JEPP'S BRIEFING

The Chart Clinic – Eighteenth in a Series

By James E. Terpstra
Sr. Corporate Vice President, Jeppesen

Communications failure? When do you finally leave your enroute altitude to descend for the approach? FAR 91.185 says "proceed to a fix from which an approach begins and commence descent . . . " Okay, where does the approach begin? What if the weather goes below minimums while on an approach? Can you continue the approach? Have you passed the precision final approach fix?

Every time we start to tackle the interpretation of some of the FARs for the terminal area, it seems that a couple of gaps prevent us from coming to the final solution. This article will cover the segments of the approach and, we hope, close some of those gaps.

If you prefer studying the approach criteria from the original source, the FAA Handbook, "United States Standard for Terminal Instrument Procedures" (TERPs), is available for review at most FAA offices. You may obtain a copy of the TERPs Handbook (8260.3A) for a nominal fee by making a written request to the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Stock Number 050-007-00345-5. The international equivalent of the TERPs criteria is the ICAO Pans-Ops which contains the design criteria for instrument approach procedures. Most countries of the world use the ICAO Pans-Ops for procedure design, although each country typically has many exceptions to the Pans-Ops in its purest form. The Pans-Ops can be obtained from ICAO in Montreal, PQ, Canada. Most of in this article is based on the U.S. TERPs criteria and U.S. FARs, but much of it is applicable in other parts of the world.

Final Approach Segment

When looking at an approach chart to determine the segments, it is usually easiest to start at the airport and work through the approach backwards because the location of the final has the least flexibility. The last segment when coming into the airport is the final approach segment, which begins at the final approach fix (FAF). The final approach fix is usually the outer marker on localizer approaches, and the VOR is the FAF on VOR or VOR/DME approaches when the VOR is not on the airport. For NDB approaches with the NDB located off the airport, the NDB usually forms the FAF. In any case, the final approach fix is designated in the profile view on Jeppesen approach charts with a small Maltese cross.

In the late 1980s, a major concept change was created by the FAA to solve an operational problem. Operators who fly according to FARs 121, 129, and 135 are required to abandon the approach if the weather goes below minimums when on final approach. When the TERPs criteria were first adopted in November 1967, the FAF was located at the outer marker (OM) for virtually all ILS approaches. This made it easy to determine the point at which to abandon the approach since the FARs said that once the final approach fix was passed and the weather was reported below minimums, the captain could, at his discretion, continue the approach. So if the weather went below minimums before the OM, the approach should be abandoned. If the OM had been passed, the captain could make the decision to continue.

Things don't always stay easy in this business. At one airport, the final approach course and descent began well before the OM. The actual glide slope capture was about seven or eight miles before the OM. At this airport, the weather was fluctuating above and below minimums for most of the day, and a number of captains decided to continue the approach after capturing the glide slope, but still before the OM.

The FAA violated every flight crew who continued the approach if they had not passed the OM and the weather went below minimums. The FARs didn't address the flights that had intercepted the glide slope way back in the intermediate segment. Because of this problem, the FAA redefined the final approach fix for precision approaches. By definition, the FAF on a precision approach is the point where the minimum glide slope intercept altitude intercepts the glide slope. So when the minimum glide slope intercept altitude intercepts the glide slope at a point two miles outside the outer marker, that is the FAF. When looking at an ILS approach, there usually is a Maltese cross at the OM. The Maltese cross is the FAF for the localizer portion of the approach, but not for the ILS approach.

Technically, the precision final approach fix is *not really a fix*, but a *point*. In ICAO terms, the precision final approach fix would be called the final approach point. The difference is that a fix is a location over the ground whereas a point is a point in space.

End of Final Approach Segment

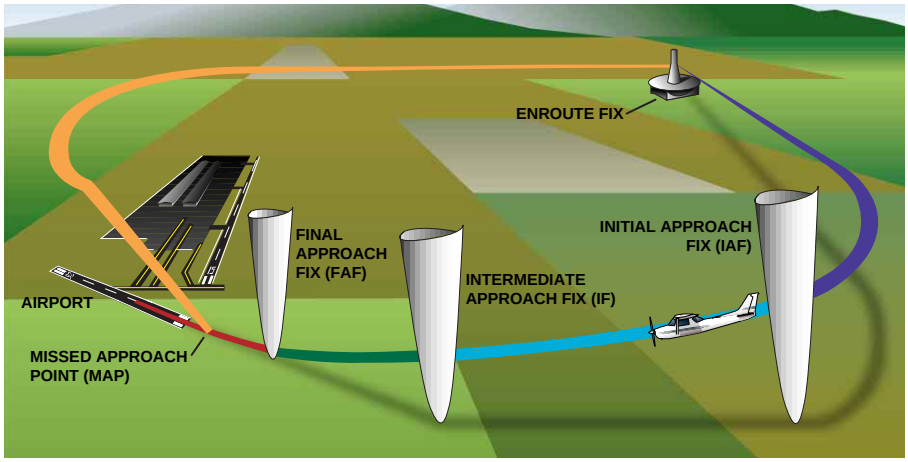
Refer to artwork for the approach segments and note that the final approach segment begins at the FAF and ends at the missed approach point (MAP). On non-precision approaches (no electronic glide slope), the missed approach point usually is located at the landing threshold (which may be a displaced threshold). On non-precision approaches, the missed approach point is most often determined by timing from the FAF.

