Holding Patterns Simplified

How to comply without confusion when you're sent into orbit

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■■ Murphy created two inescapable laws especially for aviation. The first states that headwinds shall increase in proportion to the pilot's anxiety to get home. The second says that when fuel reserves are low, an IFR pilot can expect to be sent to a holding pattern.

We have no choice about accepting Murphy's first law; it is merely an expression of Mother Nature's whimsical ways. The second axiom is less tolerable and more aggravating because the holding pattern is a man-made shackle. After all, an air traffic controller has to put an airplane somewhere when he doesn't know what else to do with it.

Holding clearances usually are issued when excessive traffic converges on a terminal area or when the destination weather is below landing minimums. Also, a pilot might be instructed to hold when the IFR runway is closed temporarily because of snow plowing or is blocked by a disabled aircraft. At such time, a pilot can either proceed to an alternate airport or etch racetracks in the sky while waiting patiently for conditions to improve.

The holding pattern is ATC's stop sign and is flashed whenever an aircraft cannot proceed.

A corollary to Murphy's Holding Law states that a holding clearance shall be issued only when the pilot is completely submerged in cockpit activity and is least prepared. Somehow, controllers always manage to comply with this rule. Whether he's driving a 707 into San Francisco or a Cessna into Santa Monica, the holding clearance always seems to catch a pilot off guard.

The inbound course of a holding pattern *usually* lies along the route of flight. In such a case, entering the pattern is no more complex than making a 180-degree turn at the holding fix. But occasionally a satanical controller sends a pilot to a pattern requiring either a teardrop or parallel entry. And that's when the suds hit the fan. The average instrument pilot hasn't had to worry about such procedures for so long that he's probably forgotten how.

After the pilot finally locates the holding fix, he usually consults that hieroglyphic holding pattern diagram on the IFR chart. But that miniscule guide looks confusingly similar to an Aresti aerobatic diagram and, if followed, can result in a teardrop entry to a Lomcevak. Desperately, the victim pilot searches the cockpit for a template or holding-pattern computer to resolve his difficulties. But by the time he finds one and figures out how to use it, the holding fix has been left behind.

There is a simple way to avoid such confusion. Once a pilot earns his instrument rating, he might consider simpler ways to enter holding patterns. There is no reason to be further intimidated by the FAA's methods because they are only *recommended methods*. No regulatory muscle has been created to enforce their use.

When the FAA devised its entry procedures, it did so with the objective of confining the aircraft as closely as possible to the lateral limits of the holding pattern. Every holding pattern is surrounded by a large womb of airspace to protect the holding aircraft. The exact size of this area varies according to altitude, distance of the farthest VOR defining the fix, and the type of aircraft (propeller-driven or jet-powered).

Figure 1 shows the airspace protecting the pilot of a propeller-driven airplane while holding at 5,000 feet at a fix 20 nautical miles from the farthest VOR defining that fix. The pilot is offered a 14- by 8-nautical-mile area

