Pre-Solo Progress Chec

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INTRODUCTION

Regulations FAR 61.87(d) dictates that prior to any student pilots flying an aircraft solo for the first time there are a number of prerequisites that need to be met including:

Pre-Flight Engine Starting and Taxi

- Proper flight preparation procedures
- Preflight planning and preparation,
- Power plant operation,
- Aircraft systems
- Taxiing or surface operations, including run-ups

Takeoff and Landings

- Normal Takeoff & Climb
- Normal Approach & Landing`
- Crosswind Takeoff & Climb
- Crosswind Approach & Landing

Basic Flight Maneuvers

- Straight and level flight,
- Turns in both directions;
- Climbs and climbing turns;
- Descents, with and without turns, using high and low drag configurations;

INTRODUCTION

Airport Operations and Traffic Patterns

- Airport traffic patterns, including entry and departure procedures;
- Collision avoidance,
- Wind shear avoidance, and
- Wake turbulence avoidance.

Cruise Flight

- Flight at various airspeeds from cruise to slow flight;

Stalls

- Stall entries from various flight attitudes and power combinations with recovery initiated at the first indication of a stall, and recovery from a full stall;

Emergency Procedures

- Emergency procedures and equipment malfunctions;
- Approaches to a landing area with simulated engine malfunctions;

INTRODUCTION

Ground reference maneuvers;

- Rectangular Course (Traffic Pattern)
- S-Turns (across a road)
- Turns around a point

Miscellaneous

- Slips to a landing
- Go-arounds.

Required Documents & Endorsements

- Medical Certificate
- Student Pilot Certificate
- Govt ID
- Airport ID badge / Ramp pass

Endorsements

- TSA Endorsement
- Initial Solo
- 90 Days Solo

FAR - REQUIREMENTS

A student pilot who is receiving training for a single-engine airplane rating or privileges must receive and log flight training for the following maneuvers and procedures:

- Proper flight preparation procedures, including preflight planning and preparation, powerplant operation, and aircraft systems;
- Taxiing or surface operations, including runups;
- Takeoffs and landings, including normal and crosswind;
- Straight and level flight, and turns in both directions;
- Climbs and climbing turns;
- Airport traffic patterns, including entry and departure procedures;
- Collision avoidance, windshear avoidance, and wake turbulence avoidance;
- Descents, with and without turns, using high and low drag configurations;
- Flight at various airspeeds from cruise to slow flight;
- Stall entries from various flight attitudes and power combinations with recovery initiated at the first indication of a stall, and recovery from a full stall;

PARKING PROCEDURES

GROUND OPERATIONS
PARKING PROCEDURES
DEALING WITH RUTS

- During preflight, note if the Warrior is parked in a rut.
- After performing the safety check, pull the aircraft through the rut to a point it does not roll backwards into the rut.

  (safety check = magnetos off, mixture idle cut-off, throttle idle),
  - Do not move the prop when pulling
- The safety check shall be accomplished before touching the prop **every time**.
- Call the ECAC office if you need help pulling it out of the rut.
- Upon returning to the Warrior ramp, taxi through the rut. This requires a bit of extra speed, but not much. Slow taxi until aligned with the parking spot, then add only enough power to allow the aircraft to taxi just beyond the rut.
- If the aircraft ends up too far for the tail chain to reach, perform the safety check and push the aircraft so the main wheels are in front of the rut.

GROUND OPERATIONS PARKING PROCEDURES

- Unless directed (by ECAC office staff) aircraft will be parked on the West Ramp area.
- Aircraft parking spots are marked on the surface by a yellow T marking.
- On the T spots there are ropes and chains. The ropes are used to tie down the wings, the chain locks the airplane at the tail loop.
- In the winter follow the ECAC winter operations procedures for parking guidance (to allow for maximum heating by the sun to melt ice / frost)
- The aircraft (unless directed) otherwise must be shutdown as per the ECAC checklist.
- Ailerons must be secured, wings tied down, tail locked using the lock that is supplied.
- All personal equipment, clothing, trash etc must be removed from the aircraft after parking and shutting the aircraft.
- **Cockpit Covers** must be placed over the aircraft and secured before leaving the ramp area.

GROUND OPERATIONS
PARKING PROCEDURES

- Remove interior waste after flight (paper water bottles etc.)
- Prevent Pens from marking interior
- Care of exterior (don’t place items on painted surfaces)
- Secure the flight control with a seat belt after flight

MAINTENANCE ISSUES

MAINTENANCE / INSPECTION REQUIREMENTS

- It is the responsibility of owner for maintaining airworthiness
- The Pilot in Command (PIC) is responsible for ensuring airworthiness before each flight including the following has been carried out and is up to date
  - 100hr
  - Annual Inspection,
  - ELT inspections, carried out
  - Transponder Inspection, carried out
  - AD's, complied with
  - Test Flights, carried out
  - Preventative maintenance, carried out
  - Pilot must review maintenance logs, approved docs showing inspections, each log must include description of work, date, signature of technician, certificate number

MAINTENANCE / ANNUAL INSPECTION

Most GA aircraft require an annual inspection according to 14 CFR 91.409.

It must be completed and approved by a mechanic with an inspection authorization (IA) **once every 12 calendar-months**.

An aircraft that is exempt from having an annual inspection must:

- **Use an approved progressive inspection plan;**
- Carry a Special Flight permit (i.e., ferry permit); or
- Carry a Provisional Airworthiness certificate.

ECAC implements a phase maintenance plan. Scheduled maintenance is carried out every quarter and replaces the Annual inspection

MAINTENANCE / 100 HR INSPECTION

100-Hour Inspection (FAR 91.409)

The 100-hour inspection is required for aircraft:

- That carry any person (other than a crew member) for hire; or
- That are provided by any person giving flight instruction for hire.

The phrase "for hire" refers to the person, not the aircraft. An FAR Part 91 example of a person carried for hire is an aerial photography flight.
If a flight instructor provides an aircraft, or any operation that supplies both flight instruction and an aircraft, that aircraft is subject to the 100-hour inspection.

An aircraft provided by the (student) pilot, who is receiving instruction, is not subject to the 100-hour inspection.

The 100-hour limit **may be exceeded by 10 hours** for the purposes of flying to a place where the inspection can be done.

The excess time must be included in computing the next 100 hours of time in service.

MAINTENANCE / PROGRESSIVE INSPECTIONS

Progressive Inspections (FAR 91.409)

East Coast Aero Club use a progressive (or phase) inspection plan.

Progressive inspections benefit owners whose aircraft experience high usage such as flight schools.

Unlike an annual or 100-hour inspection, a progressive inspection allows for **more frequent but shorter inspection phases**, as long as a**ll items required for the annual and 100-hour are inspected within the required time**.

At East Coast Aero Club

- 60 hours is the interval between inspections.
- Provided all four phase inspections get done in a one year period there is no annual inspection required.

GROUND OPERATIONS MAINTENANCE ISSUES

- All ECAC aircraft are maintained on a strict schedule. All maintenance requirements, inspections and AD's are met and kept up to date on an ongoing basis
- All pilots who encounter any issues arising with aircraft must report them to the ECAC office in a timely manner. .
- Before flying pilots are responsible to check squawks. (issues noted that do not compromise the aircraft safety). Squawks are kept in the office (small box on the counter) before all flights.
- While you are completing a pre-flight inspection on any aircraft, prior to flying - look for reasons NOT to fly.
- If you encounter maintenance / safety issues during pre-flight - contact a CFI / Office staff for further info / advice.
- If you are at a remote airport (non ECAC) call in to the ECAC office - report any issues and seek guidance.
- **If in doubt - don't fly and seek assistance**

GROUND OPERATIONS FUEL REQUESTS

After each flight pilots will ensure that fuel is requested to replenish the aircraft for for fuel used during their flight.

- Fuel will be requested from Signature Flight Support after EVERY flight.
- Once the aircraft is positioned in its final parking spot (West Ramp / T-hangars etc) Tune to appropriate frequency (**130.8 Signature at Hanscom Airport**)
- Make fuel request (Typically) "*Signature, Warrior [call sign] , [current location], Requesting a [top-off] -or- [Fuel to the tabs]*"
  - Signature will respond confirming they have the request .

- When flying to another airport you will need to make arrangements (if required) to obtain fuel from the local FBO. It is advisable to do this prior to making a cross country flight

GROUND OPERATIONS MINIMUM FUEL FOR XC FLIGHTS

14 CFR § 91.151 - Fuel requirements for flight in VFR conditions.

(a) No person may begin a flight in an airplane under VFR conditions unless (considering wind and forecast weather conditions) there is **enough fuel** to fly to the **first point of intended landing** and, assuming **normal cruising speed** -

(1) During the **day**, to **fly after that for at least 30 minute**s; or

(2) **At night**, to fly after that for **at least 45 minutes**.

WINTER OPERATIONS & SNOW REMOVAL

GROUND OPERATIONS
ENGINE PRE-HEATING

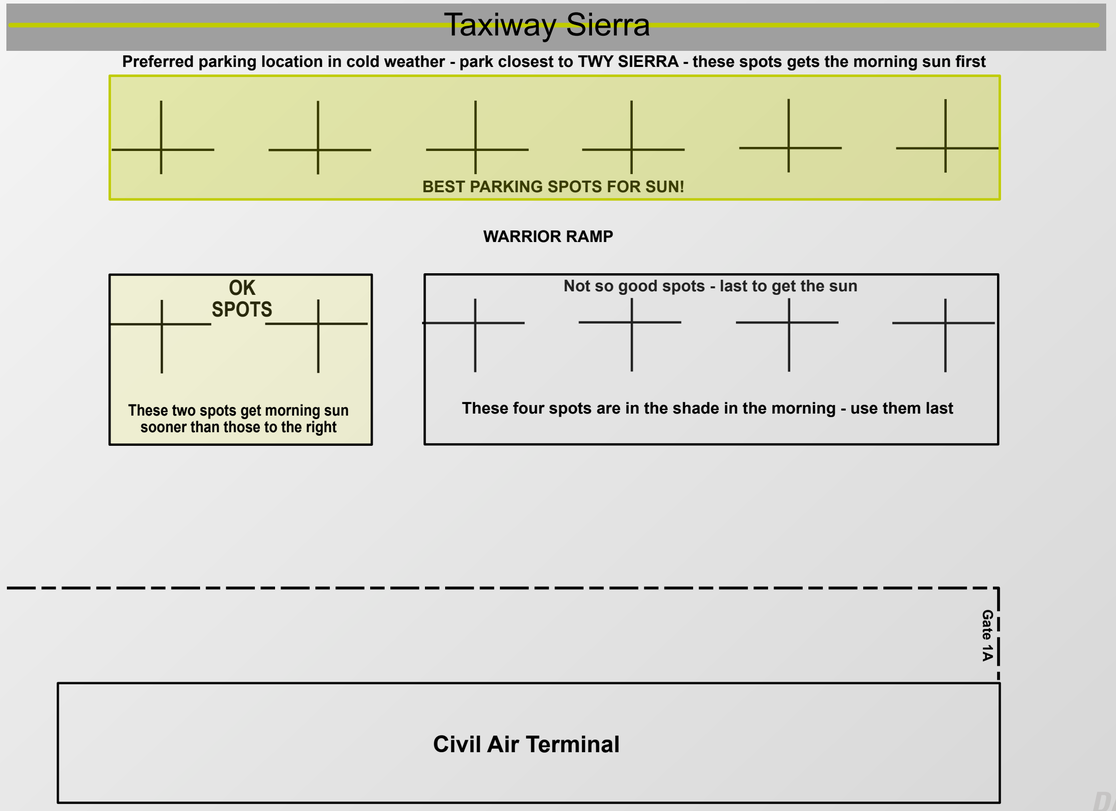
- Aircraft engine preheats are required under 40°F – if in doubt, ASK! Dispatch Phone:
- Preheat can be requested by **calling or texting 781-354-0077** on the day of your flight: Provide - Your name, Aircraft Engine start time (The time you plan to turn the key to start, NOT the time your reservations starts.)
- Aircraft will not be dispatched when temperatures are at or below 10°F or within 2 hours of 10°F

Students and instructors are encouraged to wait until after their flight to go over ground materials so they may start their preflight ASAP.

Please make every effort to keep the office up to date if you are delayed from your original start time

GROUND OPERATIONS SNOW REMOVAL & WINTER OPERATIONS

- When parking in the winter months - pay attention to where you park your aircraft when returning from a flight. This will help with melting ice and frost from the aircraft. (over night / next morning)
- Scraping ice and frost from aircraft surfaces is not permitted



GROUND OPERATIONS

MOVING AIRCRAFT ON SLIPPERY SURFACES

TAXIING ON SLIPPERY SURFACES

Moving aircraft on slippery surfaces

- Care must be taken when moving aircraft on slippery surfaces as there are many potential way to injure yourself, others, and damage the aircraft, vehicles, and other property.

Taxiing on slippery surfaces

- Taxiing on slippery taxiways or runways at excessive speed or with strong crosswinds may cause the airplane to skid. (and crash)
- Use smaller nose-wheel steering and rudder inputs.
- Limit thrust to the minimum required.
- Limit excessive breaking action
- Only use enough speed to safely move you forward
- Slow down and take care in turns not to skid off the taxiway
- Stay away from visible icy patches
- Break check - use minimum power.

IMSAFE CHECKLIST

- The “IMSAFE” checklist can be used to determine a pilot’s physical and mental readiness for flying.
- **I**llness: Even a minor illness can severely impair performance as a pilot. The safest rule is not to fly while suffering from any illness.
- **M**edication: Pilot performance can be severely impaired by both prescribed and over-the-counter medications.
- **S**tress: Stress is a term to describe the body’s nonspecific response to demands placed upon it.
- **A**lcohol: A pilot may not use alcohol within 8 hours of a flight and cannot have a blood alcohol content above 0.04%.
- **F**atigue: Fatigue can be treacherous because it may not be apparent until serious errors are made.
- **E**motion: Emotionally upsetting events may render a pilot unable to fly an airplane safely. Anger and depression will decrease alertness and lead to the pilot taking self-destructive risks.

PRE-FLIGHT PLANNING
FAR 91.103
AIM 5-1-1

§ 91.103 Preflight action.

Each pilot in command shall, before beginning a flight, become **familiar with all available information concerning that flight.** This information must include:

- For a flight not in the vicinity of an airport, **weather reports** and **forecasts, fuel requirements, alternatives** available if the planned flight cannot be completed, and any **known traffic delays** of which the pilot in command has been advised by ATC;
- For any flight, **runway lengths** at airports of intended use, and the following **takeoff and landing distance information**:
- For civil aircraft for which an approved Airplane Flight Manual (POH) containing takeoff and landing distance data is required, the takeoff and landing distance data contained therein.

