

Technical Guidelines O1 - PBN

Guidelines for RNP APCH operations

also known as RNAV(GNSS)

Edition N°2

Operational guidelines
to conduct RNAV(GNSS) approaches
LNAV, LNAV/VNAV and LPV

Addressee:

Aircraft Operators, airplane and helicopter pilots, training organizations

Ressources, territoires, habitats et logement
Énergies et climat
Prévention des risques
Développement durable
Infrastructures, transports et mer

**Présent
pour
l'avenir**

Contents

1	INTRODUCTION.....	3
2	REFERENCE DOCUMENTS AND TERMINOLOGY	3
3	OPERATIONAL CRITERIA.....	4
3.1	Selection of aerodromes during pre-flight planning	5
3.2	Determination of operational minima.....	6
3.3	GNSS coverage and availability of the RAIM function (or equivalent)	7
3.4	Operational procedures	8
3.5	Occasional operational procedures.....	9
3.6	Crew training	12
4	APPROVAL– ACCEPTANCE	14
4.1	Public Transport	14
4.2	General aviation	14
5	DOCUMENTATION – CONTENT OF FLIGHT MANUAL	15
5.1	For French operators and pilots holding a license issued by the DGAC	15
5.2	For Foreign operators	15
5.3	Flight Manual.....	15
6	SPECIAL PROCEDURES	16
7	APPENDICES	18
7.1	Regulations concerned by the RNAV(GNSS) guide:.....	18
7.2	CONVENTIONAL APPROACH, OVERLAY AND RNAV(GNSS).....	19
7.3	PHRASEOLOGY ASSOCIATED WITH RNAV(GNSS) APPROACHES	20
7.4	NEW MINIMA – CDFA.....	21
7.5	USE OF BARO VNAV – ASSOCIATED RISKS, PRECAUTIONS FOR USE.....	22
7.6	SDF.....	25

1 INTRODUCTION

The ICAO has asked States to implement the operations described in the PBN manual (Doc 9613). RNP APCH approach procedures, published under the name RNAV(GNSS)¹, will therefore become more generally adopted in the coming years.

- This guide is published in order to help operators assimilate the specifications of RNP APCH navigation, which deal with RNAV(GNSS) approaches, and the associated implications. It does not supersede the existing regulations covering this subject.
- This guide sets out good practices for planning and carrying out the various types of approaches published under the name RNAV(GNSS). It highlights certain requirements that can be found either in EU OPS or in the EASA AMC.
- This guide is intended for public air transport operators, aerial work and general aviation operators and pilots operating aircraft (aeroplanes and helicopters) certificated for this type of approach, as well as IFR schools and training centres.
- **Caution:** This guide does not deal with "RNP **AR** APCH" approach procedures, generally referred to as RNAV(RNP), which require a particular operational approval process in accordance with EASA AMC 20-26.

2 REFERENCE DOCUMENTS AND TERMINOLOGY

- ABAS: Aircraft Based Augmentation Systems
- Aerodrome: The term aerodrome, used in the ICAO generic sense of the term, also refers to landing areas specifically for helicopters, such as: helistop, helipad and heliport.
- AIC 06/12 concerning the Implementation of RNP APCH type instrument approach procedures commonly called RNAV(GNSS) approaches
- AMC 20-27 AIRWORTHINESS APPROVAL AND OPERATIONAL CRITERIA FOR RNP APPROACH OPERATIONS (RNP APCH) including APV Baro-VNAV operations
- AMC 20-28 NPA 2009-04 AIRWORTHINESS APPROVAL AND OPERATIONAL CRITERIA FOR RNAV GNSS APPROACH OPERATIONS to LPV minima using SBAS
- Operational Directive F-2012-02 "Carrying out RNP APCH approach procedures and associated training"
- **APV:** APproach Procedure with Vertical Guidance
- FPA: Flight path Angle.
- **LPV:** Localizer Performance with Vertical Guidance
- PBN: Performance Based Navigation, Doc 9613 ICAO manual defining the RNAV and RNP navigation specifications.
- RNP(APCH) / RNAV(GNSS): The ICAO terminology (PBN Manual) which designates the RNAV(GNSS) approaches is RNP APCH. However, as these approaches are published under the name RNAV(GNSS) or RNAV(GPS), the RNAV(GNSS) terminology is used in this guide.
- RNAV/GNSS system: terminology used in the guide to designate the system used for RNAV(GNSS) approaches. This term covers both GNSS systems and multi-sensor RNAV (FMS) systems using GNSS. The criteria for eligibility of systems for RNAV(GNSS) operations is described in the certification documents (EASA AMC 20 or FAA AC 20). The corresponding terminology in the PBN is RNP system.
- SBAS: Satellite Based Augmentation System
- V/S: Vertical Speed

¹ The RNAV(GPS) name can also be found, particularly in the USA.

3 OPERATIONAL CRITERIA

An RNAV(GNSS) approach covers three possible types of approach procedure:

Non-precision approach	Identified on the IAC chart by the minima line	LNAV - MDA/MDH
APV BaroVNAV approach	Identified on the IAC chart by the minima line	LNAV/VNAV - DA/DH
APV SBAS approach	Identified on the IAC chart by the minima line	LPV - DA/DH

When published on the same RNAV(GNSS) chart, these three final approaches have an initial and intermediate approach, as well as a common missed approach.

a) non-precision approach - RNAV(GNSS) LNAV

RNAV(GNSS) LNAV approaches are not associated with a vertical track in space.

