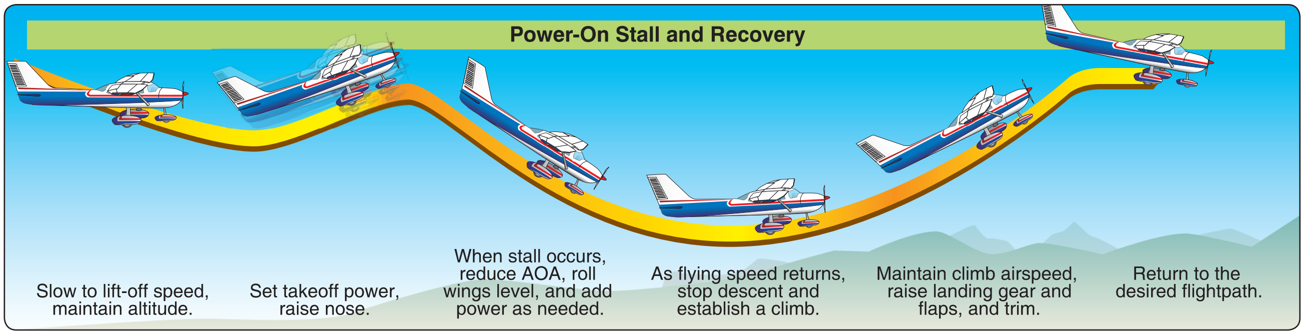

Figure 4-8. *Power-on stall.*

occurs. As described in connection with the stall characteristics discussion, continual adjustments must be made to aileron pressure, elevator pressure, and rudder pressure to maintain coordinated flight while holding the attitude until the full stall occurs. In most airplanes, as the airspeed decreases the pilot must move the elevator control progressively further back while simultaneously adding right rudder and maintaining the climb attitude until reaching the full stall.

The pilot must promptly recognize when the stall has occurred and take action to prevent a prolonged stalled condition. The pilot should recover from the stall by immediately reducing the AOA and applying as much nose-down control input as required to eliminate the stall warning, level the wings with ailerons, coordinate with rudder, and smoothly advance the power as needed. Since the throttle is already at the climb power setting, this step may simply mean confirming the proper power setting. *[Figure 4-8]*

The final step is to return the airplane to the desired flightpath (e.g., straight and level or departure/climb attitude). With sufficient airspeed and control effectiveness, return the throttle to the appropriate power setting.

Secondary Stall

A secondary stall is so named because it occurs after recovery from a preceding stall. It is typically caused by abrupt control inputs or attempting to return to the desired flightpath too quickly and the critical AOA is exceeded a second time. It can also occur when the pilot does not sufficiently reduce the AOA by lowering the pitch attitude or attempts to break the stall by using power only. *[Figure 4-9]*

When a secondary stall occurs, the pilot should again perform the stall recovery procedures by applying nose-down elevator pressure as required to eliminate the stall warning, level the wings with ailerons, coordinate with rudder, and adjust power as needed. When the airplane is no longer in a stalled condition the pilot can return the airplane to the desired flightpath. For pilot certification, this is a demonstration-only maneuver; only flight instructor applicants may be required to perform it on a practical test.

Accelerated Stalls

The objectives of demonstrating an accelerated stall are to determine the stall characteristics of the airplane, experience stalls at speeds greater than the +1G stall speed, and develop the ability to instinctively recover at the onset of such stalls. This is a maneuver only commercial pilot and flight instructor applicants may be required to perform or demonstrate on a practical test. However, all pilots should be familiar with the situations that can cause an accelerated stall, how to recognize it, and the appropriate recovery action should one occur.

At the same gross weight, airplane configuration, CG location, power setting, and environmental conditions,

