



SAM/IG/4  
WP/21  
16/07/09

**International Civil Aviation Organization  
South American Regional Office**

**FOURTH WORKSHOP/MEETING OF THE SAM IMPLEMENTATION GROUP (SAM/IG/4)  
REGIONAL PROJECT RLA/06/901**

**Lima, Peru, 19 to 23 October 2009**

**Agenda Item 3: Implementation of performance-based navigation (PBN) in the SAM Region**

**PBN implementation planning in Brasilia, Recife, Rio de Janeiro and São Paulo TMA**

(Presented by Brazil)

**Summary**

This working paper presents the AIC to be published by the Brazilian administration on 19/NOV/09, informing on the implementation planning in Brasilia, Recife, Rio de Janeiro and São Paulo TMA.

**References:**

- SAM/IG/3 Report
- Draft Brazilian Action Plan (WP/13)

**1 History**

1.1 SAM/IG/2 meeting took note that the Regional Project RLA/06/901 developed a PBN implementation plan in TMA and Approach, in order to enable a better understanding of the activities and results expected. The objective was to clearly define the products to be delivered, in order to break down the great workload in specific activities. These activities will be used as a foundation for the drafting of the programmes schedule.

1.2 The SAM/IG/2 Meeting therefore adopted the new action plan models for TMA and Approach, which incorporated the results of the PBN Seminar (Lima, 17-20 June 2008). The changes made in the action plan models did not modify the essence of the previous action plan. The SAM/IG/2 Meeting then formulated Conclusion SAM/IG/2-4.

1.3 Activity 7.5 (prepare an AIC model to report PBN implementation planning) and activity 7.6 (publish an AIC reporting the PBN implementation planning) are required in the plan models for PBN implementation in TMA, keeping in mind the need that aircraft operators carry out the necessary activities for the airworthiness and operations approval.

1.4 PBN implementation project in TMA, foreseen in the PBN implementation plan for Brazil, which is presented at WP/13, foresees, likewise, activities 7.3 and 7.4, aimed at the preparation and publication of the PBN AIC in TMA.

## 2 Analysis

2.1 The AIC reporting PBN implementation in Brasilia, Recife, Rio de Janeiro and São Paulo, TMAs is attached to this working paper as **Appendix A (English version only)**.

2.2 The AIC, in addition to PBN implementation reporting, has the objective to initiate the development of application procedures in the different navigation specifications, in airspace with ATS surveillance.

2.3 Obviously, the PBN application depends on the aircraft and operations approval for one or more navigation specifications that may be used in a specific airspace. In case Brasilia, Recife, Rio de Janeiro and Sao Paulo TMAs, SID/STARs may be executed with the following RNP APCH navigation specifications with or without Baro-VNAV application.

2.4 Keeping in mind that currently there are aircraft and operators approved for GNSS use for arrival, departure and approach, such approvals shall also be accepted for the use of the new SID, STARs and approach procedures.

2.5 Taking into consideration that there will be some TMA which will not have an adequate DME coverage, to attend RNAV-2 and RNAV-1 specifications, and that some aircraft do not have GNSS, SID and STAR will be executed by RNAV-5 approved aircraft and operators, under the following conditions:

- a) RNAV STAR – The aircraft shall be cleared to descend up to the minimum flight level in the FIR (FL 110 in the Curitiba and Brasilia FIRs, FL 080 in the Amazônica and Recife FIRs). In entering the sector minimum altitude area (MSA), the aircraft may be able to continue descending up to MSA. The descent below MSA will only be cleared with the use of radar vectors.
- b) SID RNAV – The aircraft will initially execute a “conventional” exit. In crossing the flight minimum altitude in the corresponding FIR, the aircraft will be able to be cleared to intercept an RNAV SID.

2.6 Another aspect to highlight is the anticipated application of some portions of Amendment 1 to Doc 4444 which date of applications is foreseen for November 2012. with the need that the ATCO may have the knowledge of the aircraft and operator approval status for the different navigation specifications, the Brazilian Administration has hired the necessary changes in ATC automated systems, with a view to present a flight progression band and in the radar “target” the essential information to the ATC. Then it will be necessary that aircraft operators insert the corresponding codes in boxes 10 and 28 of the FPL. Also, aircraft operators shall also have to insert the mentioned information in the RPL. Keeping in mind that amendment 1 to Doc 444 does not cover an amendment in RPL for, the Brazilian Administration has decided to adopt, preliminarily, the same codes used in RVSM implementation.