- Lateral guidance is by means of the RNAV/GNSS system and is based on GNSS positioning
- Vertical flight management is exactly the same as for non-precision approaches (VOR/DME, NDB, etc.), using either the V/S (vertical speed) or the FPA (flight path angle), or the (baro) VNAV function, depending on the operator's choice and the capability of the aircraft. In accordance with EU OPS, non-precision approaches meeting CDFA criteria must be carried out using the CDFA technique. See CDFA appendix on this subject.

For a non-precision RNAV(GNSS) / LNAV minima approach: The operator must comply with the requirements of EASA AMC 20-27 (chapter 10 and appendix 4)

b) APV BaroVNAV – RNAV(GNSS) LNAV/VNAV

- Lateral guidance is by means of the RNAV/GNSS system and is based on GNSS positioning
- Vertical guidance uses the (baro) VNAV function, for which the certification criteria are included in EASA AMC 20-27.

For an APV BaroVNAV (LNAV/VNAV minima) approach: the operator must comply with the requirements of EASA AMC 20-27 (chapter 10 and appendix 4):

c) APV SBAS – RNAV(GNSS) LPV

- Lateral and vertical guidance use the RNAV/GNSS system and are based on GNSS positioning using the GPS signal and the SBAS. The system certification criteria for this type of approach are included in EASA AMC 20-28. This is for example the WAAS in the United States and EGNOS in Europe.

To carry out an APV SBAS approach and benefit from LPV minima, the operator must conform to the requirements of EASA AMC 20-28 NPA 2009-04 (chapter 10 and appendix 3):

d) Initial and intermediate approach

An RNAV(GNSS) final approach procedure leading to LNAV, LNAV/VNAV or LPV minima, may be preceded by either an initial and intermediate T or Y approach, or by an initial and intermediate RNAV1 approach (generally preceded by an RNAV1 STAR), or by radar guidance as is the case on most of the large airport platforms.

- To be able to carry out an intermediate T or Y approach (in this case, the final, initial and intermediate approaches are published on the same chart) the operator should refer to AMC 20-27.
- To carry out the initial and intermediate RNAV1 approach, the operator should refer to the documents concerning PRNAV (RNAV1) TGL-10 (as AMC 20-16 is still being prepared).
- For radar guidance, refer to the chapters of this guide and to the chapters of AMC 20-27 and AMC 20-28.

3.1 Selection of aerodromes during pre-flight planning

Today, according to AMC 20-27, an RNAV(GNSS) approach can be selected at the destination.

Concerning the alternate aerodrome:

1. When application of the operational regulations² requires no alternate destination aerodrome: the destination aerodrome must be accessible³ by means of a conventional approach (non RNAV(GNSS)).
2. When application of the operational regulations¹ requires at least one alternate aerodrome: The alternate aerodromes must be accessible² by means of a conventional approach (non RNAV(GNSS)).
3. An RNAV(GNSS) approach cannot be used to select an alternate aerodrome at take-off.
4. For APV SBAS (LPV), the previous requirements apply, unless the airspace authority concerned does not so require. These requirements apply in French airspace (AIC A-2011-03).

² Comply with sections OPS 1.295, MIN 2.295 or MIN 3.295

³ Accessible means availability of the minima for flight planning as defined in OPS 1.297, MIN 2.297 or MIN 3.297.

3.2 Determination of operational minima

3.2.1 LNAV minima

The MDH/A selected by the operator must not be less than the greater of the following values:

- MDH/A corresponding to the aircraft category* if published by the authority in charge of the aerodrome;
- OCH/A (obstacle clearance height) corresponding to the aircraft category*;
- 300ft.

The RVR is determined by applying the tables in appendix 1 (new) to EU OPS 1.430.

*Note: for helicopters, use category H if published, otherwise aeroplane category A.

3.2.2 LNAV/VNAV minima

The DH/A selected by the operator should not be less than the greater of the following values:

- DH/A corresponding to the aircraft category* if published by the authority in charge of the aerodrome;
- OCH/A (obstacle clearance height) corresponding to the aircraft category *;
- 250ft

The RVR is determined by applying the tables in appendix 1 (new) of EU OPS 1.430.

*Note: for helicopters, use category H if published, otherwise aeroplane category A.

3.2.3 LPV minima

The DH/A selected by the operator should not be less than the greater of the following values:

- DH/A corresponding to the aircraft category* if published by the authority in charge of the aerodrome;
- OCH/A (obstacle clearance height) corresponding to the aircraft category*;
- 250ft⁴

The RVR is determined by applying the tables in appendix 1 (new) of EU OPS 1.430.

*Note: for helicopters, use category H if published, otherwise aeroplane category A.

⁴ The EU OPS today limits the DH of an LPV procedure to 250ft but in the United States, some are already published with a DH of 200ft. With the IR OPS (EASA document which is to replace the EU OPS, the minimum DH of an LPV will be 200ft

3.3 GNSS coverage and availability of the RAIM function (or equivalent)

It is up to the operator to ensure that there is GNSS coverage for the flights he is planning.

To ensure GNSS coverage, software and tools available on the Internet can be used (e.g. Augur tool).

The operator can also use GNSS NOTAMs: Three types of NOTAM are to be considered:

- GPS NOTAMs: concerning the operating status of the GPS constellation.
- RAIM NOTAMs: concerning the unavailability of the RAIM autonomous integrity monitoring function. These NOTAMs are supplied for each aerodrome for which an RNAV (GNSS) approach is published, leading to LNAV or LN AV/VNAV minima.
- EGNOS NOTAMs: concerning the unavailability of the LPV procedure with regard to the performance of the EGNOS system. These NOTAMs are supplied for each aerodrome for which an RNAV (GNSS) approach leading to LPV minima is published.

