

International Civil Aviation Organization

North American, Central American and Caribbean Office (NACC)

#### First Eastern Caribbean Civil Aviation Technical Group Meeting (E/CAR/CATG/1)

Martinique, French Antilles, France, 19 to 21 June 2013

#### **Agenda Item 4**

#### **Air Navigation Matters**

4.2 Follow-up on the implementation of the NAM/CAR Regional Performance Based Air Navigation Plan (RPBANIP) in Eastern Caribbean

#### PERFORMANCE-BASED NAVIGATION IMPLEMENTATION – TRINIDAD AND TOBAGO INITIATIVES

(Presented by Trinidad and Tobago)

SUMMARY				
This paper highlights the progress made by Trinidad and Tobago with regard to PBN implementation at both the State level and the Eastern Caribbean Regional level.				
References:				
<ul> <li>Report of the Thirty-Third Eastern Caribbean Working Group Meeting, Barbados, 4 to 8 June 2012</li> <li>Report of the Twenty – Fourth Meeting of the Directors of Civil Aviation of the Eastern Caribbean</li> <li>NAM/CAR regional Performance-Based Air Navigation Implementation Plan</li> </ul>				
Strategic	This information paper is related to Strategic			
Objectives	Objectives:			
	A. Safety – Enhance global civil aviation safety C. Environmental Protection and Sustainable			
	Development of Air Transport			

#### 1. Introduction

- 1. 1 Trinidad and Tobago recognizes that Performance-Based Navigation is the future of Air Navigation and is committed to ensuring:
  - PBN implementation at the State level
  - Harmonization of PBN implementation within the Eastern Caribbean Region

- 1.2 At the 12th Air Navigation Conference held in Montreal (Nov 19<sup>th</sup> 30<sup>th</sup> 2012), ICAO identified Performance Based Navigation (PBN) as the key enabler to the Aviation System Block Upgrades (ASBUs). Trinidad and Tobago, in accordance with the CAR/SAM Regional Air Navigation Plan, has incorporated the concepts of PBN into its strategic objectives plan and has developed and submitted to the ICAO NACC Office, a Piarco FIR PBN implementation Plan. The plan outlines the methodology for the transformation of the upper airspace into an RNAV/RNP route structure. It also addresses generically, the terminal airspace plans of Antigua, Barbados, Grenada and Trinidad and Tobago.
- Reference is made to the table in paragraph 3.3.2 of the Report of the Twenty Fourth Meeting of the Directors of Civil Aviation of the Eastern Caribbean which states that "Even though an initial PIARCO FIR PBN Implementation Plan has been developed, this Plan needs to ensure the implementation of the Regional PBN airspace concept with the coordination of a multidisciplinary group to analyze Airspace Organization and Management (AOM). This implementation requires active participation by all States, not only for harmonization but also for optimization of upper and lower airspace when proposing ATS route amendments. Similarly, implementation of more PBN approach procedures is urgently needed, and a common effort for this implementation in the E/CAR area may be coordinated."

#### 2. Accomplished/Current Tasks

- 2.1 Trinidad and Tobago sent two participants to the ICAO PBN Symposium in Montreal (Oct  $16^{th} 19^{th}$  2012). The symposium emphasised that successful PBN implementation requires executive leadership and commitment. There must be top-level endorsement in order for the necessary resources to be allocated. The Director General of the Trinidad and Tobago Civil Aviation Authority is committed to providing the resources for successful implementation.
- 2.2 PBN is linked directly to the Navigation component of CNS (Communications/Navigations/Surveillance) systems, which along with ATM, forms the building blocks for a successful Airspace Concept. Along with ATM improvements, Trinidad and Tobago has expended major resources towards the development of our CNS systems. The requirement for the introduction of RNP4 routes in the oceanic region is dependent on the availability of CPDLC and ADS-C. The current ATM system at Piarco ACC has the capability of ADS-B, ADS-C and CPDLC.
- 2.3 Another important component of PBN implementation is the formation of a multidisciplinary team to ensure collaborative decision making. In line with the CAR/SAM Roadmap for PBN, Trinidad and Tobago has formed a State PBN Core Implementation Team (PBNCIT), which has been tasked with planning, developing and implementing the various elements of the roadmap.
- 2.4 The four areas identified for development by the roadmap are the:
  - Trinidad and Tobago terminal (approach) area
  - Piarco En-route Oceanic Sector
  - Piarco En-route (Upper level) Continental Sector
  - Piarco En-route (Lower level) Continental Sector
- 2.5 Trinidad and Tobago recognizes the need to expand this team to incorporate representatives from the States within the E/CAR region in order to ensure a harmonized approach to the regional implementation of PBN.

