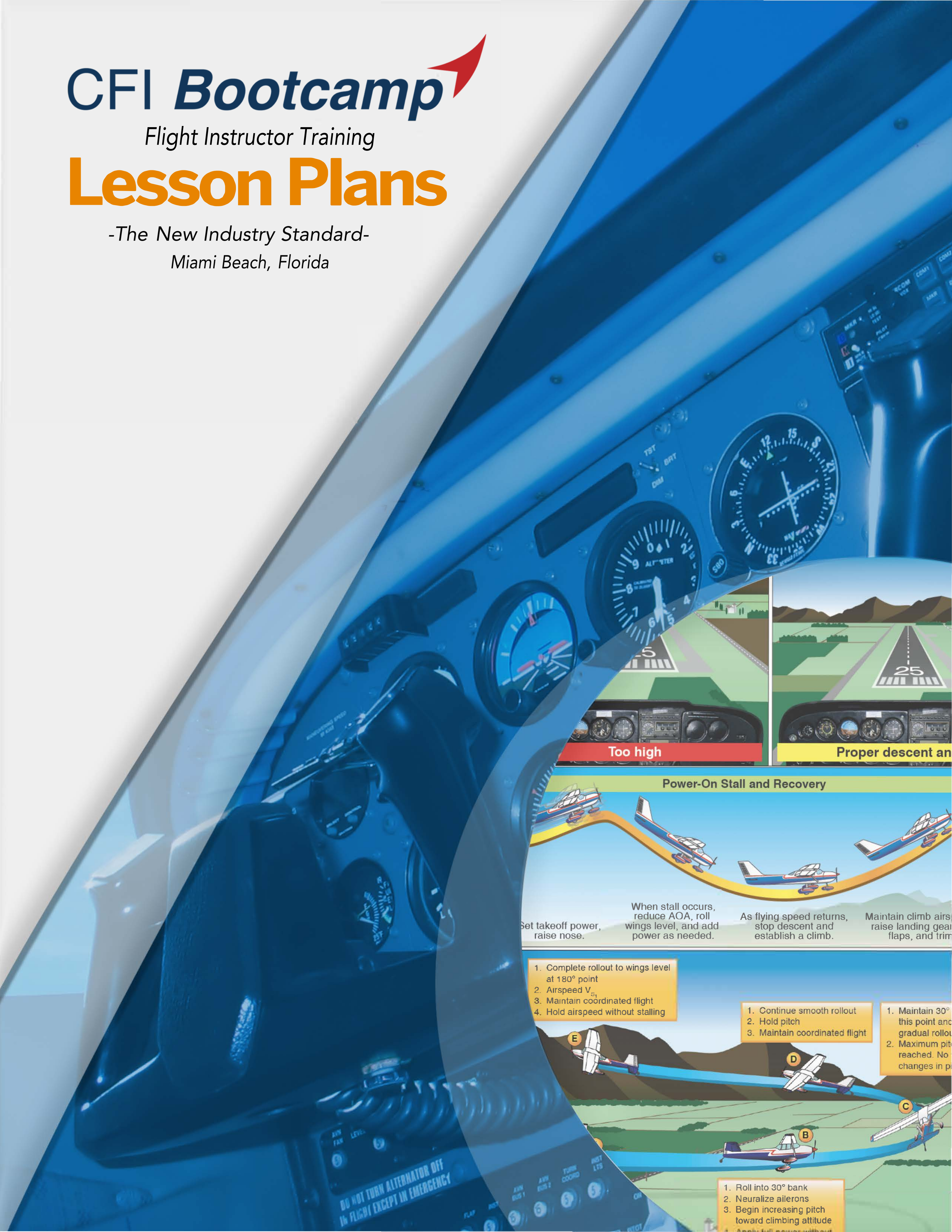
CFI Bootcamp

Flight Instructor Training

Lesson Plans

-The New Industry Standard-

Miami Beach, Florida



CFI **Bootcamp**
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Table of Contents

Lesson Plans

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Table of Contents

Lesson Plans

Lesson Plans

Thanks for purchasing the Lesson Plans and Flow Charts from CFI Boot Camp. This is the second edition with a ton of major changes to the content. I have changed almost every lesson plan to have a better flow in the presentation section, so you can use it to teach a lesson one line to the next knowing that all of the main content is complete and covered in a logical order. Key points are now exactly that, they are items to emphasize and bring out in the lesson. In every lesson there are now times noted next to the Presentation title so that and your student know how long each lesson should take on the ground. I also have included a new section for most lesson plans called additional images, so that relevant images are available at the end of the lesson plan.

Additionally, I removed Instructor's Actions and Students actions in the flight maneuvers because they are always the same. That gave me more space to make the images larger.
I included what do to for the Instructor's and Student's actions in the page just prior to the title page of the lesson plans themselves. Lastly, I updated the risk management in some sections and modified the 172 maneuvers guide to align with our maneuvers guide quick reference that we give to students at CFI Bootcamp. This is a complete set of lesson plans for flight maneuvers for Sport, Recreational, Private, Commercial Pilots, including Flight Instructors and ground topics.

Mike Shiflett - October 14, 2018 - Miami Beach, FL

The lesson plans can fit into most any training syllabus. If you don't have a training syllabus you can use ASAs or King Schools as a starting place. Both are very good.

Included in this book are all of the flight maneuvers lesson plans and ground lesson plans.

Each flight maneuver lesson plan has an Objective, Motivation, Presentation (Elements), time for how long it should take, Key Points, 172 Maneuvers Guide, Common Errors, Questions to ask the students, Completion Standards and Risk Management. The ground lessons have an Objective, Motivation, Presentation with how long it should take, Instructor's actions, Student's Actions and references. There is also additional content behind the lesson plan that includes things like images, graphs, etc.

***Note**: Where a maneuver is common to both Private and Commercial pilots such as Steep Turns, the Private Pilot Knowledge Area, Risk Management and Skills (Completion Standards) are from the Private Pilot ACS. Refer to the Commercial Pilot ACS or PTS for Completion Standards for those maneuvers.*

IMPORTANT: You need to teach each lesson plan out loud with a whiteboard and/or monitor. You will never know if you can teach the material in the plan until you do this. Simply reading over the lesson plans is NOT good enough. I realize this is a lot of work, but you will catch problems in your own understanding, flow issues and much more if you will take this on.

When teaching an actual student, you should teach from the lesson plan and at the end of your lesson you should ask the student to tell you how they will perform the maneuver. Demonstrating with a model airplane is very helpful. The idea is you don't want to get into the airplane until you are sure the student understands what they are going to do on that flight.

There are also lesson plans for ground instruction: All of the Technical subject areas in the Flight Instructor PTS are included. They contain the full lesson and include a lot of artwork and explanations.

I hope you find this book useful. Our instructors at CFI Boot Camp teach every day from these lesson plans, so they are field tested.

If you are working on your CFI now, consider purchasing our CFI Workbook. This book is intended to cement your knowledge by providing you with scenarios, assessment and study questions.

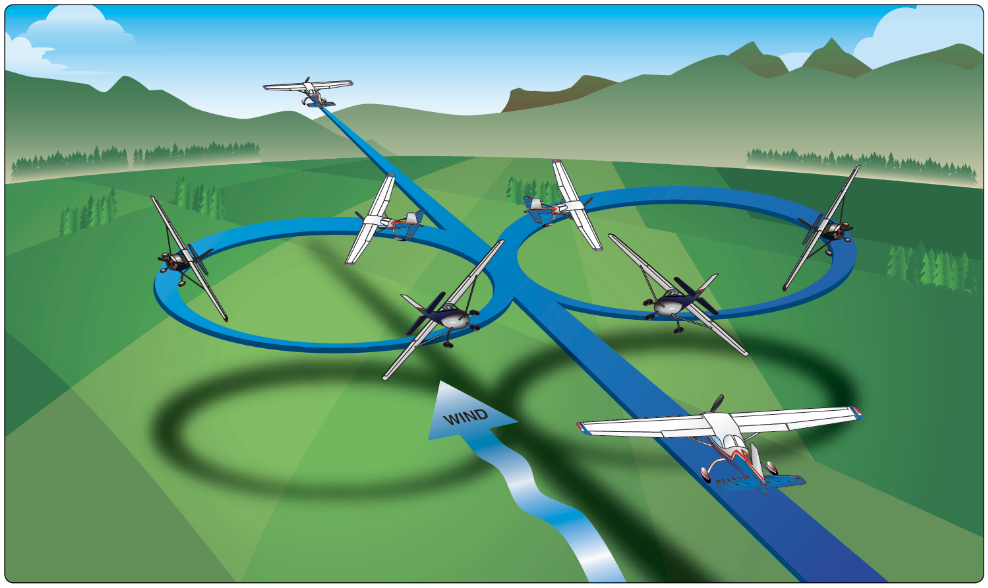
Thanks again for purchasing the Lesson Plans. Let us know how they work out for you.

Mike Shiflett - CFI Boot Camp   Web: www.cfibootcamp.com

FLIGHT MANEUVERS LESSON PLANS FOR SPORT, RECREATIONAL, PRIVATE, COMMERCIAL PILOTS AND FLIGHT INSTRUCTORS

Risk Management : Teach how to identify, assess and mitigate risks encompassing the following:

1. Failure to divide the attention between airplane control and orientation.
2. Task management.
3. Energy management.
4. Accelerated stalls.
5. Spins.
6. Failure to maintain situational awareness.
7. Collision avoidance, scanning, and obstacle avoidance.
8. Failure to maintain coordinated flight.



Questions for the Student

1. What elevator, aileron and rudder control inputs will be necessary to maintain altitude during a steep turn?
2. What is the minimum bank angle required for a steep turn for a commercial pilot? Private pilot?
3. When should the roll out begin to be wings level at the 360-degree point of the maneuver?
4. What kinds of elevator control pressures will be required when entering and maintaining the steep turn?
5. What visual references should the pilot use during the turns to maintain altitude?

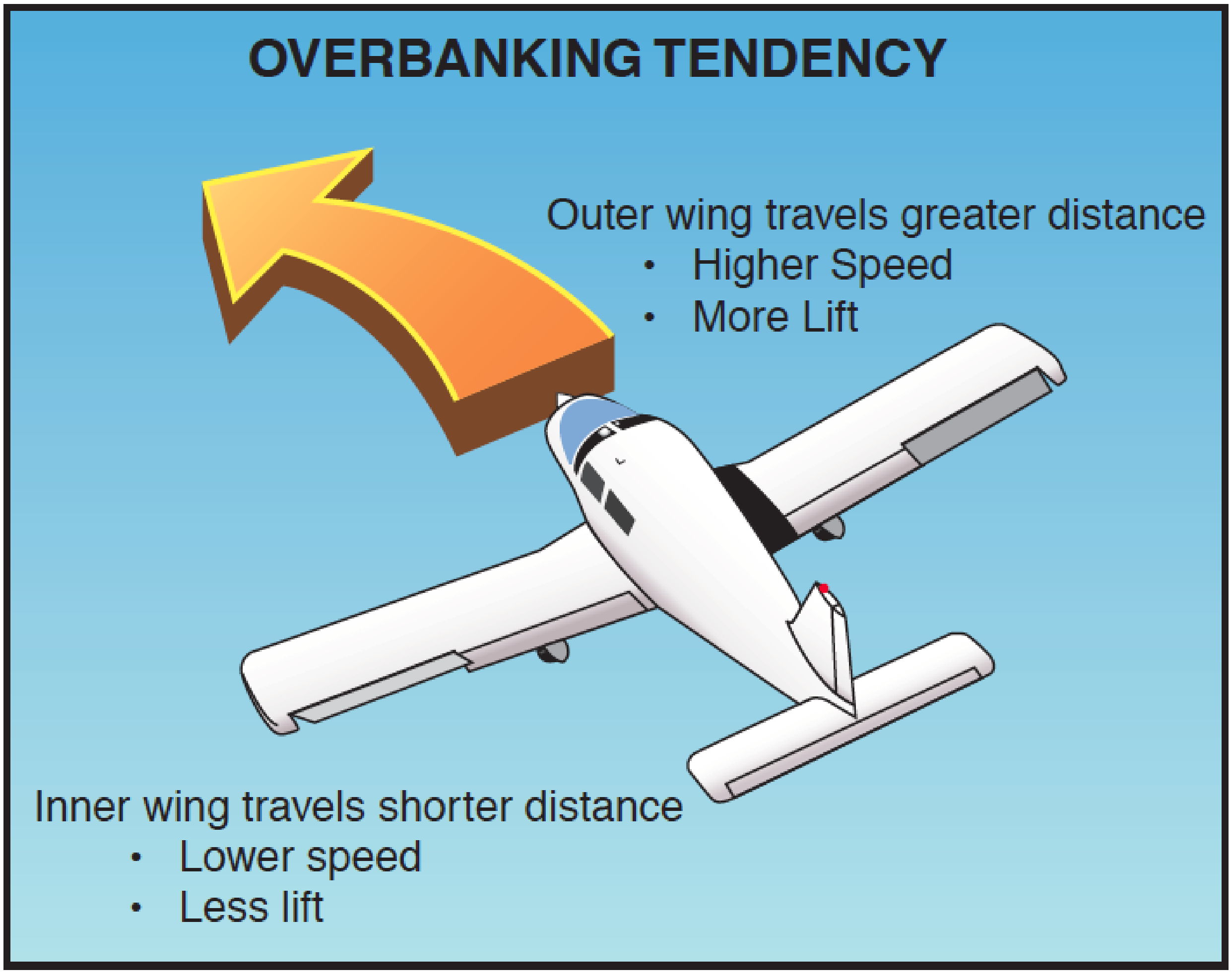
Steep Turns - Maneuvers guide

1. Clear the airspace and identify emergency landing areas
2. 2100 RPM, 90 KIAS
3. Altitude no lower than 1500 feet AGL
4. Identify a reference point in front of the aircraft and note the heading
5. Roll into a 45 - 50 degree bank turn - Stop adverse yaw with rudder.
6. Maintain bank, altitude, and airspeed
7. Elevator maintains altitude, throttle maintains airspeed, aileron - angle of bank
8. Remain coordinated
9. Begin the roll out 25 degrees before the 360 degree point - Stop adverse yaw
10. Wings level at entry airspeed and altitude at the 360-degree point
11. Reduce elevator to maintain altitude and decrease throttle for airspeed.
12. Roll into a 45 - 50 degree bank turn in the opposite direction.
13. Repeat maneuver in the opposite direction.