During pre-flight planning,

1. For an LNAV or LNAV/VNAV approach

The operator must ensure the availability of the RAIM function (or any equivalent function) at the estimated time of arrival (ETA) +/-15 minutes, using either the RAIM prediction NOTAMs or the on-board equipment prediction tool (or software performing the same function as that of the on-board equipment).

In this latter case, information about any possible satellite unavailability must be input into the predictive programme.

- For some avionics architectures, RAIM prediction may only be required in certain cases (depending on the availability of the constellation) and must be detailed in the appropriate sections of the supplement to the flight manual (AFM).
- In the case of GNSS systems comprising a RAIM function using barometric altitude data, and when this altitude data is not automatically transmitted to the GNSS system, the pilot must enter the appropriate altitude settings by hand (generally at the IAF or 30 NM from the destination aerodrome).
- If a RAIM prediction is required, a further AIM check can be made by the crew before starting the approach, if the estimated time of arrival (ETA) differs from that estimated during the pre-flight planning by more than 15 minutes. This check is run automatically by the ETSO/TSO C129a Class A1, 2NM equipment before the FAF.

2. For an LPV approach

- The operator must ensure the availability of the procedure by using the SBAS NOTAMs (in Europe EGNOS NOTAMs).
- To make an APV SBAS (LPV) approach, no RAIM prediction is required, because integrity is managed directly by the SBAS geostationary satellites.

3.4 Operational procedures

3.4.1 Prior to commencing the approach procedure

In addition to the usual final approach procedures, and before commencing the approach (before the IAF), the pilot shall check that the correct procedure, including missed approach, has been loaded, by comparison with the approach charts. This check shall concern the following points:

- The sequence of the various waypoints: the procedure contains all the waypoints indicated in the approach to be carried out and these waypoints are in the same order as on the published chart concerning the procedure.
- The reasonableness of the tracks and distances of the various approach segments and, for the final approach segment, its length and route.

Note: This at least involves checking the flight path displayed on the navigation screen (ND, MFD,...) against the approach chart.

- The final angle of descent in the case of APV BaroVNAV, LPV approaches, or if the (Baro) VNAV function is used.

Procedures for use of the (Baro) VNAV function.

See appendix 7.5 Use of Baro VNAV – Associated risks, precautions for use

Case of radar guidance:

According to the information published in the AIP, for certain approaches, the air traffic controllers can provide radar guidance to the final approach segment prior to the FAF. In this case, the RNAV/GNSS system must be capable of indicating the horizontal deviation relative to the extended final approach segment, in order to facilitate interception of the extended final approach segment. Guidance leading to interception of the final axis less than 2NM before the FAF should not be accepted.

- Manual input of the coordinates into the GNSS system by the pilot for use in the terminal area is not authorised.
- "Direct to" clearances to the IF can be accepted provided that the resulting track change does not exceed 45°, as the aircraft must not intercept the final segment less than 2NM from the FAF, in order to ensure stabilisation of the final flight path.
- "Direct to" clearances to the FAF must not be accepted.
- "Direct to" clearances to a waypoint which does not belong to the procedure must not be accepted.

3.4.2 RNAV(GNSS) approach clearance and associated phraseology

As of the first radio contact with approach air traffic control, RNAV approach clearance is requested by the pilot after checking that it is possible.

Basic phraseology of the pilot and then ATC for an RNAV(GNSS) approach on runway 26:

<i>Pilote : Clermont approach, Regional QB, requesting RNAV approach RWY 26</i>
<i>ATC : Regional QB, Clermont approach, cleared for RNAV approach RWY 26</i>

See Phraseology Appendix for other examples

3.5 Occasional operational procedures

Occasional procedures suited to the architecture of the navigation system, the failures and alarms linked to the RNAV/GNSS equipment and to the display system, must be developed by the operator on the basis of the information supplied by the aircraft manufacturer (AFM, FCOM, etc.).

In the event of a redundant or complex installation (e.g. multi-sensor), partial or multiple failure situations must be envisaged and the associated procedures developed⁵.

3.5.1 Missed approach

Go-around must take place in each of the following cases⁶:

LNAV, LNAV/VNAV and LPV approaches

- Loss of the function checking the position integrity or position error alarm (e.g.: GPS Primary loss, Unable RNP, RAIM loss/not available, RAIM position error/alert, etc.)
- Suspected database error.
- Loss of RNAV/GNSS guidance (case of architectures without lateral deviation indicator in the PFD).
- Discrepancy between the two RNAV/GNSS devices for an installation certified with two systems.
- Excessive technical error (excessive deviation⁷ noted on the lateral deviation indicator)

⁵ Unless otherwise mentioned on the approach charts, RNAV(GNSS) approaches are not authorised in DME/DME RNP 0.3. This is a point to be considered when developing procedures associated with failure situations.

⁶ This must not rule out the option for the captain to continue the approach if he considers this to be the safest alternative (e.g. the crew has sufficient visual references to continue with the approach).

⁷ The horizontal deviation must be limited to half the RNP (0.15Nm on the final approach segment, 0.5Nm on the intermediate segments). Brief overshoots (up to the RNP value) are tolerated, in particular during and just after turns.

LNAV/VNAV and LPV approaches

- In the event of loss of vertical guidance (even if lateral guidance is still displayed)
- Excessive flight technical error (excessive deviation⁸ observed on the vertical deviation indicator)

Case of LPV to LNAV reversion

For LPV approaches, some systems allow LPV to LNAV reversion if the vertical signal is lost or degraded. In this case, if LPV to LNAV reversion takes place before the FAF/FAP, the crew can envisage continuing with the approach to the LNAV minima. However, if reversion occurs after the FAF/FAP, go-around is required, unless the pilot has in sight the visual references required to continue the approach.

