Task XI.D: Cross Controlled Stalls

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Lesson Overview

Objective

The student should understand the dynamics of a crossed-control stall and therefore be able to recognize situations which could lead to a crossed-control stall. The student also should be able to safely and effectively demonstrate and properly recover from a crossed-control stall.

Reference

- Aircraft Flight Manual / Pilot's Operating Handbook
- Airplane Flying Handbook (FAA-H-8083-3B, page(s))

Key Elements

1. Too much rudder can hurt us
2. Little or no warning of a stall
3. Intuitive reactions are dangerous

Elements

1. Aerodynamics of Crossed-Controlled Stalls
2. Performing Crossed-Control Stalls

Equipment

1. White board and markers
2. References
3. iPad

Instructor Actions

1. Discuss lesson objectives
2. Present Lecture

3. Ask and Answer Questions
4. Assign homework

Student Actions

1. Participate in discussion
2. Take notes
3. Ask and respond to questions

Schedule

1. Discuss Objectives
2. Review material
3. Development
4. Conclusion

Completion Standards

The lesson is complete when the student understands the unique requirements for a crossed-control stall and can confidently recognize and recover from a crossed-control situation.

Instructor Notes

Introduction

Attention - Flirting with disaster!

https://apstraining.com/traffic-pattern-stalls/

Overview

- Review Objectives and Elements/Key ideas

What

This type of stall occurs with the controls crossed - aileron pressure applied in one direction and rudder pressure in the opposite direction.

Why

It is imperative that this type of stall not occur during an actual approach to landing, since recovery may be impossible prior to ground contact due to the low altitude. During traffic pattern operations, any conditions that result in overshooting the turn from base leg to final approach, dramatically increase the possibility of an unintentional accelerated stall while the airplane is in a crossed-control condition.

Lesson Details

The scenario is old, and is one that can kill. In a descent a pilot is turning from base to final with a little tailwind on base. This creates a situation where the aircraft overshoots the centerline, and a correction is needed.

In order to attempt to fix the problem the pilot rolls into 30° of bank, knowing that is the safe limit in the pattern. Sadly, that bank isn’t enough to fix the problem and line up the aircraft with the centerline, so the overshoot is inevitable.

Attempting to "get the nose around" the pilot, nervous about banking more at such a low altitude, feeds in left rudder to push the nose around. This action also increases lift on the right wing and decreases lift on the left. As lift increases on the right wing it starts to rise, and to counter this the pilot inputs a bit of right aileron.

The aircraft is now cross-controlled, with left rudder and right aileron.

