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Mexico City, Mexico, 22 – 25 April 2019

Agenda Item 4: ATM Situation Analysis in the CAR Region

ANALYSIS OF THE NAVIGATION SPECIFICATION TRANSITION ALONG THE TTZP/TJZS FIR BOUNDARY

(Presented by Trinidad and Tobago and United States)

| EXECUTIVE SUMMARY | |
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| This working paper presents a brief history on the regional implementation of Navigation Specifications (Nav Specs) in the CAR Region and along the Piarco (TTZP)/San Juan (TJZS) Flight Information Region (FIR) boundary. It explains why there is a discrepancy between the applications of different Nav Specs on each side of the boundary and presents evidence that the discrepancy is not a safety hazard. Finally, it calls for States and ICAO to augment efforts to promote awareness of regional Nav Specs through the modification of regional and State documents. | |
| Action: | Suggested actions are included in Section 4 |
| Strategic Objectives: | <ul style="list-style-type: none">• Safety• Air Navigation Capacity and Efficiency• Environmental Protection |
| References: | <ul style="list-style-type: none">• ICAO Doc 9613 – <i>Performance-based Navigation (PBN) Manual</i>• ICAO Doc 7030 – <i>Regional Supplementary Procedures</i>• Volume II of the Regional Air Navigation Plan• States' Aeronautical Information Publications (AIPs)• Workshop on Regional Implementation on Performance-Based Navigation PBN Airspace Redesign for the CAR Region, Mexico City, Mexico, 4 to 8 May 2015 Summary of Discussion• ICAO/IATA/CANSO Performance-Based Navigation (PBN) Harmonization, Modernization and Implementation Meeting for the North American, Caribbean and South American (NAM/CAR/SAM) Regions Mexico City, Mexico, from 2 to 6 July 2018 |

1. Introduction

1.1 During the Workshop on Regional Implementation on Performance-Based Navigation PBN Airspace Redesign for the CAR Region (Mexico City, Mexico, 4 to 8 May 2015), States were told that PBN Airspace Redesign Projects should focus on Area Navigation (RNAV) route implementation. States

were advised to realign, delete and/or implement RNAV routes in the upper airspace based on RNAV 5 navigation specification. This realignment and/or implementation of new RNAV routes in the interface of the upper airspace between the NAM/CAR/SAM were based on three representing traffic flows between North and South America:

- North America – Central America – South America
- North America – Central Caribbean – South America
- North America – Eastern Caribbean – South America

1.2 However, the same Summary of Discussion also stated that “PBN Airspace Redesign Projects should be focused on Area Navigation (RNAV) route implementation (...) criteria, [with the use of] RNAV 10 or RNP 4 for Oceanic airspace, as required”.

1.3 As a result, Trinidad and Tobago implemented three (3) new RNAV 5 routes on 17 August 2017 as agreed to by the ICAO NACC Regional Office. The routes are as follows:

- UL452
- UL462
- UL576

1.4 Additionally, UL776 was realigned for the 17 August 2017 deadline.

1.5 During the Third ICAO/IATA/CANSO Performance-Based Navigation (PBN) Harmonization, Modernization and Implementation Meeting for the NAM/CAR/SAM Regions, held in Mexico City, Mexico, from 2 to 6 July 2018, the Meeting agreed to implement numerous PBN Air Traffic Service (ATS) Routes with an effective date of 31 January 2019. At the time, the belief among each of the represented Air Navigation Service Providers (ANSPs) was that each new route would be implemented with a minimum navigation specification of RNAV 5. After the close of that meeting however, as implementation efforts were well underway in each ANSP, the Federal Aviation Administration (FAA) representative to that meeting discovered the FAA did not in fact support RNAV 5 Navigation Specification in any segment of the National Airspace System (NAS). The FAA then conducted an analysis to determine how this misunderstanding occurred and coordinated with Trinidad and Tobago to determine if the navigation specification discrepancy along its Flight Information Region (FIR) boundary represented a hazard to air navigation. The details of this analysis and the resulting determination are presented herein.

2. Discussion

2.1 The discrepancy between RNAV specifications along complimentary ATS routes (e.g. L329 and UL329 or L452 and UL452) on each side of the FIR boundary between the upper airspaces of the San Juan FIR (TJZS) and the Piarco FIR (TTZP) originates from false assumptions and the classification given to each sector within those FIRs.

