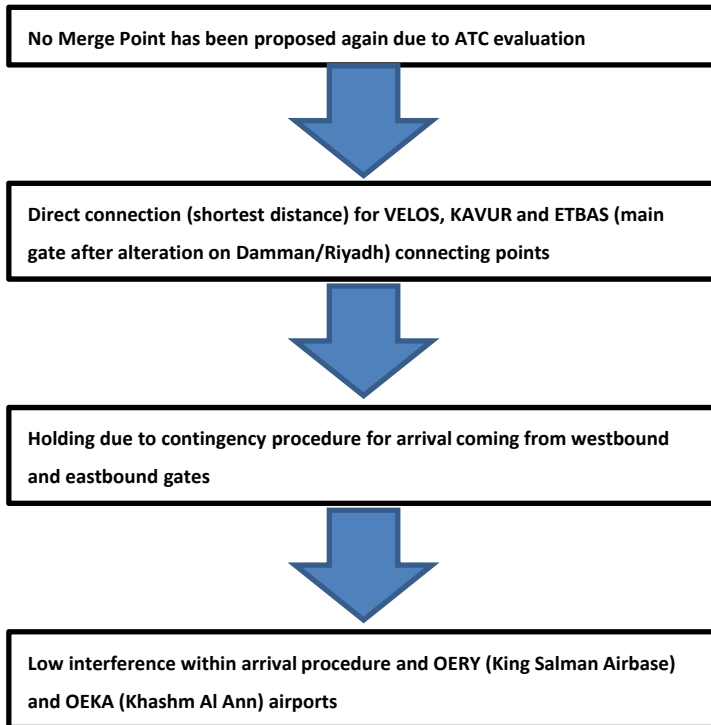
Status of Implementation

Merge Point Solution – First Conceptual Design Alteration



Status of Implementation

Second Conceptual Design Proposal



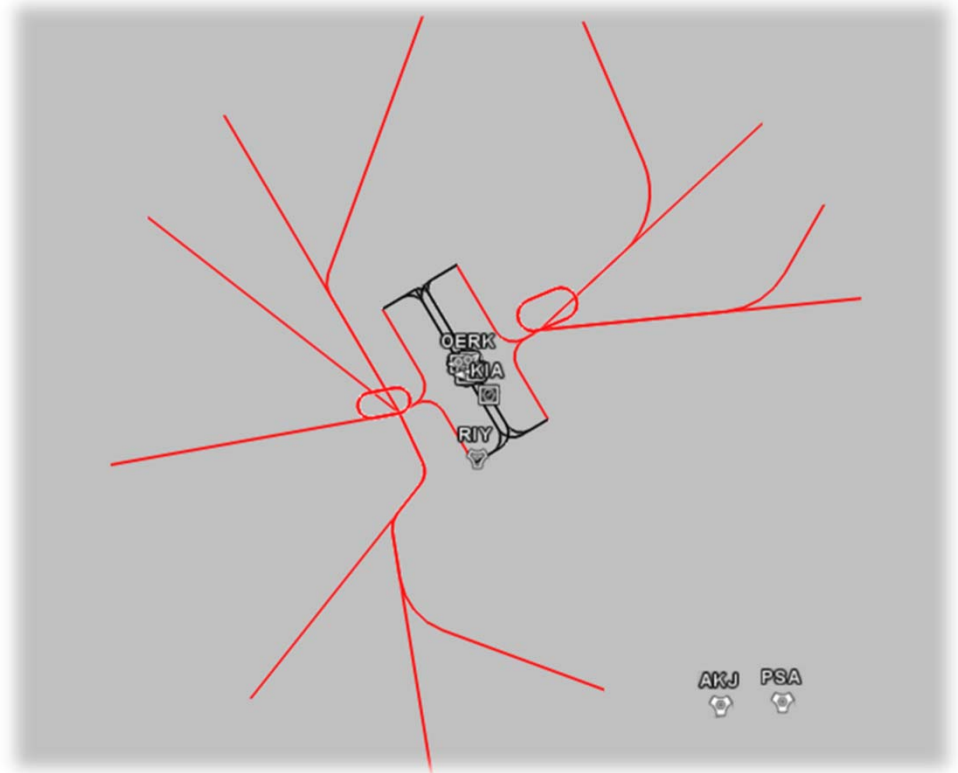
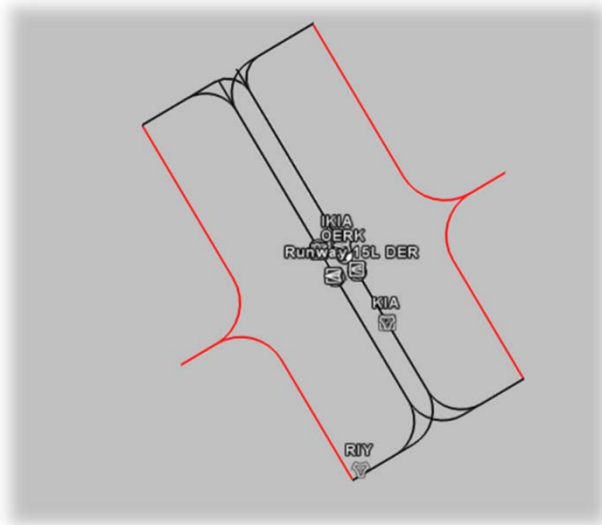
Status of Implementation

