



International Civil Aviation Organization

CAR/SAM Regional Planning and Implementation Group (GREPECAS)

**Sixth Meeting of the Air Traffic Management / Communications, Navigation and Surveillance Subgroup (ATM/CNS/SG/6) - ATM Committee**

Boca Chica, Dominican Republic, 30 June-4 July 2008

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**Agenda Item 2: Report of the ATM Committee Task Forces**  
**2.1 Performance-based navigation (PBN)**

**REPORT OF THE FIRST MEETING OF THE PERFORMANCE-BASED NAVIGATION TASK FORCE (PBN/TF/1)**

(Presented by the Rapporteur of the PBN/TF)

**SUMMARY**

This Working Paper contains the report of the first meeting of the PBN Task Force, held during the AP/ATM/13 meeting (Bogotá, Colombia, 9-13 June 2007).

**References:**

- Report of the AP/ATM/13 meeting

**1. Introduction**

1.1 The first meeting of the PBN Task Force was held during the thirteenth meeting/workshop of ATM Authorities and Planners of the CAR/SAM Regions (AP/ATM/13 - Bogotá, Colombia, 9-13 July 2007). The report of the AP/ATM/13 meeting with regard to PBN is attached as an **Appendix** to this working paper.

1.2 The PBN/TF/2 meeting was broken down into two different working groups to discuss the tasks assigned to the Air Traffic Control Working Group (ATC/WG) and to the Operations and Airworthiness Working Group (OPS/AIR/WG). The Safety and Airspace Monitoring (SAM) Working Group had no activities because the experts on the subject did not attend the meeting.

**2. Analysis**

2.1 The PBN/TF/1 discussed several issues regarding PBN implementation in the CAR/SAM Regions, mainly:

- a) Air Traffic Working Group (ATC/WG)
  - ✓ Revision status of Doc 9613, the Performance-Based Navigation (PBN) Manual
  - ✓ Action taken by the GREPECAS/14 meeting with regard to performance-based navigation (PBN) in the CAR/SAM Regions
  - ✓ Recommendations proposed by ICAO to develop the Roadmap by region
  - ✓ PBN implementation
  - ✓ PBN AIC model
  - ✓ PBN training
  - ✓ Terms of Reference and Work Programme of the PBN/TF
  
- b) Operations and Airworthiness Working Group (OPS/AIR/WG)
  - ✓ PBN Manual
  - ✓ Development of the ICAO Roadmap
  - ✓ Action taken by the GREPECAS/14 meeting
  - ✓ Performance-based navigation roadmap in the CAR/SAM Regions

2.2 The meeting formulated Conclusion AP/ATM/13/05 in order for States to establish their National PBN Implementation Plans.

***Conclusion AP/ATM/13/05 National PBN Implementation Plans***

*That in order to initiate PBN implementation, the States, Territories and International Organizations:*

- a) develop their national PBN implementation plans, considering the dates foreseen in the CAR/SAM PBN roadmap, and present them at the next AP/ATM meeting;*
- b) consider using as guidance material the PBN action plan models presented in **Appendices B, C and D** to this part of the report; and*
- c) designate a contact point who will coordinate PBN implementation activities in his/her State.*

**3 Suggested action**

3.1 The Meeting is invited to:

- a) take note of the information presented in this working paper;
- b) review the contents of Appendix A and propose any changes it deems necessary in order to lay the foundations for the report to be submitted to the ATM Committee; and
- c) discuss Conclusion AP/ATM/13/05 and the need for/viability of proposing a draft conclusion for consideration by the GREPECAS mechanism.

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**Agenda Item 4: Performance Based Navigation (PBN) in the CAR/SAM Regions****a) PBN issues related with the ATC Operations working group (ATC/WG)****Status of revised ICAO Doc 9613, *Manual on Performance Based Navigation (PBN)***

4.1 The Meeting recalled that in December 2003, ICAO established the Required Navigation Performance (RNP) Special Operations and Requirements Study Group (RNPSORSG), generally referred to as the ICAO RNP Study Group, to address the confusion in terms and proliferation of requirements for RNP-based operations. This Group amended ICAO Doc 9613, titling it as *Manual on Performance Based Navigation*, in two volumes. ICAO Secretariat determined that this document should remain as a draft until completion of series of jointly-presented ICAO-FAA-EUROCONTROL 3-day seminars on the new Manual, in all ICAO Regions, to be held from September 2007 through June 2008. The seminars for CAR/SAM regions will be carried out in Lima (16 to 20 June 2008) and Mexico City (23 to 27 June 2008). These seminars will be a feedback for the attendees on the concepts and implementation processes presented in Volume I of the Manual.

4.2 The participation of all stakeholders in the PBN implementation process is expected at the referred seminars. These can include ATM planners, air navigation service providers, regulators, air operators, ATC and procedure design personnel, aerodrome management and others. The latest information on the seminars and PBN in general can also be found at [www.icao.int/pbn](http://www.icao.int/pbn).

4.3 Volume II of the new ICAO PBN Manual contains detailed technical “Navigation Specifications” with standardized, harmonized airworthiness and operator requirements for several RNAV and RNP operations. These Navigation Specifications also contain detailed recommendations for pilot and controller training.

**ICAO State Letter AN 1 1145-07122 Key Provisions**

4.4 ICAO, recognizing that substantive changes to Volume II technical navigation specifications are not expected as a result of the PBN Manual seminars, sent a State Letter issued on 27 April 2007 stating that noting the great demand expressed by States to commence implementation of ATS routes and instrument flight procedures based on PBN, and in order to avoid proliferation of operational approval requirements, the relevant guidance material taken from the manual is being distributed at an earlier date so that States may make advance use of this critical information prior to publication of the new edition of the manual. Paragraph 5 of the referred letter urges all States wishing to implement PBN operations, to establish an appropriate approval process in accordance with the guidance material attached to the letter.

**Implementation of Navigation Specifications**

4.5 It is worth mentioning that Navigation Specifications as embodied in the PBN Manual, are not by themselves, considered to be regulatory guidance material, therefore, each State should issue its own regulations. For example, in the United States, the FAA has recently revised Advisory Circular 90-100A to reflect the provisions for RNAV 1 and RNAV 2 operations detailed in the ICAO Navigation Specifications for RNAV 1 and RNAV 2.

### **Actions adopted by GREPECAS/14 Meeting with regard to Performance Based Navigation (PBN) in the CAR/SAM Regions**

4.6 The Meeting took note of the actions adopted by GREPECAS/14 when reviewing the information concerning PBN, RNAV and RNP, and also the guidelines and directives for CAA inspectors to approve the following types of operations: RNP 10, RNP 4, RNAV 5, RNAV 2, RNAV 1, RNP APCH and RNP AR APCH (where beneficial).

4.7 With regard to Safety Assessment Seminars and Methodology, GREPECAS acknowledged that, in order to implement the PBN concept in a harmonious manner, a safety assessment of different parts of the airspace, applying different methodologies, will be required. It was also considered that there were a limited number of professionals involved in the area of safety assessment.

4.8 In this respect, the Meeting noted that ICAO had scheduled two PBN seminars to be held in both Regions, and that Airspace Safety Assessment Courses would take place in each Region. It was also noted that there was no common methodology for terminal area safety assessments, it being understood that the Separation and Airspace Safety Panel could address this issue.

4.9 In view of the above, GREPECAS agreed on conclusion 14/47, through which ICAO is requested to promote seminars on safety assessment to train personnel for working in the future implementation of PBN; and encourage the Separation and Airspace Safety Panel (SASP) to develop a common terminal area safety assessment methodology.

4.10 Concerning Operational Errors in a PBN Environment, GREPECAS considered appropriate that when developing operational risk assessment requirements as well as national regulations for PBN approval of aircraft and operators, consideration be given to the guidance and operational criteria developed by the ATM Committee at its fifth meeting. Furthermore, it requested that States/Territories/International Organizations analyse the importance of operational errors in a PBN environment, and use all possible resources for training air traffic controllers and pilots in order to reduce these errors, bearing in mind the future implementation of this concept in the CAR/SAM Regions.

### **Recommendations proposed by ICAO for development of a PBN Roadmap by region**

4.11 The Meeting was informed that ICAO, with the assistance of the RNP SORSG and other ICAO bodies (such as SASP, Instrument Flight Procedures Panel (formerly OCP) and Navigation Systems Panel), are carrying out work, to clarify all RNAV and RNP guidelines so as to ensure a common understanding of RNP and the relationship between RNP and RNAV functionality, facilitating at the same time global harmonization of existing applications as well as the establishment of the future basis of a global performance based air navigation system to benefit the entire global aviation community.

4.12 As a result of the above, new ICAO SARPs and guidelines, with amendments to various ICAO Annexes, the *Performance Based Navigation Manual*, and other related provisions are under development. Current status is as follows:

- a) Revised RNAV and RNP terminology in the Annexes:
  - Preliminary review undertaken by ANC (175-6)
  - State consultation 3<sup>rd</sup> quarter 2007
  - Applicable November 2008

- b) Performance Based Navigation Manual:
  - Available on ICAO-NET as final draft: March 2007
  - State letter with all navigation specifications included: April 2007
  - Inclusion of navigation specifications as described under paragraph 2.7 expected in 2008.
- c) Instrument Flight Procedure requirements:
  - i) PANS-OPS revision by IFPP WGWHL in August 2007
    - Consultation to the States: 1<sup>er</sup> quarter of 2008
    - Applicable at the end of 2008 or at the beginning of 2009
  - ii) RNP AR procedure design manual (final draft by September)
  - iii) Procedure design QA manual (final draft by September)
  - iv) Procedure design Training manual (final draft by September)
  - v) Procedure design software validation manual (final draft by September)
- d) ATC Separation Criteria:
  - Currently under review by the Separation and Airspace Safety Panel (SASP)

4.13 A working paper that shall be presented in September to the 36th Assembly, which has been approved by the Air Navigation Commission seeks that States and/or regions develop an implementation plan by 2009 to achieve the following goals:

- a) where RNAV operations are required, all RNAV enroute (oceanic and continental) and terminal ATS routes should be implemented according to PBN by 2016, with intermediate milestones as follows:
  1. enroute oceanic and remote airspace (RNAV 10 or RNP 4): 100 per cent implementation by 2010;
  2. enroute continental airspace (RNAV 5, 2 and 1): 70 per cent by 2010, 100 per cent by 2014; and
  3. terminal area (RNAV 1 and 2, and basic RNP 1): 30 per cent by 2010, 60 per cent by 2014, 100 per cent by 2016; and
- b) all instrument runway ends should have an approach procedure with vertical guidance (APV), either as the primary approach or as a back-up for precision approaches by 2016 with intermediate milestones as follows: 30 per cent by 2010, 70 per cent by 2014 .

4.14 The Meeting recalled that the PBN Roadmap for the CAR/SAM Regions was approved by GREPECAS/14 through Conclusion 14/46 - CAR/SAM PBN Roadmap, encouraging

States/Territories/International Organizations to adopt and apply the referred PBN Roadmap. This Roadmap included a short term (until 2010) and mid-term (2011-2015) implementation strategy. In addition, GREPECAS requested to take into consideration the implementation plan developed by ICAO and, in this regard, to review the CAR/SAM PBN Roadmap.

4.15 In view of the above, the Meeting reviewed the CAR/SAM PBN Roadmap and considered that there is no provision for implementation of a SBAS system in the CAR/SAM Region at short and medium terms for the implementation of APV-1 and APV-2 procedures, therefore, the only choice for non precision approach procedures implementation with vertical guidance are Baro-VNAV procedures.

4.16 Note was taken that ICAO Doc 9613 (PBN Manual) already contains navigation specifications for the use of APV procedures based on Baro-VNAV (Appendix A of Part B of Volume II). Doc 8168 (PANS-OPS), Volume II, establishes the criteria for preparation of Baro-VNAV procedures (Part III, Chapter 3, Section 43).

