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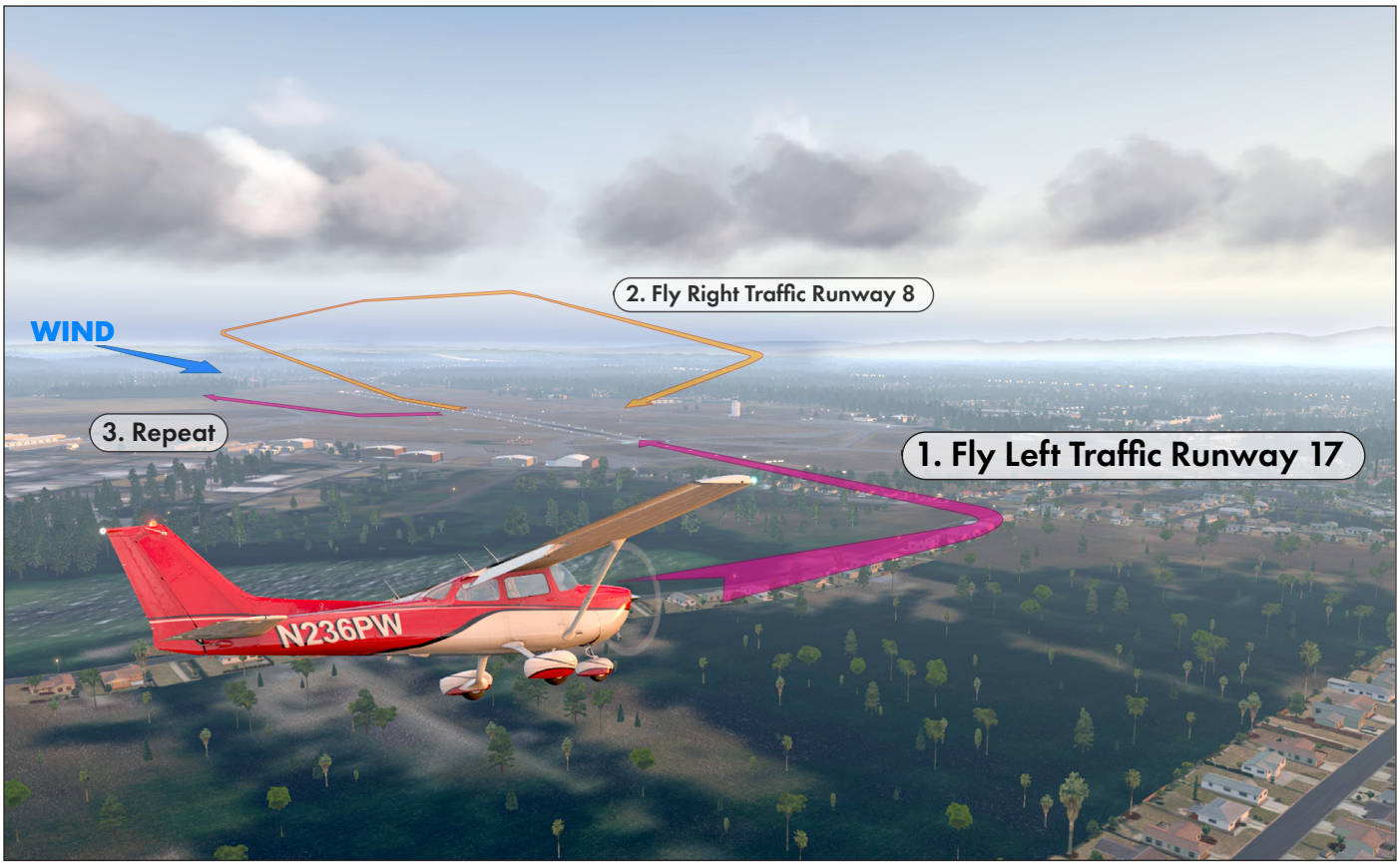
Sample Pages

Pilot Exercise Program

A Pilot-Friendly® Manual



Fifteen skill-building challenges to improve your flying!

Do not attempt the exercise using these sample pages; additional information in the manual is required.

Fixed-Wing Hover

Can you hover over a spot in a fixed-wing airplane? Sure you can. Here's how.

The old maneuver called Flight at Minimum Controllable Airspeed (MCA) taught AOA awareness and rudder coordination at slow airspeed. Flight instructors generally agreed that if they had to pick one maneuver to reveal a pilot's stick-and-rudder skills, flight at MCA would be it. You experience MCA (albeit briefly) at the beginning of a maximum performance takeoff or almost every landing flare.

