RNAV Approaches

RNAV approaches have been made possible by the widespread availability of high performance RNAV systems on all types of aircraft and in particular by the use of GNSS.

RNAV Approaches are described by a series of waypoints, legs, speed and altitude constraints stored in the onboard navigation database. Safety is improved by providing pilots with better situational awareness than on conventional Non-Precision Approaches (NPA) thereby reducing the risk of controlled flight into terrain (CFIT). Better access can also be provided to runways that are not equipped with precision approach and landing systems.

Today's Instrument Approach procedures are divided into two distinct types:

- **Precision Approach (PA)** uses an instrument landing system (e.g: ILS, GBAS, MLS) which provides both lateral and vertical guidance on a stabilised continuous descent path.

- **Non-Precision Approach (NPA)** uses conventional navigation aids such as NDB, VOR and DME to bring the aircraft to a point where the runway is in view and a visual landing can be performed. NPA procedures, which do not include vertical guidance, used to require multiple level-offs at step down fixes during the approach.
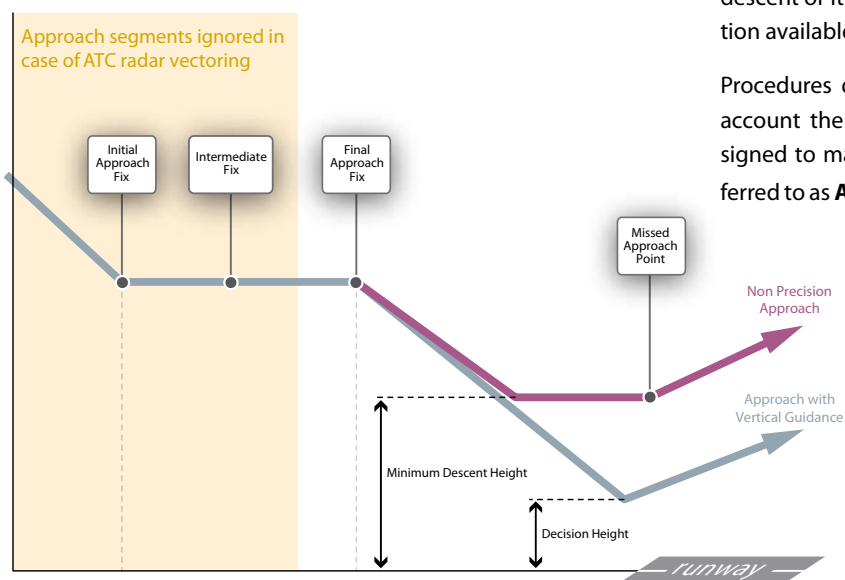
CFIT Reduction

A large proportion of CFIT accidents occur in the final approach segment of NPA. There are several improvements that can be made to conventional NPA procedures:

The **lateral RNAV (LNAV)** capability already improves flight crew situational awareness.

The Dive & Drive descent technique, which is prone to error, should now rarely be used. Operators are expected to fly NPA using the **Continuous Descent Final Approach (CDFA)** technique where a continuous descent is maintained along a vertical path.

This can be based on a manual calculation of the required rate of descent or it can make use of the vertical navigation (VNAV) function available on many aircraft.

Procedures design criteria have been developed that take into account the onboard **VNAV** capabilities. RNAV approaches designed to make use of both lateral and vertical guidance are referred to as **Approach Procedures with Vertical guidance (APV).**

Approach segments ignored in case of ATC radar vectoring

Initial Approach Fix

Intermediate Fix

Final Approach Fix

Missed Approach Point

Non Precision Approach

Approach with Vertical Guidance

Minimum Descent Height

Decision Height

runway

RNAV:	aRea NAVigation
APV:	Approach with Vertical Guidance
LNAV:	Lateral Navigation
VNAV:	Vertical Navigation
LP:	Localiser Performance
LPV:	Localiser Performance with Vertical Guidance
MDA/H:	Minimum Descent Altitude/Height
DA/H:	Decision Altitude/Height

TYPES of RNAV$_{(GNSS)}$ Approaches

RNAV Approaches are published on charts with the title **RNAV$_{(GNSS)}$ RWY XX.**

