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Miami, United States, 26-28 July 2023

Agenda Item 4: Follow-up of the Activities of the NACC/WG Task Forces
4.1 Progress reports of the AIM, AGA, ATM, CNS, MET and SAR Committees

UPDATE ON PIARCO AIRSPACE OPTIMIZATION

(Presented by Trinidad and Tobago)

| EXECUTIVE SUMMARY | |
|--|--|
| This working paper presents an update on Piarco Airspace optimization project. | |
| Action: | The suggested action is in Section 3. |
| Strategic Objectives: | <ul style="list-style-type: none">• Safety• Air Navigation Capacity and Efficiency• Environmental Protection |
| References: | <ul style="list-style-type: none">• Trinidad and Tobago Progress Report of PBN Activities within the E/CAR region from Fourth Eastern Caribbean Civil Aviation Technical Group (E/CAR/CATG/4) Meeting - Saint George's, Grenada, 6 – 7 September 2018• Report from ICAO 8th E/CAR ATM Sub-Committee Meeting on the E/CAR Airspace Design Project (October 09, 2020)• Fifth Eastern Caribbean Civil Aviation Technical Group Meeting (E/CAR/CATG/5) (September 8-10 2021)• Second Meeting of the North American, Central American and Caribbean Working Group (NACC/WG) Airspace Optimization Task Force (AO/TF/2) (February 13-17 2023)• Sixth Meeting of the CANSO IATA ICAO Free Route Airspace (CIIFRA/6) Team (AO/TF/2/ATFM/TF/4/CIIFRA/6) (February 13-17 2023)• Second Meeting of Rapporteurs of the North American, Central American and Caribbean Working Group (NACC/WG/RAP/02) (March 28-31 2023) |

1. Introduction

1.1 This working paper discusses the following initiatives within the Piarco FIR:

- Creation of Connector (Feeder Routes) to link E/CAR TMAs with Upper Level Routes in the Piarco (TTZP) FIR;
- Airspace amendments in the upper level of the Piarco FIR;

- Transitioning from 100NM lateral separation to 50NM in the Piarco Oceanic Sector;
- Proposed waypoints at the Piarco/New York FIR common boundary;
- User preferred routes in the Piarco FIR;
- Transitioning to TBO (Trajectory-Based Operations) in the Piarco FIR.

2. Discussion

2.1 Following the Fifth Eastern Caribbean Civil Aviation Technical Group Meeting (E/CAR/CATG/5), which took place online from September 8-10, 2021, Trinidad and Tobago provided comprehensive Performance Based Navigation (PBN) orientation training and briefings to those Eastern Caribbean (E/CAR) States/Territories which requested assistance. This initiative forms part of the larger effort to optimize the lower airspace of the Piarco Flight Information Region (FIR) and promote seamless air traffic flow in the region. The primary objective of this exercise was to offer critical support to the E/CAR states, enabling them to address any challenges they may encounter with their individual airspace designs. By offering these tailored training sessions, Trinidad and Tobago aims to facilitate collaborative efforts that enhance the safety and efficiency of the regional airspace and promote a more harmonious air travel environment for all stakeholders involved.

2.2 Trinidad and Tobago delivered PBN orientation training and briefings to the Eastern Caribbean (E/CAR) States/Territories in two (2) phases. A summary of the briefings is presented in **Appendix A**.

2.3 On January 26, 2023, several changes were made within the Piarco FIR. These changes aimed to enhance the efficiency and effectiveness of the airspace. See **Appendix B**.

2.4 The following are the details of the changes:

a) Implementation of new RNAV 5 routes:

- UP533
- UN669
- UP410
- UM662

These four (4) new RNAV 5 routes were introduced to facilitate more optimized and precise navigation between the Piarco FIR and Maiquetia FIR. These changes indicate a transition from conventional routes to RNAV routes for improved navigation and airspace optimization.

b) Removal of conventional routes as follows:

- UA550 was removed, while A550 was retained for flights operating at or below FL245;
- UA551 was removed, while A551 was retained for flights operating at or below FL245;

- UA561 was removed, while A561 was retained for flights operating at or below FL245.

c) Extension of UP671 from POS VOR to waypoint ROVBA:

The RNAV 5 route UP671, which originates from SPP VOR in the Panamanian FIR, traverses through Colombian and Venezuelan airspace and extends to the Piarco Oceanic Sector boundary. This provides a gateway for air traffic from the European and African regions to connect with Central and South American destinations.

