

THE HOLDING THREE-STEP

Holding isn't easy to learn, is easy to forget and has a way of being needed when least expected. Here's a way to simplify your life when it comes time to hold.

by Fred Simonds

Holding is arguably the most difficult skill to learn during instrument training and the one that seems to fade the most quickly if not rejuvenated periodically. That's why holding is explicitly required during an instrument proficiency check. Here is an organized, sure-fire way to get your holds right every time.

About Those Ts

Many pilots learn holding using a **T** checklist, where each **T** represents an action to be taken at some point in the hold, such as a Turn.

Most T-checklists are unordered and vague. By contrast, this **T** checklist (below) is chronological and specific. The table presents each event as it occurs and the action required.

The Holding Three-Step

Complicated procedures become simpler when parsed into steps. In holding

there are three: entry, execution and maintaining the established hold.

Pilots often figure out the correct entry and then make a hash of its execution, usually because they don't know the outbound course to fly before reaching the fix or because they turn inbound the wrong way. The holding three-step helps you avoid these traps.

Entry

FAA holding procedures are designed to minimize the size of the turn at the holding fix. Whichever entry minimizes degrees of turn is the entry you want. Applying this, you can often visualize the entry just by looking at the hold if printed or at the radial you are expected to hold on. Sketch an unpublished hold if it helps.

If the entry doesn't jump out at you, try the "pencil" method. It offers the triple advantages of accuracy, simplicity and applicability to any type

of hold. Best of all, you can do the minor math involved in your head.

Place a pencil flat against the center of the heading indicator and turn it diagonally 70° to the right for standard right-turn holds and 70° to the left for nonstandard holds.

Create a Pie

In so doing you create a pie with three pieces. Assuming right turns, from the top (index) of the heading indicator to 70° to the right is one piece. The second is from the index to the left, 110°. The bottom third is 180°.

Here's the magic. For right turns, if the outbound course from the fix lies up to 70° to your right, the entry is a teardrop. If the course is up to 110° to your left, it's parallel. If the outbound course lies anywhere else, it's a direct entry. Done.

It works the same way for left turns; just aim the pencil to the left, placing the 70° arc on the left and the 110° arc on the right.

The Window Method

Often the outbound course is well within an arc, making the entry type obvious. This is tantamount to the "window" method: for right turns, if the outbound course lies out the left window, it's parallel; to the right, teardrop. If behind the wing, it's direct. The window method isn't very accurate near pie edges, but it is simple.

With practice your pencil becomes an imaginary line. Next thing you know, you'll be doing the arithmetic in your head. For instance, if your heading is 348°, any outbound course between 348° and 058° must be a teardrop entry. For a parallel, the arc runs to the left to 238°. All else is direct. By the way, this is the degree (ahem) of accuracy you want if you are facing the instrument written test.

If the outbound course lies within

An organized "T" checklist for holding patterns simplifies the process of planning for, entering and flying a hold.

TIME	EVENT	ACTION
- 5 minutes before arriving at holding fix	ATC issues holding clearance	Talk - acknowledge clearance
- 3 minutes before arrival	Reduce to holding speed	Throttle
Arrival at holding fix	Turn outbound Start time Advise ATC	Turn Time Talk
+ 0 - 1 minute	Twist (set) OBS to inbound course	Twist
+ 1 minute	Turn inbound; join radial	Turn
+ 2 minutes	Cross fix; entry complete	
> 2 minutes	Maintain hold	Turn and Time

5° of a boundary, then it's your choice as to entry. Given the teardrop or parallel option, many pilots go for the teardrop as it gets you established inbound sooner.

Teardrop entries additionally require computing a heading that allows room for a turn inbound. Given right turns, you must turn to a heading 30° left of the outbound course so you can make a right turn to join the radial. For left turns, you must turn right so you can turn left.

Paradoxically, direct entries can be difficult because they are simple. Just cross the fix and turn to the outbound heading. There is no need to fly the loop beyond the holding fix.

VOR Intersection Holding

The pencil method untangles the

Gordian knot that is a VOR intersection hold. Every such intersection contains eight potential holds: four each to the left and right. All you need is the outbound course from the intersection to determine the entry. You may have to take the reciprocal of a radial defining the intersection to find it.

Now place the pencil on the outbound course. Imagine the holding racetrack alongside the pencil to its right or left. Presto, you have a top-down view of the execution as it must unfold.

Execution

Talk with ATC and acknowledge your holding clearance. Throttle back three minutes from fix.

Cross the holding fix and Turn

to the outbound course. Time begins when over or abeam the fix or when the turn is complete, whichever happens last. Turns are never timed. Talk to ATC: report the time you reached the fix and your altitude.

Having nothing to do for a whole minute, Twist the OBS to the inbound course. There is no radial to fly outbound in any hold. When time expires, Turn back toward the fix. If flying a direct entry, you are now established.

