



## **CIVIL AVIATION ADVISORY PUBLICATION**

### **CAAP 2**

(01 January 2013)

#### **B-RNAV**

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### ***APPROVAL OF YEMEN OPERATORS AND AIRCRAFT TO OPERATE UNDER INSTRUMENT FLIGHT RULES TO RNP AND IN EUROPEAN AIRSPACE DESIGNATED FOR BASIC AREA NAVIGATION***

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#### **1 PURPOSE**

This Civil Aviation Advisory Publication (CAAP) provides guidance material for the approval of operators of Yemen registered civil aircraft operating worldwide or in a Basic Area Navigation (B-RNAV) environment in the European region to Required Navigation Performance 5 (RNP 5). It identifies types of RNP equipment that the Civil Aviation and Met. Authority (CAMA) has determined to be acceptable for B-RNAV and contains guidelines for operators using global positioning system (GPS) equipment as the primary means for B-RNAV. It does not address the data collection requirements (refer CAAP 3) nor any communications or surveillance requirements that may be specified for a particular route or airspace. The approval process for RNP 5 is the same for any level of RNP.

The approval under this CAAP to operate in RNP airspace also applies to B-RNAV operations. This document is one means, but not the only means, of satisfying the intent of ICAO Doc 9613-AN/937, Manual on RNP, First Edition, 1994.

#### **2 STATUS OF THIS CAAP**

This is CAAP 2 dated 01 January 2013. It will remain current until withdrawn or superseded.



### 3 APPLICABILITY

This guidance material applies to all Yemen operators planning to operate on RNP 5 (or less) or European B-RNAV airspace or on RNP 5 & B-RNAV routes. Yemen registered aircraft, when operating inside Yemen FIR must comply with RNP 5 and, outside Yemen territorial airspace (i.e. beyond the FIR) must comply with ICAO Annex 2 and other State's regulations when operating within their airspace.

The letter of approval issued under this CAAP 2 will permit operations in European B-RNAV airspace to RNP 5, and worldwide to RNP 5 (or less), and will normally permit aircraft to comply with other State's RNAV routes (eg; RNP 10 in Australia) which may be to a lesser navigation performance but in accordance with the higher Minimum Aviation System Performance Standards (MASPS). It does not mean aircraft will automatically be approved for operations in NAT MNPS airspace or on FANS routes as operations in both of these areas/routes require specific training and authorization.

Operators of aircraft **not** equipped with CAMA approved Flight Management Systems (FMS) with barometric vertical navigation (VNAV) oceanic, en route, terminal and approach capability, must also meet the equipment and data requirements of CAAP 3 - RNP 5 DATA.



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Appendix 1. Sample Letter of Request for Initial RNP & BRNAV approval

## 5 BACKGROUND

Regional Supplementary Procedures contained within International Civil Aviation Organization (ICAO) Doc 7030/4-EUR, part 1, *Rules of the Air, Air Traffic Services and Search and Rescue*, have been amended to require aircraft operating under Instrument Flight Rules

(IFR) in designated European B-RNAV airspace to meet the accuracy criteria of Required Navigation Performance Type 5 (RNP 5).

The amendment also requires the State of Aircraft Registry or State of the Operator (CAMA) to verify conformance of the Air Operator's navigation system to RNP 5 and provide the approval necessary for aircraft to operate in a B-RNAV environment. Implementation of RNAV is one of the key elements to obtain system capacity improvements and should allow airspace users to benefit from more direct routings and greater fuel savings. In European airspace, RNAV will allow greater flexibility in airspace design and reduce the need to depend totally on ground based point source navigation aids when planning Air Traffic Services (ATS) routes. RNP 5 was chosen for the initial stage of RNAV operations in European airspace to take account of existing aircraft equipment and the current navigation infrastructure. Only RNAV equipped aircraft having a navigation accuracy meeting RNP 5 may plan for operations under IFR on the ATS routes of the Flight Information Regions (FIR)/Upper Information Regions (UIR) and/or designated Standard Instrument Departures (SID) and Standard Terminal Arrival Routes (STAR) in/out of Terminal Management Areas identified in ICAO Regional Supplementary Procedures Doc. 7030/4, paragraph 14.2.1. The implementation date for B-RNAV was 01 August, 1998.

