Task XI.F: Secondary Stalls

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Lesson Overview

Objective

The student should develop knowledge of the elements related to secondary stalls and the importance of an initial proper stall recovery.

Reference

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

Key Elements

1. Airspeed!
2. Increased Load Factor
3. More Pronounced Stall the 2nd Time

Elements

1. Aerodynamics
2. Possible Situations
3. The Maneuver

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 student understands the importance of a properly performed stall recovery.

Instructor Notes

Introduction

Attention

Fool me once shame on you. Fool me twice, shame on me. Stalling once isn't good. Stalling twice really isn't good.

Overview

- Review Objectives and Elements/Key ideas

What

A secondary stall is a stall that occurs after a recovery from a preceding stall.

Why

The loss of altitude associated with a single stall can be potentially hazardous. By stalling the aircraft, a second time while recovering from the first stall the altitude loss is amplified and the second stall may be more aggressive. Learning the proper stall recognition and recovery procedures and demonstrating a secondary stall will allow the pilot to safely recover the first time and not aggravate the situation.

Lesson Details

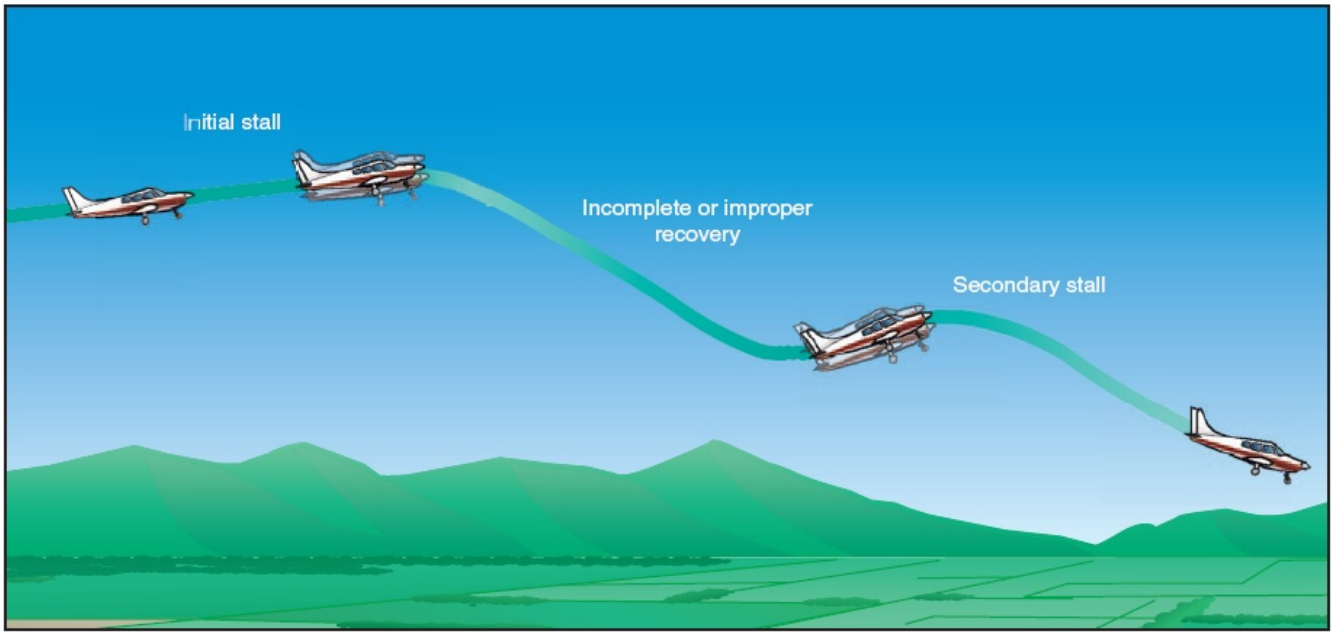
A stall occurs when the smooth airflow over the wing is disrupted and lift decreases rapidly. This is

caused by the wing exceeding its critical angle of attack. The stall is strictly related to AOA, which means it can occur at any pitch angle, with any power setting.