### 3 **Suggested action**

3.1 The meeting is invited to:

- a) Take note of the information provided in this working paper.
- b) Discuss the need to harmonize the adoption of navigation specifications in airspace using ATS surveillance.
- c) Discuss the need to harmonize the anticipated adoption of amendment 1 to Doc 4444.

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## APPENDIX A

**BRASIL**

**DEPARTAMENTO DE CONTROLE DO ESPAÇO AÉREO**

**DIVISÃO DE GERENCIAMENTO DA NAVEGAÇÃO AÉREA**

**AV GENERAL JUSTO, 160 – 2º AND. - CASTELO**

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**AIC**

**A**

**xx/09**

**19 NOV 2009**

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**PERFORMANCE BASED NAVIGATION IMPLEMENTATION IN THE BRASILIA, RECIFE,  
RIO DE JANEIRO AND SAO PAULO TMAs**

### **1 PRELIMINARY ARRANGEMENTS**

#### **1.1. PURPOSE**

The purpose of this Aeronautical Information Circular (AIC) is to present information in respect of a planning to change the air traffic flow for the implementation of Performance Based Navigation (PBN) in the Brasília, Recife, Rio de Janeiro and Sao Paulo TMAs.

#### **1.2 SCOPE**

The arrangements established by this AIC apply to all those who make use of the Standard Instrument Arrival Routes (STAR), IFR Standard Instrument Departure Charts (SID) and IFR Instrument Approach Charts (IAC), based on the Area Navigation (RNAV) and/or Required Navigation Performance (RNP), at Brasília, Recife, Rio de Janeiro and Sao Paulo TMAs, while on duty.

### **2. PERFORMANCE BASED NAVIGATION**

2.1. Performance-Based Navigation specifies the RNAV system performance requirements to aircraft operating along an ATS route, on an instrument approach procedure or in a designated airspace.

2.2. The performance requirements are defined in terms of accuracy, integrity, continuity, availability and necessary functionalities for the operation proposed by an airspace concept. The performance requirements are identified in the navigation specifications, which identify the equipments and sensors that could be used to satisfy such requirements.

2.3. There is RNP specification and RNAV specification. The RNP specification has the monitoring and alert performance on-board of the aircraft, and it is assigned as RNP “X”, where X is the accuracy value associated with the navigation performance. The RNAV specification does not have monitoring and alert performance on-board of the aircraft, and in the same way, it is assigned as RNAV “X”.

2.4. The navigation based in performance depends on:

- a) The RNAV system installation on-board the aircraft, which is being approved to meet the functional and navigation performance requirements, specified to RNAV and/or RNP operations in a specific airspace;
- b) The fulfillment, by the flight crew, of the operational requirements established by the RNAV operation regulating entity;
- c) One explicit concept of airspace, which includes RNAV and/or RNP operations; and
- d) The availability of one infrastructure that promotes adequate air navigation.

The PBN main benefits are:

- a) Increase airspace safety, through the continuous and stabilized descending procedures implementation, with vertical guidance, significantly reducing events of controlled flight into terrain (CFIT);
- b) Reduction in the aircraft flight time, through the implementation of optimum flight trajectory, independent of the ground air navigation, reducing the fuel consumption and, consequently, reducing the emissions to the environment;
- c) Utilization of the RNAV and/or RNP capacity already installed in a significant portion of aircraft fleet that flight within Brazilian airspace;
- d) Trajectory optimization, in any meteorological condition, making possible to prevent critical conditions of terrain and environment, such as aircraft noise, through the use of RNAV and/or RNP trajectories;
- e) Implementation of more precise trajectory, approach, take-off, and landing, reducing the dispersion and giving more predicable traffic flow;
- f) Delay reduction in airspace and airports with high density air traffic, with the increase in the ATC capacity, due to the implementation of parallel routes, new points in the TMA and approach procedures with lower operational minimum;

- g) Potential reduction in the parallel routes separation in order to accommodate more air traffic in the same flow;
- h) Work load reduction for the air traffic controller and pilot. The use of RNAV and/or RNP trajectory will reduce the necessity of radar vectors, and consequently, the time used in the pilot/controller communications.

