



The Chart Clinic – Database Series

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Technology has given us many new "gadgets" to make our life easier. We enjoy cell phones, e-mail, surfing the web, flying point to point using GPS and its "magic." Glass displays help us visualize our position better than we've ever had. That is the good news - but life is not as simple as it used to be.

Before GPS, when the FAA or other government authorities issued a new VOR approach procedure, you filed your revision and then when you flew the approach, you simply tuned to the VOR, set the course selector, and that was about it.

Now, when a new GPS approach is issued, you need to file the paper revision, make sure you

get the latest database update, and make sure you load the new database into your GPS in the airplane. Then when you fly the approach, you need to get the paper chart, get the airport identifier, access the airport identifier from the database in the GPS, find the list of approach procedures for the airport, select it, then look at the list of initial approach fixes, find out which IAF is appropriate for the direction you're coming from, then select the IAF and fly the approach.

Yes, GPS is a good thing - the navigation is more precise and VFR airports are now becoming IFR without anyone having to fund a ground-based navaid. Runways now have instrument approaches when they didn't before and straight-in landing minimums are now more common.

RNAV is GPS is RNAV

Back in the 1970s, the FAA began publishing RNAV approach procedures that were based on VOR DMEs and VORTACs. The "magic" of RNAV then was that you could move any VOR DME to any location you wanted as long as you were within range of the VOR DME. If the VOR DME wasn't on the centerline five miles out to form the FAF, you simply moved it to a FAF location created by the FAA and flew the approach. These RNAV approaches were known as "station mover" RNAV approaches and were created by the FAA until they reached about 500 RNAV approaches in the United States.

The "station mover" RNAV approaches are still with us today - but are now known by a different name. The FAA began a program about three years ago to rename all the RNAV approaches that were VOR DME based. That program is now complete and all the approaches have been retitled VOR DME RNAV Rwy XX approaches. About 300 of these approach procedures still exist.

And why would the FAA want to go through all the effort to rename the RNAV approach procedures to VOR DME RNAV approaches, you ask?

In 1994, the FAA issued the first GPS approach chart and has continued to create and issue about 500 new GPS approach procedures per year. That is the good news. But the bad news was that with all this effort being expended by the FAA, none of the airlines could use any of these approaches because GPS receivers had not been part of the airline avionics suite until fairly recently. That meant that all the new GPS approach procedures were usable by only one segment of the aviation industry.

The airline industry said to the FAA that they would also like to take advantage of all the new approach procedure capability but, with the name GPS in the title, they were not able to fly

the approach procedures even though most of the airlines have very sophisticated Flight Management Systems (FMSs). Many corporate operators also had the same dilemma - lots of new approach procedures, new sophisticated FMSs, and no ability to fly the GPS approaches.

Well, the FAA listened! Beginning with the 24 February 2000 revision, all new GPS approach procedures were issued with the name RNAV. Then things started to fall apart.

Database a Basic Element of GPS Approaches

The database is such an important component of GPS approaches that the approaches cannot be flown without the database. The airborne databases provided by Jeppesen are created and produced according to the ARINC 424 specification "Navigation Databases." Virtually all avionics systems use databases that are produced according to the ARINC 424 standard. The ARINC Committee was formed in September 1973 and has continued to meet once or twice a year to steadily improve the database standard.

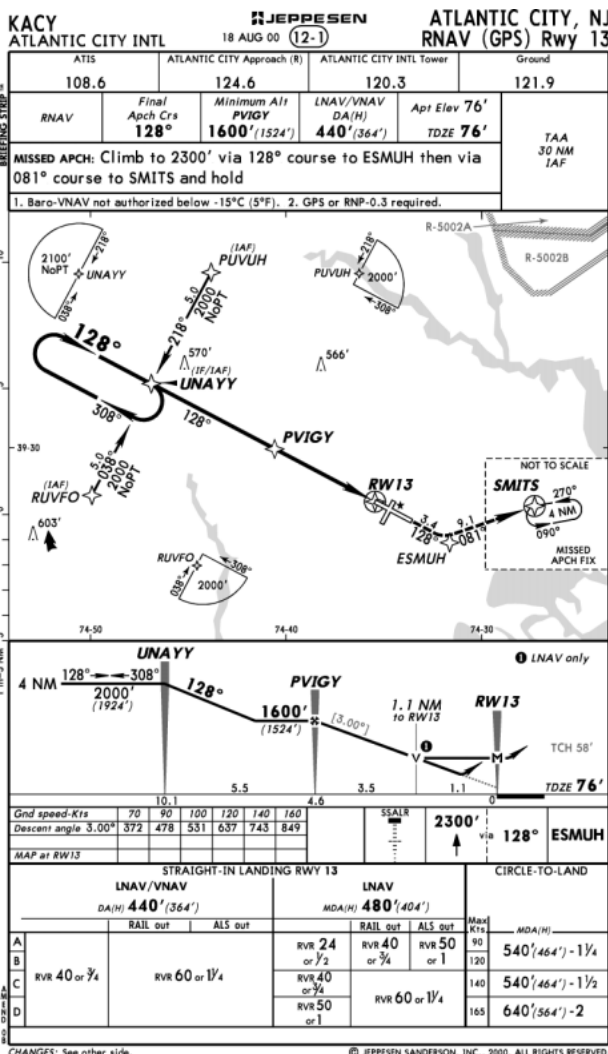
When the FAA began issuing GPS approach procedures with the new name RNAV, the coordination between the FAA and the industry for this new type of procedure had not been accomplished. In the ARINC spec, there is a field used to identify the route type. In this case, an approach procedure is a route which consists of many segments starting in the enroute environment and continuing through the missed approach segment. The route ID for approaches has a single character followed by the runway number. As an example, a VOR Rwy 09L approach would be coded in the database as V09L. An NDB Rwy 26 approach would be coded as N26 and so on.