Second Conceptual Design Proposal

T-Bar concept RNAV (GNSS) implementation for OERK Approach procedures

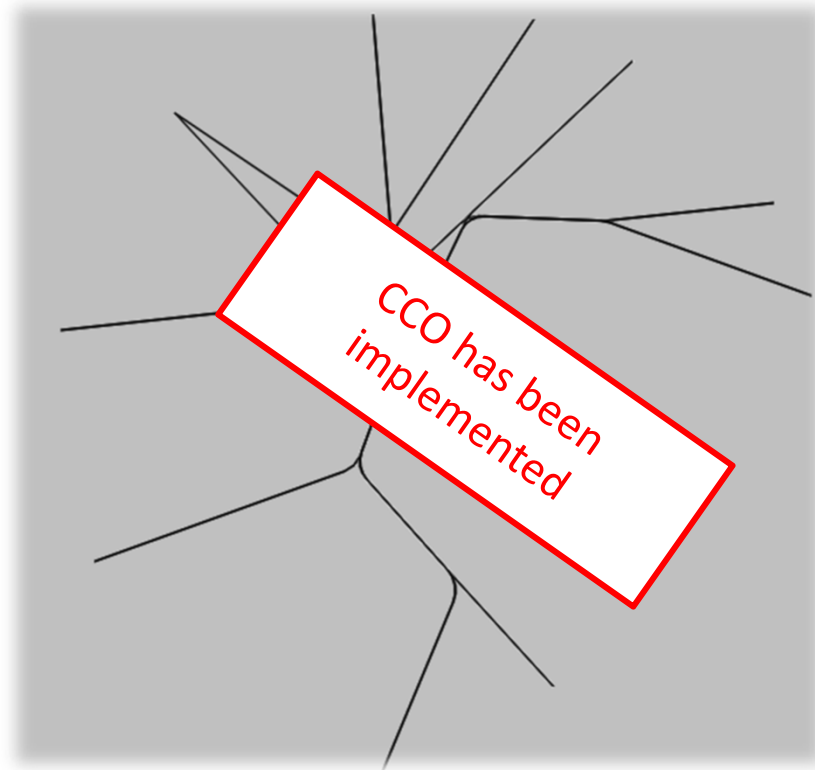
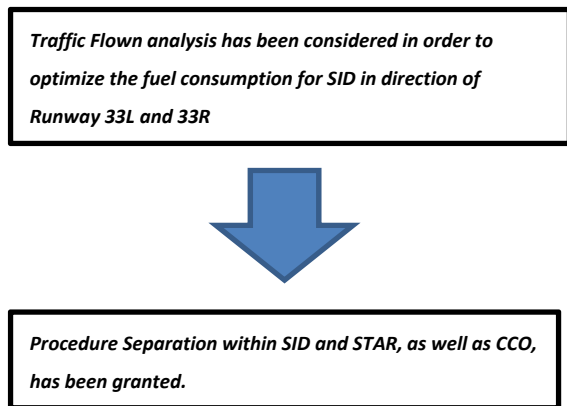


