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PRIVATE PILOT CERTIFICATE

Everything You Need To Know

Aeronautical Experience Required for Private Pilot Certificate

§ 61.109

- **40** hours of total flight time
  - **20** hours of flight training from an authorized instructor
  - **10** hours solo
    - **5** hours solo cross-country time
    - **1** solo cross-country flight of **150** (or more) nautical miles total distance, with full-stop landings at **3** points; **AND** one segment of the flight consisting of a straight-line distance of more than **50** nautical miles between the takeoff and landing locations.
    - **3** takeoffs and landings to a full stop at an airport with an operating control tower *(Each involving a lap in the pattern)*
  - **3** hours of cross-country flight training
  - **3** hours of night flight
    - **1** cross-country flight over **100** nautical miles total distance
    - **10** takeoffs and landings to a full stop *(Each involving a lap in the pattern)*
  - **3** hours of flight training in a single-engine Airplane controlling and maneuvering solely by reference to instruments.
    - Must Include:
      - Straight and level flight
      - Constant airspeed climbs and descents
      - Turns to a heading
      - Recovery from unusual flight attitudes
      - Radio communications
      - Use of navigation systems, facilities, and radar services
  - **3** hours of flight training with an authorized instructor in a single-engine airplane in preparation for the practical test, which must have been performed within the preceding **2** calendar months.

Eligibility Requirements

§ 61.103

- **17** years old
- Read, speak, and write in English
- Receive logbook endorsement from an authorized instructor who:
  - Conducted the training for the knowledge exam or reviewed the person's home study course
- Pass the required knowledge test on the aeronautical knowledge areas listed in *§ 61.105*
- Receive flight training and a logbook endorsement from an authorized instructor who:
  - Conducted the training in the areas of operation listed in *§ 61.107 (b)* that apply to the aircraft rating sought
  - Certified that the person is prepared for the required practical test
- Meet the aeronautical experience requirements of this part
- Comply with the appropriate sections of this part that apply to the aircraft category and class rating sought
- Hold a U.S. Student Pilot Certificate, Sport Pilot Certificate, Recreational Pilot Certificate, or a Private Pilot Certificate in a different category or class of aircraft.

Recency Requirements

§ 61.57 (a)

- Can not carry passengers unless within the preceding **90** days…
  - You have accomplished **3** takeoffs and **3** landings.
    - Must be the sole manipulator of the controls in the same category and class of aircraft flown.
    - If it's a tailwheel aircraft, landings must be to a full stop.
    - These may be accomplished in a full flight simulator or flight training device as long as it is…
      - Approved by the administrator for landings; AND
      - Used in accordance with an approved course conducted by a training center certified under Part 142
- **Night Takeoff and Landing Experience** *§ 61.57 (b)*
  - No person may act as PIC carrying passengers during the period of **1 hour after** sunset and ending **1 hour before** sunrise, unless within the preceding **90 days** that person has made:
    - At least **3** takeoffs and **3** landings to a full stop within that time period
    - That person acted as sole manipulator of the flight controls
    - In aircraft of the same category, class, and type

Quick Note:

"Calendar Months" means counting the month as a whole, without referencing a specific day of the month. So "Six months from December 2nd" Would be June 2nd and "Six calendar months from December 2nd is June 30th

Other Endorsements

Tailwheel Endorsement *§ 61.31(i)*

- Does not require a minimum number of hours.
- Requires specific maneuvers to be demonstrated:
  - Normal and crosswind takeoffs and landings
  - Wheel landings
  - Go-around procedures

Complex Endorsement *§ 61.31(e)*

- For airplanes with retractable landing gear, flaps, & controllable pitch propeller.
- Does not require a minimum number of hours.
- Required to log and receive ground and flight training from authorized instructor.

High-Performance Endorsement *§ 61.31(f)*

- For airplanes with an engine of more than **200** horsepower.
- Required to log and receive ground and flight training from authorized instructor.