Joint Aviation Authorities (JAA) first published advisory material for the Airworthiness Approval of Navigation Systems for use in designated European airspace for B-RNAV operations in July 1996. This material was developed by EUROCAE WG-13 and was commonly referenced as AMJ 20X2. In May 1997, Revision 1 to AMJ 20X2 was expanded to include specific guidance on the approval and use of GPS-based equipment for the purposes of conducting B-RNAV operations.

In accordance with ICAO regional agreements, operators must obtain a B-RNAV approval from the appropriate State of Registry or State of the Operator before conducting operations in European B-RNAV airspace, the approval is indicated in Operations Specifications paragraph E. Operations into designated RNP 5 airspace worldwide requires a similar approval. It should be noted that aircraft without a RNP 5 approval might be admitted to the RNP airspace by ATC but would receive a lower priority than approved aircraft.

This CAAP identifies those navigation system types and the criteria that may be used to determine acceptable means of compliance. CAMA approval of Yemen operators for RNP 5 and European B-RNAV operations is based on consideration of existing systems and previously completed airworthiness approvals, as described in the Aircraft Flight Manual (AFM), or an assessment process described in CAAP 3 or the following sections.

## **6 REFERENCES**

This CAAP should be read in conjunction with ICAO Doc 7030/4, EUR/RAC and CAAP 3, RNP 5. Other reference publications are;

- (a) European Organisation for the Safety of Air Navigation (EUROCONTROL)
  - (i) EUROCONTROL Doc 003-93 Area Navigation Equipment - Operational Requirements and Functional Requirements.

- (ii) European Air Traffic Control Harmonisation and Integration Program (EATCHIP) On Target: The First Six Years 1990-1996.
- (b) Federal Aviation Administration (FAA)
  - (i) AC 20-121A Airworthiness Approval of Airborne LORAN C Navigation Systems for Use in the US National Airspace System (NAS).
  - (ii) AC 20-130 and AC 20-130A Airworthiness Approval of Navigation or Flight Management Systems Integrating Multiple Navigation Sensors.
  - (iii) AC 20-138 (current edition) Airworthiness Approval of Global Positioning System (GPS) Navigation Equipment for use as a VFR and IFR Supplemental Navigation System.
  - (iv) AC 25-15 (current edition) Approval of Flight Management Systems in Transport Category Airplanes.
  - (v) AC 90-45A Approval of Area Navigation Systems for Use in the U.S. National Airspace System.
  - (vi) AC 90-94 (current edition) Guidelines for Using Global Positioning Systems Equipment for IFR En Route and Terminal Operations and for Nonprecision Instrument Approaches In U.S. National Airspace System.
  - (vii) Notice 8110.60 (current edition) GPS as a Primary Means of Navigation For Oceanic/Remote Operations.
  - (viii) Order 8400.12A Required Navigation Performance 5 (RNP 5) Operational Approval.
- (c) International Civil Aviation Organization (ICAO)
  - (i) Manual on Required Navigation Performance, ICAO Doc 9613-AN/937.
- (d) Joint Aviation Authorities (JAA)
  - (i) Temporary Guidance Leaflet No. 2, Revision 1: AMJ 20X2 JAA Guidance Material on Airworthiness Approval and Operational Criteria for the use of Navigation Systems in European Airspace Designated for Basic RNAV Operations.
- (e) RTCA
  - (i) Minimum Aviation System Performance Standards (MASPS): Required Navigation Performance for Area Navigation, RTCA.