- 2.6 Currently, the Trinidad and Tobago PBNCIT is in the process of analysing traffic data in the Oceanic Sector in preparation for conducting the required safety and cost-benefit analyses required for the possible introduction of a semi-flex RNAV route system in the oceanic sector aimed at increasing capacity, and improving safety and efficiency.
- 2.7 Trinidad and Tobago sent two representatives to the ICAO/IATA/CANSO Regional PBN Airspace Concept Workshop and the PBN Airspace Concept Development On-the-Job Training (OJT) in Miami Florida 11-22 March 2013 and one representative to the PBN Operational Approval Course held at the same venue from 11-15 March 2013. The knowledge gained at this workshop was invaluable and has both confirmed that the TTCAA's approach to PBN implementation is along the right path and clarified some technical issues that had previously been potential hurdles.
- 2.8 With regard to the approach sector, Trinidad and Tobago has invested heavily in both flight procedure design software and the development of personnel in this field. Although both international airports in Trinidad and Tobago already have RNAV (LNAV) (GNSS) approaches, it is expected that by September 2014, Trinidad and Tobago will have RNP approaches with APV BARO VNAV for both runways at Piarco, as well as SIDs and STARs all designed by Trinidad and Tobago personnel. Trinidad and Tobago intends to use this discipline in order to aid the other States within the E/CAR region with their terminal Airspace in accordance with the regional PBN airspace concept development and implementation.
- 2.9 The ANS department of Trinidad and Tobago has already held introductory meetings with some air operators as well as one section of our military air-guard, and there are further meetings planned with other stakeholders throughout the rest of 2013. At this time, with regard to Constant Descent Operations, coordination is taking place with American Airlines and Caribbean Airlines (into TTPP-Piarco); and Virgin Atlantic and British Airways (into TBPB-Grantley Adams). Trinidad and Tobago and Barbados have already held two teleconferences in order to develop a CDO (Continuous Descent Operation) trial plan. Once the outcome from these trials is positive, similar exercises will be initiated with other States willing to participate.
- 2.10 Trinidad and Tobago intends to collaborate / share knowledge with all of the States within the E/CAR with regard to the harmonization of PBN implementation. As a first step, the TTCAA PBN Project Manager visited Barbados on March 1st 2013 in order to deliver presentations on the PBN concept. Delegates from French West Indies also visited Trinidad and Tobago from 8<sup>th</sup>-10<sup>th</sup> April 2013 and during this meeting, the topic of collaborating with regard to PBN implementation was addressed.

#### **3.** Future Tasks

- Based on information received at the ICAO PBN Symposium (OCT 2012), the 12<sup>th</sup> Air Navigation Conference (NOV 2012), the ICAO/IATA/CANSO Regional PBN Airspace Concept Workshop March 2013) as well as from the online training obtained from the ICAO website, the TTCAA PBNCIT will continue to operate on the general tasks outlined in the PBN Implementation Task list, but will also be concentrating on the following elements:
  - Visit the other TMAs in order to provide information on the PBN Concept and to provide a platform for the formation of an E/CAR Regional PBN Implementation Team with the objective of harmonization of the implementation process through the region.

