WAAS GPS NOW IN N2108E

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So, wow, N2108E now has a new avionics stack, which includes a Garmin GNS-430W navigator. This is a very capable navigation unit with many new features. Many of our RAFA members are familiar with using the basic non-WAAS GNS-430. This document will inform those members of some changes to expect when using the WAAS-enabled GNS-430W. Some of the changes will be noticed only in IFR use of the unit, but many apply to VFR usage as well.

Garmin has published a small document which highlights some of the differences, and that document can be found at *http://www.garmin.com/manuals/GPS500W_WhatisNewwiththe400W-500WSeries.pdf* . I will not attempt to duplicate that document here, rather I will try to supplement it. Also, details of the various features discussed herein and in the Garmin document can be read about in more detail in the GNS430 Pilots' Guide available at *http://www.garmin.com/manuals/GNS430W_PilotGuideandReference.pdf* . Also download the trainer/simulator at *http://www8.garmin.com/support/download_details.jsp?id=3532* .

Most of you know that WAAS stands for Wide Area Augmentation System, and is an FAA program which added special satellites to the GPS constellation to enhance accuracy of the system using correction signals generated based on measurements by ground stations and then broadcast from the WAAS satellites. This enhanced accuracy has enabled new aviation capabilities, most notably near-precision vertical guidance on instrument procedures. The FAA created a new Technical Standards Order, TSO C146a, for certification of these units. Non-WAAS units were certified under the older TSO-C129a.

One of the first differences you will notice when turning on the 430W for the first time is that it takes longer to get through self-test and be ready for use. One reason for this is that the self-test now includes a new feature, terrain and obstacle databases. This very nice feature has two display modes to show any terrain or obstacles that meet certain criteria relative to your flight path, and it can provide warning screens. Be aware that when these warning screens pop up, they obscure the navigation screen that was being displayed, and it takes a switch action on the 430W panel to kill the warning or to go to the obstacle screen. This can catch you unaware during some critical moment of a procedure. Flying near mountains, especially mountains with towers, can trigger these screens incessantly, creating quite a distraction. I have had them render the navigator nearly useless under some conditions. So if you are planning to fly through the Columbia River Gorge at 1000 ft or some such foolish thing, you might want to consider turning the warning screens off. Yeah, I know, it sort of defeats the feature, but you have to make tradeoffs.

Next you will notice that all the navigation data is updated much faster, five times a second versus once per second.

During the enroute portion of your flights, you will observe that the CDI scaling is now 2 nm full scale, rather than 5 nm as in the 430. The needle will be more sensitive because of this. You can make it more sensitive if you prefer.

Another new feature is "Parallel Track", with which you can laterally offset your route (if using a flight plan). I don't see much use for this feature.

"Dead Reckoning" is new, but is really only a backup "coast" mode if GPS navigation is lost for some reason. The unit continues to estimate position based on last known position, speed, and direction of flight. Obviously, this is of any value only if you continue to fly the same heading and speed. I don't know what happens if you reach a turnpoint during DR.

Turn anticipation now gives a ten-second countdown before the turn.

In the 430, integrity of the navigation solution was verified by RAIM. The 430W uses Fault Detection and Exclusion (FDE), an enhancement which can detect a bad satellite signal and exclude that satellite from the navigation solution. The 430W still performs RAIM, which is the Fault Detection part of FDE, but goes further and can exclude a bad signal to maintain integrity. Note that RAIM integrity is not the same as WAAS integrity. RAIM is a function performed on the basic GPS signals. WAAS integrity is determined within the WAAS system and WAAS integrity status is broadcast as part of the WAAS signals. Loss of WAAS integrity will not affect VFR operations but may be critical to IFR WAAS instrument approaches. If WAAS integrity is degraded, the unit will downgrade approaches from LPV to LNAV/VNAV to LNAV-only, depending on the severity of the degradation.

FDE is essential to obtaining certification for the 430W to be used as sole means of navigation under IFR. The manuals say that the unit is so certified. However, check the AFM Supplement. It says that, at present, the unit does not fully meet TSO C146a and is not certified as sole means of navigation. This is supposed to be fixed in a software update that supposedly will be available later in 2007. When the software update is installed, the AFM Supplement should be revised to eliminate the restriction. All this applies only to the GPS part of the navigator, not the conventional VOR/LOC/GS portion.

On GPS instrument approaches, even LNAV-only ones, the 430W uses a different method for setting CDI scaling. On the 430, scaling transitions from 1 nm terminal sensitivity to 0.3 nm approach sensitivity as you approach the FAF (or FAWP). Sensitivity remains constant on the final approach segment. The 430W uses the same 1 nm sensitivity in the terminal area prior to the FAF, but uses angular scaling similar to an ILS on the final approach segment. It will transition from 1 nm to 0.3 nm or 2 degrees, whichever is smaller, as you approach the FAF, and becomes more sensitive as you approach the MAP.

The 430W has improved logic for Vectors To Final. It will remain in SUSPEND mode until the airplane is on the TO side of the FAF and is tracking within 45 degrees of the inbound course to the FAF.

OBS/SUSP behavior is different around the MAP. Be sure to read the manual.

Although not specific to the 430W, I will just note here that if you want to use the 430/430W to substitute for DME on an ILS/LOC-DME approach, you will find the LOC/DME waypoint (such as IMDQ) included in the VOR waypoint database.

For IFR usage of the 430W, the biggest (HUGE) new feature is vertical guidance (glide slope) enabled by WAAS. If current WAAS integrity permits, many approaches can be flown to LPV or LNAV/VNAV minima. The allowable approach type will be annunciated on the unit as LPV, L/VNAV, LNAV+V, or LNAV. The latter is a plain-old-GPS LNAV approach, but the unit provides vertical guidance on an advisory basis. The pilot is still responsible for observing any step-down fixes, although if s/he remains accurately on the advisory glide slope, fixes will be cleared. Not all LNAV-only approaches will have advisory vertical guidance provided by the unit, and there is no way to tell in advance which ones. If the procedure is coded such that the unit can provide the vertical guidance, it will do so and will annunciate LNAV+V. If it says LNAV, no vertical guidance will be provided. Note that, although intercepting the glide slope from below may be the best practice, the WAAS glide slope is not subject to the false lobe problem of ILS glide slopes. LPV and LNAV/VNAV minima are given as DA, and normal rules for observing decision altitudes apply. However, for advisory guidance on LNAV+V approaches, the minimum altitude is still a MDA and the MDA rules must be followed.

Rules for use of GPS in the National Airspace System are still evolving, and instrument pilots should remain informed. The subject is too lengthy to include in this document, and will be the subject of a subsequent one. AC90-100A is one of the main references for this subject. But let it be mentioned that the rules for using GPS to substitute for VOR, NDB, and DME have changed somewhat, and there are new rules for using GPS as substitute or alternate navigation. Also, using GPS on RNAV procedures (especially STARs and DPs) have changed. Flight planning and preparation often now includes the requirement to perform RAIM predictions and WAAS integrity determinations for the route of flight. The 430W trainer/simulator contains the proper software for these functions, and there are some FAA sites that can be used as well.