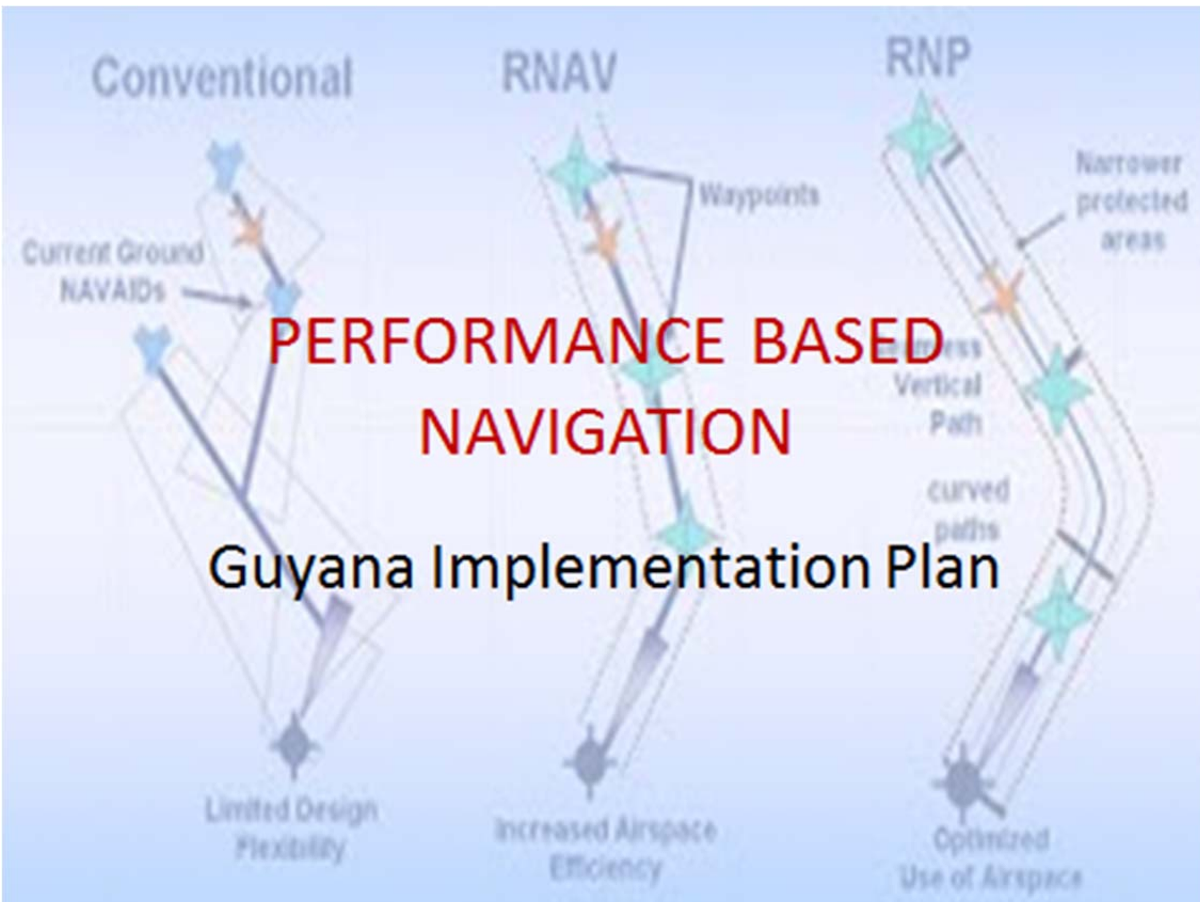
PERFORMANCE BASED NAVIGATION

Guyana Implementation Plan



Guyana - PBN Implementation Plan

Table of Contents

Guyana - PBN Implementation Plan

1. Objective

This PBN Implementation Plan has the following objectives:

a) Provide a high-level strategy for PBN implementation in Guyana. This strategy is based on PBN, area navigation (RNAV), and required navigation performance (RNP) concepts to be applied in aircraft operations in all flight phases: en-route (oceanic and continental), TMA (SIDs and STARs), and IFR approach, in accordance with implementation objectives set forth in ICAO Assembly Resolution A37-11, and based on the Bogota Declaration formulated at the Thirteenth Meeting of Civil Aviation Authorities of the SAM Region.

b) Avoid unnecessarily imposing the requirement of carrying multiple equipment units on board or having multiple ground equipment.

c) Avoid the need for multiple aircraft and operator approvals for intra- and inter-regional navigation.