- Continue the development of a trial CDO/CCO project with TBPB regarding flights between Europe and Barbados. (Barbados is suggested for this initial trial simply because collaborative work on PBN implementation has already started between the TTCAA and BCAD. It is expected that the trials will expand as collaboration continues with the other TMAs)
- Formulating a proposal to institute the RNAV 10 specification in the Oceanic Sector of the Piarco FIR (Use of 50 NM lateral separation)
- Develop a Reference Scenario for the Piarco Approach Sector. (Work has already begun on this as the team is already working with Caribbean Airlines LTD with regard to domestic routes)
- Meet with the IT Department of the TTCAA to discuss the creation of a PBN Webpage on the TTCAA site to allow the promulgation of information relating to PBN implementation, as well as investigate the possibility of hosting an online forum (e.g. GOTO MEETING) for E/CAR Regional PBN meetings/training etc.

#### 4. Conclusions

4.1 Trinidad and Tobago is committed to ensuring a harmonized approach to PBN implementation within the E/CAR Region. In this regard, Trinidad and Tobago suggests the formation of an E/CAR Regional PBN Team within the E/CAR CATG, so ECAR States and Territories participate to improve safety and capacity in the Piarco airspace aiming other improvements as decided by the meeting.



Trinidad and Tobago

June 20<sup>th</sup> 2013

# Objectives of this presentation

- Discuss State's/ANSP's responsibilities regarding the implementation of the PBN concept
- Provide information on PBN tasks conducted by TTCAA PBN Team

#### References

- ICAO PBN toolkit
- ICAO Global Air Navigation Plan (Doc 9750)
- ICAO PBN Manual (Doc 9613)
- Piarco FIR PBN Action Plan (Draft 7.0)
- TTCAA PBN Core Implementation Team Terms of Reference (Draft 4.0)

#### What is PBN?

#### <u>Performance – Based Navigation</u>

The PBN concept specifies that the aircraft navigation system performance requirements are defined in relation to specific capabilities which are needed for the proposed operations in the context of a particular airspace concept

Accuracy, Integrity, Continuity and Availability

#### Global Harmonization

The PBN concept provides a set of globally compatible Navigation Specifications aimed at ensuring standard implementations and harmonization across regions

#### Airspace Concept

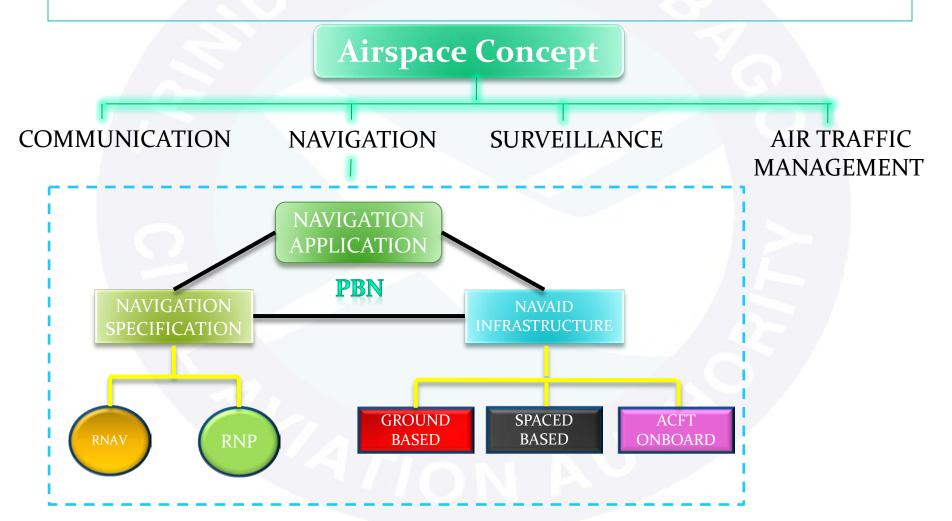
PBN is not a standalone concept

Airspace Concept – Provides the outline and intended framework of operations within an airspace

Airspace Concept Development provides a structured and systematic way of determining:

- What is to be achieved in an airspace
- How it will be achieved

#### Airspace Concept



### Why is PBN so important?

- The implementation of PBN is presently the global aviation community's highest Air Navigation priority
- ICAO Resolution A37-11 urges states to implement RNAV and RNP ATS routes and approach procedures in accordance with ICAO PBN concept laid down in the PBN Manual DOC (9613)
- PBN is key to the implementation of ICAO's Aviation System Block Upgrades (ASBUs)
- Its an enabler to continuous climb and descent operations (CCOs and CDOs)
- Directly linked to GPIs 5, 9, 11, 20 & 21(RNAV enhancements through GNSS)