2.5 These changes to the RNAV routes and extensions within the Piarco FIR demonstrate ongoing efforts to optimize airspace utilization, improve navigation capabilities, and enhance the overall efficiency of air traffic operations in the region.

2.6 As part of the CAR airspace optimization initiatives, standardization of RNAV route designators and navigation specifications is a crucial objective. An analysis identified that the UL205 route designator did not comply with the ICAO Annex 11 requirement for the naming of an internal route. Additionally, the UL205 route was never classified with an RNAV specification. After examining possible solutions, it was decided that the simplest resolution was to extend the UM402 (an existing route from Venezuelan airspace terminating at the POS VOR) northwards following the same trajectory and include the RNAV 5 specification. This would allow the "UM" designator to be used for this route, which satisfied the ICAO Annex 11 requirements for identification.

2.7 Considering the impact on the affected TMAs of TAPA (Antigua), TFFR (Guadeloupe), and TFFF (Martinique), it was crucial to carefully evaluate any changes to the UL205 route and coordinate with all affected stakeholders. A form, related to the amendment of the UL205 route, was sent to the ATS Managers of TAPA, TFFR, and TFFF. The purpose of this form was to gather feedback and agreement on the proposed changes or any objections they might have, as well as to provide any suggested alternatives.

2.8 The ATS Managers were notified of the proposed promulgation date of January 27, 2022, which refers to the official announcement and publication of the amended route. Additionally, the effective date of the changes was communicated as March 24, 2022, indicating when the amended route would become operational. By involving the ATS Managers in this process, their expertise and insights could be considered, ensuring that any concerns or suggestions were taken into account before finalizing the amendment to the UL205 route. This collaborative approach helps to enhance safety, efficiency, and coordination among the different stakeholders involved in the airspace optimization efforts. Approvals were received from all the concerned states, indicating no issues with the proposed change to the UL205 route. See **Appendix C**.

2.9 By resolving this discrepancy and standardizing the RNAV route designators and navigation specifications, the CAR airspace optimization initiatives can continue to move forward with increased efficiency and consistency in air traffic operations within the Piarco FIR. This amendment also created a connector route from the ANU VOR into South American airspace thus providing route options for air traffic that operate between North America and South America.

2.10 Further progress was made in the standardization of RNAV route designators and navigation specifications within the Piarco FIR. In September 2022, the three oceanic routes, namely UL375, UL435, and UL695, were designated as RNAV 10. Additionally, the routes UL337, UM791, and UM402 were designated as RNAV 5. By applying specific RNAV designations to these routes, it streamlined and harmonized the navigation procedures and requirements within the airspace. This standardization facilitates more efficient and accurate navigation for pilots and enhances the overall safety and effectiveness of air traffic operations. Continuing with the objectives of standardization is a significant step in optimizing airspace utilization and promoting consistency and interoperability within the aviation industry.

2.11 Trinidad and Tobago took proactive steps to coordinate various meetings between their airspace planners and the relevant personnel in the E/CAR TMAs (Terminal Control Areas) to discuss the connection of the new Upper Level routes within the Piarco FIR to the respective TMAs. Effective coordination between these entities is crucial for ensuring seamless integration and efficient operations between different airspace sectors. A summary of these Collaborative Decision Making (CDM) meetings is provided as **Appendix D**.

2.12 Trinidad and Tobago, in collaboration with the E/CAR TMAs, published an Aeronautical Information Circular (AIC) providing suggested interim routings to be utilized within the Piarco FIR following the removal of the UA550, UA551, and UA561 routes. The publication of the AIC with suggested interim routings helps to provide guidance to pilots and airspace users, allowing them to navigate within the Piarco FIR effectively. These interim routings will contribute to maintaining efficient air traffic flow and minimizing disruptions during the transition period required for the completion of the airspace design project to connect the upper level routes to the arrival/departure routes of the E/CAR TMAs.

