SOUTH AFRICAN CIVIL AVIATION AUTHORITY

TECHNICAL GUIDANCE MATERIAL
for
Performance Based Navigation

SUBJECT: **GUIDANCE MATERIAL FOR PERFORMANCE BASED NAVIGATION**

EFFECTIVE DATE: 05 September 2022

APPLICABILITY:

The requirement for approval before operations in defined PBN airspace applies to operators of aircraft involved in general aviation and commercial air transport (Parts 91,121,127 and 135).

PURPOSE:

This material contains guidance for operators preparing Performance Based Navigation approval applications for PBN authorisation. (Note: Guidance pertaining to RNP AR APCH not included in this document)

REQUIREMENTS

Part 91, 93, 121; 127, 128 and 135 of the SACAR 2011, as amended

1. REFERENCE:

i. ICAO Annex 6
ii. Civil Aviation Regulations
iii. ICAO Document 9613
iv. ICAO Document 9997
v. ICAO Document 4444

2. TERMS AND ABBREVIATIONS:

TERM	DEFINITION
Accuracy	In relation to GNSS, refers to the degree of conformance between the estimated, measured, or desired position or velocity of a system at a given time and its true position or velocity, usually presented as a statistical measure of system error, and is specified as predictable, repeatable and relative
AIRAC cycle	The Aeronautical Information Regulation and Control Cycle that documents and defines a series of common dates, and an associated standard aeronautical information publication procedure.
Aircraft-Based Augmentation System (ABAS)	An augmentation system that augments and/or integrates the information obtained from the other GNSS elements with information available on board the aircraft.

	Note: The most common form of ABAS is receiver autonomous integrity monitoring (RAIM).
Airspace, Continental	Airspace with sufficient ground infrastructure to support operations with line-of-sight radio systems for communications, navigation and surveillance.
Airspace, Oceanic/ Remote Continental	Airspace with little or no ground infrastructure that requires long range communications, navigation, and surveillance technology to support operations.
Altimetry System Error	The errors attributable to the aircraft altimetry installation including position effects resulting form normal aircraft flight altitudes.
Approach Procedure with Vertical Guidance (APV).	An instrument procedure which utilizes lateral and vertical guidance but does not meet the requirements established for precision approach and landing operations.
Area Navigation	A method of navigating which permits aircraft operation on any desired flight path within the coverage of ground or space-based navigation aids or within the limits of the capability of self-contained aids, or a combination of these.
Availability	The availability of a navigation system is the percentage of time that the services of the system within required performance limits.
Defined Path	The output of the navigation system path definition function.
Desired Path	The path the flight crew and air traffic control expect the aircraft to fly, given a particular leg of the transition.
Fault Detection	Fault Detection (FD) is a function performed by some GNSS receivers, which can detect the presence of a faulty satellite signal and provide an alert indicating system unreliability.
Navigation Specification	A set of aircraft and aircrew requirements needed to support Performance-based Navigation operations within a defined airspace. There are two kinds of navigation specification: RNAV specification. A navigation specification based on area navigation that does not include the requirement for on-board performance monitoring and alerting, designated by the prefix RNAV, e.g. RNAV 5, RNAV 1. RNP specification. A navigation specification based on area navigation that includes the requirement for on-board performance monitoring and alerting, designated by the prefix RNP, e.g. RNP 4, RNP APCH.
Performance-based Navigation	Area navigation based on performance requirements for aircraft operating along an ATS route, on an instrument approach procedure or in a designated airspace.
Receiver Autonomous Integrity Monitor (RAIM)	A form of ABAS whereby a GNSS receiver processor determines the integrity of the GNSS Navigation signals using only GPS signals or GPS signals augmented with barometric altitude(baro-aiding). This determination is achieved by a consistency check among redundant pseudo-range measurements. At least one additional satellite, needs to be available with the correct geometry over and above that needed for the position estimation, for the receiver to perform the RAIM function.
RNAV Operations	Aircraft operations using area navigation for RNAV applications. RNAV operations include the use of area navigation for operations which are not developed in accordance with this manual.
RNAV System	A navigation system which permits aircraft operation on any desired flight path within the coverage of station-referenced navigation aids or within the limits of the capability of self-contained aids, or a combination of these. An RNAV system may be included as part of a flight management system (FMS).

RNP Airspace	Areas, routes or procedures where minimum navigation performance requirements have been established and aircraft must meet that performance while flying in the designated environment.
RNP Operations	Aircraft operations using an RNP system for RNP navigation applications.
RNP Route	An ATS route established for the use of aircraft adhering to a prescribed RNP navigation specification.
RNP System	An area navigation system which supports on-board performance monitoring and alerting.
Space Based Augmentation System	A wide coverage augmentation system in which the user receives augmentation information from a satellite-based transmitter.
Total System Error	The difference between the true position and desired position. This error is equal to the vector sum of the path steering error, path definition error and position estimation error.

ABBREVIATION	DESCRIPTION
ABAS	Aircraft Based Augmentation System
AC	Advisory Circular
ADC	Air Data Computer
AFM	Aircraft Flight Manual
AMM	Aircraft Maintenance Manual
AP	Autopilot
ARP	Aeronautical Recommended Practice
ATC	Air traffic Control
ATS	Air Traffic Service
CDI	Course deviation indicator
DME	Distance Measuring Equipment
DTK	Desired Track
FAF	Final Approach Fix
FAS	Final Approach Segment
FD	Flight Director
FDE	Fault Detection and Exclusion
FMS	Flight Management System
FTE	Flight Technical Error
GNSS	Global Navigation System
IAP	Instrument Approach procedure
ICAO	International Civil Aviation Organisation
LOA	Letter of Approval/Acceptance/ Authorisation
MCDU	Multifunction control and display unit
MEL	Minimum Equipment list
NPA	Non-Precision Approach
OEM	Original Equipment Manufacturer
PBN	Performance based Navigation
RAIM	Receiver autonomous integrity monitoring
RNP	Required Navigation Performance
SID	Standard Instrument Departure
SOP	Standard Operating Procedure
SRM	Structural Repair Manual
STC	Supplemental Type Certificate

TSO	Technical Standard Orders
VNAV	Vertical Navigation

3. GENERAL

3.1 INTRODUCTION

3.1.1 Performance-based navigation (PBN) is based upon area navigation principles.

3.1.2 While various methods of area navigation have been in existence for many years, the widespread use of area navigation as a primary navigation function is a more recent phenomenon.

3.1.3 The PBN concept is intended to better define the use of area navigation systems and is expected to replace many of the existing conventional navigation routes.

3.2 PBN OVERVIEW

3.2.1 Area navigation systems evolved in a manner similar to conventional ground-based routes and procedures.

3.2.2 The early systems used very high frequency omnidirectional radio range (VOR) and distance measuring equipment (DME) for estimating their position in domestic operations, and inertial navigation systems (INS) were employed in oceanic operations.

3.2.3 In most cases a specific area navigation system was identified, and its performance was evaluated through a combination of analysis and flight testing. In some cases, it was necessary to identify the individual models of equipment that could be operated within the airspace concerned.

3.2.4 Such prescriptive requirements resulted in delays in the introduction of new area navigation system capabilities and higher costs for maintaining appropriate certification.

3.2.5 The PBN concept was developed with globally applicable performance requirements, detailed in accompanying navigation specifications, to avoid these high costs and delays.

3.2.6 The PBN concept requires that the aircraft area navigation system performance be defined in terms of the accuracy, integrity, availability, continuity and functionality necessary to operate in the context of a particular airspace concept.

3.2.7 Appropriate positioning sensors are also identified; these may include VOR/DME, DME/DME, GNSS and/or inertial systems.

3.2.8 Performance is detailed in a navigation specification in sufficient detail to facilitate global harmonization.

3.2.9 The navigation specification not only lays out the aircraft system performance requirements but also the aircrew requirements in terms of crew procedures and training, as well as any appropriate maintenance requirements, such as the provision of navigation databases.

3.3 RNAV & RNP

3.3.1 RNAV SPECIFICATIONS: RNAV specifications were developed to support existing capabilities in aircraft equipped with area navigation systems which, in the general case, were not designed to provide on-board performance monitoring and alerting.

3.3.2 RNAV specifications are similar to RNP specifications but do not require an on-board performance monitoring and alerting capability.

3.3.3 RNP SPECIFICATIONS: RNP specifications developed from a need to support operations that require greater integrity assurance, where the pilot is able to detect when the navigation system is not achieving, or cannot guarantee with appropriate integrity, the navigation performance required for the operation. Such systems are known as RNP systems.