## **7 DESCRIPTION OF TERMS USED**

### **7.1 Area Navigation (RNAV)**

This is a method which permits aircraft navigation along any desired flight path within the coverage of the associated navigation aids or within the limits of the capability of self-contained aids, or a combination of these methods. For the purpose of this CAAP, RNAV equipment is considered to be that equipment, which operates by automatically determining aircraft position from one, or a combination, of the following sensors with the means to establish and follow an intended path:

- (a) VOR/DME
- (b) DME/DME
- (c) INS\* or IRS\*
- (d) LORAN C
- (e) GPS\*

*NOTE: Equipment marked with an asterisk (\*) is subject to the limitations contained in Section 10.*

### **7.1 Basic RNAV (B-RNAV)**

B-RNAV is defined as RNAV, including the functions described in para 9.2.2, that requires an aircraft to meet a horizontal track keeping accuracy of 5 NM or better from its planned position for 95% of its flight time - RNP 5. This value includes signal source error, airborne receiver error, display system error, and flight technical error. This navigation performance assumes the necessary coverage provided by satellite or ground based navigation aids is available for the intended route to be flown.

### **7.2 Global Positioning System (GPS)**

This is a US space-based positioning, velocity, and time system composed of space, control, and user elements. The space element, nominally is composed of 24 satellites in six orbital planes. The control element consists of five monitor stations, three ground antennas and a master control station. The user element consists of antennas and receiver processors that provide positioning, velocity, and precise timing to the user.

### **7.3 Pseudorange**

This is position determination, or the obtaining of information relating to position, for the purposes of navigation by means of the propagation properties of radio waves. Pseudorange is the distance from the user to a satellite plus an unknown user clock offset distance. With four satellite signals it is possible to compute position and offset distance. If the user clock offset is known, three satellite signals would suffice to compute a position.

### **7.4 Receiver Autonomous Integrity Monitoring (RAIM)**

This is a technique whereby a GPS receiver/processor monitors the GPS. This integrity determination is achieved by a consistency check among redundant measurements.

### **7.5 Required Navigation Performance (RNP)**

This is a statement of the navigation performance accuracy necessary for operation within a defined airspace.

### **7.6 Required Navigation Performance Type**

RNP type is a description of an RNP by number. The number refers to the navigational performance accuracy in the horizontal plane and is expressed in nautical miles. For example, RNP 5 means that an aircraft must be able to navigate within 5 NM of its intended position (both across-track and along track) for at least 95% of its total flying time.

## **8 EQUIPMENT REQUIREMENTS**

### **8.1 Introduction**

The following sections provide guidance for operators on RNAV system equipment, eligibility and usage limitations as well as the documents and processes that should be used when applying for a RNP 5 & B-RNAV operational approval.

### **8.2 Aircraft Equipment**

#### **8.1.1 Equipment**

an aircraft may be considered eligible for RNP 5 & B-RNAV approval if it is equipped with one or more RNAV systems approved and installed in accordance with the guidance contained in this document. The minimum level of availability and integrity required for B-RNAV systems for use in designated European airspace can be met by a single installed system comprising one or more sensors, RNAV computer, control display unit, and navigation display(s) (e.g. HSI, or CDI), provided that the system is monitored by the flight crew and that in the event of a system failure, the aircraft retains the capability to navigate relative to ground based navigation aids (e.g. VOR, DME, and NDB).

#### **8.1.2 Functions**

the following system functions are the minimum required to conduct RNP 5 & B-RNAV operations:

- (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;  
*NOTE: In addition, where the aircraft type certificate requires more than one pilot, information to verify aircraft position should be displayed in the non-flying pilot's primary field of view.*
- (b) Display of distance and bearing to the active (TO) waypoint; and
- (c) Display of ground speed or time to the active (TO) waypoint; and
- (d) Storage of waypoints - minimum of 4; and
- (e) Appropriate failure indication of the RNAV system, including the sensors.

### **8.3 Eligibility For Operational Approval Based On The Aircraft Flight Manual (AFM)**

#### **8.3.1 Aircraft B-RNAV System Eligibility**

The aircraft can be considered eligible for B-RNAV operations, if the AFM shows that the navigation system installation has received airworthiness approval in accordance with one of the following FAA ACs: AC 90-45A, AC 20-121A, AC 20-130, AC 20-130A, AC 20-138, or AC 25-15. (or an equivalent JAA procedure)

The guidance for airworthiness approval contained in this CAAP and ACs provides aircraft navigation performance that is equivalent to RNP 5 or better (see section 10 for limitations on design and use of RNAV systems in European B-RNAV airspace). Once the operator has determined that the equipment is eligible, the operator should apply for an approval as shown in Appendix 1 and proceed in accordance with Section 9, for initial application together with aircraft in Yemen registry, use GTF-SOS-001 Special Operational Approval, see [www.camayemen.com](http://www.camayemen.com) download form.