4.17 Since the CAR/SAM Roadmap for PBN does not contain guidance on the implementation of Baro-VNAV procedures, the Meeting deemed appropriate to insert the following new paragraph in Chapter 7 of such document:

*7.3.3.1 Approach procedures for PBN should be implemented as approach procedures with vertical guidance (APV) utilizing Baro-VNAV for runways either as the primary approach or as a back-up for precision approaches for all instrument runway, based on the RNP APCH or RNP AR APCH navigation specifications.*

*Note.- PBN manual, Volume II, Attachment A contains the Specifications for utilizing Baro-VNAV in conjunction with RNP APCH.*

4.18 Consequently, the Secretariat was requested to insert editorial changes in the PBN Roadmap, according with the PBN Manual (Doc 9613). This roadmap is included in **Appendix A** to this part of the Report.

### **PBN Implementation**

4.19 The Meeting recognized that in an effort to assist States with the implementation of the global ATM Operational Concept, ICAO has drafted a new Global Air Navigation Plan (GANP), which focuses on an efficiency approach based on the operational and technical improvements that will enable aircraft operators to derive short- and medium-term benefits.

4.20 The Meeting recalled that GREPECAS, through Conclusion 14/41, approved the ATM Performance Objectives, supported by a series of “Global Plan Initiatives” (GPI), which will enable covering PBN implementation requirements particular to CAR and SAM Regions, and requested the States, Territories and International Organizations to develop their own action plans based on these ATM performance objectives. Among these, Performance-based navigation will be a key tool for a series of Global Plan Initiatives.

4.21 PBN implementation planning in the CAR/SAM Regions was practically completed with the approval of the CAR/SAM PBN Roadmap. The main task of the PBN Task Force will be to harmonise PBN implementation in the CAR and SAM Regions, taking into account the need to avoid multiple ATC procedures and operational approval processes. Considering that PBN en-route implementation will involve more than one State, Territory and International Organization, it will be appropriate that CAR and SAM

implementation groups apply the RNAV and RNP navigation specifications according to the needs and requirements of each ATM homogeneous area or main traffic flow.

4.22 The Meeting considered that the States, Territories and International Organizations should prepare their own PBN implementation plans including regional planning show in the roadmap. In order to provide guidance to the States on this matter, ICAO will prepare a national implementation plan model that for the consideration of the PBN Task Force.

4.23 Additionally, the Meeting deemed appropriate that ICAO obtains from the States, Territories and International Organizations, the names and data of the officers designated as managers of these implementation plans, who should coordinate PBN implementation activities in their States.

4.24 The national implementation plans should count, among other matters, with the action plans including the associated activities, dates and responsible for each activity. The Meeting was of the opinion that guidelines on these activities should be provided to the States, Territories and International Organizations. In view of the above, different Ad hoc groups were composed in order to develop action plans for en-route, terminal and approach PBN implementation processes.

4.25 The action plan corresponding to the enroute phase could serve as model for CAR/SAM implementation groups, while the terminal and approach action plans could be used as guidance material for the States, Territories and International Organizations. In view of the above, the Meeting adopted the following conclusion:

#### **Conclusion AP/ATM/13/05**

#### **National PBN implementation plans**

That in order to initiate PBN implementation, the States, Territories and International Organizations:

- a) develop their PBN national implementation plans considering the dates foreseen in the CAR/SAM PBN roadmap and present it at the next AP/ATM Meeting;
- b) consider to use as guidance material the PBN action plans models, presented in **Appendices B, C and D** to this part of the Report; and
- c) designate a contact point who will coordinate PBN implementation activities in his State.

#### **PBN AIC Modelo**

4.26 On the other hand, it was noted that the administration of Colombia, together with IATA and ALTA are preparing an aeronautical information circular (AIC) containing basic information on PBN implementation. These three organizations committed to present at the next meeting an AIC model to be evaluated by the PBN/TF and will be used as regional guidance material.

#### **PBN Training**

4.27 The Meeting was of the opinion that in PBN implementation, training is of vital importance and considered that, in particular, civil aviation administrations should provide greater support in the instruction and regular training to the instrument approach procedures designers. This will permit

that the States, Territories and International Organizations could accomplish the commitments acquired through the adoption of the PBN Roadmap in the CAR/SAM Regions.

4.28 The Meeting also considered that it could be necessary to have available PBN training packages for pilots and controllers. In this regard, IATA will evaluate the possibility to develop a training plan for pilots at the next PBN/TF meeting.

4.29 In addition, a working group composed by Chile, Colombia, Brazil, Dominican Republic and Paraguay was formed, in order to develop a CAR/SAM PBN/ATC Training Manual enhanced with the experiences of the States. This group will be coordinated by ICAO. The draft of this manual should be presented at the next PBN/TF meeting.

### **Terms of Reference and PBN/TF Work Programme**

4.30 The Meeting reviewed the Terms of Reference and PBN/TF Work Programme and the associated Working Groups (ATM/WG, OPS/AIR/WG) presented in **Appendix E** to this part of the Report. Concerning the terms of reference and work programme of the SAM/WG, it was agreed that ICAO jointly with CARSAMMA will review and amend them as required.

#### **b) PBN issues related with the Aircraft Operation and Airworthiness Working Group (OPS/AIR/WG)**

4.31 The OPS/AIR working group analyzed and discussed the working papers assigned to this group. The comments and conclusions of the discussions in the operations and airworthiness field are detailed as follows:

#### **PBN Manual**

4.32 The Meeting analyzed the PBN Manual, ICAO Doc. 9613 “Specifications for PBN implementation” and considered that the material included in the referred document is very valuable and should be taken into account as reference material for the preparation of national regulations, as well as of implementation programmes on PBN concept. It also mentioned that the navigation specifications established by ICAO and submitted to the States, Territories and International Organizations with State Letter AN1 1145-07122 of 27 April 2007, should be considered.

#### **Development of ICAO Roadmap**

4.33 The Meeting considered that ICAO proposals concerning the contents of the Roadmap was very important and allows the clarification of basic PBN concepts, proposing that such material be used by the administrations in their dissemination programmes of PBN concept. In addition and in view of the decision of the CAR/SAM Regions to initiate the implementation of procedures under PBN concept in a short term, the Authorities are encouraged to promote and support the participation of those involved in this process, at the seminars on PBN introduction, to be held by ICAO during 2008.

### **Actions adopted by GREPECAS/14**

4.34 One of the issues reviewed by GREPECA/14 is directly related to operational errors in a PBN environment. The OPS/AIR/WG was of the opinion that once the conclusions derived from the analysis of operational errors in a PBN environment are known, these will be considered and included in the crews training plans required in the operators approval process.

### **Performance Based Navigation Roadmap in the CAR/SAM Regions**

4.35 The working group reviewed the CAR/SAM PBN roadmap and underlined that the determination of exclusionary airspaces of terminal areas should be a local and not a regional decision. The study of the fleets operating in the referred airspace was used as a base for the decision.

4.36 Being aware of the operational advantages of having procedures considering stabilized approaches, related to approaches with vertical guidance procedures (APV), the working group was in agreement with the modifications proposed to the Navigation Roadmap. Additionally, the OPS/AIR/WG indicated that the design of vertical guidance procedures should consider their initiation at or below the transition levels.

### **PBN Action Plan**

4.37 The OPS/AIR working group provided information related to aircraft and operators approval and training to complete the action plans developed by the PBN Task Force.

### **Other items dealt with during the OPS/AIR/WG sessions**

4.38 The Meeting received detailed information on aircraft and operators approval process for the use of RNP 10 routes in the North Atlantic (WATRS) used by the FAA. This document is based on ICAO PBN Manual. The Meeting considered that this information is very useful as reference material in the preparation of national regulations for RNP 10 approval of aircraft and operators, consequently, it was agreed to include this document in **Appendix F** to this part of the Report.

4.39 Besides the working papers assigned by the Meeting, the working group reviewed the note related with LHD reports. Stressed the quality in the treatment of information and conclusions of the paper presented by CARSAMMA, demonstrating that an important part of the LHD is originated by errors in the ATC transference messages between adjacent FIRs.

4.40 Based on the above, the OPS/AIR working group was of the opinion that the administration should inform their operators on the difficulty identified, so that the necessary measures are taken, hoping that the coordination problems identified between ATC units and errors in the communications cycle between pilots and controllers are definitely solved.

**APPENDIX A**



**PBNRM**

**INTERNATIONAL CIVIL AVIATION ORGANIZATION**

**CAR/SAM ROADMAP FOR PERFORMANCE-BASED NAVIGATION**

**(Lima, July 2007)**

*Version 1.3*

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## 1. EXECUTIVE SUMMARY

1.1. Following RVSM implementation on 20 January 2005, the main tool for optimising the airspace structure is the implementation of performance-based navigation (PBN), which will foster the necessary conditions for the utilisation of RNAV and RNP capabilities by a significant portion of airspace users in the CAR/SAM Regions.

1.2. In view of the need for detailed navigation planning, it was deemed advisable to prepare a PBN Roadmap to provide proper guidance to air navigation service providers, airspace operators and users, regulating agencies, and international organisations, on the evolution of navigation, as one of the key systems supporting air traffic management, which describes the RNAV and RNP navigation applications that should be implemented in the short, medium and long term in the CAR/SAM Regions.

1.3. The CAR/SAM PBN Roadmap was developed by the CAR/SAM States and International Organizations, together with the international organizations concerned (IATA, IFALPA, IFATCA), and is intended to assist the main stakeholders of the aviation community plan the future transition and their investment strategies.

1.4. The CAR/SAM PBN Roadmap will be the basic material for the development of a broader CAR/SAM navigation strategy, which will serve as guidance for regional projects for the implementation of air navigation infrastructure, such as SBAS, GBAS, etc., as well as for the development of national implementation plans.

1.5. This document begins with a brief description of the need for a roadmap, the strategic objectives of the document, and the principles on which the implementation will be based. It should be noted that, during the transition period, conventional air navigation procedures would continue to be applied in order to safeguard the operations of users that are not RNAV- and/or RNP-equipped.

1.6. It then explains the PBN implementation strategy for both en-route and terminal area operations. It also analyses briefly the PBN concept, and lists the benefits of implementing this concept.

1.7. A review is made of data concerning the regular traffic of passengers on CAR/SAM airlines during the 1994-2004 period, CAR/SAM traffic forecasts, and traffic trends up to the year 2015.

1.8. It furthermore defines the implementation of performance-based navigation in the short, medium, and long term with respect to en-route operations, TMA operations (SIDs and STARs), and IFR approaches, broadly establishing the requirements and specifications for each stage.

1.9. The PBN Manual provides guidance of RNAV/RNP navigation specifications and encompasses two types of approvals: airworthiness, exclusively relating to the approval of aircraft; and operational, dealing with the operational aspects of the operator. RNAV/RNP approval will be granted to operators that comply with these two types of approvals.

1.10. The implementation of the performance based navigation forecast significant safety-related changes in the airspace structure as well as to the ATC system. .

1.11. After the implementation of PBN as part of the airspace concept, the total system needs to be monitored to ensure that the safety of the system is maintained. A System Safety Assessment shall be conducted during and after implementation and evidence collected to ensure that the safety of the system is assured.

## 2. EXPLANATION OF TERMS

2.1 The drafting and explanation of this document is based on the understanding of some particular terms and expressions that are described below:

**CAR/SAM PBN Roadmap.** Document offering appropriate guidance for air navigation service providers, airspace operators and users, regulating agencies, and international organizations, on the evolution of navigation, as one of the key systems supporting air traffic management, which describes the RNAV and RNP navigation applications that should be implemented in the short, medium and long term in the CAR/SAM Regions.

