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CNX80 User Newsletter

Third Edition for the CNX80
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Arinc 424 Database Leg Types supported by the CNX80

This is a fairly technical subject, however one that should make sense to you at the conclusion of this topic. Arinc 424 is an industry standard that specifies the contents and format of the database that is used by all manufacturers of RNAV equipment. This includes basic GPS navigators as well as Flight Management Systems on corporate jets or air transport airplanes.

The basic database provided to manufacturers by Jeppesen typically has all waypoints, airways, departure procedures, arrival procedures, and instrument approach procedures embedded within it. The difference between most manufacturers is how much of the data in the database is utilized and what data is thrown away.

Depending upon the level of capability of a particular navigation system, some or most of this data may not be used. If a navigation system can only perform Direct-To waypoint functions, or provide basic waypoint to waypoint flight planning, then the only data that would be preserved for use by the customer would be the waypoints themselves. In the case of a full featured system such as the CNX80, the full set of data is preserved to allow the pilot to select data as necessary in order to provide complete flight planning and guidance to the pilot.

The leg types in the database are formatted in a variety of ways to comply with the various instructions and constraints typical in an instrument procedure.

There are many leg types in the database, which was required to comply with all the existing instrument procedures and instructions that exist. At the advent of the first glass cockpit designs the industry had to find a method of adapting the existing information in the approved instrument flight procedures and be able to display them and provide guidance for them in full featured electronic navigation systems. This allowed pilots to

have complete guidance using either a flight director or autopilot from takeoff rotation to the landing flare.

At this point there are over 20 different database leg types. The CNX80 is designed to interpret the database and discern between a simple waypoint to waypoint leg, or a leg which uses a specific heading until reaching an altitude constraint (i.e. fly heading 120 degrees until reaching 1000' MSL).

All published procedures and leg types are supported by the CNX80 and available to the pilot for flight planning. Not all leg types are currently supported with roll steering guidance however. Currently leg types that are heading based have no roll steering guidance and must be flown manually. Future software revisions will include this capability, but as of this writing the implementation date is unknown.

Currently leg types with the notation "pilot nav" require the pilot to manually fly the leg, and in all cases manually sequence to the next leg in the flight plan. The exception to this is heading to altitude legs, in which the CNX80 will automatically sequence since it knows aircraft altitude. We also are considering adding capability to reduce the number of manually sequenced leg types in the future as well and provide a more automatic method of navigation.

If you're interested in what those leg types are and how they are implemented, you can go to http://www.arinc.com/aeec/draft_documents/03-115.pdf This document has graphical depictions of the leg types with examples. Go direct to page 54 to cut to the chase.

VOR bearing calculations vs. bearing calculations on other database waypoints

On long distance Direct-To's using a VOR waypoint vs. another waypoint in the database, you will see a potentially significant difference in the bearing calculations even though the two waypoints may be quite close to each other. An example would be that if you were in Los Angeles and did a Direct To Kansas City Airport (KMCI) and then subsequently did a Direct-To the VOR on field (MCI) you would see a difference of over 20° in bearing to waypoint. Or, if you were given a heading to intercept a VOR radial and used OBS mode, you might see this difference if you were at the outer edge of the service volume of the VOR.

In older GPS equipment, we did not differentiate between VORs and other waypoints when calculating bearing to waypoint. However, this caused problems. Several customers squawked this because they used their GPS as an RNAV tool and if given a clearance to intercept a VOR radial and track inbound, they would use the GPS to accomplish this.

The problem came about when the GPS used calculated magnetic variation which is not the same as the VOR station declination. VOR's are not recalibrated on a regular basis and as the years go by the difference between station declination and actual magnetic variation may be several degrees before the station is recalibrated.

The upshot of this is that when given a clearance to track inbound on the 180 radial, a VHF nav radio would provide a different bearing to the station than a great circle bearing to the station using a calculated magnetic variation. This caused ATC to complain to the flight crew that they were not on course when the equipment showed them on course. The flight crew would then complain to us that something was wrong with the GPS because the 360 course to the VOR using a standard VHF nav radio was displaced from the same GPS course. At greater distances there is a more significant difference.