2. Background

Resolution A37-11: The global performance-based navigation goals require States to develop a PBN implementation plan, as a matter of urgency, with a view to:

a) implementing RNAV and RNP operations (where required) for en-route and terminal areas, in accordance with the established deadlines;

b) implementing by 2016 approach procedures (Baro-VNAV and/or augmented GNSS) with vertical guidance (APV), including minima for LNAV only, for all instrument flight runway ends, whether as main approach or in support of precision approach, with the following intermediate milestones: 30% by 2010 and 70% by 2014; and

c) implementing direct LNAV procedures only, as an exception to b) above, for instrument flight runways at aerodromes lacking local altimeter facilities and where there are no aircraft properly equipped for APV operations with a maximum certificated take-off mass of 5 700 kg or more.

Pursuant to Resolution A37-11, SAM States have signed the Bogota Declaration. Out of the 15 goals established in said declaration, 5 are directly related and 3 are indirectly related to PBN implementation. These goals are:

Indirectly related

- Accidents – Reduce the SAM regional accident rate gap by 50% with respect to the global accident rate.
- Runway excursions – Reduce runway excursions by 20% with respect to the average rate of the Region (2007 – 2012).
- ATFM - 100% of area control centres (ACCs) providing air traffic flow management (ATFM) services.

Directly related

- Performance-based navigation (PBN) terminal – Compliance with goals established in ICAO Assembly Resolution A37-11 regarding approach procedures with vertical guidance (APV).
- En-route PBN
  - 60% of international aerodromes with PBN standard instrument departures (SIDs) / standard instrument arrivals (STARs).
  - 60% of routes/airspaces with PBN.
- CDO - 40% of international aerodromes / terminal control areas (TMAs) with continuous descent operations (CDO).
- CCO - 40% of international aerodromes / TMAs with continuous climb operations (CCO).
- Estimation of fuel savings / reduction of $C0_2$ emissions based on the ICAO fuel savings estimation tool (IFSET) - Reach 40,000 tonnes of regional CO_2 emission reduction per year in en-route PBN implementation.

Thus, PBN implementation is assigned high priority within the ATM Work Programme of the South American Regional Office and of Guyana.

3. Introduction

To effectively address the challenges of the traffic composition and complexity within the Timehri TMA it would be necessary to follow the approach set out by ICAO in its Plan to implement Performance Base Navigation (PBN) in Terminal Areas.

PBN enables the systemization of air traffic organization and strategic de-conflicting of published ATS routes (including SIDS and STARS) and instrument approach procedures so as to reduce the need for tactical ATC intervention. Put differently PBN allows aircraft – to –aircraft separation and route spacing to be build-into the airspace design.

Since PBN specification for Terminal Areas is RNAV 1, it would be necessary for the local aircraft fleet and crews to be GNSS certified in order to utilize the advantages of PBN technology.(*Sufficient time must be given for this process***).**

The success of PBN implementation will depend on effective participation by the ATM community to ensure that the operational requirements of the various airspace users, as well as those of service providers are met.

4. Strategic Objectives

4.1 En-route operations

The implementation of PBN for en-route operations in continental airspace within the jurisdiction of Guyana will be done in accordance with the SAM regional strategy to meet the following strategic objectives:

a) Safety – The implementation of RNAV-5 has enabled formal and harmonised use of RNAV in new and existing RNAV routes, and created the necessary conditions for a complete restructuring of the route network. Consequently, it will be possible to develop a less complicated route network, reducing the controller workload and thus, increasing safety.

b) Capacity – Taking into account reduced airspace complexity and the resulting reduction in controller workload, there will be an increase in ATC capacity of sectors, allowing a larger number of aircraft to fly at the same time.

c) Efficiency – The implementation of RNAV-5 will increase operational efficiency, since it will permit:

- Airspace management improvements through the repositioning of intersections.

- Better use of available airspace through a route structure that allows for the establishment of:

  - More direct routes (double and parallel, if necessary) to accommodate more air traffic.

  - “Bypass” routes for aircraft overflying highly dense TMAs.

  - Alternate or contingency routes.

  - Optimum in-flight holding positions.

  - Optimised feeder routes.

- Reduction of distances flown, resulting in fuel savings.
- Reduction in the number of navigation radio aids.

d) Environmental protection – As a result of increased efficiency and fuel savings, there will be a reduction of harmful gas emissions into the atmosphere.

