Flight Lesson: Arrival Stalls

Objectives:

1. exhibit knowledge of the elements related to arrival stalls
2. learn to recognize stalls, and take prompt and corrective action
3. be able to perform the power-off stall with minimal assistance from the instructor

Justification:

1. familiarizes the student with the conditions that produce a stall.
2. develops recognition of an approach to a stall
3. develops the habit of taking prompt preventive or corrective actions
4. it is necessary to know hot to recover from these attitudes in case of inadvertent entry
5. maneuver is required on the Private Pilot check ride.

Schedule:

Activity	Est. Time
Ground	0.75
Preflight/Taxi	0.25
Flight	1.25
Debrief	0.25
Total	2.50

Recommended Readings:

PHAK	Chapter 3: 3-20 - Stalls
AFH	Chapter 4: 4-3 to 4-8
ASF	http://flash.aopa.org/asf/aerodynamics

Elements Ground:

- Stall overview
- how a plane stalls
- fundamentals of stall recovery
- arrival stall
- procedure

Elements Air:

- arrival stall

Completion Standards:

1. when the student exhibits knowledge relating to the fundamental elements of stalls
2. when the student exhibits knowledge relating to arrival stalls
3. when the student is able to perform the arrival stall with minimal assistance from the instructor

Common Errors:

- does not look outside
- does not descend at 65 kts.

Presentation Ground:

Stalls Overview

1. Definitions
   (1) stall *:a flight maneuver in which the wing's AoA for maximum lift has been exceeded, resulting in turbulent airflow, buffeting, and loss of lift.*
      i. loss of smooth airflow over the upper surface of the wing.
      ii. "when the plane stops flying"
   (2) arrival stall *:a stall in the landing configuration, with power to idle. Also known as a "power-off stall" or "approach to landing stall"*
   (3) critical AoA *:the AoA at which the plane is no longer able to sustain flight.*

PTS Standards			
initial altitude	>1500 ft AGL	**initial config.**	takeoff config
Δ heading	±10°	**Δ bank**	±10° (max 20°)

2. Stalls
   (1) when a plane reaches a critical AoA, it can no longer fly.
   (2) this is due to the inability of the airflow over the top of the wing to flow smoothly, and thus destroys the lift of the airplane.
      i. it's when the air "can't make the turn" and departs the wing
   (3) (draw section view of wing, and progressive wings to stall angles)

how our plane will stall

1. different planes stall different ways
2. the planes we fly will always stall at the root of the wing first, and then progress outward to the tip. They will also stall from the trailing edge to the leading edge.
   (1) This is due to the angle of incidence being greater at the root than at the tip
      i. angle of incidence :the angle between the chord line, and the longitudinal axis
   (2) (draw section view of wing from root to tip)
3. reasons for design
   (1) ailerons will be effective for the longest amount of time.
   (2) stall is progressive… the wing won't all stall at the same time.
   (3) buffeting will be more pronounced, increasing ability to detect an imminent stall
   (4) more stable design… during recover, the tips recover first, allowing use of ailerons sooner.
4. a stall is a ***partial*** loss of lift. Bernoulli's lift is loss, but deflection still exists.
5. although stalls are usually associated with slow airspeeds, a stall can occur *at any airspeed, in any attitude, with any power setting*.
   (1) this AoA is usually around 18 degrees.
   (2) steep turns is a good example of potential stall at high airspeed. we are close to the critical angle of attack
   (3) remember: the reason a plane stalls is because it has reached its critical AoA. there is no other direct reason.

(4) the reason stalls are usually associated with slow airspeeds is because at a slow airspeed, the plane is flying at a higher angle of attack, and is thus closer to the critical AoA

6. Defined Stall Speeds
   (1) Vso *:airspeed at which the plane will stall in the landing configuration (C172- 41)*
   (2) Vs1 *:airspeed at which the plane will stall in the "clean" configuration (C172 - 47)*

Fundamentals of Stall Recovery

1. In any stall , there are fundamental actions that, if done correctly, will recover any plane we fly to normal flight. All fundamental actions are taken simultaneously.
   (1) decrease pitch and angle of attack
      i. since the basic cause of any stall is always an excess in AoA, the cause must be eliminated.
      ii.This is done by releasing back pressure and/or pushing forward on the controls.
         (i) nose will have a tendency to drop on its own because the location of CG is located in front of the Center of Lift (if weighted properly)
   (2) full power
      i. power will help increase airspeed, and decrease AoA
      ii. power allows us to climb (although it's not necessary to recover)
      iii. watch for pitch-up moment
      iv. prevent the nose from coming up too early, too quickly, and too high
   (3) maintain directional control using the rudder
      i. if ailerons are used, he plane will stall further (lowered aileron will increase AoA on that side)

2.Some planes are not as stable as ours and encounter problems if stalled.

3.Some planes including ours could be balanced incorrectly, and may encounter problems recovering.

Arrival Stall

1. arrival stall is practiced to simulate an accidental stall during a landing approach
2. thus, we perform it in the landing configuration
   (1) descent, power reduced, airspeed 65 kts, full flaps
3. profile view - example of the situation in which this may occur
   (1) downwind - power 2100 RPM and CGGLUMPS
      i. **C**arb head -on
      ii. **G**as - check both
      iii. **G**auges - check
      iv. **L**ights - as required
      v. **U**ndercarriage - down
      vi. **M**ixture - rich
      vii. **P**ower - check 2100 RPM
      viii. **S**eatbelts - on
   (2) "abeam the numbers"
      i. power - 1600 RPM
      ii. flaps - 10°
         (i) note: in flight, it's always good to extend and retract flaps in stages.

a. allows for incremental changes in lift and pitch, instead of dramatic changes.

iii. airspeed - 75 kts

(i) pitch controls airspeed, power controls altitude

(3) base

i. flaps - 20°

ii. airspeed - 70 kts

(4) final

i. flaps - full

ii. airspeed - 65 kts

(5) stall scenario

i. pilot fixates on the runway, and does not pay attention to airspeed.

ii. pilot realizes that he is low and pulls up instead of adding power

iii. the plane increase angle of attack, and if not corrected, the plane stalls

Procedure

1. CGGLUMPS
2. Power to 1800 RPM
3. Flaps 10° - airspeed 75 kts , 20° - airspeed 70 kts, full - airspeed - 65 kts
4. maintain altitude until 65 kts, then start descent
   (1) maintain control with aileron and rudder
5. power to idle, and pull back slowly.
   (1) expect buffeting, lack of control effectiveness, stall warning horn, and a "break" in the plane.
6. at stall, recover with reduced AoA and full power
   (1) maintain control with rudder until speed builds
   (2) watch for pitch up moment
7. when airspeed is sufficient, resume climb attitude
8. flaps - retract first set immediately
9. flaps - retract remaining flaps after positive rate of climb
10. flaps 0°, resume Vy (C172 - 73) to starting altitude
11. level off at starting altitude

Presentation Air:

1. Arrival stall
   (1) See procedure above