**Area navigation (RNAV).** A method of navigation which permits aircraft operation on any desired flight path within the coverage of ground or spaced-based navigation aids or within the limits of the capability of self-contained aids, or a combination of these

*Note.— Area navigation includes performance based navigation as well as other operations that do not meet the definition of performance based navigation.*

**Performance based navigation (PBN).** Area navigation based on **performance requirements for aircraft** operating along an ATS route, on an instrument approach procedure or in a designated airspace.

*Note.— Performance requirements are expressed in navigation specifications in terms of accuracy, integrity, continuity, availability and functionality needed for the proposed operation in the context of a particular airspace concept.*

**Navigation specification.** A set of aircraft and air crew requirements needed to support performance based navigation operations within a defined airspace. There are two kinds of navigation specifications:

**RNP specification.** A navigation specification based on area navigation that includes the requirement for performance monitoring and alerting, designated by the prefix RNP, e.g. RNP 4, RNP APCH.

**RNAV specification.** A navigation specification based on area navigation that does not include

the requirement for performance monitoring and alerting, designated by the prefix RNAV, e.g. RNAV 5, RNAV 1.

*Note.— The Performance Based Navigation Manual (Doc 9613), Volume II contains detailed guidance on navigation specifications*

### 3. ACRONYMS

#### 3.1 Lista de Acrónimos/ List of Acronyms

ADS/B	Vigilancia dependiente automática-radiodifusión Automatic dependent surveillance-broadcasting
ADS/C	Vigilancia dependiente automática-contrato Automatic dependent surveillance-contract
ANS	Servicios de navegación aérea Air navigation services
ANSP	Proveedores de Servicios de Navegación Aérea/Air Navigation Service Providers
ASM	Gestión del espacio aéreo/ Airspace Management
ATC	Control de tránsito aéreo/ Air Traffic Control
ATFM	Gestión de afluencia del tránsito aéreo/ Air Traffic Flow Management
ATM	Gestión del tránsito aéreo/ Air Traffic Management
ATN	Red de telecomunicaciones aeronáuticas/ Aeronautical Telecommunication Network
ATS	Servicio de tránsito aéreo/ Air Traffic Services
CAR/SAM	Regiones Caribe y Sudamérica/Caribbean/South American Regions
CNS/ATM	Comunicaciones, navegación y vigilancia/Gestión del tránsito aéreo/ Communications, Navigation and Surveillance/Air Traffic Management
CPDLC	Comunicaciones por enlace de datos controlador-piloto /Controller-Pilot Data Link Communications
CTA	Area de control /Control Area
DME	Equipo Radiotelemetrico/Distance-Measuring Equipment
FAR	Regulación federal de aviación/Federal Aviation Regulation
FANS-1/A	Sistemas de navegación aérea del futuro – Aviónica/ Future Air Navigation Systems - Avionics
FDE	Detección y eliminación de fallas / Fault Detection and Exclusion
FIR	Región de información de vuelo /Flight Information Region
FMS	Sistema de gestión de vuelo /Flight Management System
GBAS	Sistema de Aumentación con Base en Tierra/Ground-Based Augmentation System
GLS	Sistema de aterrizaje GBAS / GBAS Landing System
GNE	Error de navegación grave / Gross Navigation Error
GNSS	Sistema mundial de navegación por satélite / Global Navigation Satellite System
GPMS	Sistema de monitoreo de la performance del GPS / GPS Performance Monitoring System
GREPECAS	Grupo Regional de Planificación y Ejecución CAR/SAM/ CAR/SAM Regional Planning and Implementation Group
GRAS	Sistema de Aumentación Terrestre Regional / Ground Regional Augmentation System
HF	Alta frecuencia/ High Frequency
IATA	Asociación del Transporte Aéreo Internacional/ International Air Transport Association
ICD	Documento de control de interfaz / Interface Control Document
IFALPA	Federación Internacional de Asociaciones de Pilotos de Líneas Aéreas/International Federation of Air Line Pilots' Associations
IFATCA	Federación Internacional de Asociaciones de Controladores de Tránsito Aéreo/International Federation of Air Traffic Controllers' Associations

IRU/INS	Unidad de referencia inercial/Sistema de navegación inercial/ Inertial Reference Unit/Inertial Navigation System
JAA	Autoridades Conjuntas de Aviación Civil/Joint Aviation Authorities
JAR	Regulaciones Conjuntas de Aviación Civil/Joint Aviation Regulations
NAT	Atlántico septentrional /North Atlantic
NDB	Radiofaro no direccional /Non-Directional Beacon
NOTAM	Aviso al Personal Encargado de las Operaciones de Vuelo/Notice to Airmen
PBN	Navegación Basada en la Performance /Performance-Based Navigation
RNAV	Navegación de área/Area Navigation - RNAV Route: Ruta de navegación de área/Area navigation route
RNP	Performance de navegación requerida /Required Navigation Performance
RNP AR	Requerimiento de aprobación para la performance de navegación requerida/ Required Navigation Performance Approval Required
RNPC	Capacidad de la performance requerida de navegación/Required navigation performance capacity
RNPSORSG	Grupo de Estudio sobre RNP y Requerimientos Operacionales Especiales/RNP and Special Operational Requirements Study Group
SARPS	Normas y métodos recomendados (ICAO)/ Standards and Recommended Practices (ICAO)
SATCOM	Comunicaciones por satélite/Satellite Communications
SBAS	Sistema de Aumentación de Base Satelital/Satellite-based Augmentation System
SID	Salida Normalizada por Instrumentos/Standard Instrument Departure
SSR	Radar secundario de vigilancia/Secondary Surveillance Radar
STAR	Llegada Normalizada por Instrumentos/Standard Instrument Arrival
TLS	Nivel de seguridad deseado/Target Level of Safety
TMA	Area Terminal/Terminal Area
VHF	Muy alta frecuencia /Very High Frequency
VDL	Enlace de datos en VHF/ VHF Data Link
VOR/DME	Radiofaro omnidireccional VHF/Equipo radiotelemétrico/Very High Frequency Omnidirectional Radio Range/Distance-Measuring Equipment

#### 4. INTRODUCTION

##### **Need for a roadmap**

4.1 Following RVSM implementation on 20 January 2005, the main tool for optimising the airspace structure is the implementation of performance-based navigation (PBN), which will foster the necessary conditions for the utilisation of RNAV and RNP capabilities by a significant portion of airspace users in the CAR/SAM Regions.

4.2 Current planning by the Regional Planning and Implementation Groups is based on the Air Navigation Plans and the Regional CNS/ATM Plans. Currently, these plans are mostly made up by tables that do not contain the necessary details for the implementation of each of the CNS and ATM elements.

4.3 In view of the need for detailed navigation planning, it was deemed advisable to prepare a PBN Roadmap to provide proper guidance to air navigation service providers, airspace operators and users, regulating agencies, and international organisations, on the evolution of navigation, as one of the key systems supporting air traffic management, which describes the RNAV and RNP navigation applications that should be implemented in the short and medium term in the CAR/SAM Regions.

4.4 Furthermore, the CAR/SAM PBN Roadmap will be the basic material for the development of a broader CAR/SAM navigation strategy, which will serve as guidance for regional projects for the implementation of air navigation infrastructure, such as SBAS, GBAS, etc., as well as for the development of national implementation plans.

### **Objectives**

4.5 The CAR/SAM PBN roadmap has the following strategic objectives:

- a) To ensure that the implementation of the navigation item of the CNS/ATM system is based on clearly established operational requirements.
- b) To avoid unnecessarily imposing the mandate for multiple equipment on board or multiple systems on ground.
- c) To avoid the need for multiple airworthiness and operational approvals for intra- and inter-regional operations.
- d) To prevent commercial interests from outdoing ATM operational requirements, generating unnecessary costs for CAR/SAM States and International Organizations, as well as for airspace users.
- e) To explain in detail the contents of the CAR/SAM Air Navigation Plan and of the CAR/SAM CNS/ATM Plan, describing potential navigation applications.

4.6 Furthermore, the CAR/SAM PBN Roadmap will provide a high-level strategy for the evolution of the navigation applications to be implemented in the CAR/SAM Regions in the short term (2006-2010), medium term (2011-2015). This strategy is based on the concepts of Area Navigation (RNAV) and Required Navigation Performance (RNP), which will be applied to aircraft operations involving instrument approaches, standard departure (SID) routes, standard arrival (STAR) routes, and ATS routes in oceanic and continental areas.

4.7 The CAR/SAM PBN Roadmap was developed by the CAR/SAM States and International Organizations together with the international organizations concerned (IATA, IFALPA, IFATCA), and is intended to assist the main stakeholders of the aviation community plan a gradual transition to the RNAV and RNP concepts. The main stakeholders of the aviation community that benefit from this roadmap are:

- Airspace operators and users.
- Air navigation service providers.
- Regulating agencies.
- International organizations.

4.8 This roadmap is intended to assist the main stakeholders of the aviation community plan the future transition and their investment strategies. For example, airlines and operators can use this roadmap to plan future equipage and additional navigation capability investments; air navigation service

providers can plan a gradual transition for the evolving ground infrastructure. Regulating agencies will be able to anticipate and plan for the criteria that will be needed the future.

### **Principles**

4.9 The implementation of PBN in the CAR/SAM Regions shall be based on the following principles:

- a) Conduction of cost-benefit analyses to justify the implementation of the RNAV and/or RNP concepts in each particular airspace;
- b) Conduction of pre- and post-implementation safety assessments to ensure the application and maintenance of the established target levels of safety;
- c) Development of airspace concepts, applying airspace modelling tools as well as real-time and accelerated simulations, which identify the navigation applications that are compatible with the aforementioned concept.
- d) Continued application of conventional air navigation procedures during the transition period, to guarantee the operations by users that are not RNAV- and/or RNP-equipped.

### **PBN implementation strategy**

#### **En-route operations**

4.10 It is impossible to include the whole CAR/SAM airspace in a single Implementation Plan for En-Route Operations, since the restructuring of the CAR/SAM airspace for PBN application would become an extremely complicated task.

4.11 Likewise, the establishment of a single RNAV or RNP navigation specification for the CAR/SAM Regions is unlikely, bearing in mind the differences in air traffic complexity and movement, as well as the differences in CNS infrastructure, which will probably lead to the application of different airspace concepts in the CAR/SAM Regions.

4.12 Thus, the most appropriate strategy is the implementation of PBN by routing areas in CAR and SAM scenarios, according to their own airspace concepts and infrastructure characteristics, which may involve a group of States/Territories and International Organizations. This implementation strategy will be applied by the States/Territories/International Organizations themselves and will permit the establishment of the RNAV or RNP navigation specifications for the various areas that will be harmonised within the scope of GREPECAS.

#### **TMA operations**

4.13 TMA operations have their own characteristics, taking into account the applicable separation minima between aircraft and between aircraft and obstacles. It also involves the diversity of aircraft, including low-performance aircraft flying in the lower airspace and conducting arrival and departure procedures on the same path or close to the paths of high-performance aircraft.

4.14 In this sense, the States/Territories and International Organizations shall develop their own national plans for the implementation of PBN in TMAs, based on the CAR/SAM PBN Roadmap, seeking the harmonisation of the applicable RNAV and/or RNP criteria to avoid the need for multiple operational approvals for intra- and inter-regional operations, and the applicable aircraft separation criteria that will be soon published by ICAO Headquarters.

## 5. PBN CONCEPTS

5.1 Performance based navigation specifies RNAV system performance requirements for aircraft operating along an ATS route, on an instrument approach procedure or in an airspace.

5.2 Performance requirements are defined in terms of accuracy, integrity, continuity, availability and functionality needed for the proposed operation in the context of a particular airspace concept. Performance requirements are identified in navigation specifications which also identify which navigation sensors and equipment may be used to meet the performance requirement.

5.3 There are both RNP navigation specifications and RNAV navigation specifications. A RNP specification includes a requirement for onboard performance monitoring and alerting and is designated as a RNP X. A RNAV specification does not have such requirements and is designated as RNAV X.