These approach charts can have several descent minima depending on the kind of RNAV approach to be flown:

- **NPA** - an approach without vertical guidance flown to the LNAV or the LP MDA/H.
- **APV Baro** - an approach with barometric vertical guidance flown to the LNAV/VNAV DA/H.
- **APV SBAS** - an approach with geometric vertical guidance flown to the LPV DA/H

The 36th ICAO Assembly in 2007 passed a resolution encouraging States to implement approach procedures with vertical guidance (Baro-VNAV and/or SBAS) for all instrument runway ends, either as the primary approach or as a back-up for precision approaches by 2016. This resolution was reiterated at the 37th Assembly in 2010, where RNAV (GNSS) NPA was also recognised as an acceptable alternative where APV cannot be implemented.

APV Baro(*) is a vertically guided approach that can be flown by modern aircraft with VNAV functionality using barometric inputs. Most Boeing and Airbus aircraft already have this capability meaning that a large part of the fleet is already equipped.

APV SBAS is supported by Satellite Based Augmentation Systems such as WAAS in the US and EGNOS in Europe to provide lateral and vertical guidance. The lateral guidance is equivalent to an ILS localizer and the vertical guidance is provided against a geometrical path in space rather than a barometric altitude. RNAV (GNSS) approach to LP minima is also supported by SBAS.

Note (*): ICAO APV Baro procedure design criteria now allow the use of SBAS for vertical guidance. This shall however be explicitly approved by the publishing ANSP before such an operation can be conducted.
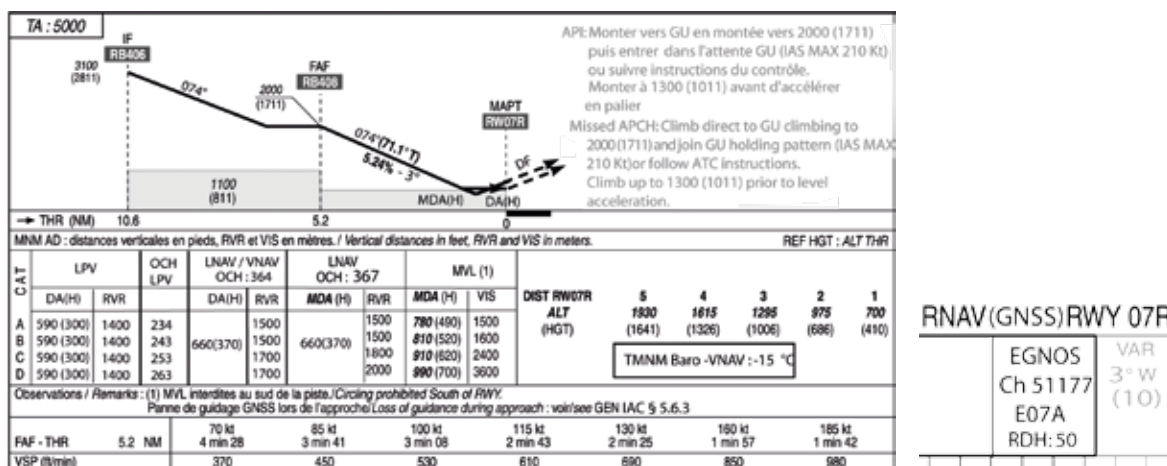
ICAO PBN Terminology

The ICAO PBN Manual (Doc 9613) classes these approaches as **RNP APCH** operations. With its new edition in 2012, the PBN Manual covers RNAV (GNSS) approaches to all 4 minima (LNAV, LP, LNAV/VNAV and LPV).

There is also an **RNP AR APCH** navigation specification which covers a different type of approach specifically for use in challen-ging obstacle environments or where tight separation requirements exist. These procedures are published on charts with the title **RNAV$_{(RNP)}$ RWY XX.** They require a particular RNP approval for the aircraft, special crew training and usually Flight Operational Safety Assessment (FOSA).

Contact

The EUROCONTROL **RNAV Approach implementation Support Group (RAiSG)** coordinates the activities necessary for the implementation of RNAV Approach procedures in ECAC.

For more information, please contact the EUROCONTROL NAVIGATION User Support Cell at:
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