HOLDING-PATTERN ENTRIES made simple

Everything you need is really right there on the panel

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■■ Teardrop, parallel, or direct? An ogre of doubt plagues every instrument student upon arrival at the holding fix—and no wonder.

Most texts, including the "bible" of instrument flight, the FAA's *Instrument Flying Handbook*, proffer ample descriptions of the whys and wherefores of holding-pattern entries, their execution, even their mathematics. Methods to determine which entry to use when the proper entry is not all that obvious are sadly neglected, however.

Although holding-pattern entries are often determined and planned en route to the fix, drift or a new crab angle may dictate an entry quite different from that originally set up. Students study holding patterns until they can recite them in their sleep. Once airborne, however, unless they can make the proper choice upon arrival at the fix, all is in vain. For it is here, at the fix and under the hood or in the trash, that the palms begin to sweat in anticipation that an unfriendly word may suddenly be heard from the ornery old flight instructor.

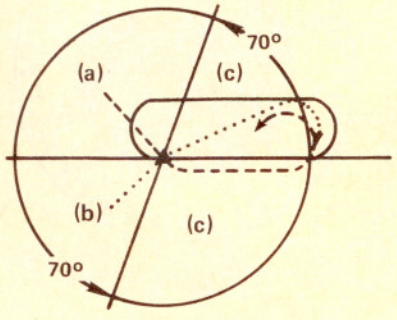
John Kirby (AOPA 433665), chief pilot instructor for Beacon Flying Service, Hyde Field, Md., says: "Some of my most trying hours occur during the holding-pattern-entry phase of the instrument course. The hood, like the Chinese water torture, constricts the thinking process. If I can get the student to make the correct entry only 50 percent of the time, I feel that I have made significant progress. Even then, he may have blundered into it. I have no way of knowing for sure."

Holding-pattern entries have a purpose. They provide the simplest, most efficient method of entry, under given conditions of wind, crab angle, and heading, on arrival at the holding fix. A properly executed entry precludes the excessive floundering about that nauseates designated flight examiners and could win a pink slip for the instrument-rating candidate.

Jim Scolaro, an inspector with the Flight Standards District Office at National Airport, Washington, D.C., has this to say about holding-pattern entries: "I like to see borderline entry situations—that is, situations where the

Entry

(a) Parallel Procedure—Parallel holding course, turn left, and return to holding fix or intercept holding course.
(b) Teardrop Procedure—Proceed on outbound track of 30° (or less) to holding course, turn right to intercept holding course.
(c) Direct Entry Procedure—Turn right and fly the pattern.



STANDARD PATTERN
Figure 1

heading is within a few degrees of demanding one entry or another. And when possible, I set up that kind of situation. If the candidate makes the proper choice, I get the feeling that he knows his stuff, that he is on top of the problem. For instrument-instructor candidates, naturally, I consider the proper choice of entry a must."

Occasionally traffic flow necessitates holding along a course or an airway so that the outbound leg flies along the radial. These holding instructions occur en route, primarily. The patterns frequently are printed on the en route charts. And the entries, usually direct, pose few problems.

The majority of holding situations, however, involve a fix, a radial, and a direction of approach to the fix. The problems posed by these entries need not continue to be the bugaboo they have proved to be in the past. By using the heading on the directional gyro, visualizing the radial on the directional gyro, and applying a simple formula, a system develops that virtually drives this particular ogre from under the student's hood. Simply stated, the system employs the resources provided on the instrument panel.

Let's set the scene with a few simple facts. In most holding situations, whether ADF, VOR, or intersection, (1) radials extend *from* the navigational aid; (2) the inbound heading will be the reciprocal of the holding radial; and (3) the heading on the holding side (that is, the outbound leg), in a no-wind condition, will be the same as the radial. Hence, if one is instructed to hold south on the 180° radial of XYZ VOR, the heading on the holding side will be 180°.

