Think the solution, experience the change
Think the solution, experience the change

RNP AR Approach Design
Don-Jacques OULD FERHAT, Head of Operations

EASA October 20th 2010 RNP AR WORK SHOP
AGENDA

- Airbus PBN services subsidiary
- Implementing a RNP AR project
- Conclusion
• Quovadis is a 100% AIRBUS Subsidiary providing a simple and full range of PBN services
• Quovadis approved by FAA to provide RNP SAAAR Consultancy Services

Project Setup & New Procedure Design

I. Cost/Benefit Analysis
II. Data Survey
III. FOSA
IV. Procedure Design
V. Procedure Testing & Validation
VI. OPS application Package & Support
VII. Upgrade Coordination
VIII. Procedure Update

RNP AR Operations

IX. Training
X. GPS Prediction
XI. RNP Monitoring
XII. Nav database validation

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Design Criteria

- RNP AR stands for Authorization Required (ICAO wording)

- A RNP AR procedure has one of the following characteristics:
  - Reduced RNP values lower than 0.3 NM in approach (down to 0.1 NM) or lower than 1 NM (down to 0.1 NM) in missed approach and/or departure
  - Curved flight path after FAF (RF legs)

*Vertical Error Budget
Design Criteria

• QUOVADIS uses the following documents as reference:

  • ICAO Doc 8168-OPS/611: Procedures for Air Navigation Services – Air Operations (PANS-OPS)

• No standard existing for Departures

• QUOVADIS Design Criteria used when needed
Working together
Implementing a RNP AR project

Typical Schedule

- Pre-Design Optimization
- Pre-Design acceptance
- Detailed design Performance Optimization
- Navigation Database Coding
- Procedure Testing & Validation
- RNP Operations

- Data Collection
- Pre-study
- Kick-Off Meeting
- Detailed design frozen
- Procedure Validation simulator and/or flight
- Technical Report

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The PBN services Company by Airbus
Implementing a RNP AR project

QUOVADIS follows the Eurocontrol Guidelines

- Flight Crew Operations
- Aircraft Performance
- Navigation Services
- Infrastructure
- Aircraft Failures
- Operating Conditions
- ATC Operations

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DATA SURVEY

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CONCEPTUAL DESIGN

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DETAILED DESIGN

INSTRUMENT APPROACH
ALT AD: 14022, THR ELEV: 13992

A319-115

Tower: 118.1 (130.0)
Minimum Temperature: -25°C

Missed Approach

Missed Approach

Climb to 18400 ft (5598 m), via the RNAV RNP missed approach to AL986 for a new approach RWY 15
- Or, proceed to AL877 for approach RWY 33
- Or, climb to MSA for diversion.

Do not exceed 250 kt until AL870, then do not exceed 220 kt until AL870, then do not exceed 250 kt until AL822, then do not exceed 220 kt until AL680.

APPROACH
- Verify EPE does not exceed RNP
- Approach not authorized when airport temperature below -25°C.
- Landing is not allowed for QNH below 995 hPa.

REQUIRED EQUIPMENT
FMGC (2)
MCU (2)
FD (2)
EFIS DU (2)
L/DEV (2)
V/DEV (2)
RNP P/B (1)
GPS (2)
IRS (3)
FCU (2)
EGPWS

FMC
- Set GA THR RED / ACC 15500/17000
EO ACC - see RTOW

NOT FOR OPERATIONAL USE
This procedure needs flight check before operational approval.
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FINAL RESULT

- RNP AR only airport with low minima (DH 280ft)
- Enhanced safety with a fully stabilized and managed approach
- Escape maneuvers

ALI, RNP AR APPROACH RWY 15
Challenging Airport (14,000ft)
And now in operations ....
Implementing a RNP AR project

Panzhihua Airport
Implementing RNP AR

ZUZH Approach RWY 02

INSTRUMENT APPROACH

ALT AD: 6492, THR ELEV: 6480

Tower 118.35 (118.8)

Minimum Temperature -4°C

Procedure GP (2.8°) and PAPI (3°) are not coincidental

Missed Approach

Climb to 11000 ft (3300 m), via the RNAV RNP missed approach to ZH655 and hold.

Do not exceed 165 kts until ZH442.

Do not exceed 230 kts between ZH442 and ZH518.

AUTHORIZED REQUIRED

APPROACH

- Verify EPE does not exceed RNP
- Approach not authorized when airport temperature below -4°C.

REQUIRED EQUIPMENT

FMGC (2)

MCDU (2)

FD (2)

EFIS DU (2)

U/DEV (2)

V/DEV (2)

RNP P/B (1)

GPS (2)

IRS (3)

FCU (2)

EGPWS

FMC

- Deselect PAN VOR
- Set GA THR RED / ACC XXXX/XXXX

ED ACC - see RTOW

SPECIFIC PROCEDURES

- Landing in CONF 3
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VALIDATION

Need to use a representative aircraft configuration for testing
When using RNP value below the RNP_{non normal} in the ACD → Failure cases to be run in an engineering simulator.
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Not Always in a Challenging Environment

- Gothenburg Landvetter Airport
- QUOVADIS is involved in VINGA project
  - Provides support to procedure design and validation
  - Leads the RNP to ILS trial
CONCLUSION

RNP AR BENEFITS

Operations Efficiency
- Increased Airport Access (curved and contained trajectories, Lower minima)
- Increased Performance (TOW)

Environment
- Fuel & Emissions Reduction
- Noise Reduction

Safety
- Reduced CFIT (Control Flight Into Terrain) risk compared to visual approach
- Stabilized approach with constant descent final angle
CONCLUSION

Modern Aircraft fitted with a dual GNSS configuration are already capable of flying RNP AR.

Regulations now exist at ICAO, FAA and EASA.

More and more airlines and countries all over the world are taking credit of these benefits.

Implementing a successful RNP AR project require many stakeholders and various skills.
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