3.4 NAVIGATION SPECIFICATIONS

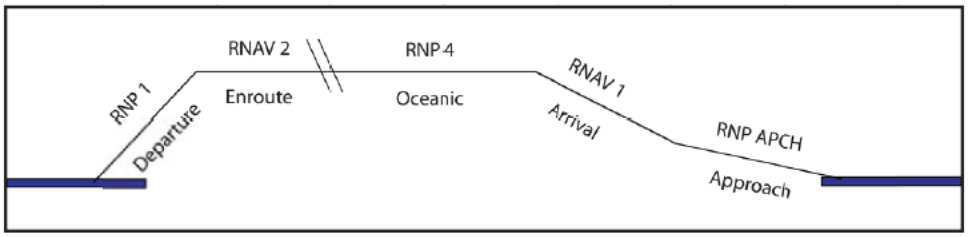
The following navigation specifications will require approval before entry into airspace defined for the navigation performance requirements:

Navigation specifications published to date

Flight Phase								
Navigation Specification	En-route Oceanic/Remote	En-route Continental	Arrival	Approach				
				Initial	Intermediate	Final	Missed	Departure
RNAV 10	10							
RNAV 5		5	5					
RNAV 2		2	2					2
RNAV 1		1	1	1	1		1	1
RNP 4	4							
RNP 2	2	2						
Advanced RNP	2	2 or 1	1 1	1 1	1 1	0.3	1 1	1 1
RNP 1		0.3	0.3	0.3	0.3	---	0.3	0.3
RNP 0.3				1	1	0.3	1 or 0.3	
RNP APCH				1 - 0.1	1 - 0.1	0.3 - 0.1	1 - 0.1	
RNP AR APCH								

3.5 APPLICATION OF NAV SPECIFICATIONS TO FLIGHT PHASE

The following graphic demonstrates how an operator may apply more than one navigation specification during a single flight—



3.6 DESIGNATION OF RNP AND RNAV SPECIFICATIONS

3.6.1 The designations for both RNP and RNAV are expressed as suffixes—

a. A RNP specification is designated as RNP X (e.g., RNP 4).
b. A RNAV specification is designated as RNAV X (e.g., RNAV 1).
c. *For both RNP and RNAV designations, the expression 'X' (where stated) refers to the lateral navigation accuracy in nautical miles that is expected to be achieved.*

3.6.2 If two navigation specifications share the same value for X, they may be distinguished by use of a prefix. e.g., Advanced-RNP 1 and Basic-RNP 1.

3.6.3 RNP approach navigation specifications are designated using RNP as a prefix and an abbreviated textual suffix e.g., RNP APCH or RNP AR APCH.

Approach navigation specifications cover all segments of the instrument approach. There are no RNAV approach specifications.

3.6.4 Because functional and performance requirements are defined for each navigation specification, an aircraft approved for an RNP specification is not automatically approved for all RNAV specifications. Similarly, an aircraft approved for an RNP or RNAV specification having a stringent accuracy requirement (e.g. RNP 0.3 specification) is not automatically approved for a navigation specification having a *less* stringent accuracy requirement (e.g. RNP 4).

3.6.5 An aircraft approved for RNP 1 will not be automatically approved for RNP 4; Aircraft approved to the more stringent accuracy requirements may not necessarily meet some of the functional requirements of the navigation specification having a less stringent accuracy requirement.

3.7 ON-BOARD PERFORMANCE MONITORING AND ALERTING

3.7.1 On-board performance monitoring and alerting is the main element that determines whether the navigation system complies with the necessary safety level associated to an RNP application; whether it relates to both lateral and longitudinal navigation performance; and whether it allows the aircrew to detect that the navigation system is not achieving, or cannot guarantee with 10^{-5} integrity, the navigation performance required for the operation.

3.7.2 RNP systems provide improvements on the integrity of operations; this may permit closer route spacing and can provide sufficient integrity to allow only RNP systems to be used for navigation in a specific airspace. The use of RNP systems may therefore offer significant safety, operational and efficiency benefits over RNAV systems.

3.8 NAVIGATION FUNCTIONAL REQUIREMENTS

3.8.1 Both RNAV and RNP specifications include requirements for certain navigation functionalities. At the basic level, these functional requirements may include:

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. Display of distance and bearing to the active (TO) waypoint;
c. Display of ground speed or time to the active (TO) waypoint;

d. Navigation data storage function; and
e. Appropriate failure indication of the RNAV or RNP system, including the sensors.

3.8.2 More sophisticated navigation specifications include the requirement for navigation databases and the capability to execute database procedures.

3.9 AIRSPACE CONCEPTS BY AREA OF OPERATION OCEANIC AND REMOTE CONTINENTAL

3.9.1 Oceanic and remote continental airspace concepts are currently supported by three navigation applications, RNAV 10, RNP 4 and RNP 2. All these navigation applications rely primarily on GNSS to support the navigation element of the airspace concept and may require ATS surveillance for certain applications.

(In the case of the RNAV 10 application, no form of ATS Surveillance service is required. In the case of the RNP 4 application, ADS contract (ADS-C) is used.)

Note: RNAV 10 = RNP 10

3.9.2 The designation RNP 10 has been used for years to define long range oceanic navigation requirements. Because the designator RNP 10 appears in numerous published documents and charts, RNP 10 will be retained in its current designation form. Under PBN, RNP 10 and RNAV 10 will be used synonymously to define these types of RNAV operations.

3.10 CONTINENTAL EN-ROUTE

Continental en-route airspace concepts are currently supported by RNAV and RNP applications.

3.11 TERMINAL AIRSPACE: ARRIVAL AND DEPARTURE

3.11.1 Existing terminal airspace concepts, which include arrival and departure, are supported by RNAV applications and RNP.

3.11.2 RNP 1 has been developed primarily for application in non-radar, low-density terminal airspace. In future, more RNP applications are expected to be developed for both enroute and terminal airspace.

3.12 APPROACH

3.12.1 Approach concepts cover all segments of the instrument approach, including—

a. Initial;
b. Intermediate;
c. Final; and
d. Missed approach.

3.12.2 Under the PBN concept, these segments call for RNP specifications requiring a navigation accuracy of 0.3 NM to 0.1 NM or lower.

4. AIRWORTHINESS REQUIREMENTS

4.1 DEMOSTRATING COMPLIANCE WITH THE NAVIGATION SPECIFICATION

Aircraft Eligibility

Note: Any PBN Ops Approvals will not be valid until the C of A has been issued

4.1.1 The operator must submit the evidence of aircraft eligibility that is provided through an aircraft Flight Manual (AFM) compliance statement, AFM Supplements or aircraft Original Equipment Manufacturer (OEM) service letter or other document certifying the aircraft meets the relevant airworthiness requirements for the intended operation.

4.1.2 Where the aircraft eligibility is not covered by the method described above, the operator will need to demonstrate the eligibility by other means. Evidence may include STC, modification data (engineering orders) that includes,

a. Conformity inspection,
b. Compliance testing,
c. Inspection certification; and
d. Appropriate maintenance certification

4.1.3 Provide details of the equipment to be used for the intended operation, the evidence may include, Aircraft equipment list that includes the equipment make, model, hardware part number (and revision number or mod status; and

a. software (part number and version) for the principle system components of the navigation, automation and radio system

4.1.4 Provide a certification statement from the operator, approved maintenance organisation (AMO) or an extract from the maintenance log to confirm that appropriate system and calibration checks have been conducted and appropriately certified.

4.1.5 Provide a certification statement from the operator or approved maintenance organisation, to confirm that there are no structural repairs or damage that would affect the authorisation. This would be a statement that "Any structural repairs in areas that could affect navigation sensors inputs or any damage in these areas have been repaired or within tolerance prescribed in the Structural Repair Manual (SRM) or any other applicable continuing airworthiness document"

4.1.6 If there are any conditions or limitations in the aircraft eligibility documentation that may affect PBN operations, these conditions and limitations must be reflected in the PBN Ops approval, OPSPECS.

4.2 CONTINUING AIRWORTHINESS

The operator must demonstrate their ability to maintain the aircraft in conformity to this type and design and compliant with the functional and performance requirements for all navigation authorisations applicable to each aircraft by complying with the following requirements.

4.3 SUBCONTRACTOR OVERSIGHT

4.3.1 The operator is responsible for the maintenance of the aircraft even though the maintenance activity may be subcontracted to the internal or external suppliers. Evidence must be provided that the operator maintains and will continue to maintain aircraft compliance with PBN Ops approval requirements and conformity to its type design.

4.3.2 Where maintenance functions are subcontracted, provide evidence of the contractual agreement with the maintenance providers (AMO), their approval certificate, OPSPECS and the operators process to oversight those organisations, including the procedure for authorising the scope of work (MCM).

4.3.3 The operators audit programme must include subcontractors and demonstrate that subcontractors have the training and capability for the work to be carried out.

4.4 AIRCRFAT MAINTENANCE PROGRAMME

4.4.1 The operator must provide the evidence that the navigation relevant systems are included in the maintenance programme and that any periodic checks and inspections are included.

4.4.2 Provide evidence that the maintenance programme depicts the required equipment at the required interval within the required calibration parameters.

4.4.3 Aircraft configuration management processes (any changes to the aircraft) are duly considered, this would typically include.

a. Relevant processes for assessing, recording and incorporating OEM instructions (SB and alike from the aircraft and relevant component manufacturer)
b. Process for ensuring comparability of changes with the aircraft and the fleet (it may include testing procedures)
c. Process for maintaining configuration list (it would include the aircraft equipment list)
d. Process for ensuring the changes singularly and in combination are reviewed to ensure the aircraft remains compliant with the type design criteria.
e. Software configuration management processes to ensure that the software (in each system is maintained in a configuration with interfacing system and has no significant operational differences between systems in the same aircraft
f. Electrical load analysis procedure, it would typically be evident by including the current ELA and an extract from the continuing airworthiness management system.

4.4.4 The operator must provide the aircraft maintenance document that provide instruction for the continuing airworthiness of the aircraft and equipment, this would typically include extract from and/or references to AMM, IPC, SRM, wiring diagram and CMMs that demonstrate.

a. Appropriate maintenance task and scheduling
b. System configuration
c. System testing
d. Part management and
e. Component repair management for the affected system

4.4.5 Provide evidence that a required test equipment is available, calibrated and maintained. This would include a list of test equipment (including part number and mod status) with associated calibration schedule and certificates. A copy of the management procedure for the equipment, it may include contractual agreement with the third parties (avionics organisation, specialised maintenance providers)

4.4.6 The operator must develop a procedure for parts management to ensure that only parts approved for the installation in the aircraft are permitted to be used in its maintenance.