More specifically, when the AOA is increased to approximately 15° to 20° (usually 18°), the air can't follow the upper curvature of the wing. This is known as the critical angle of attack. As the critical AOA is approached the air begins separating from the rear of the upper wing surface. As the AOA is increased the air is forced to flow straight back and a swirling/burbling of the air begins to flow over the upper surface. When the critical AOA is reached that turbulent flow spreads over the entire wing surface. This results in a sudden increase in pressure on the upper surface and a loss of lift. Due to the loss of lift the form drag is such that the remaining lift can't hold the aircraft aloft.

Most wings are designed to stall in a predictable and controlled manner. They stall from the root outward to the tip. This is achieved by various mechanisms, one of which is building the wing with washout (a slight twisting of the wing along the chord so the AOA is slightly different from root to tip). This leaves the ailerons somewhat effective up to the point where the wing is fully stalled.

Attempting to recover from a stall too aggressively, only with power (no pitch correction), or before the stall has been broken (before the aircraft has sufficient speed to fly) results in a secondary stall. If the original stall has not been broken more back pressure will put the aircraft into a deeper stall resulting in significant additional loss in altitude. The stall will likely be more pronounced the second time and may pitch down more steeply and yaw more violently.



Possible Situations

Performing the Secondary 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. For this demonstration configure the aircraft for landing, and trim for the normal approach airspeed.
5. Decide whether the demonstration will be power-on, or power-off, and set the power accordingly

Executing the Elevator Trim Stall

1. Perform a normal power on/off stall
2. At the stall reduce the angle of attack, then abruptly pull back on the controls (before reaching Va).
3. Recognize the stall by observing the stall warning horn, buffeting, loss of control effectiveness, full up elevator, high sink rate, and nose down pitching.

Stall Recovery

1. Back pressure should be released as in a normal stall recovery
2. Apply maximum power, and maintain coordination
3. When sufficient airspeed has been attained the airplane can be returned to straight and level flight, or established in a climb at Vxor Vy.

Additional Notes

Along with the traditional description of a secondary stall as being an attempt to return to a normal flight path by use of an "abrupt" maneuver during the stall recovery, there is another mode by which a secondary can be provoked.

In the event of a fully stalled condition, if the pilot engages in an inadequate recovery (i.e. they are trying to achieve a minimum loss of altitude and therefore are reluctant to get the nose down adequately) the aircraft may re-enter a stalled state. This is due to the fact that in a nose high fully stalled condition the aircraft might simply start to fall downward, creating an extremely high AOA because as the aircraft just falls the relative wind will start to come from underneath. An attempt to try and fly under these conditions will have the aircraft exceeding the critical AOA, and an immediate stall (secondary to the initial stall) will occur.

Common Errors

- Failure to present simulated student instruction that adequately emphasizes the hazards of secondary stalls

- Failure to establish selected configuration prior to entry
- Improper or inadequate demonstration of the recognition and recovery

Conclusion

Properly recover from the stall the first time. The second stall likely will be more pronounced and is worth avoiding.

ACS Requirements

CFI PTS Standards

To determine that the applicant

1. Exhibits instructional knowledge of the elements of secondary stalls, in selected landing gear and flap configurations by describing:
    a. Aerodynamics of secondary stalls.
    b. Flight situations where secondary stalls may occur.
    c. Hazards of secondary stalls during normal stall or spin recovery.
    d. Entry procedure and minimum entry altitude.
    e. Recognition of a secondary stall.
    f. Recovery procedure and minimum recovery altitude.
    g. Failure to establish selected configuration prior to entry.
    h. Improper or inadequate demonstration of the recognition of and recovery from a secondary stall.
    i. Failure to present simulated student instruction that adequately emphasizes the hazards of poor procedure in recovering from a primary stall.
2. Demonstrates and simultaneously explains secondary stalls, in selected landing gear and flap configurations, from an instructional standpoint.
3. Analyzes and corrects simulated common errors