

Flight Lesson: Airspeeds and Configurations

Objectives:

1. understand how airspeed changes are made.
2. be able to change airspeeds while maintaining a constant altitude.
3. understand the effects of flaps on pitch and airspeed changes.
4. be able to add and remove 10 and 20 degrees of flaps

Justification:

1. airspeed knowledge and precision is critical for landings, takeoffs, and some required maneuvers.
2. flaps are necessary for optimal landings and their use are required in the private pilot check ride.

Schedule:

Activity	Est. Time
Ground	0.5
Preflight/Taxi	0.25
Flight	1.0
Debrief	0.25
Total	2.00

Elements Ground:

- airspeed
- flaps overview
- types of flaps

Recommended Readings:

PHAK	Chapter 4: 4-1 to 4-7
	Chapter 5: 5-8 to 5-12

Elements Air:

- airspeed changes
 - straight and level
 - turns
 - climbs and descents
- Flap Changes
 - Straight and level

Completion Standards:

1. understands the theories behind airspeed and flap changes
2. able to change airspeeds and flap configurations in flight with minimal assistance from the instructor

Common Errors:

- student fails to maintain altitude when power is reduced
- student balloons or sinks when flap settings are changed

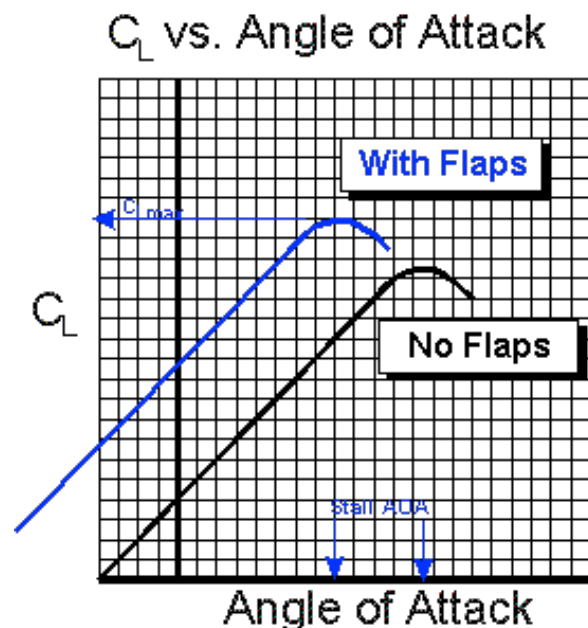
Presentation Ground:

Airspeed

1. : The speed of an aircraft relative to its surrounding air mass
2. Airspeed changes every time there is a change in power (if everything else is held constant)
 - (1) a change in power = a change in AoA
 - (2) a change in AoA = a change in airspeed
3. In depth
 - (1) When power is reduced, there is less airflow over the wing's surface. There is also less deflection below the wing's surface. This leads to reduced lift.
 - (2) To maintain altitude, the AoA must be increased to create enough lift. The new AoA also creates more drag, and thus the airspeed is reduced.
 - (3) The opposite is true when power is increased.

Flaps

1. : A movable appendage to an airfoil, usually in a wing, that changes the airfoil's lift characteristics, generally to achieve slower takeoff and landing speeds.
2. flaps are lowered and raised in unison.
3. flaps create a steeper descent angle for landing
 - (1) flaps increase lift and induced drag for any AoA
4. white arc
 - (1) : an indicated area on an airspeed indicator that indicates where full flaps can be extended and used
 - i. in a C172 the range is from 41 kts to 85 kts
 - (2) flaps in a C172 have 3 settings; 10°, 20°, 40°
5. Pitch effect
 - (1) when flaps are extended, the nose wants to pitch up (?).
 - i. This is due to the increase in lift created by the "increase in wing area"
 - ii. The lift increases due to the quick change in chordline, leading to a quick change in AoA.
 - iii. Example with Four Forces. Since lift is greater than weight (when the flaps are put in), the plane goes in that direction.
 - (2) As Pilots we want to stop the "ballooning" tendency by pushing forward to keep our pitch attitude constant as flaps are put in.
6. Airspeed effect
 - (1) If flaps are put in, and altitude is held constant, airspeed would decrease due to the increase in drag.
 - (2) If flaps are put in, and airspeed is held constant by adjusting power, the pitch attitude would be lower than normal.
 - i. due to change in chordline, amount of lift, amount of drag.



Types of Flaps

1. There are four main types of flaps: plain, split, slotted, fowler

2. plain

- (1) most basic flap style
- (2) increase airfoil camber, resulting in increase of lift and drag
- (3) moves center of pressure back resulting in nose down pitching moment

3. split

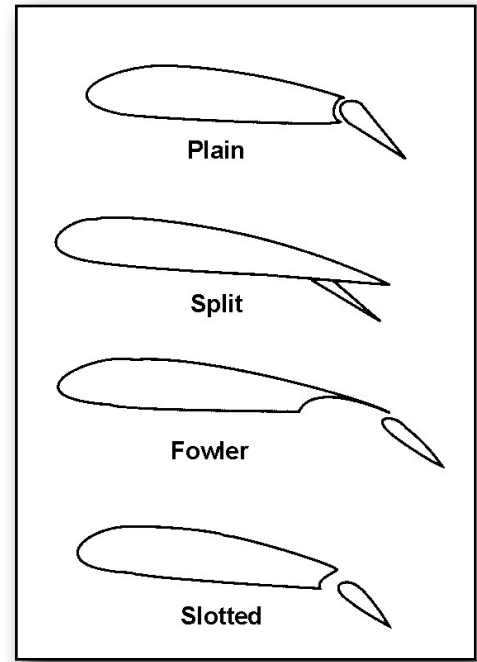
- (1) slightly greater increase in lift than plain, but significantly more drag due to turbulent airflow behind split

4. slotted

- (1) airflow from under wing is ducted to flap's upper surface allowing delays in airflow separation
- (2) produce very high CL max

5. fowler

- (1) type of slotted flap
- (2) most aircraft we fly have fowler type flaps
- (3) changes camber of wing AND wing area by sliding flap backwards
- (4) first setting usually increases lift without a significant increase in drag
- (5) other setting increase drag without a significant increase in lift



Presentation Air:

airspeed changes

1. straight and level
 - (1) hold constant altitude while reducing power to 2100 RPM
 - (2) note airspeed change.
 - (3) hold constant altitude and increase power back to cruise.
2. turns
 - (1) hold constant altitude in a turn and reduce power to 2100 RPM
 - (2) note airspeed change.
 - (3) continue turning and resume cruise power.

flap changes

1. straight and level
 - (1) power reduced
 - (2) check airspeed in white arc
 - (3) at appropriate airspeed, add 10° flap.
 - i. push nose forward to keep pitch change minimized
 - ii. maintain constant altitude
 - iii. note airspeed change
 - (4) add 20° flap
 - i. push nose forward to keep pitch change minimized
 - ii. maintain constant altitude
 - iii. note airspeed change
 - (5) remove 10° flaps at a time
 - i. hold altitude and minimize pitch changes
 - ii. note airspeed change.
1. similar exercise but keep airspeed constant, noting change in pitch and altitude.