



General Guidelines
for Obtaining Airworthiness
and Operational Approvals
for PBN Navigation Specifications

Version 1.0

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Glossary of Terms

Advisory Circular (AC) AC 90 series provide operational and airworthiness guidance for operation on U.S. Area Navigation (RNAV) routes,

Advisory Circular (AC) AC 20 series provide guidance for *Airworthiness Approvals*; *European Aviation Safety Agency (EASA) equivalent is AMC 20.*

Airworthiness is a term used to indicate when an aircraft conforms to its approved design and is in a condition for safe operation. This is indicated by the issue of an Airworthiness Certificate.

An "**Airworthiness Certificate**" is issued to an aircraft that is registered in one State and was found to conform to its approved design, typically detailed in the Type Certificate Data Sheet (TCDS), and be in a condition for safe operation, it does not guarantee the aircraft has the operational and emergency equipment installed to carry out specific operations. It is illegal to fly an aircraft on an international flight without first obtaining an airworthiness certificate from the State of Registry.

A **Type Certificate** is awarded by the State of Design to aircraft designers after they have shown that the particular design of a civil aircraft conforms to the States design standard. The TC normally includes the type design, the operating limitations, the Type Certificate Data Sheet, the applicable regulations, and other conditions or limitations prescribed by the CAA. The TC is the foundation for other approvals, including production and airworthiness approvals and would detail if the aircraft design included any Navigation Specifications.

Aircraft modification. A modification to an aircraft is typically detailed in a Supplemental Type Certificate (STC). This document is issued / validated / accepted by the State of Registry of the Aircraft. The STC defines the product design change, states how the modification affects the existing type design, lists serial number effectivity, and would be used to install / replace Navigation Specification equipment on an aircraft. It also identifies the certification basis listing specific regulatory compliance for the design change.

Acceptable Means of Compliance (AMC)

The term Acceptable Means of Compliance (AMC) is primarily used to qualify technical interpretative material to be used in the EASA certification process. In this respect, the AMC serve as means by which the certification requirements and its implementing rules, and more specifically in their annexes called Parts, can be met by the applicant.

Abbreviations

AC - Advisory Circular
AMC - Acceptable Means of Compliance
ANSP - Air Navigation Service Provider
ATM - Air Traffic Management
ATS - Air Traffic Services
CDI - Course Deviation Indicator
DME - Distance Measuring Equipment
EASA - European Aviation Safety Agency
ECAC - European Civil Aviation Conference
EUROCAE - European Organization for Civil Aviation Equipment
EUROCONTROL - European Organisation for the Safety of Air Navigation
FAA - Federal Aviation Administration (USA)
FDE - Fault Detection and Exclusion
FTE - Flight Technical Error
FMS - Flight Management System
GNSS - Global Navigation Satellite System
GPS - Global Positioning System
INS - Inertial Navigation System
IRS - Inertial Reference System
IRU - Inertial Reference Unit
JAA - Joint Aviation Authorities
LNAV - Lateral Navigation
MEL - Minimum Equipment List
MNPS - Minimum Navigation Performance Specification
NAVAID - Navigation Aid(s)
NS - Navigation Specification
NSE - Navigation System Error
OEM - Original Equipment Manufacturer
PBN - Performance Based Navigation
RAIM - Receiver Autonomous Integrity Monitoring
RNAV - Area Navigation
RNP - Required Navigation Performance
RTCA - Radio Technical Commission on Aeronautics
SID - Standard Instrument Departure
STAR - Standard Terminal Arrival
TLS - Target Level of Safety
TSE - Total System Error
VNAV - Vertical Navigation
VOR - Very High Frequency Omni-directional Radio Range

Purpose

This document provides guidance to Air Operators for obtaining Airworthiness and Operational Approvals for all Navigation Specifications contained in Volume II of the Performance Based Navigation (PBN) Manual. While the Operational Approval methodology is described to some degree on various aviation websites, this document fits all the pieces of the puzzle together, and focuses the process as regards the PBN.

Background

ICAO authorized the use of Performance Based Navigation (PBN) by a State Letter AN 11/45-07/22 *Guidance material for the issuance of PBN operational approvals* issued on 27 April 2007. The letter enclosed relevant guidance to help States in the implementation of ATS routes and flight procedures based on PBN. As such, there is a worldwide growing importance of PBN in respect of aviation safety and developing plans have been established to ensure a globally harmonized and coordinated transition to PBN by 2016 for international and domestic operations.

Some States (i.e. Japan) already implemented RNAV routes based on RNAV 1 Navigation Specification on 27 September 2007, and plan to implement routes based on the RNAV 5 Navigation Specification on 13 March 2008, as set out in the ICAO PBN Manual. Operators looking to benefit from the new routes first need to be 'approved' by their State of Operator/Registry. Therefore it is becoming more important than ever for Operators to understand how to go about obtaining 'Operational Approvals' for the different Navigation Specifications contained in the PBN Manual.

For the purpose of this document the term *Operational Approval* refers to *Airworthiness and Operational Approval*.

Navigation 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.

Performance Based Navigation therefore depends on:

- The RNAV equipment and its installation on the aircraft both being approved by the State of Operator/Registry to meet the performance; and
- Functional requirements of the Navigation Specification prescribed for RNAV operations on ATS routes or in an airspace; and
- Air crew satisfying the operating requirements set out by the regulation of the State of the Operator for RNAV operations; and
- A defined airspace concept which includes RNAV operations; and
- An available navigation aid infrastructure;

An Airspace Concept consists of the ATS route structure, separation minima and obstacle clearance, which have been developed to satisfy explicit strategic objectives e.g. safety, capacity, environment, and/or efficiency. A Navigation Application is defined to meet the needs of the Airspace Concept. It comprises a Navigation Specification (NS) and a specific navigation infrastructure. A Navigation Specification is a set of aircraft and aircrew requirements needed to support a navigation application within a defined airspace concept.

PBN facilitates the operational approval process for operators by providing a limited set of Navigation Specifications intended for global use. Nevertheless, obtaining *Operational Approvals* may be an arduous task for those operators never having gone through such a process. The PBN manual covers many subjects as it addresses the requirements of ATM Planners, Air Navigation Service Providers (ANSPs), Air Operators, Aerodrome Operators, Regulators, Air Traffic Controllers and Procedure Designers, among others. It also discusses airworthiness and operational approvals to some extent, but may not cover every step of the approval process to the necessary level of detail. It is believed that the guidelines specified in this document are going to bridge that gap and provide all the essential information to make an application for an *Operational Approval* successful.

Therefore these guidelines aim to establish a method that can be used to obtain airworthiness approval of a navigation system, and to obtain the necessary operational approval for use on designated ATS routes or in designated airspace pertaining to a particular Navigation Specification.

Note: The intent of this document is not to supersede existing processes already in place, e.g. UK approval for P-RNAV, but merely to assist Operators in those States where a process has not been established.

Introduction

Operational Approvals – Brief History

Initially, the special committee on future air navigation (FANS) developed the concept of Required Navigation Performance Capability (RNPC). ICAO approved the RNPC concept and assigned it to the Review of the General Concept of Separation Panel (RGCSPP) for further work.