AIRSPACE UNDER DISCUSSION



2.2 The FAA's airspace in the San Juan FIR, Miami Oceanic FIR, Houston Oceanic FIR, the oceanic portion of the Gulf of Mexico in the Mexico FIR, and the Western Atlantic Route System (WATRS) may apply separation minima requiring RNAV 10 as defined in ICAO's Regional Supplementary Procedures (See 4.1.1.1.1 of Doc 7030) since 2008. The FAA, looking at the region from the perspective of a continental landmass, assumed island States to its South would consider their respective airspaces as "Oceanic" in their entirety. The FAA therefore, made the assumption that in accordance with ICAO's PBN Manual (Doc 9613); all States in the region would be adhering to the same Nav Spec for route implementation.

Guidance Material Contained in ICAO Doc 9613

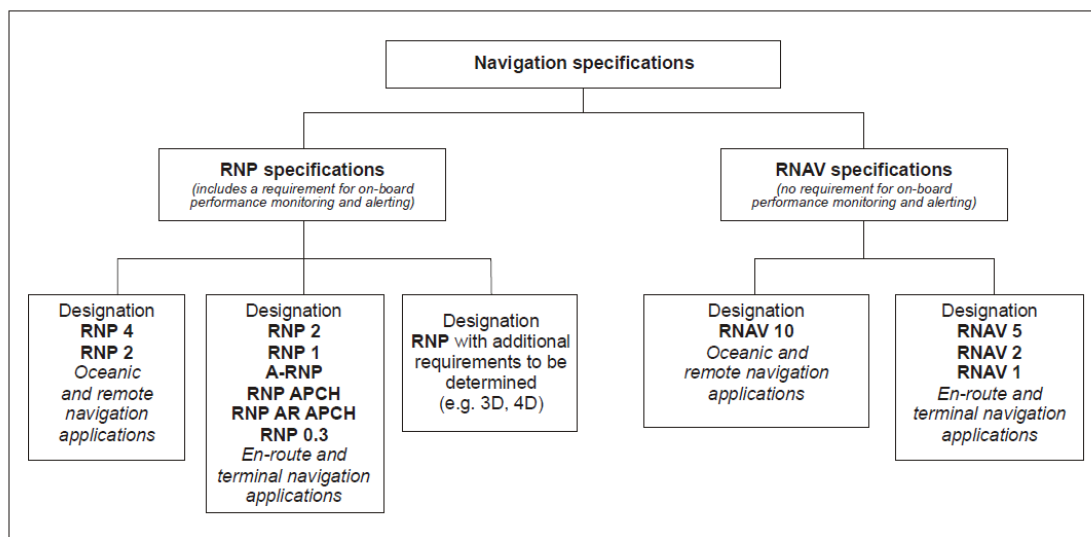


Figure I-A-1-3. Navigation specification designations

Table II-A-1-1. Application of navigation specification by flight phase

| Part Chapter | Navigation specification | Flight phase | | | | | | | |
|-----------------|--------------------------------------|----------------------------|-------------------------|---------|----------|--------------|------------------|---------------------|-----|
| | | En-route oceanic/remote | En-route continental | Arrival | Approach | | | | DEP |
| | | | | | Initial | Intermediate | Final | Missed ¹ | |
| B, Ch.1 | RNAV 10 | 10 | | | | | | | |
| B, Ch.2 | RNAV 5 ² | | 5 | 5 | | | | | |
| B, Ch.3 | RNAV 2 | | 2 | 2 | | | | | 2 |
| B, Ch.3 | RNAV 1 | | 1 | 1 | 1 | 1 | | 1 | 1 |
| C, Ch.1 | RNP 4 | 4 | | | | | | | |
| C, Ch.2 | RNP 2 | 2 | 2 | | | | | | |
| C, Ch.3 | RNP 1 ³ | | | 1 | 1 | 1 | | 1 | 1 |
| C, Ch.4 | Advanced RNP (A-RNP) ⁴ | 2 ⁵ | 2 or 1 | 1 | 1 | 1 | 0.3 | 1 | 1 |
| C, Ch.5 | RNP APCH ⁶ | | | | 1 | 1 | 0.3 ⁷ | 1 | |
| C, Ch.6 | RNP AR APCH | | | | 1-0.1 | 1-0.1 | 0.3-0.1 | 1-0.1 | |
| C, Ch.7 | RNP 0.3 ⁸ | | 0.3 | 0.3 | 0.3 | 0.3 | | 0.3 | 0.3 |

Notes:

1. Only applies once 50 m (40 m, Cat H) obstacle clearance has been achieved after the start of climb.
2. RNAV 5 is an en-route navigation specification which may be used for the initial part of a STAR outside 30 NM and above MSA.
3. The RNP 1 specification is limited to use on STARs, SIDs, the initial and intermediate segments of IAPs and the missed approach after the initial climb phase. Beyond 30 NM from the ARP, the accuracy value for alerting becomes 2 NM.

