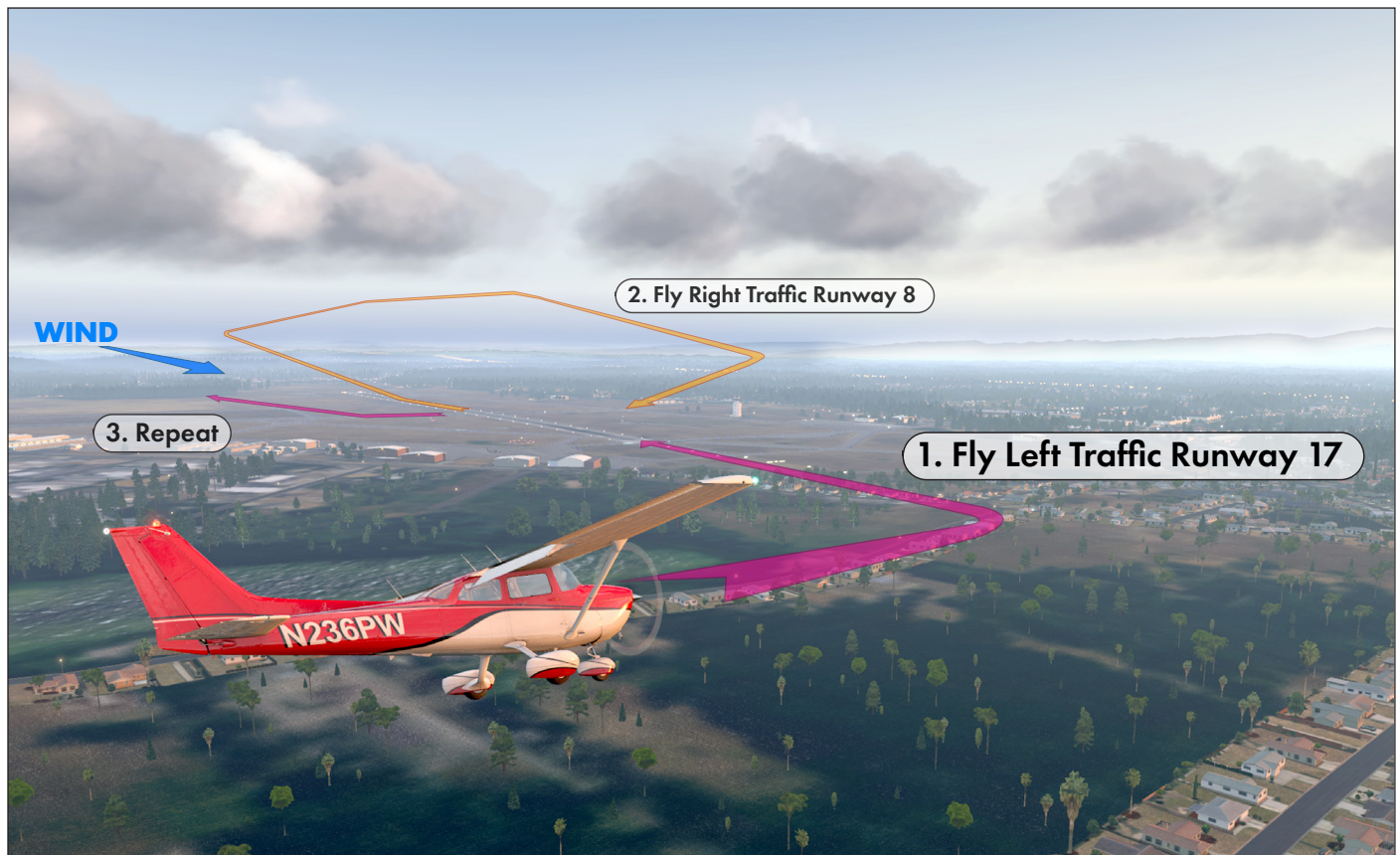


## Sample Pages

# 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.**

## Mission: Impossible?



*If your engine fails immediately after take-off, can you make the “impossible turn” and get back to the runway? Trying it out at altitude can be revealing.*

It's a staple of hangar flying and internet chats: Do you attempt a return to the runway you just departed if an engine quits on takeoff? The FAA has openly called such an attempt “the impossible turn.” Most flight instructors teach landing straight ahead. Some advocate attempting a return, citing the rare success or how it's routine for sailplane pilots.

This exercise gives you hard data to determine whether, or when, getting back to the airport is a “Mission: Impossible.”

A 180-degree turn actually puts the airplane on a track parallel to the runway, not back on it. To align, you'd continue the turn toward the runway, perhaps another 45 degrees, and then turn 45 degrees in the opposite direction. That's 270 total

degrees of turn to successfully touch down on the departure runway.

It's possible to turn around and land on the reciprocal runway from a surprisingly low altitude in many airplane types. However, it requires instantaneous and near-perfect execution. And we know perfection is almost never the case in the real world.

