Cross-Controlled Stalls (Demonstration)

Objective

To ensure the applicant learns the purpose of and can exhibit a clear understanding of the cross-controlled stall maneuver and how to perform the maneuver properly.

Purpose

Every pilot's worst nightmare is a base-to-final stall and spin. There is very little altitude and very little opportunity to recover, and these accidents are often fatal. The cross-controlled stalls demonstration introduces pilots to the hazards of uncoordinated stalls, their aerodynamics, and teaches the proper recovery procedures.

Schedule

- **Ground Lesson**: 15 minutes
- Initial
  - **Flight**: 40 minutes - *Demonstrate Maneuver*
- CFI Applicants Only
  - **Flight**: 30 minutes - *Practice Maneuver (Dual)*
  - **Flight**: 20 minutes - *Demonstrate Proficiency*
- **Debrief**: 10 minutes (*per flight*)

Equipment

- Airplane Checklist
- Whiteboard / Markers (optional)
- Model Airplane (optional)

Student Actions

- Ask any questions, receive study material for the next lesson.
- Watch linked video.
- Review listed references.

Instructor Actions

- Deliver the ground lesson (below).
- Demonstrate the maneuver in flight.
- Debrief after each flight.

Completion Standards

- **Ground**: Student can explain the purpose of the cross-controlled stall maneuver, when it may be encountered during flight training, and the proper recovery procedure.
- **Flight**: Student can perform the maneuver to the following standards:
  - Clears the area, performs a pre-maneuver checklist, and configures the airplane for landing in the **clean configuration**.
  - Selects a simulated 'runway', and begins a simulated base leg descent at **no lower than 3,500ft AGL**.
  - Descends at a normal approach airspeed and intentionally overshoots final.
  - Turns towards final, and steepens turn with inside rudder, holding opposite aileron to prevent overbanking..
  - Pulls back to hold the nose up, and induces the cross-controlled stall.
  - Recognizes and acknowledges the stall and relaxes elevator pressure and applies opposite rudder to recover.
  - Returns to a normal climb configuration and airspeed and returns to pre-maneuver altitude.

References

- LewDixAviation - “Instructing The Instructor| Part Two: The Dreaded Base To Final Turn”
    - YouTube - https://www.youtube.com/watch?v=379E6V-TgxI
- FAA-H-8083-3B (Airplane Flying Handbook) - Chapter 4, Page 5-6 [Stalls/Stall Recognition/Stall Recovery], Chapter 4, Page 11-12 [Cross-Control Stall]
- FAA-H-8083-25B (Pilot’s Handbook of Aeronautical Knowledge) - Chapter 5, Page 25-26 [Stalls]
- FAA-S-8081-6D (CFI PTS) - Area XI Task D

Ground Lesson Outline

- What are Cross-Controlled Stalls?
    - Base-to-Final Turns
    - Improper Stall Recovery
- Aerodynamics of Cross-Controlled Stalls
    - Tendency to enter a spin
    - Anatomy of the Gliding Base-to-Final Stall-Spin
        - Base Leg
        - Overshoot Final
        - Skidding Turn To Final
        - Bank Increases, Nose Falls
        - Stall
        - Spin Entry
- Entry Procedure
    - Simulate Base-to-Final Stall
    - Minimum entry altitude - 3,500ft AGL
- Recognition and Recovery
    - Relax elevator backpressure and apply anti-spin rudder
    - Minimum recovery altitude - 2,500ft AGL
- Maneuver Description - step-by-step
    - Clean configuration
    - Entry position, airspeed, etc.