2.13 The internal boundary of the Piarco continental and oceanic sectors was changed to 1800N05730W ROVBA ROSLU 0855N05700W effective January 12, 2023 (See **Appendix E**). This adjustment was a safety measure, effected to ensure provision of VHF and radar surveillance coverage throughout the area designated as the Piarco Continental Sector.

2.14 As part of the Free Route Airspace Framework within the Cayenne (SOOO) UTA/FIR, RNAV waypoints was established on the boundary between the Cayenne (SOOO) and Piarco (TTZP) UTA/FIRs on April 20, 2023 (See **Appendix G**). Free route airspace (FRA) is a specified airspace within which users may freely plan a route between a defined entry point and a defined exit point, with the possibility to route via intermediate (published or unpublished) significant points, without reference to the ATS route network, subject to airspace availability. Within this airspace, flights remain subject to air traffic control.

2.15 In 2015, a safety assessment was conducted and it was determined that with the use of Controller Pilot Data Link Communications (CPDLC), the reduction of lateral separation in the oceanic sector from 100NM to 50NM was within the required Target Level of Safety (TLS). Following the recent ATM upgrade, Trinidad and Tobago has restarted the process of reducing the lateral separation in the Piarco Oceanic Sector. CPDLC will be used to ensure effective communications between ATC and flight crew and provisions will be made to account for the convective weather that occurs during the hurricane season. The 2015 safety assessment is currently being reviewed and simulations will be conducted. It is expected that some live traffic trials will occur in the last quarter of 2023 and full implementation is expected in the first quarter of 2024. This reduction in lateral separation distance is a significant step

towards optimizing airspace utilization and increasing capacity. It enables more efficient use of available airspace, potentially reducing flight distances and enhancing overall airspace efficiency.

2.16 Trinidad and Tobago is presently collaborating with Delta Airlines and United Airlines to obtain approximate coordinate information and trajectories for past flights traversing the Piarco FIR to/from waypoints EKNUT, IPSIN, NUMGI, TUTLO, GANAK, OPADO, and IRELA. By analysing the trajectories of these past flights, Trinidad and Tobago can gather valuable data on the typical routes and flight patterns in the region. This information can then be used to create at least four (4) waypoints with a separation distance of sixty (60) NM, allowing for more precise and efficient routing between the Piarco and New York Oceanic FIRs.

2.17 Collaboration with New York ATS will be commenced in order to implement these waypoints at the common FIR boundary. This will ensure harmonization of procedures and improve efficiency in communication and coordination between the two ATS units. By establishing these waypoints, it will be easier for pilots to report their positions, route progress, and comply with ATC instructions using standardized waypoint names. Additionally, future ATS Interfacility Data Communications (AIDC) operations will benefit from the use of these waypoints as they can be integrated into automated systems for efficient and accurate data exchange between ATC and aircraft. The implementation of AIDC operations will further improving efficiency and safety in the Piarco FIR.

2.18 By definition, a User Preferred Route (UPR) is a unique flight path that aircraft operators can flight plan and fly instead of following the conventional, predetermined aviation routes published by air navigation service providers. These direct routes (DCTs) are part of the initial phase of the transition to Free Route Airspace (FRA) that allow airspace users to optimize flight and fuel planning. FRA is part of the Global Air Navigation Plan and is aligned with the ASBU FRT0 B1/1 concept. ASBU Free Route Operations FRT0 Block 0 Element 1 (B0/1, Direct routing (DCT) states that DCTs are established at national and regional levels and can be made available for flight planning within the published conditions of use. Utilizing UPRs can have several advantages. Firstly, it allows for smoother and more predictable operations as pilots can expect to receive clearances along these established routes. Secondly, it enables airspace users to optimize their flight planning by selecting routes that are known to be efficient and effective for their specific needs.