Common Errors

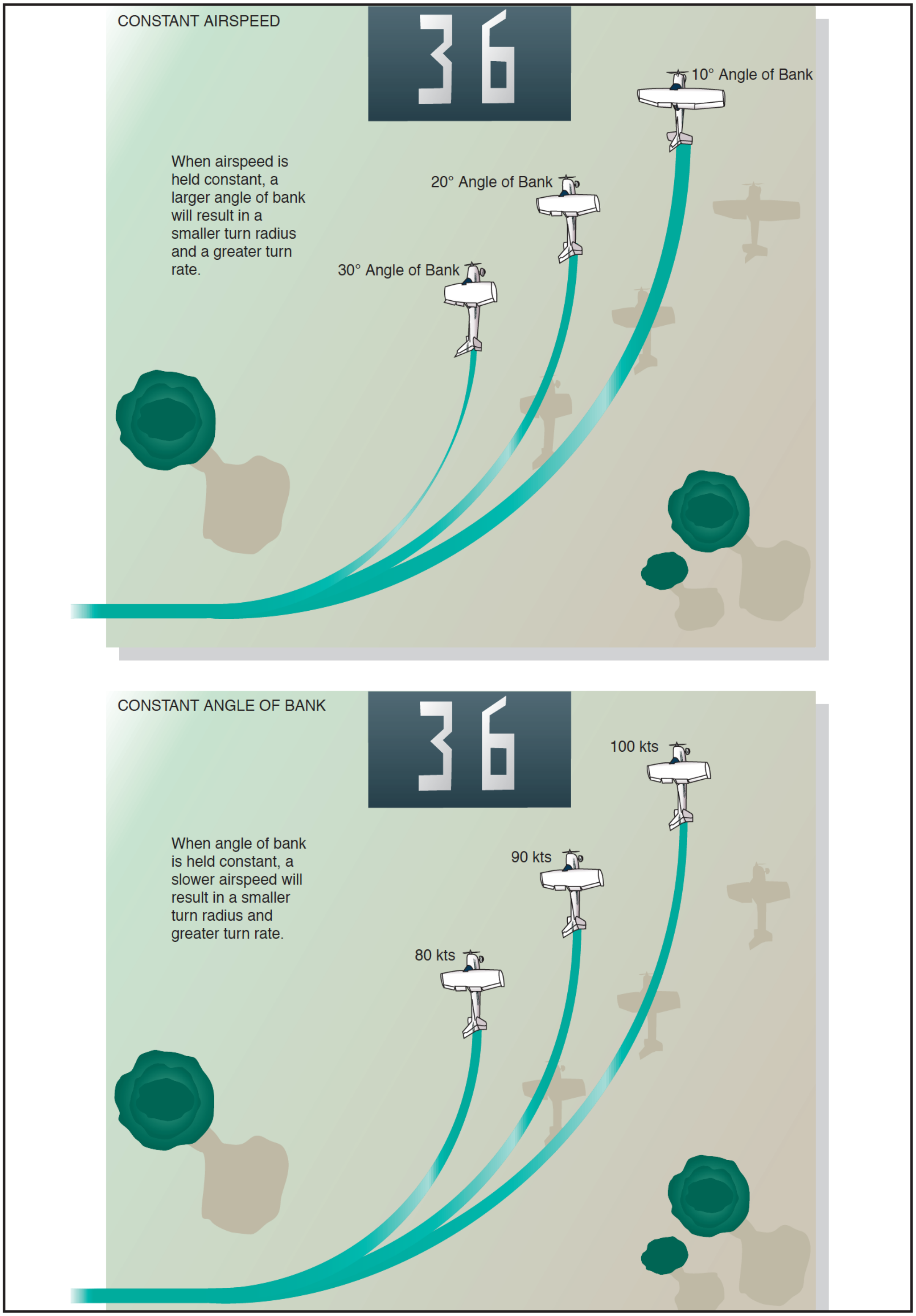
- Failure to adequately clear area
- Excessive pitch changes during entry or recovery
- Attempts to start recovery prematurely
- Failure to stop the turn on a precise heading
- Excessive rudder during recovery, resulting in skidding
- Inadequate power management
- Inadequate airspeed control
- Poor coordination
- Gaining altitude in right turns and losing altitude in left turns
- Failure to maintain a constant bank angle
- Disorientation
- Attempting to perform the maneuver by instrument reference rather than visual reference
- Failure to scan for other traffic during the maneuver

Steep Turns - Overbanking Tendency



Completion Standards

1. Establish the manufacturer's recommended airspeed or if one is not stated, a safe airspeed not to exceed V_A.
2. Roll into a coordinated 360° steep turn with a 45° bank.
3. Perform the Task in the opposite direction, as specified by the evaluator.
4. Maintain the entry altitude ±100 feet, airspeed ±10 knots, bank ±5°; and roll out on the entry heading, ±10° or as recommended by aircraft manufacturer to a safe maneuvering altitude.


CONSTANT AIRSPEED
36
10° Angle of Bank
20° Angle of Bank
30° Angle of Bank
When airspeed is held constant, a larger angle of bank will result in a smaller turn radius and a greater turn rate.
CONSTANT ANGLE OF BANK
36
100 kts
90 kts
80 kts
When angle of bank is held constant, a slower airspeed will result in a smaller turn radius and greater turn rate.

Objective :

To maintain coordinated airplane control at speeds other than cruise speed while using different drag devices while straight and level, turning, climbing or descending.

Motivation:

Develops control at slow speeds that will be used for landing.

Presentation: 30 Minutes

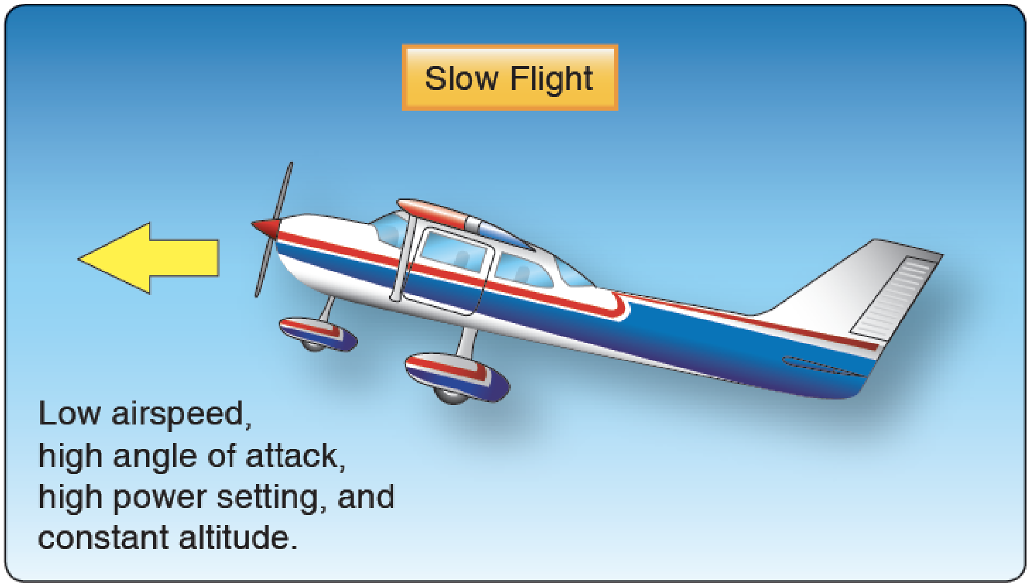
1. How this maneuver applies to different phases of flight. (Takeoff/Landing)
2. Review aerodynamics, Lift/drag (induced and parasite)
3. Why AOA increases when airspeed decreases (Lift equation/drag vs speed charts)
4. Show power available vs power required charts - at high and at low speeds the power required is high (Climb not possible)
5. Therefore: At very low speeds - PITCH FOR AIRSPEED AND THROTTLE FOR ALTITUDE
6. As speed is reduced AOA must increase - Induced drag increases so power must be also increased. This causes high torque, P-factor and slipstream causing the airplane to yaw left.
7. Prevent Yaw with rudder.
8. At slow speeds controls are not as effective, stall warning horn 5-10 kts above stall.
9. Recognize the stall horn and take corrective action if activated.

Key Points:

- Throttle controls altitude at low speeds.
- Pitch controls airspeed at low speeds. Pitching for altitude only increases drag.
- Rudder must be applied to keep the airplane from yawing - maintain fixed heading
- Flight controls will be less responsive and less effective at slower airspeeds
- Turns should be shallow. Climbs may not be possible.

Risk Management : Teach how to identify, assess and mitigate risks encompassing the following:

1. Proper understanding of Angle of Attack
2. Collision avoidance and scanning for traffic while at high nose attitudes.
3. Failure to avoid a stall or react appropriately to a stall warning
4. Failure to remain coordinated



Questions for the Student

1. Why is additional right rudder pressure necessary during slow airspeed/increased throttle conditions?
2. What control input should be used to change airspeed when flying slow?
3. How does the pilot control altitude during slow flight?
4. Why is additional power required as the airspeed slows?

Slow Flight - Flight Maneuver Guide

1. Clear the area.
2. Reduce power to 1500 RPM.
3. Maintain altitude with elevator back-pressure as the airspeed slows.
4. Lower flaps to full in stages. 10 degrees below 110, the rest below Vfe.
5. Anticipate necessary elevator pressure changes.
6. Slow to 50 KIAS. Apply throttle as necessary to maintain altitude..
7. Apply necessary pitch to maintain airspeed..
8. Apply rudder to keep the heading with the wings level with ailerons.
9. Perform a level 90 degree turn to the left. Additional throttle will be required to maintain altitude.
10. Perform a level 90 degree turn to the right.
11. Return to straight and level flight at cruise speed by applying full power first.
12. As airspeed increases, retract the flaps in stages while maintaining altitude.
13. When the airspeed is 90 KIAS reduce throttle to 2100 RPM and trim.

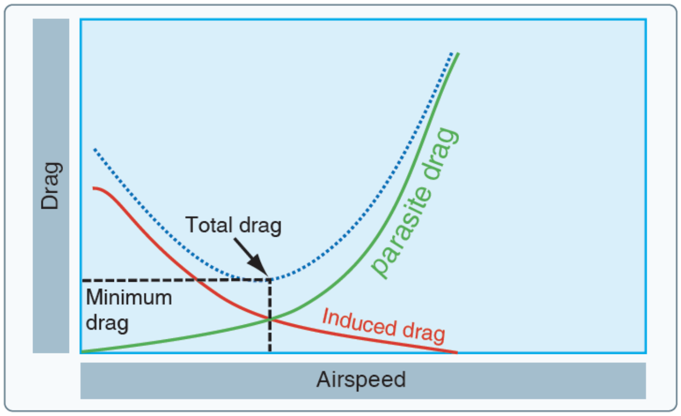
Common Errors

- Failure to adequately clear the area
- Inadequate elevator back-pressure as power is reduced, resulting in a loss of altitude
- Excessive elevator back-pressure as power is reduced resulting in a climb, followed by a rapid reduction in airspeed, and mushing of the flight controls
- Inadequate compensation for adverse yaw during turns
- Fixation on the airspeed indicator
- Failure to anticipate changes in lift as flaps are extended or retracted
- Inadequate power management
- Inability to adequately divide attention between airplane controls and orientation

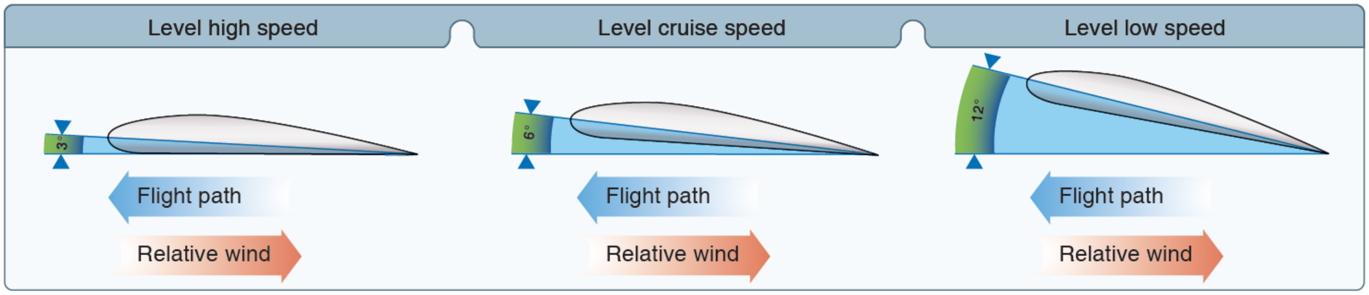
Completion Standards

1. Select an entry altitude that will allow the Task to be completed no lower than 1,500 feet AGL.
2. Establish and maintain an airspeed at which any increase in angle of attack, increase in load factor or reduction in power would result in a stall warning (e.g., aircraft buffet, stall horn, etc).
3. Accomplish coordinated straight-and-level flight, turns, climbs, and descents with flap configurations specified by the evaluator without activating a stall warning. (e.g., aircraft buffet, stall horn, etc.)
4. Divide attention between airplane control, traffic avoidance and orientation.
5. Maintain the specified altitude, ±100 feet; specified heading, ±10°; airspeed +10/-0 knots; and specified angle of bank, ±10° or as recommended by aircraft manufacturer to a safe maneuvering altitude.

