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Garmin USA, Inc. 1200 East 151st Street Olathe, Kansas 66062 PH: 913/397.8200 Fax: 913/397.8282

GNS 480/CNX80 User Newsletter

Sixth Edition
12/2/04
Paul Damschen, GNS 480/CNX80 Certification Manager

In this special edition for the holidays:

1. CNX80 vs. GNS 480
2. Determining availability of vertical guidance on approaches
3. WAAS Coverage Increases
4. GTX 32/33 STC
5. WAAS and RNP

GNS 480 vs. the CNX80

We've had several people question the new name of the CNX80 and thought they needed to upgrade to the GNS 480 for future support and growth capability. Just to emphasize and clarify: the GNS 480 is identical to the CNX80 with the exception of the bezel and the Garmin logo and model number on it. All STC documentation and future system upgrades will be applicable to both systems.

Vertical Approaches and the GNS 480

A substantial percentage of version 2.0 CNX80 upgrades have taken place and are going into service as of this writing. Many new GNS 480's have been placed into service in the last few months as well. The response has been very positive from customers and industry groups with the implementation of thousands of vertical guidance approaches and other new features found in version 2.0. We believe this will add a high degree of safety when flying instrument approaches, as you will be able to have vertical guidance and avoid multiple step downs. In general, you should find it the exception to the rule to not have vertical guidance during a GPS approach while in the U.S. with WAAS corrections available.

As of this writing about 60% of the CNX80 population has completed upgrade to v2.0 and are back in the hands of customers. When the unit comes in we also complete the rework of the display backlight transformer at the same time. The initial workload has been reduced quite a bit and if you had concerns about getting your unit returned in a timely fashion due to the initial crush of people getting their systems upgraded, now is a good time to do it.

We have also discovered the advantages of having an LPV approach here at our Salem facility. Our localizer failed a couple of weeks ago during a period of time when we had a lot of stagnant air in the Willamette Valley, with the associated low visibility and fog problems that come with this kind of weather system.

With only a single ILS for precision approaches here, most traffic was unable to make it into Salem with only a non-precision approach. Only aircraft equipped with the GNS 480 had the ability to fly the LPV precision approach and make it into Salem during those days when the localizer was out of service and the RVR in the tank. We don't know how quickly navaids get fixed in your part of the country, but in general we've noticed it takes awhile around here, especially at secondary airports. Having WAAS GPS provides GNS 480/CNX80 pilot's with primary navigation and a degree of autonomy from ground based navaids not experienced in aviation before now.

What's with all these different approach names?

There have been a number of questions regarding when and where you will receive vertical guidance from the GNS 480. Much of this was discussed in the prior newsletter, but there are exceptions to the general rules and some examples would be helpful, especially given the vagaries of the Jeppesen charts and almost no usable information in the NOS charts. Bear in mind that all these approaches can be selected and flown the same way, even though they have different depictions and names associated with them. While the data can be confusing, flying an approach with vertical guidance is actually straightforward in terms of execution. We can review the basics here along with the approach nomenclature that goes along with these approaches:

1. For vertical guidance on the approach you must a) select a GPS approach (either standalone or overlay, and not a VOR or NDB only approach) from the database and b) be in WAAS coverage with adequate horizontal and vertical position accuracy. Currently only approaches within the continental US have the data to support vertical guidance.
2. Vertical guidance is provided for three distinct types of approaches as shown on the approach charts: LPV, Lnav/Vnav, and Lnav approaches with advisory vertical guidance. From a pilot's perspective, all approaches with vertical guidance behave similarly and can be flown using the same techniques as you would an ILS approach.
3. If the GNS 480 can provide vertical guidance on the approach, it will be labeled as an Lnav/Vnav or LPV approach when you select it from the database (green text under the approach name). Lnav approaches that have advisory vertical guidance will also be shown as Lnav/Vnav approaches in the database, but will have no Lnav/Vnav minimums shown on the approach chart. In this case Lnav MDA minimums are controlling.
4. Verify the Lnav/Vnav or LPV annunciator is green (on the MAP or NAV page) once past the IAF. If it is amber, the GPS constellation may not be able to support vertical guidance and the GNS 480 will downgrade to an Lnav only approach 30 seconds prior to the FAF if the vertical protection limit is inadequate at that point. In rare instances if an Lnav approach cannot be supported, you will be notified and be required to abort the approach. The 480 will fall back to terminal limits of 1NM to provide guidance to the missed approach, or other waypoint as cleared by ATC.