Unless otherwise instructed by ATC, a missed approach must be performed according to the published procedure. The missed approach must thus be carried out in compliance with the following requirements:

3.5.1.1 Missed approach protected by conventional navigation means

If the missed approach flight path is based on conventional navigation means and the approach has to be aborted for a reason independent of the operation of the RNAV/GNSS system, the crew may continue to use the RNAV/GNSS system to follow the missed approach procedure, while monitoring its guidance with the required conventional means.

3.5.1.2 Missed approach protected by dead-reckoning navigation

If the missed approach flight path is based on dead-reckoning navigation and if the approach has to be aborted for a reason independent of the operation of the RNAV/GNSS system, the crew may continue to use the information from the RNAV/GNSS system to follow the missed approach procedure.

3.5.1.3 RNAV protected missed approach (not relying on conventional radionavigation means)

If the missed approach flight path is an RNAV procedure and if the approach has to be aborted for a reason independent of the operation of the RNAV/GNSS system, the crew must continue to use RNAV/GNSS system guidance to follow the missed approach procedure.

Extraction procedure

If the missed approach path is a RNAV procedure:

The operator may have defined previously in their procedures, an emergency procedure for the case where the loss of RNAV guidance during the approach does not allow to follow the missed approach procedure provided for the considered runway. This emergency procedure will consist in following a dead reckoning path, allowing to reach a sufficient altitude and taking into account:

- obstacles
- aircraft performance
- airspace restrictions

⁸ The vertical deviation should be limited to 75 ft in the case of APV Baro VNAV

3.5.2 RNAV protected holding pattern

Different RNAV(GNSS) holding patterns can be published:

- Holding pattern for systems with the hold function capability
- Holding pattern for systems without the hold function capability

a) Systems with the hold function:

All the holding patterns published may be performed using this function. They are coded and incorporated into the navigation systems databases. The length of the outbound leg is defined by distance information.

b) Systems without the hold function:

Holding patterns can be performed manually, unless otherwise specifically mentioned (hold function required) on the approach chart.

They will be performed using the basic functions of the RNAV/GNSS systems:

- suspension of sequence of Waypoints to be overflowed
- activation of the Waypoint acting as the basis for the holding pattern
- selection of the radial showing the inbound leg (e.g. by means of the OBS, etc.)
- compliance with the end of the outbound leg, which can be defined either by a time or by a distance from the active Waypoint (holding pattern reference).

3.6 Crew training

3.6.1 Additional training

Additional training is required for all public transport or general aviation pilots, pursuant to OPS 1.950 for public air transport in aeroplanes, pursuant to section 6.5.2 of the appendix to the Order of 21st March 2011 for public air transport in helicopters, and pursuant to section 4.1.3 of the appendix to the Order of 24th July 1991 for general aviation (all aircraft operated for aerial work or private purposes), in the event of a change in equipment or procedures.

Consequently, a pilot or crew may only be considered apt to conduct this type of approach if they have received additional approved RNAV(GNSS) training (see 3.6.2).

Training in pre-flight planning and carrying out RNAV(GNSS) approaches is not currently included in all the initial IR(A) et IR(H) instrument rating training programmes. However the training organisations using RNAV(GNSS) certificated aircraft in IR training are encouraged to include an RNAV(GNSS) training module (see 3.6.2)

Any candidate for a first IR(A) or IR(H) or F-N/IR(A) qualification or renewal or proficiency checks in accordance with FCL 1-2.210 appendice 2, FCL 1-2.240 and FCL 1-2.295 appendice 2, FCL 1.240 appendice 3 section 3.B, FCL 2.240 appendice 3 section 6 are encouraged to receive approved RNAV(GNSS) training from an FTO or TRTO organisation or an operator, completely and satisfactorily (see 3.6.2).

When extending a class or type rating combined with IR qualification, the examiner may check the RNAV(GNSS) competence.

3.6.2 Content of the training

Before performing RNAV(GNSS) approaches, the pilots must be familiar with the basic principles, limitations and special functions of the RNAV/GNSS system. They must also be familiar with the operation and particularities of the RNAV/GNSS equipment installed on the aircraft. Finally, they should be aware of the operational procedures applicable to pre-flight planning and performance of these approaches.

The minimum training shall comprise a theoretical part and a practical part.

Each shall be dispensed in accordance with a programme approved by the authority.

The operator shall define the risks and threats linked to the type of procedure (TEM, Threat and Error Management)

For example (non-exclusive list):

- Barometric error
- Effect of temperature
- Identification and visualisation of the vertical profile
- Situation of the aircraft in space (BaroVNAV profile vs ILS look alike profile)
- Equipment deterioration
- Change in approach type (LNAV, LNAV/VNAV, LPV)
- Presentation of information
- Characteristics of aircraft systems
- Operational specificities (QFE or metric operation)
- etc.

3.6.2.1 Ground Theory training

Theory training must cover at least the following points:

- Operating principles of the RNAV/GNSS system.
- Any limitations of the system.
- Characteristics (class, performance, etc.) and functionalities of the RNAV/GNSS equipment used, including alarms and error messages.
- Characteristics of RNAV(GNSS) approach procedures.
- Indication of different types of GNSS approaches (LPV, LNAV/VNAV, LNAV, etc.).
- Selection of different types of approaches (SBAS channel, etc.).
- Rules applicable to pre-flight planning (selection of aerodromes, NOTAMs, RAIM prediction).
- Normal and occasional procedures, in particular all the missed approach cases (including the corresponding phraseology).
- Manual or automatic holding pattern procedures.
- Databases (characteristics, checks and utilisation).
- Applicable minima.
- Use of approach documentation (charts, identification of the approach procedure, representation and characteristics of the various turning points).