#### **8.4 Eligibility For An Operational Approval Not Based On The AFM**

The operator may not be able to determine the airborne equipment's eligibility from the AFM, or may require a RNP 5 or B-RNAV time limit extension for non-radio updated INS-based RNAV systems beyond 2 hours (see para 10.1 below). In this case, the operator should request that the appropriate CAMA district office assess the RNAV equipment. The operator should provide the CAMA with details of the RNAV system make, model and part number, evidence of the system meeting RNP 5 accuracy and the B-RNAV required functions as defined in para 8.2.2, crew operating procedures, bulletins, and any other pertinent information. Data collection as required in CAAP 3 may be required

#### **8.5 Approved Aircraft/System List**

The CAMA Airworthiness Section will maintain a list of aircraft/navigation systems that have received approval. It will **not** be used as a means of determining qualifications for approval. The list will be maintained for statistical purposes and will provide information to operators on those aircraft and navigation systems, which have been approved.

### **9 APPLICATION & APPROVAL PROCESS**

#### **9.1 Introduction**

For RNP 5 operations, each individual aircraft should be determined to be RNP 5 capable. The individual operator must be approved by the relevant State authority before the operator conducts flights into RNP 5 airspace and receives the benefits of reduced separation minima. It should be noted that aircraft without a RNP 5 approval might be admitted to the RNP airspace by ATC but would receive a lower priority than approved aircraft.

The following sections provide guidelines for operators wishing to apply for a RNP 5 & B-RNAV operational approval.

#### **9.2 Pre-application Meeting**

Each individual operator should schedule a pre-application meeting with the CAMA district office responsible for its operations. The intent of this meeting is to discuss airworthiness and operational requirements for approval to operate in RNP 5 airspace, including:

- (a) the contents of the operator's application,

- (b) CAMA's review and evaluation of the application,
- (c) limitations (if any) on the approval, and
- (d) conditions under which the operational approval may be cancelled by CAMA.
- (e) any other operational or airspace requirements that may be established by European or other authorities for the airspace involved.

### **9.3 Form of Application**

A sample *Letter of Request* for an operator to obtain RNP 5 operational approval is shown in Appendix 1.

### **9.4 Contents of Operator's RNP 5 & B-RNAV Application**

#### **9.1.1 Eligibility Airworthiness Documents**

Relevant documentation such as sections of the AFM that document airworthiness approvals in accordance with appropriate CAMA CAR's or FAA ACs (or equivalent JAA document), must be available to establish that the aircraft is equipped with Long Range Navigation Systems (LRNSs), which meet the requirements of RNP 5 as detailed above in para 8.3.1; For operators of aircraft, which have no AFM, AC, or other supporting documentation, an assessment must be made in accordance with CAAP 3 - RNP 5 DATA.

Many aircraft and navigation systems currently in use in oceanic or remote area operations will qualify for RNP 5 based on one or more provisions of existing certification criteria. Thus, additional aircraft certification action may not be necessary for the majority of RNP 5 approvals. In these instances, additional aircraft certification will only be necessary if the operator chooses to claim additional performance beyond that originally certified or stated in the Aircraft Flight Manual and the operator cannot demonstrate the desired performance through data collection. (Refer also to CAAP 3)

#### **9.1.2 Description of Aircraft Equipment**

The applicant must provide a configuration list which details pertinent components and equipment to be used for long range navigation and RNP 5 operations.

#### **9.1.3 RNP 5 Time Limit for Inertial Navigation Systems (INS) or Inertial Reference Units (IRU) (if applicable)**

The applicant's proposed RNP 5 time limit for the specified INS or IRU must be provided (see Section 10). The applicant must consider the effect of headwinds in the area of operations in which RNP 5 operations are intended to be carried out to determine the feasibility of the proposed operation. In addition, operators of aircraft which are unable to couple the RNAV systems to the flight director or to the autopilot must assume a Flight Technical Error (FTE) of 2 NM for oceanic operations. The addition of the 2 NM FTE to the assumed navigation position error will further time limit INS/IRU equipped aircraft operating to RNP 5.