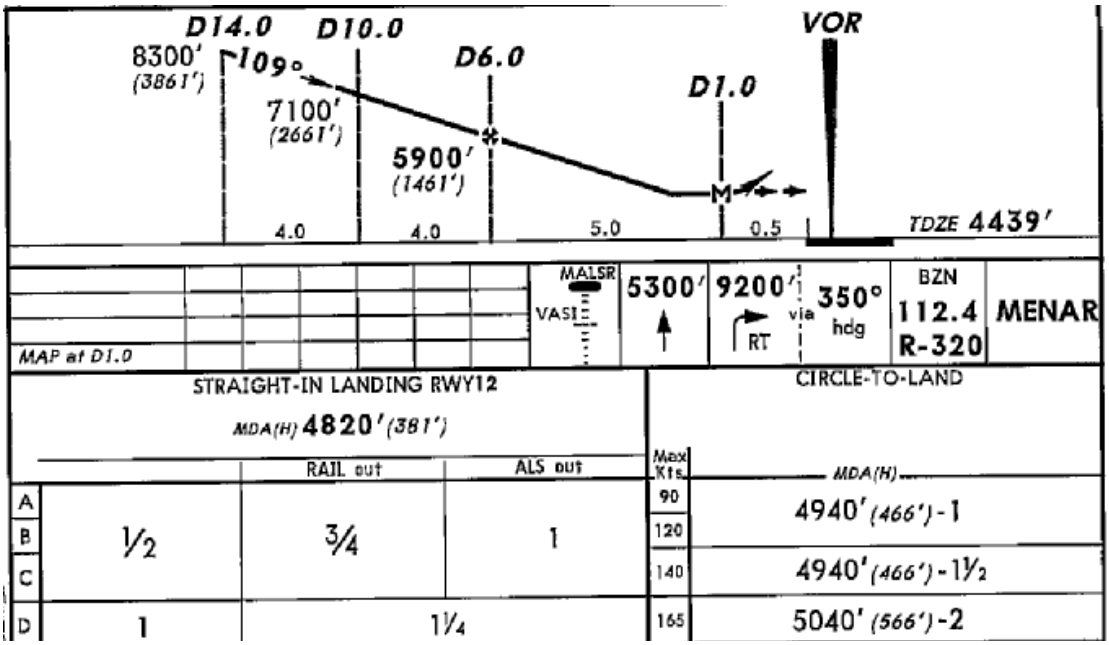
Unfortunately NOS approach charts do not depict advisory vertical guidance as do most Jeppesen charts. At this point we have not found a reliable method of determining if an approach supports advisory vertical guidance from the NOS charts, and have made requests for changes making the charts more definitive. Whether or not this request will be successful at all is anyone's guess. The most reliable method of knowing if vertical navigation will be displayed is from the GNS 480 itself, as it displays this data when the procedure is selected. You may survey the GPS approaches at your destination to see which approaches support vertical navigation without inserting one into your flight plan by using the Procedure key and selecting APPR at your destination.

Vertical guidance does not terminate at the MDA or DA. This is consistent with other systems (notably Flight Management Systems) that project vertical paths to a point in space. The vertical path extends to either the MAP or runway end waypoint depending upon the type of approach, and terminates at the altitude associated with the waypoint. This data is drawn from the database. Typically the altitude associated with the waypoint is 50' AGL for an LPV precision approach, and higher for non-precision approaches. The path angle will typically be in the 3 degree range, but may be adjusted for obstacles as a glideslope might be.

It should also be noted that the limitation for local altimeter setting is not required as it is for aircraft with FMS/Baro-Vnav systems. The vertical path does not require baro-correction and is generated solely by use of GPS altitude. Local altimeter settings are only required to determine MDA or DA on your altimeter.