2.3 As the FAA realised through its analysis, that assumption proved to be false. In reality, airspaces are comprised of sectors, and the classification attributed to those sectors is determined by the ANSPs managing them. As can be seen in the image below, in the Piarco FIR, the airspace west of 57° Longitude is classified as “Continental”.

2.4 Piarco has applied RNAV 5 Nav Spec for the routes in its continental airspace. The separation implemented is 30NM lateral spacing between two RNAV 5 routes as Piarco has direct VHF controller/pilot voice communications with ATS surveillance. This separation can also be applied in the absence of ATS surveillance.

2.5 The separation between routes with PBN specification was applied according to what is described in the following table:

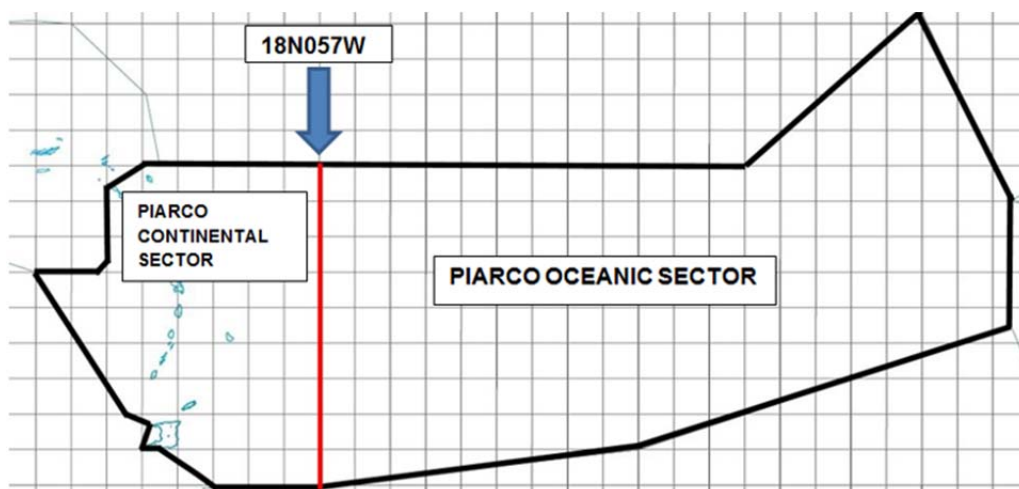
| Navigation Specification | Separation Minima | Communication | Surveillance | Remarks |
|--------------------------|-------------------|---|----------------------|--|
| RNAV 5 | 30NM | Direct VHF between pilot and controller | Without surveillance | High density of traffic |
| | 18NM | | With surveillance | 18 NM for opposite-direction routes |
| | 16.5NM | | | 16.5 NM for same-direction routes |
| | 10NM | | | If the ATC capacity for intervention allows it |

References:

*Doc. 9613, Vol. II, Part B, Chapter 2, paragraph 2.2.3

**Doc. 4444, paragraph 5.4.1.2.1.6

2.6 This is similar to the FAA offshore airspace, in which the FAA provides surveillance and VHF voice direct-controller-pilot-communications along with domestic separation minima.



2.7 For its part, it appears the rest of the States in the region were making the same assumption that if they were applying “Continental” Nav Specs in their airspaces, then the FAA was doing the same.

2.8 After realising what happened, the FAA held numerous internal discussions among subject matter experts and determined that although the situation is not ideal, it does not represent a hazard to navigation for air traffic flowing in either direction. The FAA and Trinidad and Tobago Civil Aviation Authority (TTCAA) subsequently discussed the issue to determine if the disparity in Nav Spec for recently implemented routes at the FIR boundary resulted in unintended adverse consequences. The TTCAA indicated that based on internal analysis of traffic flows using the subject ATS routes at the FIR boundary, their conclusion was congruent with FAA’s analysis. As such, it was determined that the situation is workable and does not result in a hazard to navigation

2.9 Live trials of two of the new RNAV 5 routes (UL452 and UL776) were conducted between Piarco and San Juan during the midnight shift of July 9, 2016. A Risk analysis report was completed prior to these trials. During the live trials of the RNAV 5 routes, the Unit Chief ANS Safety Trinidad and Tobago Civil Aviation Authority (TTCAA) conducted a Safety Assessment of the Trial Operations within Piarco En-Route Continental Airspace.

2.10 On 10 July 2016, an email was received from Delta (DAL) and American Airlines (AAL) with information that they show potential savings in terms of time/fuel in the use of these routes. There were no reports from the other airlines.

