

AIRPLANE FLYING HANDBOOK

2004

**U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
Flight Standards Service**

The addition of inside rudder pressure will cause the speed of the outer wing to increase, therefore, creating greater lift on that wing. To keep that wing from rising and to maintain a constant angle of bank, opposite aileron pressure needs to be applied. The added inside rudder pressure will also cause the nose to lower in relation to the horizon. Consequently, additional back-elevator pressure would be required to maintain a constant-pitch attitude. The resulting condition is a turn with rudder applied in one direction, aileron in the opposite direction, and excessive back-elevator pressure—a pronounced cross-control condition.

Since the airplane is in a skidding turn during the cross-control condition, the wing on the outside of the turn speeds up and produces more lift than the inside wing; thus, the airplane starts to increase its bank. The down aileron on the inside of the turn helps drag that wing back, slowing it up and decreasing its lift, which requires more aileron application. This further causes the airplane to roll. The roll may be so fast that it is possible the bank will be vertical or past vertical before it can be stopped.

For the demonstration of the maneuver, it is important that it be entered at a safe altitude because of the possible extreme nosedown attitude and loss of altitude that may result.

Before demonstrating this stall, the pilot should clear the area for other air traffic while slowly retarding the throttle. Then the landing gear (if retractable gear) should be lowered, the throttle closed, and the altitude maintained until the airspeed approaches the normal glide speed. Because of the possibility of exceeding the airplane's limitations, flaps should not be extended. While the gliding attitude and airspeed are being established, the airplane should be retrimmed. When the glide is stabilized, the airplane should be rolled into a medium-banked turn to simulate a final approach turn that would overshoot the centerline of the runway.

During the turn, excessive rudder pressure should be applied in the direction of the turn but the bank held constant by applying opposite aileron pressure. At the same time, increased back-elevator pressure is required to keep the nose from lowering.

All of these control pressures should be increased until the airplane stalls. When the stall occurs, recovery is made by releasing the control pressures and increasing power as necessary to recover.

In a cross-control stall, the airplane often stalls with little warning. The nose may pitch down, the inside wing may suddenly drop, and the airplane may continue to roll to an inverted position. This is usually the beginning of a spin. It is obvious that close to the ground is no place to allow this to happen.

Recovery must be made before the airplane enters an abnormal attitude (vertical spiral or spin); it is a simple matter to return to straight-and-level flight by coordinated use of the controls. The pilot must be able to recognize when this stall is imminent and must take immediate action to prevent a completely stalled condition. It is imperative that this type of stall not occur during an actual approach to a landing, since recovery may be impossible prior to ground contact due to the low altitude.

The flight instructor should be aware that 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.

ELEVATOR TRIM STALL

The elevator trim stall maneuver shows what can happen when full power is applied for a go-around and positive control of the airplane is not maintained. [Figure 4-8] Such a situation may occur during a go-around procedure from a normal landing approach

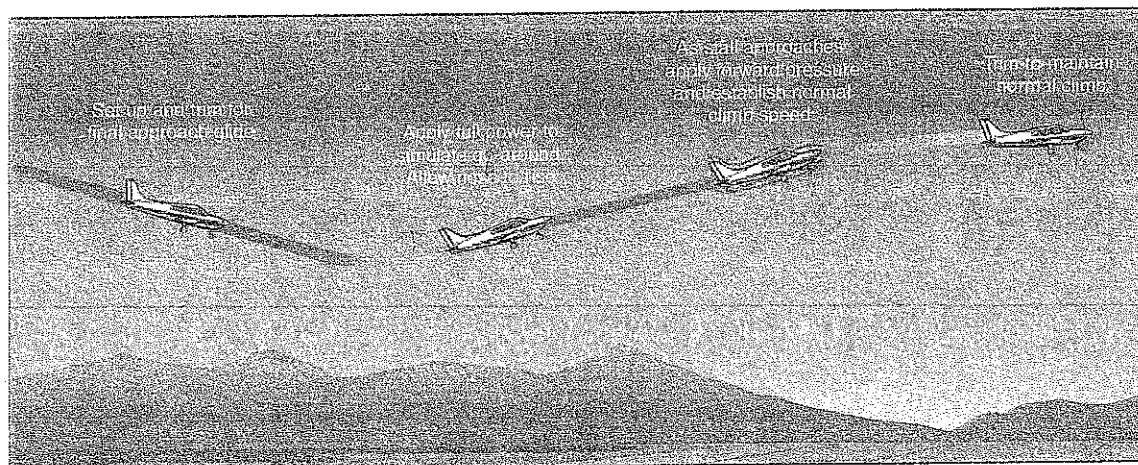


Figure 4-8. Elevator trim stall.

or a simulated forced landing approach, or immediately after a takeoff. The objective of the demonstration is to show the importance of making smooth power applications, overcoming strong trim forces and maintaining positive control of the airplane to hold safe flight attitudes, and using proper and timely trim techniques.