The task is no longer part of FAA checkrides, but the lessons it taught are as valid today as ever.

MCA is the speed in level flight at which any decrease in indicated airspeed or increase in wing loading would cause the wing to stall. It's usually performed in the landing configuration, with full flaps, to get the speed as low as possible. In this condition, the stall horn should be blaring—stall horns are usually set to sound at five to seven knots above the stall speed.

Holding altitude at MCA requires a fair amount of power, and a lot of right rudder to compensate for propeller forces. Elevator and aileron inputs have limited effectiveness at this speed. Tiny inputs may be insufficient, yet over-controlling leads to pilot-induced oscillation. Smooth, controlled flight at MCA requires a deft touch.

This exercise adds one more factor to the traditional MCA exercise. You'll hunt for winds aloft such that MCA achieves zero groundspeed—a fixed-wing hover.

Difficulty

Crew

Find Some High Winds

You'll want steady winds aloft, a forecast for 10 knots faster than your airplane's stall speed in the landing configuration. Ideally,

SAFETY NET

- Be comfortable with stall recoveries before flying this exercise.
- Fly the exercise in smooth air for maximum effect.
- Recover if cylinder or oil temperatures get too hot.

SCORECARD

The scoring happens once you're established at MCA, heading into the wind that you need. You can tally your score for a fixed-wing hover while holding a constant altitude or while making a 1000-foot change in altitude (while at MCA).

Stall warning throughout exercise:
1: Constant stall warning
0: Intermittent stall warning or stall

Altitude (or descent rate) at MCA:
1: ±50' (or ±100 fpm)
0: Deviation >50' (or >100 fpm)

Coordinated flight while at MCA:
1: ±½ ball width or PFD "line"
0: >½ ball width or PFD "line"

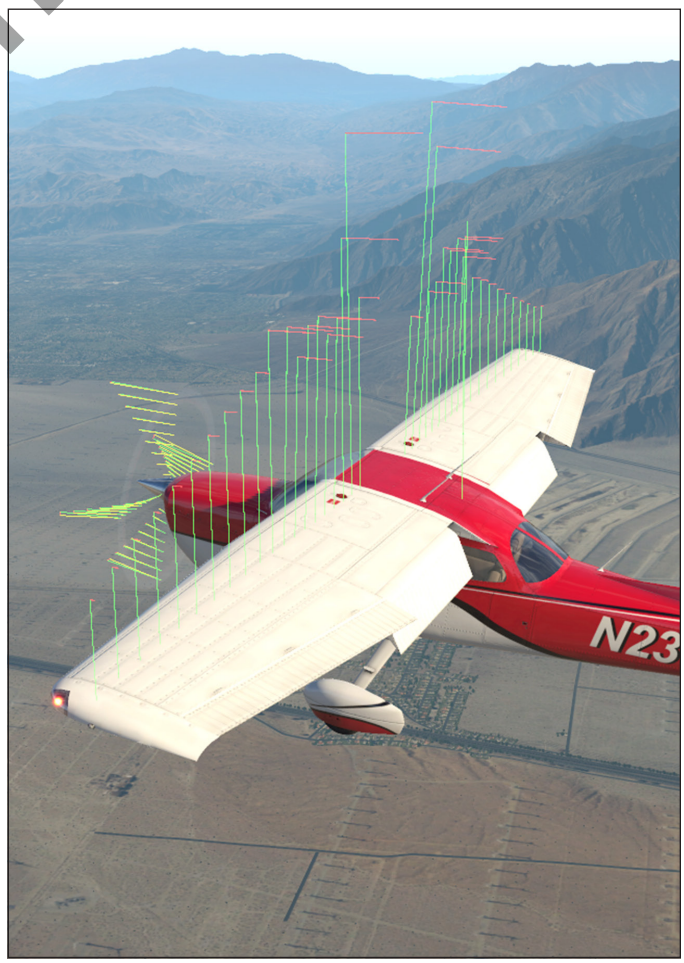
Desired heading while at MCA:
1: ±5°
0: >5°

Achieve hover for one minute:
1: Groundspeed <5 knots
0: Groundspeed ≥5 knots

Total Score for Fixed Wing Hover:

those winds should be at an altitude between 1500 and 5000 feet AGL. Clear skies in uncongested Class E or G airspace is also a big plus, so you can maneuver in any direction.