2.5. The ICAO Manual on Performance-Based Navigation (Doc. 9613) establishes various different navigation specifications that can be applied globally. Given the air traffic characteristics for Brasilia, Recife, Rio de Janeiro and São Paulo TMAs, several navigation specifications will be applied in order to allow a greater number of aircraft equipped with RNAV systems, as described below.

### **3. AIR NAVIGATION PROCEDURES AT BRASILIA, RECIFE, RIO DE JANEIRO AND SAO PAULO TMAS**

3.1. The new air navigation procedures for Brasilia and Recife TMAs (STAR, SID and IAC), based on RNAV, shall be published on 11 February 2010 and shall be implemented starting in 08 April 2010.

3.2. The new air navigation procedures for Rio de Janeiro and Sao Paulo TMAs (STAR, SID and IAC), based on RNAV, shall be published on 23 September 2010 and shall be implemented starting in 18 November 2010.

3.3. The procedures for the air navigation included in 3.1 and 3.2 must be accomplished only by operators and aircraft approved by State of Registry or by State of Operator, according to each case. The process for the Brazilian operators and aircraft approval is established by the National Civil Aviation Agency.

3.4. The use of the navigation specifications and the navigation systems described on this AIC must observe the occasional restrictions prescribed for the approval granted to aircraft and operator, issued by the Civil Aviation Authorities.

3.5. Standard Instrument Arrival Routes (STAR) and Standard Instrument Departures (SID), based on Area Navigation (RNAV)

3.5.1. The RNAV STAR and RNAV SID may be accomplished by the aircraft and operator since they are approved for one, or more, of the following navigation specifications: RNAV2, RNAV1 and Basic RNP1.

3.5.2. RNAV STAR and RNAV SID may also be accomplished by aircraft and operator approved for the accomplishment of such procedures using the GNSS.

3.5.3. Aircraft approved for RNAV 5, except those that use RNAV systems based on VOR/DME, may use the RNAV STAR. They will limit their descent to the minimum flight altitude at the FIR up to reaching the airspace limit comprised by the minimum sector altitude (MSA), prescribed at the IFR approach procedure in use at the moment of the operation. Thence, the aircraft may be authorized to descend until the minimum sector altitude.

3.5.4. Aircraft approved for RNAV5, except those that use RNAV systems based on VOR/DME, may use at first a conventional exit based on VOR or NDB. Thence, when crossing the minimum flight level at the FIR where the operation is accomplished, they may be forwarded to intercept a RNAV SID.

3.5.5. The operation of aircraft within the RNAV STAR and RNAV SID, based on the RNAV (RNAV5, RNAV2 and RNAV1) navigation specifications will be conditioned to the use of the ATS Surveillance System by the involved ATC units. Only aircraft and operator approved for the Basic RNP1 navigation specification may remain using the RNAV STAR and RNAV SID, when the ATS Surveillance System is unavailable.

3.5.6. In the specific case of Recife TMA, there will be no enough DME coverage to attend the requirements prescribed for RNAV2 and RNAV1, using the navigation system based on DME/DME. Under those circumstances, operators intending to use the RNAV STAR and RNAV SID, applying both RNAV2 and RNAV1 navigation specifications, must compulsorily use the GNSS.

### 3.6. RNAV Approach Procedures

3.6.1. The RNAV approach procedures may be accomplished by the aircraft and operator since they are approved for the RNP APCH Navigation Specification.

3.6.2. The RNAV approach procedures may also be accomplished by the aircraft and operator since they are approved for the accomplishment of such procedures using the GNSS.

3.6.3. Brasilia and Recife Aerodromes will be provided with RNAV/ILS and RNAV/Baro-VNAV procedures. The conduction of such procedures will also require the specific aircraft and operator approval .

### 3.7. Identification of STAR, SID and Approach Procedures

3.7.1. RNAV STAR and RNAV SID that allow the use of the RNAV5, RNAV2 and RNAV1 navigation specifications will be identified as RNAV STAR or RNAV SID.