RNAV Transition in order to link RNAV STAR with RNAV (GNSS) IAP for OERK



Status of Implementation

Second Conceptual Design Proposal



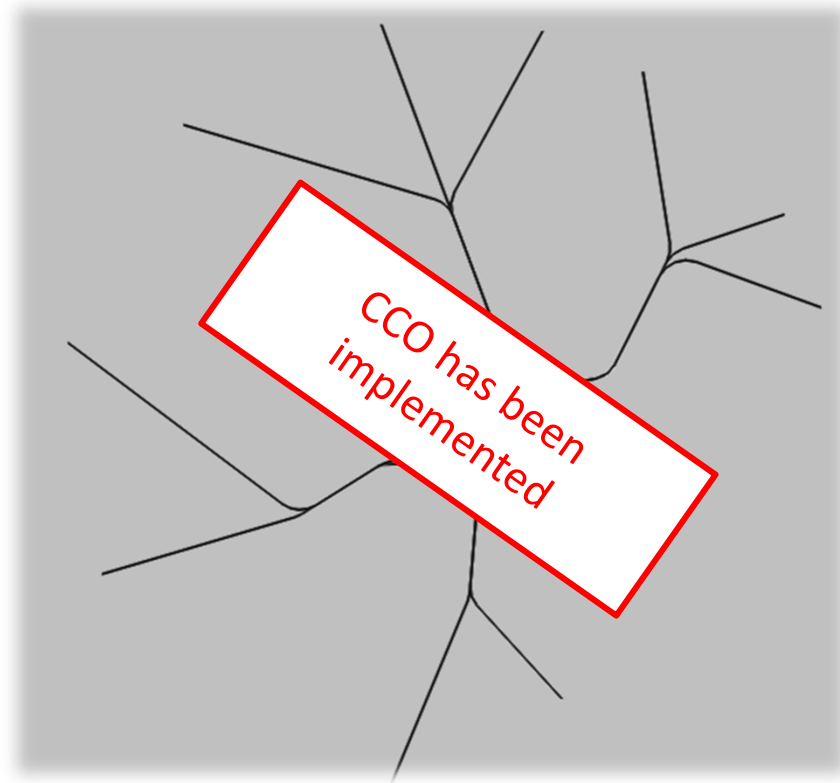
Status of Implementation

Second Conceptual Design Proposal

Traffic Flown analysis has been considered in order to optimize the fuel consumption for SID in direction of Runway 15L and 15R

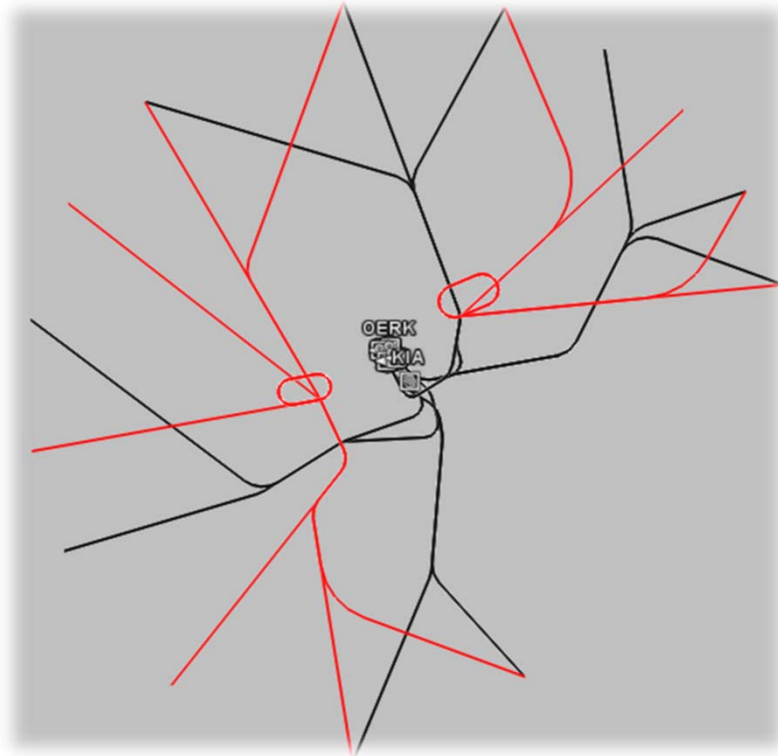


Procedure Separation within SID and STAR, as well as CCO, has been granted.