Climb to that altitude, and clear the area above and below for traffic. Fly directly into the wind. This is trivial if you have a display with a wind vector. If



Maintaining a steady MCA requires finesse at high angles of attack and relatively high power. The flight controls don't have the authority they do at cruise speeds and it's easy to over control. Note the lift lines at cruise speed (upper) and MCA (lower). The green lines going up show lift—just enough to counter gravity in both cases. But the red lines pointing aft show drag due to lift, which is much higher at MCA. (The lines on the prop are thrust.)

SEE IT IN THE SIM

Location: Palm Springs Intl., Palm Springs, CA (KPSP). Runway 31L.
Conditions: Surface winds 310 @ 50.

not, experiment to find the heading that provides the lowest ground speed.

Get Slow, Really Slow

On that heading, gradually slow the airplane while maintaining level flight. It's your choice whether or not to extend flaps, but that's generally a better choice for speed, visibility, and (in some cases) engine cooling. Retractable gear can be up or down. However, if there's a warning horn that sounds when flaps are fully extended but the gear is up, you'll probably want to fly MCA with the gear down.

Once in configuration, adjust power as needed to slow to just above stall speed while maintaining altitude. You'll hear the stall warning horn—and that's OK during this exercise.

Flying at MCA is a bit of a balancing act: manage power and pitch to fly level at just above stall speed in this configuration at the airplane's current weight. Do this while maintaining altitude and heading. Maintain wings level and heading primarily with rudder. Deflecting ailerons at a high angle of attack can cause one wing to stall before the other and create an incipient spin. Lower the angle of attack at the first aerodynamic indication of a stall.

Maneuver for a "Ground Stop"

Look at your groundspeed. While holding altitude and heading at MCA, see if you can get the groundspeed to tick down to zero without stalling. Heading adjustments to find a zero groundspeed are allowed, as is adding power to climb a bit, while still at MCA, or reducing power to descend. You're hunting for just the right spot to sustain zero groundspeed.

Keep an eye on those engine temps and take a break every few minutes to let the engine cool as necessary. It also helps just to take a break from the blaring stall horn.

When you nail that coveted "GS 0," take a photo of your panel showing altitude, power setting, indicated airspeed, and ground speed at zero. Challenge your social media friends to match that.

If you can't reach zero groundspeed, you may need to find another altitude, or even try a different day. Technically, it's no harder to fly at 5 knots groundspeed than zero, but it looks better on camera.

However, if you just need a couple knots, or to add another layer of complexity, you can try climbing or descending while you're maintaining a fixed-wing hover. Add (or reduce) power to move vertically exactly 1000 feet. That's harder to capture for posting online, but it shows mastery of flight at MCA.

It's Worth Flying Some Real MCA

After decades of pilots practicing MCA for their checkrides, the FAA decided continued flight with the stall horn blaring would breed complacency. Pilots would feel comfortable with the stall warning horn and delay recovery from near-stall conditions. Real-world data supporting this notion is thin, at best. However, this exercise does have you intentionally cause a warning system to activate and stay on. We'll say it here even though it should go without saying: If you hear a stall warning when you don't expect it, reduce your AOA.

Regardless of the current checkride standards, the training value of flight at MCA is as valid today as ever. MCA teaches airplane handling and control at high AOAs. High AOA occurs in certain critical phases of flight, but it's brief. That means it takes a lot of takeoffs and landings to develop these skills without some other way to explore it.

Flight at MCA at altitude extends the time you have to practice these skills, so you can apply them when you need them most, close to the runway. Adding an extra dimension of heading into the wind so your MCA results in a zero groundspeed makes it more challenging and fun.

It also looks unusual and cool from the ground if anyone else is watching.

PUMP IT UP: THE CONSTANT-HEADING PATTERN

Difficulty

Crew

Start with your airplane on the numbers for a runway of your choice. It can be short, as you won't need much of it. Center your heading bug, if you have one, on the runway heading.

Now, add some winds at the surface—monster winds. Start with a steady wind at least 1.5 times the flaps-up stall speed. So if you're flying a Cessna 172 with a Vs of 41 knots, that's a 63-knot wind. You can dial that down for more of a challenge. Be sure that the wind is blowing straight down the runway.

Apply power and take off. You'll be airborne almost instantly and could climb vertically, if you flew slow enough. Pitch forward and make progress into that wind at perhaps 30 or 40 knots over the ground as you climb. That's your upwind (no kidding) leg.