3.7.2. RNAV STAR and RNAV SID, based on the Basic RNP1, with application of GNSS or under the approval of the aircraft and operator for the use of GNSS at SID/STAR, must be identified as RNAV STAR (GNSS) or RNAV SID (GNSS).

3.7.3. The RNAV approach procedures, based on the APCH RNP navigation specification or under the approval of the aircraft and operator for the use of GNSS for IFR approach, will be identified as RNAV (GNSS).

### 3.8. Completion of the Flight Plan

3.8.1. The status of operator and aircraft approval relating to any type of RNAV and /or RNP navigation specifications must be indicated on the Filed Flight Plan (FPL), by inserting the letter “R” in item 10 of the Flight Plan form.

3.8.2. For the specific case of the Repetitive Flight Plan (RPL), the above mentioned approval must be indicated by inserting the letter “R” in item “Q” of the RPL, as follows: EQPT/R.

3.8.3. The approval status of PBN must be detailed in item 18 of the FPL or in item “Q” of the RPL, by inserting the following alphanumeric codes, not exceeding 8 codes , or 16 characters, preceding the designator PBN/:

| <b><u>RNAV Specifications</u></b> |                                |
|-----------------------------------|--------------------------------|
| Code                              | Navigation Specification       |
| B1                                | RNAV 5 – All permitted sensors |
| B2                                | RNAV 5 GNSS                    |
| B3                                | RNAV 5 DME/DME                 |
| B5                                | RNAV 5 INS ou IRS              |
| C1                                | RNAV 2 – All permitted sensors |
| C2                                | RNAV 2 GNSS                    |
| C3                                | RNAV 2 DME/DME                 |
| C4                                | RNAV 2 DME/DME/IRU             |
| D1                                | RNAV 1 – All permitted sensors |
| D2                                | RNAV 1 GNSS                    |
| D3                                | RNAV 1 DME/DME                 |



|                                  |                                     |
|----------------------------------|-------------------------------------|
| D4                               | RNAV 1 DME/DME/IRU                  |
| <b><u>RNP Specifications</u></b> |                                     |
| Code                             | Navigation Specification            |
| O1                               | Basic RNP 1 – All permitted sensors |
| O2                               | Basic RNP 1 GNSS                    |
| O3                               | Basic RNP 1 DME/DME                 |
| O4                               | Basic RNP 1 DME/DME/IRU             |
| S1                               | RNP APCH                            |

3.8.4. The status of operator and aircraft approval relating to the use of the GNSS must be indicated by inserting the letter “G” in item 10 of the Flight Plan form.

3.8.5. For Repetitive Flight Plan (RPL), the above mentioned approval status must be indicated by inserting the letter “G” in item “Q” of the RPL, as follows: EQPT/G.

#### **4. PBN OPERATIONS WITHIN THE BRASILIA, RECIFE, RIO DE JANEIRO AND SAO PAULO TMAs**

4.1. Aircraft and operator without RNAV and/or RNP navigation specifications approval may still fly within the Brasilia, Recife, Rio de Janeiro and Sao Paulo TMAs after the implementation dates mentioned on the items 3.1 and 3.2 by using the conventional procedures (VOR/DME or NDB) or under radar vectoring used by the ATC units involved by the aircraft operations. However, sometimes, the involved ATC units may authorize the operation of such aircraft out of their optimum flight profile by increasing the distance to be flown or by using altitude restrictions.

4.2. Updated documentation and information about PBN implementation at Brasilia, Recife, Rio de Janeiro and Sao Paulo TMAs may be found at the following website of the Department of Airspace Control : <http://www.decea.gov.br/cns-atm> .

4.3. Additional information could be obtained through the following contacts:

**Air Navigation Management Division:**

- Tel: ++55-21-21016273;
- Fax: ++55-21-21016233;
- Email: [dgna@decea.gov.br](mailto:dgna@decea.gov.br).

**5. FINAL ARRANGEMENTS**

**5.1** Non-expected circumstances which may nevertheless be detected shall be revised by the current Chief of Airspace Control Department Subdepartment of Operations.