#### **Benefits of PBN**



## State Responsibility

Individual States are responsible for developing national regulatory material which addresses the PBN applications relevant to:

- Their airspace, or
- Operations conducted in another state by the operators and aircraft registered in their state

### State Responsibility

#### States are also responsible for:

- Provision of an Aeronautical Information Service (in accordance with Annex 15)
- Oversight, approval and in some cases the actual design of RNAV / RNP procedures (unless delegated to an ANSP or 3<sup>rd</sup> party)

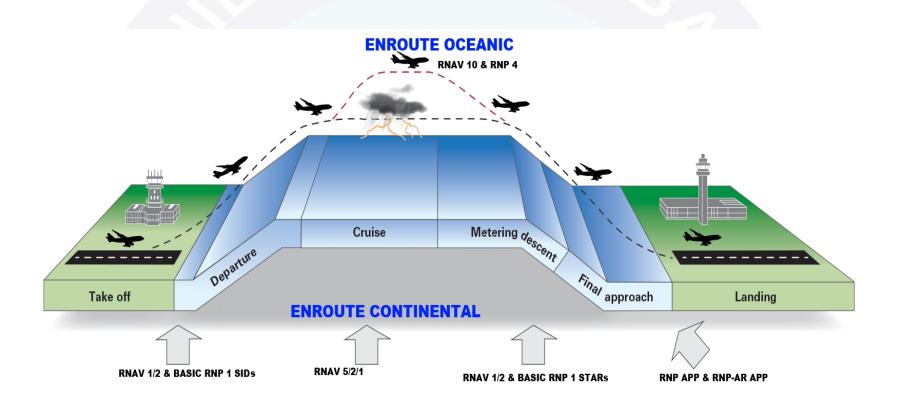
### State Responsibility

The State of the Operator/Registry is responsible to ensure that the aircraft is properly certified and approved to operate (operational approval) in accordance with the prescribed navigation specification

### State/ANSP's Responsibilities

- Ensuring PBN implementation within its Terminal Airspace (SIDs and STARs)
- Implementing RNAV/RNP APV (Approach with Vertical Guidance) approaches for all instrument RWY's either as a primary approach or as a backup for precision approaches by 2016 (ICAO Resolution A37-11)

### **PBN** Implementation



#### PBN Implementation- ICAO Recommendations

- Top-down approach
- Formation of a multidisciplinary team
- Collaborative decision making
- Safety Analysis
- Cost Benefit Analysis
- Testing/Simulations
- Implementation
- Monitoring

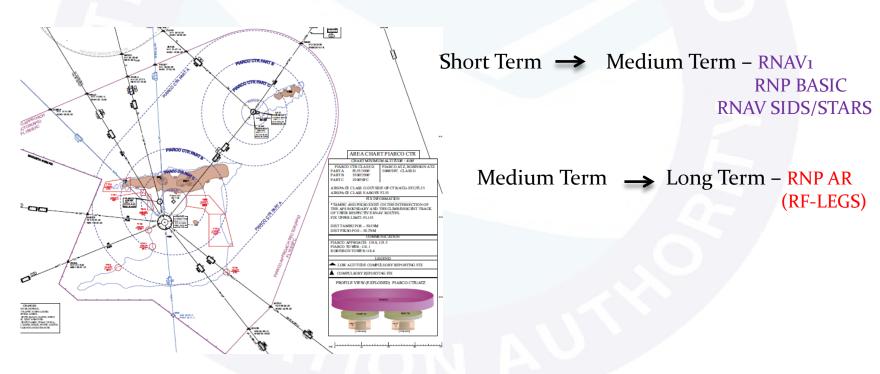
#### Core team composition

- ATCOs
- AIS
- Procedure Designers
- Airspace planners
- Regulatory body
- Pilots/Airline operators