Additional Images



$$L = \frac{C_L \cdot \rho \cdot V^2 \cdot S}{2}$$



Objective :

Develop recognition of an impending stall or stalled condition in the landing configuration and prevent a stall or unstall the airplane after a stall occurs.

Motivation:

Recognizing, avoiding, recovery from stalls avoids stall/spin accidents.

Presentation: 15 Minutes

1. Stall aerodynamics - Critical AOA, not speed dependent, flight path vs relative wind, how load factor and weight affect stall speed.
2. AOA vs lift - Can generate lift at low speeds but not more than the critical angle.
3. Airplane in the landing configuration, full flaps on approach speed, descending.
4. Inducing the stall - Power idle (like the flare) raise the nose to landing attitude.
5. Importance of coordination - Avoid a stall with Yaw (Describe spin basics)
6. Approach to stall indications. Loss of control effectiveness, stall warning horn, buffeting.
7. Full stall indications - Un-commanded nose down attitude due to loss of lift Possible wing drop.
8. Stall recovery procedure. Reduce AOA with elevator until the stall symptoms are gone, use full power to minimize altitude loss and rudder to stop yaw.
9. If a wing drops, prevent it from dropping further with rudder. Unstall the wing with elevator, then level with wing with aileron. Do NOT level the wings with rudder (Possible spin - Stall with Yaw.)

Key Points:

- Airplane will be in the landing configuration, on approach speed, descending.
- Stall recovery can always be made by reducing the AOA with elevator.
- Power is only necessary to minimize altitude loss.

Risk Management : Teach how to identify, assess and mitigate risks encompassing the following:

1. Aerodynamic factors AOA to airspeed, Load factor, weight, configuration
2. The range and limitations of stall warning indicators
3. Actions for maximum performance and the consequences of failing to do so.
4. Collision avoidance, scanning, and obstacle avoidance.
5. Failure to follow the stall recovery procedure.
6. Failure to maintain coordinated flight during the maneuver.
7. Secondary stalls and inadvertent stalls or spins

Questions for the Student

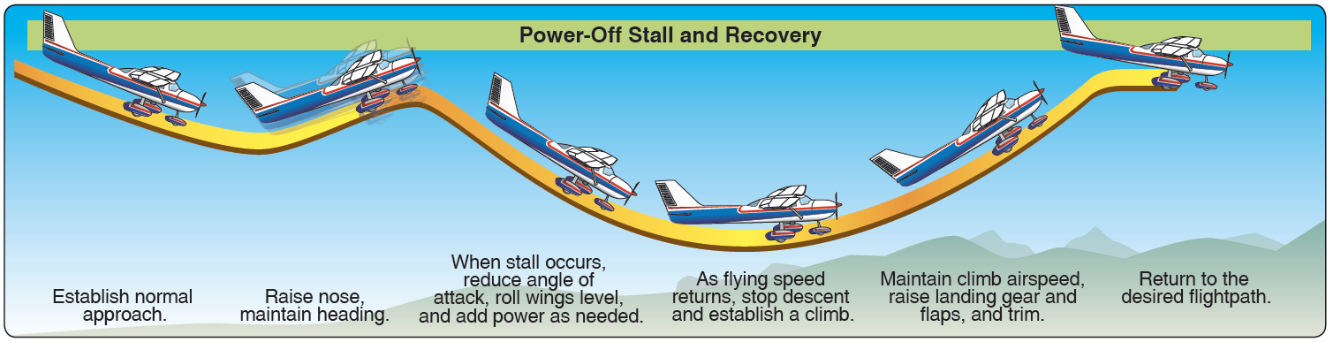
1. How will the controls feel during the initial symptoms of a stall?
2. How is angle of attack related to a stall?
3. What would happen if the flaps were raised too quickly during stall recovery?
4. To un-stall the wing what must the pilot do?

Power-Off Stall - Flight Maneuver Guide

1. Clear the area - Pick a reference point - Recovery altitude by 1500 AGL
2. Carb Heat ON - 1700 RPM - 80 KIAS.
3. Apply flaps incrementally.
4. Trim airplane for level flight.
5. Establish 65 KIAS and then throttle to idle.
6. Slowly apply elevator back-pressure to raise the nose to just above the horizon
7. Continue applying back-pressure until symptoms of a stall appear.
8. Allow airplane to fully stall before recovery (private). Buffeting for Commercial
9. Begin stall recovery when stall symptoms appear (Buffeting for Commercial) Recover from the stall by lowering the angle of attack.
10. Apply full throttle and stop yaw with rudder. - carb heat off.
11. Retract flaps to 20 degrees.
12. Observe a positive rate of climb.
13. Retract remaining flaps incrementally.
14. Return to normal cruise configuration.

Additional Images

Stall Recovery Template	
1. Wing leveler or autopilot	1. Disconnect
2. a) Pitch nose-down b) Trim nose-down pitch	2. a) Apply until impending stall indications are eliminated b) As needed
3. Bank	3. Wings Level
4. Thrust/Power	4. As needed
5. Speed brakes/spoilers	5. Retract
6. Return to the desired flight path	



Common Errors

- Failure to clear 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 wing-low condition during entry
- Excessive elevator back 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 and potential secondary stall.
- Excessive airspeed build-up during recovery
- Failure to take timely action to prevent a full stall during the conduct on imminent stalls

Completion Standards

1. Select an entry altitude that will allow the Task to be completed no lower than 1,500 feet AGL.
2. Establish a stabilized descent in the approach or landing configuration, as specified by the evaluator.
3. Transition smoothly from the approach or landing attitude to a pitch attitude that will induce a stall.
4. Maintain a specified heading, ±10°, if in straight flight, and maintain a specified angle of bank not to exceed 20°, ±10° if in turning flight, while inducing the stall or as recommended by the aircraft manufacturer to a safe maneuvering altitude.
5. Recognize and recover promptly after a full stall has occurred.
6. Retract the flaps to the recommended setting.
7. Execute a stall recovery in accordance with procedures set forth in the AFM/POH.
8. Accelerate to V_X or V_Y speed before the final flap retraction and return to the altitude, heading and airspeed specified by the examiner.

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Aerodynamics Lift and Drag
Lesson Plans

Objective :

To understand the aerodynamic concepts of how an airplane can overcome it's own weight and to understand how resistance to it's movement is generated and managed.

Motivation:

An airplane must overcome it's weight to fly and must be able to move through the air in order to do it. An understanding of these aerodynamic concepts/forces allow the pilot to understand how to anticipate and manage these forces.

Presentation: 45 Minutes Airplane

Components to Introduce:

1. Fuselage – Airplane minus the wings and stabilizers – contains the cabin, engine etc.
2. Airfoil – Generates force to overcome weight
3. Horizontal Stabilizer – Allows the airplane to be controlled to balance the effect of the airfoil

The Four Forces:

1. Weight
2. Lift
3. Thrust
4. Drag

Lift and Weight

1. For an airplane to fly it must overcome it's weight. Weight is always directed downward.
2. The force created to overcome weight is called lift
3. Newtons Third Law – Reaction
4. Bernoulli's Principle – Relationship of Pressure and Velocity
5. Airfoil components
6. Show restricted pipe and relate it to an airfoil
7. Relative wind – Parallel and opposite the flight path
8. Angle of attack of the airfoil – Larger AOA increases the path on the top of the airfoil = more velocity = increase in lift
9. Lift equation – Lift = $1/2\ \rho V^2 S C_L$ – Lift increases at the square of the velocity

10. Critical angle of attack – Air can no longer stay attached to the airfoil – Aerodynamic stall occurs – Lift decreases
11. Lift equation – variables controlled by the pilot are velocity and C_L (Angle of attack) The
12. slower the airplanes speed the more Angle of Attack is needed (C_L)
13. As speed or AOA increases lift increases and the Center of Lift (C_p) moves forward
14. Cp needs to always be behind the Center of gravity (CG)
15. Purpose of the horizontal stabilizer – Provides tail down force – keeps the wing from causing the airplane to rotate forward around it's CG.

Drag and Thrust

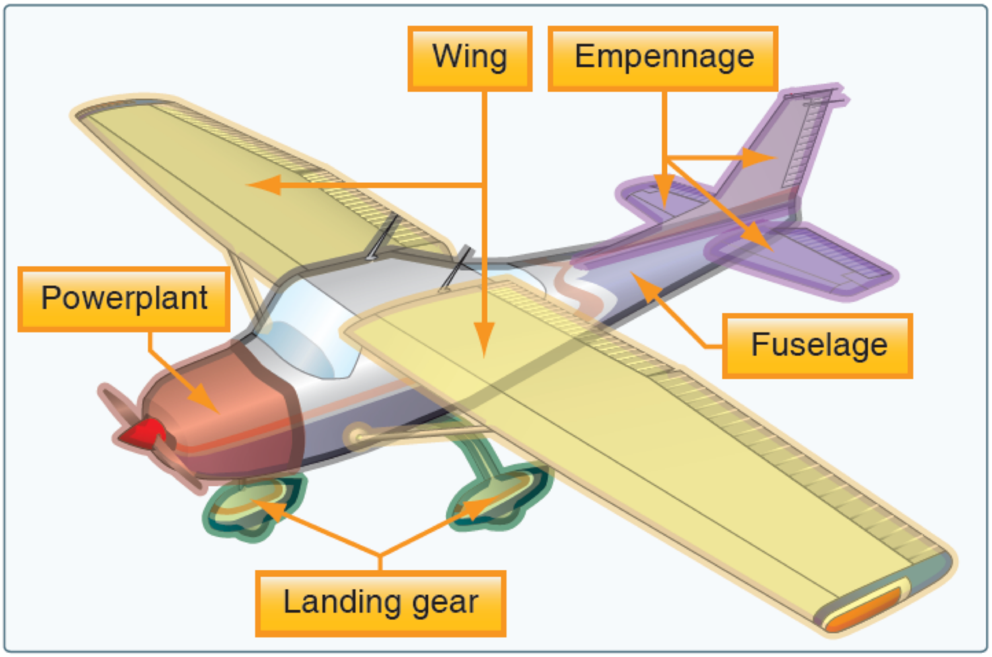
1. Thrust provides a means to create speed (Velocity)
2. Force that opposes motion that opposes thrust
3. Parasite drag caused by the airplane parts – The larger the surface area the more the drag
4. Parasite drag – Increases at the square of the speed – Show graph Drag vs Speed
5. Induced drag – As speed is slowed more AOA is needed – Lift vector is tilted rearward – component of lift acting rearward has to be overcome by thrust or speed slows
6. Induced drag – Wingtip vorticies increase with higher AOAs. At the wingtips the High pressure below can corkscrew up toward the low pressure area of the wing. It takes energy to create the vorticies and this energy is lost the airflow causing lift which means more drag
7. Induced drag – Show graph of Drag vs speed – Induced drag increases as speed is reduced (AOA is generating lift instead of Velocity)
8. Total drag is the combination of Parasite and induced drag (Show graph of Drag vs speed with total drag curve)
9. The lowest drag occurs at a particular speed
10. Drag must be overcome by thrust in order to both speed up (Parasite drag) or to go slower (Due to induced drag) to maintain level flight
11. Ground effect and how it relates to a decrease in drag

Wing Design and Planform

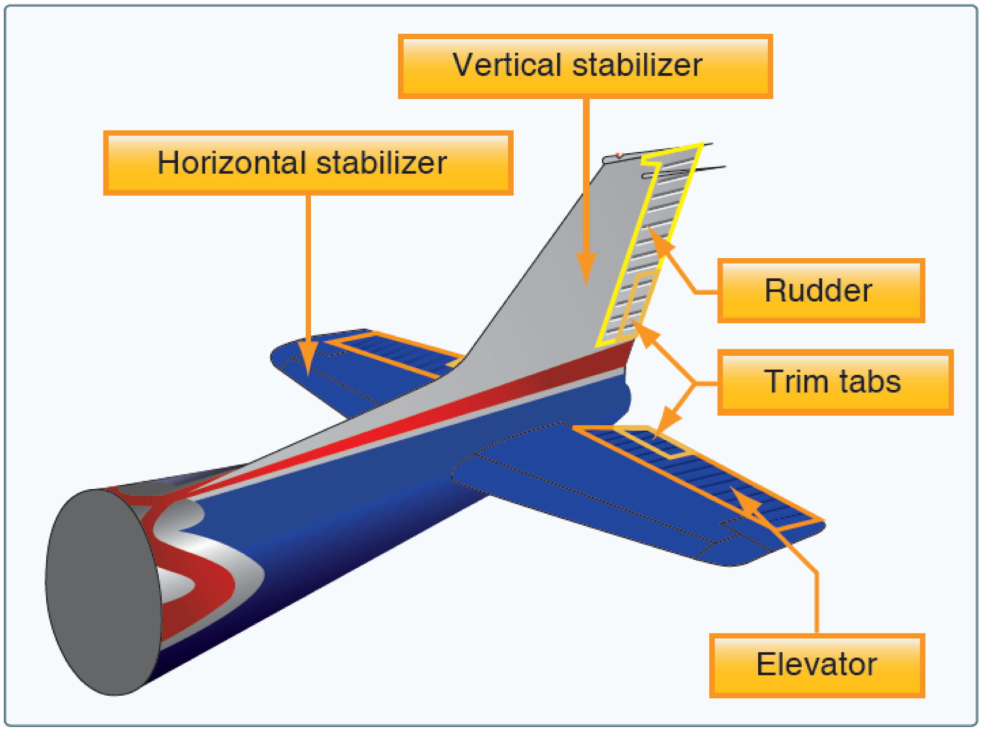
1. Aspect ratio as it relates to production of lift and drag
2. Design choices of various wing planforms for speed and handling