At a safe altitude and after ensuring that the area is clear of other air traffic, the pilot should slowly retard the throttle and extend the landing gear (if retractable gear). One-half to full flaps should be lowered, the throttle closed, and altitude maintained until the airspeed approaches the normal glide speed. When the normal glide is established, the airplane should be trimmed for the glide just as would be done during a landing approach (nose-up trim).

During this simulated final approach glide, the throttle is then advanced smoothly to maximum allowable power as would be done in a go-around procedure. The combined forces of thrust, torque, and back-elevator trim will tend to make the nose rise sharply and turn to the left.

When the throttle is fully advanced and the pitch attitude increases above the normal climbing attitude and it is apparent that a stall is approaching, adequate forward pressure must be applied to return the airplane to the normal climbing attitude. While holding the airplane in this attitude, the trim should then be adjusted to relieve the heavy control pressures and the normal go-around and level-off procedures completed.

The pilot should recognize when a stall is approaching, and take prompt action to prevent a completely stalled condition. It is imperative that a stall not occur during an actual go-around from a landing approach.

Common errors in the performance of intentional stalls are:

- Failure to adequately clear the area.
- Inability to recognize an approaching stall condition through feel for the airplane.
- Premature recovery.
- Over-reliance on the airspeed indicator while excluding other cues.
- Inadequate scanning resulting in an unintentional wing-low condition during entry.
- Excessive back-elevator pressure resulting in an exaggerated nose-up attitude during entry.

- Inadequate rudder control.
- Inadvertent secondary stall during recovery.
- Failure to maintain a constant bank angle during turning stalls.
- Excessive forward-elevator pressure during recovery resulting in negative load on the wings.
- Excessive airspeed buildup during recovery.
- Failure to take timely action to prevent a full stall during the conduct of imminent stalls.

SPINS

A spin may be defined as an aggravated stall that results in what is termed "autorotation" wherein the airplane follows a downward corkscrew path. As the airplane rotates around a vertical axis, the rising wing is less stalled than the descending wing creating a rolling, yawing, and pitching motion. The airplane is basically being forced downward by gravity, rolling, yawing, and pitching in a spiral path. [Figure 4-9]

The autorotation results from an unequal angle of attack on the airplane's wings. The rising wing has a decreasing angle of attack, where the relative lift increases and the drag decreases. In effect, this wing is less stalled. Meanwhile, the descending wing has an

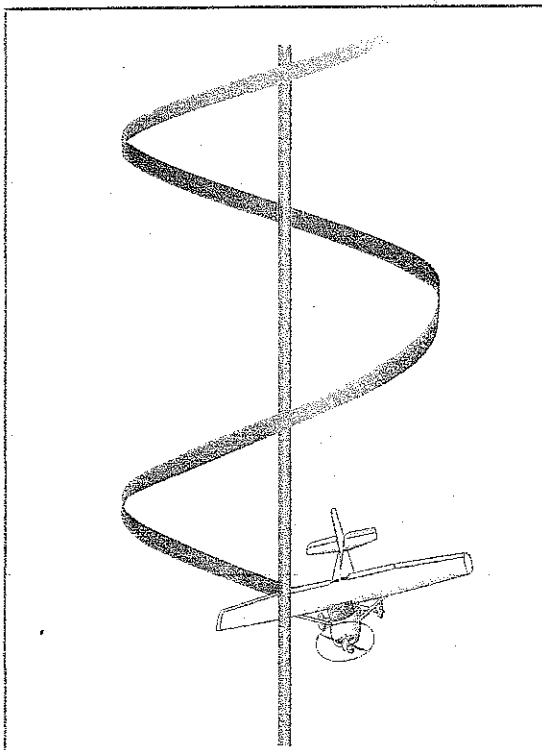


Figure 4-9. Spin—an aggravated stall and autorotation.