PIPER WARRIOR - POWERPLANT

POWERPLANT

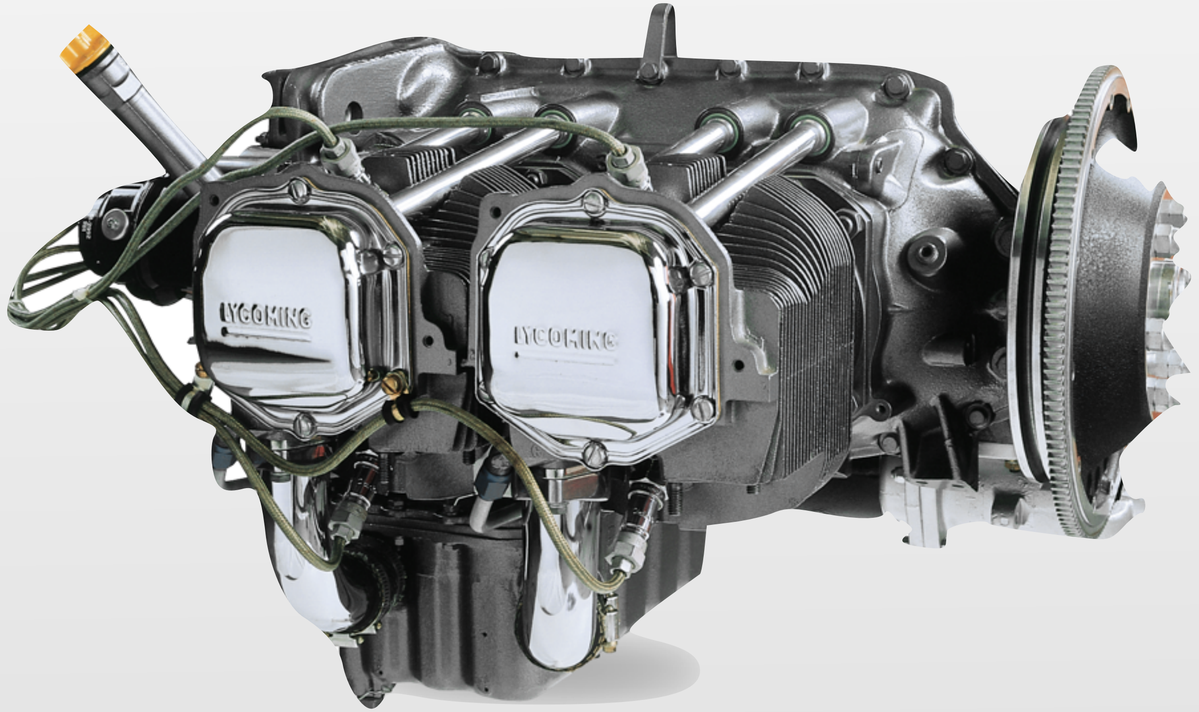
- **Engine** = Piper Warrior - **Lycoming 0-320-D3G**
- **Horsepower** = **160 HP @ 2700 RPM**
- **Magnetos** = Two engine driven magnetos. An aircraft magneto is an engine driven electrical generator that uses permanent magnets and coils to produce high voltage to fire the aircraft spark plugs. This device requires no external electrical source to operate.
- **"P" Leads**. The wire(s) that connects the primary winding of a magneto to the ignition switch. The magneto is turned off by grounding its P-lead
- Number of **spark plug**s 2 per cylinder - 2 x 4 cylinders = 8
- The ECAC **Oil Capacity** requirements is **6.0 qusrts for all flights.** *(The Piper Warrior holds a maximum of 8 Quarts Total.*

RECIPROCATING (PISTON) ENGINE

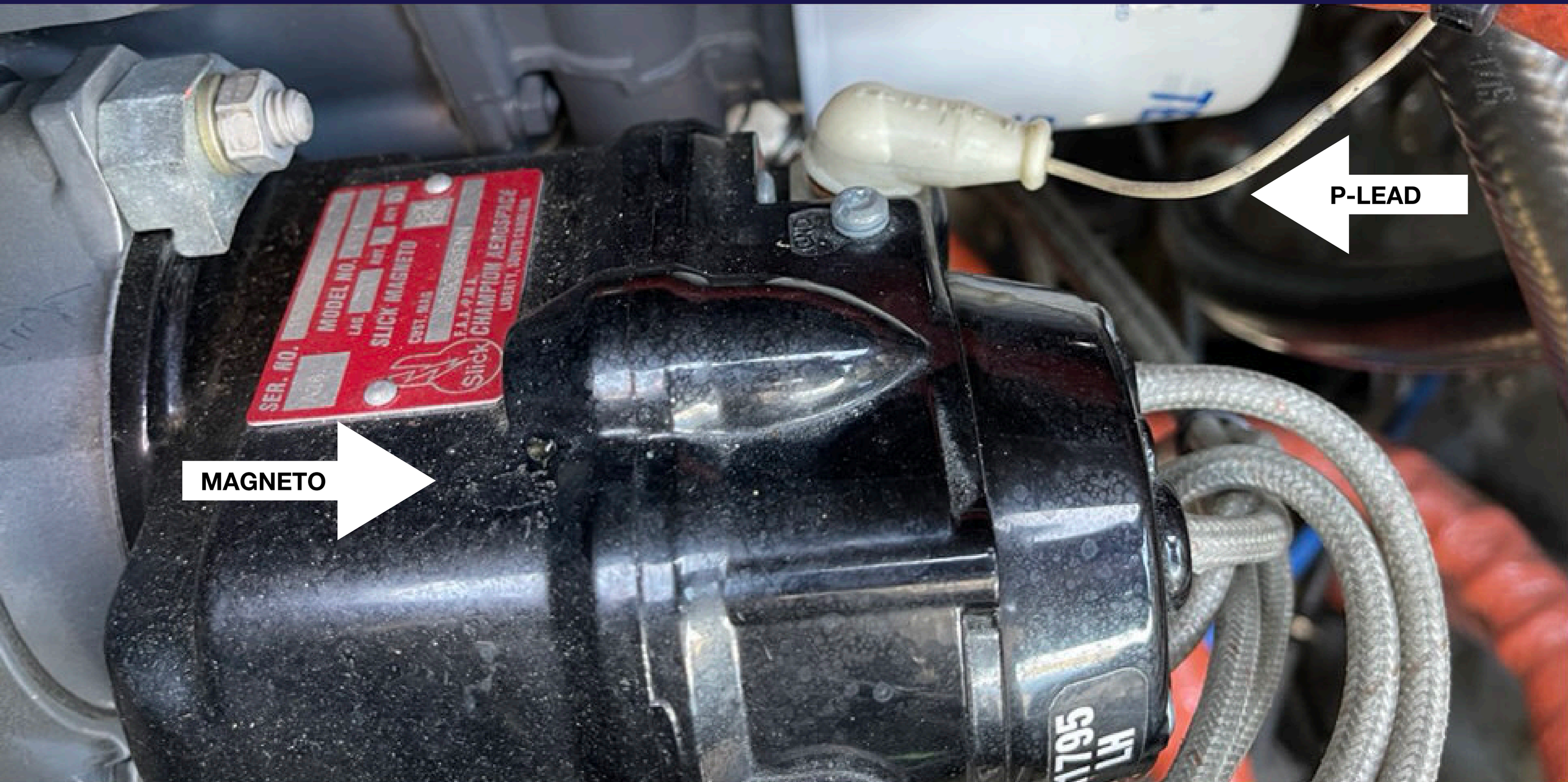
Lycoming and Continental produce designs unchanged since the 1950s (or earlier!)

In training airplanes such as Cessna or Piper:

- 4-Cylinder
- Horizontally Opposed
- Normally Aspirated
- Direct Drive
- Air/Oil-cooled
- Carburetor
- 160-180 HP



MAGNETO / P-LEAD



MAGNETO

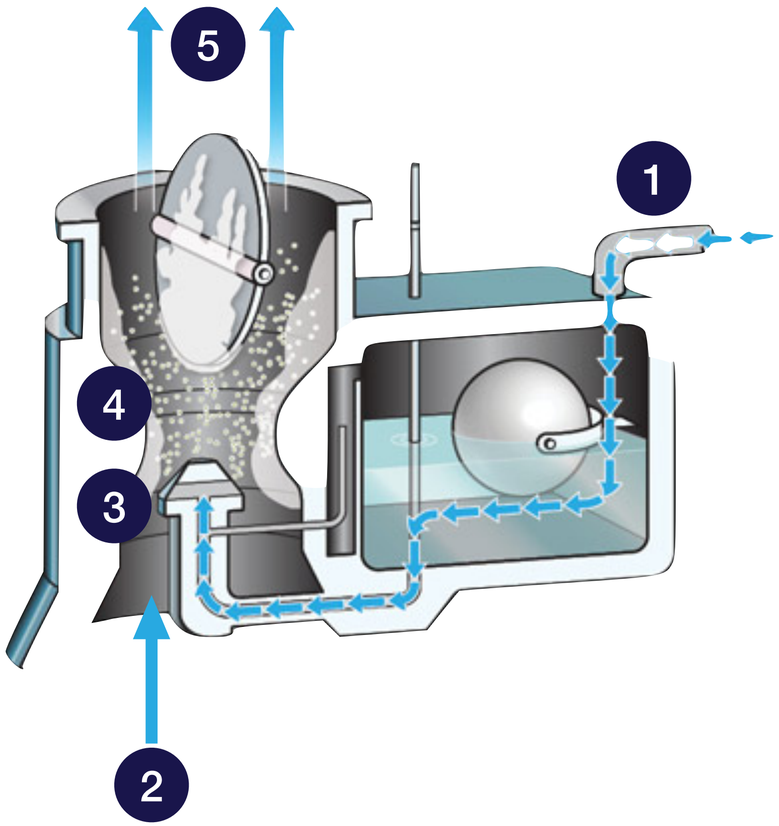
- The magneto is a self-contained electrical generator that produces high-voltage electrical pulses to ignite the fuel-air mixture in the engine's cylinders.
- Operates independently of the aircraft's electrical system and doesn't rely on a battery or external power source. Instead, it generates its own electricity through the principles of electromagnetic induction.
- The magneto is engine driven and starts generating electrical pulses whenever the airplane's engine is cranked / running,

A magneto consists of several key components:

- **Magnet:** A permanent magnet is used to create a magnetic field within the magneto.
- **Armature**: This is a rotating coil of wire placed between the poles of the magnet. As the armature rotates, it cuts through the magnetic lines of force, inducing an electrical current in the coil.
- **Distributor:** The distributor is responsible for directing the high-voltage pulses to the appropriate spark plugs in the correct firing order.

CARBURETOR / CARBURETOR HEAT

CARBURETOR



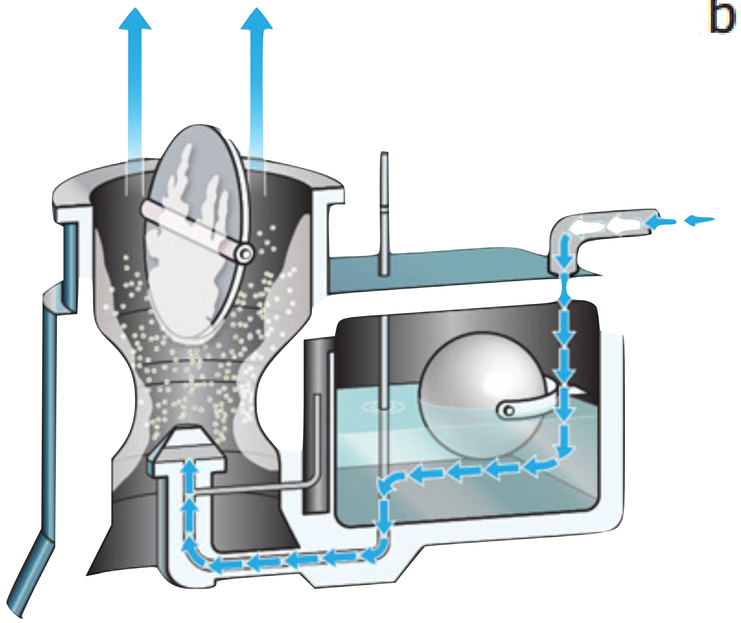
Carburetors are critical components in aircraft engines, particularly in older piston engine aircraft. They play a crucial role in mixing the right amount of air and fuel to create a combustible mixture that powers the engine.

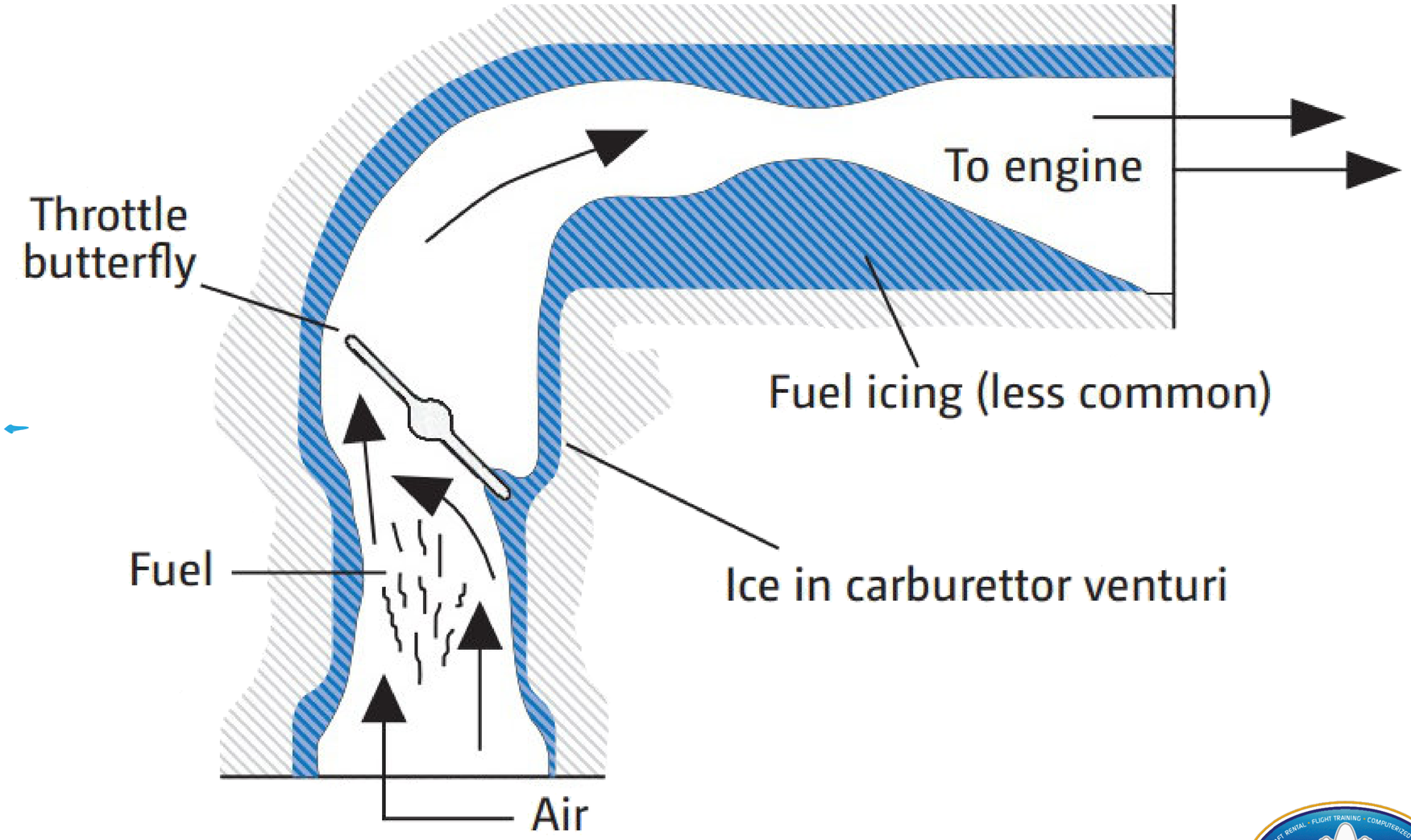
1. Fuel is pumped into the carburetor and stored in the reservoir
2. Intake: The carburetor begins by drawing in air from the outside through an air filter. This air is essential for the combustion process, as it provides oxygen for the fuel to burn.
3. Mixing Air and Fuel: Inside the carburetor, there are various chambers and passages. The flow of fuel is controlled by the throttle, which the pilot adjusts to regulate engine power. As the fuel is introduced, it mixes with the incoming air to create a combustible mixture.
4. Venturi Effect: As the air and fuel mixture passes through a constricted area called the Venturi, its velocity increases, which lowers the pressure within the Venturi.
5. Air and Fuel Mixture: The carburetor carefully controls the ratio of air to fuel to create the optimal mixture for combustion. This mixture is then delivered to the engine's cylinders through a manifold, where it is ignited to produce power.