3.6.2.2 Practical training

3.6.2.2.1 Ground Practical training.

Practical training on the ground, which lasts a minimum of two (2) hours, must cover the handling and utilisation of an RNAV/GNSS navigation system comparable to that installed on the aircraft.

For the purposes of this training, the equipment used may be presented or installed on a computer, a simulation bench, an FSTD (flight simulation training device), or an aircraft on the ground.

3.6.2.2.2 Practical training in-flight or on an FSTD

This training will be given:

- either on an aircraft of the same class or the same type as that used operationally;
- or on a simulator, representative of the aircraft used operationally.

In both cases, the RNAV/GNSS equipment used shall be comparable with that used operationally.

This training shall comprise at least four (4) RNAV(GNSS) approaches.

Two (2) of them shall comprise an abort following simulation of a degraded situation (loss of RNAV capability or RAIM alarm for example), followed by performance of a missed approach.

This training will be performed with a crew composition corresponding to the minimum requirement set by the operator or the flight manual, for performance of these RNAV(GNSS) approaches.

3.6.2.3 Certification

The head of the organisation dispensing the training will certify complete and satisfactory performance of the training by each pilot. The pilot may have to present without undue delay, his attestation upon request by an authorised representative of DGAC.

3.6.3 Additional requirements

Additional requirements for public air transport pilots and flight crews:

- The operator shall ensure that each pilot undergoes a check-out before conducting this type of approach. This check-out can be replaced by satisfactory training on an STD and/or in-flight as required above.
- RNAV(GNSS) approaches are to be included in the recurrent training and checking programmes required by section OPS 1.965 for public air transport in an aeroplane and by section 6.5.3 of the appendix to the Order of 25th February 1985 for public transport in a helicopter, with the same requirements as those concerning conventional non-precision approaches.

The recurrent training and checking programme shall comprise theoretical refresher training, experience feedback and a sufficient number of RNAV (GNSS) approaches to ensure that the pilot's proficiency is currently satisfactory.

4 APPROVAL– ACCEPTANCE

4.1 Public Transport

To conduct an RNAV(GNSS) approach, the airline must have been approved by its supervisory authority. The AOC (Air Operator's Certificate) must refer to the approved operational capability per type of aircraft.

Heading: Special authorisations / navigation specification for PBN operations: RNP APCH LNAV and/or LNAV/VNAV and/or LPV

4.2 General aviation

Pilots holding licenses issued by DGAC

Before conducting an RNAV(GNSS) approach, the aircraft must have been certificated for this type of approach and the pilot must have undergone training approved by the DGAC in accordance with chapter 3.6.

Other pilots

To conduct an RNAV(GNSS) approach, the aircraft and its crew must fulfil the directive of the authority issuing the pilot's license.

5 DOCUMENTATION – CONTENT OF FLIGHT MANUAL

The aircraft flight manual (AFM) specifying the RNP capability of the aircraft must be included in the dossier, to ensure that for the airworthiness part, the aircraft is eligible for RNAV(GNSS) operations.

5.1 For French operators and pilots holding a license issued by the DGAC

- The certification criteria applicable to RNAV(GNSS) approaches leading to LNAV and LNAV/VNAV minima are described in document "AMC 20_27" (AIRWORTHINESS APPROVAL AND OPERATIONAL CRITERIA FOR RNP APPROACH OPERATIONS (RNP APCH) including APV Baro-VNAV operations)
- The certification criteria applicable to RNAV(GNSS) approaches leading to LPV minima are described in document "AMC 20_28" NPA 2009-04 (AIRWORTHINESS APPROVAL AND OPERATIONAL CRITERIA FOR RNAV GNSS APPROACH OPERATIONS to LPV minima using SBAS)

5.2 For Foreign operators

The aircraft "RNP APCH" capability shall have been certified by the aircraft registration authority.

5.3 Flight Manual

Public air transport operators must amend their flight manuals to include:

- A description of the operation of the RNAV/GNSS navigation system used.
- The procedures applicable to pre-flight planning.
- The normal procedures in flight, including the distribution of tasks (flight crew).
- Occasional procedures.
- Database integrity monitoring measures.
- The list of the various types of RNAV(GNSS) approaches that could be conducted.
- The pilot and crew training requirements.

All operators must also amend the check-lists, QRH and Minimum Equipment Lists (MEL) (or the document used for this purpose in general aviation) in order to incorporate the use of RNAV/GNSS equipment for this type of approach.

6 SPECIAL PROCEDURES

Certain RNAV(GNSS) procedures can comprise particularities (in particular deviations from the international procedure design standards). Before conducting an approach such as this, the operator must, in addition to the requirements of this guide, analyse the particularities and familiarise himself with any special requirements published in the AIP of the country in which the aerodrome is located.

Depending on the results of this analysis, the operator shall set up a formal procedure evaluation process before authorising its use. This process should make provision for:

- Performance of this procedure, either by means of the aircraft in VFR conditions, or on an approved class D simulator with daytime display containing the up-to-date visual scene specific to the aerodrome in question. The purpose is to evaluate the controllability of the procedure and detect any incompatibilities between the coding of the procedure and the aircraft's guidance system.
- Referral to the operator's (operational) authority for its opinion.
- Development of an additional pilot training programme to take account of the problems involved in the performance of RNAV(GNSS) approaches with particular characteristics.