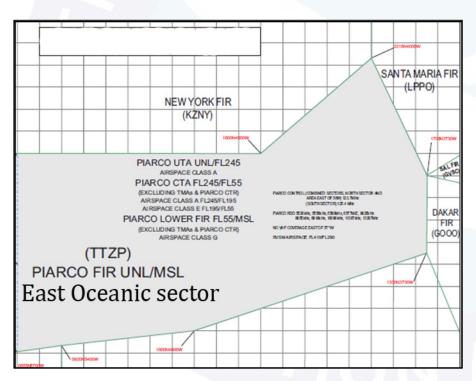
#### Other Stakeholders

- Airport Authorities
- Airline Operators
- General Aviation
- National Security
- Other relevant Ministries e.g.
   (Environmental/Finance/Tourism etc.)

 PBN implementation within the terminal airspace (Approach sector) of Trinidad and Tobago



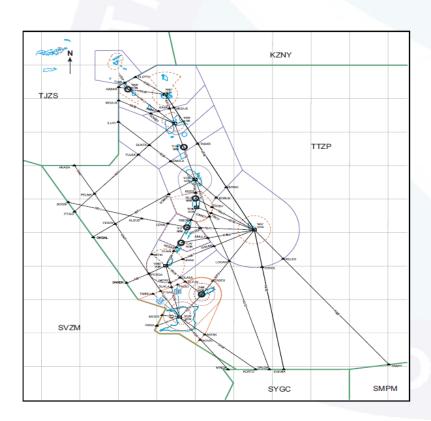
 PBN implementation within the En-route East Oceanic Sector of the Piarco FIR



Short→ Medium term – RNAV 10

Medium → Long term – RNP4

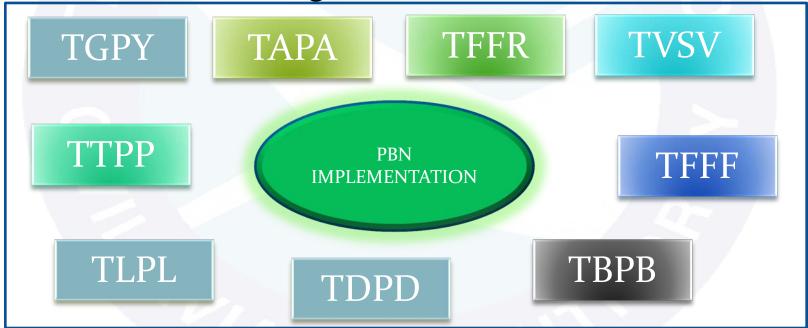
 PBN implementation within the En-route Continental sector of the Piarco FIR



Short Term → Medium Term – RNAV<sub>5</sub>

Medium Term → Long Term - RNAV<sub>2</sub>

Ensuring harmonization of PBN implementation within the ECAR Region



# TTCAA's PBN Core Implementation Team (PBNCIT)

- In accordance with ICAO Resolution 37/11, Trinidad and Tobago has developed and submitted to the ICAO NACC Regional Office, a Performance - Based Navigation (PBN) Roadmap for the Piarco FIR.
- The implementation of the Piarco FIR PBN Action Plan requires the establishment of a multidisciplinary team to collect /analyze data, conduct research, develop procedures, perform safety assessments and ensure that the required collaboration with all stakeholders is carried out.

#### Objectives of the TTCAA PBNCIT

- To implement the PBN concept within the National Airspace of Trinidad and Tobago
- To implement the PBN concept within the En-route Oceanic Sector of the Piarco FIR
- To implement the PBN concept within the En-route Continental Sector of the Piarco FIR
- To aid the TMAs within the Piarco FIR with the implementation of their National Plans in order to ensure harmonization of the PBN concept within the ECAR region
- To ensure the harmonization of PBN implementation within the Piarco FIR with the Regional/Global plans

#### **PBN Tasks**

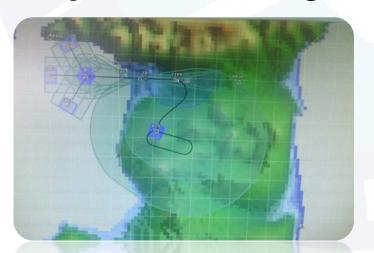
- Developing/modifying an airspace concept
- Electronic DATA collection /analysis /distribution
- Collaboration with stakeholders
- Developing/modifying regulatory framework
- Conducting cost benefit analyses
- Conducting safety assessments
- Developing/conducting training in PBN matters