Airline captain and air crash investigator Brian Schiff proposed a specific exercise to determine when it may be possible to make such a return, which you can try yourself.

### Try This Experiment

Climb to an altitude where you could safely perform a power-on stall. Clear the area—both below and behind you—and then align the airplane with a prominent road or other surface landmark that you'll recognize because you'll make a 360-degree turn back to it. (The reason for 360 degrees will be clear in a moment.)

For reference, start on an even thousand alti-

#### SAFETY NET

- Practice this exercise at a safe altitude.
- Reduce bank angle and/or G load at the first stall indication.
- Clear airspace including below and behind you before the maneuver.
- Use this technique in a real emergency only if it is riskier to land straight ahead.



Starting from a known altitude (4000 feet here) climb at  $V_y$  (1). At engine failure (4500 feet here), hold your pitch for five seconds (2). Pitch down for  $V_{bg}$  and roll 45 degrees (3). After 360 degrees of turn, pitch up for a flare (4). The total altitude loss is what it would take you reach your departure runway. This airplane flared with only 10 feet to spare from the “ground” of 4000 feet.

tude. This is simulated ground level. Begin with the set up for a traditional power-on stall: Set a normal takeoff configuration and slow to a normal rotation speed, and then apply takeoff power and pitch up to a takeoff climb attitude.

However, don't pitch up further as you might for a power-on stall. Instead, simulate a sudden engine failure by having the instructor reduce the throttle to idle. This doesn't precisely provide true engine-out performance, but is much safer than actually failing your only engine. The instructor should note the altitude at which the simulated failure occurred, which is your altitude above the simulated ground.

### Don't Do Anything

Next—and this is critical to the exercise—do nothing but hold the normal climb attitude pointed straight ahead *for a full five seconds*. Research indicates that when faced with an unexpected engine failure, pilots take about five



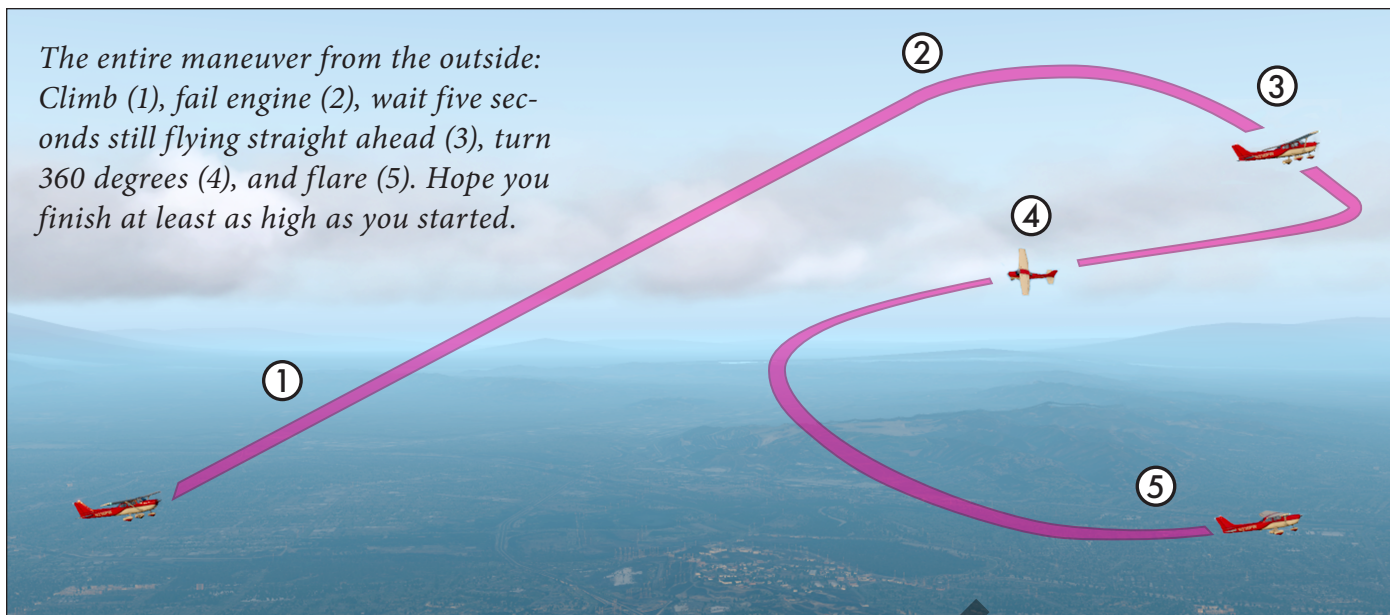
### SEE IT IN THE SIM

Location: Santa Monica Municipal, Santa Monica, CA (KSMO) Runway 21.

Conditions: Returning after the engine stops at 600' AGL. Scattered clouds, Winds 180 @ 6.