ANNEXES

7 APPENDICES

7.1 Regulations concerned by the RNAV(GNSS) guide:

- The Performance-based Navigation (PBN) Manual (Doc 9613)
- ICAO Appendix 6
Part I – 9th edition July 2010 - International Commercial Air Transport – chapter 7.2.2
Part II – 7th edition July 2008 - International General Aviation - chapter 2.5.2.2
- Commission Regulation (EC) N°859/2008 of 20th August 2008 (EU OPS)
Sections 1.225, 1.230, 1.243, 1.290, 1.295, 1.297, 1.340, 1.400, 1.405, 1.430, 1.950, 1.965.
- Arrêté du 23 septembre 1999 concerning technical conditions for helicopter operation by a public air transport company (OPS 3).
Article 4.
Appendix: sections 3.225, 3.230, 3.290, 3.295, 3.297, 3.340, 3.400, 3.405, 3.430, 3.950, 3.965.
- Arrêté du 24 juillet 1991 concerning the conditions for the use of general aviation civil aircraft (aerial work and private use).
Article 1, second paragraph.
Appendix: chapter IV, sections 4.1.2 and 4.1.3.1 - chapter V, section 5.5.
- Arrêté du 20 mars 1998 concerning the use of aircraft operational minima in general aviation (aerial work and private use).
Article 1.
Appendix: sections MIN 2.225, 2.295, 2.297, 2.400, 2.405, 2.430.

Note: if any of the above provisions are modified by the publication of new Orders (Arrêtés), the new provisions shall then be applied.

7.2 CONVENTIONAL APPROACH, OVERLAY AND RNAV(GNSS)

A. Conventional approach (non-precision): publication example **VOR/DME RWY27**

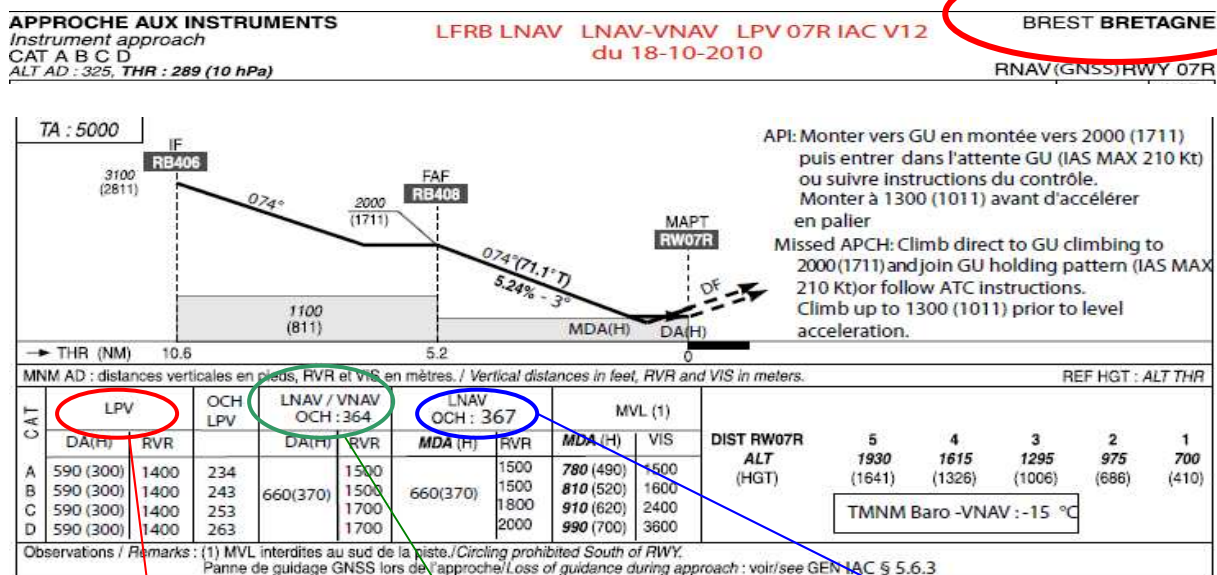
- ⇒ The primary navigation means is the VOR DME associated with the approach
- ⇒ Performance is possible using the FMS, **provided that** the VOR DME raw data are displayed to check the consistency of the information given by the FMS. In the event of a difference between the FMS flight path and the VOR axis, the latter must be followed or a go-around performed in the event of excessive deviation from the VOR axis.

B. Overlay approaches: publication example **VOR/DME or GPS RWY 27** (mainly found in the United States)

- ⇒ The primary navigation means is either the VOR DME or the GNSS.
- ⇒ To perform them with the RNAV/GNSS system, the operator must comply with the requirements of EASA AMC 20-27

C. RNAV(GNSS) approaches: publication example **RNAV(GNSS) RWY 07R**

- ⇒ The primary navigation means is the GNSS (either GPS + ABAS or GPS + SBAS).
- ⇒ See the following diagram for interpretation of the various minima cases (LNAV MDA; LNAV/VNAV DA; LPV DA)



APV SBAS (AMC 20-28)

Lateral guidance: GNSS + SBAS

APV BaroVNAV (AMC 20-27)

Lateral guidance: GNSS

Non-precision approach (AMC 20-27)

Lateral guidance: GNSS

Vertical plane management: CDFA (use of V/S, FPA or (Baro) VNAV for aircraft so

7.3 PHRASEOLOGY ASSOCIATED WITH RNAV(GNSS) APPROACHES

In terms of phraseology no distinction is made between the different types of RNAV(GNSS) approaches (no distinction according to LPV, LNAV/VNAV, or LNAV minima)

From the first radio contact with the approach control unit, RNAV approach clearance is requested by the pilot after checking that it can be carried out.

