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 automatica-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/ Internacional 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 Aproval 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

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.

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.

<table>
<tr><th colspan="2">Short Term (until 2010)</th></tr>
<tr><th>Airspace</th><th>RNAV or RNP navigation specification</th></tr>
<tr><td>Route (Oceanic o Remote)</td><td>RNP 10 Corridor EUR/SAM and Santiago/Lima/AORRA/WATRS</td></tr>
<tr><td>Route (Continental)</td><td>RNAV 5 in selected airspaces</td></tr>
<tr><td rowspan="2">TMA</td><td>RNAV-1 in radar environment and with adequate ground navigation infrastructure.</td></tr>
<tr><td>RNP 1 – No radar environment and/or without appropriate DME coverage.</td></tr>
<tr><td>Approach</td><td>RNP APCH in most possible airports and in all international airports.
RNP AR APCH in airport where there are operational benefits.</td></tr>
<tr><td colspan="2">• Non compulsory installation of RNAV equipment on board of non equipped aircraft in TMA and APP
• Mixed Operations (equipped and non equipped aircraft) in TMA and APP
• Required RNAV 2 equipment above FL350 for flights to/from United States.</td></tr>
</table>

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.

Medium Term (2011-2015)	
Airspace	**RNAV or RNP navigation specification**
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**
• RNP2 required equipment over FL290 for flights to/from United States. ** *GBAS procedures are currently not covered under the PBN concept*	

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.

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, or through national agencies.