Additional Images

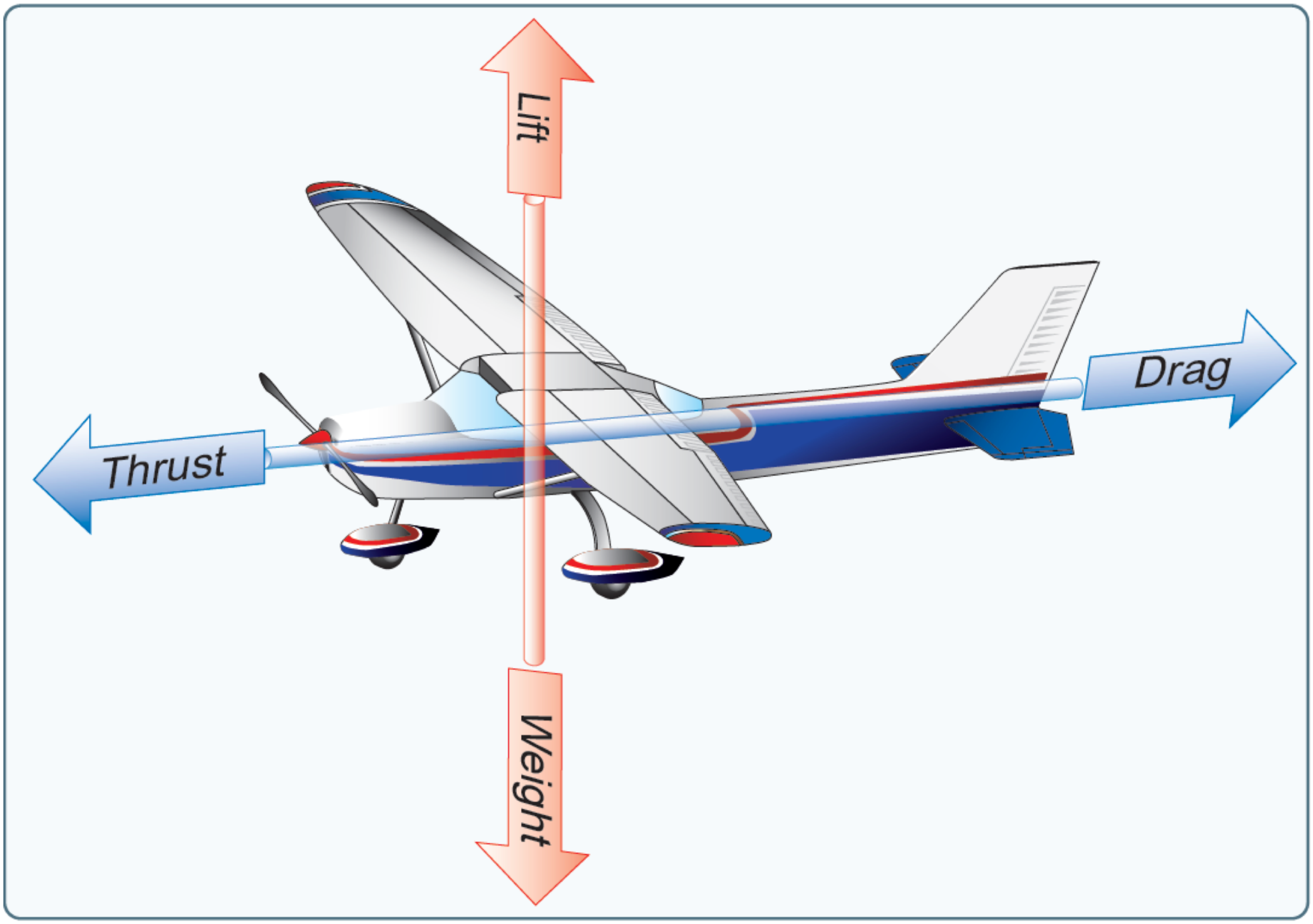
Components of an airplane



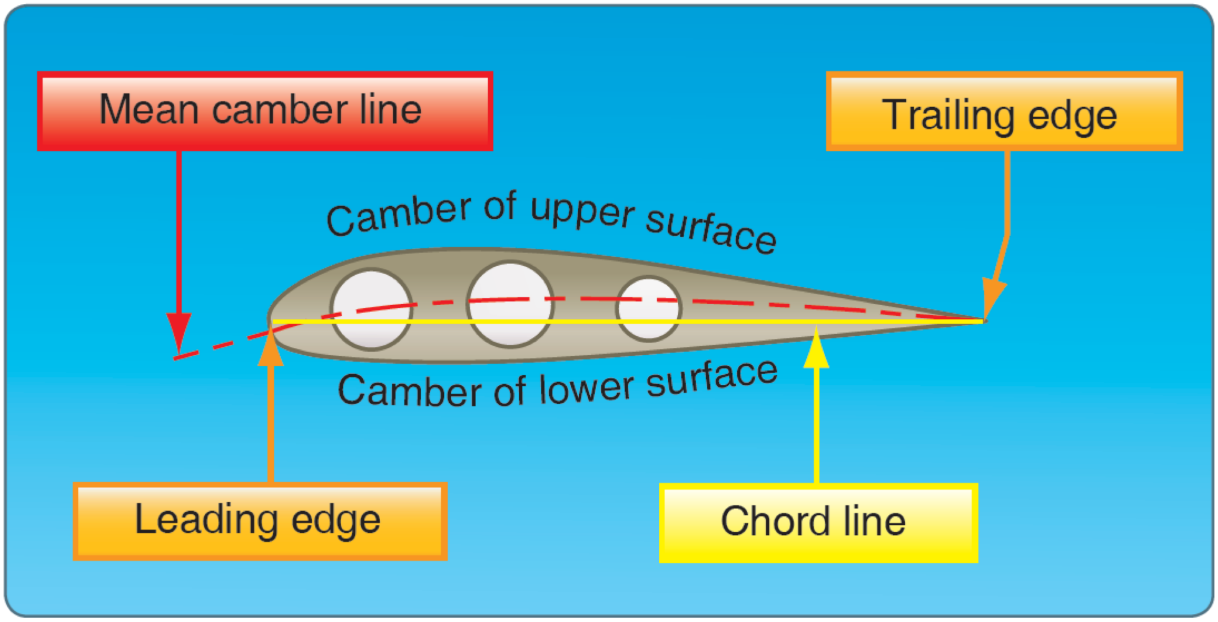
Horizontal Stabilizer



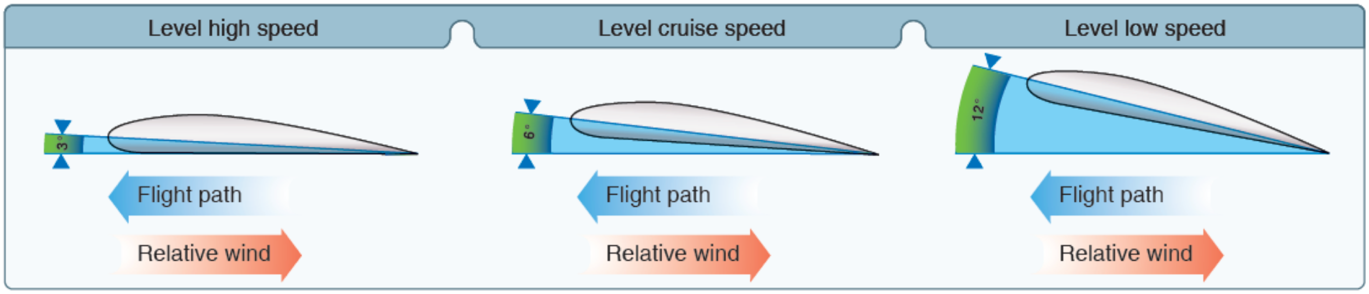
The Four Forces



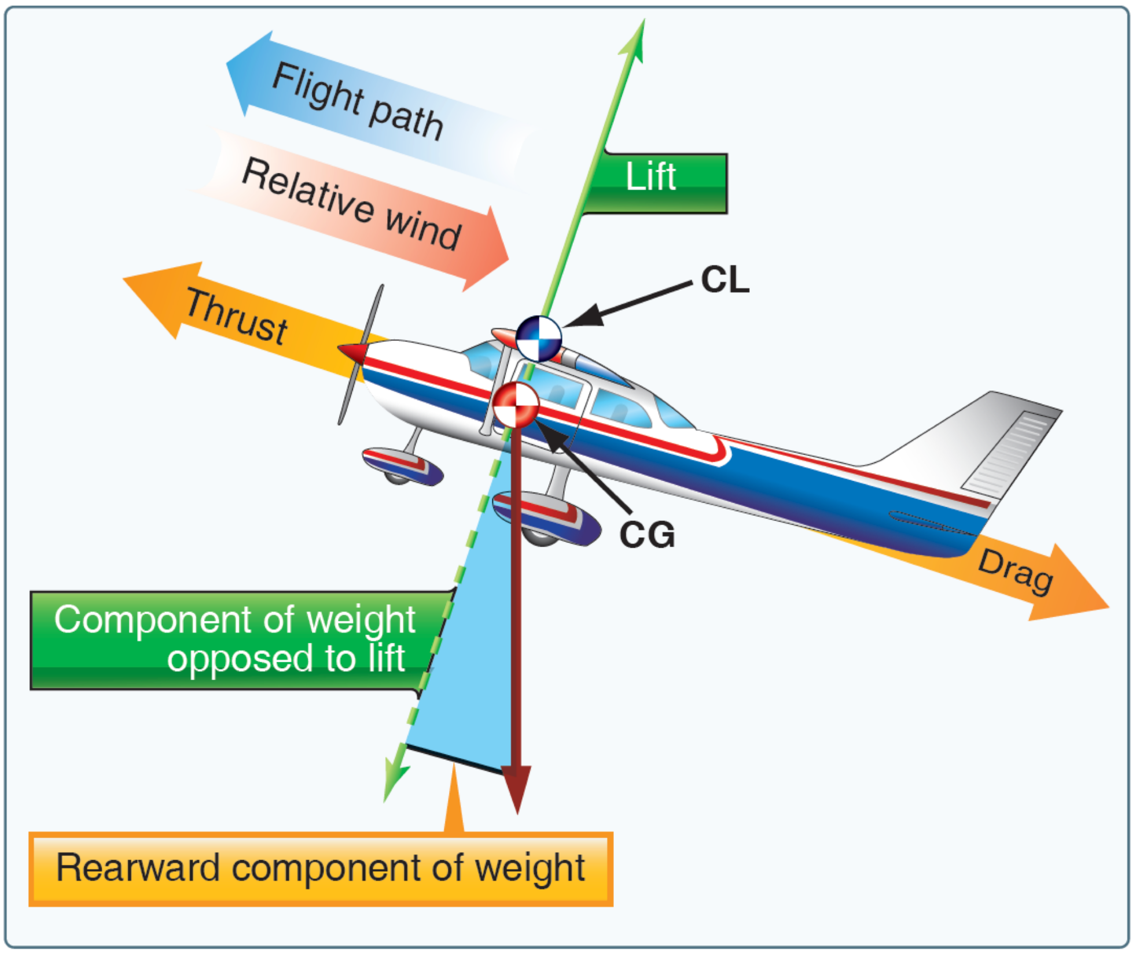
Parts of an airfoil



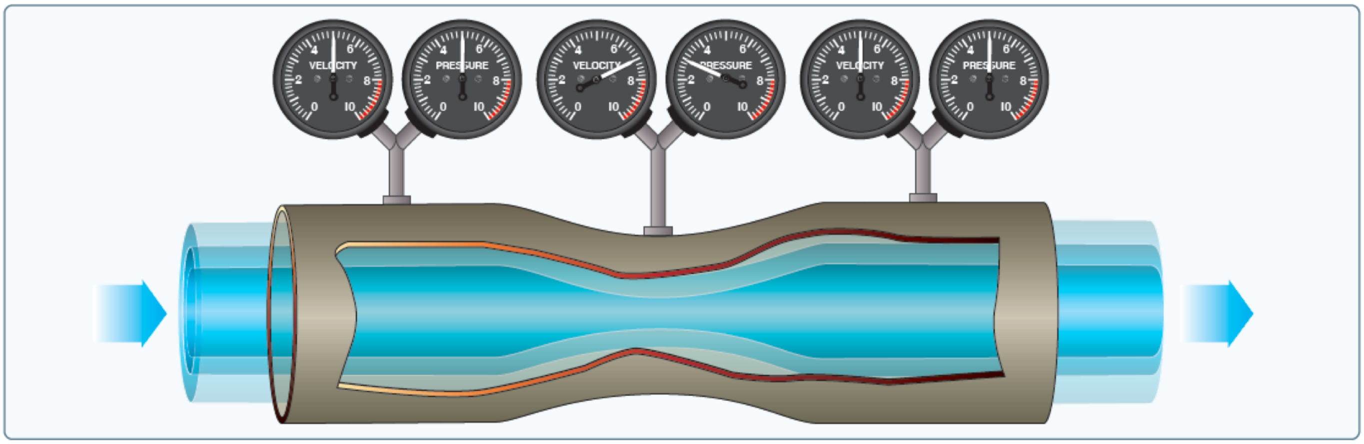
Relative wind as speed changes along the same flight path



