

JEPP'S BRIEFING



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While riding jumpseat in an airline in the far east, our CEO watched as the crew received a clearance from ATC for a hold at an intersection at FL250. Our CEO looked at the high altitude enroute chart and saw a nonstandard, left turn holding pattern depicted at the intersection.

The crew had the FMS engaged so that a holding pattern could be entered automatically. It was going to be easy. The inbound leg for the holding pattern was the airway they were flying so the entry to the holding pattern would be a direct entry. To everyone's surprise, at the intersection the airplane entered into a standard holding pattern with right turns. Uh oh.

What happened?

As you can imagine, many questions started. Why did the airplane enter a standard holding pattern instead of a nonstandard hold with left turns? Was the holding pattern in the database wrong? Was the holding pattern missing from the database? Could a holding pattern from the low altitude structure have been inadvertently entered into the database?

A thorough check of Jeppesen's master aeronautical database revealed that the holding pattern was there with the left turns. OK so far. Did the correct holding pattern get extracted for that airline? Yes, that was correct. After chasing the problem, it was interesting what was found.

Many of the early FMSs had very limited storage capacity and airlines have struggled with a balancing act of including as much as possible while discarding only non-essential information. In the case of the holding pattern, the airline had made the decision to add a number of new approach procedures to their database, but in the process they had to make a tough decision - and that decision was to eliminate all the holding patterns from their databases to make room for the additional approaches. And somehow, that information had failed to reach the crews. The crew was unaware that the holding patterns were missing from their databases until they had the misfortune to make a hold in the wrong direction.

Final Authority in the Cockpit

There have been many discussions about the differences between what is seen on the paper charts and what is carried aboard the airplane in databases. And when there are differences, what should be considered the final authority - charts or databases? The answer has to be the paper charts - for lots of reasons.

The discussion about the holding patterns is one example of why charts have to be the final authority. This also leads to the awareness that airborne data-

The Chart Clinic - Database Series

bases are not substitutes for charts - they are supplemental information with different goals than the role of paper charts. As important as databases are, they really are onboard the airplane to provide navigation guidance and situational awareness, but they are not intended as a substitute for paper charts.

Missing Path Terminators

In order to make all the FMS and GPS avionics fly the intended paths on DPs (SIDs), STARS, and approaches, the database includes path/terminators that define courses, paths, and the way that each of the paths is terminated. Most of the legs on GPS approaches are TF legs, or tracks between two fixes. Since the TF legs represent the predominant leg type, some GPS manufacturers have implemented *only* TF legs. If you don't pay close attention to what the chart says and fly only the paths on the GPS avionics, you may end up flying a path that does not comply with the defined approach procedure.

As an example, refer to the Ft. Pierce, Florida GPS Rwy 9 approach procedure. The missed approach says to climb to 1,000 feet and then make a climbing right turn to 2,000 feet direct to the ANGEE fly-over waypoint and hold. In some GPS systems, the path from the MAP to ANGEE is a straight line. That creates two problems. First, the path makes a shortcut which may take you close to some obstacle that is the reason for the straight ahead climb. Second, some GPS avionics systems have not implemented the concept of fly-over waypoints. By definition, all waypoints are fly-by waypoints unless specifically designated as fly-over waypoints. This means that the GPS might begin a turn before arriving at the waypoint instead of waiting until *after* you pass it.

Since the MAP at Ft. Pierce (and all other GPS and RNAV approaches) is a fly-over waypoint, the FAA intends for you to *pass the MAP before* initiating the missed approach procedure. If your GPS doesn't have an implementation for the fly-over fixes, you need to ensure you pass the MAP before initiating any turn. At Ft. Pierce, the fly-over designation is academic since the missed approach proceeds straight ahead anyway, but many missed approaches begin with a turn so you need to watch what your course guidance is telling you.

Why are some Approaches Missing?