With evolving navigation systems, the RGCSPP, in 1990, realized that capability and performance were distinctly different. Since airspace planning is dependent on measured performance rather than designed capability, RNPC was changed to Required Navigation Performance (RNP). The RGCSPP then developed the concept of RNP further by expanding it as a statement of the navigation performance accuracy necessary for operations within a defined airspace or route. It published ICAO Doc 9613, the *Manual on Required Navigation Performance*. While the title of the document reflects 'RNP', it also establishes parameters for area navigation (RNAV).

Prior to RNAV operations, there was no requirement for Operational Approvals; also referred to as Navigation Approvals by some States. Aircrews had to be qualified for IFR flight, and aircraft had to be equipped with navigation equipment corresponding to ground-based navigation aids defining ATS routes.

The first Operational Approval resulted from implementing the Minimum Navigation Performance Specification (MNPS). The guidance material was first published in 1979 and was primarily for the information of pilots and dispatchers planning and conducting operations in the North Atlantic (NAT) airspace. The MNPS Operations Manual specified required navigation performance through the mandatory carriage and proper use of particular navigation equipment, together with its installation and maintenance procedures, plus flight crew navigation procedures and training that all had to be approved by the State of Operator/Registry. While aircraft had to demonstrate Total System Error (TSE) navigation accuracy of ± 12.6 NM 95% of the total flying time, MNPS was never referred to as RNP 12.6.

Therefore the first Operational Approval for 'Required Navigation Performance' was for RNP 10, written by the FAA in 1996 in the form of Order 8400.12. This first edition was cancelled on January 24, 1997, and replaced by Order 8400.12A¹ on February 9, 1998.

At about this time, Basic Area Navigation (B-RNAV) was developed by the European Civil Aviation Conference (ECAC), and became mandatory on April 23, 1998 as the primary means of navigation in all ECAC en-route airspace; however there was not a specific Operational Approval requirement for B-RNAV.

1

On April 23, 1998 Anchorage Air Route Traffic Control Center (ARTCC) implemented lateral separation standards within the NOPAC (North Pacific) route structure from FL 310 to FL 390 to all aircraft that are RNP 10 approved. On the same day, Australia and New Zealand implemented RNP in the Tasman Sea airspace. As of Dec. 3, 1998 (Oakland NOTAM A4335/98), a 50 nm lateral separation standard was applied in the Central Pacific (CENPAC) (Pacific Organized Track System only) to all aircraft that are RNP 10 approved.

Following B-RNAV was the RVSM Operational Approval, effective in January 2002, which prescribed both airworthiness requirements, to ensure aircraft height-keeping performance in accordance with the RVSM Minimum Aviation System Performance Standards (MASPS), and also crew operating procedures.

What is noteworthy in these four examples is that the approval process comprises two equally important elements, one focusing on aircraft eligibility and the other on the airline operating procedures. The airworthiness approval can be determined from either statements in the Aircraft Flight Manual (AFM) or AFM supplements, or advice from OEM (e.g. Boeing Service Letter) and the *Operational Approval* is based on operating procedures, flight crew training, and control of the navigation database process (where required). The *Airworthiness* and *Operational Approval* is obtained in accordance with national operating rules of the State of Operator/Registry for individual aircraft type group/equipment.

Transition to PBN introduces the potential for aircraft to demonstrate requirements compliance through a mix of capabilities, rather than only specific equipment. That is why the approval is based on total 'performance' and is not tied to any specific navigation equipment. ICAO PBN Manual provides a standardized set of performance and functionality criteria for each Navigation Specification that is used by States as the basis for aircraft certification and operational approvals. It is worthy of note that a Navigation Specification does not in itself constitute regulatory guidance material, and consequently an Operational Approval is NOT GRANTED against the PBN Navigation Specification, but the applicable regulatory material of the State of Operator/Registry corresponding to a particular Navigation Specification.

Operational Approval

Common misconceptions regarding terminology

Commercial operators are issued an "air operator certificate" (AOC) by the CAA of the State of the Operator. An AOC means a certificate that authorizes the holder of the certificate to operate a commercial air service. These operators are referred to generally as "air operators". In a broad sense, the AOC is an operational approval (no capital letters), and it will specify such items as authorization for a type of operation (commercial air transportation of passengers, cargo, etc.), aircraft types, VFR, VFR over-the-top, and IFR, etc. By the term Operational Approval in this document we really mean *Airworthiness* and *Operational* approvals, also referred to as "Operations Specifications" (or Ops Specs) in North America for example, and an *Operational Approval* or "Ops Spec" can be added to the AOC. It must be stressed that it is the AC, AMC or Order that is the certifying document, and the compliance will not be approved against the PBN nor any Navigation Specification. However operators can use the PBN Navigation Specifications for preliminary guidance as they encompass information regarding 'aircraft eligibility' as well as 'operational responsibilities', of the operator in terms of operating procedures, training, documentation, etc. For general aviation (GA), a Letter of Authorization may be required in place of the Ops Spec, and as such provide one solution, but is by no means a norm. This document cannot account for all the different terminology used around the world, and therefore will continue using the term *Operational Approval*, which is the two-step process providing operational and airworthiness guidance for operation in a given airspace or on certain routes as defined by the AC, AMC or Orders and summarized in the PBN Navigation Specification.

Another common misconception regarding compliance with a Navigation Specification may be the overriding focus on the navigation accuracy, which may be derived from the Navigation Specification title, for example RNAV 2. The erroneous assumption may be that an aircraft capable of ± 2 NM navigation accuracy (95% of the flying time) is qualified to operate on RNAV 2 routes. Navigation accuracy is a start, but there is a lot more to the PBN Navigation Specification as will be illustrated in the following sections of this manual. Therefore any notions about any single element have no real merit, as 'navigation accuracy' is merely one of the many requirements of the *Airworthiness Requirements* side of the *Operational Approval* equation.

As stated in the Background section, the PBN manual addresses the approval process to some extent in Volume II, Implementing RNAV and RNP, Parts B (for RNAV) and C (for RNP). Guidance for each Navigation Specification can be found in Paragraph X.3.2.2, titled operational approval. The guidelines in this document will take the reader a few steps further. The goal is to describe in detail what is required step-by-step along the approval process path from the beginning to the end in a logical and systematic manner.

Approval Process

Step 1 - Pre-Application Meeting

The assessment of a particular operator is made by the State of Operator/Registry for that operator and in accordance with national operating rules. It is therefore recommended that aircraft operators are to contact their national authority and schedule a 'pre-application' meeting. The authority may for example be a certificate issuing office, or, in the European Union, EASA aircraft operators should apply to their national Authority.

There may be different offices dealing with specific approvals depending on the regulations applicable to the operator. For example, commercial aircraft Operators will receive an approved operations specifications (ops spec) and therefore might be seeking their approval from the same office that issues the AOC and associated Operations Specifications.

The intent of this meeting is to inform the operator of what may be expected in regard to the approval process and to discuss the contents of the operator's application, and to provide the operator with the requirements for the operational approval. An example of the basic requirements is listed below:

- a. Evidence of aircraft eligibility;
- b. Assessment of the operating procedures for the navigation systems to be used;
- c. Control of those procedures through acceptable entries in the Operations Manual;
- d. Identification of flight crew, dispatcher (or equivalent) and maintenance training requirements; and
- e. Where required, control of the navigation database process.