4.4.7 The operator must provide the evidence that the maintenance personnel or personnel involved in the continuing airworthiness of the aircraft are appropriately trained in the maintenance of the affected systems. This training is over and above the type rating training. However, evidence may include an extract from the appropriate syllabi for type training. The training should include maintenance controllers, dispatchers and the aircraft cleaners to the appropriate degree, evidence include:

a. Syllabi of training
b. Training programme (including currency when required)
c. Testing methods, it should establish both knowledge and competency aspects
d. Records of training and competency of individuals trained. Records mut be kept by the operator, however if maintenance is provided by a third party the operator must demonstrate appropriate oversight of the organisation.

4.4.8 Procedure to be developed for managing navigation database. Evidence would include contractual subscriptions with appropriate suppliers.

4.5 AIRCRAFT CONFIGURATION MANAGEMENT

4.5.1 The operator is responsible for the configuration of their aircraft; therefore, no changes may be made to the aircraft unless the operator has accepted the changes and authorised its incorporation in the aircraft which includes all modifications sources including aircraft and equipment OEM service bulletins.

4.5.2 When an aircraft is fitted with dual installation that use the same equipment, the installation should have the same configuration. Minor installation differences are acceptable provided there is no significant operational impact.

4.6 SOFTWARE CONFIGURATION MANAGEMENT

4.6.1 Procedure to be developed for aircraft configuration management that ensures that aircraft software configuration is managed and compliant with a type design. Where the system is fitted with the multiple installations of a system, the software in each system must be maintained in a configuration that is compatible and has no significant differences between systems in the same aircraft. The prescribed software configuration limitations must be observed by the operator.

4.6.2 Since software changes relatively frequently and aircraft of nominally the same make/model have different equipment and software installed, the operator need a robust method of ensuring that maintenance personnel are aware of the acceptable software configuration applicable to each aircraft, therefore each aircraft will have a list of the software that is acceptable for installation in that aircraft.

4.6.3 As part of the programme the operator should include maintenance tasks to audit all the software installed in each aircraft at least annually, any discrepancies found must be resolved prior return to service. If the configuration management of an aircraft software is sub-contracted details of the arrangement must be included in the aircraft configuration management documents.

Note: ARINC 666 Electronic Distribution of Software and ARINC 667 Guidance for the Management of field loading software provide details on the management of aircraft software. New Zealand CAA AC 91-18 Aircraft Software Configuration Management also provide guidance on acceptable means of managing the configuration of aircraft software.

4.7 SYNTHETIC TRAINING DEVICE CONFIGURATION MANAGEMENT

4.7.1 Procedure to ensure that all training devises are maintained so that they accurately replica the aircraft.

4.7.2 The engineering function personnel responsible for managing the configuration of training devises need to have a direct link to the flight simulators.

4.7.3 Similarly, there must also be a direct link to the flight operations department since aircraft changes can also affect operating procedures and require changes to flight crew training syllabi and /or procedures.

4.8 MAINTENANCE PERSONNEL TRAINING

4.8.1 All maintenance personnel must be trained to ensure that aircraft are maintained compliant to their type design for PBN operations. The following knowledge requirements are applicable for PBN.

a. Area navigation principles: the basis of all PBN operations and the same general knowledge is applicable to all navigation specifications.
b. PBN fundamentals: personnel should have a sound knowledge of PBN fundamentals including the navigation specifications and their intended applications and the differences between RNAV and RNP navigation specifications.
c. Navigation system principles: personnel should have a detailed knowledge of the navigation systems installed in the operator's fleet. Should include the operation systems with GNSS and radio updating.
d. Navigation database management: procedure, verification requirements and updating aircraft navigation database.
e. Maintenance practice: it should include maintenance practices and the importance of aircraft configuration management particularly in relation to software.
f. Operator MEL provisions: maintenance personnel must be aware of the operator MEL provisions related to PBN operations and their applications.

Note1: Navigation compliance statements in the AFM for legacy aircraft are likely to not be in PBN terms, particularly for stand-alone GNSS approvals. Common terms for GNSS operational capability state "en route", "terminal" or "non-precision approach" (NPA).

Note2 These terms equate approximately to RNP 2, RNP 1 and RNP APCH – LNAV respectively for TSO C129 or C146 approved equipment.

Note3 Some statements of operational capability are provided in the AFM Limitations section while some are in the General section.

4.9 BARO V-NAV

4.9.1 If the AFM states the aircraft is qualified for Baro-VNAV, the sensitive area surrounding the static vents or pitot-static pressure heads must be examined to ensure that there is no damage within the sensitive area exceeding acceptable limits defined by the aircraft OEM. If there is damage within the sensitive area or there is substantial damage or repairs adjacent to the sensitive area, there must be evidence from aircraft OEM confirming that this damage is acceptable.

4.9.2 The repair record must include reference to the SRM section used to determine compliance with the Baro-VNAV requirements. If the repair is adjacent to the sensitive area but is substantial, a statement of the acceptability of the repair and the continuing compliance with Baro-VNAV requirements should be obtained from the aircraft manufacturer

5. OPERATIONAL PROCEDURES

5.1 Standard operating procedures (SOPs) must be developed to cover both normal and non-normal (contingency) procedures for the systems used in the PBN operation. The SOPs must address—

5.1.1 Pre-flight planning requirements including the MEL and, where appropriate, RNP/RAIM prediction.

5.1.2 Actions to be taken prior to commencing the PBN operation.

5.1.3 Actions to be taken during the PBN operation; and

5.1.4 Actions to be taken in the event of a contingency, including the reporting to the operator and to the CAA of significant incidents such as navigation errors not associated with transitions from an inertial navigation mode to a radio navigation mode; Unexpected deviations in lateral or vertical flight path attributed to incorrect navigation data; significant misleading information without failure warning; total loss or multiple failures of the PBN navigation equipment; or problems with ground navigation facilities leading to significant navigation errors.

6. FLIGHT PLANNING

6.1 PROCEDURES REQUIRED FOR ALL NAVIGATION SPECIFICATIONS

6.1.1 FLIGHT PLAN

6.1.1.1 The operator is to include operating procedures ensure that the flight plan Items 10 and 18 will be completed correctly and contain the appropriate codes.

6.1.1.2 Normal codes for Block 10 are:

a. R = PBN
b. G = GNSS
c. Z = Comments in Block 18

6.1.1.3 Normal codes for Block 18 are: Indication of RNAV and/or RNP capabilities. Include as many of the descriptors below, as apply to the flight, up to a maximum of 8 entries.

Example: PBN/ then

A1 RNAV 10 (RNP 10)
B1 RNAV 5 all permitted sensors
B2 RNAV 5 GNSS
B3 RNAV 5 DME/DME
B4 RNAV 5 VOR/DME
B5 RNAV 5 INS or IRS
B6 RNAV 5 LORANC
C1 RNAV 2 all permitted sensors
C2 RNAV 2 GNSS
C3 RNAV 2 DME/DME
C4 RNAV 2 DME/DME/IRU
D1 RNAV 1 all permitted sensors
D2 RNAV 1 GNSS
D3 RNAV 1 DME/DME

D4 RNAV 1 DME/DME/IRU
RNP SPECIFICATIONS
L1 RNP 4
O1 Basic RNP 1 all permitted sensors
O2 Basic RNP 1 GNSS
O3 Basic RNP 1 DME/DME
O4 Basic RNP 1 DME/DME/IRU
S1 RNP APCH
S2 RNP APCH with BARO-VN

6.1.1.4 Significant data related to navigation equipment, other than specified in PBN/, as required by the appropriate ATS authority. Indicate GNSS augmentation under this indicator, with a space between two or more methods of augmentation.

Example: NAV/ then RNP2 (no space)

6.2 AVAILIBILTY OF NAVAID INFASTRUCTURE

6.2.1 Flight planning procedures must determine the availability of navigation aids to support the required navigation performance on the planned route.

6.2.2 An operator must confirm the availability of the NAVAID infrastructure, required for the intended routes, including those for use in a non-GNSS contingency, for the period of intended operations using all available information. Procedures should determine the availability of RAIM or SBAS signal and functions as appropriate to ensure GNSS integrity.

6.2.3 For aircraft navigating with SBAS capability, operators should check appropriate GNSS RAIM availability in areas where the SBAS signal is unavailable. This RAIM availability must use a ground-based prediction service so GNSS planned system outages are included in the availability assessment.

6.2.4 For navigation relying on DME, procedures to check NOTAMs to verify the condition of critical DMEs must be included. Assess capability to navigate (potentially to an alternate destination) in case of failure of critical DME while airborne.

6.3 NAVIGATION DATA BASE

6.3.1 Operator is to specify the nominated person responsible for the management of the database integrity validation and updating process.

6.3.2 Procedures to be developed to ensure on-board navigation data will be current and appropriate to the route being flown and for potential diversions. Navigation databases are expected to be current for the duration of the flight. If the AIRAC cycle is due to change during flight, operators and pilots should establish procedures to ensure the accuracy of navigation data, including suitability of navigation facilities used to define the routes and procedures for flight.

6.3.3 To preserve the integrity of the navigation data, operators must include a procedure that ensures errors must be reported to the supplier.

6.3.4 The navigation database must be obtained from a supplier that holds a Letter of Acceptance from their National Authority and should be Type II.

6.4 GENERAL OPERATING PROCEDURES

It is recommended operators consult ICAO document 9613 for detailed procedural guidance on the below requirements.