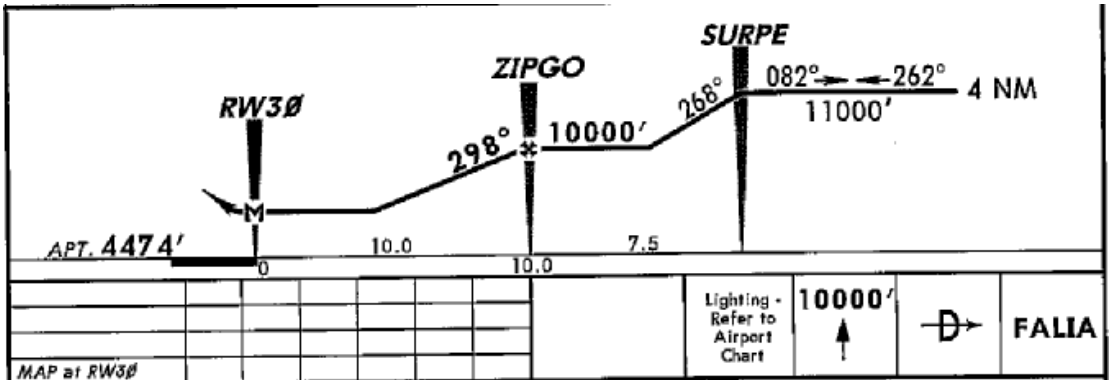
Some Approach Examples

To look at approaches with and without vertical guidance I'll use some examples at KBZN (Bozeman, MT), KCVO (Corvallis, OR) and KSLE (Salem, OR).

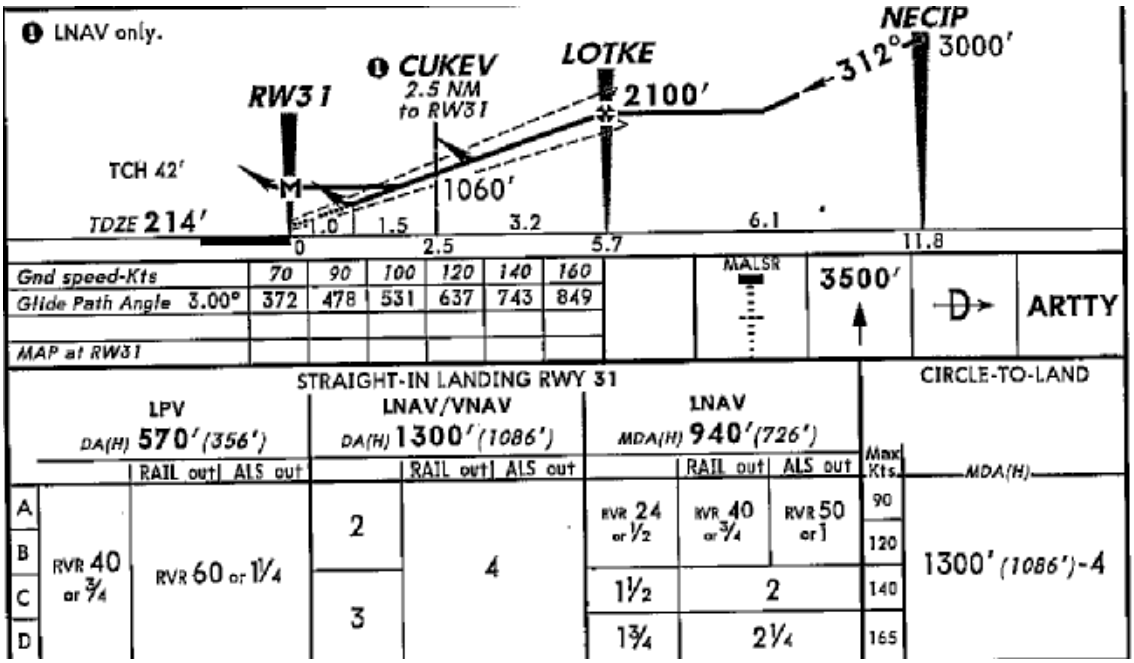


This approach is the GPS 12 approach to KBZN and has a couple of interesting twists to it. The profile view of the GPS 12 approach shows a vertical path with a solid black line, but no mention of an Lnav/Vnav minimum. In this case, the MAP is offset from the end of the runway by a half mile. This waypoint MADSE, is the D1.0 fix shown above and is the MAP which is the point the vertical path will be built from.