The letter "R" was established early in the ARINC 424 development to be used for RNAV approaches which were the "station mover" variety. A VOR DME RNAV Rwy 35R approach is coded as R35R. Just recently, RNAV approaches that required GPS were given the route identifier of "P" since the letter "G" had already been taken. The ARINC spec was also revised to accommodate RNAV approaches that were based on GPS. Since the letter "R" had already been used, the letter "E" was used to indicate an RNAV approach based on GPS.

All this confusing? Without getting into any more detail, when the GPS approaches were issued as RNAV approaches, no one in the industry (database suppliers and avionics manufacturers) was ready to use the new code "E." Therefore a decision was made to use the existing letter "R" for RNAV or "P" for GPS. If the letter "P" had been used, the GPS approach name in the avionics would not have matched the RNAV name on the chart nor the RNAV clearance given by the controller. Not good. So the decision was made to use the letter "R" so the approach procedure name in the avionics, charts, and clearances all matched.

GPS Avionics Needs GPS Approaches

GPS receivers that are certified to fly IFR approaches require the code letter "P" in order to activate the Receiver Autonomous Integrity Monitoring (RAIM) function. The RAIM checks the reception of the satellites to ensure that the required amount of GPS satellites and the



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quality of the GPS satellite signals is OK for IFR approaches. With the code letter "R", the avionics doesn't know the approach is a GPS approach so the RAIM is not activated in some avionics systems.

Another need for the GPS route identifier "P" in the database is that the course deviation indications are required to become more sensitive at the final approach fix. On the VOR DME RNAV approaches, there is no requirement for a change of sensitivity at the FAF so the coding of the GPS approaches as RNAV didn't activate the sensitivity change at the FAF.

But, did it help the airlines? Yes in some cases, but not all Flight Management Systems were able to use the RNAV procedures because of things such as RNP requirements.

What's the Solution?

Beginning with the 25 January 2001 effective date, the name of the RNAV approach procedures will change. Refer to the RNAV (GPS) Rwy 13 approach into Atlantic City, New Jersey and you can see the format and name for the new title for GPS approaches. You might ask "What good does that new title do?" Beginning with the January revision, all approach procedures in the database will have dual coding for an interim period. This means that GPS receivers will receive the database coding with the letter "P" for the RNAV (GPS) approaches and the Flight Management Systems will receive the database coding with the letter "R" for the RNAV (GPS) approaches.

Beginning in January, when you receive a clearance for the Atlantic City RNAV (GPS) Rwy 13 approach, the controller will refer to it as the RNAV approach and you will find it listed in your avionics unit as a GPS approach. Since the letters GPS are in the title (even though in parentheses), the title on the approach chart will be virtually the same as on the avionics equipment.

The FAA Handbook 7110.65 which specifies the terminology used by controllers and pilots will be revised to reflect the new approach procedure titles. Since the letters GPS are in parentheses, they will be silent in the approach clearances. The clearance for the Atlantic City approach from the controller will be "... cleared RNAV Rwy 13 approach."

Coordination

No one is an island - especially in this world of electronics. All of our dependencies spread across many organizations to successfully implement new technology. We collectively need to look at new ways of doing business when coordination is required.

When new ideas are implemented by governments authorities, coordination needs to happen much further in advance. The FAA has agreed to begin a prototyping method of delivery for new advances to ensure that everybody who has responsibility in the process has a chance to test the capability before it is turned over for final use. Before WAAS approaches are commissioned, the FAA has agreed to issue new sample approaches for prototyping to ensure the databases and avionics have the ability to implement them before the effective date. This new process



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should help the learning curve for the final users since new things can be introduced once.

Now that databases are central to IFR and VFR navigation, any changes to new types of approaches and equipment requirements need to be coordinated with everyone in the "string" of implementation. The next article will continue on databases with a discussion on the new duplication of approach procedures to the same runway. ☺



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