5.4 Performance based navigation therefore depends on:

- the RNAV system and installation on the aircraft being approved to meet the performance and functional requirements of the navigation specification prescribed for RNAV operations in an airspace; and
- Air crew satisfying the operating requirements set out by the regulator for RNAV operations; and
- A defined airspace concept which includes RNAV operations; and
- an available Navaid infrastructure;

Note: Additional information may be obtained in the Performance Based Navigation Manual, Doc 9613.

## 6. BENEFITS OF PERFORMANCE-BASED NAVIGATION

6.1 Air traffic growth in the CAR/SAM Regions is foreseen at mid term, at the same time that the economical activity. A growth of 6.2, 5.5 y 5.6, % of regular passenger air traffic of CAR/SAM Regions airlines is foreseen in 2005/2006/2007, respectively, as compared to global growth forecast of 7.6, 6.5 and 6.2%, respectively. At long term, airlines passengers air traffic in the Region is expected to grow at an average of 4.0% until year 2015. This growth may lead to air traffic congestion periods which may guide to ATM lack of efficiency.

6.2 In order to ensure ATM efficiency and avoid unnecessary restrictions to airspace users, specifications should be avoided as to how to satisfy navigation requirements indicating only which is the performance and navigation functionality required from the RNAV system. Under the PBN concept, the generic navigation requirements are defined based on operational requirements. Thus, users may evaluate the available options as regards technology and air navigation services which could permit to satisfy these requirements. The solution elected should be the most cost-effective

6.3 The development of the Performance Based Navigation Concept recognizes that advanced aircraft RNAV systems are achieving a predictable level of navigation performance accuracy which, together with an appropriate level of functionality, allows a more efficient use of available airspace to be realized. It also takes account of the fact that RNAV systems have developed over a 40 year period and as a result there are a large variety of implementations. Identifying navigation requirements rather than on the means of meeting the requirements will allow use of all RNAV systems meeting these requirements irrespective of the means by which these are met.

6.4 The main benefits derived from the implementation of PBN are:

- a) Increased airspace safety through the implementation of continuous and stabilised descent procedures that avoid controlled flight into terrain (CFIT);
- b) Reduced aircraft flight time due to the implementation of optimal flight paths, with the resulting savings in fuel and environmental protection.
- c) Use of the RNAV and/or RNP capabilities that already exist in a significant percentage of the aircraft fleet flying in CAR/SAM airspace.
- d) Improved airport and airspace arrival paths in all weather conditions, and the possibility of meeting critical obstacle clearance and environmental requirements through the application of optimised RNAV or RNP paths.
- e) Implementation of more precise approach, departure, and arrival paths that will reduce dispersion and will foster smoother traffic flows.
- f) Reduced delays in high-density airspaces and airports through the implementation of new parallel routes and new arrival and departure points in TMAs.
- g) Possible reduction of spacing between parallel routes to accommodate more traffic in the same flow.
- h) Reduced workload for air traffic controllers and pilots due to reduced communications time.

## **7. IMPLEMENTATION OF PERFORMANCE-BASED NAVIGATION**

### **7.1 ATM operational requirements**

7.1.1 The Global ATM System makes necessary to adopt an airspace concept able to provide an operational scenerio that includes Routes Network, Minimum separation, Assessment of obstacles clearance, and CNS infrastructure that satisfies safety specific strategic objectives, capacity, efficiency, environment and technology addressed for the implementation of performance based navigation.

7.1.2 In this regard, the following programmes will be developed in different areas:

- a) traffic and cost benefit studies
- b) automation necessary update
- c) operations simulation in different scenarios
- d) ATC personnel training
- e) FPL processing
- f) AIS support
- g) WGS 84 implementation
- h) uniform classification of adjacent and regional airspaces
- i) RNAV/RNP application in SIDs and STARs
- j) RNAV routes implementation and coordination

7.2 RNAV/RNP approval will cover to types of approvals: airworthiness, which will exclusively deal with aircrafts approval, and operations, which will take care of the operational aspects of air transport operators. The fulfilment of these types of approvals will permit operators to obtain RNAV/RNP approval.

### 7.3 **Short term (up to 2010)**

#### 7.3.1 En-route operations

7.3.1.1 Taking into account air traffic low density in oceanic airspaces, no significant changes are expected in the present airspace structure that will demand changes in applied RNAV navigation specifications. The only exception will be RNP-10 application in the WATRS Airspace, which will demand a significant change in the CAR Region airspace structure. In airspaces where RNP-10 is applied (EUR/SAM Corridor, Lima-Santiago de Chile Routes and South Atlantic Random Routes System), no short-term changes are expected.

7.3.1.2 In the continental airspace, RNAV-5 implementation in selected airspaces is expected, where possible to obtain operational benefits and available CNS infrastructure is able to support it.

#### 7.3.2 TMA operations (SIDs and STARs)

7.3.2.1 The application of RNAV-1 in State-selected TMAs, in radar environments, with ground navigation infrastructure is expected, which permits DME/DME and DME/DME/INS operations. In this phase mixed operations (equipped and non-equipped) will be admitted, and RNAV-1 operations shall be initiated when an adequate percentage of air operations are approved.

7.3.2.2 In non-radar environments and/or in environments that do not count with adequate ground navigation infrastructure, the application of RNP-1 is expected in State-selected TMAs with exclusive application of GNSS, whenever an adequate percentage of air operations are approved. In this TMA will also be admitted approved and non-approved aircrafts. The application of overlay procedures or exclusive RNP procedures will depend on air traffic complexity and density.

### 7.3.3 IFR approaches

7.3.3.1 Approach procedures for PBN should be implemented as approach procedures with vertical guidance (APV) utilizing Baro-VNAV for runways either as the primary approach or as a back-up for precision approaches for all instrument runway ends, based on the RNP APCH or RNP AR APCH navigation specifications.

*Note.- PBN manual, Volume II, Attachment A contains the Specifications for utilizing Baro-VNAV in conjunction with RNP APCH.*

7.3.3.2 The application of RNP APCH approach procedures (basic GNSS) is expected in the maximum possible of State-selected international airports, maintaining conventional approach procedures for non-equipped aircraft.

7.3.3.3 The application of RNP AR approach procedures is expected in State-selected airports, where operational benefits can be obtained, based on the existence of significant obstacles.

<b>Short Term (until 2010)</b>	
<b>Airspace</b>	<b>RNAV or RNP navigation specification</b>
Route (Oceanic or Remote)	RNP 10 Corridor EUR/SAM and Santiago/Lima/AORRA/WATRS
Route (Continental)	RNAV 5 in selected airspaces
TMA	RNAV-1 in radar environment and with adequate ground navigation infrastructure.
	RNP 1 – No radar environment and/or without appropriate DME coverage.
Approach	RNP APCH in most possible airports and in all international airports. RNP AR APCH in airport where there are operational benefits.
<ul style="list-style-type: none"> <li>• Non compulsory installation of RNAV equipment on board of non equipped aircraft in TMA and APP</li> <li>• Mixed Operations (equipped and non equipped aircraft) in TMA and APP</li> <li>• Required RNAV 2 equipment above FL350 for flights to/from United States.</li> </ul>	

## 7.4 Medium term

### 7.4.1 En-route operations

7.4.1.1 The application of RNP 4 in the oceanic airspace is expected, with utilization of ADS/CPDLC, in order to allow the use of lateral and longitudinal separation of 30 NM. This application will depend on the evolution of the aircraft fleet flying in the airspace.

7.4.1.2 In this phase, the application of RNP-2 is expected in selected areas of the continental airspace, with high air traffic density and exclusive application of GNSS, depending on the analysis of ground infrastructure, which will indicate whether it is possible to use RNAV applications. The

establishment of a backup system will be necessary as well as the development of contingency procedures in the event of GNSS failure. The application of RNP-2 will facilitate the PBN application in non surveillance airspace. With the exclusive application of GNSS more control of the GNSS signal is needed, through GPS Monitoring Systems that include NOTAM, FDE, etc.

#### 7.4.2 TMA operations

7.4.2.1 In this phase, it is expected to extend the application of RNAV (RNP) 2/1 in State-selected TMAs, depending of ground infrastructure and of aircrafts navigation capacity. In TMAs of high air traffic complexity and movement (excluding airspaces), the use of RNAV or RNP 1 equipments will be mandatory. In TMAs of less air traffic complexity, mixed operations will be admitted (equipped or non-equipped).

#### 7.4.3 IFR approaches

7.4.3.1 In this phase the extended application of procedures RNP APCH and RNP AR in selected airports (as mentioned under par. 7.3.3) is expected. Also, the initiation of application of GLS procedure is expected to guarantee a smooth transition between TMA phase and the approximation has, basically using GNSS for the two phases.

<b>Medium Term (2011-2015)</b>	
<b>Airspace</b>	<b>RNAV or RNP navigation specification</b>
Route (Oceanic or Remote)	RNP 4 in the oceanic airspace
Route (Continental)	RNP 2 in selected airspaces
TMA (SID/STAR)	Expansion of RNAV-1 or RNP-1 application Compulsory RNAV 1 or RNP 1 approval for aircraft operating in greater air traffic density TMAs (exclusionary airspace)
Approach	Expansion of RNP APCH and RNP AR APCH application Application of GBAS procedures**
<ul style="list-style-type: none"> <li>• RNP2 required equipment over FL290 for flights to/from United States.</li> </ul> ** <i>GBAS procedures are currently not covered under the PBN concept</i>	

## 8. SAFETY ASSESSMENT

8.1 The implementation of the performance based navigation requires safety-related changes in the airspace structure as well as to the ATC system, including new procedures that only shall be applied after a safety assessment has demonstrated that an acceptable level of safety will be met. For these purposes, safety assessment shall be carried out in accordance with ICAO provisions.

8.2 After the PBN implementation, all the system should be monitored in order to ensure to maintain safety. In case of unforeseen events, dependency in charge of monitoring should propose and coordinate with all interested parts the implementation of mitigating measures as soon as possible.

## APPENDIX A

Reference documentation for developing operational and airworthiness approvals

Organisation	Code	Title
ICAO	Doc 9613	Performance Based Navigation (PBN)
ICAO	State Letter AN 1 1145-07122	PBN Key provisions
ICAO	Doc 8168 – OPS/611	Vol. I and II, Aircraft operations
ICAO	Doc 4444	Procedures for air navigation services – Air traffic management
ICAO	Doc 8733	CAR/SAM air navigation plan
ICAO	Doc 7030	Regional supplementary procedures (SUPPS)
FAA	Order 8400.10	Required navigation performance 10 (RNP 10) operational approval
FAA	AC 90-96	Approval of US operators and aircraft to operate under instrument flight rules (IFR) in European airspace designated for basic area navigation (BRNAV/RNP 5)
FAA	AC 90-100A	US Terminal and en route area navigation
FAA	AC 90-101	Approval guidance for RNP procedures with SAAAR
FAA	Order 8260.52	United States standards for required navigation performance (RNP) approach procedures with special aircraft and aircrew authorization required (SAAAR)
JAA	Leaflet No. 2 (TGL 2) Rev 1	Guidance material on airworthiness approval an operational criteria for the use of navigation systems in European airspace designated for basic RNAV operations
JAA	Leaflet No. 3 (TGL 3) Rev 1	Interim guidance material on airworthiness approval and operational criteria for the use of the NAVSTAR Global Positioning System (GPS)
JAA	Leaflet No. 10 (TGL 10)	Airworthiness an operational approval for precision RNAV operations in designated European airspace
EUROCONTROL	Doc 003-93	Area navigation equipment: operational requirements and functional requirements
RTCA	Do-236B	Minimum aviation system performance standards: Required navigation performance for area navigation
RTCA	Do-238A	Minimum operational performance standards for required navigation performance for area navigation