6.5 RNAV 10

6.5.1 The required procedures below are for the implementation of RNP 10 to support 50 NM lateral and the 50 NM longitudinal distance-based separation minima in oceanic or remote area airspace.

6.5.2 RNP 10 was developed for operation in oceanic and remote areas and does not require any ground-based NAVAIDs. infrastructureWhile RNP 10 operational approval primarily relates to the navigation requirements of the airspace, operators and pilots are still required to take account of all operational documents relating to the airspace, which are required, before conducting flights into that airspace.

FLIGHT PLANNING:
Procedure to ensure aircraft is approved for RNP 10 operations.
Procedure to ensure that two LRNSs are operational.
Procedure to ensure that the RNP 10-time limit has been taken into account (INS/IRU only). (Operators to see ICAO Doc 9613 for further guidance)
Procedure to ensure that FDE is available (GNSS only).
Procedure to ensure the FPL: "R" should appear in field 10 and PBN/A1 in field 18.
Verify the flight-planned route including diversions.
PRE-FLIGHT
Procedure to ensure the review of flight technical records & confirm that maintenance actions are complete.
Procedure to ensure that the condition of navigation antennas and surrounding fuselage skin is satisfactory *(this check may be accomplished by a qualified and authorized person other than the pilot, e.g., a flight engineer or maintenance person)*
Emergency procedures for RNP 10 operations (*crew must be able to recognize when the aircraft is no longer able to navigate to its RNP 10 approval capability and ATC must be advised.*
EN-ROUTE
Procedure to ensure that both LRNSs are RNP 10 capable at the oceanic point of entry.
Procedure to ensure that prior to the oceanic point of entry, the aircraft position must be independently checked and updated if necessary *(This may require DME/DME and/or VOR checks to determine NSEs through displayed and actual positions.)*
Procedures must ensure mandatory navigation cross-checks to identify navigation errors in sufficient time to prevent aircraft from inadvertent deviation from ATC-cleared routes
Procedure that informs ATC if unable to comply with RNP 10 requirements or of any deviation required for contingency procedures.
Procedure the ensure the aircraft follows route center line within 5 NM. (*Pilots should use a lateral deviation indicator, flight director, or autopilot in lateral navigation mode on RNP 10 operations. All pilots are expected to maintain route centre lines, as depicted by on-board lateral deviation indicators and/or flight guidance, during all RNP operations described in this manual unless authorized to deviate by ATC or under emergency conditions. For normal operations, cross-track error/deviation (the difference between the RNAV system computed path and the aircraft position relative to the path) should be limited to ±½ the navigation accuracy associated with the route (i.e., 5 NM). Brief deviations from this standard (e.g., overshoots or undershoots) during and immediately after route turns, up to a maximum of one time the navigation accuracy (i.e., 10 NM), are allowable)*
UPDATE LRNS POSITION
CONTINGENCY

Procedures that address the inability to comply with ATC clearance due to meteorological conditions, aircraft performance or pressurization failure and weather deviation.
Procedures that address air-ground communications failure. (*Flight crew should continue with the flight plan in accordance with the published "lost communications procedure" in the event of a communications failure*)

6.5.3 Radio Position Updating

Operators are to specify if automatic or manual updating will be utilized.

6.5.4 Automatic updating

Any updating procedure that does not require the pilot to manually insert coordinates. '

6.5.5 Automatic updating is acceptable provided that:

a. Procedures for automatic updating are included in an operator's training programme; and
b. Pilots are knowledgeable of the updating procedures and of the effect of the update on the navigation solution.

6.5.6 An acceptable procedure for automatic updating may be used as the basis for an RNP 10 approval for an extended time.

6.5.7 Data must be provided to support automatic updating. The data provided must present a clear indication of the accuracy of the update and the effect of the update on the navigation capabilities for the remainder of the flight.

6.5.8 If manual updating is not specifically approved, manual position updates are not permitted in RNP 10 operations. Manual radio updating may be considered acceptable for operations in airspace where RNP 10 is applied provided that:

a. Operators show that their updating and training procedures include measures/cross-checking to prevent Human Factors errors and the pilot qualification syllabus is found to provide effective pilot training (if an operator is using an external service provider for training, the operator must produce evidence to demonstrate this requirement has been met); and
b. The operator provides data that establish the accuracy with which the aircraft navigation system can be updated using manual procedures and representative NAVAIDs. Data should show the update accuracy achieved in in-service operations. This factor must be considered when establishing the RNP 10 time limit for INS or IRU.

6.6 RNAV 5

6.6.1 The required procedures below are for implementing RNAV 5 in the en-route phase of flight. It provides the operator with criteria to enable operation in airspace where the carriage of RNAV meeting 5 NM lateral accuracy is already required.

6.6.2 The RNAV 5 specification does not require an alert to the pilot in the event of excessive navigation errors. Since the specification does not require the carriage of dual RNAV systems, the potential for loss of RNAV capability requires an alternative navigation source.

6.6.3 While operational approval primarily relates to the navigation requirements of the airspace, operators and pilots are still required to take account of all operational documents relating to the airspace, which are required, before conducting flights into that airspace.

6.6.4 RNAV 5 operations are based on the use of RNAV equipment which automatically determines the aircraft position in the horizontal plane using input 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; and
d. GNSS.

FLIGHT PLANNING
Procedure to ensure the aircraft is approved for RNAV 5 operations.
Procedure to verify RAIM availability (GNSS only).
Procedure to verify the availability of NAVAIDS (non-GNSS).
Procedures to ensure the navigation database is current and appropriate for the area of operation.
Procedure to ensure the FPL: "R" should appear in field 10 and PBN/B1–B5 (as appropriate) in field 18.
Procedure to verify the flight-planned route and should include any diversions.
GENERAL OPERATING PROCEDURES
Procedure to instruct crew to advise ATC if unable to comply. *(Operators and pilots should not request or file RNAV 5 routes unless they satisfy all the criteria. If an aircraft not meeting these criteria receives a clearance from ATC to conduct an RNAV procedure, the pilot must advise ATC that he/she is unable to accept the clearance and must request alternate instructions.)*
Procedure to confirm that the navigation database is up to date.
Procedure to cross-check the chart with the RNAV system display *(pilots should cross-check the cleared flight plan by comparing charts or other applicable resources with the navigation system textual display and the aircraft map display, if applicable. If required, the exclusion of specific NAVAIDs should be confirmed).*
Procedure to cross-check with conventional NAVAIDS to monitor for navigational reasonableness.
Procedure that ensures the aircraft follows route center lines within 2.5 NM (*All pilots are expected to maintain route centre lines, as depicted by on-board lateral deviation indicators and/or flight guidance, during all RNAV operations described in this manual, unless authorized to deviate by ATC or under emergency conditions. For normal operations, cross-track error/deviation (the difference between the RNAV system-computed path and the aircraft position relative to the path) should be limited to ±½ the navigation accuracy associated with the procedure or route (i.e., 2.5 NM). Brief deviations from this standard (e.g., overshoots or undershoots) during and immediately after procedure/route turns, up to a maximum of one times the navigation accuracy (i.e., 5 NM), are allowable.)*
Procedure to not modify the flight plan in the RNAV system after ATC heading assignment until a clearance is received to re-join the route or a new clearance is confirmed.
CONTINGENCY
Procedure to advise ATC if unable to meet the requirements for RNAV 5, Air-ground communications failure and GNSS RAIM alert or loss of RAIM.

6.7 RNAV 1 & RNAV 2

6.7.1 The required procedures below are for the implementation of RNAV 1 and RNAV 2. The RNAV 1 and 2 specification is applicable to all ATS routes, including routes in the en-route domain, SIDs and STARS.

6.7.2 It also applies to IAPs up to the FAF. The RNAV 1 and 2 specification is primarily developed for RNAV operations in a radar environment (for SIDs, radar coverage is expected prior to the first RNAV course change).

6.7.3 While operational approval primarily relates to the navigation requirements of the airspace, the pilot is still required to take account of all operational documents relating to that airspace before conducting flights into it.

FLIGHT PLANNING
Procedure to ensure that the aircraft is approved for RNAV 1 and RNAV 2 operations.
Procedure to verify RAIM availability (GNSS only).