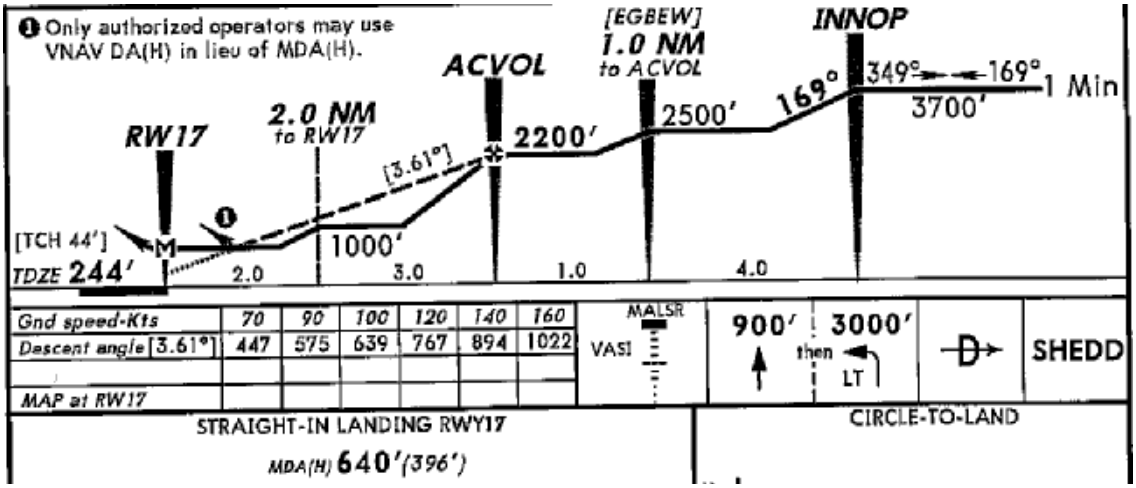
In this case the vertical descent from EHUTU, the D6.0 fix, to the MAP is a shallow descent of just over 1000' with a lengthy leg of 5 NM to accomplish it in. Although not depicted, the database has a standard vertical profile of 3 degrees associated with the MAP. Obviously you will not intercept this path at the FAF at 5900'. If you remain at 5900' MSL and continue on past the FAF, you will intercept the vertical path outside of the MAP which will carry you down to the MDA at MADSE. At this point you can either continue and land with the runway in sight or go missed. At MADSE the vertical guidance will be discontinued and the VDI flagged. The GNS 480 will then sequence to the first leg of the missed approach.



Shown above is an excerpt from the RNAV GPS-A circling approach to KBZN. This approach is an Lnav only approach and does not support vertical guidance, since the RW30 waypoint does not have an altitude and vertical path associated with it. The VDI will remain flagged throughout the approach. If this approach depicted a light grey dashed line vertical profile at ZIPGO, then the GNS 480 would support vertical guidance.



Above is a portion of the RNAV 31 Z approach at KSLE which may be flown as an LPV, Lnav/Vnav, or Lnav only approach. The LPV precision approach is depicted in the same fashion as an ILS would be in the profile view. The additional waypoint (CUKEV) is only applicable if flying the approach as an LNAV approach, and the additional missed approach arrows are depicted for each type of approach. Notably this approach has an odd situation where the Lnav/Vnav minimums are higher than the Lnav minimums as the result of TERPS obstacle clearance criteria. In this case a tower penetrated the vertical path causing the Lnav/Vnav minimums to be raised. You should also remember that if vertical guidance for an Lnav/Vnav approach can be supported, so can the LPV. In this case, there would never be a reason to fly the Lnav/Vnav approach, just the LPV. If WAAS could not support the LPV approach, an Lnav only approach would be possible.