- o Basic phraseology used by the pilot and ATC to perform an RNAV(GNSS) approach to runway 26:

Pilote : *Clermont approach, Regional QB, we request an RNAV approach on runway 26*

ATC : *Regional QB, Clermont approach, RNAV approach authorized on runway 26*

- o Phraseology in case of loss of RNAV capability:

Pilote : *AFR 070, RNAV impossible due to equipment*

- o Pilot/ATC phraseology in case of radar guidance followed by a final RNAV (GNSS) approach

Pilote: *De Gaulle approach, AFR070, we request [final] RNAV approach on right runway 08*

ATC : *AFR070, De Gaulle approach, leave BALOD heading 030, radar guidance for [final] RNAV on right runway 08.*

Then

ATC : *AFR070, De Gaulle, turn right heading 060, descend to 4000ft QNH 1026, [final] RNAV approach authorized on right runway 08.*

- o Pilot/ATC phraseology in the event of initial and intermediate RNAV1 approach (ODRAN 1A in the example) with an identifier followed by an RNAV(GNSS) final approach

Pilot: *Orly approach, AFR070, we request [final] RNAV approach on runway 06*

ATC : *AFR070, Orly approach, ODRAN 1A for [final] RNAV authorized on runway 06*

Then

ATC : *AFR070, Orly approach, [final] RNAV approach on runway 06*

Guidelines for RNP APCH operations also known as RNAV (GNSS)

7.4 NEW MINIMA – CDFA

The new minima entered into force in July 2011. The new minima take into account of the CDFA flight technique required by the regulations (EU OPS) for conducting all the non-precision approaches and not only RNAV(GNSS) LNAV approaches.

This appendices is now handled in a specific operational guideline: ST-GuideO2-NewMinima

7.5 USE OF BARO VNAV – ASSOCIATED RISKS, PRECAUTIONS FOR USE

There are two possible situations for using the (Baro) VNAV function:

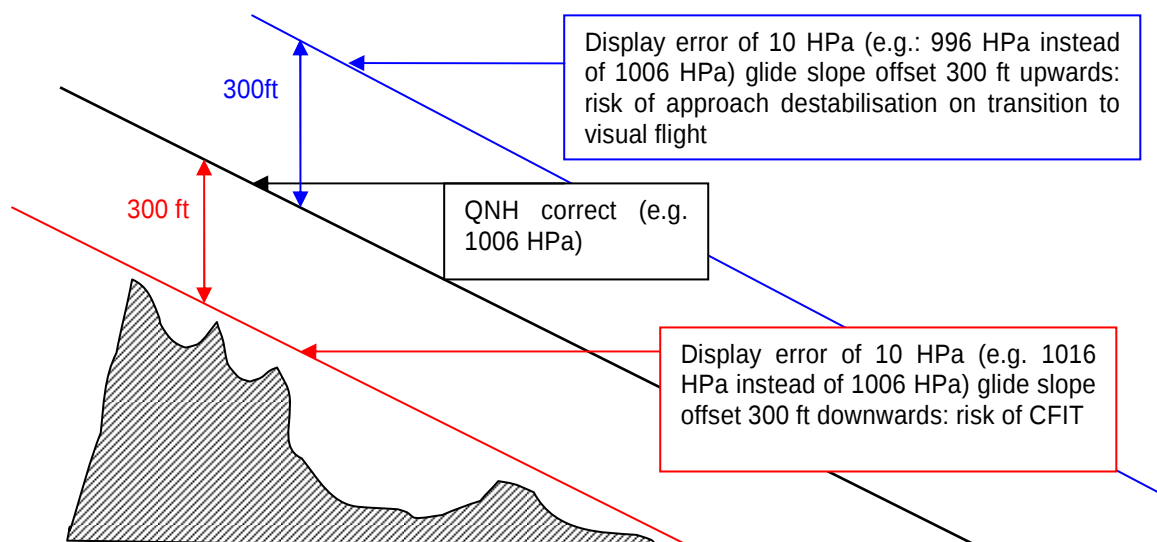
1. Either to manage the vertical plane of non-precision approaches (to help with CDFA)
2. Or to carry out an APV BaroVNAV (required function)

In both cases, the pilots must take the usual precautions:

7.5.1 Altimeter setting

The pilots must know that the vertical flight path in Baro VNAV is influenced by altimeter setting errors. These errors may not be detected by a cross-check between the altimeter reading and the values given on the approach chart (altitude – distance verification).