Procedure to ensure the availability of NAVAIDS (non-GNSS).
Procedure to verify that the navigation database is current and appropriate for the region and must include the NAVAIDs, waypoints, and relevant coded ATS routes for departure, arrival, and alternate airfields.
Verify the FPL: "R" should appear in field 10 and PBN/C1-D4 (as appropriate) in field 18.
GENERAL OPERATING PROCEDURES
Procedure to verify the flight-planned route.
Procedure to comply with AFM limitations and manufacturer's instructions.
Procedure that instructs crew to advise ATC if unable to comply with the requirements for RNAV 1/RNAV 2. *(Operators and pilots should not request or file RNAV 1 and RNAV 2 routes unless they satisfy all the criteria. If an aircraft not meeting these criteria receives a clearance from ATC to conduct an RNAV procedure, the pilot must advise ATC that he/she is unable to accept the clearance and must request alternate instructions.)*
Procedure to ensure the crew confirm the navigation database is up to date *(Pilots must verify proper entry of their ATC assigned route upon initial clearance and any subsequent change of route. Pilots must ensure the waypoints sequence, depicted by their navigation system, matches the route depicted on the appropriate chart(s) and their assigned route).*
Procedure to retrieve SIDs/STARs only from the database. *(Pilots must not fly an RNAV 1 or RNAV 2 SID or STAR unless it is retrievable by route name from the onboard navigation database and conforms to the charted route. However, the route may subsequently be modified through the insertion or deletion of specific waypoints in response to ATC clearances. The manual entry, or creation of new waypoints by manual entry, of latitude and longitude or rho/theta values is not permitted. Additionally, pilots must not change any RNAV SID or STAR database waypoint type from a fly-by to a fly-over or vice versa)*
Procedure to cross-check the chart with the RNAV system display (*Pilots should cross-check the cleared flight plan by comparing charts or other applicable resources with the navigation system textual display and the aircraft map display, if applicable. If required, the exclusion of specific NAVAIDs should be confirmed)*
Procedure to cross-check with conventional NAVAIDS to monitor for navigational reasonableness.
Procedure to use appropriate display and scaling *(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 RNAV 1, ±2 NM for RNAV 2, or ±5 NM for TSO-C129() equipment on RNAV 2 routes).*
Procedure to ensure aircraft follows route center line within 1 or 0.5 NM. *(For normal operations, cross-track error/deviation (the difference between the RNAV system computed path and the aircraft position relative to the path, i.e., FTE) should be limited to ±½ the navigation accuracy associated with the procedure or route (i.e., 0.5 NM for RNAV 1, 1.0 NM for RNAV 2). Brief deviations from this standard (e.g., overshoots or undershoots) during and immediately after procedure/route turns, up to a maximum of one times the navigation accuracy (i.e., 1.0 NM for RNAV 1, 2.0 NM for RNAV), are allowable.)*
Procedure to instruct crew to not modify the flight plan in the RNAV system after ATC heading assignment until a clearance is received to re-join the route or a new clearance is confirmed.
RNAV SID REQUIREMENTS
Procedure to ensure that prior to take-off check the RNAV system, aerodrome and procedure loaded and the displayed position *(Prior to flight, pilots must verify their aircraft navigation system is operating correctly and the correct runway and departure procedure (including any applicable en-route transition) are entered and properly depicted. Pilots who are assigned an RNAV departure procedure and subsequently receive a change of runway, procedure or transition must verify the appropriate changes are entered and available for navigation prior to take-off. A final check of proper runway entry and correct route depiction, shortly before take-off, is recommended)*
Procedure that ensures the crew engage LNAV no later than 500 ft above aerodrome elevation.
Procedure to ensure the correct level of performance*. Pilots must use an authorized method (lateral deviation indicator/navigation map display/flight director/autopilot to achieve an appropriate level of performance for RNAV 1.*
If DME/DME only, do not use RNAV until within adequate DME coverage.
If DME/DME/IRU only, confirm navigation position within 0.17 NM of the start of the take-off roll. If DME/DME/IRU only, confirm Navigation position within 0.17 NM of the start of the take-off roll.
Procedure that ensures when using GNSS, acquire signal before start of take-off roll. (*For aircraft using TSO-C129/C129A equipment, the departure airport must be loaded into the flight plan in order to achieve the appropriate navigation system monitoring and sensitivity. For aircraft using TSO-C145a/C146a avionics, if the departure begins at a runway waypoint, then the departure airport does not need to be in the flight plan to obtain appropriate monitoring and sensitivity.)*
RNAV STAR REQUIREMENTS
Procedure to verify that the correct STAR is loaded and displayed. *(The active flight plan should be checked by comparing the charts with the map display (if applicable) and the MCDU. This includes confirmation of the waypoint sequence, reasonableness of track angles and distances, any altitude or speed constraints, and, where possible, which waypoints are fly-by and which are fly-over. If required by a route, a check will need to be made to confirm that updating will exclude a particular NAVAID. A route must not be used if doubt exists as to the validity of the route in the navigation database)*

Contingency preparations *(Where the contingency procedure requires reversion to a conventional arrival route, necessary preparations must be completed before commencing the RNAV route)*
Procedure modification in response to ATC instructions *(Route modifications in the terminal area may take the form of radar headings or "direct to" clearances and the pilot must be capable of reacting in a timely fashion. This may include the insertion of tactical waypoints loaded from the database. Manual entry or modification by the pilot of the loaded route, using temporary waypoints or fixes not provided in the database, is not permitted.)*
Procedure to observe speed and altitude constraints.
CONTINGENCY
Advise ATC if unable to comply with the requirements for RNAV 1/RVAV 2 and air-ground communications failure. (*Flight crew should continue with the flight plan in accordance with the published "lost communications procedure" in the event of a communications failure*)
Procedure in the event of loss of RNAV capability. *The pilot must notify ATC of any loss of the RNAV capability, together with the proposed course of action. If unable to comply with the requirements of an RNAV route, pilots must advise ATS as soon as possible. The loss of RNAV capability includes any failure or event causing the aircraft to no longer satisfy the RNAV requirements of the route*

6.8 RNP 4

6.8.1 The required procedures below are for the implementation of RNP 4, originally developed to support 30 NM lateral and the 30 NM longitudinal distance-based separation minima in oceanic or remote area airspace.

6.8.2 RNP 4 was developed for operations in oceanic and remote airspace, therefore, it does not require any ground-based NAVAID infrastructure.

6.8.3 GNSS is the primary navigation sensor to support RNP 4, either as a stand-alone navigation system or as part of a multi-sensor system. While operational approval primarily relates to the navigation requirements of the airspace, operators and pilots are still required to take account of all operational documents relating to the airspace, which are required, before conducting flights into that airspace.

FLIGHT PLANNING
Procedure to ensure that the aircraft is approved for RNP 4 operations.
Procedure to ensure that the navigation database current is current.
Procedure to verify the availability of FDE.
Verify the FPL: "R" should appear in field 10 and PBN/L1 in field 18.
Procedure to ensure the crew review flight technical records and confirm that maintenance actions are complete.
EN-ROUTE
Procedure that ensures both LRNSs must be RNP 4 capable at the oceanic point of entry *(If an item of equipment required for RNP 4 operations is unserviceable, then the pilot should consider an alternate route or diversion for repairs)*
Procedure that requires crew to perform mandatory navigation cross-checks to identify navigation errors in sufficient time to prevent inadvertent deviation from ATC-cleared routes.
Procedure for crew to notify ATC if unable to comply with the requirements for RNP or of any deviation required for a contingency.
Procedure to ensure aircraft follows route center line within 2 NM (*Pilots should use a lateral deviation indicator, flight director, or autopilot in lateral navigation mode on RNP 4 routes. Pilots may use a navigation map display with equivalent functionality to a lateral deviation indicator as described in 1.3.3.7.1 b). Pilots of aircraft with a lateral deviation indicator must ensure that the lateral deviation indicator scaling (full-scale deflection) is suitable for the navigation accuracy associated with the route (i.e., ±4 NM). All pilots are expected to maintain route center lines, as depicted by on-board lateral deviation indicators and/or flight guidance during all RNP operations described in this manual unless authorized to deviate by ATC or under emergency conditions. For normal operations, cross-track error/deviation (the difference between the RNAV system computed path and the aircraft position relative to the path) should be limited to ±½ the navigation accuracy associated with the route (i.e., 2 NM). Brief deviations from this standard (e.g., overshoots or undershoots) during and immediately after route turns, up to a maximum of one-times the navigation accuracy (i.e., 4 NM), are allowable.)*
CONTINGENCY

Procedures that address the inability to comply with ATC clearance due to meteorological conditions, aircraft performance or pressurization failure and weather deviation.
Procedures that address air-ground communications failure. (*Flight crew should continue with the flight plan in accordance with the published "lost communications procedure" in the event of a communications failure*)

6.9 RNP 2

6.9.1 RNP 2 is primarily intended for a diverse set of en-route applications, particularly in geographic areas with little or no ground NAVAID infrastructure, limited or no ATS surveillance, and low to medium density traffic.

6.9.2 Use of RNP 2 in continental applications requires a lower continuity requirement than used in oceanic/remote applications. In the latter application, the target traffic is primarily transport category aircraft operating at high altitude, whereas continental applications may include a significant percentage of GA aircraft.