Items b, c and d involve the CAA of the State of the Operator.

In a nutshell, as part of operational approval, operators will be instructed to review their Airplane Flight Manuals (AFM) or AFM Supplements for compliance statements, or obtain evidence of compliance from the OEM or an approved design organization, assess Standard Operating Procedures, update their operations manuals, provide pilot/dispatch/maintenance training, and get the database from an approved supplier, or implement approved navigation database integrity checks.

Attachment 1 lists a set of Airworthiness and Operational 'requirements' and recommended 'actions' by the Applicant Operator.

Approval Process

Step 2 – Application

Contents of the Operator's NS Application.

(Attachment 2 provides an 'example' of a sample application letter).

1. Eligibility Airworthiness Documents – sufficient documentation should be available to establish that the aircraft has an appropriate AFM, AFM Supplement (AFMS), if applicable, and is otherwise suitably qualified to operate in or to fly the intended Navigation Specification RNP/RNAV ATS routes or procedures (e.g. STARs and SIDs).

Description of Aircraft Equipment – The applicant should provide:

- a. A configuration list, which details pertinent components and equipment to be used for PBN Navigation Specification RNP/RNAV operations including the approval status, typically a Technical Standard Order (TSO).
- b. Details of the modification(s) to install the equipment on the aircraft and its approval by the State of Registry against applicable AC, AMC or Order.
- c. The instructions for continued airworthiness issued by the equipment manufacturer from (a) above and the designer of the modification from (b) above.
- d. Details of the management and control when updating / changing the software / database on the aircraft, including the documentation and certification of the work within the aircraft's maintenance records.

Note: the process may be modified to account for multiple PBN NS RNAV/RNP Operational Approval applications being requested

2. Operational Training Programs and Operating Practices and Procedures for the navigation systems to be used
 - a. Commercial Air operators should submit training syllabi and other appropriate material to the National Authority of the State/Registry to show that the operational practices, procedures and training items related to PBN Navigation Specification RNP/RNAV operations are incorporated in various training programs where applicable (e.g. initial, upgrade, recurrent). Training for other personnel should be included where appropriate (e.g. dispatchers, maintenance), and should match guidelines of the PBN Manual, Volume II, Part B&C, Paragraph X.3.5 - Pilot Knowledge and Training. Practices and procedures in the following areas should be standardized using the guidelines of PBN Manual, Volume II, Part B&C, Paragraph X.3.4 – Operating Procedures. This Paragraph highlights pre-flight planning, general operating procedures, specific requirements and contingency procedures. The company Standard Operating Procedures (SOPs) should reflect operating procedures as addition/change to the FCOM,

which covers system use. Emphasis should be on flight crews being conversant with RNAV/RNP general principles and specific applications.

3. Operational Manuals and Checklists.
 - a. Commercial Air Operators. The appropriate manuals and checklists should be revised to include information/guidance on standard operating procedures detailed in PBN Manual, Volume II, Part B&C, Paragraph X.3.4. Appropriate manuals should include navigation equipment operating instructions and any procedures for the navigation systems to be used as required by the PBN Navigation Specification, to operate in a specific area of operations (e.g. contingency procedures). Manuals and checklists should be submitted for review as part of the application process.
4. Where required, control of navigation database process. RTCA DO-200A/EUROCAE ED-76 data chain integrity process should be documented and include procedures for the recording and certification of software / database changes in the aircraft records, to comply with the maintenance requirements of the State of Registry.
5. Past Performance. An operating history of the operator should be included in the application. The applicant should address any past events or incidents related to navigation errors for its operations.
6. Minimum Equipment List. Any MEL revisions necessary to address the PBN Navigation Specification provisions of this guidance, which should be no less restrictive than the MMEL.
7. Maintenance. The operator should submit a copy of the revised maintenance program, which includes the recommendations from the instructions for continued airworthiness detailed in 1 above, for approval by the State of Registry in accordance with the AC, AMC or Order with respect to the appropriate PBN Navigation Specification at the time the operator applies for operational approval.

Examples of required aircraft navigation equipment, functional requirements, operating procedures, pilot training and database requirements are provided in Attachment 3 - Airworthiness and Operational Approval Matrix. This attachment shows only selected **examples** to provide an indication of what may be expected. Operators **must** consult the PBN Manual for a complete list of requirements for each PBN NS.

Approval Process

Step 3 – Evaluation of Application and Issue of Approval.

1. Review and Evaluation of Applications. Once the application has been submitted, the National Authority of the State/Registry will begin the process of review and evaluation. Please note that a minimum (number – depending on State) of working days will normally be required to check and confirm the information. If the content of the application is insufficient, the National Authority of the State/Registry will request additional information from the operator. When all the airworthiness and operational requirements of the application are met, the issuing National Authority of the State/Registry will issue the appropriate Operational Approval/Operations Specification (Ops Spec) for approval to operate in the PBN Navigation Specification airspace or on (RNP/RNAV) ATS routes for a specific time.
2. The operational approval will likely be documented through the State of the Operator amending the Air Operational Approval/Operations Specification (Ops Spec) associated with the AOC for commercial air operators or the CAA of the State of Registry approving the AFM and, for general aviation operators, issuing the Letter of Authorization (LOA) .
3. Investigation of Navigational Errors or Reportable Events. Demonstrated navigation accuracy provides the basis for determining the lateral spacing and separation necessary for traffic operating on a given route. Any navigation errors will be investigated to prevent their recurrence. Radar observations of each aircraft's proximity to the centreline are typically noted by Air Traffic Service facilities. If any observation indicates that an aircraft was not within an established limit, the reason for the apparent deviation from the centreline may need to be determined and steps taken to prevent a recurrence. A reportable event could be a 'map shift' for example.
4. Revoking of the Approval/Operations Specification (Ops Spec) or Letter of Authorization (LOA). When appropriate, the appropriate CAA may consider the error reports in determining remedial action. Repeated errors attributed to specific piece of navigation equipment may result in withdrawal of the Operational Approval/Operations Specification (Ops Spec).

Summary

Operators are reminded that airworthiness certification alone does not authorise operators to conduct any NS operations, as operational approval is also required to confirm the adequacy of the operator's normal and contingency procedures, pilot training and database requirements for any particular PBN NS.

It should also be noted that any Navigation Specification does not in itself constitute regulatory guidance material against which either the aircraft or the operator will be assessed and approved, and that the Operational Approval will be made against a specific AC, AMC or Order. Aircraft are certified by their State of manufacture and operators are approved in accordance with their National Civil Aviation Regulations. The Navigation Specification provides the technical and operational criteria, and can be used by national authorities for preparation of regulatory guidance material. This holds particularly true for the Basic-RNP 1 and RNP APCH Navigation Specifications as there is currently no regulatory guidance material in the form of Advisory Circular or an Order for these two Navigation Specifications, against which either the aircraft or the operator may be assessed.