Figure 1

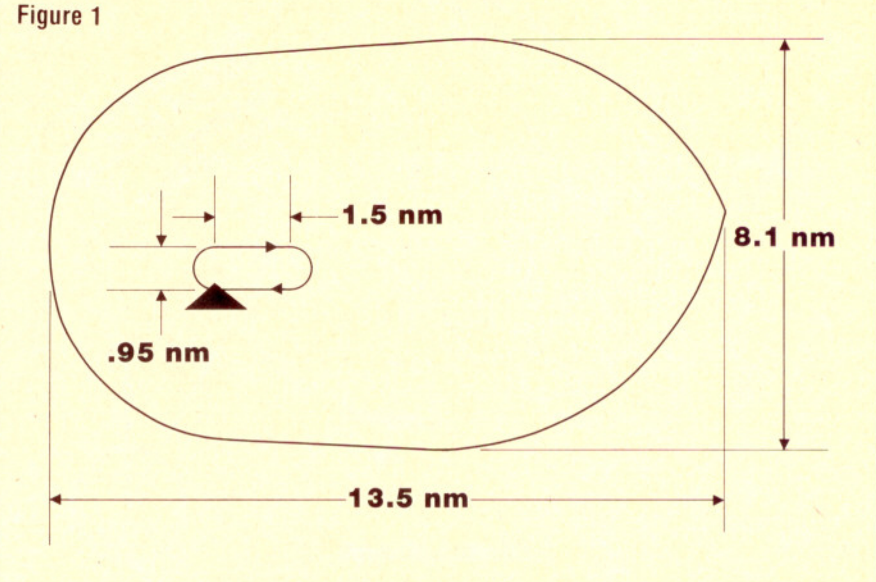


Figure 2

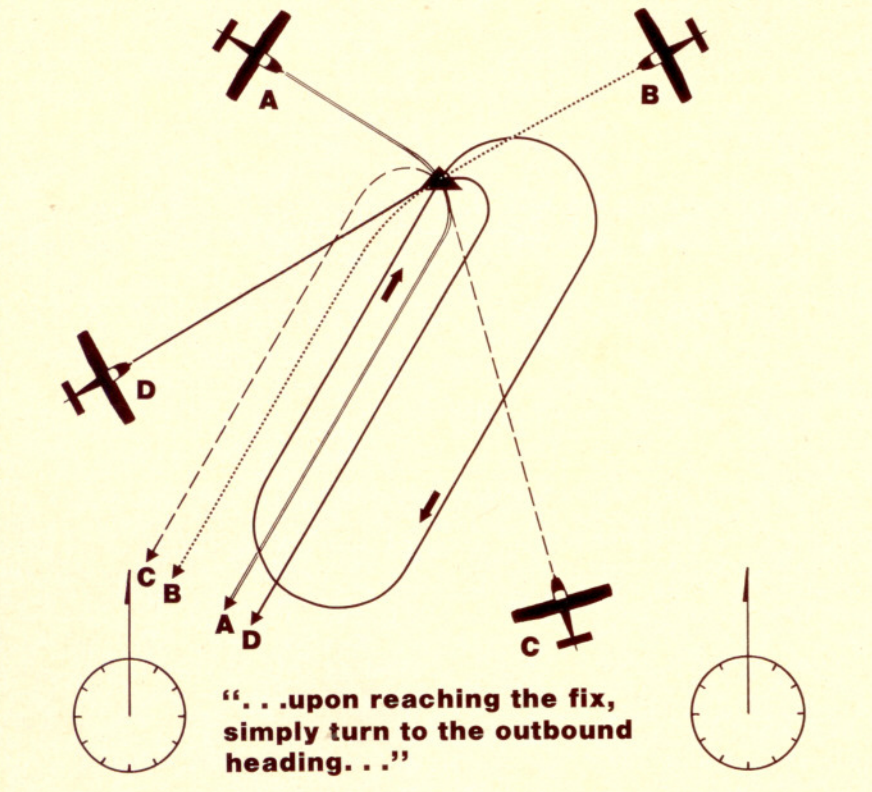
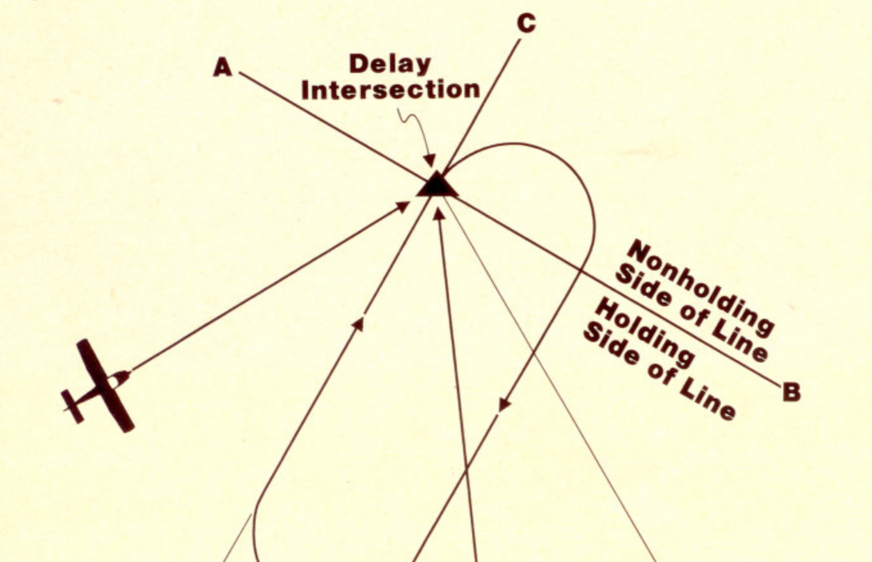