6.9.3 The RNP 2 specification is based upon GNSS. RNP 2 shall not be used in areas of known GNSS signal interference.

FLIGHT PLANNING
Procedure to ensure that the aircraft and crew are approved for RNP 2 operations.
Procedure to verify RAIM availability *(The availability of the NAVAID infrastructure, required for the intended routes, including any non-RNAV contingencies, must be confirmed for the period of intended operations using all available information. Since GNSS integrity (RAIM or SBAS signal) is required, the availability of these should also be determined as appropriate. For aircraft navigating with SBAS receivers (all TSO-C145()/C146()), operators should check appropriate GPS RAIM availability in areas where the SBAS signal is unavailable.)*
Procedure to ensure that the navigation database is current (*Navigation databases are expected to be current for the duration of the flight. If the AIRAC cycle is due to change during flight, operators and pilots should establish procedures to ensure the accuracy of the navigation data, including the suitability of navigation facilities used to define the routes and procedures for flight).*
GENERAL OPERATING PROCEDURES
Procedure to instruct crew to comply with the manufacturer's instructions/procedures.
Advise ATC if unable to comply with the requirements for RNP 2 (*Operators and pilots should not request or file RNP 2 procedures unless they satisfy all the criteria. If an aircraft not meeting these criteria receives a clearance from ATC to conduct an RNP 2 procedure, the pilot must advise ATC that he/she is unable to accept the clearance and must request alternate clearance.*)
Procedure to verify aircraft position and entry of assigned route *(At system initialization, pilots must confirm that the aircraft position has been entered correctly. Pilots must verify proper entry of their ATC assigned route upon initial clearance and any subsequent change of route. Pilots must ensure that the waypoint sequence depicted by their navigation system matches the route depicted on the appropriate chart(s) and their assigned route)*
Procedure to retrieve routes from the database. *(Pilots must not fly a published RNP 2 route unless they can retrieve the route by name from the on-board navigation database and confirm it matches the charted route. However, pilots may subsequently modify the route through the insertion or deletion of specific waypoints in response to ATC requests and clearances. Pilots must not make manual entries or create new waypoints by manual entry of latitude and longitude or rho/theta values for fixed, published routes. Additionally, pilots must not change any route database waypoint type from a fly-by to a fly-over or vice versa. For flexible route structures, entry of latitude and longitude may also be permitted provided the potential for entry error by pilots is accounted for during associated safety analyses.)*
Procedure to use appropriate display and scaling (*For RNP 2 routes, pilots must use a lateral deviation indicator, flight director, or autopilot in lateral navigation mode. Pilots of aircraft with a lateral deviation display must ensure that the lateral deviation scaling is suitable for the navigation accuracy associated with the route (e.g., full-scale deflection: ±2 NM for RNP 2 or ±5 NM in the case of some TSO-C129a equipment) and know their allowable lateral deviation limits.)*
Procedure to ensure aircraft follows route center line within 1 NM. *(All pilots must maintain a centre line, as depicted by on-board lateral deviation indicators and/or flight guidance during all RNP 2 operations described in this manual, unless authorized to deviate by ATC or under emergency conditions. For normal operations, cross-track error/deviation (the difference between the system computed path and the aircraft position relative to the path, i.e., FTE) should be limited to ±½ the navigation accuracy associated with the route (i.e., 1 NM for RNP 2). Brief deviations from this standard (e.g., overshoots or undershoots) during and immediately after turns, up to a maximum of one times the navigation accuracy (i.e., 2 NM for RNP 2) are allowable. Some aircraft do not display or compute a path during turns; therefore, pilots of these aircraft may not be able to confirm adherence to the ±½ lateral navigation accuracy during turns but must satisfy the standard during intercepts following turns and on straight segments.)*
Procedure to manually select bank angle limiting functions. (*Manually selecting or use of default aircraft bank limiting functions may reduce the aircraft's ability to maintain desired track and the pilot should not use these functions. Pilots should understand*

*manually selecting aircraft bank-limiting functions may reduce their ability to satisfy ATC path expectations, especially when executing large angle turns. However, pilots should not deviate from AFM procedures and should limit the use of such functions within accepted procedures that meet the requirements for operation on an RNP 2 route*Procedure to manually select bank angle limiting functions. *Manually selecting or use of default aircraft bank limiting functions may reduce the aircraft's ability to maintain desired track and the pilot should not use these functions. Pilots should understand manually selecting aircraft bank-limiting functions may reduce their ability to satisfy ATC path expectations, especially when executing large angle turns. However, pilots should not deviate from AFM procedures and should limit the use of such functions within accepted procedures that meet the requirements for operation on an RNP 2 route)*
Procedure to instruct crew not to modify the flight plan in the RNAV system after ATC heading assignment until a clearance is received to re-join the route or a new clearance is confirmed.
Procedure that ensures if RNP input is required, select RNP 2 or lower
CONTINGENCY
Advise ATC if unable to comply with the requirements for RNP 2. *(The pilot must notify ATC of any loss of the RNP 2 capability (integrity alerts or loss of navigation). If unable to comply with the requirements of an RNP 2 route for any reason, pilots must advise ATC as soon as possible. The loss of RNP 2 capability includes any failure or event causing the aircraft to no longer satisfy the RNP 2 requirements.)*
Air-ground communications failure *(In the event of communications failure, the pilot should continue with the published lost communications procedure.)*

6.10 RNP 1

6.10.1 RNP 1 is intended to support arrival and departure procedures using GNSS positioning only. Other than the sole requirement for GNSS there is no significant difference between the RNAV 1 and RNAV 2 specification and RNP 1. RNP 1 shall not be used in areas of known navigation signal (GNSS) interference.

6.10.2 While operational approval primarily relates to the navigation requirements of the airspace, operators and pilots are still required to take account of all operational documents relating to the airspace, which are required by the appropriate State authority, before conducting flights into that airspace.

FLIGHT PLANNING
Procedure to ensure that the aircraft and crew are approved for RNP 1 operations.
Procedure to verify RAIM availability *(The availability of the NAVAID infrastructure, required for the intended routes, including any non-RNAV contingencies, must be confirmed for the period of intended operations using all available information. Since GNSS integrity (RAIM or SBAS signal) is required, the availability of these should also be determined as appropriate. For aircraft navigating with SBAS receivers (all TSO-C145()/C146()), operators should check appropriate GPS RAIM availability in areas where the SBAS signal is unavailable.)*
Procedure to ensure that the navigation database is current (*Navigation databases are expected to be current for the duration of the flight. If the AIRAC cycle is due to change during flight, operators and pilots should establish procedures to ensure the accuracy of the navigation data, including the suitability of navigation facilities used to define the routes and procedures for flight).*
Verify the FPL: "R" should appear in field 10 and PBN/O2 in field 18.
GENERAL OPERATING PROCEDURES
Procedure to instruct crew to comply with the manufacturer's instructions/procedures.
Advise ATC if unable to comply with the requirements for RNP 1 (*Operators and pilots should not request or file RNP 1 procedures unless they satisfy all the criteria. If an aircraft not meeting these criteria receives a clearance from ATC to conduct an RNP 1 procedure, the pilot must advise ATC that he/she is unable to accept the clearance and must request alternate instructions.*)
Procedure to verify aircraft position and entry of assigned route *(At system initialization, pilots must confirm that the aircraft position has been entered correctly. Pilots must verify proper entry of their ATC assigned route upon initial clearance and any subsequent change of route. Pilots must ensure that the waypoint sequence depicted by their navigation system matches the route depicted on the appropriate chart(s) and their assigned route)*
Procedure to retrieve SIDs/STARs only from the database. (*Pilots must not fly an RNP 1 SID or STAR unless it is retrievable by procedure name from the on-board navigation database and conforms to the charted procedure. However, the procedure may subsequently be modified through the insertion or deletion of specific waypoints in response to ATC clearances. The manual entry, or creation of new waypoints, by manual entry of latitude and longitude or rho/theta values is not permitted. Additionally, pilots must not change any SID or STAR database waypoint type from a fly-by to a fly-over or vice versa.)*

Procedure for crew to cross-check the chart with the RNAV system display. *(Pilots should cross-check the cleared flight plan by comparing charts or other applicable resources with the navigation system textual display and the aircraft map display, if applicable. If required, the exclusion of specific NAVAIDs should be confirmed)*
Procedure for crew to cross-check with conventional NAVAIDS to monitor for navigational reasonableness. *(Cross-checking with conventional NAVAIDs is not required, as the absence of integrity alert is considered sufficient to meet the integrity requirements. However, monitoring of navigation reasonableness is suggested, and any loss of RNP capability shall be reported to ATC.)*
Procedure to use appropriate display and scaling (*For RNP 1 routes, pilots must 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 RNP 1).*
Procedure to ensure aircraft follows route center line within 0.5 NM. *(All pilots are expected to maintain centre lines, as depicted by on-board lateral deviation indicators and/or flight guidance during all RNP 1 operations described in this manual, unless authorized to deviate by ATC or under emergency conditions. For normal operations, cross-track error/deviation (the difference between the system computed path and the aircraft position relative to the path, i.e., FTE) should be limited to ±½ the navigation accuracy associated with the procedure (i.e., 0.5 NM for RNP 1). Brief deviations from this standard (e.g., overshoots or undershoots) during and immediately after turns, up to a maximum of one times the navigation accuracy (i.e., 1.0 NM for RNP 1) are allowable.)*
Procedure to instruct crew not to modify the flight plan in the RNAV system after ATC heading assignment until a clearance is received to re-join the route or a new clearance is confirmed.
Procedure that ensures if RNP input is required, select RNP 1 or lower.
RNP 1 SID REQUIREMENTS
Procedure that ensures that prior to take-off crew check the RNAV system, the aerodrome, procedure loaded and the displayed position. (*Prior to commencing take-off, the pilot must verify that the aircraft's RNP 1 system is available, operating correctly, and that the correct airport and runway data are loaded. Prior to flight, pilots must verify their aircraft navigation system is operating correctly and the correct runway and departure procedure (including any applicable en-route transition) are entered and properly depicted. Pilots who are assigned an RNP 1 departure procedure and subsequently receive a change of runway, procedure or transition must verify that the appropriate changes are entered and available for navigation prior to take-off. A final check of proper runway entry and correct route depiction, shortly before take-off, is recommended.)*
Procedure that instructs crew to engage LNAV no later than 500 ft above aerodrome elevation. *(The pilot must be able to use RNP 1 equipment to follow flight guidance for lateral navigation)*
Procedure to use an authorized method to achieve RNP 1 (AP/FD/Map/ L/DEV indicator) to achieve an appropriate level of performance for RNP 1.
If GNSS, signal must be acquired before start of takeoff roll. (*For aircraft using TSO-C129a avionics, the departure airport must be loaded into the flight plan in order to achieve the appropriate navigation system monitoring and sensitivity. For aircraft using TSO-C145()/C146() avionics, if the departure begins at a runway waypoint, then the departure airport does not need to be in the flight plan to obtain appropriate monitoring and sensitivity. If the RNP 1 SID extends beyond 30 NM from the ARP and a lateral deviation indicator is used, its full-scale sensitivity must be selected to not greater than 1 NM between 30 NM from the ARP and the termination of the RNP 1 SID.)*
RNP 1 STAR REQUIREMENTS
Procedure to verify that the correct STAR is loaded and displayed. *(The pilot should verify that the correct terminal route has been loaded. The active flight plan should be checked by comparing the charts with the map display (if applicable) and the MCDU. This includes confirmation of the waypoint sequence, reasonableness of track angles and distances, any altitude or speed constraints, and, where possible, which waypoints are fly-by, and which are fly-over. If required by a route, a check will need to be made to confirm that updating will exclude a particular NAVAID. A route must not be used if doubt exists as to the validity of the route in the navigation database.)*
Procedure for contingency preparations *(Where the contingency procedure requires reversion to a conventional arrival route, necessary preparations must be completed before commencing the RNP 1 procedure)*
Procedure modifications in response to ATC instructions *(Procedure modifications in the terminal area may take the form of radar headings or "direct to" clearances and the pilot must be capable of reacting in a timely fashion. This may include the insertion of tactical waypoints loaded from the database. Manual entry or modification by the pilot of the loaded route using temporary waypoints or fixes not provided in the database is not permitted)*
Procedure to verify the correct operation of the navigation system and that the correct procedure, transition and runway are loaded.
Procedure to observe speed and altitude constraints.
Procedure more than 30 NM from ARP use FD/AP or set FSD to 1 NM. (*Aircraft with TSO-C129a GNSS RNP systems: If the RNP 1 STAR begins beyond 30 NM from the ARP and a lateral deviation indicator is used, then full scale sensitivity should be manually selected to not greater than 1 NM prior to commencing the STAR. For aircraft using a lateral deviation display (i.e., navigation map display), the scale must be set for the RNP 1 STAR, and the flight director or autopilot should be used.)*
CONTINGENCY