When flying approaches without an electronic glide slope, the lowest altitude to which you can descend is a minimum descent altitude (MDA). This means you should descend after the FAF until reaching that altitude, and then level off at the MDA until the specified time has elapsed. Remember that the time on the approach chart is based on *ground speed*. To fly this segment accurately, you should compute the true airspeed from the indicated airspeed and pressure altitude, and then apply the wind to come up with the correct ground speed.

On a precision approach (one with an electronic glide slope), the missed approach point is the intersection of the localizer, the glide slope, and an altitude usually 200 feet above the touchdown zone elevation. This minimum altitude is called the decision altitude (DA). Timing is not necessary while descending on the glide slope, but the altitude must be monitored closely when approaching the minimum altitude. Unless visual contact has been made with the runway environment, you must immediately execute a missed approach at the point where the airplane is on the localizer and glide slope and reaches the DA.

Decision Altitude versus Decision Height

When the TERPs criteria first went into effect, the minimum altitude on precision approaches was called a decision height (DH).



Technically, this is not correct since the point is determined by barometric altitude - which measures altitude, not height. Jeppesen charts have been including the letters DA(H) for decision altitude (height) with both figures since the mid-1980s to show both values. The FAA is gradually adopting the term decision altitude to replace decision height. All new WAAS and LAAS approaches will have minimums expressed as decision altitudes (heights).

Making the Miss Early

After passing the FAF, there are times the decision is made to execute the missed approach - well before the MAP. Assume for a moment that the missed approach instructions say the missed approach is a climbing right turn to an altitude at a holding fix. If the decision is made to miss the approach before reaching the missed approach point, when can the turn be initiated? When should the climb be initiated?

Since the approach procedure segments are designed with very specific trapezoids that protect the airspace around defined approach tracks, the aircraft is protected *only within these trapezoids*. Therefore, when executing a missed approach prior to the MAP, the final approach track must be flown until passing the MAP, and then the turn can be made. The altitude is a different story. The climb can be initiated immediately; but as soon as the airplane is cleaned up, you have to make the mandatory report to ATC that you have made the missed approach. You can continue to climb to the missed approach procedure altitude. If you need to fly an altitude other than specified in the missed approach procedure, you can discuss this with ATC.

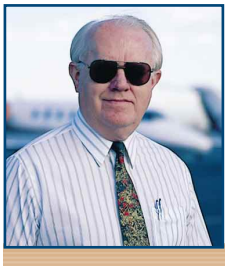
Final Approach Descent Gradients

The optimum descent gradient on the final approach is 300 feet per nautical mile and the maximum descent is 400 feet per nautical mile. The obstruction clearance on final varies according to the type of approach and other criteria such as: length of the final, distance to the altimeter source, and alignment of the final to the landing runway. One important item to remember is that the MDA does not necessarily provide a clear zone all the way from the FAF to the MAP.

Rules are made to be broken - (not really a good thing to say in this business.) But there are legitimate cases. As an example, the maximum descent gradient of 400 feet per nautical mile is equivalent to 3.77º. If you look closely at the Van Nuys, California ILS Rwy 16R approach, the glide slope angle is 3.90º. It is obviously higher than the maximum. So what about the rules in TERPs?

The terrain is so high to the north of Van Nuys that if the glide slope had to be lower, the approach could not be installed at the airport. When this happens, the instrument approach procedure design specialist has worked out all possible means of complying with TERPs, but when they find they cannot, they submit the exception to a special FAA office that specializes in handling waivers to TERPs. Although the exceptions are rare, they are granted when necessary.

In the next article, we will continue discussing the segments of the approach. By the way, where does the approach begin? According to paragraph 230 of TERPs, the approach begins at the initial approach fix (IAF).



James E. Terpstra is senior corporate vice president, flight information technology at Jeppesen. His ratings include ATP, single and multi-engine, airplane and instrument flight instructor. His 6,000+ hours include 3,200 instructing. For comments, please Email: JimTerps@jeppesen.com