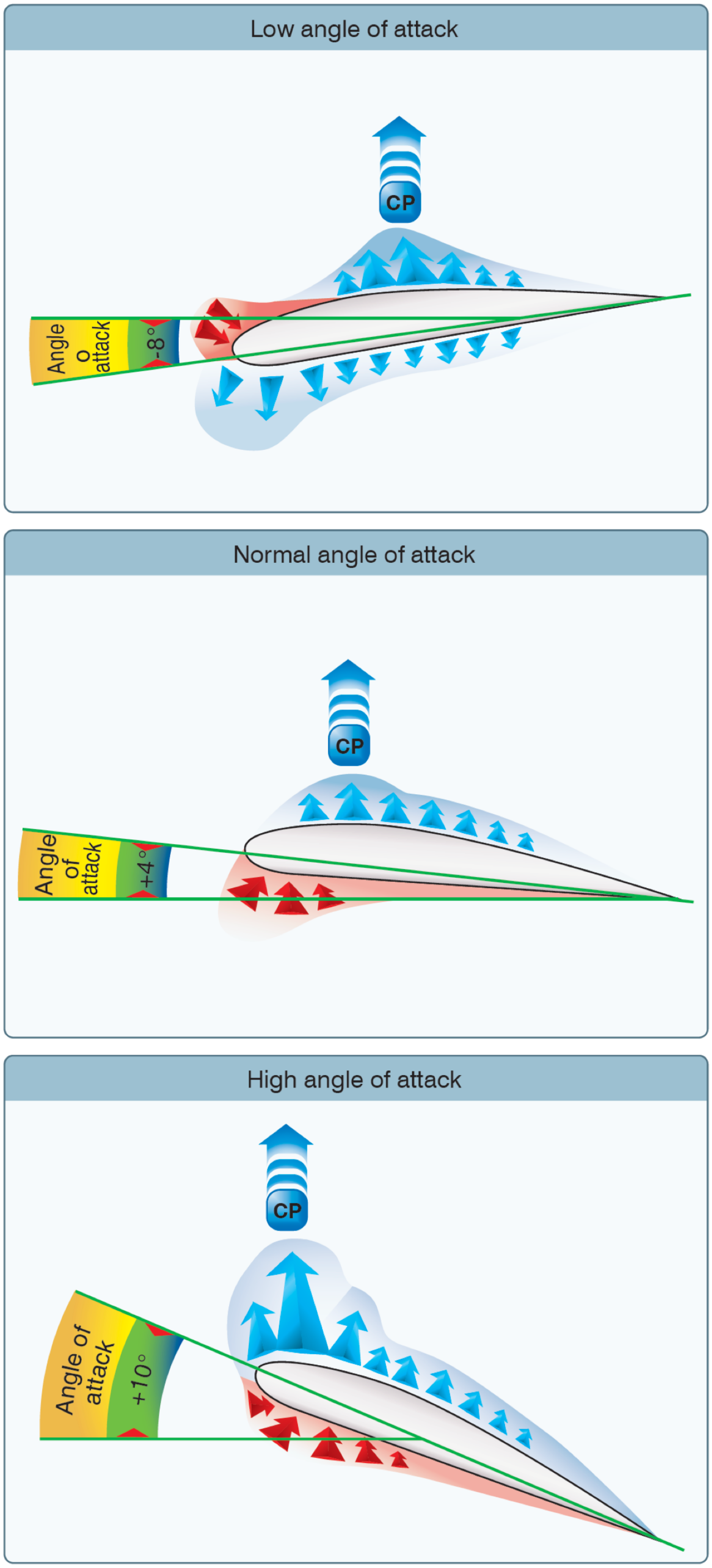
Relative wind in a climb



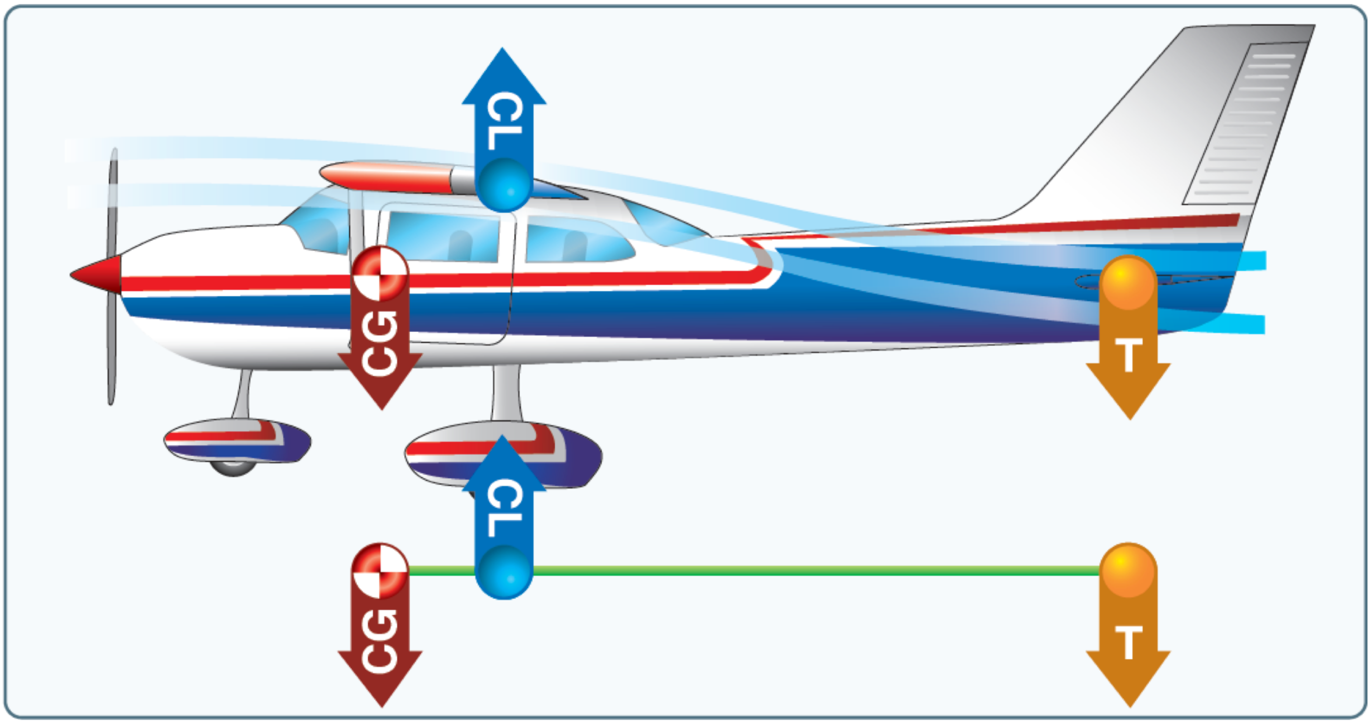
Relative wind in a climb



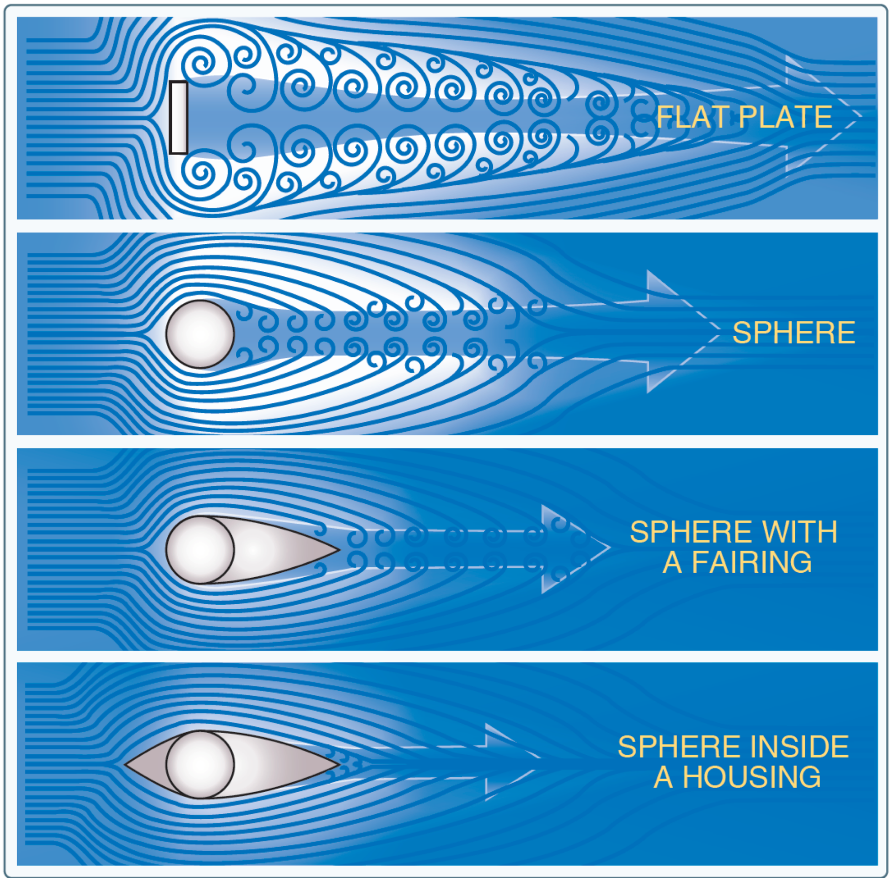
Center of pressure changes with angle of attack