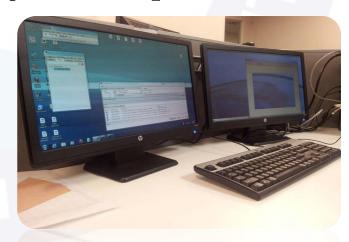
 Trinidad and Tobago, in accordance with the CAR/SAM Regional Air Navigation Plan, has incorporated the concepts of PBN into its strategic objectives plan and has developed and submitted to the ICAO NACC Office, a Piarco FIR PBN implementation roadmap

- Along with ATM improvements, Trinidad and Tobago has expended major resources towards the development of our Communications /Navigations /Surveillance (CNS) systems
- The requirement for the introduction of RNP4 routes in the oceanic region is dependent on the availability of CPDLC and ADSC. The current ATM system at Piarco ACC has capability for ADS-B, ADS-C and CPDLC.

- Representatives from Trinidad and Tobago participated in ICAO PBN / GNSS implementation workshops in 2010, 2011 and 2012
- Trinidad and Tobago sent two participants to the ICAO PBN Symposium in Montreal (Oct 16<sup>th</sup> – 19<sup>th</sup> 2012)
- Trinidad and Tobago sent two representatives to the ICAO/IATA/CANSO Regional PBN Airspace Concept Workshop and the PBN Airspace Concept Development On-the-Job Training (OJT) in Miami Florida 11-22 March 2013 and one representative to the PBN Operational Approval Course held at the same venue from 11-15 March 2013

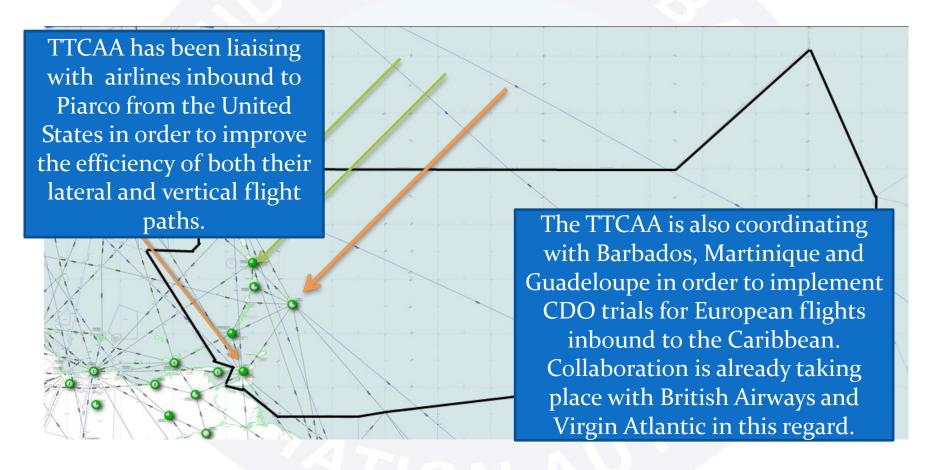
• With regard to the approach sector, the TTCAA has invested heavily in both procedure design software and the development of personnel in this field. It is expected that by September 2014, Trinidad and Tobago will have RNP approaches with BaroVNAV for both runways at Piarco designed by TTCAA personnel