4.2 Terminal control areas (SIDs and STARs) and approach

The implementation of RNP1 and/or RNAV1 at the main TMAs, and of RNP APCH with Baro-VNAV at all thresholds used for IFR and/or RNP AR APCH operations where operational benefits (safety, efficiency, and access) can be obtained will mainly satisfy the following strategic objectives:

a) Safety – The implementation of RNP1 and/or RNAV-1 at the TMAs will permit segregation of arrival and departure paths, avoiding conflicts between aircraft. Use of RNP APCH with APV/Baro-VNAV and/or RNP AR ACPH will reduce the risk of controlled flight into terrain (CFIT).

b) Capacity – Use of RNAV-1 and/or RNP1 SIDs/STARs will permit reduced use of Surveillance/radar vectors and, thus, a reduction in airspace complexity and controller workload, increasing ATC capacity of sectors and allowing a larger number of aircraft to fly at the same time.

c) Efficiency – The implementation of RNP1 and/or RNAV-1 will improve efficiency, since the establishment of well-defined departure and arrival points will permit the restructuring of the routes arriving to/departing from the TMA, reducing flight time. STAR and approach interaction will create the conditions for the establishment of optimum arrival paths, from the en-route phase to the final approach. Likewise, RNP1 and RNAV-1 navigation precision will make aircraft paths more predictable, facilitating aircraft separation and reducing the need for air traffic controller intervention in case of aircraft deviation from the foreseen paths. STAR and approach integration will also improve predictability.

d) Environmental protection – Improved efficiency and fuel savings will reduce the emission of harmful gases into the atmosphere. Furthermore, the use of CDO/CCO will help reduce aeronautical noise.

e) Access – The implementation of RNAV (GNSS) approach with Baro-VNAV and/or RNP AR APCH at airports lacking ILS or whose terrain/obstacles result in high meteorological operational minima, will improve aerodrome access under adverse meteorological conditions.

5. Implementation

5.1 En-route operations

En-route PBN implementation is dealt with at regional level, taking into account that the main traffic flows straddling two or more States.

The regional PBN implementation strategy for en-route operations is based on the route network version concept, taking into account that airspace structure changes resulting from air traffic growth, traffic demand displacement from one Region or airport to another, and available technology, amongst other aspects. The use of route network versions reflects the need for periodic, comprehensive reviews to make sure that the best possible airspace structure is always available within the context of an integrated development concept. Route network versions are the result of a broader route network analysis based on traffic and fleet navigation capacity statistics, seeking the elimination of routes not being used and the exclusion or reduced use of “conventional” routes in a given airspace volume where most users have the capability of conducting RNAV-5 operations.

Furthermore, SAM route network versions must seek a complete route network restructuring through full integration of ATS routes, control sectors, TMAs, etc., using the flexible use of airspace concept. Likewise, the use of specific airspace modelling and fast-time ATC simulation tools should be assessed.

5.2 Complete redesign of terminal area.

5.2.1 TMA –Timehri

5.2.2 Preliminary operational requirements – see Appendix B (Airspace concept)

5.2.3 Tentative date of implementation – See Appendix C

5.3 Implementation of arrivals and departures, using CDO and CCO

The purpose of the PBN SID and STAR implementation programme is to publish these instrument procedures for all thresholds that operate IFR, with the use of CDO and CCO techniques.

Plans for, and the status of, implementation of PBN arrivals and departures, with or without the use of CDO and CCO techniques, are shown in **Appendix A,** and will be updated and delivered to the SAM Regional Office every six months, on 30 June and 31 December each year.

5.4 PBN approach

The purpose of the Aerodrome Approach Implementation Programme is to publish RNAV (GNSS) approach procedures for all thresholds that operate IFR, with the possibility of using vertical navigation (LNAV/VNAV) by using Baro-VNAV. Furthermore, ILS approach procedures will be published for airports with ILS equipment to facilitate arrival and approach interface.

Plans for, and the status of, implementation of PBN approach procedures are shown in **Appendix A**, which will be updated and delivered to the SAM Regional Office every six months, on 30 June and 31 December each year.