CARBURETOR HEAT

- When Carburetor heat is applied, hot air flows into the carburetor to melt ice that may have built up in the venturi.
- Carburetor ice is a buildup of ice or frost on the inside surfaces of the carburetor.
- It can form both on the inner surfaces of the tube and on and around the throttle valve inside the carburetor. Ice in the carburetor restricts the flow of fuel and air to the engine, reducing power and possibly leading to engine failure.
- Carb ice forms when water vapor in the air condenses inside the carburetor when the temperature is at or below freezing.
- Data from the National Transportation Safety Board show that carb ice was a cause or factor in **250 accidents** from 2000 to 2011.
- In its safety alert on the subject, the NTSB stated that accident evidence shows that many pilots "**inaccurately believe carburetor icing is only a cold -or- wet-weather problem.**"

CARBURETOR ICING





CARBURETOR HEAT

- When selected (turned on) Carburetor heat preheats the air before it enters the carburetor and either prevents carburetor ice from forming or melts any ice which may have formed.
- When heat is applied, **unfiltered air enters directly** through the ram air inlet.
- This induction air passes through part of the exhaust system acting as the heating mechanism and continues onto the carburetor.
- By manipulating the carburetor heat control in the cockpit, you are simply opening or closing an air valve allowing unfiltered heated air in while dumping filtered cold air overboard, and vice versa.

INDUCTION FIRE ON START

INDUCTION FIRE ON START

Over-priming is the leading cause for engine fires on the ground.

If your engine doesn't start, how many times are you going to re-prime? How many times does it take to over prime?

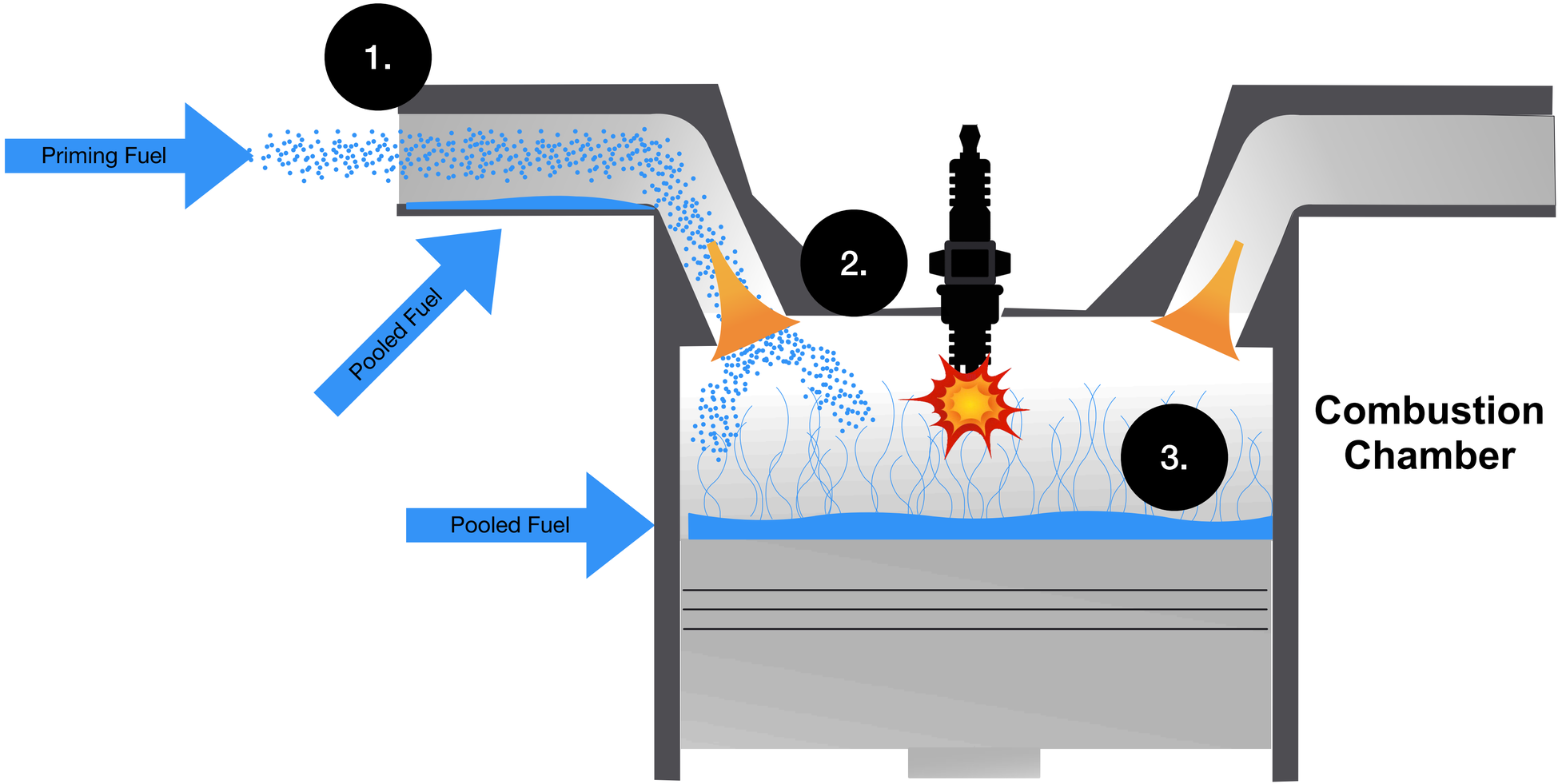
During a cold engine start, you have to prime the engine. When you prime an engine, you're putting fuel into the cylinders (or the intake manifold) so that the engine can fire. Pilots tend to over-prime the engine by priming too much or too many times.

In contrast, there are very few people who prime too little.

So what happens when you over-prime?

When you prime the engine, the extra fuel goes to one of three places:

1) The intake manifold, right in front of the intake valve.
2) The valve-chamber, where the fuel will be sucked into the cylinder.
3) Directly into the cylinder itself.


1.
Priming Fuel
Pooled Fuel
2.
Pooled Fuel
3.
Combustion Chamber

INDUCTION FIRE ON START

Scenario:

You're starting a cold engine, so you have to prime.

You prime the engine a little more than normal, maybe 2-3 times.

When you try to start the engine, it won't fire up.

You figure that you haven't primed enough, so you prime again.

This process repeats, and results in you flooding the engine.

So how do you know if you've over-primed?

And what should you do if that's the case?

PROCEDURE FOR ENGINE FIRE ON START

SECTION 3 PIPER AIRCRAFT CORPORATION EMERGENCY PROCEDURES PA-28-161, WARRIOR III

3.3 EMERGENCY PROCEDURES CHECKLIST ENGINE FIRE DURING START

- STARTER - CONTINUE CRANKING
- MIXTURE - CUTOFF
- THROTTLE - OPEN
- ELECTRIC FUEL PUMP - OFF
- FUEL SELECTOR - OFF (PUSH IN TAB TO TURN OFF)
- **ABANDON IF FIRE CONTINUES**

ELECTRICAL


PUSH
CRSR
CDI
OBS
MSG
FPL
PROC
OFF
BATT
MASTR
OFF
ALTR
OFF
FUEL
PUMP
OFF
NAV
LIGHT
OFF
STROB
LIGHT
OFF
LDG
LIGHT
OFF
RADIO
MASTR

ELECTRICAL
MASTER SWITCH & ALTERNATOR SWITCH

Purpose of Master Switch and Alternator Switch (if installed)

- A master switch, which usually has two halves—one controlling the **battery,** and another for the **alternator** or generator
- This configuration enables the flow of power to aircraft systems.
- It also allows the battery or alternator / generator to be turned off, this is helpful if electrical-system troubleshooting is required.

ELECTRICAL MALFUNCTIONS

Loss of alternator output is detected through **zero reading on the ammeter** and **alternator inop annunciator.**

NOTE: Anytime the bus voltage is below 25 dc, the Low Bus Voltage Annunciator will be illuminated.

Before executing the following procedure, ensure that the reading is zero, and not merely low, by actuating an electrically powered device, such as the landing light. If no increase in the ammeter reading is noted, alternator failure can be assumed.

POH SECTION 3 EMERGENCY PROCEDURES

- ALT annunciator light illuminated:
  Ammeter ..... Check to verify inoperative alternator -
- If ammeter shows zero:
  ALT switch …OFF -
- Reduce electrical loads to minimum:
- ALT circuit breaker ..... Check and reset as required
- ALT switch ON
- If power not restored: ALT switch ... OFF

If alternator output cannot be restored, reduce electrical loads and land as soon as practical. Anticipate complete electrical failure.

Duration of battery power will be dependent on electrical load and battery condition prior to failure.

ELECTRICAL CIRCUIT BREAKER “POPPED”

Circuit breakers are used to prevent fire.

- Circuit breakers protect wire and cable from damage owing to an over-current condition.
- They protect the circuit when the temperature and time duration characteristics of the over-current condition are outside the Circuit Breaker's design limits.
- When the heat exceeds a preset amount, the bimetallic element bends causing the spring-loaded contact to trip and open the circuit.
- A circuit breaker will usually trip (pop) when there is an electrical fault that could cause damage to the circuit. This is usually an excess of current, a power surge or a faulty component.
- The electrical load should be reduced as much as possible. Check for an open alternator field circuit breaker.
- "Do not reset a popped circuit breaker unless it is necessary for the flight, and even then, don't push it back in more than once."

ELECTRICAL FIRE

If an electrical fire is indicated (smoke in the cabin), the battery master switch should be turned OFF.

The cabin vents should be opened and the cabin heat turned OFF.

A landing should be made as soon as possible.

POH SECTION 3 EMERGENCY PROCEDURES

- Source of fire - check (Electrical fire / smoke in cabin):
- Battery Master switch - OFF
- ALTR Switch - OFF
- Vents - Open
- Cabin heat - OFF
- Land as soon as practical.

BRAKES AND STEERING

BRAKING AND STEERING

- Rudder Pedals, the lower (black) pedals are used to steer the aircraft on the ground
- Brakes are the upper (silver) pedals are used to stop the aircraft on the ground

Brake Check

- The aircraft breaks must be checked by the pilot (if flying solo) and by both pilots (i.e student then CFI) when there are dual pilots- in a GA airplane. This is done by observing the following procedure.
  - Pilot: I have the flight controls - I will check my brakes. (“you have the flight control, I have the flight controls”) **(three way exchange of controls)**
  - Pilot applies enough thrust to get the aircraft moving.
  - Once the aircraft begins to move, all thrust is removed, throttle fully retarded so engine is idling.
  - Brakes are checked and the aircraft will come to a stand still.
  - The second pilot will repeat the procedure before handing controls back to the student and / or PIC.

SYSTEM FAILURES IN FLIGHT

LOSS OF ELEVATOR / STABILATOR CONTROL

FAA's Airplane Flying Handbook, (Chapter 17 Emergency Procedures) states:
A break or disconnect in only one of these cables normally does not result in a total loss of elevator control. In most airplanes, a failed cable just results in a partial loss of pitch control.

When experiencing a loss of up-elevator control, the pilot can retain pitch control by:

- Applying considerable nose-up trim
- Pushing the control yoke forward to attain and maintain desired attitude
- Increasing forward pressure to lower the nose and relaxing forward pressure to raise the nose
- Releasing forward pressure to flare for landing

When experiencing a loss of down-elevator control, the pilot can retain pitch control by:

- Applying considerable nose-down trim
- Pulling the control yoke aft to attain and maintain attitude
- Releasing back pressure to lower the nose and increasing back pressure to raise the nose
- Increasing back pressure to flare for landing

LOSS OF ELEVATOR / STABILATOR CONTROL

Trim mechanisms can be useful in the event of an in-flight primary control failure.

For example, if the linkage between the cabin and the elevator fails in flight, leaving the elevator free to weathervane in the wind, the trim tab can be used to raise or lower the elevator within limits.

The trim tabs are not as effective as normal linkage control in conditions such as low airspeed, but they do have some positive effect—usually enough to bring about a safe landing.

If an elevator becomes jammed, resulting in a total loss of elevator control movement, various combinations of power and flap extension offer a limited amount of pitch control. A successful landing under these conditions, however, can be problematic.

LOSS OF AIRSPEED INDICATOR

Checking “Airspeed Alive” on takeoff

Saying “airspeed alive” during the takeoff roll happens when the pilot completes the preflight checklist by confirming that the airspeed indicator is giving a reading which makes sense.

it means that the airspeed indicator has started to be able to indicate airspeed, i.e.: the needle on the gauge is moving.

Air is entering the pitot tube as the plane moves through the air, the air, entering the pitot registers as the air presses harder against the diaphragm, which moves the needle.

LOSS OF AIRSPEED INDICATOR

Airspeed indicator fails after takeoff (pitch and power)

It is likely that you will have some kind of blockage to the pitot static system.

Use pitot heat - if the pitot is blocked with ice this will clear the blocked pitot

Think Sight picture! Nose to the horizon = Vy 79 kts , slight lower = cruise speed 87kts

Straight and level power off = best glide 73kts

Use all available resources, PAPI, aim spot - does it move up or down / climbing, sinking. Talk to ATC - advise you have no ASI they will assist as much as they can

Final approach, better to be a little fast rather than slow - you can bleed airspeed off in ground effect.

LOST COMMS

Light Signal	On the Ground	In the Air
Steady Green	Cleared for takeoff	Cleared to land
Flashing Green	Cleared to taxi	Return for landing (to be followed by steady green at proper time)
Steady Red	Stop	Give way to other aircraft and continue circling
Flashing Red	Taxi clear of landing area (runway) in use	Airport unsafe - Do not land
Flashing White	Return to starting point on airport	Not applicable
Alternating Red and Green	General warning signal - Exercise extreme caution	General warning signal - Exercise extreme caution

LEFT TURNING TENDENCIES

LEFT TURNING TENDENCIES

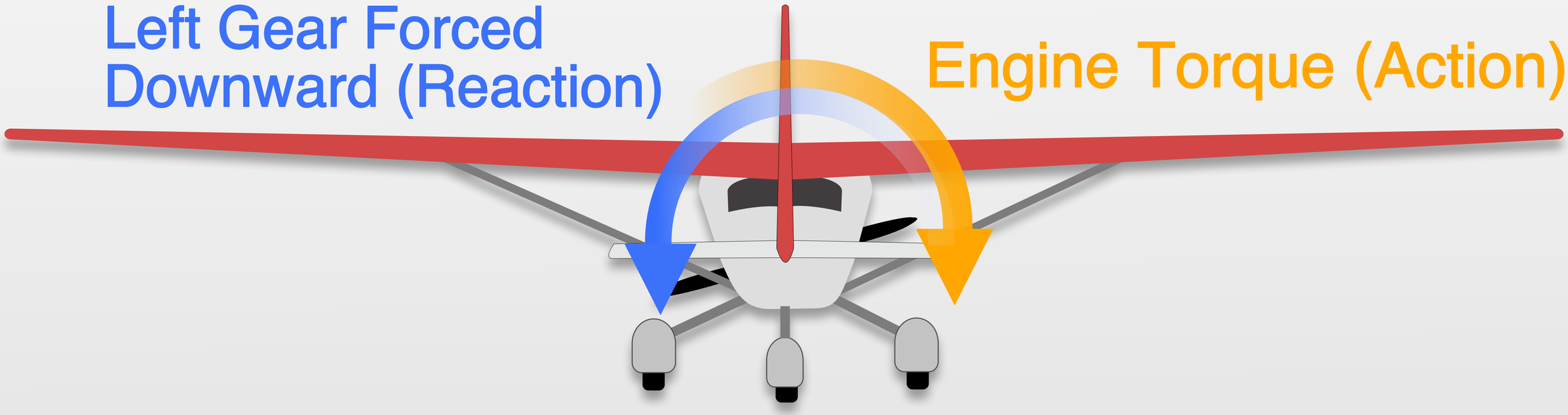
- There's a reason your plane want to veer left when you are taking off.
- Actually, there are 4 of them, and they're called **left-turning tendencies**.
  - **P-factor** (Asymmetric loading of the Propeller Disc)
  - **Torque Effect** (reaction from engine and propeller)
  - **Spiraling Slipstream** (Corkscrewing effect of the slipstream from the propeller)
  - **Precession** (Gyroscopic action of the propeller)

TORQUE EFFECT

Torque is a measure of the force that can cause an object to rotate about an axis.