Figure 3



within which to maneuver his machine into a racetrack pattern that measures only 1.0 by 2.5 nautical miles (assuming a 90-knot holding airspeed, one-minute legs, and no-wind conditions).

Clearly, he can use any *reasonable* method of entry without having to worry about violating the limits of protected airspace.

Figure 2 illustrates one extremely simple method that can be used to enter *any* holding pattern regardless of the direction from which it is approached. It is the only method to use (even during an FAA flight test) when ATC issues a holding clearance just as the aircraft passes over the holding fix. All the astonished pilot has to do (after crossing the fix) is to turn to the outbound heading of the holding pattern and remain on that heading for one minute. This initial procedure requires no mental gymnastics and is foolproof.

During the minute of outbound flight, set the VOR course selector to the inbound course of the holding pattern and decide which way to turn to intercept that radial. At the end of the minute, turn toward the radial, intercept it and track inbound to the fix. That's all there is to it. The airplane has been established in the holding pattern with a minimum of fuss and bother.

This technique of "turning to the outbound heading" can be used without fear of recrimination whenever a pilot is doubtful about which of FAA's three *recommended* entry methods to use. It is an easy, safe and legal technique.

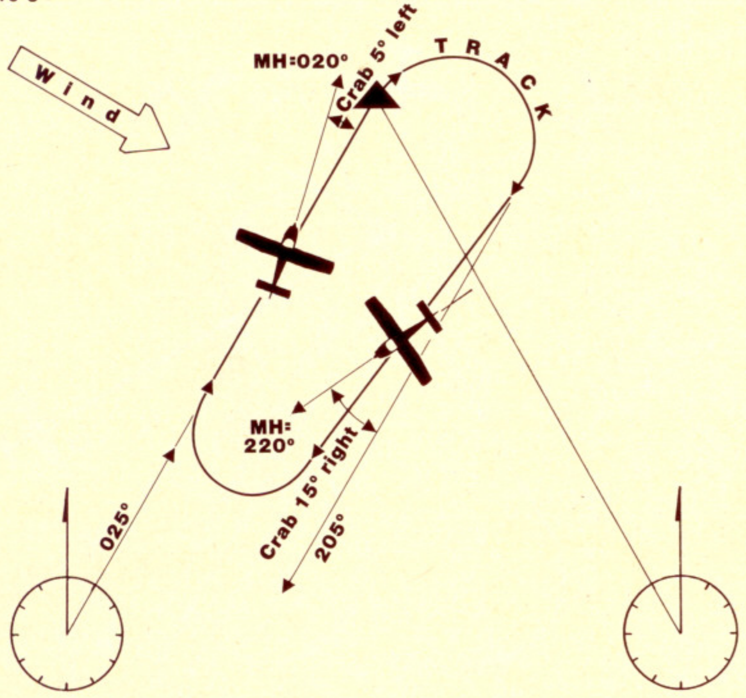
(Although FAA examiners prefer that instrument-rating applicants demonstrate standard entries during a flight test, they won't fail anyone who uses reasonable procedures and remains well within protected airspace.)

If a pilot desires to use the FAA's entry procedures, he can do so with much less effort by slightly modifying those techniques. The suggestion that follows doesn't require correlating those 70- and 110-degree relative bearings and sectors to aircraft heading and holding pattern alignment. Instead, use 90-degree quadrants because they are so much easier to visualize.

For example, assume that a pilot has been cleared to hold at Delay Intersection (Figure 3). According to the FAA's *recommendations,* there are three ways to enter the pattern depending upon the direction from which the fix is approached: the teardrop, the parallel or the direct entry.