#### **9.1.4 Manuals, Training and Checklists**

AOC holders and private operators must revise their operations manual and checklists to include information/guidance on standard operating procedures. Appropriate manuals should include navigation operating instructions and contingency procedures where specified i.e. weather deviation procedures. Manuals and checklists must be submitted for review as part of the application process. Practices and procedures in the following areas must be standardised and include flight planning; pre-flight procedures at the aircraft for each flight; procedures before entry into an RNP 5 route or airspace; in-flight, contingency and flight crew qualification procedures. **All** operators must submit training syllabi and other appropriate material to the appropriate CAMA district office to show that the operational practices and procedures and training items related to RNP 5 operations are incorporated in training programs where applicable (e.g. initial, upgrade, recurrent).

#### 9.1.5 Past Performance

An operating history for the operator must be included in the application. The applicant must address any events or incidents related to navigation errors for that operator, which have been covered by training, procedures, maintenance, or the aircraft/navigation system modifications that are to be used.

#### 9.1.6 Minimum Equipment List (MEL)

Any MEL revisions necessary to address the RNP 5 provisions of the guidance material in this CAAP must be approved (e.g. if approval is based on 'Triple-Mix' the MEL must reflect that three navigation units must be operating as well as specifying any other required dispatch conditions).

#### 9.1.7 Maintenance

Where applicable, the operator should submit a maintenance program for approval at the time the operator applies for an approval. The holder of the design approval, including either the type certificate (TC) or supplemental type certificate (STC) for each individual navigation system installation must be submitted together with a set of complete Instructions for Continued Airworthiness. (where appropriate).

### 9.5 Evaluation, Investigation and Cancellation

#### 9.1.8 Evaluation of Applications

Once the application has been submitted, the CAMA will begin the process of review and evaluation. If the content of the application is deficient, the CAMA will request additional information from the operator. When all the airworthiness and operational requirements of the application are met, the Director Flight Safety may issue the approval to operate in RNP 5 & B-RNAV airspace and routes.

#### 9.1.9 Letter of Approval

RNP 5 operational approvals will be issued in the form of Operations Specifications paragraph E, should there is limitation on the equipment other than standard specifications it will be reflected in the remark section of the operations specifications.

## **10 LIMITATIONS ON NAVIGATION SYSTEMS USE**

Although the following navigation systems have RNAV capability, limitations are required for their use when conducting operations in designated RNP 5 & B-RNAV airspace.

### **10.1 Inertial Navigation Systems (INS)**

Those approved INS system installations which meet the required functions of para 8.2.2, but do not have automatic radio navigation updating of INS position, are limited to a maximum two hour time limit for operation in designated B-RNAV airspace from the time that the system is placed in the navigation mode (NAV SELECT). The CAMA will give consideration to extending the two hour time limit for specific INS configurations.

Requests for time extensions should be submitted with supporting rationale and data through the appropriate CAMA regional office (Attn: Assistant Deputy Chairman). The CAMA airworthiness sections will coordinate the evaluation of such requests with the FAA or JAA.

*NOTE: Certain INSs perform automatic radio navigation aid updating after the pilot makes a manual selection of navigation aids. Such systems are not limited to the two hour time limit discussed above, provided that the operator has established procedures for pilots to follow.*

### **10.2 Loran C**

Use of Loran C, in compliance with AC 20-121A, is considered an acceptable means to comply with B-RNAV in those areas of European airspace and on routes having acceptable Loran C coverage. Loran users should refer to the AFM to determine if operational use of the Loran system is limited to a specified Loran C Operational Area.