2.19 By working with Airlines; ICAO Regional Offices (NACC and SAM); Civil Aviation Navigation Services Organization (CANSO) CANSO ATFM data exchange network for the Americas (CADENA); and International Air Transport Association (IATA), Trinidad and Tobago was able to facilitate the development of optimized city - pair UPRs that can be used by dispatchers for filing flight plans (FPLs).

2.20 Prior to the implementation of UPR in the Piarco FIR, a ninety (90) day route optimization trial were conducted with Delta Airlines from July 27, 2021 - October 25, 2021 and Caribbean Airlines August 6, 2021 – November 3, 2021.

2.21 Prior to the implementation of UPR in the Piarco FIR, a ninety (90) day route optimization trial were conducted with Delta Airlines from July 27, 2021 - October 25, 2021 and Caribbean Airlines August 6, 2021 – November 3, 2021.

2.22 The savings for Delta Airlines, as provided by CADENA, for the service Atlanta (KATL) – Sao Paulo (SBGR)- Atlanta (KATL) are as follows:

| ATL/SBGR/KATL: Jul 27 -Oct 25, 2021 | | |
|-------------------------------------|---------|--------------------|
| Savings | 73-Day* | 1-Year (Projected) |
| Flight minutes: | 235 | 1,175 |
| Fuel (kg): | 62,035 | 140,693 |
| CO2 (kg): | 88,918 | 444,590 |
| Ops cost (US\$): | 41,925 | 209,625 |

Note: Trial for 90 days and data available for 73 days.

2.23 The savings for Caribbean Airlines, as provided by CADENA, for the service, Port of Spain (TTPP) – Miami (KMIA)- Port of Spain (TTPP) are as follows:

| TTPP/KMIA/TTPP: Aug 6 -Nov 3, 2021 | | |
|------------------------------------|--------|--------------------|
| Savings | 90-Day | 1-Year (Projected) |
| Flight minutes: | 256 | 1,038 |
| Fuel (kg): | 46,780 | 86,055 |
| CO2 (kg): | 67,052 | 271,934 |
| Ops cost (US\$): | 39,494 | 160,170 |

2.24 Trinidad and Tobago published an Aeronautical Information Circular (AIC) on September 8, 2022 which provides airline flight dispatchers with a series of user-preferred routes that can be filed in flight plans (See **Appendix F**). By outlining these user-preferred routes, the AIC offers a standardized and widely recognized set of routes that have been identified as popular choices among airspace users. This helps streamline flight planning processes and facilitates efficient coordination between pilots and ATC. It also enhances the situational awareness and improves overall flight efficiency. This, in turn, can contribute to reduced fuel consumption, shorter flight durations, and minimized environmental impact.

2.25 Following the Second Meeting of the North American, Central American and Caribbean Working Group (NACC/WG) Airspace Optimization Task Force (AO/TF/2); the Sixth Meeting of the CANSO IATA ICAO Free Route Airspace (CIIFRA/6) Team (AO/TF/2/ATFM/TF/4/CIIFRA/6) and the Second Meeting of Rapporteurs of the North American, Central American and Caribbean Working Group (NACC/WG/RAP/02), it was determined that TBO Trajectory Based Operations (TBO) is the primary objective of AO for the CAR region. TBO is an air traffic management concept that aims to improve the efficiency, capacity, and safety of the airspace system. TBO shifts the focus from traditional ground-based navigation and control to a system centred around the aircraft's trajectory. In TBO, aircraft trajectories are carefully planned and managed, taking into account factors such as weather conditions, traffic flow, airspace constraints, and operational requirements. By providing more precise and predictable flight paths, TBO enables controllers and pilots to optimize routes, reduce separation minima, and enhance situational awareness. TBO also enables more efficient operations during convective weather events, such as hurricanes, by allowing for flexible trajectory adjustments to avoid hazardous weather areas while maintaining optimal routes.