- According to Sir Isaac Newton's Third Law… "**For every action, there is an equal and opposite reaction."**
- The propeller on a single engine airplane is driven clockwise (from the point of view of the pilot) directly by the crankshaft of the engine .
- When the propeller turns in the clockwise direction, the airplane will want to roll in the opposite, anti clockwise direction.

TORQUE EFFECT



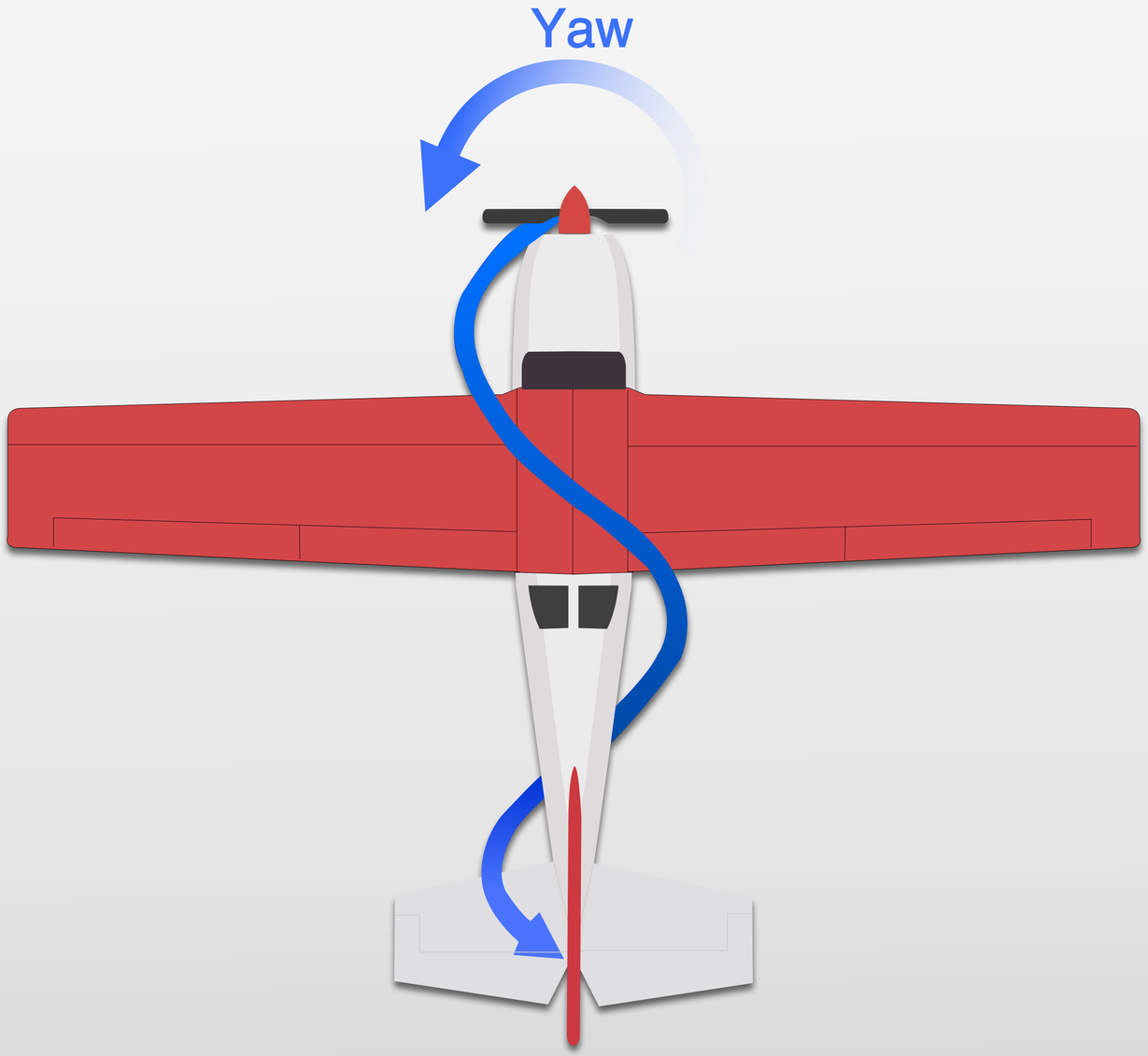
TORQUE EFFECT

- During the takeoff roll the engine is developing **maximum power.**
- The left roll forces the left side of the aircraft downward toward the runway and in turn causes the left hand side tire to have more friction with the ground than the right tire, thus turning the aircraft to turn left.
- Torque effects the airplane in ALL phases of the flight
- The way to counter spiraling slipstream is to use **right rudder.**

SPIRALLING SLIPSTREAM

- During takeoff, (High Propeller Power, Low Airspeed) the air accelerated behind the propeller, known as the 'slipstream', follows a corkscrew pattern.
- Wind blown aft by the propeller spirals around the aircraft, then **strikes the left side of the vertical stabilizer**.
- This causes the **tail to swing right** and the **nose to yaw left** around the vertical axis.

SPIRALLING SLIPSTREAM



SPIRALLING SLIPSTREAM

- Spiraling slipstream has its greatest effect upon the airplane when your **propeller is moving fast** and your **plane is moving slow**. Takeoff is a great example of this scenario.
- An airplane in a climb compresses the spiral causing it to be felt to a greater degree.
- As forward speed increases the spiral elongates and becomes less effective.
- The way to counter spiraling slipstream is to use **right rudder.**

SPIRALLING SLIPSTREAM

P-FACTOR

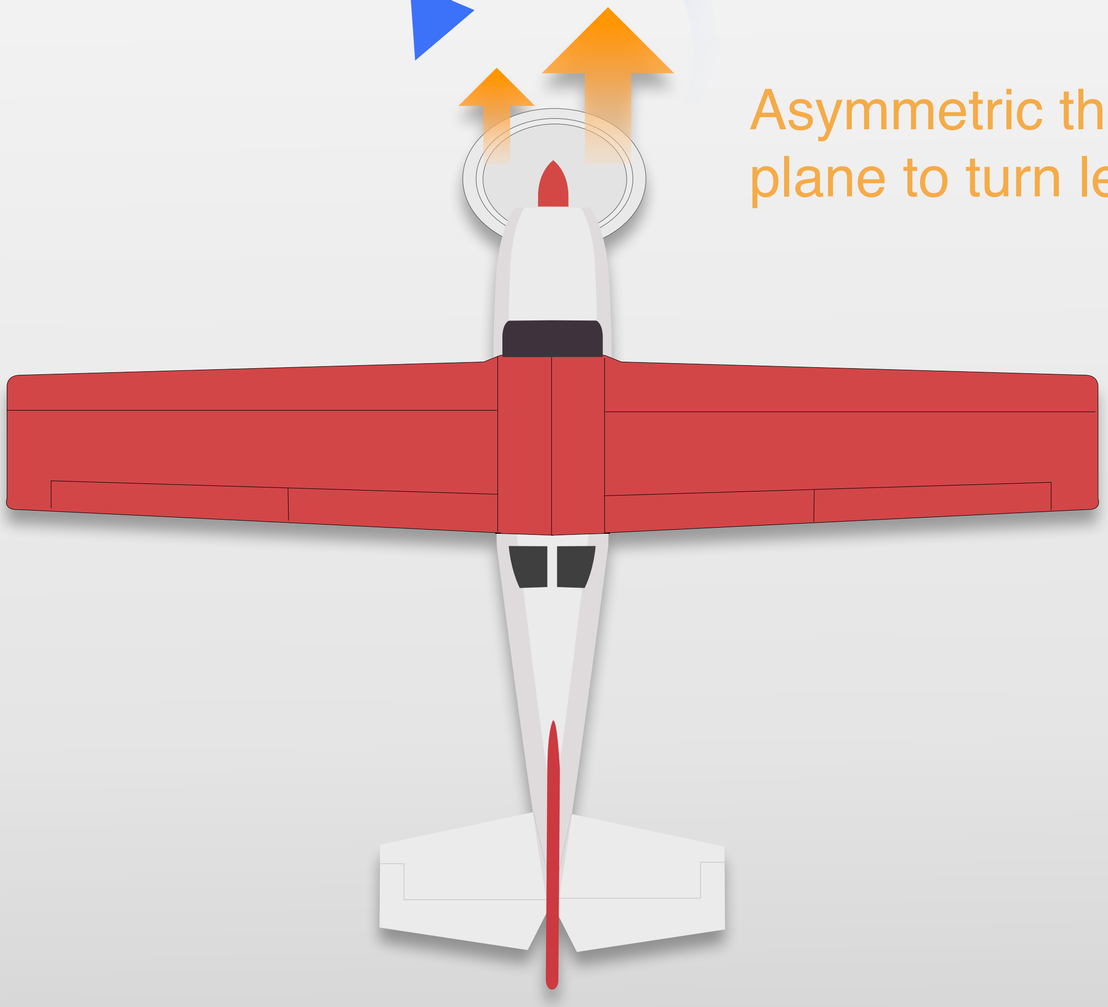
- P-factor describes the uneven loading of a propeller (or the asymmetric loading of the propeller), which develops at anytime the airplane has a greater angle of attack than 0°
- The descending blade of the propeller takes a bigger bite of air than the ascending blade in the climb (also has a greater forward velocity).
- It therefore creates more thrust on the right side of the propeller than the left side, causing the airplane to turn left.

P-FACTOR

Relative Wind

Yaw

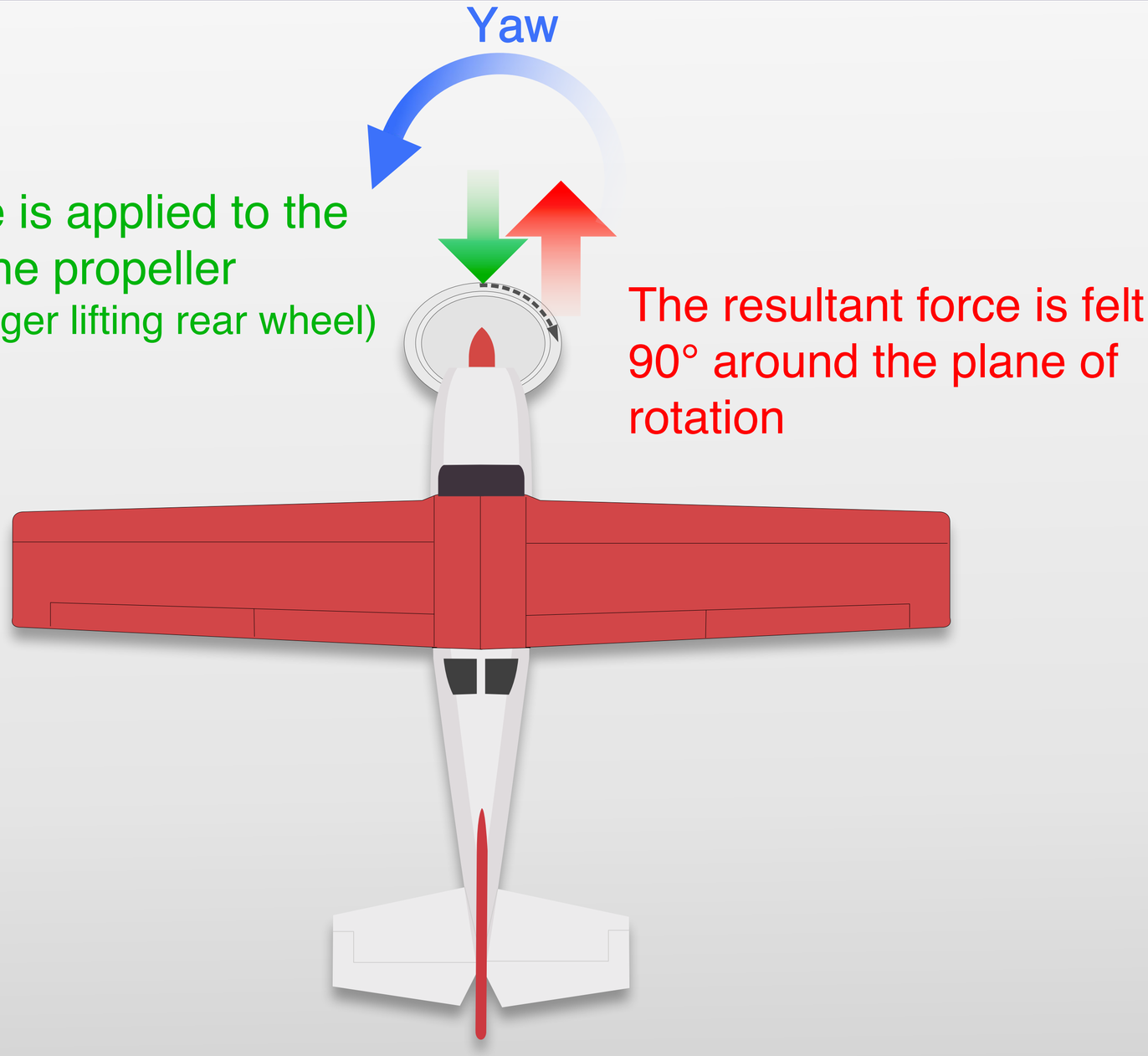
Asymmetric thrust causes plane to turn left.



GYROSCOPIC PRECESSION

- A spinning propeller is essentially a gyroscope (a spinning disc).
- That means a spinning propeller takes on the two properties of a gyroscope
  - Rigidity in space
  - Precession.
- For this lesson we are only going to explain the precession part.
- Precession happens when you apply force to a spinning disc. (In the case of an airplane you will change the pitch of the airplane.
- When you apply a force to part of the disc, and the effect of that force (the resultant force) is felt 90° in the direction of rotation of the disc.

GYROSCOPIC PRECESSION



GYROSCOPIC PRECESSION

- This, for the most part, only applies to tailwheel airplanes when they lift their tail off the runway during takeoff.
- As the tail comes up, a force is applied to the top of the propeller. And since the propeller is spinning clockwise, that force is felt 90 degrees to the right.
- That forward moving force, on the right side of the propeller, creates a yawing motion to the left.