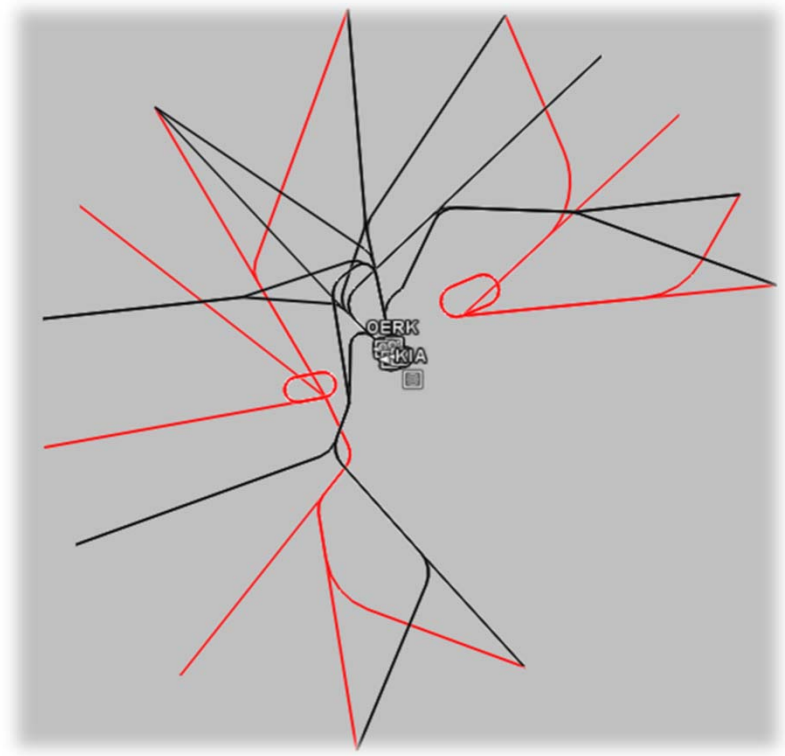


Status of Implementation

Second Conceptual Design Proposal

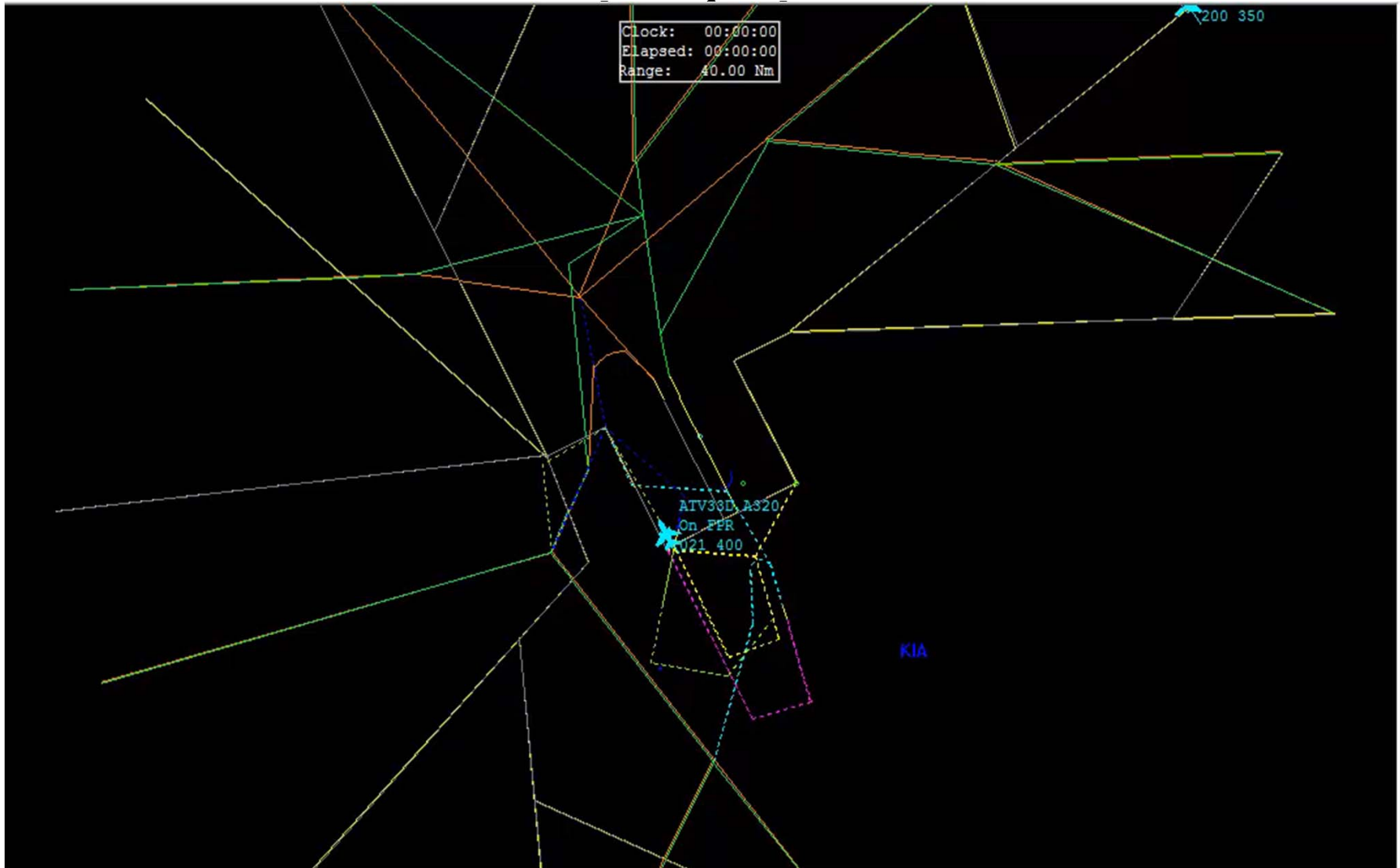