2.26 Trinidad and Tobago is in the process of amending its airspace concept for the Piarco FIR to be aligned with the CAR regional airspace optimization plan and will focus on transitioning to FRA as the first phase to achieving the objective of TBO.

3. Suggested Actions

3.1 The Meeting is invited to:

- a) Note the information contained in this paper;
- b) Participate in activities related to the Airspace Optimization plan for the Piarco FIR;
- c) Develop a proposed schedule of Airspace Design meetings over 2023/2024 between Trinidad and Tobago and each E/CAR State or groups of States to accomplish the goal of harmonizing the connectivity of Upper and Lower Airspaces of the Piarco FIR; and
- d) Discuss any relevant matters as appropriate.

APPENDIX A
SUMMARY OF PBN TRAINING AND BRIEFINGS CONDUCTED BY TRINIDAD AND TOBAGO

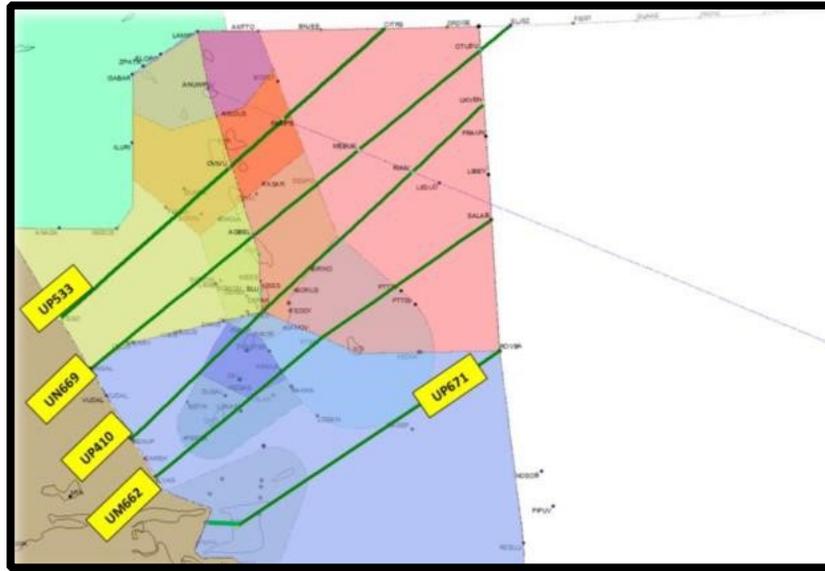
1. The PBN orientation training/briefing session for Barbados took place on October 8, 2021. Representatives from the Piarco Airspace Design Team provided comprehensive PBN orientation training and briefings to Barbados Airspace Design Team
2. On December 2, 2021, PBN orientation training/briefing sessions were conducted for Grenada, St Lucia, and St Vincent and the Grenadines. Trinidad and Tobago's Subject Matter Experts (SMEs) engaged with representatives from these countries to offer guidance and support in optimizing their individual airspace designs, fostering a more efficient and harmonious air traffic environment in the E/CAR region.
3. Trinidad and Tobago is committed to continue to provide briefings as necessary towards the goal of the harmonization of the upper/lower airspace within the Piarco FIR leading to enhanced air traffic management in the Eastern Caribbean.
4. The Agenda for these briefings were as follows:
 - PBN Overview
 - ICAO/IATA Airspace Design Principles
 - Data Collection and Analysis Requirements
 - Collaborative Decision Making (CDM) requirements
 - Introduction to TMA Instrument Flight Procedures
 - Key Operational Responsibilities
 - ICAO Reference Documentation
 - Logistics for the delivery of Airspace Optimization/PBN Briefings to the E/CAR States
 - General Discussions (Questions and Answers)
 - i. Available Resources
 - ii. Constraints
 - iii. Operational needs
5. Feedback from the E/CAR Airspace teams indicated that the training sessions were informative and assisted them greatly in their understanding of the requirements of PBN implementation and airspace optimization.
6. Following the successful PBN orientation training and briefing sessions held in October 2021 and December 2021, Trinidad and Tobago continued its efforts to promote regional collaboration and cooperation in the optimization of the Eastern Caribbean airspace. On February 15, 2022, Trinidad and Tobago delivered an Airspace Optimization/PBN Briefing presentation to the airspace teams of Grenada, St Lucia, and St Vincent and the Grenadines. The objective of this presentation was to provide further support to the E/CAR states and enhance their understanding of the airspace optimization and PBN initiatives. Subsequently, on February 17, 2022, Trinidad and Tobago conducted another Airspace Optimization/PBN Briefing presentation for the Barbados Airspace Team. This presentation aimed to provide Barbados with critical support and insights into airspace optimization and PBN initiatives, enabling them to enhance their airspace designs and improve air traffic flow.