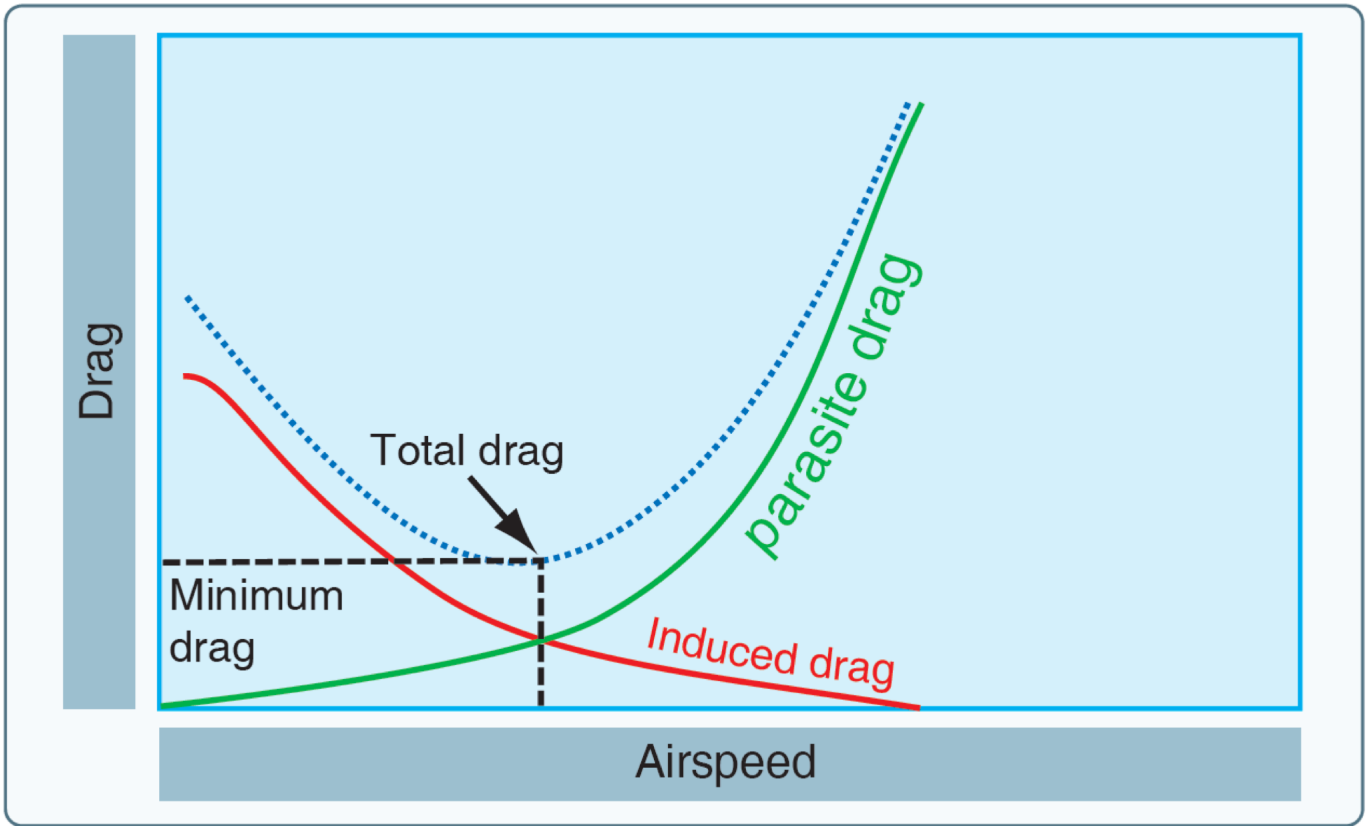
Tail-Down Force



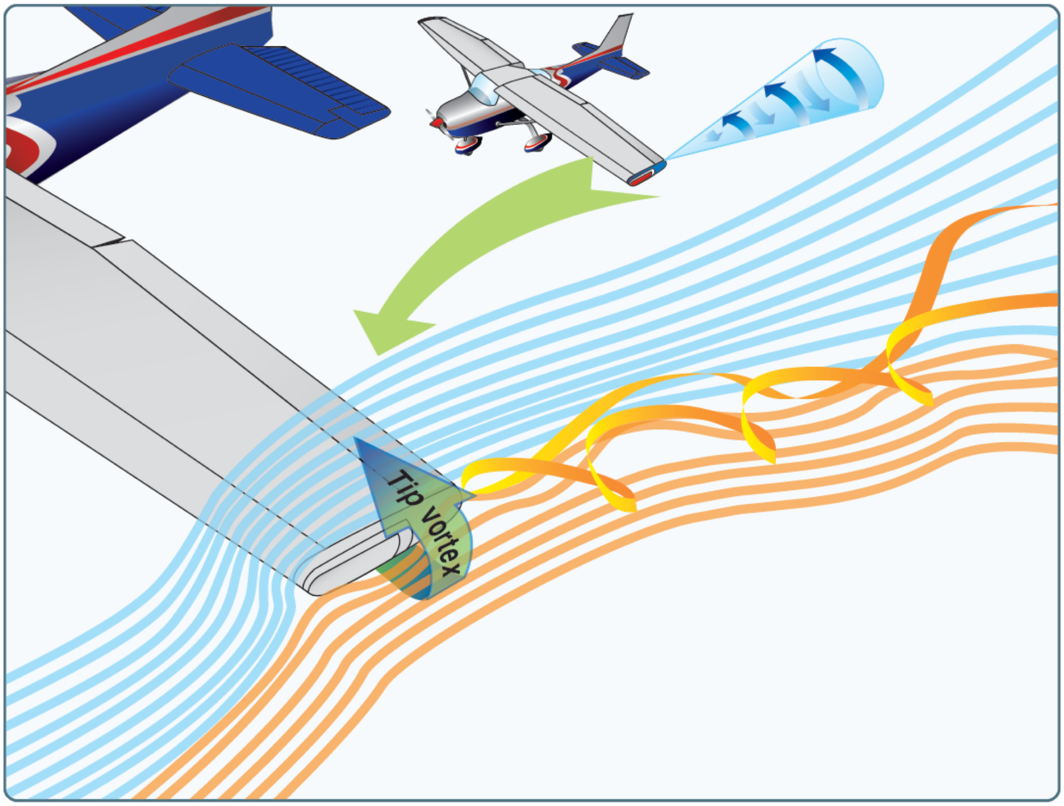
Parasite drag

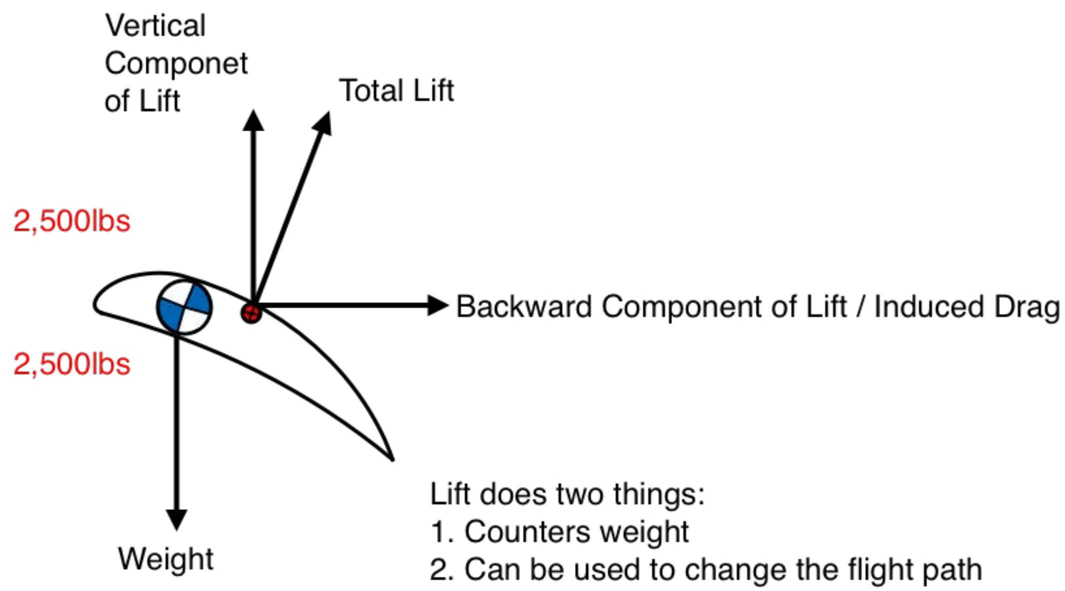


Drag Vs Speed



Wingtip Vortices

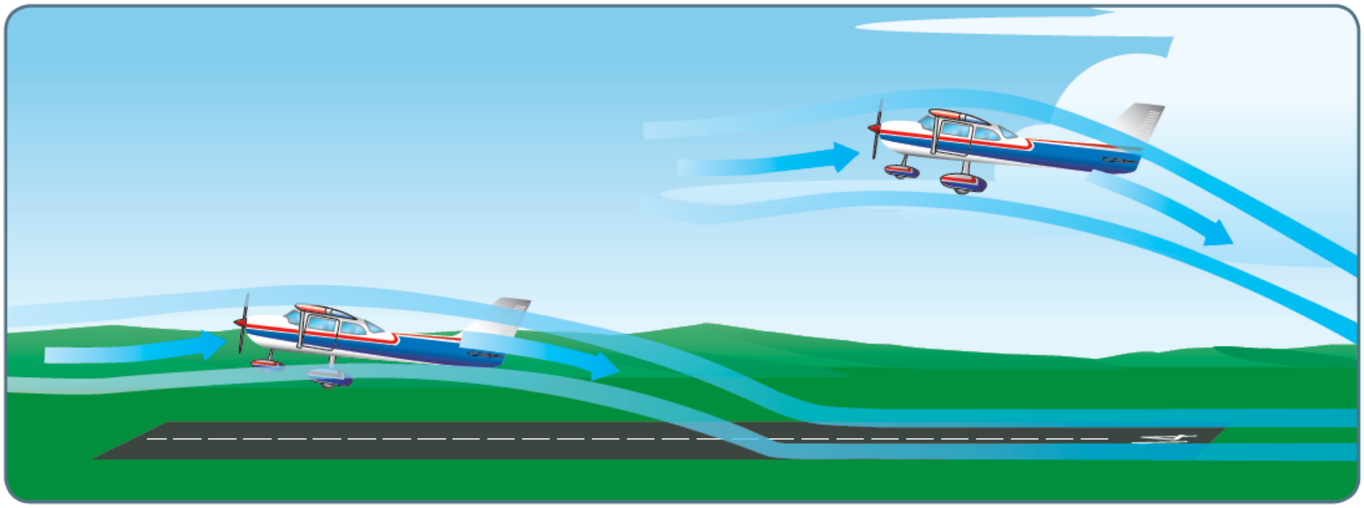




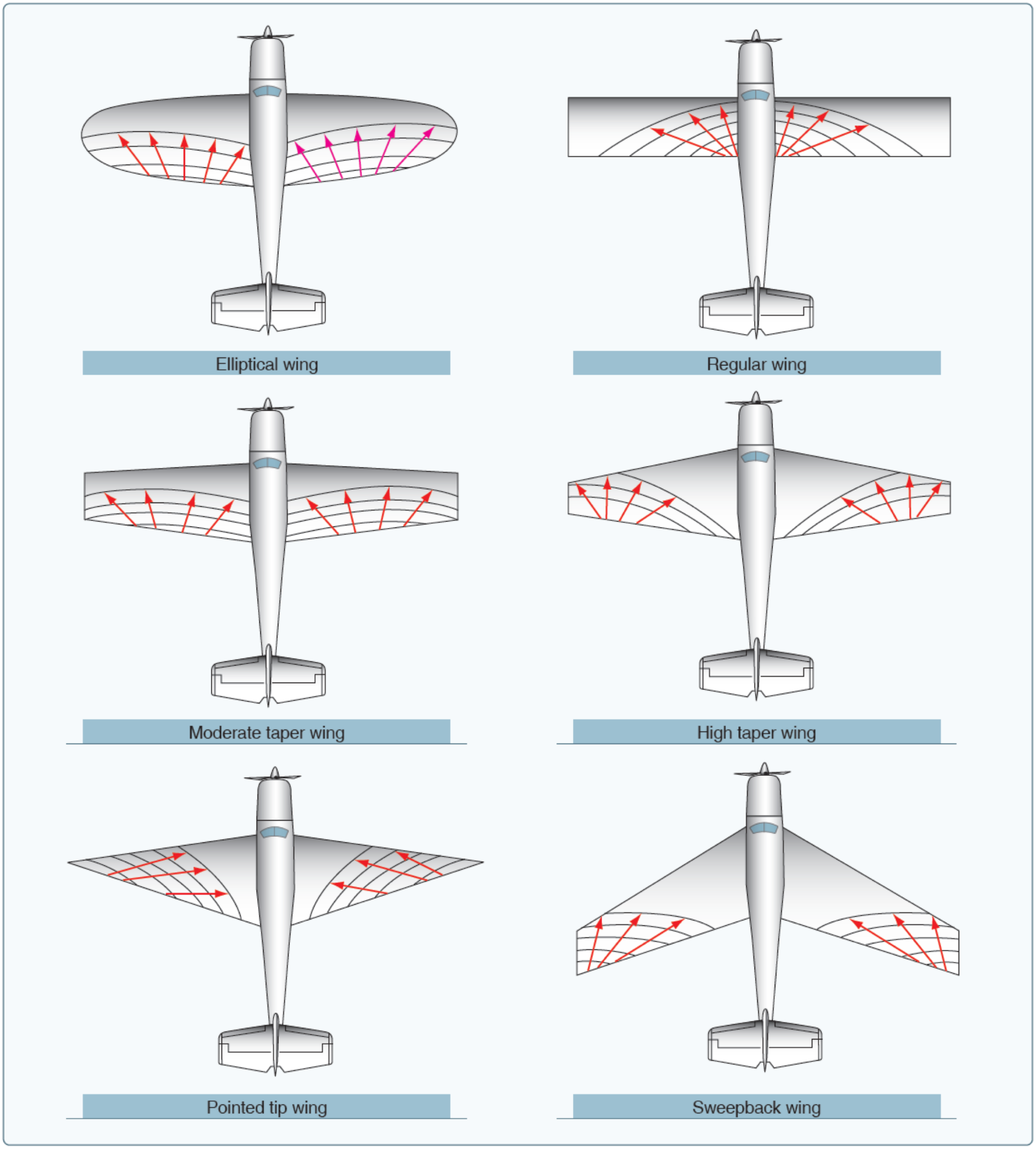
Lift does two things:
1. Counters weight
2. Can be used to change the flight path

Thrust causes an airplane to climb, Lift causes flight path to be redirected.

Ground effect changes the airflow



Wing Planforms



Objective :

The student will understand how a training or transport airplane achieves stability around it's three axes. The student will also understand how the center of gravity affects the control over the airplane the pilot has.

Motivation:

Understanding stability will help the pilot understand when and to the extent a control input may be necessary after the airplane is disturbed by the environment such as turbulence. Understanding how the center of gravity determines how controllable the airplane is will also help the pilot load the airplane in a safe manner where controllability is assured.

Presentation: Aircraft stability and Controllability 30 Minutes

Axes of the airplane and motion around the center of gravity

1. The airplane rotates in three axes around it's center of gravity
2. The three axes are: Lateral, Longitudinal and Vertical. This relates to the airplane: Pitch, Roll and Yaw

Stability

1. Airplane stability relates to how the airplane behaves if disturbed from it's flight path
2. Static stability – The initial tendency of the airplanes movement once disturbed
3. Types of static stability – Positive, Neutral and Negative
4. Dynamic stability – The tendency of the airplanes movement over time
5. Types of dynamic stability – Positive, Neutral and Negative
6. Longitudinal stability (Pitching) – Achieved by more or less tail-down force due to downwash. Also thrust-line will affect stability when power is changed
7. Lateral stability (Rolling) – Achieved in a high wing airplane by pendulous effect and keel effect.
8. Lateral stability (Rolling) – Achieved in a low wing airplane by Dihedral
9. Vertical stability (Yawing) – Achieved by the fuselage aft of the CG and the vertical stabilizer
10. Free directional Oscillations (Dutch Roll) – Dihedral brings the wings level before the nose is aligned with the relative wind. This causes the airplane to form a figure eight along the horizon. Dampens down eventually

11. Spiral instability – Caused by good directional stability – Strong directional stability on the airplane results in the nose aligning to the relative wind quickly compared to the weak dihedral causing the airplane to bank. The outside wing travels faster than the inside wing and the bank increases. Easy for a pilot to fix. Better control then Dutch roll so most airplanes are designed with spiral instability rather than Dutch roll.