ADVERSE YAW

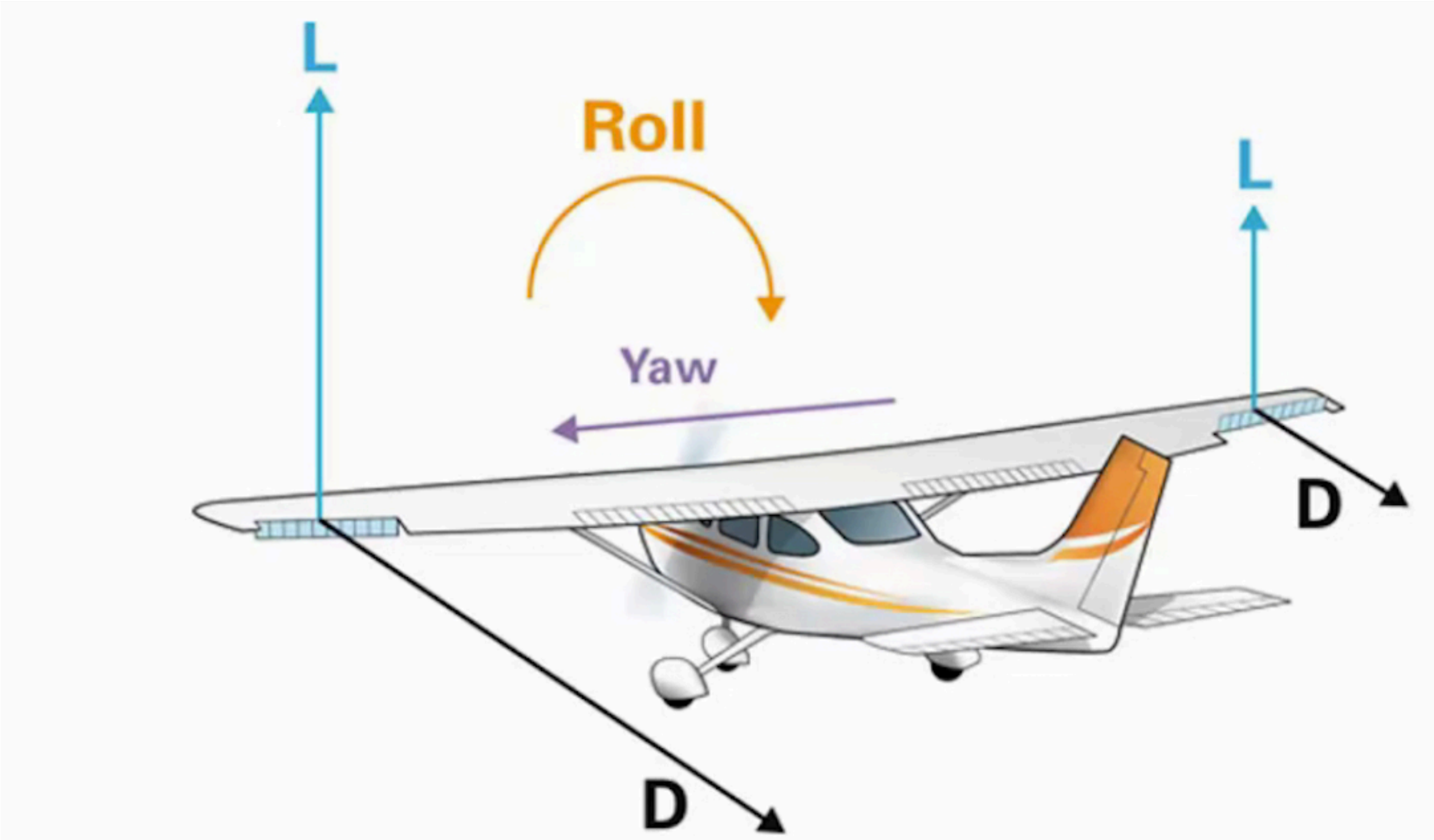
ADVERSE YAW

To make an airplane turn, it is necessary to **change the direction of lift** by banking the wings.

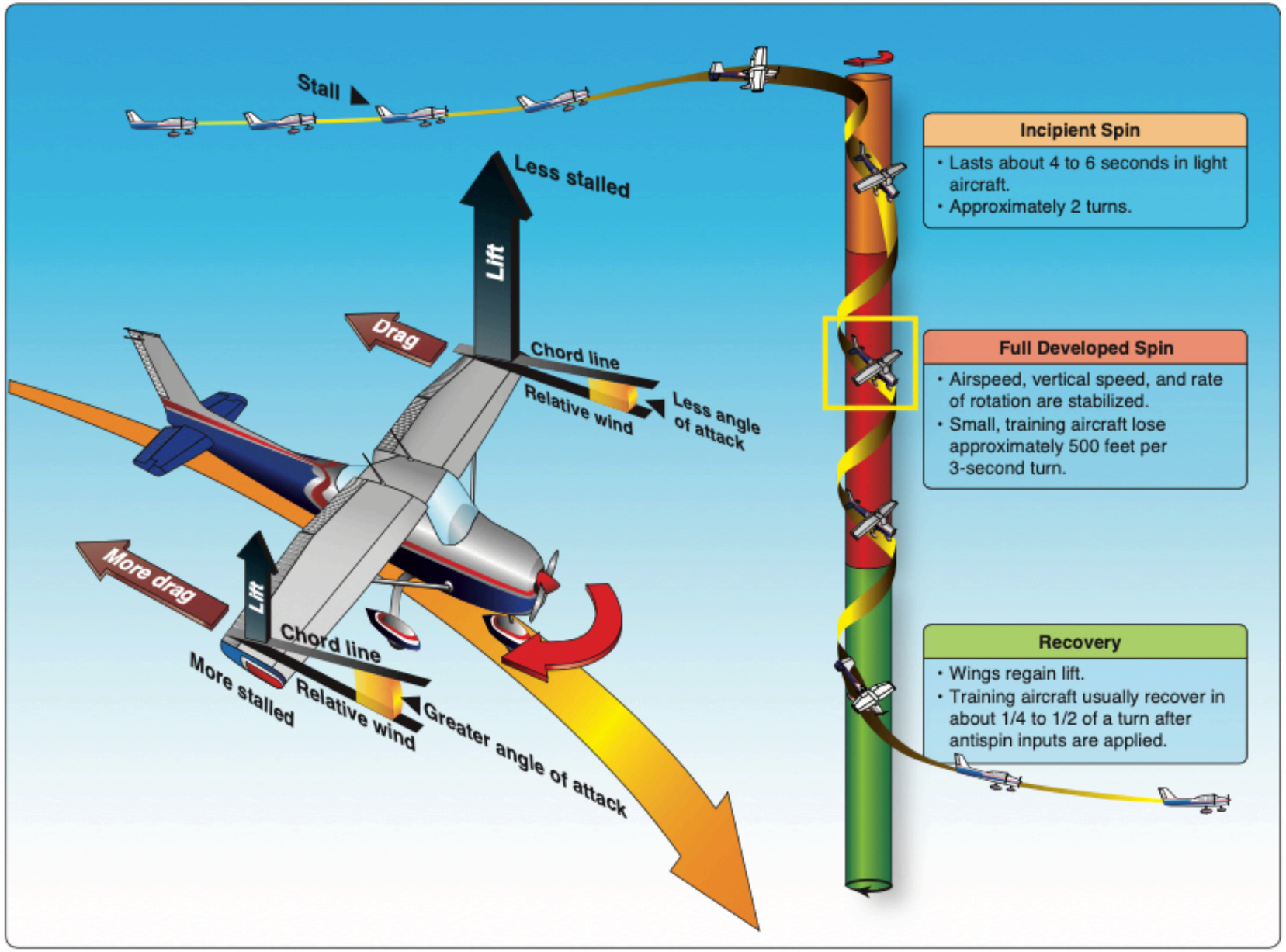
Adverse yaw is the natural and undesirable tendency for an aircraft to yaw in the opposite direction of a roll.

- Adverse yaw during a turn entry is caused by
  - **decreased induced drag on the lowered wing** and
  - **increased induced drag on the raised wing**.
- **It is corrected with correct rudder input.**
- When rolling out of a steep-banked turn, the lowered aileron (on the inside wing) creates more drag than when rolling into the turn because the wing's angle of attack is greater as the rollout is started.
- When rolling out of a steep-banked turn, the lowered aileron (on the inside wing) creates more drag than when rolling into the turn because the wing's angle of attack is greater as the rollout is started.

ADVERSE YAW

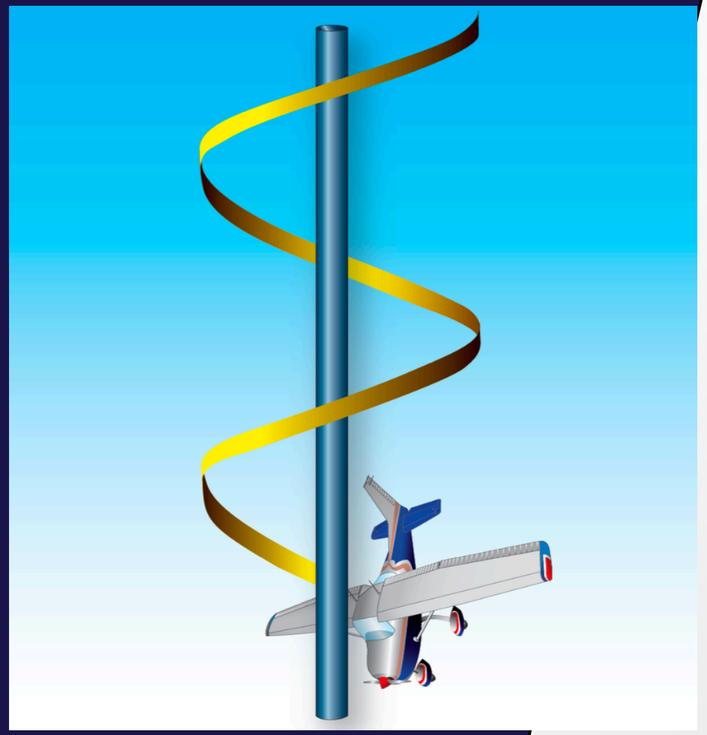


SPIN AVOIDANCE



SPINS

AIRPLANE FLYING HANDBOOK



- A spin is a “stall with a yaw” which results in rotation about the spin axis.
  This means that if you stall the aircraft while in a **cross-coordinated** state you risk entering a **spin**.
- Mishandling of yaw control during a stall increases the likelihood of a spin entry.
- A spin results in the airplane following a downward corkscrew path.
- During a spin, the airplane rotates around its vertical axis affected by different lift and drag forces on each wing, and the airplane descends due to gravity, rolling, yawing, and pitching in a spiral path.
- Spins can be entered, either intentionally or unintentionally, from any flight attitude and at practically any airspeed.

SPINS - CAUSES

- An airplane stalls when the **critical angle of attack is exceeded**.
- The critical angle of attack **remains constant** regardless of gross weight.
- The critical **angle of attack is independent of the speed of airflow over the wings.**
- A spin occurs when, after a full stall, the wing that drops continues in a stalled condition while the rising wing regains and continues to produce some lift, causing the rotation.
  (The difference between a spin and a steep spiral is that in a spin, the wings are stalled.)
- A **stalled wing is a prerequisite of a spin**. If the aircraft is allowed to become excessively slow and a stall is induced with an uncoordinated attitude, a spin will develop.
- Even though both wings are stalled, they are still producing “some” lift, the wing producing more lift than the other, will raise, while the wing producing less lift will drop. After the wing drops, the spin enters the incipient phase, and auto-rotation will begin

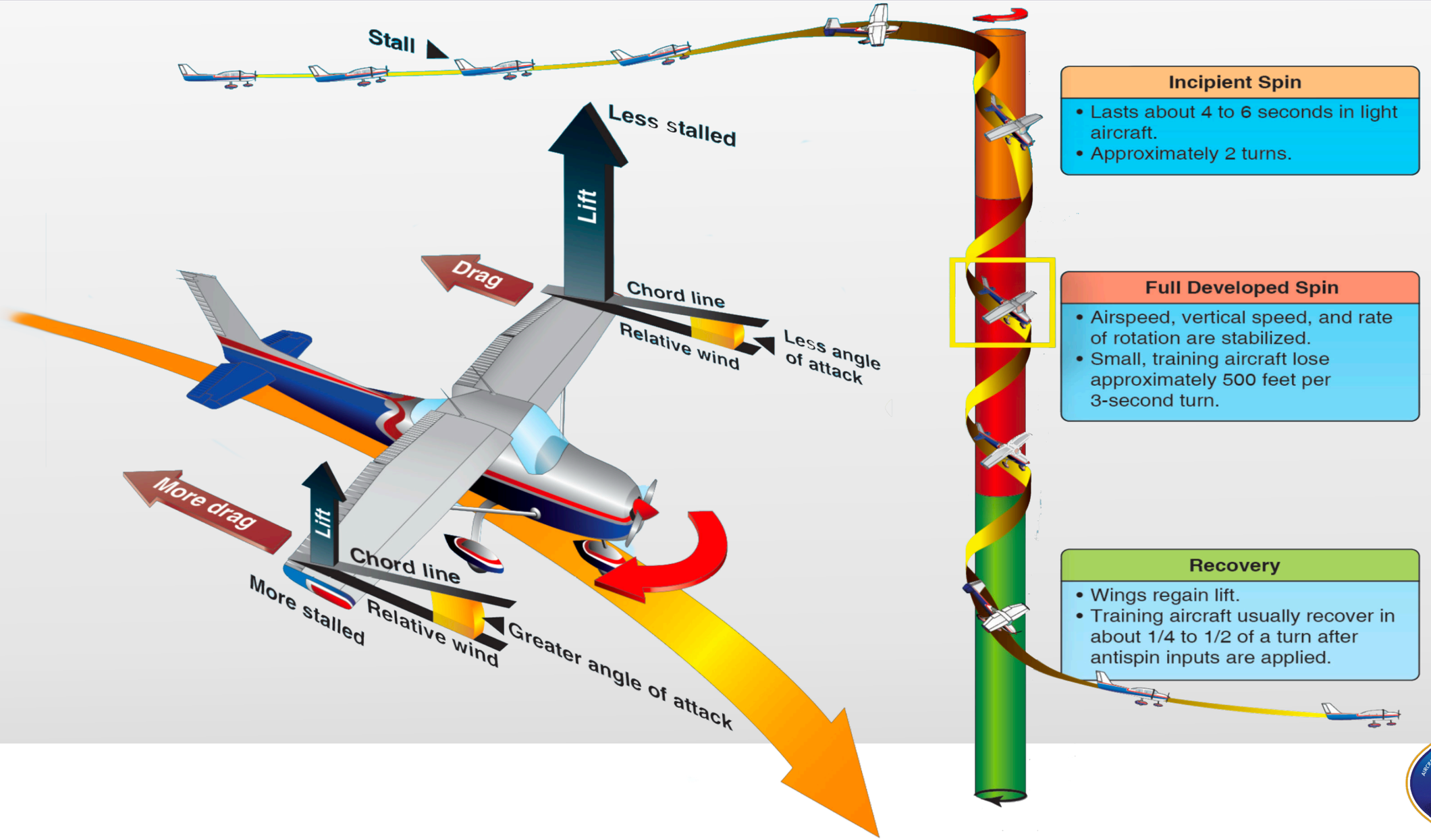
SPINS - LIKELY TIMES A SPIN MAY OCCUR

- The **most common** cause for a spin to develop is in the traffic pattern, during the **base-to-final turn**.
  - In this scenario, the aircraft is uncoordinated (improper pilot technique) due to the pilot not using proper control inputs at low speeds, then attempts a base-to-final turn.
  - Overshooting final approach. When you have missed the base to final turn and try to turn back toward the runway you will be typically have a lot of left control to fly back to the runway heading. the nose will be pointing left. Right rudder is applied to bring the nose to the right. If you stall at this point you will be at high risk of stalling the airplane.

Engine Out

- When encountering an engine out - pilots will look for a spot to land, often too far away.
- Trying to stretch the subsequent glide, will result in the pilot pitch the aircraft up (anything other than best glide airspeed will cause the airplane to descend faster)
- If in the process you become uncoordinated and you stall the aircraft you will get into an inadvertent spin.

FOUR PHASES OF A SPIN: ENTRY, INCIPIENT, DEVELOPED, AND RECOVERY



Incipient Spin

- Lasts about 4 to 6 seconds in light aircraft.
- Approximately 2 turns.

Full Developed Spin

- Airspeed, vertical speed, and rate of rotation are stabilized.
- Small, training aircraft lose approximately 500 feet per 3-second turn.

Recovery

- Wings regain lift.
- Training aircraft usually recover in about 1/4 to 1/2 of a turn after antispin inputs are applied.

RECOVERY FROM A SPIN

To recover from a spin (**PARE**)

- **P**ower - Throttle to Idle.
- **A**ilerons - Neutralize the Ailerons.
- **R**udder - Apply Full Opposite Rudder.
- **E**levator - Apply Forward Elevator to Break the Stall.

As Rotation Stops, Neutralize the Rudder.

Slowly Recover, Do Not Overload Airframe.