Advise ATC if unable to comply with the requirements for RNP 1. *(The pilot must notify ATC of any loss of the RNP capability (integrity alerts or loss of navigation), together with the proposed course of action. If unable to comply with the requirements of an RNP 1 SID or STAR for any reason, pilots must advise ATS as soon as possible. The loss of RNP capability includes any failure or event causing the aircraft to no longer satisfy the RNP 1 requirements of the route.)*
Air-ground communications failure *(In the event of communications failure, the pilot should continue with the published lost communications procedure.)*

6.11 BARO-VNAV PROCEDURES

6.11.1 The procedures below are required for implementing IFPs where baro-VNAV is authorized for RNP APCH approaches.

6.11.2 Baro-VNAV is intended to be applied where vertical guidance and information are provided to the pilot on IAPs containing a vertical flight path defined by a vertical path angle. Baro-VNAV may also be defined by altitude constraints but only for flight phases other than approach. Guidance for operational use is provided in PANS-OPS (Doc 8168), Volume I.

GENERAL OPERATING PROCEDURES
Procedure to instruct crew to comply with the manufacturer's instructions/procedures.
Procedure to instruct crew to take precautions to switch altimeter settings at appropriate times or locations and request a current altimeter setting if the reported setting may not be recent, particularly at times when pressure is reported or is expected to be rapidly decreasing. Remote altimeter settings are not allowed.
Procedure for cold weather temperatures *(when cold weather temperatures exist, the pilot should check the chart for the IAP to determine the limiting temperature for the use of baro-VNAV capability. If the airborne system contains a temperature compensation capability, the manufacturer's instructions should be followed for the use of the baro-VNAV function)*
CONTINGENCY
Where the contingency procedure requires reversion to a conventional procedure, necessary preparations should be completed before commencing the RNAV procedure, consistent with operator practices.

6.12 RNP APPROACH

6.12.1 RNP approach (RNP APCH) procedures include existing RNAV (GNSS) approach procedures designed with a straight segment. The RNP APCH specification is based on GNSS to support RNP APCH operations down to LNAV or LNAV/VNAV minima.

6.12.2 The missed approach segment may be based upon the conventional NAVAID (e.g., VOR, DME, NDB).

FLIGHT PLANNING
Procedure to verify that the aircraft and crew are approved for RNP APCH operations to LNAV or LNAV/VNAV minima.
Procedure to verify RAIM availability. *(The availability of the NAVAID infrastructure, required for the intended routes, including any non-RNAV contingencies, must be confirmed for the period of intended operations using all available information. Since GNSS integrity (RAIM or SBAS signal) is required, the availability of these should also be determined as appropriate. For aircraft navigating with SBAS receivers (all TSO-C145()/C146()), operators should check appropriate GPS RAIM availability in areas where the SBAS signal is unavailable.)*
Verify that the navigation database is current *(the pilot must ensure that approaches which may be used for the intended flight (including alternate aerodromes) are selected from a valid navigation database (current AIRAC cycle), have been verified by the appropriate process (navigation database integrity process) and are not prohibited by a company instruction or NOTAM)*
Procedure to ensure that during the pre-flight phase, the 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
Procedure that ensures pilots must take account of any NOTAMs or operator briefing material that could adversely affect the aircraft system operation, or the availability or suitability of the procedures at the airport of landing, or any alternate airport; and for missed approach procedures based on conventional means (VOR, NDB), operators and pilots must

ensure that the appropriate airborne equipment required for this procedure is installed in the aircraft and is operational and that the associated ground-based NAVAIDs are operational.
Verify the FPL: "R" should appear in field 10 and PBN/S1 in field 18.
PRIOR TO COMMENCING THE PROCEDURE
Procedure to verify that the correct procedure is loaded by comparison with the approach charts. This check must include the waypoint sequence, and reasonableness of the tracks and distances of the approach legs, and the accuracy of the inbound course and length of the FAS.
Procedure to cross-check the chart with the RNAV system display *(which waypoints are fly-by and which are fly-over)*
Verify the GNSS sensor in use (only multi-sensor systems).
Procedure to input the barometric altimeter setting (only ABAS requires barometric input). *(The current airport barometric altimeter setting should be input at the appropriate time and location, consistent with the performance of the flight operation.)*
Procedure to perform a RAIM availability check if ETA is more than 15 minutes different from the FPL ETA (only for ABAS). *(This check is also processed automatically 2 NM before the FAF for an E/TSO-C129a Class A1 receiver.)*
Procedure that ensures crew do not modify the flight plan in the RNAV system after ATC heading assignment until a clearance is received to re-join the route or a new clearance is confirmed. "Direct to" clearances accepted up to IF, provided that the resulting track change at the IF does not exceed 45 degrees.
Procedure that ensures crew do not modify the final approach segment *(The lateral definition of the flight path between the FAF and the MAPt must not be revised by the pilot under any circumstances)*
DURING THE PROCEDURE
Procedure that ensures the aircraft is established on the final approach course before starting descent.
Procedure to verify that the approach mode is activated 2 NM prior to FAF.
Procedure to utilize an appropriate display *(The appropriate displays must be selected so that the following information can be monitored: a) the RNAV-computed desired path (DTK); and b) the aircraft position relative to the path (cross-track deviation) for FTE monitoring.)*
Procedure that instructs crew to discontinue the approach if the navigation display is flagged invalid; loss of integrity alert; loss of integrity alerting function prior to the FAF or if the FTE is excessive
Procedure that instructs crew does not use the RNP system in missed approach if the RNP system is not operational; or missed approach is not loaded from the database.
Procedure that ensures aircraft follows the route centre line within 0.5/0.15/0.5 NM. (*During the RNP APCH procedure, pilots must use a lateral deviation indicator, flight director and/or autopilot in lateral navigation mode. Pilots of aircraft with a lateral deviation indicator (e.g., CDI) must ensure that lateral deviation indicator scaling (full-scale deflection) is suitable for the navigation accuracy associated with the various segments of the procedure (i.e., ±1.0 NM for the initial and intermediate segments, ±0.3 NM for the FAS down to LNAV or LNAV/VNAV minima, and ±1.0 NM for the missed approach segment). All pilots are expected to maintain procedure centre lines, as depicted by on-board lateral deviation indicators and/or flight guidance during the whole approach procedure, unless authorized to deviate by ATC or under emergency conditions. For normal operations, cross-track error/deviation (the difference between the RNP system computed path and the aircraft position relative to the path) should be limited to ±½ the navigation accuracy associated with the procedure (i.e., 0.5 NM for the initial and intermediate segments, 0.15 NM for the FAS, and 0.5 NM for the missed approach segment). Brief deviations from this standard (e.g., overshoots or undershoots) during and immediately after turns, up to a maximum of one-times the navigation accuracy (i.e., 1.0 NM for the initial and intermediate segments), are allowable.)*
If baro-VNAV is used, follow vertical path ±75 ft.
Procedure that instructs crew to execute a missed approach if the lateral or vertical deviations exceed the limits.
GENERAL OPERATING PROCEDURES
Procedure to advise ATC if unable to meet the requirements for an RNP APCH. *(Operators and pilots must not request an RNP APCH procedure unless they satisfy all the criteria in the relevant State documents. If an aircraft not meeting these criteria receives a clearance from ATC to conduct an RNP APCH procedure, the pilot must advise ATC that he/she is unable to accept the clearance and must request alternate instructions.)*
Procedure that instructs pilots to comply with the manufacturer's instructions/procedures
If the missed approach is based on conventional means, appropriate navigation equipment must be installed and serviceable.
Procedure that encourages crew to utilize the FD or AP if available.
CONTINGENY

Procedure to advise ATC if unable to comply with the requirements for an RNP APCH. *(The pilot must notify ATC of any loss of the RNP APCH capability, together with the proposed course of action. If unable to comply with the requirements of an RNP APCH procedure, pilots must advise ATS as soon as possible. The loss of RNP APCH capability includes any failure or event causing the aircraft to no longer satisfy the RNP APCH requirements of the procedure. The operator should develop contingency procedures in order to react safely following the loss of the RNP APCH capability during the approach.)*
Air-ground communications failure *(In the event of communications failure, the pilot must continue with the RNP APCH in accordance with the published lost communications procedure.)*

6.13 RADIUS TO FIX (RF) PATH TERMINATOR

6.13.1 The pilot must use either a flight director or autopilot when flying an RF leg. The pilot should comply with any instructions or procedures identified by the manufacturer as necessary to comply with the recognized performance requirements.