References

Copies of EUROCONTROL documents may be requested from EUROCONTROL, Documentation Centre, GS4, Rue de la Fusee, 96, B-1130 Brussels, Belgium; (Fax: 32 2 729 9109). Web site: <http://www.ecacnav.com>

Copies of EUROCAE documents may be purchased from EUROCAE, 102 rue Etienne Dolet – 92240 Malakoff – France (FAX: +33 1 46 55 62 65) – Web site: www.eurocae.eu

Copies of FAA documents may be obtained from Superintendent of Documents, Government Printing Office, Washington, DC 20402-9325, USA. Web site: <http://www.faa.gov/certification/aircraft/> (Regulation and Guidance Library)

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). Web site www.rtca.org.

Copies of ARINC documents may be obtained from Aeronautical Radio Inc., 2551 Riva Road, Annapolis, Maryland 24101-7465, USA. Web site: <http://www.arinc.com>

Copies of JAA documents are available from JAA's publisher Information Handling Services (IHS). Information on prices, where and how to order, is available on the JAA web site, <http://www.jaa.nl> , and on the IHS web sites <http://www.global.his.com> , and <http://www.avdataworks.com> .

Copies of EASA documents may be obtained from EASA (European Aviation Safety Agency), 101253, D-50452 Koln, Germany.

Copies of ICAO documents may be purchased from Document Sales Unit, International Civil Aviation Organization, 999 University Street, Montreal, Quebec, Canada H3C 5H7, (Fax: 1 514 954 6769, or e-mail: sales_unit@icao.org) or through national agencies.

Attachment 1

Airworthiness and Operational Requirements and recommended Actions

AIRWORTHINESS REQUIREMENTS	
<p><u>Requirement</u> Airworthiness Compliance statement</p>	
<p><u>Action</u></p> <ul style="list-style-type: none"> i. the AFM may contain a statement confirming RNP or RNAV capability/Navigation Specification requirement if the systems were installed at aircraft manufacture, or ii. the AFM supplements may contain a statement confirming RNP or RNAV capability/Navigation Specification requirement if the systems were installed by modification after the aircraft was manufactured, or iii. manufacturer Customer Service letter confirming aircraft type with delivered navigation system is compliant, or iv. contact aircraft manufacturer/installer for compliance statement 	
<p><i>PBN Navigation Specifications Operational Approvals are based on the following ACs, AMCs or Orders</i></p>	
<p>RNP 10 RNAV 5 RNP 4 RNAV 2 RNAV 1 Basic RNP 1* RNP APCH* RNP AR APCH</p>	<p>FAA Order 8400.12A/AMC 20 under development AC 90-96A/EASA AMC 20-4 FAA Order 8400.33/ AMC 20 under development AC 90-100A AC 90-100A AC20-130A, AC20-138 or AC 20-138A AC20-130A, AC20-138 or AC 20-138A AC 90-101/AMC 20 under development</p>
OPERATIONAL REQUIREMENTS	
<p><u>Requirement</u> Operational procedures for pre-departure, departure, enroute, arrival and contingency conditions</p>	
<p><u>Action</u> Develop Standard Operating Procedures (SOPs) for</p> <ul style="list-style-type: none"> i. pre-departure; ii. departure; iii. enroute; iv. arrival; v. approach; and vi. non-RNAV contingencies 	
<p><u>Requirement</u> Procedures for Incident Reporting</p>	
<p><u>Action</u> Show how incidents are reported by crews to the operator for remedial action</p>	
<p><u>Requirement</u> Crew training</p>	
<p><u>Action</u> Develop training material pertinent to Navigation Specification comprising briefings, and guidance material for departures, enroute, arrivals and approach, covering normal and contingency procedures</p>	

Requirement

On-going integrity checking of navigation database

Action

Database sourced from a data supplier with appropriate Letter of Acceptance (LoA) – no further integrity checks required to comply with NS RNP/RNAV operations, except for RNP AR APCH! *If the data supplier does not possess a LoA, the Operator must confirm integrity checking of NS procedures at each AIRAC cycle. Discrepancy reporting procedures is required for database errors and difficulties flying the procedure. Affected procedures must be inhibited from use until rectified and discrepancies reported to the database supplier.*

Procedures in the maintenance control manual detailing the management and control of updating / changing the software / database on the aircraft, including the documentation and certification of the work within the aircraft's maintenance records.

Requirement

MEL to account for NS RNP/RNAV operations

Action

Review current MEL & amend if required, ensuring the requirements are no less restrictive than the MMEL, to ensure safe operation under all phases of normal operations and for non-RNP/RNAV contingency conditions

* There are currently no 'Orders' or 'Advisory Circulars' for Basic-RNP 1 and RNP APCH, for example the equivalent of AC 90-100A. As such, in order to issue an Operational Approval for these two NSs, the appropriate regulatory authority of each State of Operator/Registry must accept the guidance in the Navigation Specification as regulatory material.

Note: FAA AC 90-RNP is currently under development to support Basic-RNP 1 and RNP APCH, and is expected to be published during the 2008/2009 timeframe.

Attachment 2

Sample Letter of Request by an **AIR CARRIER** to obtain PBN Navigation Specification **OPERATIONAL APPROVAL**

SUBJECT: Request for PBN RNP/RNAV Approval				
TO: Appropriate national authority of the State of Operator/Registry for that operator				
SECTION 1 OPERATOR/AIRFRAME DETAILS				
APPLICANT DETAILS – Required for all Approval Requests				
<ol style="list-style-type: none"> 1. Please give the official name and business or trading name(s), address, mailing address, e-mail address and contact telephone/fax number of the applicant <p style="margin-left: 40px;"><i>Note: For an AOC holders, company name, AOC number and e-mail address will suffice</i></p> <p>[<i>Insert Airline Name</i>] request that Operational Approval be issued for a PBN Navigation Specification RNP [<i>insert number(s)</i>] and/or RNAV [<i>insert number(s)</i>]</p> <p>The following [<i>Insert Airline Name</i>] aircraft meet the requirements and capabilities as defined/specified in Order or AC [<i>Insert number of Order or AC</i>], dated [<i>insert the date of this Order/AC</i>] for a PBN Navigation Specification RNP [<i>insert number</i>] or RNAV [<i>insert number</i>]</p>				
AIRCRAFT DETAILS – Required for all Approval Requests				
<ol style="list-style-type: none"> 2. Airplane type(s), series, manufacturer(s) serial number(s), registration mark(s), mode “S” address code(s), date(s) of modification of the MEL(s) 				
Aircraft Type	Aircraft Series	Manufacturer’s Serial Number	Registration	Mode “S” Code (hexadecimal)
SECTION 2 PBN NAVIGATION SPECIFICATION				
Please refer to the specific Chapters of the PBN Manual, Volume II, Part B&C for guidance.				
<ol style="list-style-type: none"> 3. Operations Manuals must include normal procedures, contingency procedures, incident reporting and flight crew training – give reference(s) of details pertinent to PBN Navigation Specifications operations. Include with submission copies of relevant sections from Operations and Training Manuals. <ul style="list-style-type: none"> • Air Crews must be familiar with operating procedures in accordance with PBN Manual, Volume II, Part B&C, Paragraph X.3.4 • Training of flight-crews must be accomplished in accordance with PBN Manual, Volume II, Part B&C, Paragraph X.3.5 4. Minimum Equipment List – reference of MEL where the Navigation Specification operations are addressed. Include with this submission a copy of the relevant page of pages of the proposed or actual MEL where the operation is addressed. 				