### Documentation availability

The documentation described in paragraph 1 of this document may be obtained at the following websites:

- a) Copies of EUROCONTROL documents may be requested from EUROCONTROL, Documentation Centre, GS4, Rue de la Fusee, 96, B-1130 Brussels, Belgium; (Fax: 32 2729 9109). Website: <http://www.ecacnav.com>.
- b) Copies of EUROCAE documents may be purchased from EUROCAE, 17 rue Hamelin, 75783 Paris Cedex 16, France (Fax: 33 1 4505 7230). Web site: <http://www.eurocae.org>.
- c) Copies of FAA documents may be obtained from the Superintendent of Documents, Government Printing Office, Washington, DC 20402-9325, USA. Website: <http://www.faa.gov/certification/aircraft/> (Regulation and guidance library).
- d) Copies of RTCA documents may be obtained from RTCA Inc., 1140 Connecticut Avenue, N.W., Suite 1020, Washington, DC 20036-4001, USA, (Tel: 1 202 833 9339). Website: [www.rtca.org](http://www.rtca.org).
- e) Copies of ARINC documents may be obtained from Aeronautical Radio Inc., 2551 Riva Road, Annapolis, Maryland 24101-7465, U.S.A. Website: <http://www.arinc.com>.
- f) Copies of JAA documents are available from the JAA's Publisher Information Handling Services (IHS). Information on prices, where and how to order is available in the JAA website: <http://www.jaa.nl> and in the IHS websites: <http://www.global.his.com> and <http://www.avdataworks.com>.
- g) Copies of EASA documents may be obtained from EASA (European Aviation Safety Agency), 101253, D-50452 Koln, Germany.
- h) Copies of ICAO documents may be purchased from the Document Sales Unit, International Civil Aviation Organization, 999 University Street, Montreal, Québec, Canada H3C 5H7, Fax: 1 514 954 6769, or at: [sales\\_unit@icao.org](mailto:sales_unit@icao.org), or through national agencies.

**APPENDIX B****PBN en-route Action Plan  
GPI 1, 4,5, 7, 8, 10, 11, 12, 16, 21,23**

<b>1.    Airspace structure</b>	<b>Starting Date</b>	<b>Termination Date</b>	<b>Remarks</b>
1.1   Collect air traffic data, in order to identify all possible improvements to traffic flows			
1.2   Analysis navigation capability of the fleet			
1.3   Optimise the current airspace structure in accordance with the implementation needs of PBN concept			
1.4   Reorganise the network or implement new routes based on the analysis of the PBN concept, as necessary			
1.5   Coordinate new airspace structure with the users, as necessary.			
<b>2.    Prepare Cost-Benefit analysis, if necessary</b>			
2.1   Prepare Preliminary Cost-Benefit analysis			
2.2   Prepare Final Cost-Benefit analysis			
<b>3.    Safety Plan</b>			
3.1   Define the methodology to be used for routes safety assessment depending on its navigation specification			
3.2   Prepare an action plan in accordance with the methodology determined			
3.3   Prepare Safety Assessment			
<b>4.    Coordinate with Industry, National and International Organizations</b>			
4.1   Establish an implementation date			

4.2	Coordinate with military authorities			
4.3	Establish the documentation format of RNAV/RNP CAR/SAM Website			
4.4	Report to the Regional Office			
<b>5.</b>	<b>ATC Automated Systems</b>			
5.1	Evaluate the impact of PBN concept application in the ATC Automated Systems			
5.2	Implement the necessary changes in the ATC Automated Systems			
<b>6.</b>	<b>Aircraft and operators approval</b>			
6.1	Be aware of the national implementation programme and of the required navigation specifications			
6.2	Analysis of aircraft, crews and operators requirements for route specification (terminal/approach areas) in the framework of the specifications of the PBN manual			
6.3	Publication of national regulations			
6.4	Aircraft and operators approval (for each type of procedures and specification)			
6.5	Establish and keep up to date a registry of approved aircraft and operators			
6.6.	Verify the operation within the continuous surveillance plan (aircraft and procedures)			
<b>7.</b>	<b>Standards and Procedures</b>			
7.1	Evaluate GNSS use regulations			
7.2	Develop and publish AIC notifying PBN implementation planning			

7.3	Publish AIP Supplement including applicable standards and procedures			
7.4	Review Procedures Manuals of the ACC involved			
7.5	Update Letters of Agreement			
7.6	Periodic review of the development regarding the actions for ACAS/TCAS Advisories for RNAV/RNP operations			
7.7	Develop regional documentation and its harmonization			
7.8	Publish ATC policies and procedures at the Internet website, if necessary			
7.9	Inform the procedures to accommodate non-approved RNAV/RNP domestic aircraft, when applicable			
7.10	Identify traffic areas and procedures, if necessary			
7.11	Conduct ATC simulations to identify the workload/operational factors, if necessary, and report the simulations activities to the ATM Committee			
7.12	Provide procedures to handle non-approved aircraft (including first delivery, humanitarian, maintenance)			
7.13	Revision of practices and procedures for fuel consumption management and environmental care			
<b>8.</b>	<b>Training</b>			
8.1	Develop documentation for dispatchers training and maintenance			
8.2	Develop training documentation for Air Traffic Controllers and AIS Operators			
8.3	Conduct training (air traffic controllers, AIS operators)			

8.4	Hold seminars oriented to operators, indicating the plans of the Authority and the operational and financial benefits of its implementation			
<b>9.</b>	<b>Implementation Decision</b>			
9.1	Evaluate operational documentation availability (ATS, OPS/AIR)			
9.2	Evaluate approved operations (compliance of the % operations established - see 6.3)			
9.3	Complete Safety Assessment			
9.4	Publication of "trigger" NOTAM			
<b>10.</b>	<b>Monitoring of the System Performance</b>			
10.1	Develop Programme for Post-implementation follow-up operations			
10.2	Execute Programme for Post-implementation follow-up operations			

## APPENDIX C

<b>PBN TMA and Approach Action Plan GPI 5, 7, 8, 10, 11, 12</b>			
	<b>Start</b>	<b>End</b>	<b>Responsible party</b>
<b>1 Airspace structure</b>			
1.1 Identify SID/STARs/RNAV TMA that will be implemented in a short term			
1.2 Identify improvements to SID and/or STARs procedures, as per the main traffic flows in TMA			
1.3 Analyse aircraft fleet navigation capacity operating in the TMA			
1.4 Develop an airspace structure for TMA, including SIDs/STARs and RNAV approach procedures			
<b>2 Prepare Cost-Benefit analysis</b>			
2.1 Prepare preliminary Cost-Benefit analysis			
2.2 Prepare final Cost-Benefit analysis			
<b>3. Airspace Safety assessment</b>			
3.1 Develop a TMA safety assessment model, if necessary			
3.2 Prepare a data collection programme for airspace safety assessment			
3.3 Prepare preliminary airspace safety assessment			
3.4 Prepare final airspace safety assessment			
<b>4 Establish collaboration in decision-making (CDM) process</b>			
4.1 Coordinate implementation needs with ATS users, aircraft operators and military authorities			

<b>PBN TMA and Approach Action Plan GPI 5, 7, 8, 10, 11, 12</b>				
		<b>Start</b>	<b>End</b>	<b>Responsible party</b>
4.2	Establish implementation dates			
4.3	Establish the format of documentation of the CAR/SAM RNAV/RNP website			
4.4	Report implementation progress to the corresponding ICAO Regional Office			
<b>5.</b>	<b>ATC automated systems</b>			
5.1	Assess impact of PBN implementation in ATC automated systems			
5.2	Implement the necessary changes in ATC automated changes			
<b>6</b>	<b>Aircraft and operator approval</b>			
6.1	Be aware of the national implementation programme and of the required navigation specifications			
6.2	Analyse aircraft approval requirements, crews and operators requirements for en-route navigation specifications (terminal/approach areas) as established in PBN manual			
6.3	Publish process of operational approval			
6.4	Aircraft and operators approval (for each type of procedures and specification)			
6.5	Establish and keep up to date a registry of approved aircraft and operators			
6.6.	Verify the operation within the continuous monitoring plan (aircraft and procedures)			
<b>7.</b>	<b>Standards and procedures</b>			
7.1	Assess the regulations on the use of GNSS, and if such were the case, proceed to its publication			
7.2	Prepare and publish AIC reporting PBN implementation planning			

<b>PBN TMA and Approach Action Plan GPI 5, 7, 8, 10, 11, 12</b>				
		<b>Start</b>	<b>End</b>	<b>Responsible party</b>
7.3	Publish AIP Supplement containing applicable standards and procedures			
7.4	Review the operational model of ATS units involved			
7.5	Verification/Flight inspection for publication of SIDs and STARs, etc.			
7.6	Update letters of operational agreement between ATS units			
<b>8</b>	<b>Training</b>			
8.1	Develop programme and documentation for pilot training			
8.2	Develop programme and documentation for air traffic controllers and AIS operators			
8.3	Provide training programme (pilots, air traffic controllers, AIS operators, etc.)			
8.4	Hold seminars oriented to operators indicating the plans and operational and economical benefits expected			
<b>9.</b>	<b>Decision for implementation</b>			
9.1	Evaluate operational documentation availability (ATS, OPS/AIR)			
9.2	Evaluate approved aircraft and operations (compliance of the % operations established - see 6.4)			
9.3	Implement regional improvements (RNAV, RNP, WGS-84, etc).			
9.4	Publish "trigger" NOTAM			

<b>PBN TMA and Approach Action Plan GPI 5, 7, 8, 10, 11, 12</b>			
	<b>Start</b>	<b>End</b>	<b>Responsible party</b>
<b>10. System Performance Monitoring</b>			
10.1 Develop post-implementation TMA operations monitoring programme			
10.2 Execute post-implementation TMA operations monitoring programme			
<b>Pre operational implementation date</b>			
<b>Definitive implementation date</b>			

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Appendix D to the Report on Agenda Item 4

**APPENDIX D**

<b>PBN APP Action Plan GPI 1, 12, 16, 21, 23</b>			
	<b>Start Date</b>	<b>End Date</b>	<b>Remarks</b>
<b>1.     Airspace structure</b>			
1.1.   Analyse aircraft fleet capacity operating in selected airport.			
1.2    Evaluate existing infrastructure to determine the needs for adequacy to PBN concepts Analysis of aircraft fleet navigation capacity operating in the TMA			
1.3    Develop APP procedures based in PBN concepts.			
1.4    Use the existing radar vectorial guidance patterns as a basis for the design of trajectories for arrivals and departures.			
1.5    coordinate new procedures with users.			
<b>2.     Prepare Cost-benefit analysis</b>			
2.1    Prepare Preliminary Cost-Benefit analysis			
2.2    Prepare Final Cost-Benefit analysis			
<b>3.     Airspace safety assessment</b>			
3.1    Develop safety assessment model for TMA, if necessary			
3.2    Prepare data collection programme for airspace safety assessment			
3.3    Prepare preliminary airspace safety assessment			
3.4    Prepare final airspace safety assessment			
3.5    Determine and carry out ATC simulations, as necessary			

<b>PBN APP Action Plan GPI 1, 12, 16, 21, 23</b>			
	<b>Start Date</b>	<b>End Date</b>	<b>Remarks</b>
<b>4. Establish collaboration decision making (CDM) process</b>			
4.1 Coordinate implementation need s with ATS users, aircraft operators and military authorities			
4.2 Establish implementation date			
4.3 Establish the documentation format of CAR/SAM RNAV/RNP Website			
4.4 Report implementation progress to the corresponding Regional Office			
<b>5 ATC automated systems</b>			
5.1 Evaluate PBN implementation impact in the ATC Automated Systems			
5.2 Implement the necessary changes in the ATC Automated Systems			
<b>6 Aircraft and operator approval</b>			
6.1 Acknowledge the national implementation programme and required navigation specifications			
6.2 Analyse aircraft approval, crews and operators for routes specifications (terminal areas/approach) as established within the PBN manual framework.			
6.3 Publish operational approval process.			
6.4 Approval of aircraft and operators (for each type of procedure and specification)			
6.5 Establish and keep updated a record of approved aircraft and operators record			
6.6 Verify operation within the continuous monitoring programme (aircraft and procedures)			