SLIPS (FORWARD SLIP TO LANDING)

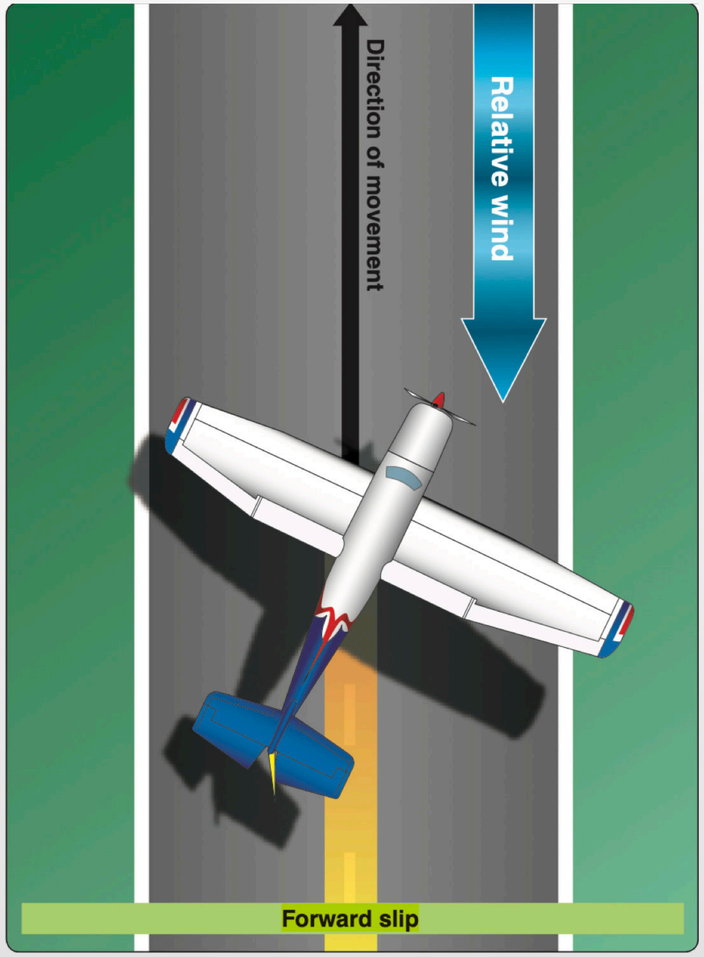
SLIPS

- A slip occurs when the bank angle of an airplane is too steep for the existing rate of turn.
- Unintentional slips are most often the result of uncoordinated rudder/aileron application.
- **Intentional slip**s, however, are used to **dissipate altitude without increasing airspeed** and/ or to adjust airplane ground track during a crosswind.
- Intentional slips are especially useful in forced landings and in situations where obstacles need to be cleared during approaches to confined areas.
- A slip can also be used as a means of **rapidly reducing airspeed** in situations where wing flaps are inoperative or not installed.

FORWARD SLIP TO A LANDING

- A forward slip is used to dissipate altitude and increase descent rate without increasing airspeed.
- In a forward slip, the airplane's direction of motion continues the same as before the slip was begun.
- Assuming the airplane is originally in straight coordinated flight, **the wing on one side is lowered by use of the ailerons**.
- Simultaneously, sufficient **opposite rudder is used to yaw the airplane's nose in the opposite direction** such that the **airplane remains on its original flightpath**.
  - The nose of the airplane will no longer point in the direction of flightpath.
  - In a forward slip, the amount of slip, and therefore the sink rate, is **determined by the bank angle**.
    - The steeper the bank, the steeper the descent.
    - In order to use the maneuver to lose altitude, **power is normally reduced to idle**.
  - The pilot controls airspeed using elevator control.
- **When a crosswind is present**, the pilot should **lower the upwind wing** such that the airplane is banked into the crosswind since slipping into the wind makes it easier to remain on the original flightpath.

SLIPS (FORWARD SLIP TO LANDING)

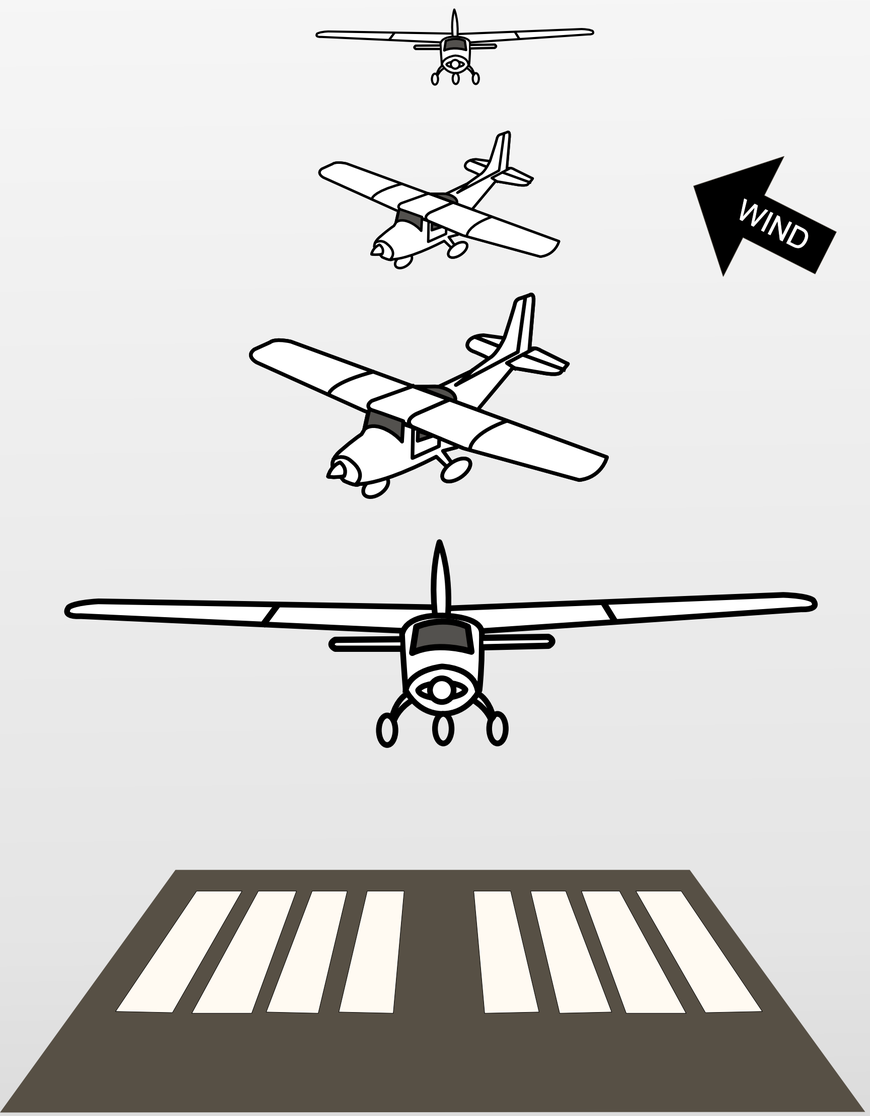


- A Forward is a deliberately cross coordinated manipulation of the ailerons and rudder to increase drag and steepen an approach (reduce height) without gaining much airspeed,
- Uses the benefit of increased drag to dissipate altitude.
- The sideslip moves the aircraft sideways (often, only in relation to the wind) where executing a turn would be inadvisable.
- Used when above normal approach glide-slope on approach to land.

A slip can be used:

- When you are high on final approach
- If you need to clear an obstacle or lose altitude quickly?
- Increase a descent rate without ballooning your airspeed.

SLIPS (FORWARD SLIP TO LANDING)



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Used when:

- Above normal approach glide-slope on approach to land.
- If you need to clear an obstacle or lose altitude quickly?
- Increase a descent rate without increase your airspeed.

CROSSWIND CORRECTION

CROSSWIND CORRECTION (CRAB ANGLE)

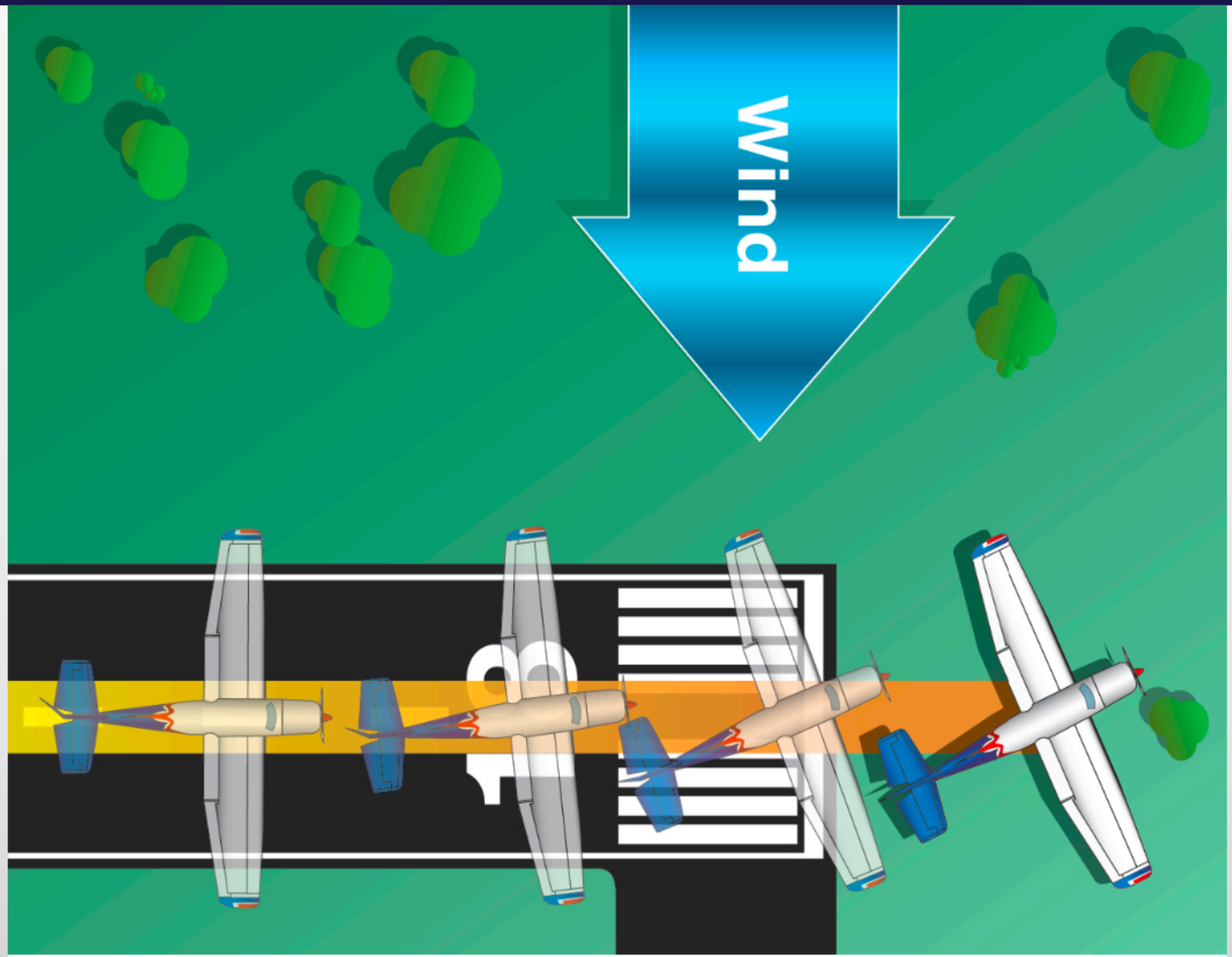
When an aircraft is pointed in one direction but moving in another direction, it is said to “crab”.

- A crab is often introduced to fly a desired track when being pushed off that course by the wind
- One way to correct for crosswind conditions during landing is by purposefully establishing a crab, using the rudder and ailerons to angle the aircraft's nose into the direction of the wind while keeping the wings level.

examples of when a crab angle is useful

- Tracking towards a runway to stay on course with the final approach direction
- Staying on a course / heading during cruise flight
- Tracking to a VOR on a radial

CROSSWIND CORRECTION



RUNWAY INCURSION

RUNWAY INCURSION

Runway Incursion:

Any occurrence at an aerodrome involving **the incorrect presence of an aircraft, vehicle, or person** on the protected area of a **surface designated for the landing and takeoff of aircraft**.

Surface Incident:

Any unauthorized or unapproved movement within the designated **movement area** (excluding runway incursions)

- or -

An occurrence in that same area associated with the operation of an aircraft that **affects or could affect the safety of flight**.

RUNWAY INCURSION

Approximately three runway incursions occur each day at towered airports within the USA

Pilot Deviations:

- Crossing a runway hold marking without clearance from ATC
- Taking off without clearance
- Landing without clearance

Operational Incidents (OI):

- Clearing an aircraft onto a runway while another aircraft is landing on the same runway
- Issuing a takeoff clearance while the runway is occupied by another aircraft or vehicle

Vehicle (Driver) Deviations:

- Crossing a runway hold marking without ATC clearance

RUNWAY INCURSION TAXIING

- Make taxi route planning an integral part of pre-flight planning.
- **Be current with your knowledge of airport signage**
- **Understand what mandatory hold points are**
- **Make a note of mandatory hold points.**
- Review airport layout(s) as part of pre-flight planning
- Make a note of hot spots.
- Listen to ATIS to understand runway(s) in use. -or-
- Know the traffic patterns for un-towered airports
- **Ensure you have (and use) Airport Diagram(s) during taxiing**

Prior to taxiing

- Know where you are on the airport and what the location is called.
  - You will need to tell ATC so they can issue you a taxi clearance.
- Pickup ATIS / Runway information.
- Be ready to taxi when you call ATC. (They will be looking for you)

RUNWAY INCURSION AIRPORT HOT SPOTS

Hot spots are generally a **complex or confusing** taxiway or taxiway and runway intersection.

Hot spots have a history or potential **risk of collision or runway incursion**, and require heightened attention by pilots and drivers.

Heightened attention by pilots, drivers and controllers is necessary.

Hot Spots depictions are made with with **three shapes** and two meanings.

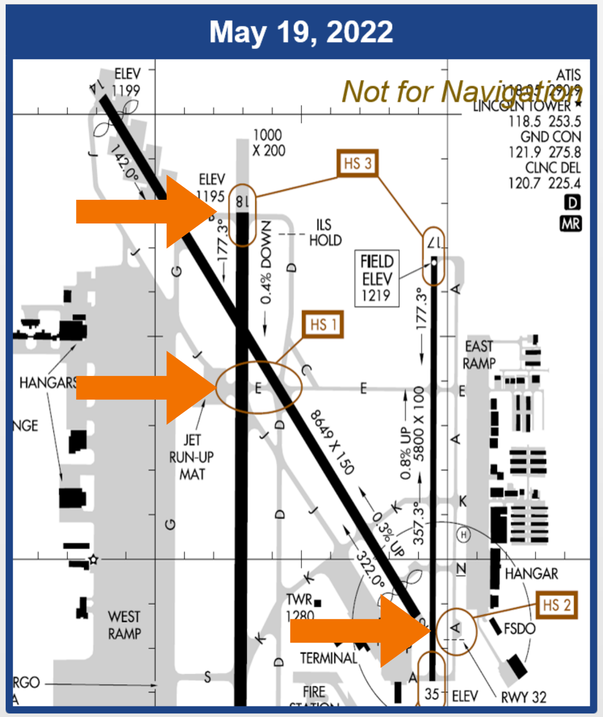
- A circle or ellipse will depict these hot spots, which include issues such as:
- Hold short line infractions
- Approach hold issues
- Complex taxiway configurations
- Movement-non movement boundary area issues
- Tower line of sight problems
- Marking and signage issues.