### **10.3 GPS**

#### **10.1.1 GPS Design.**

CAMA approved GPS installations must provide pseudorange step detection and health word checking functions in accordance with FAA TSO-C129a, paragraphs (a)(5)(vii)6 and a(6). Compliance with these requirements can be established by;

- (a) A statement in the AFM that the GPS equipment meets the criteria for primary means of navigation in oceanic and remote airspace, or
- (b) A placard on the GPS receiver evidencing it meets TSO-129a, or

- (c) A FAA (or equivalent) letter of design approval for the applicable equipment. Operators should contact the avionics installer or manufacturer to determine if the equipment complies and if a letter of design approval is available. Manufacturers may obtain a letter by submitting appropriate documentation to the relevant FAA Aircraft Certification Office. Operators should keep this letter with the AFM entry as evidence of RNP 5 & B-RNAV eligibility. Any limitations included in the letter of design approval should be reflected in a letter of finding to operators, or
- (d) GPS equipment that has been approved in accordance with TSO C-129, but which does not satisfy the step detection and health word checking, may still obtain a letter of design approval for RNP 5 & B-RNAV. In this case, RNP 5 & B-RNAV operations are limited to flights where RAIM outages do not exceed 5 minutes. With this restriction, TSO C-129 equipment is equivalent to equipment that provides step detection and health word checking. The maximum RAIM outage must not be extended beyond 5 minutes for TSO C-129 equipment.

#### 10.1.2 Flight Planning Restrictions for GPS.

During pre-flight planning, if 24 satellites (23 if baro aiding is incorporated into the GPS installation) are projected to be operational for the flight, then the aircraft can depart without further action. If, however, 23 or fewer satellites (22 if baro aiding incorporated), are projected to be operational, then the availability of GPS integrity (RAIM) must be confirmed for the intended flight (route and time). This should be obtained from a prediction program that is provided in the GPS unit installed in the aircraft, a prediction program run outside the aircraft (such a program should use the same algorithms as those in the aircraft GPS units), or from an alternative method that is acceptable to the CAMA. Information on alternative methods will be coordinated with the FAA and JAA. In the event of a predicted continuous loss of RAIM of more than 5 minutes for any part of the intended flight, the flight should be delayed, cancelled, or rerouted on a track where RAIM requirements can be met. Alternate methods should be submitted for approval through the appropriate CAMA office (Attn: Assistant Deputy Chairman).

#### 10.1.3 GPS Integrity Monitoring.

Where a GPS Integrity Monitoring (RAIM) Prediction Program is used as a means of compliance with para (b) above, it must meet the following criteria:

- (a) The program must provide prediction of availability of the integrity monitoring (RAIM) function of the GPS equipment, suitable for conducting RNP 5 (B-RNAV) operations in designated European airspace;
- (b) The prediction program software must be developed in accordance with at least RTCA DO 178B/EUROCAE 12B, level D guidelines;

- (c) The program must use either a RAIM algorithm identical to that used in the airborne equipment, or an algorithm based on assumptions for RAIM prediction that give a more conservative result;
- (d) The program must calculate RAIM availability based on a satellite mask angle of not less than 5 degrees, except where use of a lower mask angle has been demonstrated to be acceptable to the CAMA;
- (e) The program must have the capability to manually designate GPS satellites which have been notified as being out-of-service for the intended flight; and
- (f) The program must allow the user to select:
  - (i) The intended route and declared alternates;
  - (ii) The time and duration of the intended flight.
- (g) A position error log must be kept for all sectors.

#### 10.1.4 Loss Of RAIM En Route.

In the event of loss of the RAIM detection function, the GPS stand-alone equipment may continue to be used for navigation as long as the flight crew determines, by cross checking other on-board navigation systems, that the GPS system is continuing to provide an acceptable level of IFR navigation performance. Otherwise, the flight crew must notify ATC and revert to an alternative means of navigation (e.g. VOR, DME, or NDB).

#### 10.1.5 Actions When Failure Detected.

In the event of a detected failure (including detected failure of satellites for GPS-based RNAV systems), the flight crew must notify ATC and revert to an alternative means of navigation.

#### 10.1.6 Availability of VOR, DME, OR ADF.

VOR, DME or ADF capability should be installed and operative consistent with the applicable operating rules and intended route to ensure availability of a suitable alternative means of navigation in the event of GPS/RNAV system failure.

### **11 GENERAL OPERATING PROCEDURES**

For B-RNAV and all RNP 5 operations, the flight crew must be familiar with the normal operating procedures and the contingency procedures detailed below.