The essence of an entry involves the relationship between the heading of the aircraft and the holding radial: the heading because it indicates the direction of approach *to* the fix, and the radial because its value establishes the position of the 70° and 110° line.

Figure 1 depicts a few of the salient aspects of the holding pattern and the 70° dividing line, as presented in the FAA's *Instrument Flying Handbook* and in Part I of the *Airman's Information Manual*.

In presenting the holding pattern and the 70° line (Figure 1), the FAA places the emphasis on the direction *from which* the airplane is proceeding to the fix. This system plays down the role of the heading in relation to the radial. Attention is focused on what has happened—the past—and only obliquely refers to the future—the entry.

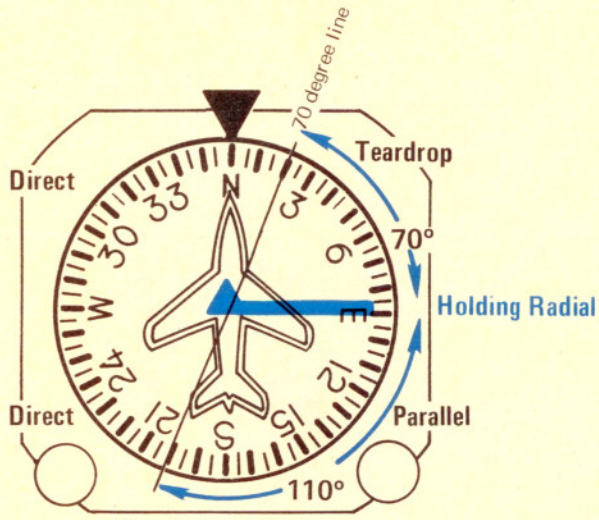


Figure 2

But 360 degrees describe a circle, and since the 70° line bisects the circle (70°+110°=180°), a 70° arc and a 110° arc lie on the *other* side, the *heading* side, of the holding pattern also.

Now, mentally flip everything so that you can picture your approach *to* the holding fix, using headings shown on your directional gyro. On the other side of the line that slashes the holding radial we will again find 70° and 110° arcs. These arcs are on the *heading* side of the holding pattern, and in Figure 2 they are depicted in relation to the holding radial.

In Figure 2, we have overlaid a holding radial of 090° on the face of the DG. Once you have pictured your holding