5.5 Fuel savings and reduction of CO_2 emissions

Fuel savings and the reduction of CO_2 emissions to be achieved through PBN implementation will be calculated using the IFSET tool, with a view to determining the efficiency of such implementation. The aforementioned calculation will be part of the complete redesign of the main TMAs and of the implementation of SIDs, STARs, and APV approach procedures. These calculations of fuel savings and CO_2 emission reduction will be delivered to the SAM Regional Office every six months, on 30 June and 31 December each year.

Calculations of actual fuel savings and reduction of CO_2 emissions will be performed during the post-implementation phase, using tools that retrieve data from Flight Operations Quality Assurance and/or other means that could provide actual information on fuel savings. Once these data are available, they will be delivered to the SAM Regional Office.

Appendix A

Status of implementation of PBN SIDs, STARs, and approach procedures

DATA COLLECTION DATE: 31 DECEMBER 2015												
STATE	CAR/SAM ANP INTERNATIONAL AIRPORTS	IFR thresholds	VFR thresholds	APV IAP	LNAV IAP	RNPAR IAP	PBN SID	PBN STAR	CCO SID	CDO STAR	OBS
GUYANA	GUYANA (2 AIRPORTS)										
	CHEDDI JAGAN INT'L	(2)	(2)	(1)	(6)	(0)	(0)	(2)	(0)	(2)	All published
		06/24	11/29	YES**	YES	NO	NO	YES	NO	YES	
	OGLE INT'L	2	2	0	2	0	0	0	0	0	
		07/25*	07/25*	NO	YES						RNAV GNSS IAP.

Note: The cited AIRAC dates are tentative, based on the capability of publishing instrument procedures.

(1) * Only one Runway available and it is used for both IFR and VFR.
(2) ** SYCJ ILS IAP – temporarily withdrawn to facilitate RWY06/24 extension at both ends.

Appendix B

Guyana Airspace Concept (extract)

2.1 OVERVIEW

To effectively address the challenges of the traffic composition and complexity within the Timehri TMA it would be necessary to follow the approach set out by ICAO in its Plan to implement Performance Base Navigation (PBN) in Terminal Areas.

PBN enables the systemization of air traffic organization and strategic de-conflicting of published ATS routes (including SIDS and STARS) and instrument approach procedures so as to reduce the need for tactical ATC intervention. Put differently PBN allows aircraft – to –aircraft separation and route spacing to be build-into the airspace design.

Since PBN specification for Terminal Areas is RNAV 1, it would be necessary for the local aircraft fleet and crews to be GNSS certified in order to utilize the advantages of PBN technology.(*Sufficient time must be given for this process***)**

In this regard therefore taking into consideration the current Navigation infrastructure and aircraft fleet certification; the design of the airspace while utilizing PBN concepts will allow for creation of SIDS and STARS and departure and arrival routes/procedures that would strategically de-conflict the traffic as far as practicable and all aircraft being cable of navigating along the desired tracks identifying the relevant way points/significant points using the current **Navaids (TIM VOR/DME)** and other prominent geographical locations that are familiar to most flight crews and ATCOS.,

2.2 TERMINAL AREA DESIGN

2.2.1 Standard Instrument Departure (SID), Standard Arrival Routes (STAR) and Terminal Routes –SYCJ.

2.2.2 SYCJ – RWY06: This RWY is predominantly used for arrivals, utilizing the ILS RWY06 approach procedure. The design of one SID and one STAR to link RWY06 will strategically de-conflict arrivals and departures at SYCJ.

2.2.2.1 STAR –LIKEV ONE ARRIVAL (coded name LIKEV1)

This STAR will start from significant Waypoint LIKEV at 30NM and Radial 320 (G443) TIM VOR/DME and ends at the THR RWY06 with specific bearing, distances and altitudes that will also allow for traffic to/from SYGO and the West sector to be separated easily. More importantly this STAR will separate traffic that will depart from RWY06 on the SID –DABIX ONE DEPARTURE (DABIX1) until the TMA (see map).

2.2.2.2 SID – DABIX ONE DEPARTURE (coded name DABIX1)

This SID will start from SYCJ RWY06 with a continuous climb on RWY heading to Waypoint BOLAP then left turn to Waypoint DABIX direct to the ATS route structure. The specific bearings, distances and altitudes will allow for separation of traffic to/from SYGO and for traffic arriving at SYCJ on STAR LIKEV1.

2.2.3 Standard Departure (SD) and Standard Arrival Routes (STAR) –visual –SYGO.

2.2.3.1 SYGO – RWY07: This RWY is predominantly used for arrivals, utilizing the RNAV RWY07/Visual approach procedure or VFR arrival procedures. The design of SDs and STARs - Visual to link RWY07 will strategically de-conflict arrivals and departures at SYGO.

