



Federal Aviation Administration

Required Navigation Performance (RNP) Approaches (APCH)

The expansion of Global Positioning System (GPS)-based instrument approach procedures (IAP), a key element of NextGen's Performance Based Navigation (PBN) initiative, provides benefits for pilots and stakeholders. This fact sheet will focus on the most common navigation specification called "RNP Approach (RNP APCH)" and titled Area Navigation (RNAV), "RNAV (GPS) Rwy XX". These procedures offer several lines of minima to accommodate varying levels of aircraft equipage and airport environments without requiring additional navigation equipment at the airport. This promotes airport efficiency and access, pilot flexibility and operational safety.

Note: The other approach navigation specification, or set of aircraft and aircrew requirements needed to support a navigation application within a defined airspace, is reserved for complex airspace and called RNP Authorization Required Approach (RNP AR APCH). Authorized pilots of certified aircraft can fly IAP based on RNP AR APCH, which are titled "RNAV (RNP) Rwy XX".

With Vertical Guidance

Localizer Performance with Vertical Guidance (LPV)

Pilots can take advantage of the improved accuracy of Wide Area Augmentation System (WAAS) lateral and vertical guidance with LPV minima. Pilots fly to a decision altitude (DA) and the angular guidance provided increases in sensitivity as the aircraft gets closer to the runway (or point in space for helicopters). To aid pilots in transferring their ILS flying skills to these vertically guided RNP approaches, lateral and vertical deviations are nearly identical at similar distances. As of February 2016 there are over 3,600 LPV lines of minima serving 1,762 airports.

Lateral Navigation/Vertical Navigation (LNAV/VNAV)

Horizontal and approved vertical guidance is also available to the LNAV/VNAV line of minima. LNAV/VNAV utilizes approved vertical guidance offered by WAAS and approach certified baro-VNAV systems. Minimums are published as a DA. When conducting these operations to a DA, the pilot must adhere to any procedural temperature limitations unless employing temperature compensation under an authorization from ATC. As of February 2016 there are over 3,500 LNAV/VNAV lines of minima serving 1,669 airports.

CATEGORY	A	B	C	D	E
LPV DA	829/24 200 (200-½)				
LNAV/VNAV DA	1017/40 388 (400-¾)				
LNAV MDA	1120/24	491 (500-½)	1120/40 491 (500-¾)	1120/50 491 (500-1)	1120/60 491 (500-1¼)
CIRCLING	1160-1	531 (600-1)	1160-1½ 531 (600-1½)	1240-2 611 (700-2)	1240-2½ 611 (700-2½)
HUNTSVILLE INTL-CARL T. JONES FIELD (HSV)					

Without Vertical Guidance

Localizer Performance without Vertical Guidance (LP) and Lateral Navigation (LNAV)

Pilots may use WAAS-enabled GPS systems for LNAV, but WAAS is not mandatory. WAAS equipment is mandatory for LP. LP minima are added in locations where terrain or obstructions do not allow publication of vertically guided LPV minima. Lateral sensitivity increases as an aircraft gets closer to the runway (or point in space for helicopters). LP is not a fail-down mode for LPV; LP and LPV are independent. LNAV is not a fail-down mode for LP. LP will not be published with lines of minima that contain approved vertical guidance (i.e. LNAV/VNAV or LPV).

Both LP and LNAV lines of minima are Minimum Descent Altitudes (MDA) rather than DAs. It is possible to have LP and LNAV minima published on the same approach chart. Based on criteria, designers should only publish LP minima if it provides lower minima than LNAV. As of February 2016 there are over 600 LP lines of minima at 436 airports and over 6,000 LNAV lines of minima at 2,747 airports.

CATEGORY	A	B	C	D
LP MDA	1660-1 295 (300-1)			NA
LNAV MDA	1800-1	435 (500-1)	1800-1¼ 435 (500-1¼)	NA
CIRCLING	1900-1	506 (600-1)	1900-1½ 506 (600-1½)	NA
MESA/FALCON FIELD (FFZ)				

Important Terms and Concepts

Advisory Vertical Guidance

Depending on the manufacturer, WAAS-enabled GPS units might provide advisory vertical guidance in association with LP or LNAV minima. The manufacturer should use a notation to distinguish advisory vertical guidance (e.g. LNAV+V). The system includes an artificially created advisory glide path from the final approach fix to the touchdown point on the runway. The intent is to aid the pilot in flying constant descent to the MDA. LNAV+V is not the same as LNAV/VNAV or LPV. Pilots must use the barometric altimeter as the primary altitude reference to meet all altitude restrictions. Advisory vertical guidance is not required and is an optional capability.

Approved Vertical Guidance

Approved vertical guidance provides operational benefit permitting the use of the LPV, LNAV/VNAV and ILS lines of minima. WAAS vertical guidance can support LPV minima as low as 200 feet AGL. Approved vertical guidance is available on LNAV/VNAV minima and existed before the WAAS system was certified. At that time, only aircraft equipped with a flight management system (FMS) and certified baro-VNAV systems could use the LNAV/VNAV minimums. Today, LNAV/VNAV minima may be flown using approved WAAS equipment. Pilots must use the barometric altimeter in a similar fashion for ILS, LPV, and LNAV/VNAV minima.

Barometric Aiding (Baro-Aiding)

Barometric aiding is an integrity augmentation that allows a GPS system to use a non-satellite input source (e.g. the aircraft pitot-static system) to provide vertical reference and reduces the number of required satellites from five to four. Baro-aiding requires four satellites and a barometric altimeter input to detect an integrity anomaly. The current altimeter setting may need to be entered into the receiver as described in the operating manual. Baro-aiding satisfies the Receiver Autonomous Integrity Monitoring (RAIM) requirement in lieu of a fifth satellite.

Barometric Vertical Navigation (Baro-VNAV)

Baro-VNAV uses barometric altitude information from the aircraft's pitot-static system and air data computer to compute vertical guidance for the pilot. The specified vertical path is typically computed between two waypoints or an angle from a single way point. When using baro-VNAV guidance, the pilots should check for any published temperature limitations on the approach chart which may result in approach restrictions.

For more information please refer to the following:

Aeronautical Information Manual (AIM) Paragraphs: 1-1-17, 1-1-18, 5-1-16, and 5-4-5

Advisory Circulars:

AC 90-105 (), *Approval Guidance for RNP Operations and Barometric Vertical Navigation in the U.S. National Airspace System and in Oceanic and Remote Continental Airspace*

AC 90-107 (), *Guidance for Localizer Performance with Vertical Guidance and Localizer Performance without Vertical Guidance Approach Operations in the U.S. National Airspace System*

It is the pilot's responsibility to use the current barometric altimeter setting to ensure compliance with altitude restrictions for all approach operations.