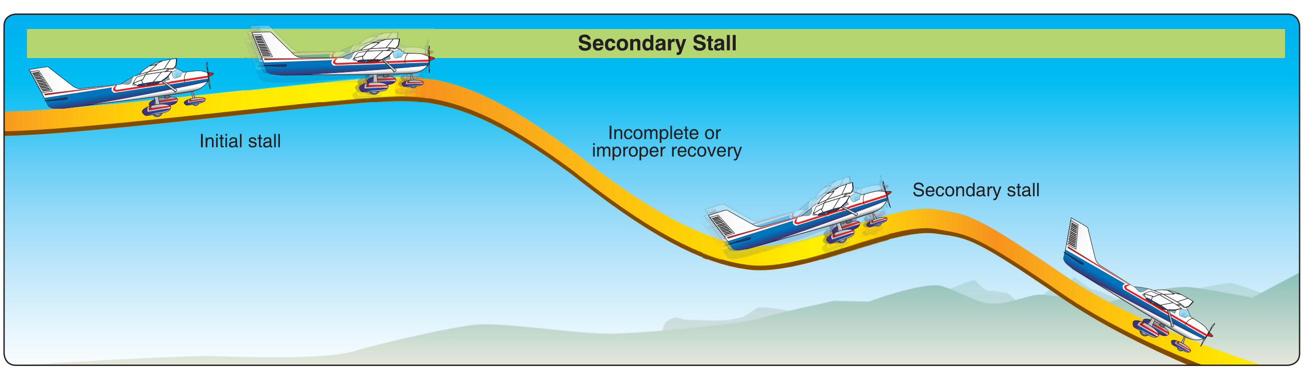

Figure 4-9. *Secondary stall.*

a given airplane consistently stalls at the same indicated airspeed provided the airplane is at +1G (i.e., steady-state unaccelerated flight). However, the airplane can also stall at a higher indicated airspeed when the airplane is subject to an acceleration greater than +1G, such as when turning, pulling up, or other abrupt changes in flightpath. Stalls encountered any time the G-load exceeds +1G are called "accelerated maneuver stalls". The accelerated stall would most frequently occur inadvertently during improperly executed turns, stall and spin recoveries, pullouts from steep dives, or when overshooting a base to final turn. An accelerated stall is typically demonstrated during steep turns.

A pilot should never practice accelerated stalls with wing flaps in the extended position due to the lower design G-load limitations in that configuration. Accelerated stalls should be performed with a bank of approximately 45°, and in no case at a speed greater than the airplane manufacturer's recommended airspeed or the specified design maneuvering speed (V_A).

It is important to be familiar with V_A, how it relates to accelerated stalls, and how it changes depending on the airplane's weight. V_A is the maximum speed at which the maximum positive design load limit can be imposed either by gusts or full one-sided deflection with one control surface without causing structural damage. Performing accelerated stalls at or below V_A allows the airplane to reach the critical AOA, which unloads the wing before it reaches the load limit. At speeds above V_A, the wing can reach the design load limit at an AOA less than the critical AOA. This means it is possible to damage the airplane before reaching the critical AOA and an accelerated stall. Knowing what V_A is for the weight of the airplane being flown is critical to prevent exceeding the load limit of the airplane during the maneuver.

There are two methods for performing an accelerated stall. The most common accelerated stall procedure starts from straight-and-level flight at an airspeed at or below V_A. Roll the airplane into a coordinated, level-flight 45° turn and then smoothly, firmly, and progressively increase the AOA through back elevator pressure until a stall occurs. Alternatively, roll the airplane into a coordinated, level-flight 45° turn at an airspeed above V_A. After the airspeed reaches V_A, or at an airspeed 5 to 10 percent faster than the unaccelerated stall speed, progressively increase the AOA through back elevator pressure until a stall occurs. The increased back elevator pressure increases the AOA, which increases the lift and thus the G load. The G load pushes the pilot's body down in the seat. The increased lift also increases drag, which may cause the airspeed to decrease. It is recommended that you know the published stall speed for 45° of bank, flaps up, before performing the maneuver. This speed is typically published in the AFM.

An airplane typically stalls during a level, coordinated turn similar to the way it does in wings level flight, except that the stall buffet can be sharper. If the turn is coordinated at the time of the stall, the airplane's nose pitches away from the pilot just as it does in a wings level stall since both wings will tend to stall nearly simultaneously. If the airplane is not properly coordinated at the time of stall, the stall behavior may include a change in bank angle until the AOA has been reduced. It is important to take recovery action at the first indication of a stall (if impending stall training/checking) or immediately after the stall has fully developed (if full stall training/checking) by applying forward elevator pressure as required to reduce the AOA and to eliminate the stall warning, level the wings using ailerons, coordinate with rudder, and adjust power as necessary. Stalls that result from abrupt maneuvers tend to be more aggressive than unaccelerated, +1G stalls. Because they occur at higher-than-normal airspeeds or may occur at lower-than-anticipated pitch attitudes, they can surprise an inexperienced pilot. A prolonged accelerated stall should never be allowed. Failure to take immediate steps toward recovery may result in a spin or other departure from controlled flight.

Cross-Control Stall

The objective of the cross-control stall demonstration is to show the effects of uncoordinated flight on stall behavior and to emphasize the importance of maintaining coordinated flight while making turns. This is a demonstration-only maneuver; only flight instructor applicants may be required to perform it on a practical test. However, all pilots should be familiar with the situations that can lead to a cross-control stall, how to recognize it, and the appropriate recovery action should one occur.

The aerodynamic effects of the uncoordinated, cross-control stall can surprise the unwary pilot because it can occur with very little warning and can be deadly if it occurs close to the ground. The nose may pitch down, the bank angle may suddenly change, and the airplane may continue to roll to an inverted position, which is usually the beginning of a spin. It is therefore essential for the pilot to follow the stall recovery procedure by reducing the AOA until the stall warning has been eliminated, then roll wings level using ailerons, and coordinate with rudder inputs before the airplane enters a spiral or spin.

A cross-control stall occurs when the critical AOA is exceeded with aileron pressure applied in one direction and rudder pressure in the opposite direction, causing uncoordinated flight. A skidding cross-control stall is most likely to occur in the traffic pattern during a poorly planned and executed base-to-final approach turn in which the airplane overshoots the runway centerline and the pilot attempts to correct back