Controllability

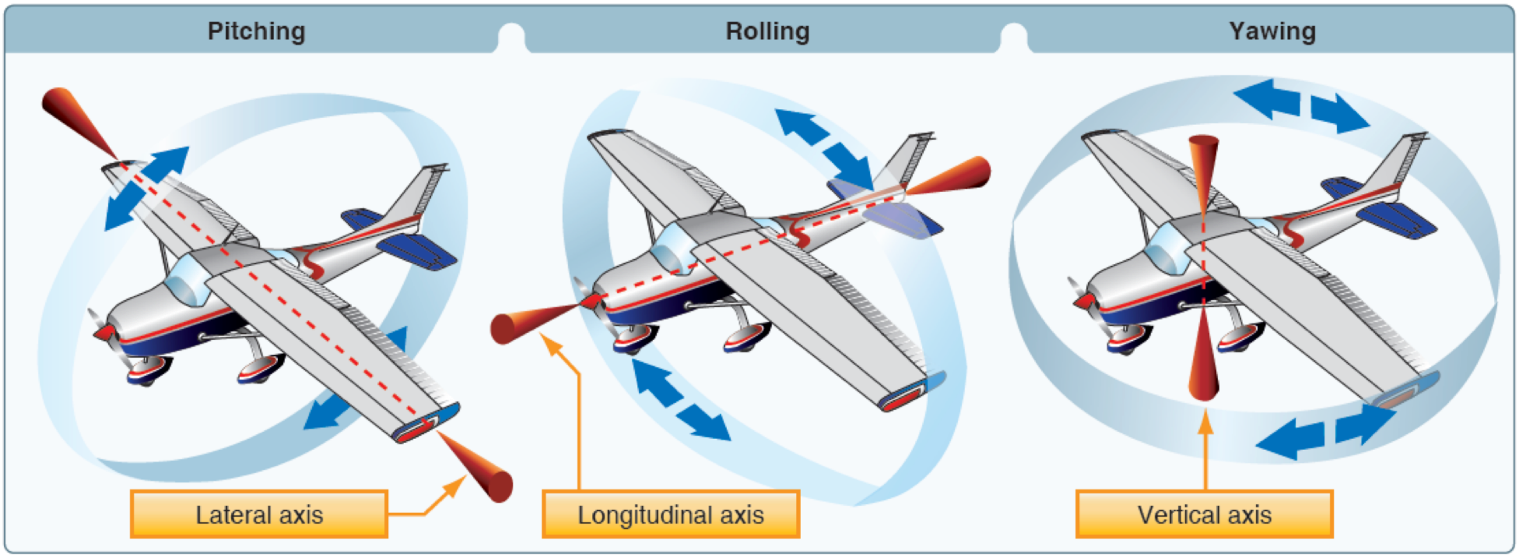
1. Controllability – The CG to the Cp is the determining factor. Design of the CG limits consider the amount of elevator control available to operate over all of the airplanes speed ranges.
2. CG location too far forward means less elevator travel upward – Not able to produce enough tail-down force (Impossible to flare). Very stable as a stall results in un-stalling quickly as the CG pulls the airplane down in the un-stalled direction
3. CG location too far aft means too much tail-up force. Elevator may not be able to provide enough tail-up force to keep from stalling

Completion Standards

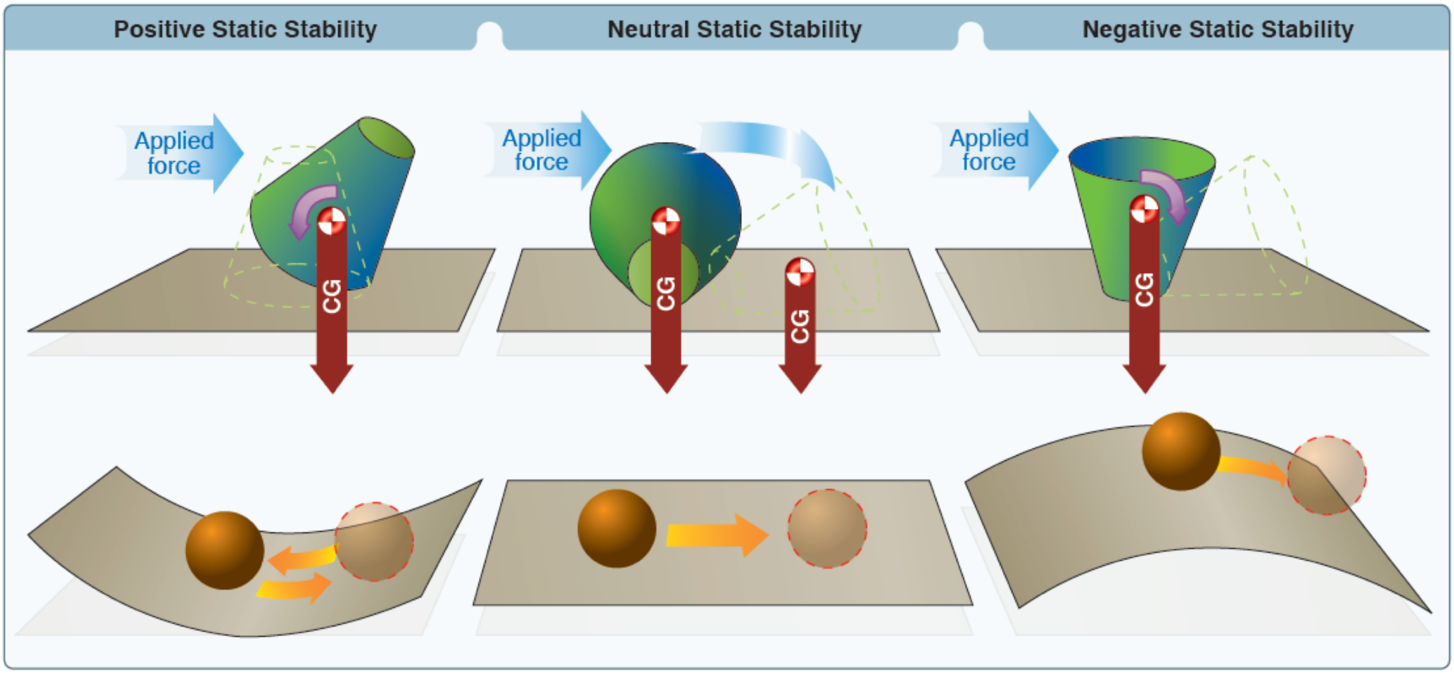
The student will be able to show how an airplane achieves stability around it's three axes using a model airplane or whiteboard. The student will also explain why an airplanes center of gravity is important for controllability