<b>PBN APP Action Plan GPI 1, 12, 16, 21, 23</b>				
		<b>Start Date</b>	<b>End Date</b>	<b>Remarks</b>
<b>7</b>	<b>Standards and procedures</b>			
7.1	Assess the regulations on the use of GNSS and if such were the case, proceed to its publication.			
7.2	Prepare and publish AIC reporting PBN implementation planning			
7.3	Publish AIP supplement containing applicable standards and procedures			
7.4	Review operational model of ATS units involved			
7.5	Verification/Flight inspection for publication of APP procedures.			
7.6	Update letters of operational agreement between ATS units			
<b>8.</b>	<b>Procedures design</b>			
8.1	Development or approach RNP procedures			
8.2	Coordinate new procedures with users			
<b>9</b>	<b>Training</b>			
9.1	Develop a training programme and documentation for pilots			
9.2	Develop training programme and documentation for Air Traffic Controllers and AIS Operators			
9.3	Conduct training programmes (pilots, air traffic controllers, AIS operators)			
9.4	Hold seminars oriented to operators, indicating the plans and the operational and financial benefits expected			

<b>PBN APP Action Plan GPI 1, 12, 16, 21, 23</b>			
	<b>Start Date</b>	<b>End Date</b>	<b>Remarks</b>
<b>10 Implementation decision</b>			
10.1 Evaluate operational documentation availability (ATS, OPS/AIR)			
10.2 Evaluate approved aircraft and operations (compliance of the % operations established - see 6.4)			
10.3 Implement regional improvements (RNAV, RNP, WGS-84, etc).			
10.4 Publish "trigger" NOTAM			
<b>11. System Performance Monitoring</b>			
11.1 Develop post-implementation APP operations monitoring programme			
11.2 Execute post-implementation APP operations monitoring programme			
<b>Pre operational implementation date</b>			
<b>Definitive implementation date</b>			

## APPENDIX E

### TERMS OF REFERENCE AND WORK PROGRAMME OF THE PERFORMANCE-BASED NAVIGATION TASK FORCE (PBN/TF) AND WORKING GROUPS

### TERMS OF REFERENCE AND WORK PROGRAMME OF THE PERFORMANCE-BASED NAVIGATION TASK FORCE (PBN/TF)

#### 1. Terms of reference

Carry out specific studies and develop guidance material for RNAV/RNP implementation in the en-route, terminal, and approach flight phases, taking into account the performance-based navigation (PBN) concept, according to the ICAO Strategic Objectives and Global Plan Initiatives (GPI) on this matter (GPI 5, 7, 10, 11, 12, 20, 21).

#### 2. Work Programme

- a) Analyse the application of GNSS to support all flight phases.
- b) Establish training requirements.
- c) Verify the status of implementation of WGS-84.
- d) Follow-up of PBN implementation for en-route, TMA, and approach operations to ensure its harmonisation intra- and inter-regionally, as well as among the States involved.
- e) Submit the developed PBN work to the ATM Committee.

#### 3. Composition

Argentina, Brazil\*, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, France, Haiti, Panamá, Peru, Trinidad and Tobago, United States, Uruguay, Venezuela, COCESNA, IATA, IFALPA, IFATCA, and SITA.

#### 4. Rapporteur

Julio César Pereira

<b>STATUS OF IMPLEMENTATION OF THE TASKS ASSIGNED TO THE SAM/WG, ATM/WG AND OPS/AIR/WG</b>	
<b>WORK PROGRAMME OF THE SAFETY AND AIRSPACE MONITORING WORKING GROUP (SAM/WG)</b>	
<b>Terms of reference:</b> The SAM/WG is responsible for mathematical and statistical analysis to assist with the maintenance and on going monitoring of safety through the assessment of collision risk for the CAR/SAM Regions en-route operations and other tasks as agreed with RNAV/RNP Task Force.	
<b>TASK</b>	<b>STATUS OF IMPLEMENTATION</b>
a) To contribute with the PBN Roadmap for the CAR/SAM Regions in the safety assessment and airspace area.	Completed
b) To develop a program of data collection to support its activities;	Ongoing
c) To develop a monitoring program to ensure that the quantity and quality of the data collected allow an assessment of the collision risk;	Ongoing
d) To review existing mathematical and statistical techniques to assure their appropriateness for the CAR/SAM regions;	Ongoing
e) To ensure the transferability of aircraft data collected in other airspace regions;	Ongoing
f) To support the assessment of the safety of the operations using the RNAV and/or RNP concepts during the Verification and Operational Phases by the production of collision risk assessments based on data collected to determine whether the TLS is being met;	Ongoing
g) To devise suitable methodologies for incorporating the effects of projected traffic increases and system changes on occupancy and collision risk in the future environment;	Ongoing
h) To identify those elements which are critical in the assessment of collision risk and suggest areas where improvements might be effective in reducing risk;	Ongoing

i) To establish a policy for investigating those errors that may jeopardize satisfaction of the Target Level of Safety (TLS);	Ongoing
j) To coordinate periodically data collections in order to ensure that the parameter values used in the collision risk models remain current;	Ongoing
k) To track the progress of the States under the task list and to report States' progress to PBN TF;	Ongoing
l) To accomplish other tasks as directed by the PBN Task Force;	
m) To provide material for the PBN website administrator;	Ongoing
n) To verify the lateral and longitudinal separation minima applicable in the CAR/SAM Regions using the collision risk models, taking into account the communications, navigation and surveillance infrastructure;	Ongoing
o) Coordinate with CARSAMMA the establishment of an approved aircraft database to fly within RNAV and/or RNP designated airspace.	Ongoing

**WORK PROGRAMME OF THE AIR TRAFFIC  
MANAGEMENT WORKING GROUP  
(ATM/WG)**

**Terms of reference:** The ATM/WG is responsible to deal with issues related with air traffic services in RNAV/RNP airspace.

<b>TASK</b>	<b>STATUS OF IMPLEMENTATION</b>
a) Contribute with the RNAV/RNP Roadmap improvements for the CAR/SAM Regions in the ATM field.	Ongoing
b) Develop the CAR/SAM RNAV/RNP Operational Concept.	Completed
c) Identify the airspace in which RNAV and RNP concepts will be implemented.	Completed
d) Recommend material and training methods for ATC personnel.	Ongoing
e) Harmonize the necessary changes to the regional documentation.	Ongoing
f) Provide the appropriate material for the RNAV/RNP internet website administrator.	Ongoing
g) Comply with other tasks as required by the PBN Task Force.	
h) Develop the principles in which PBN implementation will be based.	Completed
i) Adopt the new PBN, RNAV and RNP concept.	Completed
j) Identify the benefits of PBN implementation.	Completed
k) Analyse Traffic forecasts in the CAR/SAM Regions.	Completed
l) Define short, mid and long terms.	Completed
m) Establish ATM requirements.	Completed
n) Establish guidelines for data collection for airspace planning and safety assessment.	Completed

o) Analyse the need for developing in-flight (airborne) contingency procedures.	Ongoing
p) Analyse the need for additional aeronautical phraseology for RNAV/RNP operations.	Ongoing
q) Identify the need for utilisation of simulation tools in speed time.	Ongoing

<b>WORK PROGRAMME OF THE AIRCRAFT OPERATIONS AND AIRWORTHINESS WORKING GROUP (OPS/AIR/WG)</b>	
<b>Terms of reference:</b> The OPS/AIR/WG is responsible for addressing pilot operations, airworthiness, and aircraft approval issues.	
<b>TASK</b>	<b>STATUS OF IMPLEMENTATION</b>
a) To contribute with the roadmap in the OPS/AIR environment.	Completed
b) To harmonize policy on operations and airworthiness issues related to RNAV and RNP.	Completed
c) To develop and harmonize guidance related to the implementation of RNAV and RNP, including Minimum RNAV/RNP Aircraft System Performance Specifications (MASPS); and considering the infrastructure of communications, navigation and existing and planned surveillance for CAR/SAM Regions.	Completed
d) To develop a procedure for verification of competence of aircraft flight crews which have reached its navigation capacity based on service performance and which do not count with simulators with such capacity.	Ongoing
e) To track the progress made by States on the tasks listed and report it to the PBN/TF;	Ongoing
f) To send the appropriate material to the PBN/TF website administrator;	Ongoing
g) To accomplish other tasks as directed by the PBN Task Force.	

**APENDICE/APPENDIX F**

(Available in English only)

RNP 10 Authzn Job Aid.doc

3 July

**2007 ICAO PBN Manual References Incorporated****PBN-BASED JOB AID: OPERATOR APPLICATION TO CONDUCT RNP 10 OPERATIONS IN WATRS PLUS CTAs**

**Introduction.** This RNP 10 Job Aid was developed by the FAA Hq Flight Technologies & Procedures Division (AFS-400) to provide guidance to States, operators and inspectors on the process for operators to obtain RNP 10 authorization (approval) for operation on WATRS Plus Control Areas (CTA) oceanic routes or areas. Application of 50 NM lateral separation between aircraft authorized RNP 10 or RNP 4 is planned to be introduced in WATRS Plus CTAs on 5 June 2008. The WATRS Plus CTAs are: the West Atlantic Route System (WATRS), the Atlantic portion of Miami Oceanic Airspace and the San Juan FIR. **(50 NM separation is currently applied in the Pacific, the South Atlantic and other global areas between aircraft authorized RNP 10 or RNP 4).**

**Explanation of RNP 10 vs. RNP 4.** RNP 10 is the minimum “Navigation Specification” required for the application of 50 NM lateral separation. RNP 4 is an operator option. A separate RNP 4 Job Aid will be posted on the FAA WATRS Plus Webpage. “Navigation Specification” is a term from the new ICAO Doc 9613 (ICAO Performance Based Navigation (PBN) Manual).

**Important Explanatory Notes.** See Part 1 “Notes on Issuing Commercial Operator Operations Specifications and IGA Letters of Authorization”.

**Purposes of this Job Aid.** The Job Aid:

1. Provides core RNP 10 reference documents for operators and inspectors.
2. Provides a series of tables that show: the content of an application, related reference paragraphs, location in operator application (documents/exhibits) where an RNP 10 element is addressed and columns for the inspector to comment on, and track the status of various RNP 10 program elements.

**Job Aid Organization****Page**

Part 1.....General Information.....	3
Part 2.....Operator/Aircraft Identification Information.....	6
Part 3.....Content of Operator Application for RNP 10 Authorization.....	7

Part 4.....Operator Application (Exhibits/Documents) For RNP 10 Authority (Approval).....9  
 Part 5.....Determining RNP 10 Aircraft Eligibility.....11  
 Part 6.....Basic Pilot Procedures for RNP 10 Operations.....12  
 Part 7.....In-flight Contingency, Weather Deviation & Strategic Lateral Offset Procedures.....13  
 Part 8.....To be added by 31 July 2007: Operating Policy/Procedures Specific to WATRS Plus 50 NM lateral Separation.....15  
 Part 9.....Contacts.....15

**Recommended Inspector And Operator Actions.** The following are suggestions on how the job aid can be used:

	Lead	Action
1	Inspector	Reviews the “ <b>Basic Events in the RNP 10 Approval Process</b> ” in Part 1 with the operator in the pre-application meeting to provide an overview of approval process events.
2	Inspector	Reviews this Job Aid with the operator to establish the form and content of the operator application for RNP 10 authority.
3	Operator	Uses the Job Aid as a guide to assemble documents/exhibits for its application for RNP 10.
4	Operator	Annotates Job Aid to show location of RNP 10 program elements in the operator exhibits/documents.
5	Operator	Submits Job Aid and RNP 10 operator application (exhibits/documents) to inspector.
6	Inspector	Annotates Job Aid to show task or document “complete/satisfactory” or “open/further operator action required”.
7	Inspector	Informs the operator as soon as possible, when further operator action is required.
8	Operator	Provides inspector, when requested, with revised material.
9	Inspector	Issues Operations Specifications (OpSpecs) or IGA Letter of Authorization (LOA), as applicable, to operator when required tasks and documents are completed.