Getting More Detailed

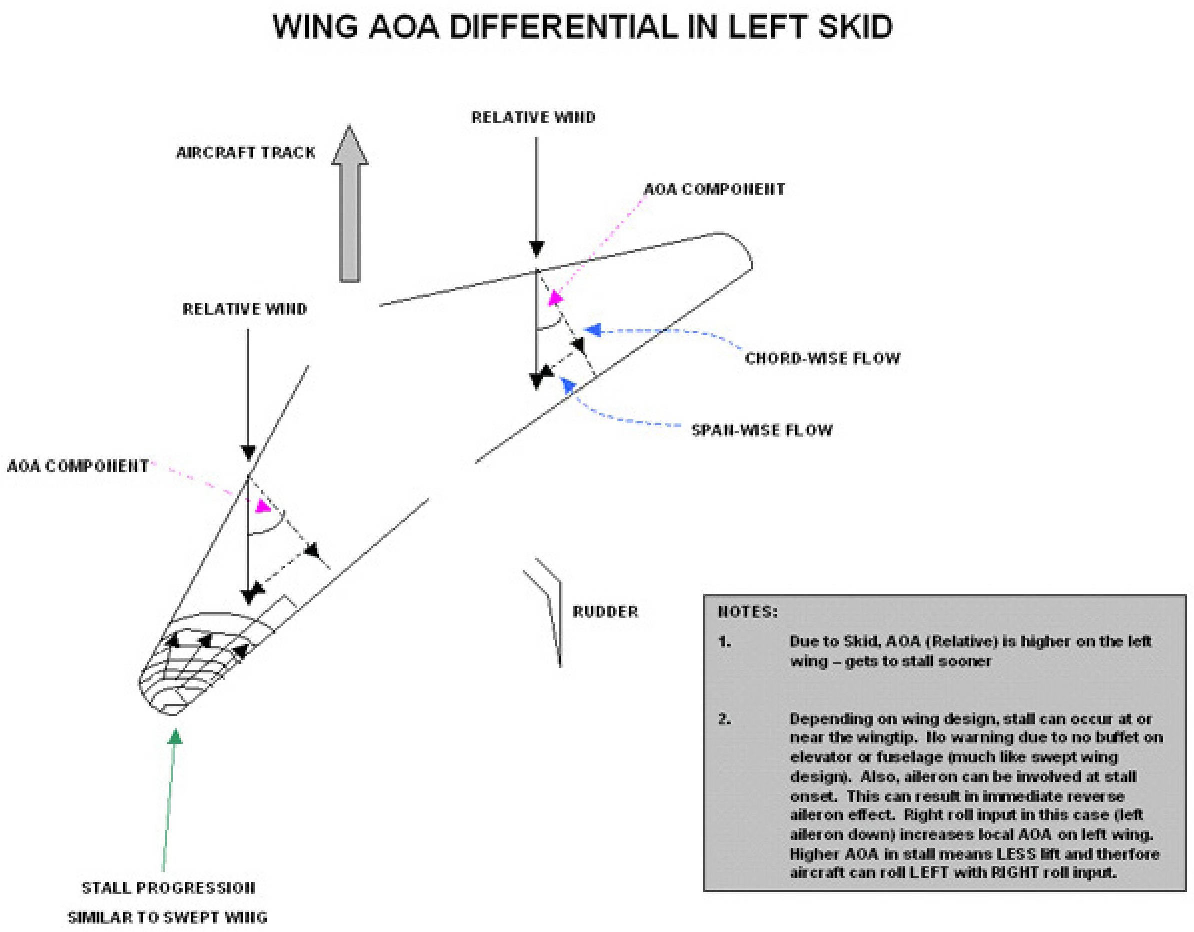
Rudder is your friend when recovering from a stall, but too much of a good thing is still too much and can hurt you. Looking at a hypothetical traffic pattern cross-controlled stall, the results of too much rudder can be explored.

Rudder coordinates roll inputs and cancels the yaw effects associated with the engine and propeller in normal flight, which is all good. But what happens when the aircraft enters uncoordinated skidding flight? In this scenario excess rudder is applied and the nose of the aircraft yaws left (assuming a normal left hand pattern), the aircraft slows down, the nose drops, and the aircraft gets some left roll. The left roll is due to the yaw accelerating the right wing; as the right wing is accelerated forward it generates more lift than the left wing, thus rolling the aircraft.

As the aircraft enters the uncoordinated yaw the fuselage turns broadside into the relative wind, creating an increase in total drag. This explains the loss of airspeed and the drop of the nose.

In order to maintain the bank angle, airspeed, and pitch angle while skidding the pilot has to make adjustments with the controls. Right roll is needed to maintain bank angle, and power is needed to overcome the increased drag. Back pressure is needed to increase the AOA and maintain pitch.

In this scenario the left wing has a higher AOA than the right, which means it is closer to the critical stalling AOA, and will likely stall first. The right roll induced by applying left rudder increases the AOA on the left wing even further, so the left wing has multiple reasons to be closer to the critical stalling AOA.



This diagram helps try and illustrate the differences in AOA when the aircraft is in a left skid.