Additional Images

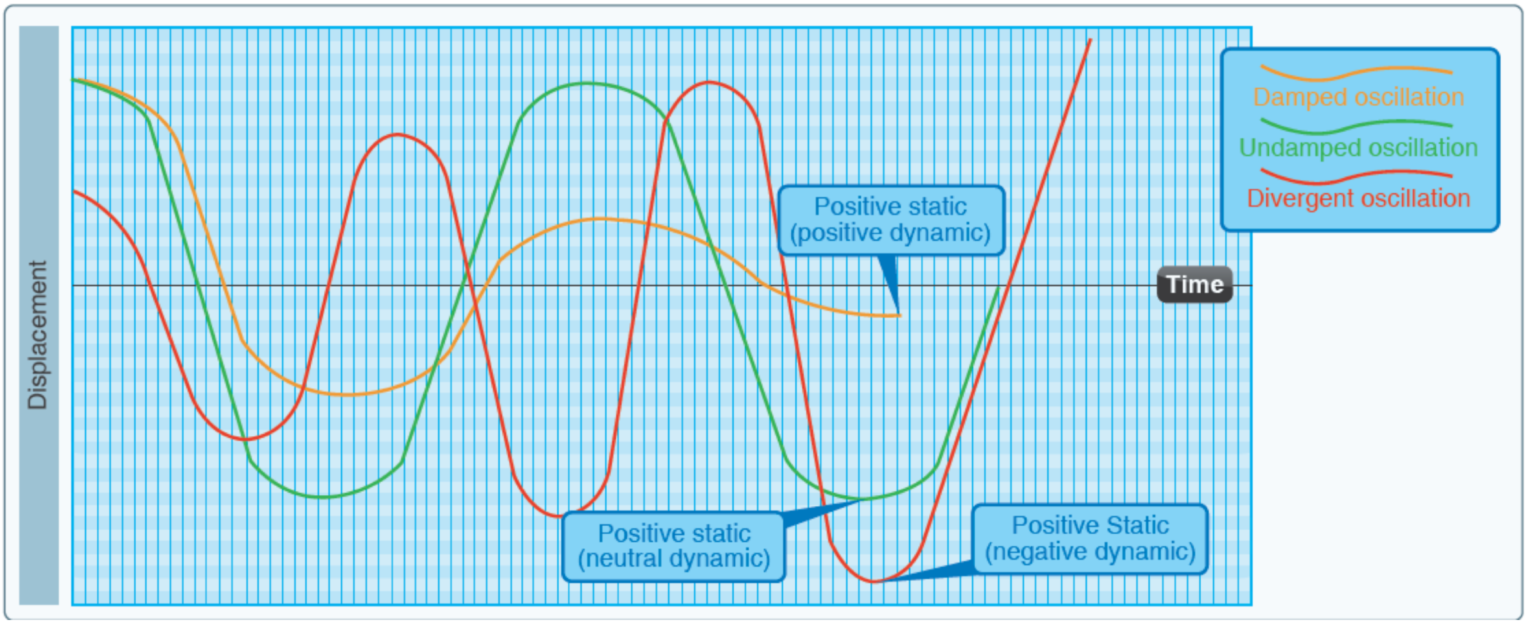
Axes of an airplane



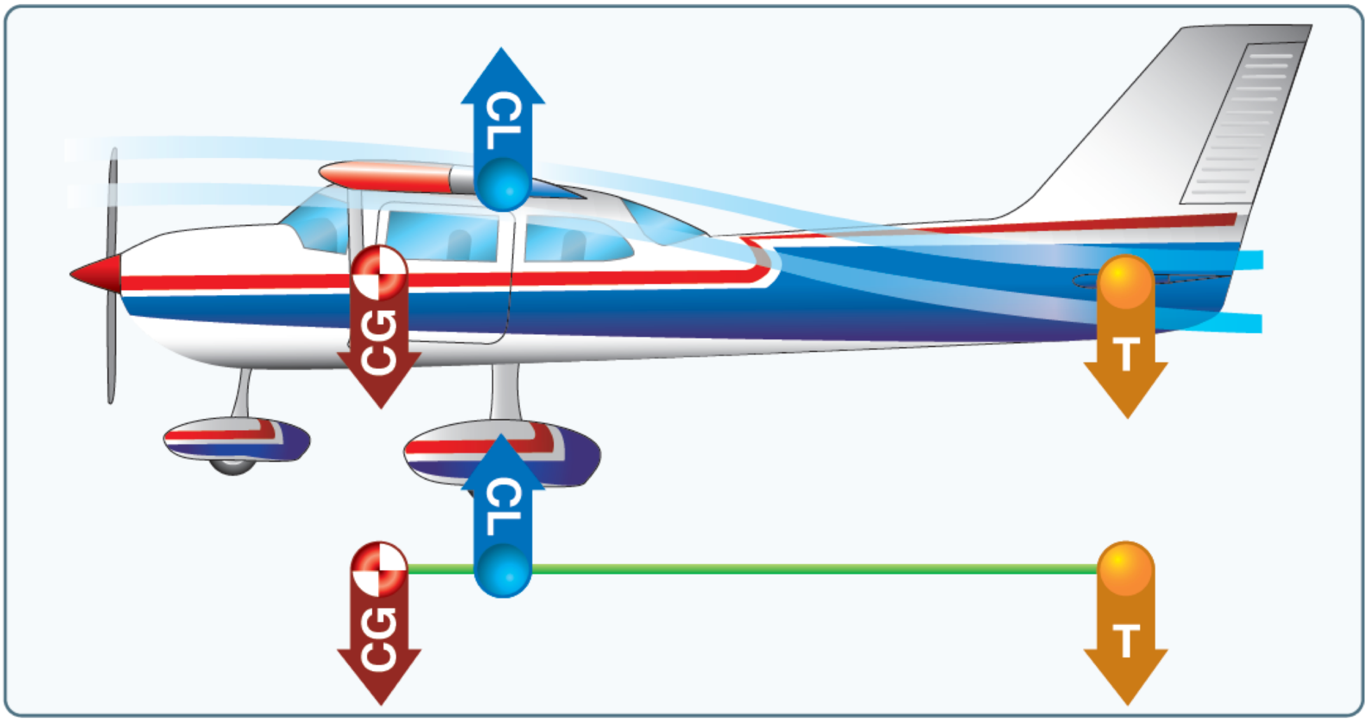
Types of static stability



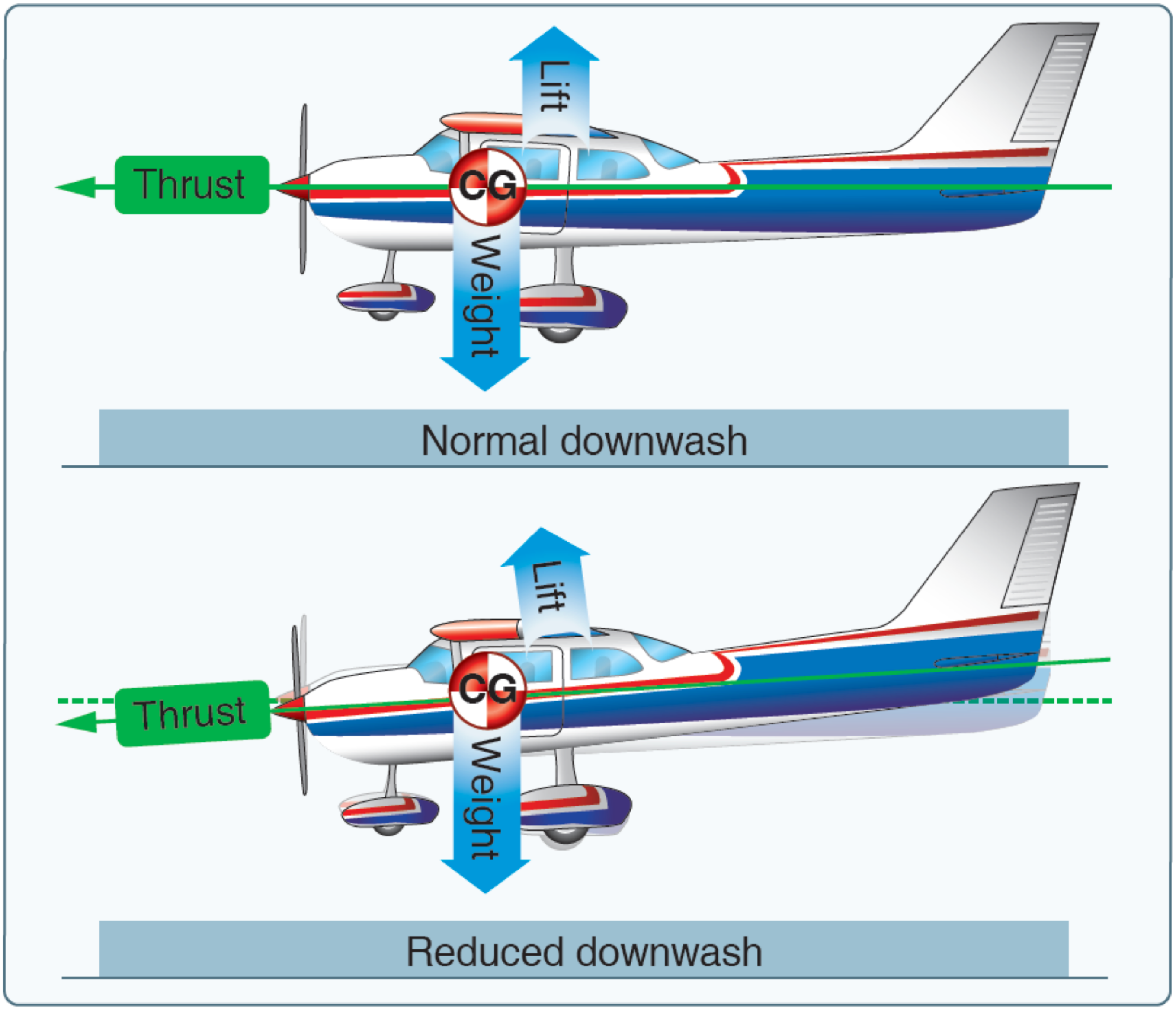
Dynamic stability and the effects of dampening



Longitudinal Stability



Downwash effect on longitudinal stability



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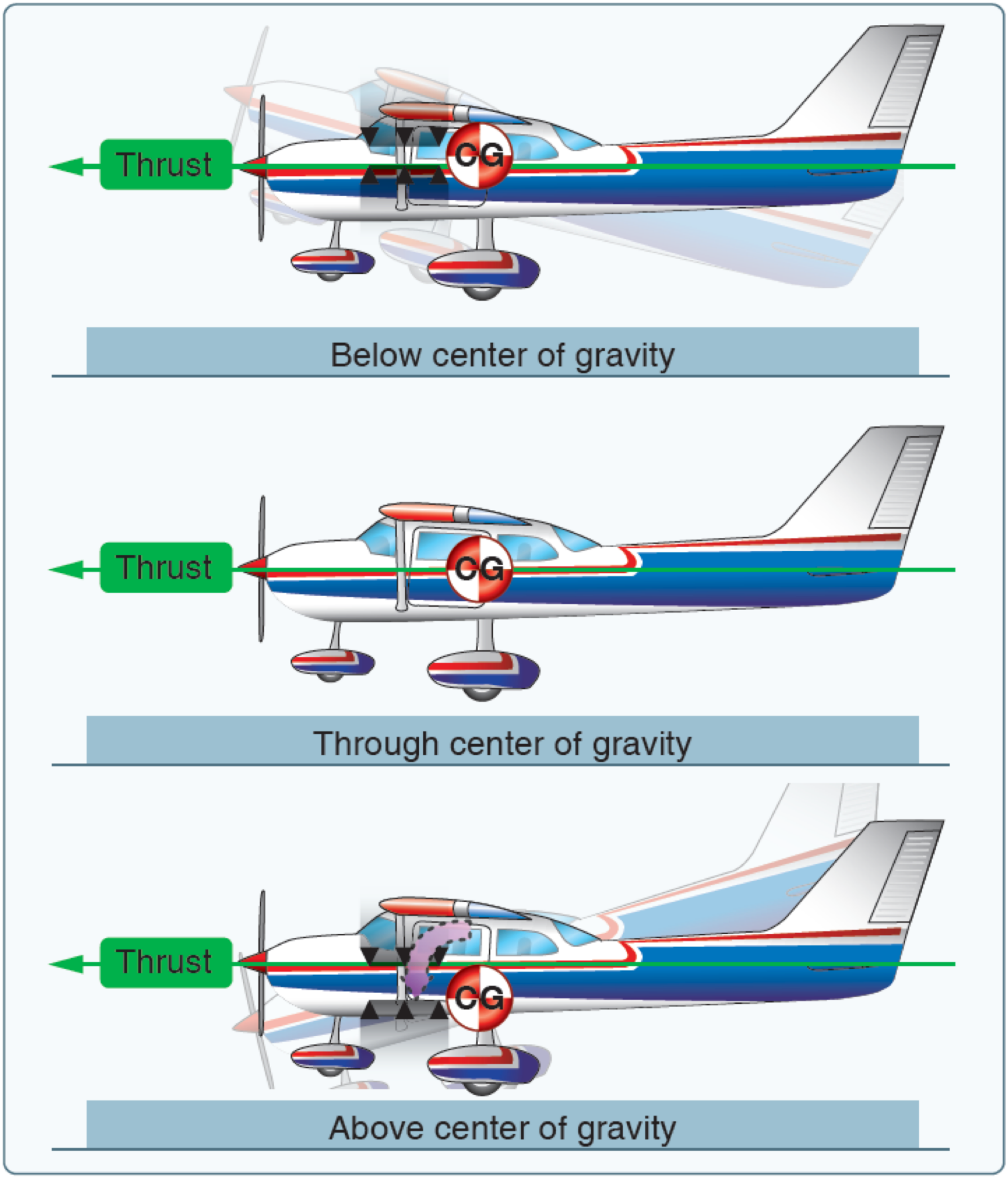
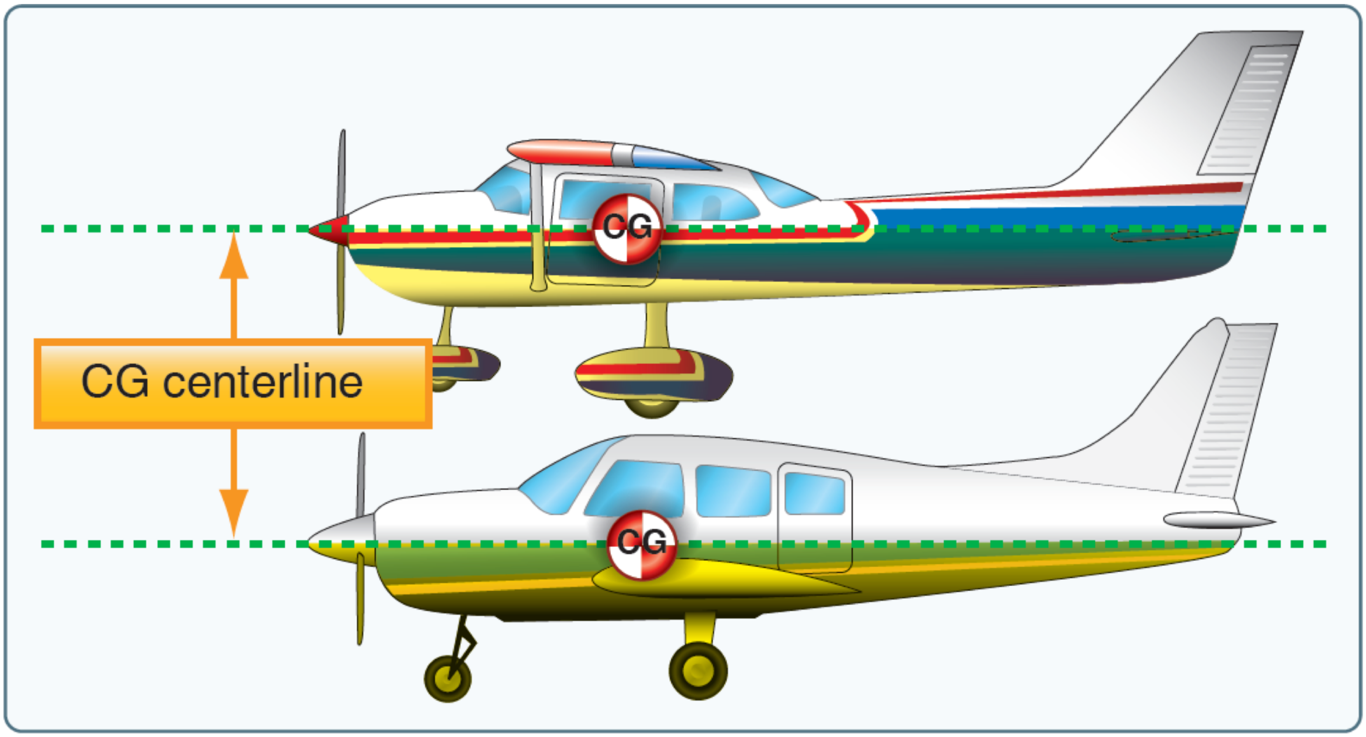
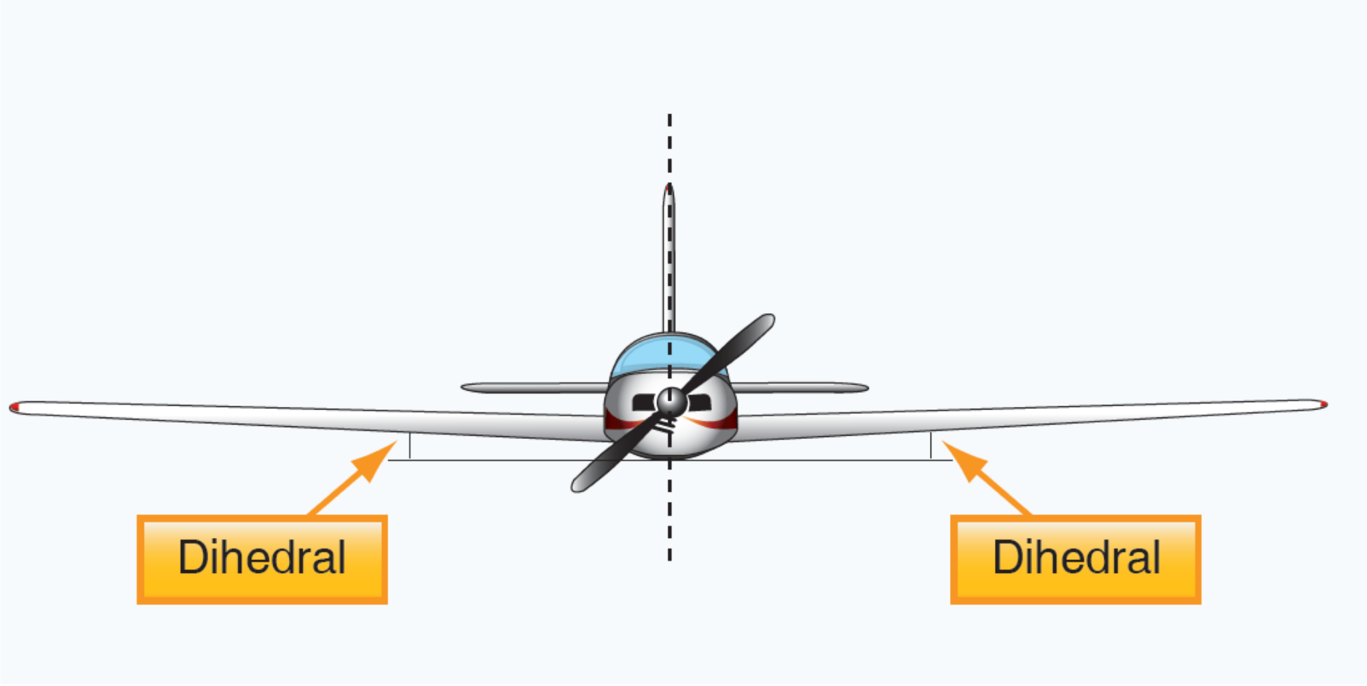
How the thrust line affects longitudinal stability



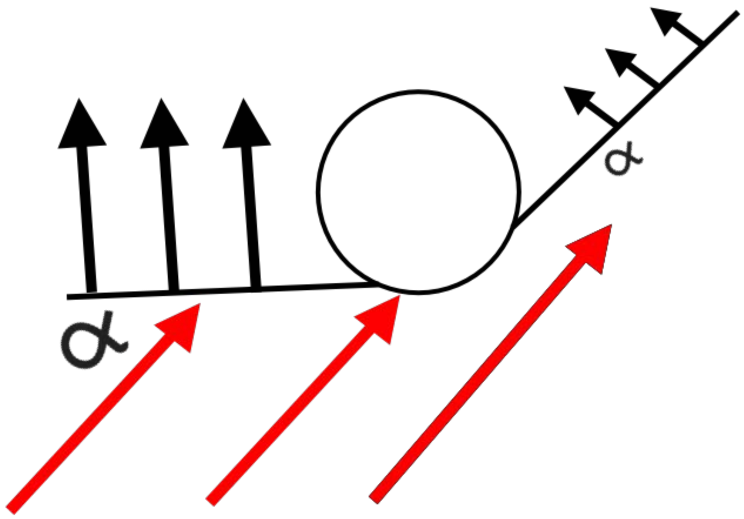
Keel effect



Dihedral



Increase of lift due to Slip



Fuselage and fin for directional stability