Above is a portion of the GPS 17 approach at KCVO. This is an example of an approach that will provide advisory vertical guidance to you. The light gray dashed line at the FAF (ACVOL) depicts the intercept of the advisory vertical path. The GNS 480 will annunciate Lnav/Vnav when the approach is selected. This indicates that a vertical path is provided. It is not, however an Lnav/Vnav approach, and does not have Lnav/Vnav minimums. The MDA of 640' remains controlling in this case for a straight in landing.

The VDI will become active when ACVOL becomes the active waypoint, and the intercept of the path may be treated in the same fashion as the LPV vertical path. Interim step down altitudes constraints will be met if you remain on the vertical path. The vertical guidance will terminate at the runway end waypoint, and level off at the MDA should be anticipated. Although not depicted on this approach, most advisory vertical guidance profiles are designed to intercept a VDP. You may either continue to the MAP at MDA or initiate the missed approach climb when you reach MDA on the vertical path and/or the VDP.

New STC to support Garmin GTX 33/32 Mode S/C transponders

A new STC to support the installation of remote mount transponders to the GNS 480 and CNX80 is available. New software interfaces were added to allow the GNS 480 to interface to Garmin's line of Mode C and Mode S panel mount and remote mount transponders in v2.0. The GTX 330 and GTX 33 will allow the display Traffic Information Services (TIS) traffic data. The GTX 33 may be remote mounted and will feed both the GNS 480/CNX80 and MX20 displays with TIS traffic data.

The expanding WAAS envelope and selecting WAAS corrections off and on

Currently FAA is adding additional monitoring stations in Alaska, and negotiations are being completed for additional stations in Mexico as well. The implementation of these stations will greatly increase the size of the WAAS correction envelope to include the majority of Alaska, Canada, and northern Mexico. It is also expected to cover a large part of the Gulf of Mexico.

To support European, Australian, or other areas outside of WAAS coverage, the ability to manually select WAAS corrections off and on has been provided. This forces the WAAS engine to revert to a fault detection and exclusion method of determining satellite health. This has been verified as having resolved the issues associated with WAAS corrections in areas outside the continental US.

If you operate in Europe or other remote areas outside of WAAS coverage, we recommend you select WAAS corrections off to eliminate any Loss of Integrity messages you might receive.

WAAS and RNP

RNP is something that has been coming along for awhile and will start to affect the National Airspace System (NAS) in the next few years. If you are not familiar with the term, RNP (Required Navigation Performance) is slated to become a standard for determining whether or not you can accept a particular clearance for a route or a procedure. For example, if you were to file for an RNAV RNP airway with an RNP requirement of 5 NM, then you could file for this particular route if you have the primary navigation equipment necessary and your navigation accuracy is better than 5 NM. Another example would be an instrument approach which would require an RNP of 0.3 NM or better. There is a direct correlation between these RNP values and the capabilities inherent in the GNS 480.

The plan is to use the GNS 480 on some new airways in southeast Alaska allowing the pilot to file for significantly lower MEA's. In most cases we're talking about dropping the MEA from as high as 10,000 MSL to 3-4,000 MSL, given the fact that the MEA is no longer dictated by VOR placement and reception limitations. Only equipment certified to TSO C146a for primary navigation and meeting the RNP requirements may file for these routes at these MEA altitudes. TSO C129a GPS equipment cannot be used for primary navigation on these routes. Based upon the success of this new application, additional airways may have their MEA's adjusted in the continental US, and Garmin GNS 480 customers will be able to take advantage of this. We are in the process of reviewing the requirements and working with FAA to determine whether the GNS 480 can meet all RNP requirements. We'll keep you advised of progress in this area, and let you know when you will be able to take advantage of this capability with your GNS 480, although we expect this to take a year or two for this initial trials to be completed.

Other Topics

Please let us know if you have any questions or comments. Several of you have and we do appreciate the feedback allowing us to directly address your questions, concerns, and providing you with the best customer service we can.

We certainly hope your Christmas and New Years Holidays are enjoyable. We would like to extend our appreciation for your support of Garmin products and we hope the coming year is a prosperous one for each of you.

Please feel free to contact us by visiting www.garmin.com and send your comments to the technical support group (support.salem@garmin.com): Attention Paul Damschen, Flight Test.

This Newsletter along with the first five editions can be found on the web at: www.garmin.com/products/gns480/