**PART 1 – GENERAL INFORMATION****Basic Events In RNP 10 Authorization Process**

	<b>Operator Actions</b>	<b>State Inspector Actions</b>
1	Establishes need to obtain RNP 10 authority for WATRS Plus CTA operation.	
2	Reviews Airplane Flight Manual (AFM), AFM Supplement or Type Certificate Data Sheet or other appropriate documents (e.g., Service Bulletins, Service Letters) to determine aircraft eligibility for RNP 10. Operator contacts airplane or avionics manufacturer, if necessary, to confirm airplane eligibility for RNP 10.	
3	Contacts State civil aviation authority to arrange a <b>pre-application meeting</b> to discuss requirements for operational approval.	
4		Establishes, during pre-application meeting: <ul style="list-style-type: none"> <li>• Form and content of operator application (exhibits/documents) supporting RNP 10 authorization.</li> <li>• Date prior to start of operations when operator application should be submitted for evaluation</li> </ul>
5	Submits operator application (exhibits/documents) to appropriate State Authorities with sufficient time prior to the planned start of RNP 10 operations for evaluation. Time prior to planned start to be specified by State authority.	
6		Reviews operator application (submissions).
7		Issues operational approval in the form of OpSpecs (Commercial) or IGA LOA, as appropriate, when airworthiness and operational requirements are fulfilled.

**Part I (continued)**

**WATRS PLUS WEBPAGE: Core Documents, Contacts, etc.** The FAA “**WATRS Plus Webpage**” can be accessed from the FAA Oceanic and Offshore Operations Homepage: [www.faa.gov/ats/ato/130.htm](http://www.faa.gov/ats/ato/130.htm)

<b>Core ICAO Reference Documents</b>	<b>Subject or Title</b>	<b>WATRS Plus Webpage Location</b>
ICAO Performance Based Navigation (PBN) Manual (new ICAO Doc 9613)	Vol. II, Part B; Chapter 1 (RNP 10); Vol. II, Part C, Chapter 1 (RNP 4)	Section 2, ICAO Guidance
Pilot Procedures: In-flight Contingencies, Weather Deviation, SLOP	Extract From FAA Notice of ICAO Doc 4444 Procedures	Section 2, Operating Policy
<b>*Core FAA Reference Documents</b>	<b>Subject or Title</b>	<b>WATRS Plus Webpage Location</b>
FAA Order 8400.12 (as amended)	RNP 10 Operational Approval	Section 2, Operator/Aircraft RNP 10 Authorization Policy/Procedures
Acceptable Nav System Configurations For RNP 10	Explanation of Dual Equipage Requirements	Section 2, Operator/Aircraft RNP 10 Authorization Policy/Procedures
FAA Notice (planned for late July 2007)	WATRS Plus Policy/Procedures (to be applicable 5 June 2008)	Section 2, Operating Policy
FAA Inspector Guidance:	FAA Inspector Guidance on RNP 10 Operational Approval	Section 2, FAA Flight Standards Inspector Guidance
FAA Notice 8000.340, Fig. 1.5.5	RNP 4 Authorization For Oceanic and Remote Areas.	Section 2, Operator/Aircraft RNP 10 Authorization Policy/Procedures

**\*Note:** the FAA RNP 10 authorization process is in accordance with the ICAO PBN Manual. No action is required for operators and aircraft previously approved under FAA Order 8400.12 (as amended).

**Example FAA IGA (FAA Part 91) Letters of Authorization (LOA): Operations Safety System (OPSS) Generated**

1. OPSS LOA B036 (Operation in Required Navigation Performance Airspace)
2. OPSS LOA D098 (Flight in Special Areas of Operations For Short-term Operations)

**Example FAA Operations Specifications (OpSpecs) Paragraphs**

1. B036 (Class II Navigation Using Multiple Long-Range Navigation Systems (LRNS))
2. B054 (Class II Navigation Using Single Long-Range Navigation system): See Part 8 of this Job Aid for FAA policy reference on operation of Non-RNP 10 aircraft (including aircraft with one LRNS operating) in WATRS Plus CTAs after the June 2008 project implementation.

### **PART 1 (cont.)**

#### **Notes on Issuing Commercial Operator Operations Specifications (OpSpecs) and IGA Letters of Authorization (LOA).**

1. **Responsible State Authority (ICAO Guidance).**
  - a. International Commercial Operators: State of Registry makes the determination that the aircraft meets the applicable RNP requirements; State of Operator issues operating authority (e.g., Operations Specifications (OpSpecs)).
  - b. International General Aviation (IGA) Operators: State of Registry makes determination that aircraft meets the applicable RNP requirements and issues operating authority (e.g., Letter of Authorization (LOA)).
2. **FAA Policies For Consideration**
  - a. **Separate IGA Area of Operation LOAs. IGA (FAA Part 91) operators are not required to be issued LOAs for individual areas of operations.** The operator is responsible under Annex 2, paragraph 2.3.2 for policies/procedures applicable to individual areas of operation.
  - b. An IGA (FAA Part 91) operator holding a current LOA showing RNP 10 authority does not have to re-apply for RNP 10 authority in WATRS Plus Control Areas.
  - c. **Inspector Action for IGA (FAA Part 91) Operators. FAA inspector action is to “accept” RNP 10 related operations and airworthiness programs.** Formal “approval” is not required. (Reference FAA Order 8700.1, Chapter 3, paragraph 11).
  - d. **An operator planning to obtain initial RNP 10 authority for WATRS Plus CTAs may apply for and be issued authority based on operational policies published and referenced in this Job Aid.** When WATRS Plus-specific operational policy/procedures are published in late July 2007, inspectors and operators will be notified and this Job Aid will be modified accordingly. (See Job Aid, Part 8).

#### **Other Related ICAO Reference Documents**

1. ICAO Annex 2 (Rules of the Air). See paragraphs 2.3 (Responsibility for compliance with the rules of the air) and 5.1.1 (Aircraft equipment).

2. ICAO Annex 6 (Operation of Aircraft), Part 1 (International Commercial Air Transport) and Part 2 (International General Aviation). See paragraph 7.2 (Navigation Equipment).
3. ICAO Doc 4444 (Procedures For Air Navigation Services – Air Traffic Management), paragraph 15.2 (Special Procedures For In-flight Contingencies In Oceanic Airspace)

**PART 2: OPERATOR/AIRCRAFT IDENTIFICATION INFORMATION**

**OPERATOR NAME:** \_\_\_\_\_

AIRCRAFT MAKE, MODEL, SERIES	# REGISTRATION NUMBER(S)	## SERIAL NUMBERS(S)	LONG-RANGE NAVIGATION SYSTEMS (LRNS): NUMBER, MANUFACTURER & MODEL	RNP TYPE REQUESTED (E.G., RNP 10, RNP 4)

**##Note:** may be provided separately in a form and manner acceptable to the inspector.

**DATE OF PRE-APPLICATION MEETING** \_\_\_\_\_

**DATE APPLICATION RECEIVED:** \_\_\_\_\_

**DATE OPERATOR PLANS TO START RNP 10 OPERATIONS** \_\_\_\_\_

**NOTIFICATION TIME TO CAA ADEQUATE?**           YES           NO

**Note:** Separate IGA (FAA Part 91) LOAs are not required to be issued for individual areas of operations.

**PART 3:** CONTENT OF OPERATOR APPLICATION FOR RNP 10

	<u>CONTENT OF OPERATOR APPLICATION FOR RNP 10</u>	<b>ICAO PBN Manual, Part B, Chapter 1</b>	<b>Where Found in Operator Exhibits/Documents</b> <b>Note:</b> operator should update this column to reflect the content of its application.	<b>FAA Inspector Recommendation and/or Comments</b>	<b>Inspector Tracking: Item Status and Date</b>
1.	<b>Operator Request Letter:</b> statement of intent to obtain RNP 10 authority. (Recommended)	1.3.2 (Approval Process) (General)	Exhibit A		
2.	<b>Aircraft/Navigation System RNP 10 Eligibility Group.</b> Airworthiness documents that establish the proposed aircraft/navigation system group, its RNP 10 approval status and, in a form acceptable to the inspector, a list of airframes in that group.	1.3.2.1 (Aircraft Eligibility)  1.3.3.2 (Criteria for Specific Navigation Systems)	Exhibit B, C, D, as applicable		
2a.	<b>Dual Equipment Requirement:</b> at least two Long Range Navigation Systems (LRNS) with adequate display and functionality for oceanic operations	1.3.3 (Aircraft Requirements)	Exhibit B, C, D, as applicable		
3.	<b>Time Limit For INS or IRU Only Equipped Aircraft.</b> Approved or requested RNP 10 time limit for aircraft for which Inertial Navigation Systems (INS) or Inertial Reference Units (IRU) are the only source of Long Range Navigation (LRN). (Not applicable to GPS equipped aircraft)	1.3.3.2.2 (Standard)  1.3.3.2.3 (Extended)	Exhibit E		

4.	<p><b>RNP-10 Area of Operations For INS or IRU Only Equipped Aircraft.</b> Documentation establishing the RNP-10 area of operations or routes for which the specific aircraft/navigation system is eligible. (Not applicable to GPS equipped aircraft)</p>	<p>1.3.4.7 (Route Evaluation) 1.3.4.8 (Effect of Enroute Updates)</p>	Exhibit E		
5.	<p><b>a. Part 91 (General Aviation) Pilot Training or Knowledge.</b> (e.g., operator in-house training, part 142 training center or other course of instruction). <b>b. Part 121 or 135 Pilot and, if applicable, Dispatcher Training documents.</b></p>	<p>1.3.2.2.2, 1.3.5 (Training Documentation) 1.3.4 (Pilot) Operating Procedures including emergency (contingencies) (See Job Aid Parts 6 &amp; 7)</p>	Exhibit H		

#	<p align="center"><u>CONTENT OF OPERATOR APPLICATION FOR RNP 10</u></p>	<p align="center"><u>ICAO PBN Manual (Doc 9613) Vol. II Part B</u> <u>Reference Paragraphs:</u></p>	<p align="center"><b>Where Found in Operator Exhibits/Documents</b> <u>Note:</u> operator should update this column to reflect the content of its application.</p>	<p align="center"><b>FAA Inspector Recommendations and/or Comments</b></p>	<p align="center"><b>Inspector Tracking: Item Status and Date”</b></p>
6.	<p><b>a. IGA (FAA Part 91) Operations Manuals or Documents.</b> Operations Manual or section of operator’s application documenting RNP 10 operational policies and procedures. <b>b. Commercial (FAA Part 121 or 135) Operations Manuals and Checklists.</b> <b>Maintenance Practices.</b> For aircraft with established LRNS maintenance practices, provide document references. For newly installed LRNS, provide maintenance practices for review.</p>	<p>1.3.2.2.3; 1.3.4; 1.3.4.2 c); Contingency, Weather, Strategic Lateral Offset Procedures (See Job Aid Parts 6 &amp; 7).</p>	<p>Exhibit I</p>		
7.	<p><b>Maintenance Practices.</b> For aircraft with established LRNS maintenance practices, provide document references. For newly installed LRNS, provide maintenance practices for review.</p>	<p>1.3.2.2.4 (second paragraph)</p>	<p>Exhibit F</p>		
8.	<p><b>Minimum Equipment List (MEL) updates, if applicable.</b> (Only applicable if operator conducts operations under an MEL).</p>	<p>1.3.2.2.4 (first paragraph)</p>	<p>Exhibit G</p>		