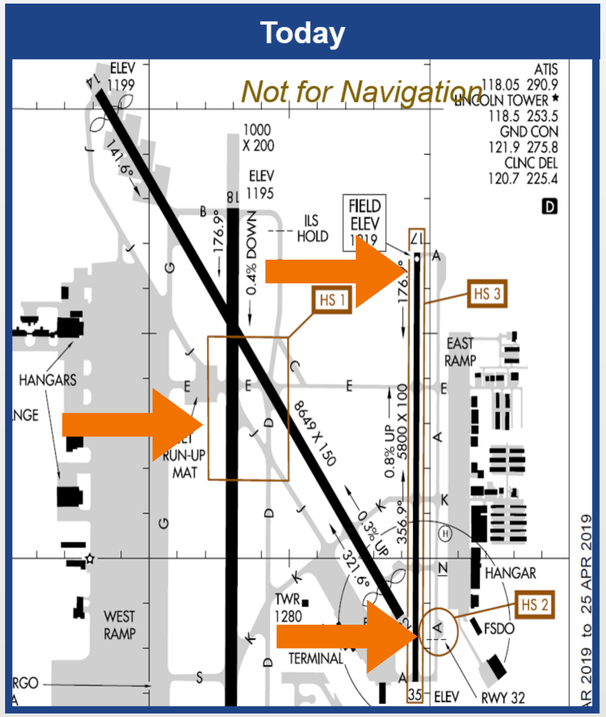
TAXIWAY HOTSPOT DIAGRAMS

The FAA have standardized symbols to **three shapes** with two distinct meanings:

- A circle or ellipse will depict these hot spots, which include issues such as:
  - Hold short line infractions
  - Approach hold issues
  - Complex taxiway configurations
  - Movement-non movement boundary area issues
  - Tower line of sight problems

- A cylinder for wrong surface hot spots.
  - Wrong surface hot spots depict locations where an aircraft has inadvertently attempted to or actually departed or landed on the wrong surface. A cylinder will depict these hot spots.





RUNWAY INCURSION COMMUNICATIONS

TOWERED AIRPORT

- Use standard ATC phraseology at all times to facilitate clear and concise communication
- On initial contact with any controller, state: what you are, who you are, where you are and, what you want.
- **Focus on the ATC clearance** / Don't perform any nonessential tasks while communicating with ATC
- **Write down all clearances from ATC**
- **Read back** taxi instructions **including any runway crossing or hold instructions (mandatory)**
- **Understand the route** and the **clearance** before beginning to taxi
- **If in doubt ask** for clarification.
- When taxiing up to the runway hold short line be ready to communicate with the tower - stating your intentions. **READ BACK ALL HOLD SHORT INSTRUCTIONS**
- If the controller does not explicitly clear you for take of or to line up and wait **DO NOT** cross the runway hold short line.
- **IF IN DOUBT ASK AND CONFIRM!**

RUNWAY INCURSION COMMUNICATIONS

UNTOWERED AIRPORT

Maintain situational awareness

- Be familiar with the local traffic pattern direction and pattern altitude
- Be aware of the routes into and out of the airport and know where you are and other aircraft are operating at all times
- Know that other aircraft may be using an IAP to runways other than the runway in use for VFR operations
- During calm wind conditions, be aware that flight operations may occur at more than one runway at the airport

Departing

- Remember **not all aircraft are radio-equipped**; therefore, before entering or crossing a runway, listen on the CTAF for inbound aircraft information.
- Scan the full length of the runway, including the final approach and departure paths of the runways you intend to enter or cross.

Communication

- **Be alert and communicate** your intentions on the common traffic advisory frequency (CTAF), and **listen for other aircraft** operating on, to, and from the airport.

Be your own controller - clear yourself to enter taxiways and runways the same way a ATC controller would. Check and double check to ensure that you only enter runway areas when it is completely safe to do so

RUNWAY INCURSION COMMUNICATIONS

GENERAL RULES

- Always give 100% attention to taxiing
- Don’t follow other aircraft - their clearance will be different to yours
- Ensure that the clearance you heard is for you - if in doubt ask!
- Don’t ever cross a runway or other mandatory hold boundary unless you are 100% sure you are cleared - don’t assume - clarify!
- Don’t ever cross a runway or other mandatory hold boundary without checking left / right that it is **clear to do so.** (even if you have a clearance)
- Use all available resources to ensure you do not enter protected areas without a clearance
- **Turn on and use all lights when crossing a runway - make yourself visible.**
- Expedite all crossings of runway areas

ABORTED LANDING / GO AROUNDS

REJECTED LANDINGS / GO AROUND

Whenever landing conditions are not satisfactory, a go-around is warranted. There are many factors that can contribute to unsatisfactory landing conditions.

Note: The go-around is not strictly an emergency procedure. It is a normal maneuver that is also used in an emergency situation.

When to execute a go-around

- **Anytime you believe safety is (or could be) compromised** and that there is a risk to the you or other's safety is at risk.
- You've **floated well past your touchdown point** - If you are landing too far down the runway to stop safely. The rule of thumb says that if the aircraft isn't on the ground in the first third of the runway — go around.
- If you are **not stabilized** for the approach by 500' AGL (VFR) i.e the speed or the alignment isn't right, go around (including no landing clearance)
- If there is the **presence of another aircraft, vehicle or person on the runway**.
- Experiencing severe **wind shear**
- **Air traffic control** requests / requires a go-around
- After a hard bounce, go-around **to avoid porpoising**
- You **overshoot your base to final turn**
- You realize you **forgot to complete your checklists** or you're **not configured for landing**.
- **<u>It just doesn't "feel right."</u>**

PERFORMING A GO AROUND

When the decision to go around is made the following steps should be carried out:

Power

The instant a pilot decides to go around, **full or maximum allowable takeoff power must be applied** smoothly and without hesitation and held until flying speed and controllability are restored.

Attitude

Attitude is critical when close to the ground, and when power is added, a deliberate effort on the part of the pilot is required to **prevent the nose from pitching up prematurely**. An attitude is maintained that permits a buildup of airspeed well beyond the stall point before any effort is made to gain altitude or to execute a turn.

Configuration

After establishing the proper climb attitude flaps must be configured to remove high drag. (and secondly landing gear if retractable - in case the airplane inadvertently touches down as the go-around is initiated

Communications

You must notify ATC / CTAF of your intentions to go around. This is the last step. Safety of the airplane is the priority - Once you have completed the previous step you may nofify others of your intention to go aound

PERFORMING A GO AROUND

The 5 C's of a Go-Around

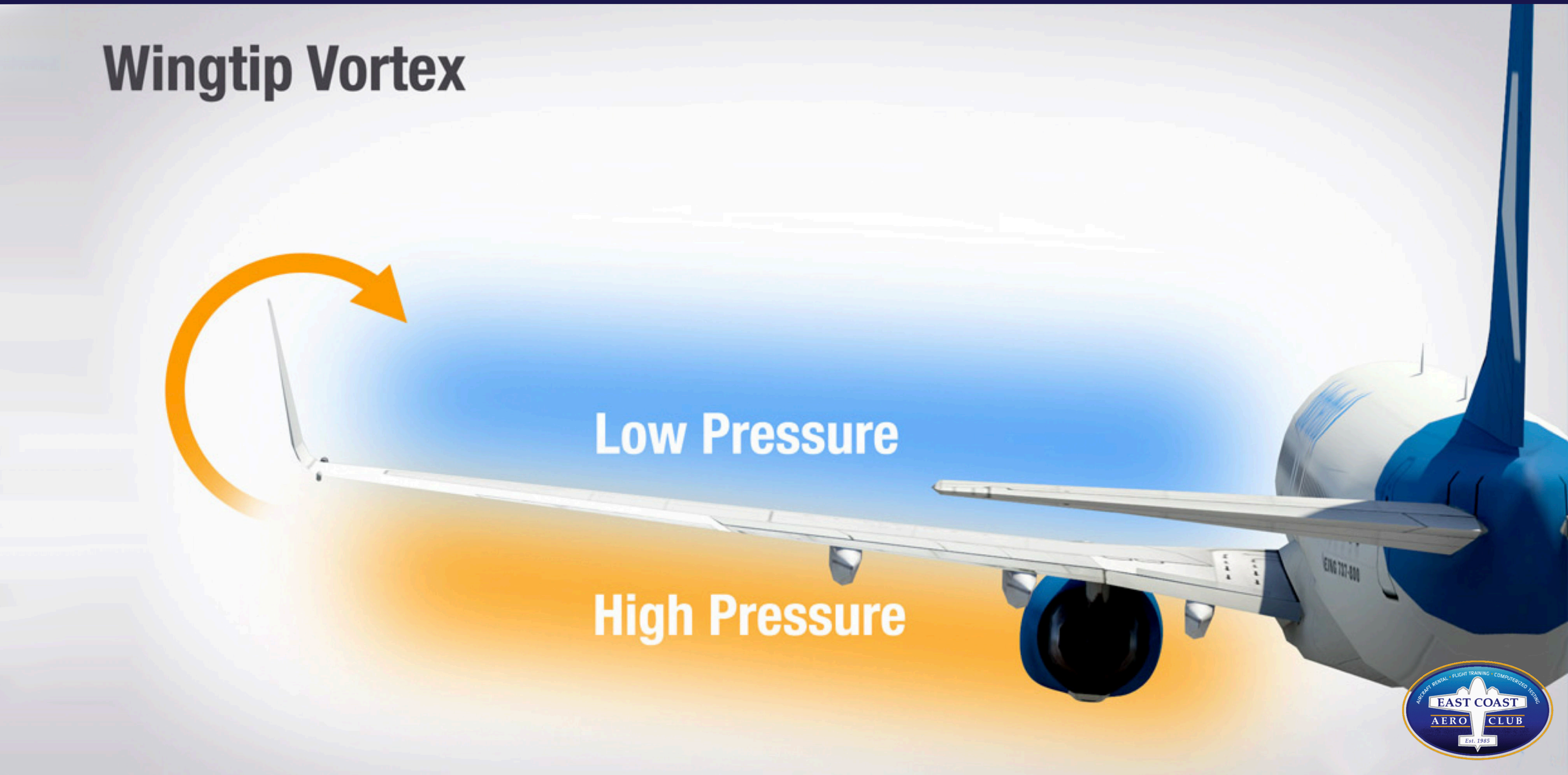
- **Cram** - Full Power
- **Climb** - At Vx or Vy as Appropriate
- **Clean** - Retract Flaps and Landing Gear
- **Cool** - Open Cowl Flaps (if applicable)
- **Call** - Inform ATC of Go-Around Decision

WAKE TURBULENCE AVOIDANCE

WHAT IS WAKE TURBULENCE

- It easy to think that wake turbulence only comes from very large jet aircraft like a fully loaded 747 or large Airbus.
- However, “large” aircraft come in many sizes smaller than a 747 - especially when you are flying a Piper Warrior or a Cessna 172.
- Those larger aircraft still represent an issue to smaller training aircraft.
  As a result, it is important to practice wake turbulence procedures **anytime** you are landing or taking off after a larger aircraft than what you’re flying.