5. Give details of the navigation system that supports the Navigation Specification operation(s) for which the approval is being requested. **Include the type of and number or Flight Management System, and the type and number of positioning sensors.**
6. Give reference to the Navigation Specification operations Airworthiness Compliance Statement(s). **Include with this submission copies of relevant sections from the AFM, or other supporting certification data.**
 - Aircraft eligibility must be determined through demonstration of compliance against the relevant airworthiness criteria and the requirements in accordance with PBN Manual, Volume II, Part B&C, Paragraph X.3.3
7. Provide evidence that your navigation database has been obtained from an approved supplier of aeronautical and navigation data (Type 1 LoA) and that your packed data is from an approved FMS Manufacturer (Type 2 LoA) in accordance with RTCA/EUROCAE document DO-200A/ED-76
 - Navigation Database and supplier requirements are stated in the PBN Manual, Volume II, Part B&C, Paragraph X.3.6
 - The three main European database suppliers (Jeppesen (Germany), EAG (UK) and Lufthansa FlighNav (Switzerland) have all been audited by EASA and have received their Letters of Acceptance (LoA) (Type 1). The FAA carried out a parallel processes and has issued a Type 1 LoA to Jeppesen (USA). Operators also have to demonstrate that they are receiving their packed data from an approved FMS manufacturer (Honeywell, Rockwell Collins, Smiths, etc.) who will require a Type 2 LoA. The FAA has awarded a Type 2 LoA to Honeywell for RTCA DO-200A compliance. The number of FAA LoAs will increase as further audits are completed.

SECTION 3 SIGNATURE BLOCK

Signature:

Name:
(BLOCK LETTERS)

Title:

Date:

Attachment 3

Airworthiness and Operational Approval Matrix – Examples of Requirements

Operational Approval Process (PBN Vol II, Part B/C, Paragraph X.3.2.2)	Evidence of Aircraft Eligibility	Assessment of the on-board navigation system for the following functional requirements	Assessment of the Operating Procedures for the navigation system(s) to be used	Control of those procedures through acceptable entries in the Operations Manual(s)	Identification of flight crew, flight dispatchers and maintenance personnel knowledge and training	Where required, control of navigation database process
RNP/RNAV 10	<p>(PBN Vol II, Part B, Paragraph 1.3.3) FAA Order 8400.12A Two independent and serviceable long-range navigation systems (LRNSs) comprising an inertial navigation system (INS), an inertial referencing system (IRS)/flight management system (FMS) or a global navigation satellite system (GNSS). IRU accuracy and reliability must be assessed. Requirement for up to 6.2 hours of flight time without radio position updating.</p>	As per FAA Order 8400.12A	<p>(PBN Vol II, Part B, Paragraph 1.3.4) Flight Planning:</p> <ul style="list-style-type: none"> • Verify RNP 10 time limit • Verify requirement for GNSS such as Fault Detection and Exclusion (FDE) <p>Pre-flight procedures:</p> <ul style="list-style-type: none"> • Review maintenance logs • Review emergency procedures • IRU alignment before extended range flights <p>Enroute:</p> <ul style="list-style-type: none"> • Prior to entry of oceanic airspace position of aircraft must be checked as accurately as possible <p>Cross-check procedures to identify any navigation errors</p>	<p>(PBN Vol II, Part B, Paragraph 1.3.4) General Operating Procedures</p> <ul style="list-style-type: none"> • RNP 10 route time limit must be established for aircraft equipped with only INS or IRU • Calculations must start at the point where the system is placed in the navigation mode • The stop point may be the point where aircraft begins to navigate with reference to DME/DME, or comes under ATC surveillance • RNP 10 navigation capability may be extended by updating • MEL update 	<p>(PBN Vol II, Part B, Paragraph 1.3.5) Pilot training</p> <ul style="list-style-type: none"> • Commercial operators should ensure that flight crews have been trained so that they are knowledgeable of the topics contained in the PBN Navigation Specification, the limits of their RNP 10 navigation capabilities, the effects of updating, and RNP 10 general operating and contingency procedures • Operator maintenance procedures will require updating to ensure appropriate monitoring of the IRU performance to the RNP 10 requirements. 	<p>PBN Vol II, Part B, Paragraph 1.3.6) Database process not required for RNP 10</p>

Operational Approval Process (PBN Vol II, Part B/C, Paragraph X.3.2.2)	Evidence of Aircraft Eligibility	Assessment of the on-board navigation system for the following functional requirements	Assessment of the Operating Procedures for the navigation system(s) to be used	Control of those procedures through acceptable entries in the Operations Manual(s)	Identification of flight crew, flight dispatchers and maintenance personnel knowledge and training	Where required, control of navigation database process
RNP 4	<p>(PBN Vol II, Part C, Paragraph 1.3.3) FAA Order 8400.33 FAA AC 20-130A FAA AC 20-138A</p> <ul style="list-style-type: none"> • Aircraft fitted with GNSS only as an approved long range navigation system for oceanic and remote airspace operations must meet the technical requirements specified in paragraph 1.3.3. • Appropriate standards are FAA Technical Standard Orders (TSO) C129a or C146(), and EASA Technical Standard Orders (ETSO) C129a or C146() • Multi-Sensor Systems Integrating GNSS with integrity provided by RAIM. Multi-sensor systems incorporating GPS with RAIM and FDE that are approved under FAA AC20-130A 	<p>(PBN Vol II, Part C, Paragraph 1.3.3.2) Functional requirements</p> <ul style="list-style-type: none"> • display of navigation data; • track to fix (TF); • direct to fix (DF); • direct—to function; • course to fix (CF); • parallel offset; • fly-by transition criteria; • user interface displays; • flight planning path selection; • flight planning fix sequencing; • user defined course to fix; • path steering; • alerting requirements; • navigation data base access; • WGS 84 geodetic reference system, and • automatic radio position updating. 	<p>(PBN Vol II, Part C, Paragraph 1.3.4) Pre-flight planning</p> <ul style="list-style-type: none"> • The onboard navigation data must be current and include appropriate procedures • Review contingency procedures for the event that aircraft can no longer navigate to its RNP 4 capability <p>Enroute</p> <ul style="list-style-type: none"> • At least two LRNSs must be operational at the entry point to RNP 4 airspace • Advise ATC of any deterioration or failure of the navigation equipment that falls below the required level 	<p>(PBN Vol II, Part C, Paragraph 1.3.4) General Operating Procedures</p> <ul style="list-style-type: none"> • Cross-checking procedures must be in place to identify navigation errors • Use a lateral deviation indicator, flight director or autopilot in lateral deviation mode on RNP 4 routes • Pilots may use a navigation map display with equivalent functionality to a lateral deviation indicator • MEL update 	<p>(PBN Vol II, Part C, Paragraph 1.3.5) Pilot training</p> <p>Operators must ensure that flight crews are trained and have appropriate knowledge of topics contained in the PBN Navigation Specification, the limits of their RNP 4 navigation capabilities, the effects of updating and RNP 4 contingency procedures</p>	<p>(PBN Vol II, Part C, Paragraph 1.3.6) The navigation database should be obtained from a supplier that complies with RTCA DO-200A/EUROCAE ED 76. LoA issued by the CAA of the State of Registry demonstrates compliance with this requirement.</p>