#### **11.1 Navigational Performance**

Aircraft must meet a cross-track keeping accuracy and along-track positioning accuracy no greater than +/- 5 NM for 95% of the flight time in RNP 5 airspace.



## 11.2 Navigation Equipage

All aircraft operating in RNP 5 oceanic and remote airspace, except as authorised by the CAMA, must have at least two independent navigation systems of integrity such that the navigation system does not provide misleading information.

## 11.3 Flight Plan

Operators must indicate the ability to meet RNP 5 for the route or area in accordance with ICAO Doc 4444 (PANS-RAC) Appendix 2 Item 10: Equipment. The letter 'R' must be placed in Field 10 of the flight notification to indicate the pilot has:

- (a) reviewed the planned route of flight, including the route(s) to any alternate aerodrome(s), to identify the types of RNP involved, and
- (b) confirmed that the operator and aircraft have been approved by the CAMA for RNP operations, and
- (c) confirmed that the aircraft can be operated in accordance with the RNP requirements for the planned route of flight, including the route(s) to any alternate aerodrome(s).

## 11.4 Availability of Nav aids

At dispatch or during flight planning, the operator must ensure that adequate navigation aids are available en route to enable the aircraft to navigate to RNP 5.

## 11.5 Route Evaluation For RNP 5 & B-RNAV Time Limits

When planning operations in areas where RNP 5 is applied, the operator must establish that the aircraft will comply with the authorised time limitation on the routes that it intends to fly. In making this evaluation, the operator must consider the effect of headwinds and, for aircraft not capable of coupling the navigation system or flight director to the autopilot, FTE. The operator may choose to make this evaluation on a one time basis or on a per flight basis. The operator should consider the points listed in the following sub-sections in making this evaluation.

### 11.5.1 Route Evaluation

The operator must establish the aircraft's capability to satisfy the RNP 5 time limit established for dispatch or departure into RNP 5 airspace.

### 11.5.2 Start Point for Calculation

The calculation must start at the point where the system is placed in the navigation mode or the last point at which the system is expected to be updated.

### 11.5.3 Stop Point for Calculation

The stop point may be one of the following:

- (a) the point at which the aircraft will begin to navigate by reference to ICAO Standard Nav aids (VOR, DME, NDB) and/or comes under radar surveillance from ATC; or
- (b) the first point at which the navigation system is expected to be updated.

### 11.5.4 Sources of Wind Component Data

The headwind component to be considered for the route may be obtained from any source found acceptable to the CAMA. Acceptable sources for wind data include; the Bureau of Meteorology, National Weather Service, Bracknell, industry sources such as Boeing Winds on World Air Routes, and historical data supplied by the operator.

### 11.5.5 One Time Calculation Based on 75% Probability Wind Components

Certain sources of wind data establish the probability of experiencing a given wind component on routes between city pairs on an annual basis. If an operator chooses to make a one time calculation of RNP 5 & B-RNAV time limit compliance, the operator may use the annual 75% probability level to calculate the effect of headwinds (This level has been found to be a reasonable estimation of wind components).

### 11.5.6 Calculation of Time Limit For Each Specific Flight

The operator may choose to evaluate each individual flight using flight planned winds to determine if the aircraft will comply with the specified time limit. If it is determined that the time limit will be exceeded, then the aircraft must fly an alternate route or delay the flight until the time limit can be met. This evaluation is a flight planning or dispatch task.

- (a) When a navigation database is installed, the database validity must be checked before the flight.
- (b) Other NAVAIDs (e.g. VOR, DME, and ADF) must be selected so as to allow immediate cross-checking or reversion in the event of loss of RNAV capability.
- (c) Position error log on all sectors.

## 11.6 Contingency Procedures

The flight crew must be familiar with the following general provision. Pilots must notify ATC of conditions (e.g. equipment failures and weather conditions) that may affect the ability of the aircraft to maintain position within the designated RNP 5 & B-RNAV airspace. In this case, flight crews must state their intentions, coordinate a plan of action, and obtain a

revised ATC clearance. If unable to obtain an ATC clearance prior to deviating from the RNP 5 or B-RNAV airspace, the flight crew must follow established contingency procedures, as defined by the region of operation, and obtain an ATC clearance as soon as possible.