To simplify the holding problem the pilot should draw the racetrack pattern on his chart. For some unknown reason, pilots protect their IFR charts

Figure 6



HOLDING PATTERNS continued

Savvy instrument pilots not only know how to simplify holding procedures, they also know how to occasionally escape from having to hold at all.

If a pilot is relatively far from the holding fix when he receives the holding clearance, he should immediately advise ATC that he's reducing airspeed. He then slows to the aircraft's best endurance speed. This airspeed is very nearly the same as that used for a power-off glide and results in the use of minimal engine power.

This serves three purposes. First of all, it gives the pilot more time to prepare for the holding entry. Second, it reduces the per-mile fuel consumption and conserves fuel at a time when it might be desperately needed. Finally, reducing airspeed *consumes part of the holding delay while en route* and reduces the amount of holding necessary at the clearance limit. It is certainly far more comfortable to cruise in a straight line at reduced airspeed than to chase your tail around a holding pattern.

With some luck, a pilot might be able to consume the entire delay while en route and not have to hold at all. This technique, by the way, is common practice among airline pilots, and controllers have become used to it.

Once established in a holding pattern, it usually is necessary to begin timing the inbound and outbound legs. The duration of the outbound leg is adjusted so that the inbound leg is one minute long (when holding at or below 14,000 feet msl). When above 14,000 feet, the inbound leg should be a minute-and-a-half long.

Timing the legs, however, is a pain in the empennage. There really is a better way, but only when holding on a VORTAC radial and when the airplane is equipped with an operable DME.

At such times, a pilot has only to request holding with 5-mile DME legs, for example. Controllers almost always comply with this request. Subsequent turns in the pattern are then made with respect to DME indications, not the clock. The procedure is considerably simplified.

With respect to time, be very skeptical about Expect Further Clearance (EFC) and Expect Approach Clearance (EAC) times issued by controllers.

When issued the EFC, don't plan on having sufficient fuel reserves solely on the basis of this estimate. When the EFC expires, you might be issued further holding instructions with a new and extended EFC. Likewise, an EAC can be extended depending on traffic, weather conditions, etc.

In other words, don't continue holding and burning the reserve fuel needed to divert to an alternate on the basis of an optimistic EAC or EFC. When the time comes to divert, do so without hesitation. It is tempting to continue holding with the thought that an approach clearance is *probably* imminent. But the result could be an untimely and lethal case of fuel exhaustion.

Figure 6 shows a pilot holding in a pattern situated at right angles to the prevailing wind. Notice that when the turn is initiated over the holding fix, the wind causes the turn radius to increase. Conversely, a turn at the opposite end of the pattern is into the wind, which reduces turn radius.

Pilots often attempt to correct for this drift by using a steep bank when turning downwind and a shallow bank when turning into the wind. This is improper and makes the job of holding unnecessarily difficult. All turns in the pattern should be at the standard rate (three degrees per second for light airplanes) or with a 30-degree bank angle, whichever requires the shallowest bank angle (unless a flight director is used).

The easiest way to correct for wind drift is to first determine the crab angle necessary to track the inbound course of the holding pattern. Then, triple this wind-correction angle and apply it to the no-wind heading normally used to fly the outbound leg.

For example, if the pilot in Figure 6 uses a 5-degree, left crab to track the inbound course, he should correct 15 degrees to the right while flying outbound. When the proper corrections are applied, the pattern flown should resemble the one shown in the diagram.

A final note of caution concerns the holding "stack," a situation where numerous aircraft are holding at the same fix, but at different altitudes (hopefully).

When the bottom man in the stack is cleared to leave the pattern, clearances are usually issued—one at a time—for successive aircraft to descend 1,000 feet to the next lower altitude. A problem can arise when one pilot is slow to initiate the descent while an impatient pilot only 1,000 feet above makes like a dive bomber. The result can be a near miss or worse.

To prevent such a conflict, never report vacating a holding altitude until actually doing so. Also, make descents in the stack at 500 fpm, no more—no less. These simple steps can go a long way toward preventing an encounter of the wrong kind.

Unfortunately, there is no advice available to help a pilot totally circumvent Murphy's Holding Law. Hopefully, however, some of this advice can be used to ease the burden of compliance. □