2.11 In July 2017, prior to the implementation of new RNAV 5 routes in the Piarco continental sector on 17 August 2017, a teleconference was held between Piarco and the San Juan CERAP to discuss procedures NORTH/SOUTH of waypoint GEECE upon implementation of NAM/CAR/SAM new RNAV routes and RNAV Routes’ continuation in that FIR. The team in San Juan requested an agreement about the routes beyond the transfer points, for seamless flight operations. Dialogue was held on how aircraft would fly in San Juan’s airspace after position GEECE (UL776) and also with reference to position ANADA (UL452). During the teleconference, it was agreed that after position GEECE, traffic proceeding north and northeast would be routed DCT FERNA and for traffic proceeding northwest from GEECE DCT BQN into Miami’s airspace. This can be done bidirectional. San Juan also mentioned that airspace near ANADA and GEECE is still considered Oceanic airspace, because although there is radar coverage, there is an issue with radio communication coverage. San Juan advised that they use RNAV 10 lateral separation of 50NM for aircraft at the same level northbound at the Piarco/San Juan FIR boundary once the routes are diverging as the distance between ANADA and GEECE satisfies RNAV 10 requirements for aircraft at the same level.



2.12 Piarco advised that the RNAV 5 lateral separation of 30NM exists at the Piarco/San Juan FIR boundary southbound from ANADA and GEECE. Therefore, Piarco will accept traffic at the same level and time at these waypoints once they are routed on the RNAV 5 airways.

2.13 Aircraft equipage data was collected by Piarco to determine RNAV 5 and RNAV 10 capabilities of aircraft using its FIR. As of mid-2018, the data shows 95% RNAV 10 and 83% RNAV 5 capabilities.

2.14 The following flight plan example shows a flight from KMIA (Miami) to SBGR (Sao Paulo). As can be seen, the flight is both RNAV 10 which is A1 and RNAV 5 equipped which is B1. The flight transits from San Juan's FIR (L452) into Piarco's FIR (UL452).

(FPL-TAM8195-IS

-B77W/H-SDE2E3FGHIJ4J5M1RWXYZ/HB1D1

-KMIA1525

-N0489F310 SKIPS2 SKIPS Y290 BITAC/M083F330 Y290 HAGIT DCT

HARBG/N0493F330 L452 ANADA UL452 ACARI/N0490F350 UL452 BSI UZ6

NIMKI UZ38 MOXEP MOXEP1A

-SBGR0747 SBGL SBKP

-PBN/A1B1C1D1L1O2S1S2 DAT/1FANS DOF/190401 REG/PTMUC

EET/TJZS0126 TTZP0213 SVZM0303 SYGC0305 SMPM0342 SBAZ0405 SBBS0548 SBCW0741 SEL/FMCQ

CODE/E4818B OPR/TAM RIF/CHORD IRULI

SBBR RMK/TCAS PBN NO B6 PER/D

-A/WHITE RED BLUE E/0920 P/TBN D/8 380 ORANGE J/L R/UE S/MJ C/)

3. Conclusion

3.1 In conclusion, the FAA and the TTCAA agree there is no need to have identical Nav Spec applications for cross boundary routes. It is advisable however, that discussions taking place during the planning phase of new PBN ATS Routes should take into consideration the classification of the adjacent airspace sectors and the RNAV recommendation for each classification.

3.2 Aircraft operators need clear guidance on the navigation specification necessary for the separation minima being applied. It is also the responsibility of airline/aircraft operators to adhere to the Navigation Specifications required to operate on RNAV routes. Piarco prescribes the carriage of RNAV 5 on specific identified routes or for specific areas/flight levels of their airspace. The Eastern Caribbean AIP clearly indicates the navigation application is RNAV 5 utilizing the navaid infrastructure of GNSS and the navaid specification for these routes is RNAV 5.

3.3 Part 2 (EN ROUTE), Section 7.4 (Operational Policy 50NM Lateral Separation) of the FAA's AIP explains the operational procedures associated with RNAV (RNP) 10 and RNP 4 equipped and non-equipped aircraft in each of the airspaces along the FAA's southern boundary.

3.4 However, regional navigation specification information is not as accessible as it should be. Volume II of the CAR/SAM Air Navigation Plan lists the significant points and segments for all PBN ATS routes in the region but does not mention anything about the Nav Specs applied in the airspaces they transit or on the specific route details. Additionally, Chapter 4 of ICAO Doc. 7030 – CAR, has no information in section 4.1.1.2 (RNAV 5) which could be used to clarify regional Nav Spec applications.

4. Suggested Actions

4.1 The Meeting is invited to:

- a) discuss the scenario presented;
- b) agree that a RNAV 5 to RNAV 10 (Navigation Specification) transition at a FIR boundary does not constitute a safety hazard; and
- c) consider updating State AIPs, and ICAO Doc. 7030 – CAR or Volume II of the CAR/SAM Regional Air Navigation Plan to include relevant Nav Specification Information.