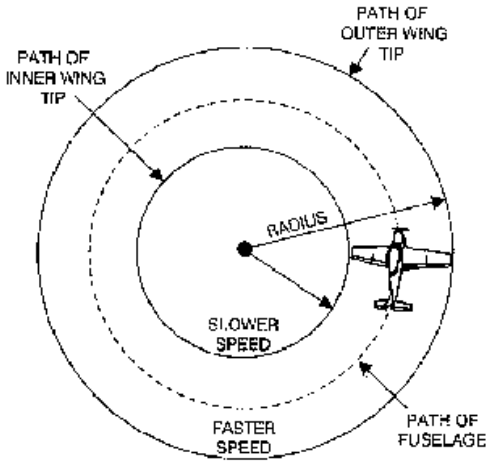
Common Errors

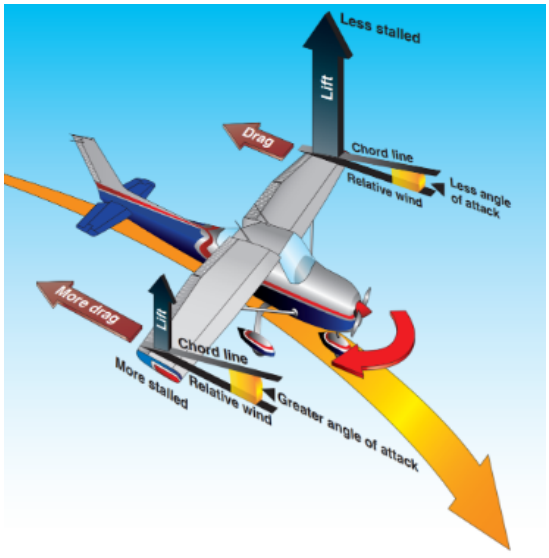
- Failure to establish selected configuration prior to entry.
- **Failure to establish a cross-controlled turn and stall condition that will adequately demonstrate the hazards of a cross-controlled stall.**
- **Improper or inadequate demonstration of the recognition and recovery from a cross-controlled stall.**
- Failure to present simulated student instruction that emphasizes the hazards of a cross-controlled condition in a gliding or reduced airspeed condition.

Ground Lesson Content

- **What are Cross-Controlled Stalls?** - Cross-controlled stalls are exactly what they sound like: stalls that happen while *uncoordinated*, usually with the controls 'crossed'. Usually they involve a skidding turn. These stalls are considerably more dangerous than normal stalls. Most pilots have been taught since very early in their training to avoid cross-controlled stalls at all costs. Cross controlled stalls usually happen by accident, and they can surprise pilots in the traffic pattern, or in the practice area.
    - **Base-to-Final Turns** - The most common place a cross-controlled stall would occur is, inadvertently, during a gliding, base-to-final turn. Pilots often have been taught to fear banking too much when close to the ground, and in situations where they have overshot the base-to-final turn, they may try to steepen the turn without increasing the bank. This leads to a skidding ('bottom rudder') turn, where the ailerons are being held opposite in order to fight to overbanking tendency.
    - **Improper Stall Recovery** - Another place where a cross-controlled stalls are encountered is during improper recovery from stalls performed in training. If the airplane is uncoordinated when entering the stall, one wing will tend to drop rapidly. Surprised and inexperienced pilots attempt to raise the falling wing with aileron, deepening the stall, and leading to a *secondary*, cross controlled stall.

- **Aerodynamics of Cross-Controlled Stalls** - To understand the danger of cross-controlled stalls, pilots must understand the aerodynamics involved. In an uncoordinated, usually *skidding*, turn, one wing is being blanketed partially by the fuselage, as well as flying a shorter path than the outside wing, resulting in the inside wing flying slightly slower than the outside wing. This leads to a stall where the inside wing stalls first, even when the outside wing may still be flying normally, creating a violent tendency to bank in the direction of the stalled wing.





    - **Tendency to enter a spin** - The situation described above is the same process that occurs during a spin entry, and **uncoordinated, cross-controlled stalls will rapidly become spins if prompt corrective action is not applied!**
    - **Anatomy of the Gliding Base-to-Final Stall-Spin** - The typical 'entry' procedure for an unintentional gliding, base-to-final spin is as follows:

- **Base Leg** - Airplane is flying on a base leg, approaching the turn to final. The airspeed is low for approach and landing, and often allowed to get *too low*.
- **Overshoot Final** - The airplane overshoots final approach. This often occurs when there is a left crosswind on a left base, with the crosswind providing an unexpected tailwind on base.
- **Skidding Turn To Final** - The pilot banks the airplane towards final, and not wanting to increase bank any further, applies *bottom* or *inside* rudder to hasten the turn to final.
- **Bank Increases, Nose Falls** - The pilot notices that the airplane wants to continue to bank towards the turn, so they apply opposite aileron. This cross-controlled, uncoordinated situation increases drag and causes the nose to fall.
- **Stall** - The pilot attempts to raise the nose with elevator and the airplane begins to stall. The increased stall speed from the banked turn, combined with the uncoordinated crossed-controls, causes the inside wing to stall first, rolling the airplane towards the inside of the turn.
- **Spin Entry** - If left uncorrected, the airplane will begin spinning in the direction of the turn.

- **Entry Procedure**
  - **Simulate Base-to-Final Stall** - To demonstrate the cross-controlled stall maneuver, the pilot should designate a road or other line feature on the ground as a 'runway' and fly a simulated descending base leg to line up with it. Overshoot final approach, and make an uncoordinated, skidding turn to attempt to line up. Maintain pitch to induce the stall.
  - **Minimum entry altitude** - The maneuver should be started **no lower than 3,500ft AGL**.

- **Recognition and Recovery** - In general, pilots should recognize the factors that lead to a cross-controlled stall and prevent the base-final stall situation from developing in the first place. However, if one does occur, and a wing drops, it is important to recognize that **aileron input will only worsen the situation**. Relax elevator pressure, and apply immediate opposite (anti-spin) rudder to raise the dropping wing. If a stall indication is heard during a tight turn, or a wing drops hard after a stall, apply the cross-controlled stall recovery:
  - **Relax elevator backpressure and apply opposite (anti-spin) rudder**
  - **Minimum recovery altitude** - Recovery should be made **no lower than 2,500ft AGL**.

Maneuver Description

- **Entry Altitude** - Cross-controlled stalls are effectively spin entries, and so should always be performed at a safe altitude, in case of a delayed or inadequate recovery, or other problems. The maneuver should be performed such that accounting for altitude loss during the stall, or the ensuing incipient spin, the final altitude is no lower than 2,500 feet AGL. Therefore it is best to begin the maneuver **at least 3,500 feet AGL**.
- **Checklists** - Pilots must perform a pre-maneuver checklist before beginning the maneuver. Because this maneuver is meant to simulate an approach to landing, it is a good idea to also perform a pre-landing checklist. **Because significant altitude may be lost in this maneuver, make sure to clear the area below the airplane as well!**
- **Ground Reference** - Select a suitable linear ground reference (road, canal, etc) to represent the 'runway' and set up a descending base leg to it.
- **Entry Airspeed** - The maneuver should be started at a normal approach airspeed.
- **Configuration** - Configure the airplane in the **clean configuration**, to avoid overspeeding the flaps in the event of an unintentional spin.
- **Entry Power** - Initially, reduce the power to begin a normal descent for landing at the approach airspeed.
- **Overshoot Final** - Intentionally overshoot the normal base-to-final turn.
- **Bank** - Make a turn towards the 'runway' at a normal pattern bank angle. The bank angle should be **20-30 degrees** to keep a low load factor.
- **Skid** - After the airplane is established in a stable descending turn towards final, attempt to tighten the turn with inside rudder, while holding opposite aileron to prevent the airplane from banking further.
- **Stall** - Acknowledge (call out) the first indications of an approaching stall (especially the buffet or stall warning horn). Maintain back elevator pressure and allow the airplane to stall.
- **Recovery** - Promptly **reduce back elevator pressure, apply opposite rudder to stop the falling wing, and smoothly recover to a normal pitch attitude.** Once the airplane has regained flying airspeed, apply full power and establish a climb at Vx or Vy to get back to the pre-maneuver altitude.
- **Coordination** - This maneuver is intentionally flown uncoordinated, but be aware of the potential for entering a spin and be prepared to apply spin recovery techniques.
- **This is a visual maneuver!** Eyes should remain outside the cockpit as much as possible to scan for traffic and to monitor the progress of the maneuver.