The solution was to use magnetic variation when intercepting courses to VOR's. Going back to our example, if you did a Direct-To as mentioned above, and were physically able to tune the MCI VOR, both would track identically. This feature is mentioned in the Pilot's Guide on page 13 in the OBS mode section.

V1.3 Update

V1.3 has been released and is shipping. This minor revision was done primarily to add additional Arinc 429 words to the Arinc serial bus to support EFIS installations. The additional data transmitted is detailed in section 2.8.10 of the latest revision of the installation manual, which can be downloaded from www.garminat.com under the document downloads section. We will post it as soon as the revision is FAA approved.

This version transmits all data required for most EFIS installs (aircraft position, guidance, wind calculations etc), with the exception of flight plan data for display on the EFIS moving map. Various EFIS systems require different formats and resolving this will require additional systems engineering and software revision. Please call tech support for additional information if you intend to drive an EFIS system with the CNX80.

Intercepting Airways where there is no database waypoint

There aren't very many places in the US anymore that have airways intercepting without a database waypoint at that location. However, there are a few and once in a while you might get a clearance to track outbound on one airway until intercepting another and there's no waypoint at the intercept. There is a user waypoint feature lets you accomplish this fairly quickly.

User waypoints can be defined by place/bearing/distance manually on the user waypoint page, but this can be time consuming. The easiest method is to make sure that airways (Jet or Victor as appropriate) are turned on in the moving map page and then press the CRSR to activate the Pan mode. At a fairly low range scale (20 NM or less for greater accuracy) use the knobs to put the "X" on the airway intersection and then press the "MRK" button to create a user waypoint at that point. You'll be taken to the User Waypoint page and the identifier of the waypoint will be at the top of the page. You may rename this waypoint to whatever you wish or use the default name.

In the flight plan, edit your flight plan and insert the waypoint after the termination of the last airway waypoint and then insert the first waypoint of the intercepted airway, then Execute. Here's an example clearance (refer to your Jepp Low Altitude enroute chart): You're cleared from the Madison, WI VOR (MSN) via V2 to BAE then fly outbound on V30 to intercept V7 to the Chicago Heights VOR (CGT) to land at Lansing Muni. We've built the user waypoint (we'll call it U0001, please ignore the fact that there's a waypoint in the database for the sake of this example as there's none identified on the low altitude en route chart), and we'll build the new flight plan as follows:

1. Insert the Origin and Destination airports (KMSN and KIGQ respectively)
2. Insert the first waypoint, MSN
3. Insert airway V2 to BAE
4. Insert the user waypoint U0001
5. Insert the waypoint PETTY
6. Insert airway V7 terminating at CGT
7. Execute the new flight plan.

That's it. You will need a valid GPS position to get a moving map and use the Pan mode if you do this prior to departure.

Other Topics

New Training Tools

There are two new training products available in the near term for CNX80 owners or users. Reproduction of these items for distribution will take three to six weeks.

The first, the CNX80 computer simulator (Windows only), is near completion and will be included on the revised CNX80 product CD. This will allow you to go through the CBT (Computer Based Training) material and run the simulator simultaneously on your computer for a more productive training session. A CD with both the CBT and CNX80 PC simulator is available from the Garmin catalog for $41. The simulator alone may be downloaded from the Garmin AT website for free. It's 11 MB in size, so be prepared for lengthy download time if you have a dial up internet connection.

We have also completed an in flight demonstration video of the CNX80 and MX20. This will be available as a stand alone DVD that you can play on any PC that has a DVD drive or your home DVD player. This DVD demonstrates some of the new features of V2.0, namely the LPV approach capability as well as some other new enhancements. We also demonstrate flight planning and real time execution of flight plan changes, holding etc, on the DVD. It will be available as an order item from the Garmin catalog for $25.

There is also a new module on the CBT which reviews the integration of features between the MX20 and CNX80. This revision of the CBT will be available by the end of February.

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.

Please feel free to contact us by visiting www.garminat.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 two editions can be found on the web at:
http://www.garminat.com/cnx_docs.shtml.