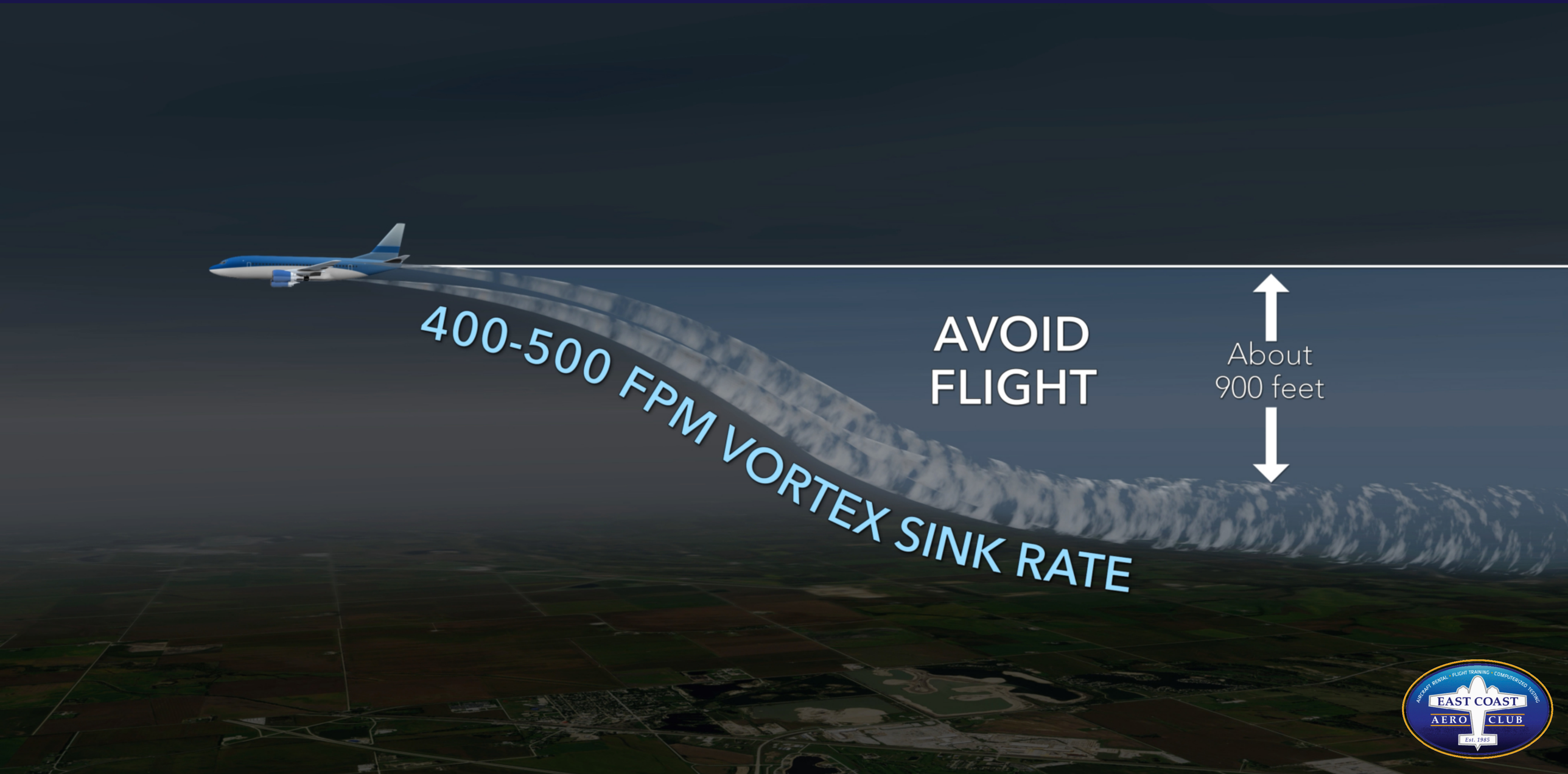
WING TIP VORTICES



WAKE TURBULENCE AVOIDANCE PROCEDURES

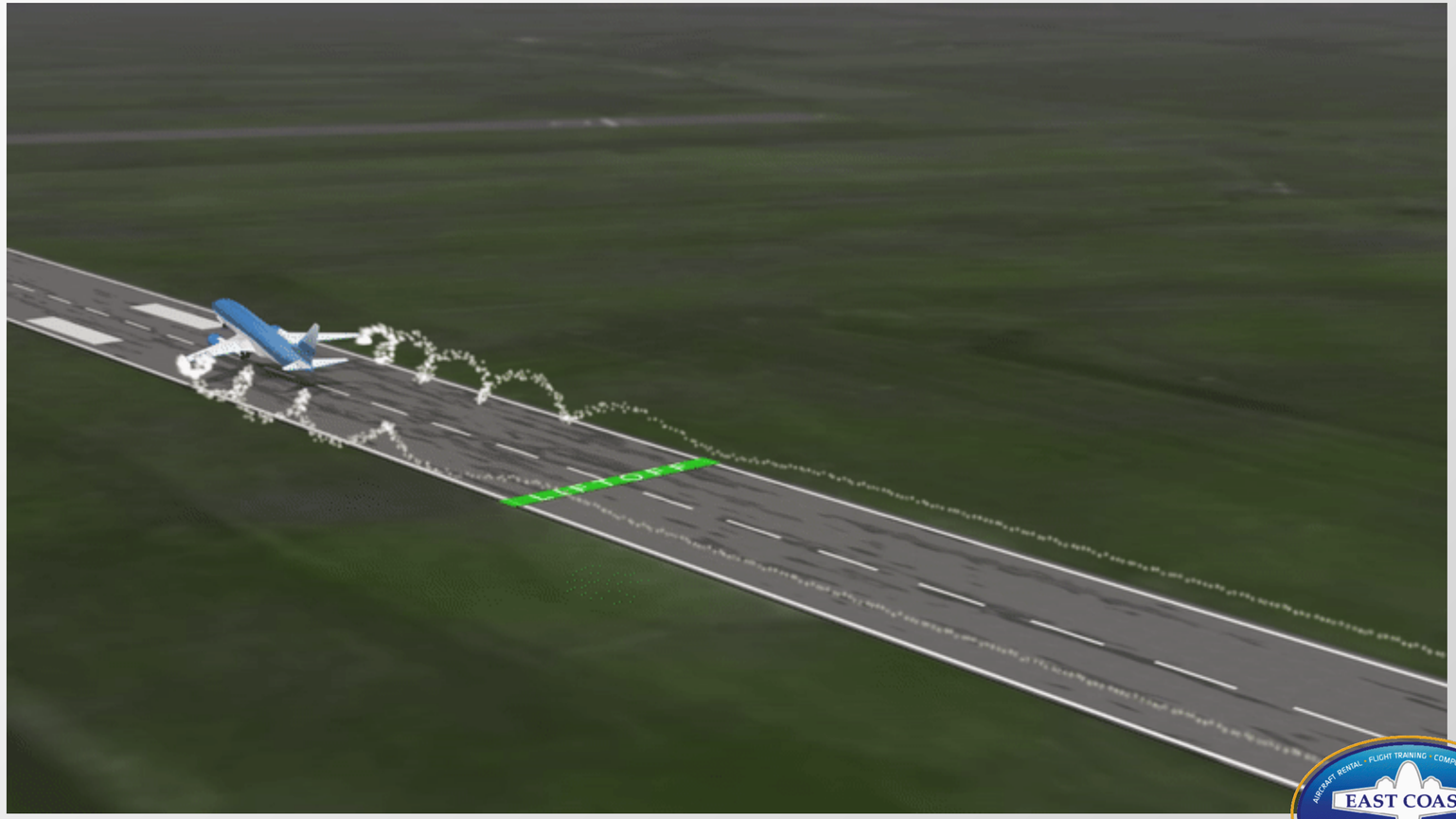
While en route or flying near a large airplane in the terminal environment, avoid flying under the flight path as the wake vortices will sink below the flight path at a rate of **400-500 FPM**

WINGTIP VORTEX

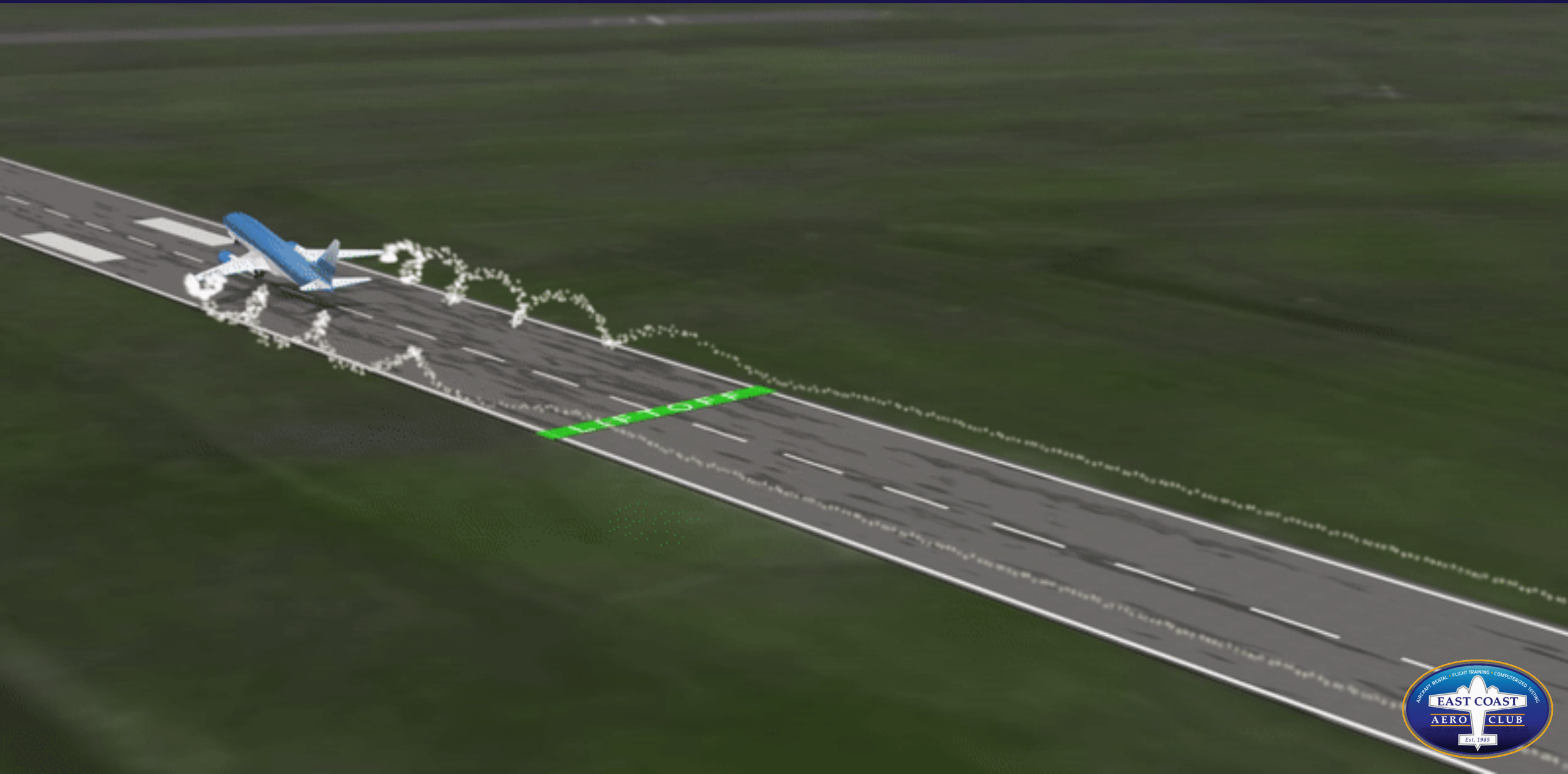


WAKE TURBULENCE AVOIDANCE PROCEDURES

Taking off behind a large airplane – **rotate prior** to the point at which the preceding aircraft rotated and **make a turn into the wind if possible**

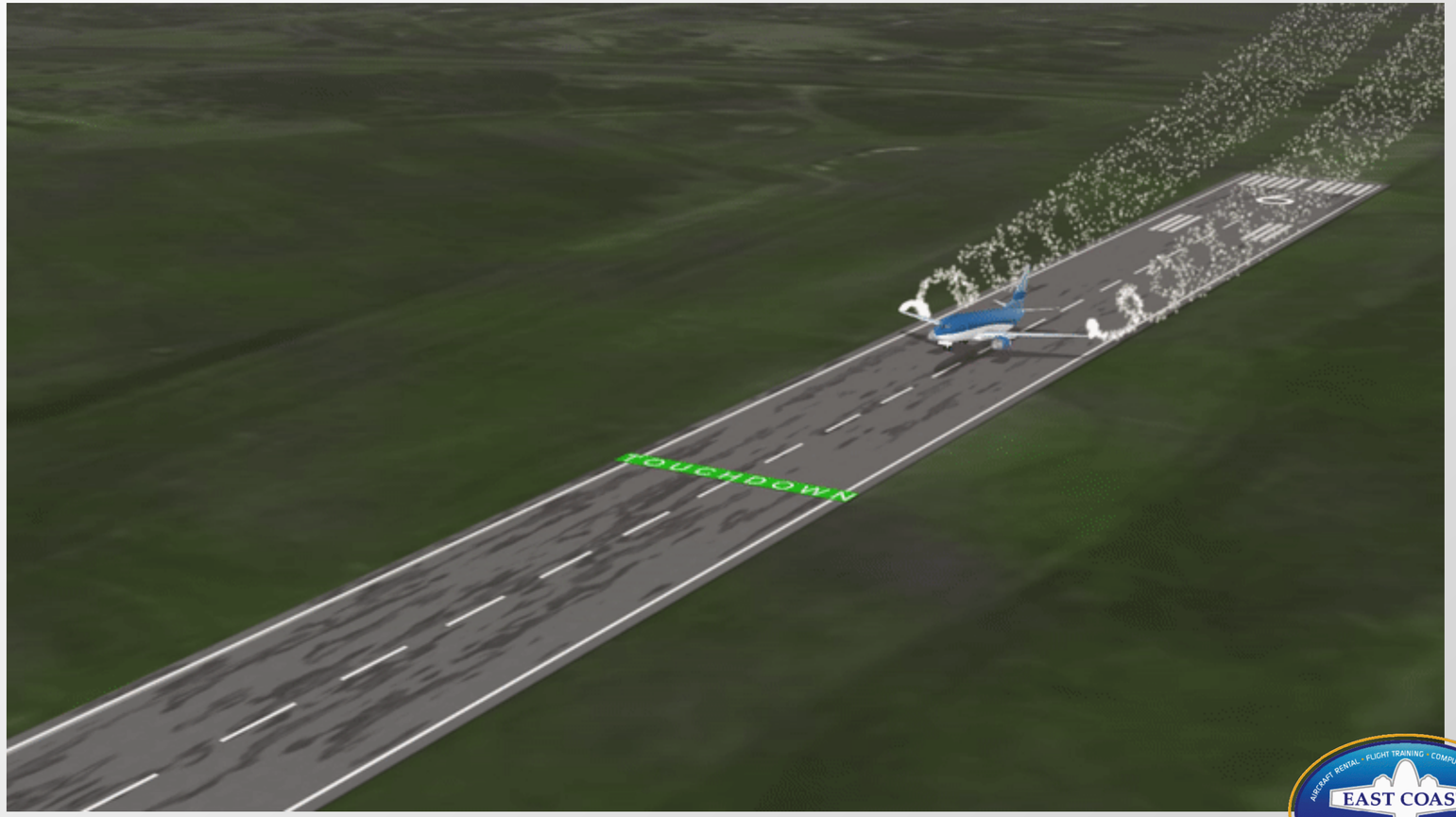


AVOIDING WAKE TURBULENCE - TAKING OFF



WAKE TURBULENCE AVOIDANCE PROCEDURES

Landing behind a larger airplane – approach the runway above the preceding airplane's path and touch down **aft of the point** where the other airplane's wheels contacted the runway:

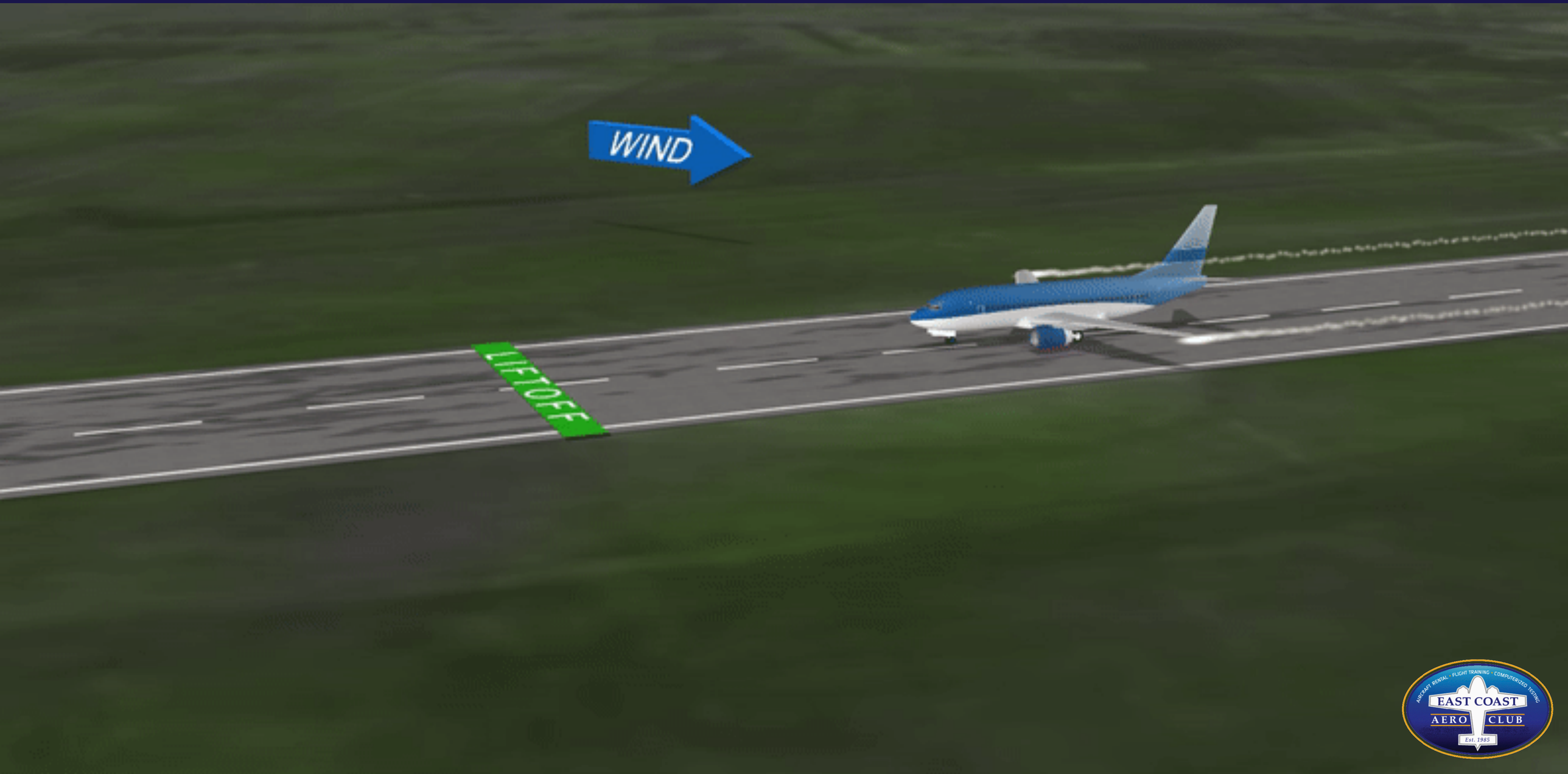


AVOIDING WAKE TURBULENCE - LANDING

WAKE TURBULENCE AVOIDANCE PROCEDURES

Landing behind a departing airplane – touch down **before the point** where the other airplane **lifted off**:

AVOIDING WAKE TURBULENCE - LANDING



SQUAWK CODES

Squawk codes are entered into the aircraft transponder.

They allow ATC to identify your aircraft on radar.
Squawk codes also allow pilots to transmit discreet codes to allow ATC to identify aircraft in distress / lost communications / military intercept etc.

1200 VFR
7500 Hijack *(75-Man with a knife)*
7600 Lost Communications *(76-Radio needs to be fixed)*
7700 Emergency - *(77 Falling from heaven)*
7777 Military Intercept

Mayday Mayday Mayday - Used for life threatening situations
Pan pan - Pan pan - Pan pan - Used in non life threatening situations