For parallel entries, the inbound turn is always opposite the hold: turn left for right-turn holds and right for left-turn holds.

The Instrument Flying Handbook calls for a turn "greater than 180°" to join the radial inbound. About 45° will get you on course fast. It's a com-

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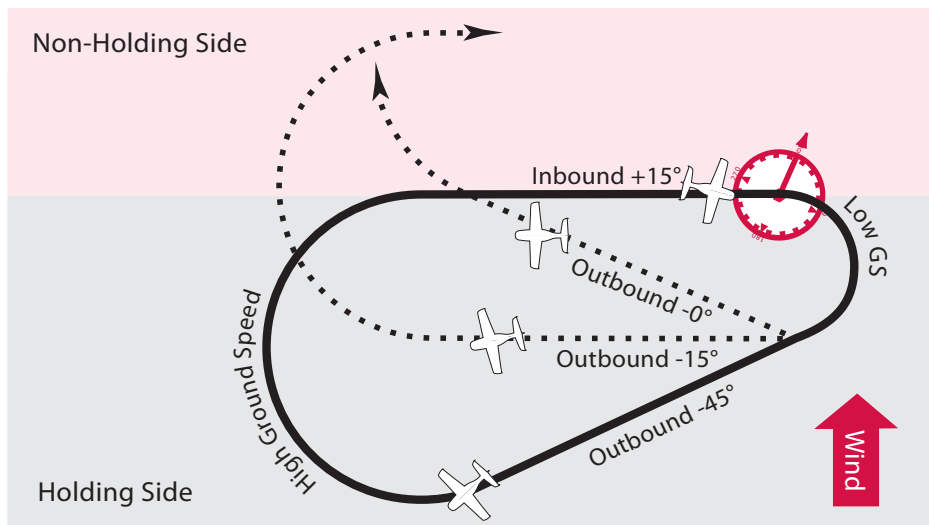
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promise between turning too much and overshooting the radial versus not turning enough.

The latter means that you never join the radial inbound. If you cross the fix instead, or miss it entirely and unexpectedly find it behind you, simply turn outbound and soldier on.

Teardrop turns inbound are in the same direction as the hold. You are not stuck with standard rate while joining the radial. You can use up to 30° bank or whatever angle your flight director calls for to join it.

For parallel and teardrop entries the first inbound leg need not be timed as the starting point varies. However, timing it offers some idea of groundspeed and reinforces the habit of timing all inbound legs.

Maintain the Hold

Once established, the inbound leg to the fix is supposed to be one minute at 14,000 feet and below and a minute and a half above.

Given wind, make drift corrections inbound and outbound. The rule of thumb is to take whatever drift correction you use inbound and triple it on the outbound leg. Therefore a 10° right correction to maintain the inbound course translates into a 30° left correction outbound. You can also adjust the outbound leg time.

The goal is to make standard rate

Turns at both ends and make the inbound leg Time correct for your altitude. This can only be achieved by successive approximations. ATC knows that your first few turns will be less than textbook.

Occasionally you'll need to throw out the textbook and modify your hold to stay clear of nasty weather. Do what you need to do and advise

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the controller.

You can ask to modify your holding clearance before and even after entering the hold. Request a different inbound course and longer leg time if weather or convenience dictate. Let common sense guide you.

The "Crisis Hold" Entry

While the AIM discourages alternative hold entries, the 80/260 "crisis hold" entry is useful when ATC snaps a hold at you from nowhere and you need to make an entry immediately, or if a holding fix occurs early during a missed approach.

In the 80/260 entry, cross the fix

Once in the hold, triple the inbound wind correction on the outbound leg to allow for standard rate turns at each end.

and then turn 80° toward the holding side followed immediately by a 260° turn back to the fix. Then fly the hold as instructed.

Depart the holding fix when ATC clears you beyond it. Be sure to inform ATC so that succeeding aircraft can be cleared into the airspace you vacate.

Lighten Up

Even the smallest holding pattern area is large enough to contain a Category A or B aircraft flying a maximum speed of 175 kt IAS plus a generous safety buffer, and most areas are larger.

Since turn radius varies as the square of speed, a 90 kt airplane will need one quarter the radius of a 175 kt flyer. Equally, the leg length for the slower airplane will be about half that of the faster bird. Flying at 90 kt or perhaps at maximum endurance speed, you would have to make a pretty egregious mistake to stray outside even the smallest holding area.

ATC radar sweeps you every 6 seconds at most. Ergo, a quick heading correction will likely go unnoticed. While ATC has other things to do beyond watching your every turn, the AIM says that ATC will try to detect an airplane that strays out of holding airspace and will assist in returning the aircraft to its assigned area.

One of the best ways to practice holds is in a simulator. You can experiment with different kinds of holds and wind from any desired direction. As with everything, practice makes perfect. It pays off when you get that dreaded call from ATC, "Say ready to copy holding clearance."

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