Runway 15L and 15 R Departure and Arrival operations

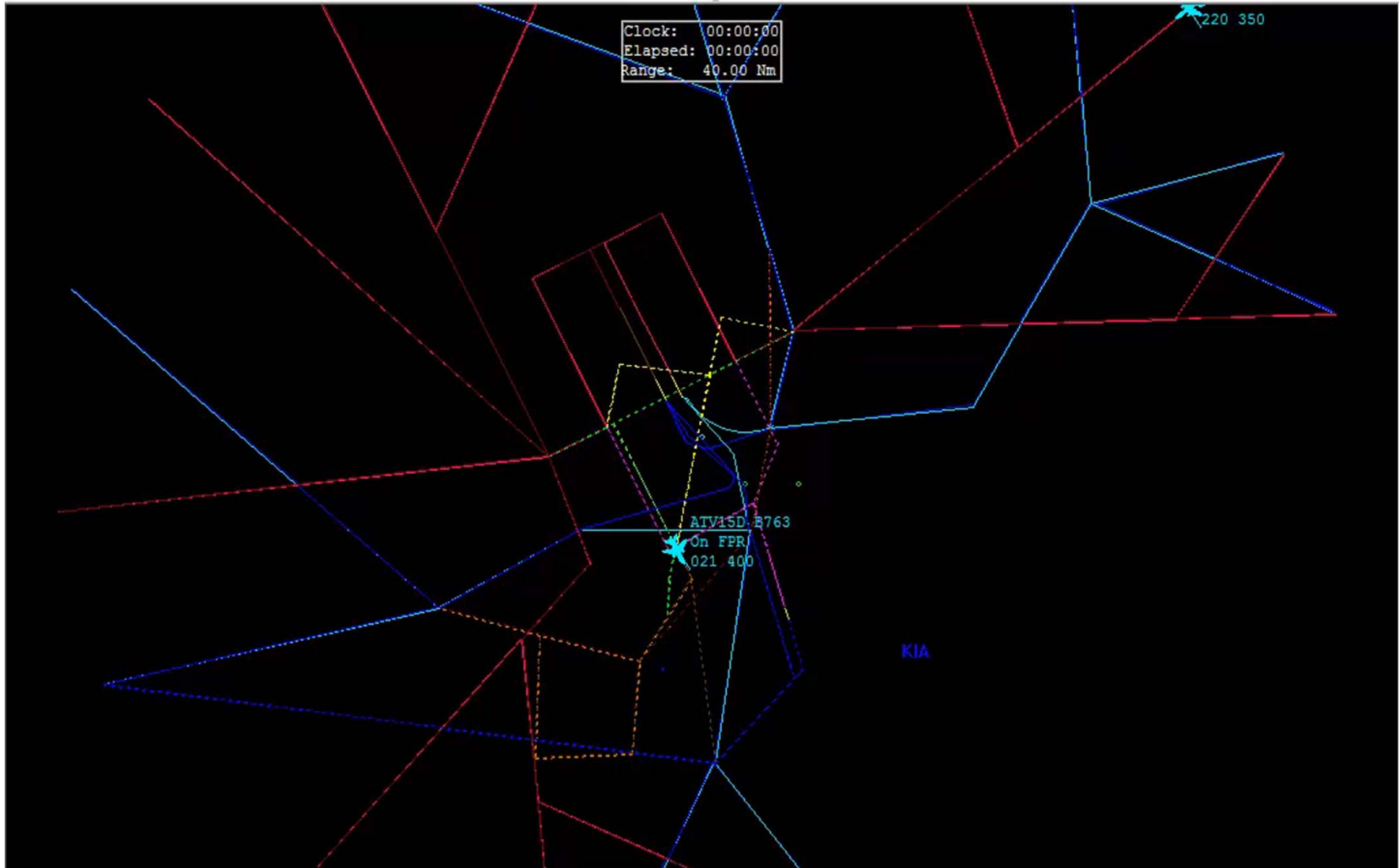


Runway 33L and 33R Departure and Arrival operations