7. The Agenda for these briefings were as follows:

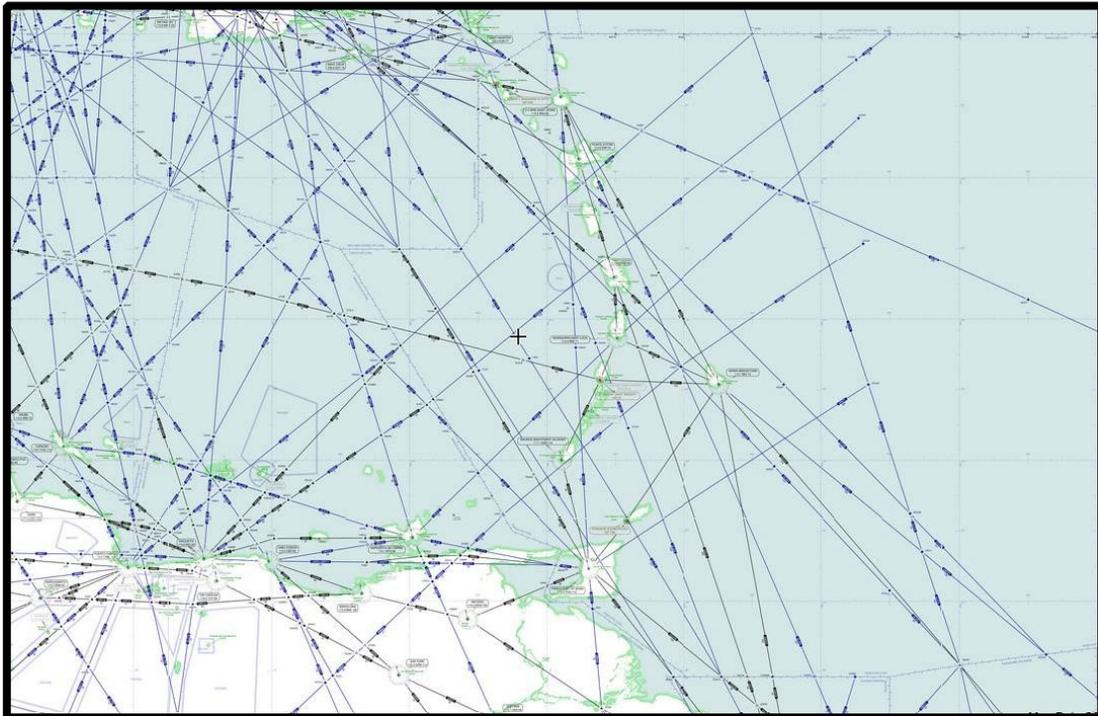
- Introduction to ICAO Global Air Navigation Plan (GANP)
- Understanding the ICAO Aviation System Block Upgrades (ASBUs)
- Introduction to PBN Concepts and Applications
- Piarco FIR PBN Redesign Plan
- Review of RNAV Instrument Approach Procedures (IAPs)
- Review of RNAV Standard Instrument Departures (SIDs)
- Review RNAV Standard Instrument Arrivals (STARs)
- Discussions, Questions and Answers

8. Trinidad and Tobago received positive feedback from the E/CAR airspace teams regarding the effectiveness, subject knowledge, and engagement of the presentation. Such feedback is valuable in ensuring continuous improvement and maintaining high-quality training sessions in the future.