Operational Approval Process (PBN Vol II, Part B/C, Paragraph X.3.2.2)	Evidence of Aircraft Eligibility	Assessment of the on-board navigation system for the following functional requirements	Assessment of the Operating Procedures for the navigation system(s) to be used	Control of those procedures through acceptable entries in the Operations Manual(s)	Identification of flight crew, flight dispatchers and maintenance personnel knowledge and training	Where required, control of navigation database process
RNAV 5	(PBN Vol II, Part B, Paragraph 2.3.3) EASA AMC 20-4 or FAA AC 90-96 RNAV equipment automatically determining aircraft position using inputs from one or a combination of the following types of position sensors, together with the means to establish and follow a desired path: a) VOR/DME b) DME/DME c) INS or IRS d) GNSS	(PBN Vol II, Part B, Paragraph 2.3.3.3) Functional Requirements a) Continuous indication of aircraft position relative to track to be displayed to the pilot flying on a navigation display situated in his primary field of view b) Where the minimum flight crew is two pilots, indication of aircraft position relative to track to be displayed to the pilot not flying should be in primary field of view. c) Display of distance and bearing to the active (To) waypoint d) Display of ground speed or time to the active (To) waypoint e) Storage of waypoints; minimum of 4 f) Appropriate failure indication of the RNAV system, including the sensors.	(PBN Vol II, Part B, Paragraph 2.3.4) Pre-flight planning <ul style="list-style-type: none"> The availability of the navigation aid infrastructure, required for the intended routes, must be confirmed Pilot must confirm the availability of the onboard navigation equipment necessary for the operation Navigation data base shall be current and appropriate for the region on intended operation Availability of navigation aids for any non-RNAV contingencies must be confirmed 	(PBN Vol II, Part B, Paragraph 2.3.4) General Operating procedures <ul style="list-style-type: none"> Pilots shall not file RNAV 5 routes unless they satisfy all the criteria in relevant documents Pilots must adhere to any AFM limitations or operating procedures required to maintain the navigation accuracy Flight progress should be cross-checked with conventional navigation aids Pilots should use a lateral deviation indicator, flight director or autopilot in lateral navigation mode Pilots may use a navigation map display with equivalent functionality to a lateral deviation indicator 	PBN Vol II, Part B, Paragraph 2.3.5) Pilot training <ul style="list-style-type: none"> Capabilities and limitations of the RNAV system Operations and airspace for which the RNAV system is approved Contingency procedures for RNAV failures Appropriate phraseology Flight planning requirements Turn anticipation Interpretation of electronic displays and symbols RNAV equipment operating procedures Determination of cross-track error deviation 	Database process not required for RNAV 5 , however, where a navigation database is carried and used, it must be current and appropriate for the region of intended operation.

Operational Approval Process (PBN Vol II, Part B/C, Paragraph X.3.2.2)	Evidence of Aircraft Eligibility	Assessment of the on-board navigation system for the following functional requirements	Assessment of the Operating Procedures for the navigation system(s) to be used	Control of those procedures through acceptable entries in the Operations Manual(s)	Identification of flight crew, flight dispatchers and maintenance personnel knowledge and training	Where required, control of navigation database process
RNAV 2	(PBN Vol II, Part B, Paragraph 3.3.3) FAA AC 90-100A The following systems meet the accuracy, integrity and continuity requirements of these criteria: <ul style="list-style-type: none"> • GNSS FAA TSO-C145(), TSO-C146(), or TSO-C129() • DME/DME RNAV • DME/DME IRU RNAV Operators can take credit for prior approval to P-RNAV or US-RNAV, a comparison of EASA TGL-10 and AC90-100A is provided in PBN Vol II, Part B, Paragraph 3.3.2.4 <ul style="list-style-type: none"> • Navigation Systems/FMS listed in Attachment 4. meet the performance requirement for RNAV 1 and RNAV 2. 	(PBN Vol II, Part B, Paragraph 3.3.3.3) Functional requirements Capability: <ul style="list-style-type: none"> • to execute a “direct to” function • for automatic leg sequencing • to execute ATS routes from the on-board database • to execute the following leg transitions: <ul style="list-style-type: none"> ○ Initial Fix ○ Course to Fix ○ Direct to Fix ○ Track to Fix • to display an indication of the RNAV system failure • for multi-sensor systems, capability for automatic reversion to alternate RNAV 	(PBN Vol II, Part B, Paragraph 3.3.4) Pre-flight planning <ul style="list-style-type: none"> • Pilots should file the appropriate flight plan suffix • The availability of the navigation aid infrastructure must be confirmed for the intended period of operation • The availability of RAIM should be determined General Operating Procedures <ul style="list-style-type: none"> • Pilots shall not file RNAV 2 routes unless they satisfy all the criteria in relevant documents • Pilots must confirm that the navigation database is current 	(PBN Vol II, Part B, Paragraph 3.3.4) General Operating Procedures <ul style="list-style-type: none"> • Pilots must not fly SIDs or STARs unless they are retrieved by name from on-board navigation database • Pilots should use a lateral deviation indicator, flight director or autopilot in lateral navigation mode • Pilots may use a navigation map display with equivalent functionality to a lateral deviation indicator Contingency procedures <ul style="list-style-type: none"> • Pilots must notify ATC of any loss of RNAV 2 capability 	(PBN Vol II, Part B, Paragraph 3.3.5) Pilot Training <ul style="list-style-type: none"> • Depiction of waypoint type • Turn anticipation with consideration to speed and altitude effects • Initialize navigation system position • Retrieve and fly a SID or a STAR with appropriate transition • Fly direct to a waypoint • Fly course/track to a waypoint • Intercept a course/track • Determine cross-track error deviation • Resolve route discontinuities • RNAV holding function 	(PBN Vol II, Part B, Paragraph 3.3.6) The navigation database should be obtained from a supplier that complies with RTCA DO-200A/EUROCAE ED 76. LoA issued by the CAA of the State of Registry demonstrates compliance with this requirement.