High-Altitude Endorsement *§ 61.31(g)*

- For airplanes with a service ceiling or maximum operating altitude, whichever is lower, above **25,000** ft. MSL
- Required to log and receive ground and flight training from authorized instructor. Training must include these subjects:
  - High-altitude aerodynamics and meteorology
  - Respiration
  - Hypoxia & high-altitude sickness
  - Duration of consciousness without supplemental oxygen
  - Effects of prolonged usage of supplemental oxygen
  - Causes and effects of gas expansion
  - Incidents of decompression
  - Other physiological aspects of high-altitude flight

Limitations as a Private Pilot

§ 61.113

- May not pay less than the pro rata share of the operating expenses of a flight with passengers, provided the expenses involve only fuel, oil, airport expenditures, or rental fees.
- With some exceptions, no private pilot may act as pilot in command of an aircraft that is carrying passengers or property for compensation or hire; nor may that person, for compensation or hire, act as pilot in command of an aircraft.
- The exceptions
  - A private pilot MAY act as pilot in command for hire or compensation in connection with any business or employment IF:
    - The flight is only incidental to that business or employment AND
    - The aircraft does not carry passengers or property for compensation or hire
- A private pilot MAY act as pilot in command of a charitable, nonprofit, or community event flight.
- A private pilot, who is an aircraft salesperson and who has at least **200** hours of logged flight time may demonstrate an aircraft in flight to a prospective buyer.
- A private pilot may act as PIC of an aircraft towing a glider or unpowered ultralight vehicle.

Requirements to Solo

§ 61.87

- An Aeronautical Knowledge Test *(Not the FAA Knowledge Test)*
  - Airspace rules and procedures for the airport being used
  - Flight characteristics and operational limitations for the make and model of the aircraft to be flown
  - Must be administered by the student's Instructor
  - The instructor must review all the incorrect answers before authorizing the flight
- Pre-solo flight training
  - Must have received and logged training for the maneuvers and procedures for the aircraft flown
  - Demonstrate proficiency and safety to an instructor in the make and model of aircraft to be flown
- Maneuvers and procedures
  - Must have received and logged flight training for the following:
  - Demonstrate proficiency and safety to an instructor in the make and model of aircraft to be flown
    - Preflight
    - Taxiing or surface operations (Including run-ups)
    - Takeoffs and landings (Including normal and x-wind)
    - Straight and level flight, and turns in both directions
    - Climbs, with/without turns
    - Airport traffic patterns (entry and departure procedures)

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- Collision avoidance, wind-shear avoidance, wake turbulence avoidance
- Descents, with/without turns (high and low drag configurations)
- Flight at various airspeeds (from cruise to slow flight)
- Stall entries from various altitudes and power combinations (recovery initiated at the first indication of a stall + recovery from FULL stall)
- Emergency procedures and equipment Malfunctions
- Ground reference maneuvers
- Approaches to a landing area with simulated engine malfunctions
- Slips to a landing
- Go arounds

- Endorsement Requirements
  - Must have received an endorsement in the student's logbook for the specific make and model aircraft to be flown **within the 90 days preceding the flight**

Soloing at Night

- A student pilot may not operate an aircraft in solo flight at night unless that student pilot has received:
  - Flight training at night including takeoffs, approaches, landings, and go-arounds at night at the airport where the solo flight will be conducted
  - Navigation training at night in the vicinity of the airport where the solo flight will take place
  - An endorsement in the student's logbook for the specific make and model aircraft to be flown for night solo flight within the preceding **90** days of the date of the solo flight

Endorsements Needed to Solo

- Essential ones:
  - Pre-Solo Knowledge *§ 61.87 (b)*
  - Pre-Solo Flight Training *§ 61.87 (c)*
  - Initial Solo *§ 61.87 (n)*
- As Needed Endorsements:
  - Each additional **90** calendar-day period *§ 61.87 (p)*
  - Solo Flight at Night *§ 61.87 (o)*
  - Take-Offs and Landings at the airport within **25** nautical miles *§ 61.93 (b)(1)*
  - Solo in Class B *§ 61.95 (a)*

NTSB Reporting

National Transportation Safety Board (NTSB)

- The NTSB is NOT the FAA, and they have their own rules when it comes to accident and incident reporting.

Accident vs. Incident

Aircraft Accident *§ 830.2*

- An occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight and all such persons have disembarked, and which any person suffers death or serious injury, or in which the aircraft receives substantial damage.
- "Serious Injury" is defined as…
  - Hospitalization for more than 48 hours, commencing within 7 days from the date of the injury was received
  - A fracture of any bone *(except simple fractures of fingers, toes, or nose)*
  - Severe hemorrhages, nerve, muscle, or tendon damage
  - Internal organ injury
  - Second or third-degree burns, or any burns affecting more than 5 percent of the body surface
- Substantial damage is defined as…
  - Damage or failure which adversely affects the structural strength, performance, or flight characteristics of the aircraft.