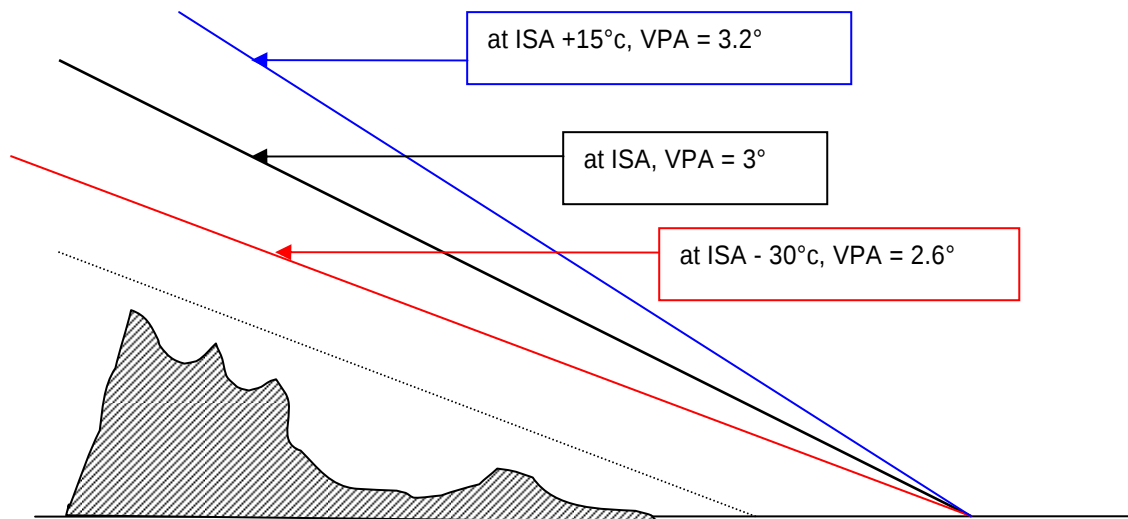
RNAV(GNSS) LNAV/VNAV approaches are not authorised if there is no local altimeter setting (local QNH).



It is also important for the pilot to have recent altimeter setting information. The crew should thus request confirmation of the altimeter setting before passing the FAF.

7.5.2 Effect of temperature

If the temperature is significantly different from the ISA value, the Baro VNAV vertical plane will be different from the nominal plane of the procedure, with no effect on the information presented to the pilot. Thus a vertical slope based on the altimeter information will be shallower in cold weather and steeper in hot weather without there being any vertical deviation displayed on the pilot's vertical deviation indicator. (see diagram)



Example of the effect of temperature on a BaroVNAV vertical profile for an aerodrome situated at sea level. For a nominal slope (black line) of 3°, the actual slope will be 2.6° for ISA -30 (red line) and therefore closer to any obstacles, and will be 3.2° for ISA+15°(blue line) and thus steeper.

7.5.3 Temperature correction

On certain avionics equipment, it is possible to enter the temperature at the airport, so that the system can correct the vertical profile in Baro VNAV.

7.5.4 Case of temperatures below minimum temperatures published on the approach chart

On the RNAV(GNSS) approach charts for which there is an APV BaroVNAV approach (presence of LNAV/VNAV minima), a minimum temperature use is published.

As a general rule, pilots should not use the FMS (Baro)VNAV function when the temperature is below the temperature limit published on the approach chart.

The associated non-precision approach (LNAV) can be performed but management of the vertical plane should use another flight technique (vertical speed (V/S) or flight path angle (FPA)).

Pilots should then apply the cold temperature corrections necessary to comply with the different published minimum altitudes, i.e.:

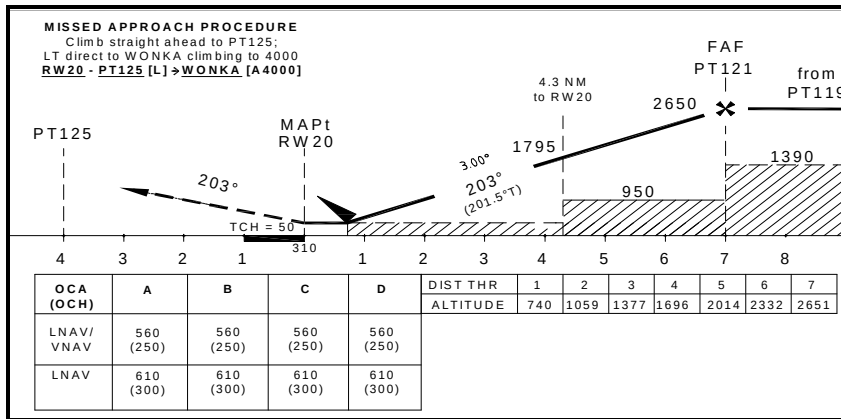
- The altitude heights for the final segment (FAF, SDF, altitude/distance table);
- The MDA/H; and
- The V/S and/or FPA values.

1. If temperature variations cannot be compensated for by avionics system, APV BaroVNAV approach is not allowed when temperature transmitted to the crew is lower than limit temperature published on the approach chart.

2. If temperature variations can be compensated for by avionics system, APV Baro VNAV approach is allowed but pilots must then apply cold temperature corrections required to comply with DA/DH.

7.6 SDF

Certain charts can publish descent markers (step down fix - SDF).



The SDF are used to "eliminate" an obstacle, when designing the non-precision procedure, to determine the landing minima (in the example above, it enables the minima to be reduced from 950 ft to 250 ft), it is associated with the minimum flight path altitude and its distance from the MAPt (1795ft and 4.3 Nm respectively in the above example). The pilot must then ensure that he does not descend below this altitude at a distance greater than the MAPt (in the above example the aircraft must not pass below 1795 ft before 4.3 Nm from the MAPt).

SDF are not used for APV BaroVNAV or APV SBAS approaches. However, as these approach procedures are generally published with a non-precision RNAV(GNSS) LNAV minima approach, some SDF may be published even though LNAV/VNAV and/or LPV minima are already published on the approach chart.

Verification of the altitude/distance at passing the SDF is only required for pilots using the LNAV minima.

Ressources, territoires, habitats et logement
Énergies et climat Développement durable
Prévention des risques Infrastructures, transports et mer

**Présent
pour
l'avenir**

Direction générale de l'Aviation

Direction de la sécurité de l'Aviation
civile

50, rue Henry Farman
75 720 Paris Cedex 15

Tél. : xx xx xx xx xx
Fax : xx xx xx xx xx