Operational Approval Process (PBN Vol II, Part B/C, Paragraph X.3.2.2)	Evidence of Aircraft Eligibility	Assessment of the on-board navigation system for the following functional requirements	Assessment of the Operating Procedures for the navigation system(s) to be used	Control of those procedures through acceptable entries in the Operations Manual(s)	Identification of flight crew, flight dispatchers and maintenance personnel knowledge and training	Where required, control of navigation database process
RNAV 1	(PBN Vol II, Part B, Paragraph 3.3.3) FAA AC 90-100A The following systems meet the accuracy, integrity and continuity requirements of these criteria: <ul style="list-style-type: none"> • GNSS FAA TSO-C145(), TSO-C146(), or TSO-C129() • DME/DME RNAV • DME/DME IRU RNAV Operators can take credit for prior approval to P-RNAV or US-RNAV, a comparison of TGL-10 and AC90-100 is provided in PBN Vol II, Part B, Paragraph 3.3.2.4 <ul style="list-style-type: none"> • Navigation Systems/FMS listed in Attachment 4. meet the performance requirement for RNAV 1 and RNAV 2. 	PBN Vol II, Part B, Paragraph 3.3.3.3) Functional requirements Capability: <ul style="list-style-type: none"> • to execute a “direct to” function • for automatic leg sequencing • to execute ATS routes from the on-board database • to execute the following leg transitions: <ul style="list-style-type: none"> ○ Initial Fix ○ Course to Fix ○ Direct to Fix ○ Track to Fix • to display an indication of the RNAV system failure for multi-sensor systems, capability for automatic reversion to alternate RNAV 	(PBN Vol II, Part B, Paragraph 3.3.4) Pre-flight planning <ul style="list-style-type: none"> • Pilots should file the appropriate flight plan suffix • The availability of the navigation aid infrastructure must be confirmed for the intended period of operation • The availability of RAIM should be determined General Operating Procedures <ul style="list-style-type: none"> • Pilots shall not file RNAV 1 routes unless they satisfy all the criteria in relevant documents Pilots must confirm that the navigation database is current	(PBN Vol II, Part B, Paragraph 3.3.4) General Operating Procedures <ul style="list-style-type: none"> • Pilots must not fly SIDs or STARs unless they are retrieved by name from on-board navigation database • Pilots should use a lateral deviation indicator, flight director or autopilot in lateral navigation mode • Pilots may use a navigation map display with equivalent functionality to a lateral deviation indicator Contingency procedures <ul style="list-style-type: none"> • Pilots must notify ATC of any loss of RNAV 1 capability 	(PBN Vol II, Part B, Paragraph 3.3.5) Pilot Training <ul style="list-style-type: none"> • Depiction of waypoint type • Turn anticipation with consideration to speed and altitude effects • Initialize navigation system position • Retrieve and fly a SID or a STAR with appropriate transition • Fly direct to a waypoint • Fly course/track to a waypoint • Intercept a course/track • Determine cross-track error deviation • Resolve route discontinuities RNAV holding function	(PBN Vol II, Part B, Paragraph 3.3.6) The navigation database should be obtained from a supplier that complies with RTCA DO-200A/EUROCAE ED 76. LoA issued by the CAA of the State of Registry demonstrates compliance with this requirement.

Operational Approval Process (PBN Vol II, Part B/C, Paragraph X.3.2.2)	Evidence of Aircraft Eligibility	Assessment of the on-board navigation system for the following functional requirements	Assessment of the Operating Procedures for the navigation system(s) to be used	Control of those procedures through acceptable entries in the Operations Manual(s)	Identification of flight crew, flight dispatchers and maintenance personnel knowledge and training	Where required, control of navigation database process
<p>Basic-RNP 1</p>	<p>(PBN Vol II, Part C, Paragraph 3.3.3) The following systems meet the accuracy, integrity and continuity requirements of these criteria:</p> <ul style="list-style-type: none"> • a) GNSS stand-alone systems or GNSS sensors used in multi-sensor systems should be approved in accordance with E/TSO-C129a or E/TSO 146(), E/TSO C115b FMS, • b) installations should be approved according to AC 20-130A or AC20-138 or AC20-138A. 	<p>(PBN Vol II, Part C, Paragraph 3.3.3.3) Functional requirements Capability:</p> <ul style="list-style-type: none"> • to execute a “direct to” function • for automatic leg sequencing • to execute ATS routes from the on-board database • to execute the following leg transitions: <ul style="list-style-type: none"> ○ Initial Fix ○ Course to Fix ○ Direct to Fix ○ Track to Fix • to display an indication of the RNAV system failure • to load a Basic-RNP 1 procedure from database by procedure name 	<p>(PBN Vol II, Part C, Paragraph 3.3.4) Pre-flight planning</p> <ul style="list-style-type: none"> • Operators and pilots intending to conduct operations on Basic-RNP 1 SIDs and STARs should file the appropriate flight plan suffixes • The onboard navigation data must be current and include appropriate procedures • The availability of the navigation aid infrastructure must be confirmed for the intended period of operation • The availability of RAIM should be determined 	<p>(PBN Vol II, Part C, Paragraph 3.3.4) General Operating Procedures</p> <ul style="list-style-type: none"> • Pilots should use a lateral deviation indicator, flight director or autopilot in lateral navigation mode • Pilots of aircraft with a lateral deviation display must ensure that lateral deviation scaling is suitable for the navigation accuracy associated with the route/procedure (e.g., full-scale deflection: ± 1 nm for Basic-RNP 1) • For normal operations, cross-track error/deviation should be limited to $\pm \frac{1}{2}$ the navigation accuracy associated with the procedure (i.e. 0.5 nm for Basic-RNP 1). 	<p>(PBN Vol II, Part C, Paragraph 3.3.5) Pilot Training</p> <ul style="list-style-type: none"> • Depiction of waypoint type • Turn anticipation with consideration to speed and altitude effects • Initialize navigation system position • Retrieve and fly a SID or a STAR with appropriate transition • Fly direct to a waypoint • Fly course/track to a waypoint • RNP system specific information • aircraft configuration and operational conditions required to support Basic-RNP 1 operations, i.e., appropriate selection of CDI scaling 	<p>(PBN Vol II, Part C, Paragraph 3.3.6) The navigation database should be obtained from a supplier that complies with RTCA DO-200A/EUROCAE ED 76. LoA issued by the appropriate regulatory authority demonstrates compliance with this requirement.</p>