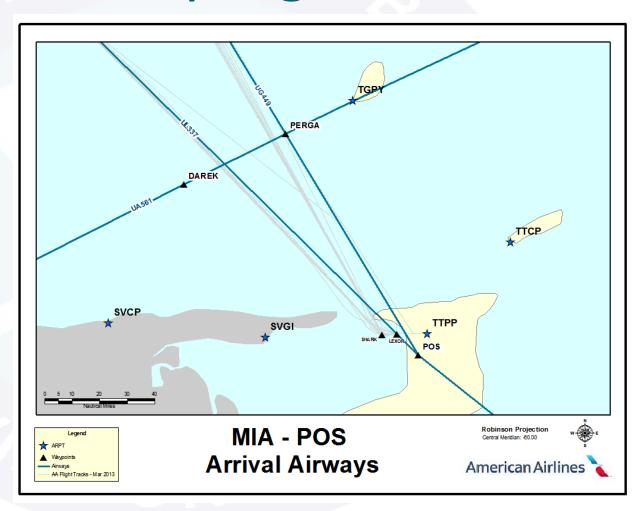


- The ANS department of the TTCAA has already held introductory meetings with some air operators as well as one section of our military air-guard, and there are further meetings planned with other stakeholders planned throughout the rest of 2013
- The TTCAA has also held meetings with the Lands and Survey Department of Trinidad and Tobago and is aggressively pursuing the acquisition ETOD based on the accuracy requirements outlined in Annex 15

- Currently, the core team is in the process of analysing traffic data in the oceanic sector in preparation for conducting the required safety and cost-benefit analyses required for the possible introduction of a semi-flex RNAV route system in the oceanic sector aimed at increasing capacity, and improving safety and efficiency
- The team is also analyzing the current upper airspace route structure and is experimenting with conceptual re-designs



Information provided by American Airlines with regard to their flight paths into Trinidad



Information provided by American Airlines based on a one minute level-off at F190

Based on \$2.986 USD per gallon. An increased fuel burn of 750lbs equates to US \$111.94

#### 777-300ER

	Time (min)	Fuel (lbs)	Dis (NM)
CDO Descent	17.2	1188	96.7
Step at FL190 for 1 min	20.9	1967	102.0

Notes

Beginning at FL370 and 555,000lbs

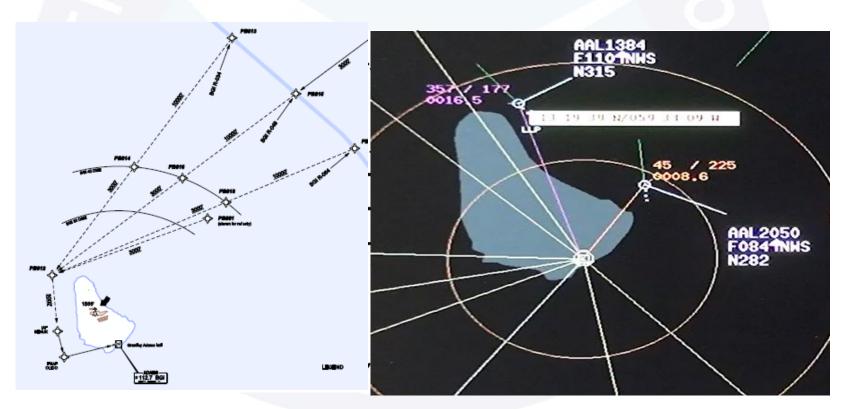
#### A319 w/ Sharklets

	Time (min)	Fuel (lbs)	Dis (NM)
CDO Descent	15.9	318	93.5
Step at FL190 for 1 min	19.2	704	98.8

Notes

Beginning at FL370 and 138,000lbs

 Collaboration with Barbados with regard to arrival / departure procedures in relation to CDOs/CCOs



Trinidad and Tobago has been coordinating with the domestic carrier in order to develop an arrival /departure procedure between the islands of Trinidad and Tobago in order to improve the efficiency of their operation and reduce workload on our ATCOs

Trials with local operators



#### Moving forward

- Trinidad and Tobago will continue to develop its expertise in the various elements of Performance Based Navigation
- Trinidad and Tobago has recently become members of CANSO and will be seeking their assistance in continuing the PBN implementation process
- Trinidad and Tobago will continue to collaborate with all Stakeholders/International Organizations in order to improve the safety and efficiency of the services provided within the Piarco FIR

#### Moving forward

- Trinidad and Tobago will provide basic guidance on PBN implementation to States within the E/CAR
- Trinidad and Tobago will share available knowledge/experience on technical issues relating to PBN implementation
- Trinidad and Tobago recommends that the E/CAR Region form a PBN Task Group, under the ATM committee, in order to ensure harmonization of PBN implementation.



# Thank you for your attention