### **11.7 Navigation and System Errors**

It is a condition of the approval that pilots/operators notify the relevant CAMA district office of any lateral navigational errors of 8 NM or more, longitudinal navigational errors of 5 NM or more, longitudinal navigational errors or 3 minutes or more variation between the aircraft's estimated time of arrival at a reporting point and its actual time of arrival, or navigation system failures.

### **11.8 Operations and Training Manuals**

The operator's Operations and Training Manuals must be current and contain the pilot knowledge requirements for the route or airspace to be operated, and include operating guidance on pre-flight, enroute, contingency procedures and piloting responsibilities.

## **1. PILOT TRAINING**

Pilots knowledge requirements, must include the following areas;

- (a) RNP definition as it relates to B-RNAV requirements in European airspace and other designated areas;
- (b) Airspace where RNP 5 is required;
- (c) Changes to charting and documents to reflect RNP 5;
- (d) Navigation equipment required to be operational for flight in designated RNP 5 & B-RNAV airspace, limitations associated with the RNAV equipment;
- (e) Flight planning requirements;
- (f) Contingency procedures (e.g. for equipment failure);
- (g) En route, terminal, and approach procedures applicable to RNAV;
- (h) Position error log and notification requirements;
- (i) Operations Manual information and procedures; and
- (j) The information in this CAAP.

## **2. NAVIGATION AND SYSTEM ERRORS**

### **13.1 Investigation of Navigation and System Errors**

Demonstrated navigation accuracy provides the basis for determining the lateral route spacing and separation minima necessary for traffic operating on a given route. Accordingly, lateral and longitudinal navigation errors are investigated to prevent their recurrence. Radar observations of each aircraft's proximity to track and altitude, before coming into coverage of short-range nav aids at the end of the oceanic route segment, are typically noted by Air Traffic Service (ATS) facilities. If an observation indicates that an aircraft is not within the established limit, the reason(s) for the apparent deviation from track or altitude may need to be determined and steps taken to prevent a recurrence.



### 13.2 Cancellation of RNP 5 & B-RNAV Approval

When appropriate, the CAMA may consider any navigation error reports in determining remedial action. Repeated navigation error occurrences, attributed to a specific piece of navigation equipment, may result in cancellation of the *Letter of Approval* for use of that equipment. Information that indicates the potential for repeated errors may require a modification of an operator's training program. Information that attributes multiple errors to a particular pilot crew may necessitate remedial training.



**APPENDIX 1**

**SAMPLE LETTER OF REQUEST FOR INITIAL RNP & B-RNAV APPROVAL**

File Reference

Assistant Deputy Chairman  
Civil Aviation and Met. Authority  
P.O. Box 7251  
Sana'a, Yemen

Dear Sir

**SUBJECT: APPLICATION FOR RNP & B-RNAV OPERATIONAL APPROVAL**

**(Aircraft operator)** requests that operational approval be given to conduct en route operations on designated RNP (*state value...eg RNP 4*) & B-RNAV routes and in designated RNP & B-RNAV airspace with a maximum time of **(number)** hours between navigation system updates.

The following **(aircraft operator)** aircraft meet the requirements and capabilities as defined/specified in CAAP 2, B-RNAV.

AIRCRAFT TYPE/SERIES	NAVIGATION EQUIPMENT	COMMUNICATIONS EQUIPMENT	B-RNAV & RNP TIME LIMIT
	List navigation equipment by;  Name: Type: Model: Manufacturer:	List communication equipment by;  Name: Type: Model: Manufacturer:	Number of hours or unlimited

Flight crews have been trained in accordance with the requirements of the ICAO Manual on RNP (Doc 9613) and guidance material in CAMA CAAP 2, B-RNAV.

Yours sincerely  
Signature  
(Name)  
(Appointment/Title)



**APPENDIX 2. SAMPLE LETTER OF APPROVAL FOR RNP & B-RNAV OPERATIONS**

CAMA will not be issuing letter of approval, the means of approval is indicated in the paragraph E of the operations specifications