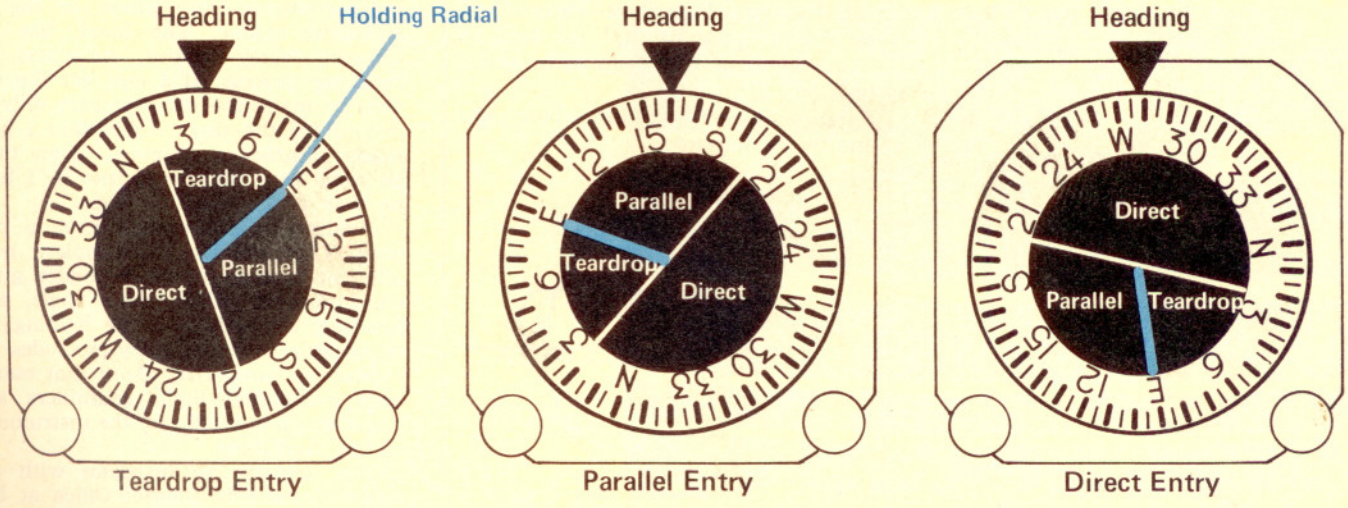


Figure 3

radial on the DG, you can also eyeball the 70° and 110° arcs on either side of the radial. Look at your heading as indicated at the top of the DG, see where it falls in relation to the arcs, apply the following formulas, and your instrument will tell you what kind of holding pattern entry to make:

Holding Radial − 70° = Teardrop
Holding Radial + 110° = Parallel
All Other Headings = Direct

Staying with our assumed holding radial of 090°, any heading located on the same half of the bisected circle as the radial must be either teardrop or parallel; headings between 020° and 090° will be teardrop; between 090° and 200° parallel; and a heading of 090° either teardrop or parallel—your choice. Headings of 020° and 200° give a choice of direct or teardrop, or direct or parallel, respectively. Any heading between 201° and 019° must be direct.

Rephrased and refined: (1) Heading on same side of DG as radial: teardrop or parallel; definitely not direct. (2) Heading to left of radial but within 70° of radial: teardrop. (3) Heading to right of radial but within 110° of radial: parallel. (4) Heading on side of half circle opposite radial: direct.

Figure 3 provides examples.

ATC will not always accommodate you with a holding radial that makes for easy subtraction or simple addition. When this happens, perform the arithmetic that is easiest (subtract the 70 or add the 110), then imagine a line from that point across the face of the DG to the reciprocal so the circle is bisected and the end limits are set. If you were told to hold on the 020° radial of XYZ VOR, for instance, the radial-minus-70 subtraction would be too distracting to perform under the hood. Therefore, add 110° to the radial, which gives you 130° (any heading between 020° and 130° would be a parallel entry, and you could stop right there), then let your eye cruise across the face of the DG to its reciprocal, 310 degrees. The circle is bisected, and any heading between 130° and 310° would require a direct entry. Of course, a heading between 310° and 020°, the 70° arc, would be teardrop.

Inspector Scolaro's propensity for borderline choices between entries is not as picayunish as might first appear. Holding is normally associated with approach transitions. And the closer the approach, the more rapid-fire the instructions, the more explicit the decisions, the more precise the skill requirements.

Says Scolaro: "If an instrument-pilot candidate was confronted with one of these borderline-entry situations and he failed to make the correct choice, yet made his initial turns in the correct direction—that is, toward the holding side—I personally would not bust him for that alone. On the other hand, if he did make the proper choice, I would be somewhat impressed and would make note of his performance."

Headings adjoining the radial, the 70° point, or the 110° point are infrequent, fortunately. If you visualize the radial on the DG, the headings routinely fall well within the teardrop or parallel arcs and are as obvious as are headings requiring direct entries. Once you're accustomed to thinking of heading in relation to radial while approaching the fix, these borderline cases should present no special problems.

By the same token, nonstandard patterns—those requiring left turns—present no special problems either. Simply reverse the formula so that the radial *plus* 70° equals teardrop, and the radial *minus* 110° equals parallel. All other headings equal direct.

"The beauty of this system," says John Kirby, "is that it precludes the customary pitfalls. The student is not distracted with mathematical gymnastics; he is not required to doodle on his chart unsystematically; he can fly the plane and make the entry because everything he really needs is there on the panel. The system gives system where no system existed before. And above all, the system tends to enhance precision. In instrument flying the more precise you are the safer you are bound to be." □