Status of Implementation



Status of Implementation



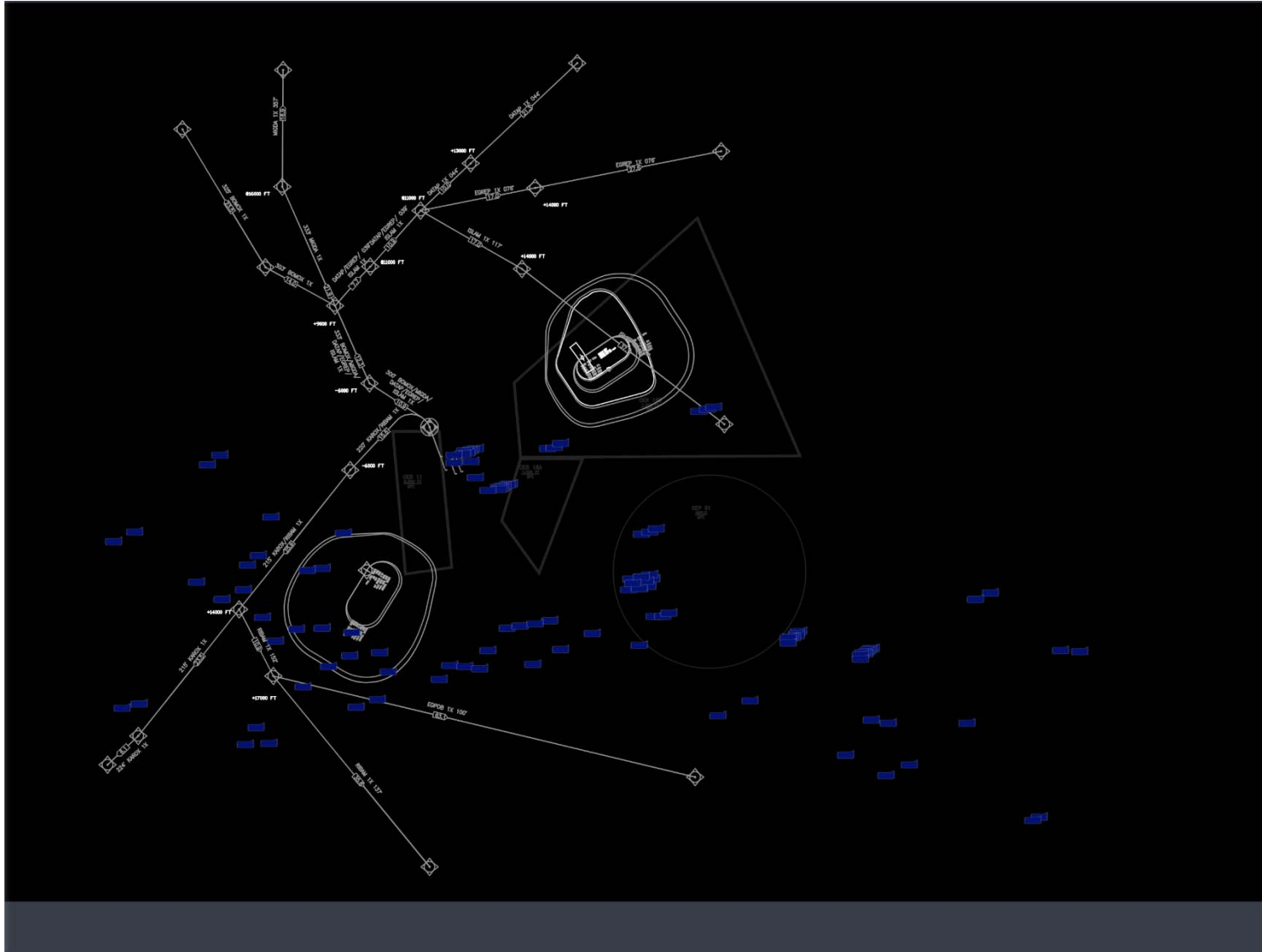
PBN SG/3 Cairo, Egypt, 11-13 February 2018