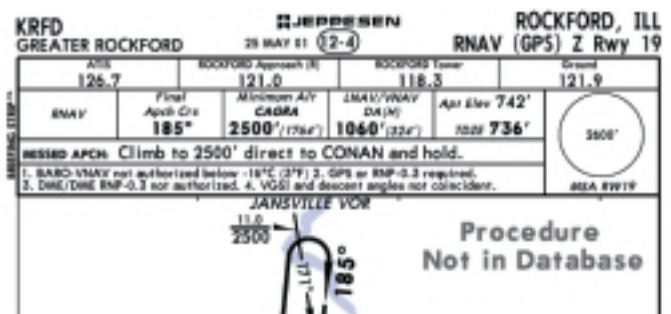
In December 1992, the first approach procedures were published that



authorized the GPS Phase Two overlay program. That program authorized GPSs to be used to fly all 4,500 non-precision, non-localizer approach procedures in the United States. These were called GPS overlay procedures. When the GPS was used to fly the overlay approach procedure, the underlying VOR or NDB had to be *monitored*, but the GPS could be used to navigate the approach.

Later, the FAA initiated the Phase Three GPS program by specifying some procedures that could be flown *without monitoring* the navaid on which the procedure was based. Not only did the navaid not have to be monitored, it actually could be off the air and the GPS could be used to fly the approach. All of the Phase Three approaches are identified with the words "or GPS" in the procedure title.

As the FAA began their program to create 500 new GPS approach procedures per year, they published procedures to runways that had Phase Two or Three overlay procedures. As the duplication started, it was agreed there was no need to have both GPS procedures and overlay procedures. All of the Phase Two overlays were gone by January 2001. The Phase Three overlay procedures are going away as the FAA creates new RNAV (GPS) approach procedures. All the Phase Two approach procedures have been removed from the GPS databases and the Phase Three approaches are being deleted as they are replaced with standalone GPS or RNAV approach procedures.



FMS and GPS Approach Database Differences

FMS databases include most ILS, localizer, VOR, and NDB approaches in their area of coverage whereas GPS databases include only those approaches that are authorized to be used by GPS avionics systems. This does not mean, however, that all approaches that are charted are included in the database. As an example, some GPS approach procedures have not been designed with transitions, but require RADAR vectors for the approach. By definition in the FAA TSO-129a, all GPS avionics require an initial approach fix (IAF) to start the approach. If there is no IAF on the approach, the GPS avionics can't have the approach in the database. In other cases, the approach starts at the intermediate fix (IF) which is the final approach course fix (FACF) and specified by the FAA to be an IAF. This duplicate designation causes some avionics systems to reject the approach from the database. This dual designation problem is being fixed and many approach procedures will be added to the GPS database.

Also, some approach procedures are just too complicated to be coded into a database. Some circle-to-land approaches fall in this category and many of them are missing. Other approaches have multiple transitions and some of them can't be coded. In these cases, the charted approach can be flown but not with the automated systems that use databases.

Two Approaches to the same Runway

The FAA and other government authorities publish more than one approach to the same runway. In the database, duplicates cannot be accepted. To solve this dilemma, a letter has been added after the navaid type in the approach procedure title. The letters that are used start at the end of the alphabet so that they aren't confused with the letters at the beginning of the alphabet that are used to indicate approaches that don't have straight-in landing minimums.

As an example, at Rockford, Illinois there are two RNAV (GPS) approach procedures to Runway 19. Many of the avionics systems were designed to handle only one approach to a runway and couldn't anticipate the solution of using a letter to make the procedures unique. Because of the expense of modifying software on avionics, many systems won't be able to handle both procedures. As a result, you will see a note "Procedure Not in Database" on some of the approach charts until the capability exists to have both procedures in the database.

Can the Database Substitute for a Chart?

GPS and FMS avionics systems are designed to be navigation tools - not aeronautical charts. Charts are *always* needed for complete information. Many items that are on charts are in the databases, but not all information is included such as controlled airspace, restrictive airspace, minimum airway altitudes, obstacles, terrain, communications frequencies, Center boundaries, political boundaries - and the list goes on.

Will the database ever include all the information on a chart? Yes. Will it be soon? No, there is a need for



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Conclusion

This is the last article in the database series and concludes the Jeppesen articles. I trust the information has helped to understand the background and reasons behind the information shown on our paper charts and the data contained in aeronautical databases. ✈



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