    *Note: A prop strike is **NOT** considered substantial damage.*

Aircraft Incident

- An occurrence other than an accident, associated with the operation of an aircraft, which affects or could affect the safety of operations.

Instrument Rating Required

- When acting as PIC in IFR weather conditions *§ 61.3*
- When carrying passengers for compensation or hire on cross-country *§ 61.133*
- Flight in Class A airspace *§ 91.135*
- Flight in Special VFR between sunset and sunrise *§ 91.157*

What You Need to Have With You

§ 61.3

- Pilot certificate issued by the FAA
- Photo identification (1 of these)
  - Driver's license
  - Government identification card
  - U.S. Armed Forces identification card
  - Official Passport
  - Credential that authorizes unescorted access to secure areas of an airport
- Medical Certificate
  - Class of medical must match the operational privileges being exercised
- Radio Operator Permit
  - Only if operating outside of the U.S.

Change of Address

§ 61.60

You have 30 days to update your information on IACRA.FAA.gov

Special Flight Permits

§ 21.197

- May be issued in these specific scenarios
  - Flying an aircraft to a base where repairs, alterations, or maintenance are to be performed, or to a point of storage.
  - Delivering or exporting an aircraft
  - Production flight testing of new production aircraft
  - Evacuating aircraft from areas of impending danger
  - Conducting customer demonstration flights in new production aircraft that have satisfactorily completed production flight tests.

Category, Class, and Type

(For Airmen)

- Category
  - The broadest classification of aircraft *Examples:* Airplane, Rotorcraft, Glider, and Lighter than air
- Class
  - Classification of aircraft within a category *Examples:* Single-engine, Multiengine, Land, Sea
- Type
  - Specific make and basic model of aircraft *Examples:* C172, P28, C182, B737

Minimum Fuel Requirements
§ 91.151

Fuel from **departure** to **destination** + (*day*) Fuel for an additional **30 Minutes** calculated at normal cruise speed/alt. | (*night*) Fuel for an additional **45 Minutes** calculated at normal cruise speed/alt.

Preflight Self Assessment

§ 91.17, AIM 8-1-1

"**IM SAFE**"

I - Illness
M - Medication
S - Stress
A - Alcohol
F - Fatigue
E - Emotion/Eating

Preflight General

"**PAVE**"

P - Pilot
A - Aircraft
V - EnVironment
E - External Factors

Required Aircraft Documents

§ 21.5, 91.103, 91.1, 91.203

"**ARROW**"

A - Airworthiness Certificate
R - Registration
R - Radio Operator License *(for international flights)*
O - Operating Limitations & Information *(in AFM)*
W - Weight and Balance Data *(aircraft specific)*

Decision Making & Risk Management

"**DECIDE**"

D - *Detect* a change has occurred
E - *Estimate* the need to counter the change
C - *Choose* what is the desired outcome
I - *Identify* the solutions
D - *Do* the necessary actions
E - *Evaluate* the effects of the actions

Required Aircraft Maintenance Inspections

"**AV1ATES**"

A - Annual Inspection *§ 91.409*
- Every 12 Calendar Months

V - VOR Check *§ 91.171*
- Every 30 Days

1 - 100 Hour Inspection *§ 91.409*
- Required if flying for hire

A - Altimeter *§ 91.411*
- Every 24 Calendar Months

T - Transponder *§ 91.413*
- Every 24 Calendar Months

E - ELT *§ 91.207*
- Every 12 Calendar Months
- Battery must be replaced after more than 1 hour of cumulative use

- or -

If 50% of the usable battery life is expired

S - Static System *§ 91.411*
- Every 24 Calendar Months

Confirmation of airworthiness is the responsibility of the Pilot-In-Command

Minimum Required Equipment for VFR Flight

§ 91.205

"**A TOMATO FLAMES**"

A - Altimeter
T - Tachometer for each engine
O - Oil Temp indicator for each engine
M - Manifold pressure gauge for each engine
A - Airspeed Indicator
T - Temp gauge for each liquid cooled engine
O - Oil pressure gauge for each engine
F - Fuel quantity gauge for each fuel tank
L - Landing gear position lights
A - Anti-collision lights *(aircraft certified after 03/11/96)*
M - Magnetic compass
E - ELT
S - Safety belts/shoulder harnesses

Minimum Required Equipment for VFR Night Flight

All day VFR + "**FLAPS**"