APPENDIX B

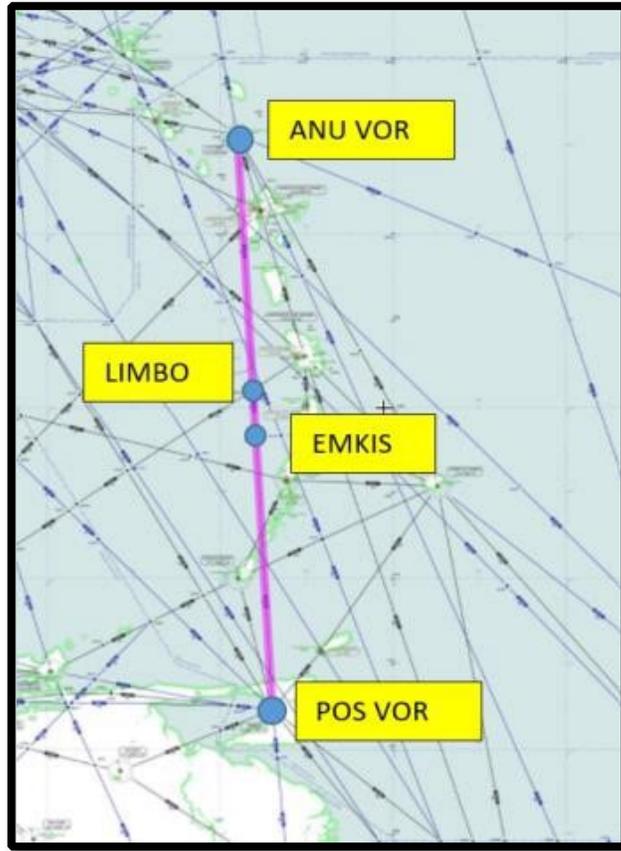


NEW EAST WEST RNAV 5 ROUTES IN THE PIARCO FIR
Source : IDS Airspace Designer



CONNECTIVITY OF THE NEW RNAV 5 ROUTES IN THE PIARCO AND MAIQUETIA FIRS
Source : SkyVector

APPENDIX C



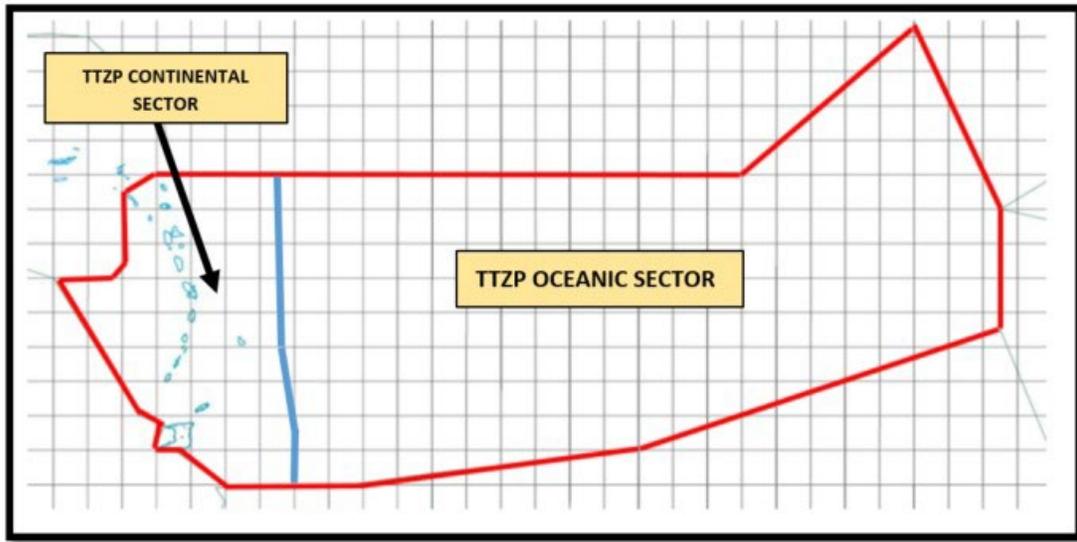
REPLACEMENT OF THE UL205 BY EXTENDING THE UM402 POS VOR EMKIS LIMBO ANU VOR
Source image: SkyVector