Status of Implementation

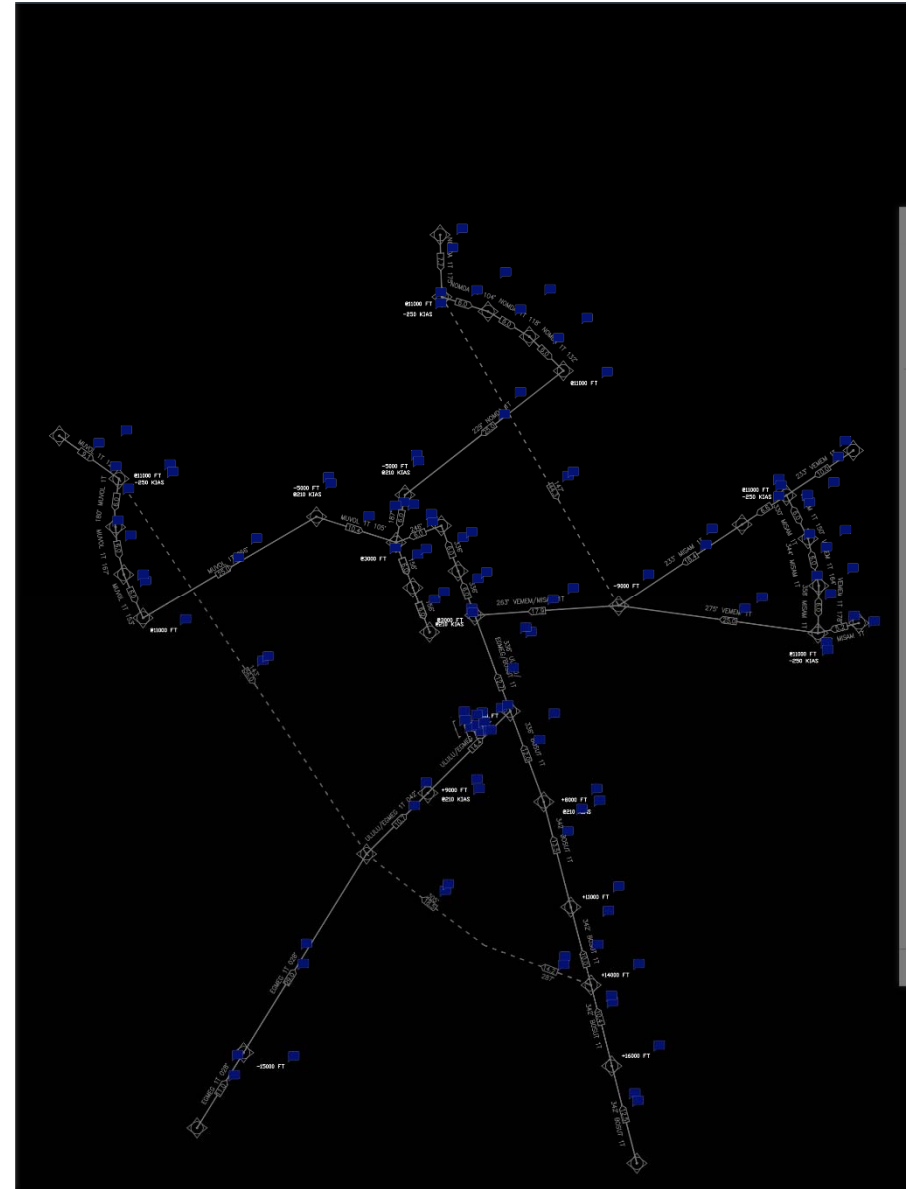
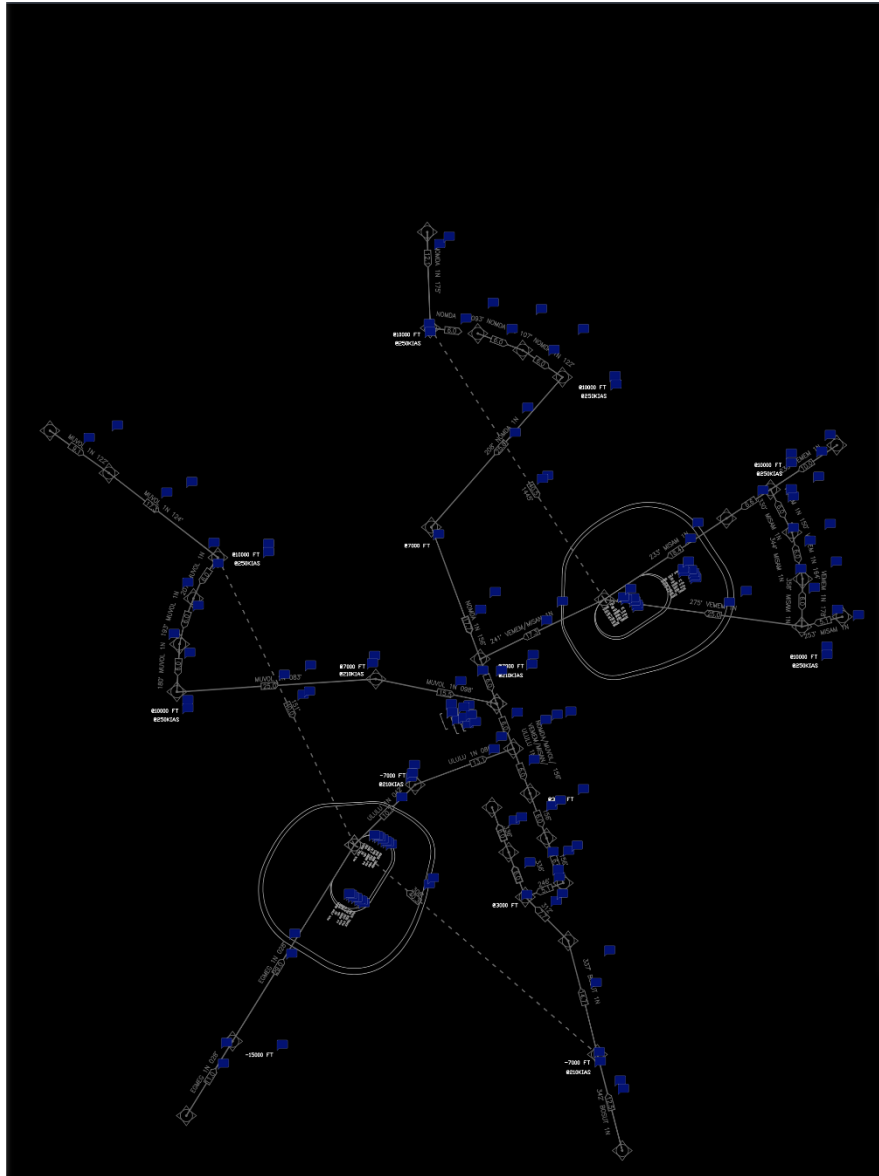
Jeddah / King Abdulaziz International Airport