6.13.2 Verify the requirement for RF legs by reviewing the appropriate chart.

6.13.3 Require the dispatcher/ pilots to determine that the installed autopilot/ flight director is operational when the dispatch of a flight is predicated on flying an RNP procedure with an RF leg.

6.13.4 Not authorize a pilot to fly a published RNP procedure unless its retrievable by the procedure name from the aircraft navigation database and conforms to the chartered procedure. The lateral path must not be modified, with the exception of complying with ATC clearances/instructions.

6.13.5 Require the aircraft to be established on the procedure prior to the beginning of the RF leg.

6.13.6 Require the pilot to maintain the centre line of the desired path on RF legs. For normal operations, the FTE should be limited to within ½ the required navigation accuracy associated with the procedure.

6.13.7 Require the pilot to not exceed maximum airspeeds associated with the design of the RF leg where published.

6.13.8 Require the pilot to maintain the current bank and roll out on the charted RF exit course, if an aircraft system failure results in the loss of capability to follow an RF leg. The pilot should advise ATC as soon as possible of the system failure.

6.14 ABAS/SBAS (ALL NAVIGATION SPECS)

6.14.1 Using ground-based RAIM availability prediction software taking account of the latest GNSS NOTAMs. Operators using SBAS augmentation should also check the relevant SBAS NOTAMs to determine the availability of SBAS.

6.14.2 Notwithstanding pre-flight analysis results, because of unplanned failure of some GNSS or DME elements (or local interference), pilots must realize that integrity availability (or GNSS navigation altogether) may be lost while airborne which may require reversion to an alternate means of navigation.

6.14.3 Therefore, pilots should assess their capability to navigate in case of failure of the primary sensor or the RNP system. RAIM prediction is not required where the equipment uses SBAS augmentation, and the planned operations are within the service volume of the SBAS system.

6.14.4 In the event of a predicted, continuous loss of appropriate level of fault detection of more than the time specified below for any part of the operation, the operator should have procedures to revise the flight plan (e.g., delay the departure or plan a different route):

a. 34 minutes for RNAV 10 routes.
b. 20 minutes for RNP 4 routes
c. 5 minutes for RNP 2 oceanic / remote continental routes and all continental operations.

6.15 CONTINGENCY PROCEDURES

6.15.1 Procedures should be developed to ensure that the pilot must notify ATC of any loss of the RNAV/RNP capability (integrity alerts or loss of navigation), together with the proposed course of action.

6.15.2 If unable to comply with the requirements of a RNAV/RNP SID or STAR for any reason, pilots must advise ATS as soon as possible. The loss of RNAV/RNP capability includes any failure or event causing the aircraft to no longer satisfy the RNAV/RNP requirements of the route or procedure.

6.15.3 Where stand-alone GNSS equipment is used:

a. In the event of that there is a loss of the RAIM detection function, the GNSS position may continue to be used for navigation. The pilot should attempt to cross-check the aircraft position, with other sources of position information, (e.g., VOR, DME and/or NDB information) to confirm an acceptable level of navigation performance. Otherwise, the pilot should revert to an alternative means of navigation and advise ATC.
b. In the event that the navigation display is flagged invalid due to a RAIM alert, the pilot should revert to an alternative means of navigation and advise ATC.

6.15.4 Flight crew should continue with the flight plan in accordance with the published “lost communications procedure” in the event of a communications failure.

a. Pilots are required to report navigation errors.

6.16 NAVIGATION DATA BASE MANAGEMENT

6.16.1 The navigation database is a safety critical item; therefore, the operator must have nominated person responsible for the management of the database integrity validation and updating process in order to ensure its integrity is not compromised.

6.16.2 The operator should have a copy of the LOA for the supplier of their navigation data.

a. A Type 1 LOA is for the processing of navigation that is a generic database.
b. A Type 2 LOA is for the processing of navigation data applicable to specific equipment.

6.16.3 Operators are responsible for ensuring that their aircraft do not attempt to carry out operations for which they are not qualified. This can be accomplished by either ensuring that the navigation database does not contain procedure for which the aircraft is not qualified, or the aircraft navigation system will not load and execute such procedures.

6.16.4 Data integrity errors do occur therefore to preserve the integrity of the navigation data, all errors must be reported to the supplier. If a hazardous condition is likely to arise, reporting the error using the SACAA accident or incident reporting procedures.

6.16.5 Navigation data errors include all of the potential errors in a navigation database rather than just positional errors. If a procedure is coded incorrectly i.e., the wrong path terminator or waypoint transition is used, this must also be reported since the aircraft flight path will be affected.

6.17 MINIUM EQUIPMENT LIST

6.17.1 Where there are minimum system requirements for PBN approvals, the operator MEL must reflect the requirements e.g., dual systems for oceanic operations or map displays with operations including curved flight paths.

6.17.2 The operators MEL needs to be revised to reflect the aircraft configuration and the operations being undertaken.

6.17.3 The interdependencies between systems needs to be reflected in the MEL to ensure that all system required functionalities are considered when applying the provisions of the MEL. This is particularly significant for GNSS where the Terrain Awareness and Warning System (TAWS) and Automatic Dependent Surveillance – Broadcast (ADS-B) systems require GNSS inputs to operate.

6.18 TRAINING

6.18.1 An operator may elect to use the services of a third-party training provider.

6.18.2 Details of these provider's should be included in the Operator's check and training manual. Any deficiencies with a third-party course must be addressed by the operator.

6.18.3 Since a third-party training service provider is a subcontractor to the operator, the operator is responsible for the oversight of the training provided.

6.18.4 The operator should have details of their oversight provisions in their manuals with the subcontractors being included in the operator's audit program.

6.19 KNOWLEDGE REQUIREMENTS

6.19.1 Area navigation principles. Area navigation is the basis for all PBN operations, and the same general knowledge is applicable to all navigation specifications. Pilots with previous experience with area navigation operations may not be familiar with some of the more advanced features such as radius to fix (RF) legs, fixed radius transitions, required time of arrival or the application of vertical navigation.

6.19.2 Navigation system principles. Flight crews should have a sound knowledge of the navigation system to be used. The relevance of the navigation system to the particular PBN operation should be clearly established. For example, knowledge of inertial navigation and updating is relevant to requirements for some oceanic and remote navigation specifications, as is knowledge of GNSS for RNP APCH operations.

6.19.3 **Equipment operation and functionality**. Considerable variation exists in the operation of navigation equipment, cockpit controls, displays and functionality. Crews with experience on one type of installation or aircraft may require additional training on another type of equipment. Special attention should be paid to the differences

between stand-alone GNSS equipment and flight management systems with GNSS updating and degraded modes of operation such as loss of integrity or loss of GNSS.

6.19.4 **Flight planning.** Knowledge of the relevant aspects of each of the navigation specifications that relate to flight planning is required.

6.19.5 **Operating procedures.** The complexity of operating procedures varies considerably between different PBN operations. RNP APCH and RNP AR APCH require a detailed knowledge of standard operating procedures for both normal and non-normal operations.

6.19.6 **Performance monitoring and alerting.** Flight crew responsibilities with respect to performance monitoring and alerting provided by the navigation system must be clearly understood.

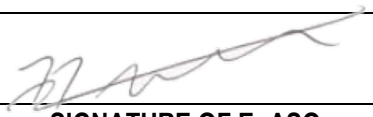
6.19.7 **Operating limitations.** Operating limitations (e.g., time limits, minimum equipment) vary both between and within the navigation specifications, and flight crews need to be able to recognize this and plan accordingly. Alternative means of navigation or other contingency procedures must be addressed. Flight crews need to be aware of the ATC procedures that may be applicable to the particular PBN operation.

6.20 FLIGHT TRAINING REQUIREMENTS

6.20.1 **Arrival**, approach and departure operations require flight training and the demonstration of flight crew competency. The amount of flight training required varies with the anticipated operation, previous training and experience. Ongoing and recurrent training should also be included.

6.20.2 *Arrival and departure*. Because arrival and departure operations require strict adherence to track during periods of higher workload and may be associated with minimum terrain clearance and reduced route spacing, crews need to be fully conversant with the operation of the navigation system. Consequently, unless crews have significant appropriate operational experience, simulator or flight training must be provided. Particular care should be taken when this type of operation is conducted with stand-alone GNSS equipment where functional limitations require crew intervention.

7. DOCUMENT AUTHORISATION

	Siphamandla Mhlanga Manager High/Low Cap	06 September 2022
SIGNATURE OF MANAGER:	**NAME IN BLOCK LETTERS**	**DATE**
REVIEWED & VALIDATED BY:		
	CAPT E MATABA	12-09-2022
SIGNATURE OF SM: FOD	**NAME IN BLOCK LETTERS**	**DATE**
APPROVED BY:		
	Neil de Lange E:ASO (Act.)	12 September 2022
SIGNATURE OF E: ASO	**NAME IN BLOCK LETTERS**	**DATE**

END