APPENDIX D
A SUMMARY OF CDM MEETINGS WITH E/CAR STATES

1. Details of the meetings between the E/CAR TMAs and Piarco are as follows:
 - a) Meeting with St Vincent and the Grenadines: The meeting took place on October 4, 2022. This meeting would have provided an opportunity for Trinidad and Tobago and the TMA of St Vincent and the Grenadines to discuss the integration of the new Upper Level routes and ensure effective coordination between the two entities.
 - b) Meeting with Grenada: The meeting was held on October 6, 2022. The purpose of this meeting was to discuss the integration of the new Upper Level routes within the Piarco FIR with the Grenada TMA. It allowed for productive discussions and coordination between the two entities.
 - c) Meeting with Martinique: The meeting took place on October 6, 2022. The primary agenda of this meeting was to connect the new Upper Level routes within the Piarco FIR to the Martinique TMA. It provided an opportunity for Trinidad and Tobago and the TMA of Martinique to collaborate and ensure seamless integration.
 - d) Meeting with Barbados: The meeting occurred on October 7, 2022. This meeting would have focused on connecting the new Upper Level routes within the Piarco FIR to the Barbados TMA. It provided a platform for Trinidad and Tobago and the TMA of Barbados to collaborate and address any relevant concerns.
 - e) Meeting with St Lucia: The meeting occurred on October 13, 2022. The focus of this meeting was to connect the new Upper Level routes within the Piarco FIR to the St Lucia TMA. It facilitated discussions and coordination between Trinidad and Tobago and the TMA of St Lucia.
 - f) Joint meeting with Martinique and St Lucia: This meeting was held on October 26, 2022. It involved both Martinique and St Lucia TMAs and aimed to address the integration of the new Upper Level routes within the Piarco FIR to these respective TMAs. The joint meeting allowed for efficient coordination and collaboration between Trinidad and Tobago and the TMAs of Martinique and St Lucia.
 - g) Meeting with Guadeloupe: The meeting took place on April 19, 2023. The purpose of this meeting was to connect the new Upper Level routes within the Piarco FIR to the Guadeloupe TMA. It provided an opportunity for Trinidad and Tobago and the Guadeloupe TMA to discuss the integration process and ensure effective coordination.
 - h) Note: A meeting with the TMA of Antigua and Barbuda is still outstanding.

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APPENDIX E



INTERNAL BOUNDARIES OF THE PIARCO CONTINENTAL AND OCEANIC SECTORS

APPENDIX F**PIARCO (TTZP) OPTIMIZED ROUTES – END TO END**

For overall situational awareness, the optimized routes in the table below are predefined routes from origin to destination and have been coordinated, reviewed, and approved by all of the ANSPs along the route. Coordination of the following routes apply to Brazil, Guyana, Trinidad and Tobago and United States.

| Optimized Routes | Predefined Routes - Origin to Destination |
|-------------------------|--|
| TTPP - KMIA | TTPP DCT ANADA DCT MUNOZ DCT HARBG Y330 FODED DCT MADIZ DCT FOXID DCT FLIPR FLIPR7 KMIA |
| KMIA - TTPP | KMIA SKIPS2 SKIPS Y290 HAGIT Y421 HARBG L452 ANADA UG449 PERGA ITRAK NAPKO LEXOR TALUS TTPP |
| KATL - SBGR | KATL VRSTY2 MCN DCT YANTI Q89 MANLE Y185 RENAH Y355 FIPEK Y294 GESSO L467 ANADA DCT KORTO DCT SUMVA SBGR |
| SBGR - KATL | SBGR SUMVA DCT KORTO DCT ANADA L452 HARBG Y421 HAGIT Y306 VENDS Y185 MANLE Q89 SHRKS DCT LAIRI DCT LARZZ JJEDI2 KATL |