9.	<p><b>Operating History.</b> Operating history that identifies past problems, incidents, track keeping errors, if any, and actions taken to correct the situation.</p>	1.3.2.2.5 (past performance)	Exhibit J		
10.	<p><b>Removal of RNP 10 Operating Authority.</b> Awareness of the necessity to follow up action after navigation error reports, and the potential for removal of RNP 10 operating authority.</p>	1.3.7 (Oversight of Operators)	Exhibit K		

**PART 4: OPERATOR APPLICATION (EXHIBITS/DOCUMENTS)**

Exhibit	Exhibit/Document Title	Operator Indication of Inclusion	INSPECTOR COMMENTS
A	(Recommended) <b>Operator Letter Requesting RNP 10 Authority</b>		
B	<b>Aircraft Eligibility Group.</b> Operator statement of RNP 10 Eligibility Group or Groups into which its aircraft/Long Range Navigation System (LRNS) combinations fall. See Job Aid Part 5.		
C	<b>Aircraft airworthiness documents.....showing RNP 10 ...</b> in accordance with ICAO PBN Manual, e.g., AFM, AFM Revision, AFM Supplement or Type Certificate Data Sheet (TCDS) showing that aircraft LRNS are RNP 10 eligible. (See Job Aid Parts 4 and 5).		
D	<b>Aircraft Modified To Meet RNP 10 Standards.....documentation of aircraft inspection and/or modification. If applicable,</b> maintenance records documenting installation or modification of aircraft/LRNS (e.g., FAA Form 337 (Major Repair and Alteration))		
E	<b>RNP 10 Time Limit: Applicable To RNP 10 Only For INS or IRU Only Equipped Aircraft:</b> Documentation establishing the RNP 10 time limit and area of operations or routes for which the specific aircraft/navigation system is eligible. (Not applicable to GPS equipped aircraft. RNP 4 requires GPS equipage))		
F	<b>Maintenance Program:</b> for aircraft with established LRNS maintenance practices, provide list of document or program references. For newly installed LRNS, provide LRNS maintenance practices for review.		
G	<b>Minimum Equipment List (MEL) (only for operators operating under an MEL):</b> MEL or MMEL showing provisions for LRNS		
H	<ol style="list-style-type: none"> <li>1. <b>IGA (FAA Part 91) Operator Method of Pilot Training/Knowledge:</b> operator in-house training, part 142 training center or other course of instruction.</li> <li>2. <b>Commercial Operator (FAA Part 121 or 135) Pilot &amp;, if applicable, Dispatcher Training documents</b></li> </ol>		
I	<b>1. IGA (FAA Part 91) Operator Operations Manuals or Documents:</b> Operations Manual <b>or</b> section of operator's application documenting RNP 10		

	operational policy/procedures.		
	<b>2. Commercial (FAA Part 121 or 135) Operations Manuals</b>		

**PART 4: OPERATOR APPLICATION (EXHIBITS/DOCUMENTS) SUBMITTED (cont.)**

<b>Exhibit</b>	<b>Exhibit/Document Title</b>	<b>Operator Indication of Inclusion</b>	<b>INSPECTOR COMMENTS</b>
J	<b>Operating History.</b> (If any, past problems, incidents, track keeping errors, corrective actions.)		
K	<b>Removal of RNP 10 Operating Authority.</b> Awareness of necessity for timely, effective follow-up to navigation errors and potential for removal of RNP 10 or RNP 4 authority.		

**\*SUBMISSION INCLUDES:** \_\_\_ AIRCRAFT/LRNS COMPLIANCE DOCUMENTATION  
 \_\_\_ OPERATIONAL POLICY/PROCEDURES  
 \_\_\_ MAINTENANCE MANUAL SECTIONS RELATED TO LRNS (if not previously reviewed)

**PART 5 GUIDE FOR DETERMINING AIRCRAFT ELIGIBILITY**

#	Subject	ICAO PBN Manual Vol. II, Part B Chapter 1 Reference Paragraphs:	Location in Operator Exhibits	FAA Recommendations/Comments	Inspector Tracking Item Status & Date
1	Dual Long Range Navigation System Equipage (minimum)	1.3.3	B, C, as applicable		
2	Eligibility Group 1 – Aircraft Eligibility Through RNP Certification (RNP compliance documented in Airplane Flight Manual (AFM))	1.3.2.1 (Method 1)	B, C, as applicable		
3	Eligibility Group 2 – Aircraft Eligibility Through Prior Navigation System Certification	1.3.2.1 (Method 2)	B, C, D, as applicable		
3a	INSS or IRUs Approved In Accordance With 14 CFR Part 121, Appendix G (Time limit 6.2 hours)	1.3.3.2.2 (Standard Time)	B, C, D, as applicable		
3b	INSS or IRUs Approved For North Atlantic MNPS or Australian RNAV Operations (Time limit 6.2 hours)	1.3.3.2.2 (Standard Time)	B, C, D, as applicable		
3c	Obtaining Approval For Extended INS or IRU Time Limit	1.3.3.2.3 (Extended Time Limit)	B, C, D, as applicable		
3d	GNSS Approved to Primary Means of Navigation Standards (reference AC 20-138, as amended)	1.3.3.2.1	B, C, D, as applicable		
3e	Multi-sensor Systems Integrating GPS (reference AC 20-130, as amended)	1.3.3.2.1	B, C, D, as applicable		
3f	Equipage With One GPS and One Other Approved LRNS (e.g., INS or IRU).	1.3.3.2.4	B, C, D, as applicable		

4	<b>Eligibility Group 3 – Eligibility Through Data Collection</b>	1.3.2.1 (Method 3)	B, C, as applicable	
4a	<b>Sequential Method</b>	1.3.2.1	B, C, as applicable	
4b	<b>Periodic Method</b>	1.3.2.1	B, C, as applicable	

**PART 6: BASIC PILOT PROCEDURES FOR RNP 10 OPERATIONS**

#	Subject	ICAO PBN Manual Vol. II, Part B Chapter 1 Reference Paragraphs	Location In Operator Exhibits	FAA Recommendations/Comments	Inspector Tracking Item Status & Date
1	<b>Flight Planning.</b>	1.3.4, 1.3.4.1	Exhibits H and I		
	Verify aircraft authorized RNP 10 and two long-range navigation systems (LRNS) operational.	1.3.4.1, 1.3.4.3	Exhibits H and I		
	When equipped with INS or IRU only, verify that RNP 10 time limit (area of operations) is accounted for.	1.3.4.1,	Exhibits H and I		
	** Annotate ICAO Flight Plan block 10 (Equipment) with “R” and “Z” and annotate Item/Field 18 with “NAV/RNP10”. <b>See Job Aid Part 8).</b> -If two approved LRNS not operational, delete above annotations & operate in accordance with applicable policy.	1.3.4.4  **Block 10 “Z” and Item/Field 18 annotations are WATRS Plus area policy.	Exhibits H and I		
	As applicable, verify that NavAids, including GNSS requirements such as Fault Detection & Exclusion (FDE) are	1.3.4.1 1.3.4.5	Exhibits H and I		

	accounted for.				
	Account for navigation system operating restriction, if any.	1.3.4.1	Exhibits H and I		
2	<b>Pre-flight Procedures at the Aircraft.</b>	1.3.4.2	Exhibits H and I		
	Review maintenance logs and forms for LRNS status; confirm navigation database current.	1.3.4.2 a) 1.3.6	Exhibits H and I		
	During external inspection of aircraft, check condition of navigation-related items such as navigation antennas.	1.3.4.2 b)	Exhibits H and I		

#	Subject	ICAO PBN Manual Vol. II, Part B Chapter 1	Location In Operator Exhibits	FAA Recommendations/Comments	Inspector Tracking Item Status & Date
3	<b>En route Procedures</b>	1.3.4.6	Exhibits H and I		
	Before oceanic entry point, verify two LRNS operating. If not, notify ATC and operate in accordance with policy applicable to the airspace.	1.3.4.6	Exhibits H and I		
	Before entering oceanic airspace, perform navigation accuracy check and position update (if necessary) using accepted method. See item 4 below.	1.3.4.6	Exhibits H and I		
	Follow in-flight operating drills to prevent inadvertent deviation from cleared routes.	1.3.4.6	Exhibits H and I		
	Advise ATC of loss of long-range navigation capability and operate in accordance with policy applicable to the airspace.	1.3.4.6	Exhibits H and I		

4	<b>LRNS Position Updating</b>		Exhibits H and I	
	Automatic Position Updating (as applicable)	1.3.4.9	Exhibits H and I	
	Manual Position Updating (as applicable)	1.3.4.10	Exhibits H and I	

**PART 7: IN-FLIGHT CONTINGENCY, WEATHER DEVIATION & SLOP (STRATEGIC LATERAL OFFSET PROCEDURES)**

- Explanation:** The guidance cited below is not applicable to a specific lateral separation standard (i.e., it is not applicable only to RNP 10/50 nm lateral). It is applicable to general oceanic operations (i.e., above, below and within RVSM airspace). An operator may have previously adopted the guidance for oceanic operations. If so, the operator only needs to confirm that that is the case.
- WATRS Plus Webpage Reference:** see Section 2, Operating Policy document entitled: “Contingency, Weather Deviation and Strategic Lateral Offset Procedures”.
- ICAO Doc 4444:** FAA guidance reflects ICAO Document 4444, section 15.2 (*Special Procedures For In-flight Contingencies In Oceanic Airspace*).

#	Subject	# <u>Webpage Reference Document Paragraphs</u>	Location In Operator Exhibits	FAA Recommendations/ Comments	Inspector <u>Tracking</u> Item Status & Date
1	<b>Special Procedures For In-flight Contingencies In Oceanic Airspace</b>		Exhibits H and I		
	<b>Introduction</b> (purpose of in-flight contingency procedures)	<b><u>Introduction:</u></b> paragraphs 1, 2	Exhibits H and I		
	<b>General Procedures</b>	<b><u>General Procedures:</u></b> Paragraphs 1-4	Exhibits H and I		
	<b>Special Procedures For ETOPS Aircraft</b>	<b>ETOPS Aircraft</b>	Exhibits H and I		

2	<b>Weather Deviation Procedures For Oceanic Operations</b>	<b>Paragraph b</b>	Exhibits H and I	
	<b>General Procedures</b>	Paragraphs 1-3	Exhibits H and I	
	<b>Obtaining Priority From ATC When Weather Deviation Required</b>	Paragraph 4	Exhibits H and I	
	<b>Actions To Be Taken When Controller-Pilot Communications Are Established</b>	Paragraph 5	Exhibits H and I	
	<b>Actions To Be Taken If A Revised ATC Clearance Cannot Be Obtained</b>	Paragraph 6	Exhibits H and I	

#	Subject	# <u>Webpage Reference Document Paragraphs</u>	Location In Operator Exhibits	FAA Recommendations/Comments	Inspector Tracking Item Status & Date
3	<b>Strategic Lateral Offsets Procedures (SLOP) In Oceanic Airspace</b>	<b>Paragraph c</b>			
	<b>Introduction (objective of SLOP)</b>	Paragraph 1	Exhibits H and I		
	<b>Guidelines For Offset Positions</b>	Paragraph 2	Exhibits H and I		
	<b>Guidance For Using SLOP</b>	Paragraph 3	Exhibits H and I		
	<b>SLOP Application In The San Juan FIR And Bermuda Airspace</b>	Paragraphs 3(f) and 3(g)	Exhibits H and I		

**PART 8 – OPERATING POLICY/PROCEDURES SPECIFIC TO WATRS PLUS** (to be published in late July 2007 timeframe)**PART 9 – ICAO AND FAA CONTACTS**

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