PBN Implementation Mid 2018

Status of Implementation



Status of Implementation



Status of Implementation

Overview:

- New GACA Regulations Part 172 available on GACA Website
- IFPs provider to be certified by GACA (national or external provider)
- Flight validation provider to be certified by GACA
- IFPs Design Section within SANS
- PANS-OPS Inspectorate within GACA
- Audit program to certify SANS/IFPs during 2018
- Chief designer already certified by GACA responsible of the IFP and of the designers qualification's
- New project of Airspace concept on going
- eTOD survey project on going
- Update survey data every 5 years (regulations)
- Design Automation tools updated to the latest amendment of ICAO Doc 8168
- Link and exchange between AIM database, eTOD database and Design automation tools (FPDAM) based on XML files
- Regular trainings and refreshments

Post assessment of PBN Implementation and lessons learned

- Simulation and coordination with ATCO and stakeholder before implementation (Do not rush)
- PBN implementation for near airports at the same time is recommended
- Get feed back from users after implementation
- Review IFPs after feed back from users
- Use automation tools, digital data, eTOD and minimize human calculations
- Involve Regulator from the beginning (conceptual design)
- Must ensure total operation is safe
- Needs to understand/consider all elements (Aircraft capability, operations, planning, training, ATCO, Crew, etc.)
- Establish regulatory framework / national advisory material
- Establish approval process and issue Approval and validation procedures

Challenges

- Establishing priorities
- Establishing requirements for airspace redesign projects
- Performing a good coordination plan between stakeholders (to not design and publish IFPs or routes not needed)
- Developing and performing a follow-up and inspections
- Ensuring that PBN is environment-friendly
- Improving safety and increasing airspace capacity

Thoughts/Recommendations

- Establish interactive coordination between stakeholders and plan for the priorities
- Separate regulator and IFP provider and establish audit, approval and certification process
- Safety Risk assessment must consider all factors including traffic density, airspace complexity, ATS route structure, Type of aircraft ,ATCO requirements, Noise and any safety-significant before implementation of PBN
- Accurate data and obstacle survey are necessary
- Reconsider DME/DME coverage

Thank you