*The entire maneuver from the outside: Climb (1), fail engine (2), wait five seconds still flying straight ahead (3), turn 360 degrees (4), and flare (5). Hope you finish at least as high as you started.*



### SCORECARD

Your score is a combination of reaction and precision. You'll react to power loss with a pitch down after the "startle response" to establish the right speed, then swing a 360-degree turn with minimal G-loading and a stable airspeed, before finally flaring the airplane in a simulated landing on the heading you started on.

Establish correct pitch and speed:

1: Vbg on first push

0: Hunt for Vbg or stall horn

Maintain 45-degree turnback bank angle:

1:  $\pm 5^\circ$

0: Variations  $> 5^\circ$

Minimize altitude loss in 360° turn:

1:  $< 800'$

0:  $\geq 800'$

Maintain Vbg in 360-degree turn:

1:  $\pm 5$  knots during turn

0: Variation  $> \pm 5$  knots during turn, or stall horn

Simulate touchdown on heading and under control:

1: On heading  $\pm 5^\circ$  in flare

0: Off heading  $> 5^\circ$  in flare

Total Score for Mission Impossible:

seconds to detect the problem, determine whether it requires a reaction, decide what the response should be, and then make a control input. Research shows that during this five-second "startle event," pilots tense up on the controls and subconsciously apply back pressure to maintain a normal-looking departure attitude. All the while the airplane is climbing and decelerating toward flaps-up stall speed with a slowly increasing G load.

After the five count, push the nose down to the attitude that yields best glide (Vbg). It will be a significant forward push, because you must regain lost speed and accelerate to Vbg. In many airplanes, this is about the same attitude that you see on short final while making a short-field landing. (Tip: Practicing short field landings regularly helps prepare you for engine failure on takeoff. )

While pushing the nose down, simultaneously bank 45 degrees. Most pilots feel more comfortable making left turns, so bank to the left. Mathematics prove that a 45-degree bank is an optimal compromise between rate of turn and altitude lost. As long as you push the nose down firmly to Vbg attitude, you will not increase G load significantly even at 45 degrees of bank, thus stall speed is not increased noticeably.

Maintain coordination, bank angle,



and airspeed while you make a complete 360-degree turn to realign with your ground reference. When you've completed the 360, pitch to a flare attitude and see if this flare was above—or below—the virtual ground.

### Note the Required Altitude

The amount of altitude lost in this maneuver, from simulated power loss and “startle response” to the end of a 360-degree turn, represents the minimum altitude AGL from which you could attempt to return to the runway if an engine quit on takeoff. This provides a small buffer for safety given that in an actual emergency pilots may not fly as precisely as they do during an exercise.

Of course, you shouldn't attempt the turn unless you have regularly practiced the maneuver. If you want this technique in your toolkit, practice this exercise periodically. Schiff also points out: “A turnback should be attempted only when it is more hazardous not to.” If you have options straight ahead or at a slight angle, don't attempt to return to the runway.

There's a natural desire to turn a crippled airplane back to the departure runway. The accident record shows that simply following the urge often has disastrous results. However, as the areas around airports are becoming more built up with houses and businesses, it leaves few (if any) options for an engine-out landing that doesn't put persons on the ground at risk. Even if you can't make it back to a runway, it may be that your best bet is to attempt a return to the airport area and land on the infield, a taxiway or another runway. You'll also want to turn into any crosswind in most cases to minimize your lateral distance traveled in the turn. This requires an assessment of the options and obstacles for your departure runway before you depart, which is something all responsible pilots should do.

Knowing the minimum altitude for making it all the way back to the runway helps you decide a lesser altitude where you'd at least have the option of reaching the flat airport grounds. If nothing else, the rescuers can reach you more quickly and it keeps innocent bystanders out of the picture.

### PUMP IT UP: LOW ALTITUDE TURN BACK

Set up at the airport of your choice and first try it with no-wind conditions and from the altitude you determined in the “Mission: Impossible” exercise. You should be able to return to the airport and land. Note how being closer to the ground creates a strong urge to pull back on the controls. That's a killer in the real world.



Now add some winds. It's best to use real-world winds so you can check them on your iPad or web browser. Pick an airport with some interesting winds and try again. A strong headwind becomes a tail-

wind and high ground speed in the opposite direction, so you may go off the far end of the runway. Turning into a crosswind reduces your turn radius and also minimizes the total amount of turn necessary to align with the runway.

Experiment and find the minimum altitude needed to make it to the runway. Find the minimum altitude that permits a 180-degree turn back to the airport grounds. Just remember to delay five seconds each time. The danger in doing these exercises is convincing yourself that you're an expert in turning back because you could repeatedly do it in the sim. Remember that you were expecting the failure and doing repeated practice. It's another animal if it surprises you in the real world.

Also try some straight-ahead and 90-degree turns such as taking off toward the ocean and turning to land on a beach.



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