When you reach pattern altitude, hold your heading and pitch up to an airspeed equal to the headwind you set for the sim. You'll be essentially stationary over the ground. Nudge the left wing down so you begin to drift left for the crosswind leg, but add enough right rudder to hold your heading and enough back pressure to hold altitude. Most sims will require a bit of power to maintain altitude. Drift left on the crosswind leg as fast as you can manage without drifting backwards or losing altitude.

When you reach a position to join the downwind leg, pitch up and slow the airplane to just above stall speed. Extend flaps to fly even slower. Adjust power as necessary to hold altitude as you drift backwards on the downwind leg.

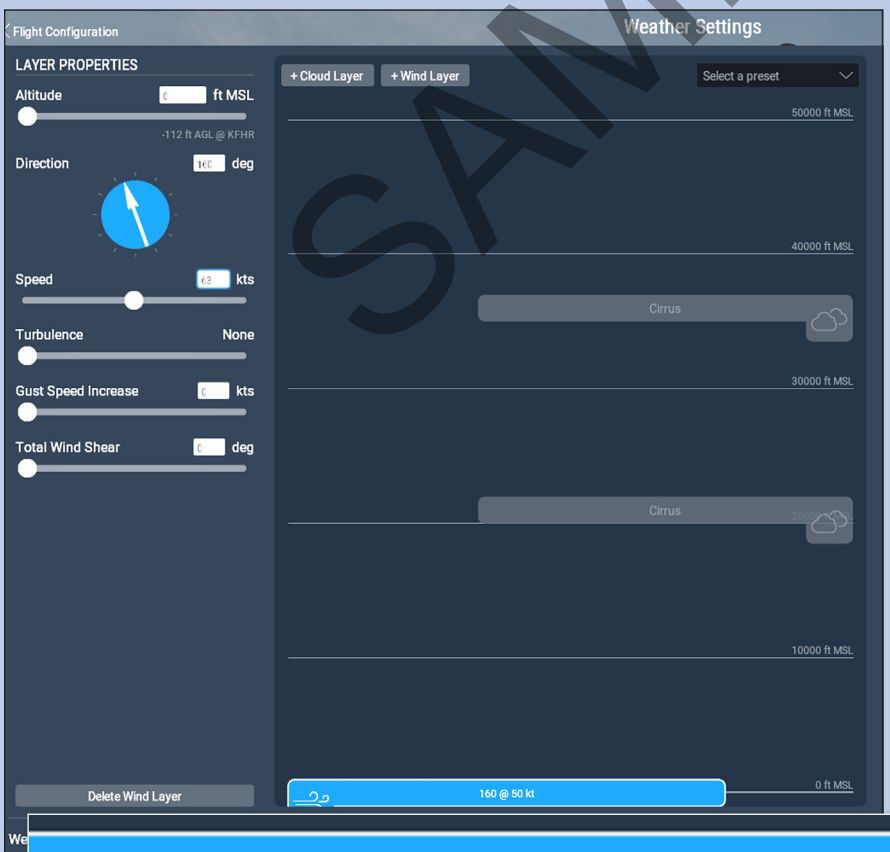
On a typical pattern, you descend when you reach a position abeam your landing target, so you'll do that on this pattern. As you come abeam the numbers, reduce power so that you descend while drifting backwards in this nearly stalled attitude. When you're ready to fly the base leg, dip your right wing to drift sideways and use opposite rudder to maintain the same heading you've maintained since takeoff. Pitch down to increase airspeed to match the wind. (You may need to retract flaps.) Adjust power as necessary.

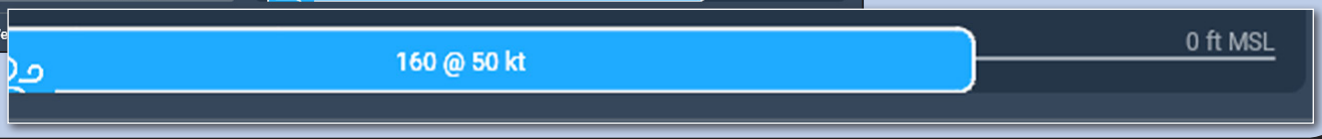
Final approach will require pitching forward and driving into the wind as you descend. The flare involves pitching up to stop all forward motion, as you adjust power to descend vertically those last couple feet and touch down exactly where you started.

Ideally, the heading bug never moved for the entire pattern.

In theory, you could do this in the real world with something like a STOL Supercub flying in a constant 45-knot wind at the surface at a runway with no nearby buildings or trees that would create hazardous mechanical turbulence.

Or, maybe not.





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