

#### SHAPING OUR FUTURE SKIES

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### TERMINAL AIRSPACE REDESIGN IN THE CURAÇAO FIR II

PBN implementation and benefits

**Thursday 8 December 2022** 

In coordination with





### **Concept of Operations**

#### **Design guidelines for PBN procedures**

- Routes based on actual tracks : direct route to the IAF or FIR exit point
  - Shorter routes
  - More predictable
- Overlay conventional procedures when designing PBN procedures: transparent for ATC
  - Transparent operation for ATC
  - Consistency
- Support Continuous Climb / Descent Operations
  - Optimized vertical profile
  - Nuisance (noise and emissions) reduced









**STAR RWY 11 (2018)** 





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### **ICAO IFP/FPD process**

- Does this process work?
- Is this process optimized?
- Can you achieve full benefits with this process?
- How does this standard IFP process ensure that your concept of operations work?

In our experience, with these standard processes, the conceptual part (ConOps, conceptual flight procedure

design, etc.) are often overlooked as people are typically more worried about ticking the boxes for all the steps and

being ICAO compliant than assessing the (expected/desired) operational concept.







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### **Cooperative and pragmatic approach**













### **Cooperative and pragmatic approach**

Data acquisition: data analysis and requirements







### One size fits all ?

## One design DOES NOT fit all airspaces

TAILOR YOUR PROCEDURES TO YOUR NEEDS!

HOW?

### **Balanced approach: MMP**



- Your requirements (e.g. ATCos) may not be supported by your systems → Procedures needed to balance the human requirements and the systems capabilities.
- Your procedures and systems may no longer support your team's requirements.

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#### FIND THE OPTIMAL BALANCE

The better the system support, the less the requirements on men





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### **Cooperative approach**



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Airport Operator

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### Lessons learnt

✓ Work together

✓ Involve stakeholders in the development as soon as possible

✓ Flight procedures shall facilitate traffic management by ATC









### Implementation

### **Strategic deconfliction**

#### **Applied in the three islands**

- Main traffic flow comes from the North
- Outside the CTRs:
  - Vertical separation
- Within the CTRs:
  - Strategic deconfliction of SIDs and STARs: Arrivals and departures are geographically separated (45° sector)
  - North/South procedures are laterally separated (RNAV 1  $\rightarrow$  7NM)
- Flight procedures are deconflicted by design



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An Airspace Concept containing an extensive PBN route structure with lateral and vertical strategic de-confliction envisages minimal tactical intervention by the controller

 $\rightarrow$  the benefit provided by PBN can be maximized.

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### **Full deployment at TNCA**



### **Outcome of the implementation**







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#### **Route improvement**

- Opportunity to solve, thanks to the flexibility of PBN, current issues / operational challenges.
- Opportunity to optimize instrument flight procedures (conventional SIDs were also redesigned to meet the new operational requirements).
- Opportunity to overlay conventional and PBN procedures:
  - One unique set of procedures for the air traffic controller
  - Transparent operation

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- Less training required (initial- and recurrent training)
- Minimum number of conventional procedures



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#### Factors contributing to a workload reduction

#### **Pilots**

- Optimized FMS support
- Optimized CCO/CDO profile
- Increased predictability
- Increased situational awareness
- Less tactical interventions
- Less R/T required
- Fuel and CO<sub>2</sub> savings (CCO/CDO + track miles)
- Harmonization of PBN requirements with other countries (fleet equipment investment costs)

#### ATCos

- Traffic deconflicted by design
- Less tactical intervention
- Less vectoring
- Less R/T
- One unique set of procedures to remember (conventional and PBN procedures overlay)
- Less training required







#### **ATCo Deployment**

- With the new airspace structure, the frequency of sector splits is reduced leading to a more efficient ATCo deployment.
- The amount of time in which the three different positions are opened is reduced.
- With a clearer distinction of the tasks and areas of responsibilities for ATC, the ATCos can focus on their core tasks.
- Previous area and approach controllers have both been trained for the area and terminal control, making them exchangeable, improving roster efficiency.









#### Fuel and emissions savings – CCO/CDO implementation

- On average, each departure flown as CCO saves 119 kg of fuel and 376 kg of CO<sub>2</sub>
  - For an airport with 15.000 take-offs per year & assuming that only 10% are flown as a CCO: the fuel and emission savings would increase up to 178,5 t of fuel and 564 t of CO<sub>2</sub>
  - By increasing the rate to 50%, the yearly fuel and emission savings would increase to 892,5 t of fuel and 2820 t of CO<sub>2</sub>
- On average, each arrival flown as CDO saves 70kg of fuel and 221 kg of CO<sub>2</sub>
  - For an airport with 15.000 landings per year & assuming that only 10% are flown as a CDO: the fuel and emission savings would increase up to **105 t of fuel** and **332 t of CO<sub>2</sub>**
  - By increasing the rate to 50%, the yearly fuel and emission savings would increase to 525 t of fuel and 1659 t of CO<sub>2</sub>

In the meantime, enhancing operational efficiency by improving the vertical flight efficiency (CDO/CCO) is the easiest manner in which ATM can contribute to reducing fuel and CO2 emissions

"Net Zero emissions in aviation will only be achievable through the introduction of new aircraft types (powered by electricity or hydrogen) and the widespread availability and adoption of Sustainable Aviation Fuel (SAF). Both of these will take many years to have a major effect." (EUROCONTROL)



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#### Fuel and emissions savings – track miles

- On average, a track reduction of 1 NM saves up to 7,5kg of fuel and 23,6 kg of  $CO_2$ .
- Track extension can be caused by ATC tactical intervention or suboptimal routes (longer than necessary).
- When track miles of fairly efficient routes are reduced by **3-5 NM**, considering the number of aircraft flying the procedure every day, the amount of track miles saved per year and, therefore, fuel and CO<sub>2</sub> savings, are considerably.
  - Considering an airline that operates three times per week with only one flight per day, the average yearly fuel saving would be 4,6 t of fuel and 14,7 t of CO<sub>2</sub> only in that route operated by that airline!
- When redesigning conventional STARs to implement PBN arrival routes, the reduction in track miles was of the order of **10-60 NM** 
  - Considering an airline that operates three times per week with only one flight per day, the average yearly fuel saving after implementing PBN procedures (track miles reduction = 30 NM) would be 34,9 t of fuel and 110,4 t of CO<sub>2</sub> only in that route operated by that airline!







#### **Fuel savings per flight**









### **PBN: the biggest takeaway**

- PBN is a means to make your routes independent from the ground NAVaids.
- It is a powerful tool to improve and optimize your concept of operations.
- If you are considering implementing PBN flight procedures: avoid implementing PBN just because it is mandated but make use of that opportunity to optimize and solve some existing issues.









### **QUESTIONS AND ANSWERS**









#### If you would like to know more, please contact us:





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Experts in air traffic management

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### THANK YOU



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