2.2.3.2 STAR –Visual – These routes will align traffic flow from the North West sector to SYGO RWY 07 approach.

2.2.3.2.1 KALUP ONE (Coded name KALUP 1). This STAR will start from Waypoint KALUP direct to GO120 to join the approach procedure to RWY07. The traffic must cross KALUP at the specified altitude to be separated (below) the departing traffic via DABIX1B.

2.2.3.2.2 MEXEN ONE (coded name MEXEN 1). This STAR will start from Waypoint MEXEN at F035 direct to GO120 to cross GO140 at A025 and join the approach procedure for RWY07.

2.2.3.2.3 SIBOM ONE (coded name SIBOM 1). This STAR will start from Waypoint SIBOM at F035 direct to GO120 to cross GO150 A025 and join the approach procedure for RWY07.

2.2.3.3 Standard Departure Routes Visual - (SD). These routes will start from RWY07 direct to specific Waypoints to cross them at altitudes that will strategically separate the departing traffic from traffic arriving on STARs KALUP 1, MEXEN 1 and SIBOM 1.

2.2.3.3.1 DABIX ONE BRAVO VISUAL (code name DABIX 1). This Standard departure (SD) route will start from SYGO RWY07 with a continuous climb on RWY heading until the coastline then left turn direct Waypoint DABIX F035 or above, direct destination.

2.2.3.3.2 ALBOK ONE VISUAL (coded name ALBOK 1). This SD route will start from SYGO RWY07 with a continuous climb on RWY heading until the coastline then left turn direct Waypoint DABIX TO CROSS IT AT F035 or above, then transit the TMA on a specific bearing and altitude to terminate at Waypoint ALBOK.

2.2.3.3.3 TIMEHRI ONE VISUAL (coded name TIM 1). This SD will start from SYGO RWY07 with a continuous climb on RWY heading until the coastline, left turn direct DABIX to cross it at F035, direct GO110 at F060 or below, and direct TIM F060 or above direct destination. In addition to 2.2.3.3, this SD will also separate traffic arriving at SYCJ on STAR –LIKEV ONE and traffic Departing SYCJ on SID – DAXIB ONE.

2.2.3.3.4 LITOL ONE VISUAL (coded name LITOL 1). This SD will start from SYGO RWY07 with a continuous climb on RWY heading, right turn direct ENMOR direct DABUM, direct XXXX at F050 or above, and direct LITOL or above direct destination.

Appendix C

GUYANA - PROJECT PLANNING

	ACT	*(to be read from bottom-up)*	No. of Days	Key Dates (latest)
IMPLEMENT	**15**	Implementation of Airspace Change (Match Airac Cycle date)	20	**11/10/2016**
	14	Implementation Planning - Write up LoAs - ATC System Changes	90	8/12/2016
	14	Training seminar and awareness programs.	15	7/28/2016
VALIDATE		Additional working day buffer to allow for un foreseen delays	131	3/19/2016
	12-13	Procedure Design and Validation + 56 day AIRAC cycle - ATC Training ‡	100	12/10/2015
	11	Airspace Concept Validation by Fast-Time Simulation (Preparation and runs) ATM synthetic tracks.	10	11/30/2015
DESIGN			5	11/25/2015
	10	Selection of ICAO Navigation Specification	5	11/20/2015
	7-9	Finalize - Airspace Design - Routes and Holds	15	11/5/2015
	9	Airspace Design - volume and sectors	10	10/26/2015
	7	2nd Iteration: Airspace Design - Routes and Holds, volumes and sectors.	10	10/16/2015
	8	Navigation Analysis of Airspace Design	15	10/1/2015
	7	1st Iteration: Airspace Design - Routes and Holds	10	9/21/2015
PLANING	**6**	Data collection and agreement on CNS/ATM assumptions incl. Fleet capability; traffic sample etc.	10	9/11/2015
	5	Select Safety Criteria; Determine Performance Criteria and understand Safety Policy Considerations	10	9/1/2015
	4	Analyse Reference Scenario (incl. Data collection of full ATM operations and critical review of current operations)	25	8/7/2015
	1 - 3	Agree Operational Requirement; Project Planning; Create Airspace Design Team; Agree Project Objectives and Scope	30	7/8/2015