Adding additional complexities to this situation, envision the airflow when in a left skid. The tail has swung to the right, and the stall will proceed starting at the tip of the back-trailing (left) wing. Therefore the disturbed airflow will not go over the elevator, and the normal pre-stall buffet will not be experienced.

Finally, since the stall is going to occur starting outboard (unlike a normal straight-ahead stall, which progresses from the wing root) the left aileron will be ineffective. This collection of circumstances combine to create a situation where the stall can occur with little warning, be more pronounced, and be less controllable. It isn't surprising, given those factors, that the cross-controlled stall can cause the aircraft to roll inverted.

Since this can happen low to the ground (i.e. during the base-to-final turn) there is little altitude for recovery. If the aircraft has rolled inverted, and the pilot has no aerobatic training, the natural reaction is to pull … which is exactly the wrong reaction.

Bottom line : intuitive recovery techniques don't work.

The recovery from this stall is to release control pressures and add power as needed to recover. The proper recovery must be performed before entering an abnormal attitude (particularly if low to the ground).

Performing the Cross-Control Stall Maneuver

Before Starting

1. Perform the pre-maneuver checklist
    a. Fuel Pump - ON
    b. Mixture - RICH
    c. Gauges - GREEN
2. Ensure that the area is clear of traffic
3. Select a starting altitude
    a. The aircraft must be recovered above 1,500 feet AGL
4. Select the desired configuration for the aircraft for the maneuver
    a. Gear down, if retractable, and flaps up due to the possibility of exceeding the aircraft's limitations.

Executing the Cross-Control Stall

1. Roll into a medium bank turn
    a. This simulates the base-to-final turn, with an overshoot of the centerline.
2. During the turn input excessive rudder pressure in the direction of the turn, but hold the bank angle with opposite aileron.
3. Increase back elevator pressure to keep the nose from lowering
4. All the above control pressures should be increased until the aircraft stalls.
    a. The plane may stall without the normal warning signs.

Stall Recovery

1. Release the control pressures, and increase power as needed
    a. Recovery must occur before the aircraft enters an abnormal attitude. Otherwise the aircraft could enter a vertical spiral or a spin. The pilot must be able to recognize when this sort of stall is imminent and must take immediate action to prevent a completely stalled condition.
    b. **Do NOT attempt to correct the roll with opposite aileron, as that will only increase the roll to an inverted condition.**

Spin Recovery

Since this maneuver can result in a spin, recovery from spins is included here.

1. Power - idle
2. Ailerons - neutral
3. Rudder - opposite spin direction

4. Elevator - briskly forward
    a. This should break the stall, then when the spin stops …
5. Rudder - relaxed
6. Elevator - recover from dive

Bottom Line: Stay coordinated to avoid a cross-control stall!

Common Errors

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

Conclusion

It is imperative that this type of stall not occur during an actual approach to landing, since recovery may be impossible prior to ground contact due to the low altitude. During traffic pattern operations, any conditions that result in overshooting the turn from base leg to final approach, dramatically increases the possibility of an unintentional accelerated stall while the airplane is in a cross-control condition. If overshooting, do not try to correct with rudder, instead initiate a go-around and try again.

ACS Requirements

CFI PTS Standard

To determine that the applicant

1. Exhibits instructional knowledge of the elements of crossed-control stalls, with the landing gear extended by describing:
    a. Aerodynamics of crossed-control stalls.
    b. Effects of crossed controls in gliding or reduced airspeed descending turns.
    c. Flight situations where unintentional crossed-control stalls may occur.
    d. Entry procedure and minimum entry altitude.
    e. Recognition of crossed-control stalls.
    f. Recovery procedure and minimum recovery altitude.
2. Exhibits instructional knowledge of common errors related to crossed-control stalls,

with the landing gear extended by describing:

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

3. Demonstrates and simultaneously explains a crossed-controlled stall, with the landing gear extended, from an instructional standpoint.
4. Analyzes and corrects simulated common errors related to a crossed-controlled stall with the landing gear extended.