Operational Approval Process (PBN Vol II, Part B/C, Paragraph X.3.2.2)	Evidence of Aircraft Eligibility	Assessment of the on-board navigation system for the following functional requirements	Assessment of the Operating Procedures for the navigation system(s) to be used	Control of those procedures through acceptable entries in the Operations Manual(s)	Identification of flight crew, flight dispatchers and maintenance personnel knowledge and training	Where required, control of navigation database process
RNP APCH	<p>(PBN Vol II, Part C, Paragraph 5.3.3) The following systems meet the accuracy, integrity and continuity requirements of these criteria:</p> <ul style="list-style-type: none"> • a) GNSS stand-alone systems, equipment should be approved in accordance with TSO-C129a/ ETSO-C129a Class A1 or E/TSO-C146() • b) GNSS sensors used in multi-sensor system (e.g. FMS) equipment should be approved in accordance with TSO C129 ()/ ETSO-C129 (), FDE is recommended, E/TSO C145() • c) Multi-sensor systems using GNSS should be approved in accordance with AC20-130A or TSOC115b, as well as having been demonstrated for RNP APCH capability. 	<p>(PBN Vol II, Part C, Paragraph 5.3.3.3) Functional requirements:</p> <ul style="list-style-type: none"> • Capability to execute the following leg transitions: <ul style="list-style-type: none"> ○ Initial Fix ○ Track to Fix ○ Direct to Fix • The lateral deviation display must have full-scale deflection suitable for current phase of flight & must be based on the Total System Error requirement. Scaling is ± 1NM for initial and intermediate segments and ± 0.3 NM for final segment • Flight director and/or autopilot is not required for this type of operation • Capacity to load from the database into the RNAV system the whole approach to be flown. The approach must be loaded from the database, into the RNAV system, by its name. 	<p>(PBN Vol II, Part C, Paragraph 5.3.4) Pre-flight planning</p> <ul style="list-style-type: none"> • Operators must file the appropriate flight plan suffixes and the on board navigation data must be current and include appropriate procedures • The pilot must ensure that approaches are selectable from a valid navigation data base • Pilot should ensure sufficient means are available to navigate and land at the destination or at an alternate aerodrome in the case of loss of RNP APCH airborne capability • For missed approach procedures based on conventional means (VOR, NDB) the appropriate airborne equipment required to fly this procedure is installed in the aircraft and is operational, and associated ground-based navigation aids are operational. 	<p>(PBN Vol II, Part C, Paragraph 5.3.4) General Operating Procedures</p> <ul style="list-style-type: none"> • Air crew must verify the correct procedure was loaded by comparison with approach charts including the waypoint sequence reasonableness of tracks and distances of approach legs, and accuracy of the inbound, and the course and length of the final approach segment • For multi-sensor systems, crew must verify during the approach that GNSS sensor is used for position computation • Aircraft must be established on final approach course no later than the FAF before starting descent • The crew must check approach mode annunciator is properly indicating approach-mode integrity within 2 NM before the FAF 	<p>(PBN Vol II, Part C, Paragraph 5.3.5) Pilot Training</p> <ul style="list-style-type: none"> • Meaning and proper use of RNP systems • Levels of automation, mode annunciations, changes, alerts, interactions, reversions, and degradation • Functional integration with other aircraft systems • The meaning and appropriateness of route discontinuities as well as related flight crew procedures • Turn anticipation with consideration to speed and altitude effects • Initialize RNP system position • Retrieve and fly an RNP APCH • Fly interception of an initial or intermediate segment of an approach following ATC notification • Fly direct to a waypoint • Determine cross-track error/deviation 	<p>(PBN Vol II, Part C, Paragraph 5.3.6) The navigation database should be obtained from a supplier that complies with RTCA DO-200A/EUROCAE ED 76. LoA issued by the appropriate regulatory authority demonstrates compliance with this requirement.</p>

Operational Approval Process (PBN Vol II, Part B/C, Paragraph X.3.2.2)	Evidence of Aircraft Eligibility	Assessment of the on-board navigation system for the following functional requirements	Assessment of the Operating Procedures for the navigation system(s) to be used	Control of those procedures through acceptable entries in the Operations Manual(s)	Identification of flight crew, flight dispatchers and maintenance personnel knowledge and training	Where required, control of navigation database process
RNP AR APCH	(PBN Vol II, Part C, Paragraph 6.3.3) AC 90-101 <ul style="list-style-type: none"> The aircraft must comply with FAA AC 20-129 and either FAA AC 20-130 or AC 20-138, or equivalent All aircraft operating on RNP AR APCH procedures must have a cross-track navigation error no greater than the applicable accuracy value (0.1 NM to 0.3 NM) for 95 per cent of the flight time. This includes positioning error, flight technical error (FTE), path definition error (PDE) and display error. 	(PBN Vol II, Part C, Paragraph 6.3.3.3) Functional requirements: Additional guidance and information concerning many of the required functions is provided in EUROCAE ED-75A/ RTCA DO-236B. The aircraft must have the capability to execute leg transitions and maintain tracks consistent with the following paths: <ol style="list-style-type: none"> A geodesic line between two fixes; A direct path to a fix; A specified track to a fix, defined by a course; and A specified track to an altitude. 	(PBN Vol II, Part C, Paragraph 6.3.4) Pre-flight planning <ul style="list-style-type: none"> The operator must have a predictive performance capability, which can forecast whether or not the specified RNP will be available at the time and location of a desired RNP AR APCH operation Predictive capability must account for known and predicted outages of GNSS satellites or other impacts on the navigation system's sensors RNP AR APCH procedures require GNSS updating 	(PBN Vol II, Part C, Paragraph 6.3.4) General Operating Procedures <ul style="list-style-type: none"> Pilots are not authorized to fly a published RNP AR APCH procedure unless it is retrievable by the procedure name from the aircraft navigation database and conforms to the charted procedure The flight crew's operating procedures must ensure the navigation system uses the appropriate navigation accuracy throughout the approach Pilots must use a lateral deviation indicator, flight director and/or autopilot in lateral navigation mode on RNP AR APCH approach procedures. 	(PBN Vol II, Part C, Paragraph 6.3.5) Pilot Training <ul style="list-style-type: none"> Each operator is responsible for the training of flight crews for the specific RNP AR APCH operations exercised by the operator The operator must include training on the different types of RNP AR APCH procedures and required equipment. Training must include discussion of RNP AR APCH regulatory requirements. The operator must include these requirements and procedures in their flight operations and training manuals 	(PBN Vol II, Part C, Paragraph 6.3.6) The navigation database should be obtained from a supplier that complies with RTCA DO-200A/EUROCAE ED 76. LoA issued by the appropriate regulatory authority demonstrates compliance with this requirement.

Attachment 4

AC 90-100A [ICAO RNAV 1 and RNAV 2] Nav System/FMS Airworthiness Compliance Table

(Sample only – full list available at http://www.faa.gov/about/office_org/headquarters_offices/avs/offices/afs/afs400/afs410/policy_guidance/ click on AC 90-100A next to Compliance Table)

Manufacturer	Nav System/FMS	Part Number	Software Version	Approval using GNSS	Approval using DME/DME/IRU	Database Integrity
Airbus	A300-600 A310 Sperry FMS	404.3914.936	17	NO	YES	YES
Airbus	A300-600 A310 Sperry FMS	405.2510.955	ACARS	NO	YES	YES
Airbus	A330/A340	B490CAM0308	L10CD7	YES	YES	YES
Airbus	A320 family Honeywell Pegasus FMS	C13042AA01	Std P1C8	YES	YES	YES
Airbus	A320 family Thales FMS	C13043AA01	S1C1	YES	YES	YES
Boeing	B747	Must have CMA 900 Nav System retrofit per Boeing service bulletin	Boeing 747- SL-02-017-B	YES	YES	Yes, given DB supplier compliance to DO-200A
Boeing	B757/767	FMC part numbers S242T102-226/330 and on	200K FMC	N/A	YES	Yes, given DB supplier compliance to DO-200A
Embraer ERJ-135/145 and Legacy (30 March 2007)	Honeywell FMS NZ2000	7018879-03014 MOD B	5.2B	Yes	Yes (for those a/c equipped with IRS)	Yes, Honeywell has a type 2 LOA
Embraer ERJ-145 (Predictive RAIM with Universal Offline Flight Planning) (1 Oct 2007)	Universal UNS-1K	1116-42-1116	603			Yes, Universal has a type 2 LOA
Gulfstream C37B	Honeywell FMS Primus Epic (PlaneView)	EB7031236	-00301 and subsequent	YES (TSO-C115B performance and TSO-129 C1) GPS module part number 245-601736	YES, conditional on pilot entry of NOTAM navigation aids on the FMS NOTAM page	YES