F - Fuses *(spare set)*
L - Landing light *(if for hire)*
A - Anti-collision light
P - Position lights *(navigation lights)*
S - Source of power *(such as battery)*

Preflight Planning Info Required

§ 91.103

"**NW KRAFT**"

N - NOTAMs
W - Weather reports and forecasts
K - Known traffic delays
R - Runway length of intended use
A - Alternatives available
F - Fuel requirements
T - Takeoff and landing performance data

Types of 30 Day VOR Checks

§ 91.171
(with acceptable tolerances)

VOT - ±4°
Repair Station - ±4°
VOR Ground Checkpoint - ±4°
VOR Airborne Checkpoint - ±6°
Dual VOR Cross-Check - ±4°
Above a Prominent Ground Landmark
On a selected radial at least 20 NM from a VOR flying at a "reasonably low altitude" ±6°

Operating with Inoperative Equipment

§ 91.213

- Is the equipment required by:
  - An Airworthiness Directive (AD)
  - Regulations for type of flight operation
  - VFR Day certification requirements
  - An operational equipment list

Yes
Flying is NOT PERMITTED without a special flight permit

No
Flying is PERMITTED, so long as:
- equipment is removed

- or -

- deactivated and placarded "inoperative"
- pilot/mechanic determines safe to fly

If the aircraft has a Minimum Equipment List (MEL), refer to the MEL guidance.

Required Test Flight

§ 91.407 (b)

No person may carry any person (other than crewmembers) in an aircraft that has undergone maintenance affecting flight characteristics unless a test flight has been completed and logged by someone with at least a private pilot certificate.

Magnetic Compass Errors

"**DV MONA**"

D - Deviation
V - Variation
M - Magnetic dip
O - Oscillation
N - North/South turn errors **"UNOS"**
(**U**ndershoot **N**orth/**O**vershoot **S**outh)
A - Acceleration errors **"ANDS"**
(**A**ccelerate **N**orth/**D**ecelerate **S**outh)

Airspeed Indicator Markings

White Arc -
Flap operating range.
min is V_{SO} and max is V_{FE}

Green Arc -
Normal operating range.
Starts at V_{S1} & ends at V_{NO}

Yellow Arc -
Caution range.
Fly only in smooth air with caution.
Relative to V_A

Red Line -
Warning range. V_{NE}.
Structural damage possible.

Types of Speeds

- **Indicated Airspeed (IAS)** - Speed indicated on the airspeed indicator
- **Calibrated Airspeed (CAS)** - Indicated airspeed corrected for instrument and position errors
- **Equivalent Airspeed (EAS)** - Calibrated airspeed corrected for compressibility error
- **True Airspeed (TAS)** - Actual speed through the air. Equivalent Airspeed corrected for non-standard temperature and pressure
- **Mach number** - The ratio of True Airspeed relative to the local speed of sound
- **Groundspeed** - Actual speed across the ground. True Airspeed corrected for wind conditions.
- **Critical Mach** - Lowest Mach number at which the airflow over any part of the aircraft reaches the speed of sound.

Speed Review

V-Speeds

- **V_A** - Design maneuvering speed
- **V_S** - Stall speed, clean configuration
- **V_{SO}** - Stall speed, landing configuration
- **V_{S1}** - Stall speed, specific configuration
- **V_F** - Design flap speed
- **V_{LE}** - Max landing gear extended speed
- **V_{FE}** - Max flap extended speed
- **V_{NO}** - Max structural cruise speed
- **V_{NE}** - Never exceed speed
- **V_X** - Best angle of climb
- **V_Y** - Best rate of climb
- **V_G** - Best glide speed
- **V_{REF}** - Calculated final approach speed

Max Airspeeds in the United States

§ 91.117

- **250 kts** - Below 10,000 ft MSL
- **200 kts** - Under Class B airspace, or inside a VFR corridor through Class B
- **200 kts** - At or below 2,500 ft within 4 NM of Class C or D airport
- **Mach 1.0 or Higher** - (speed of sound) above 10,000 ft MSL *§ 91.817(a)*

Types of Altitudes

- **Indicated Altitude** - Uncorrected altitude indicated on the altimeter when barometric pressure is set to current pressure setting.
- **Pressure Altitude** - Altitude corrected for non-standard pressure.
- **Density Altitude** - Pressure altitude corrected for non-standard temperature.
- **True Altitude** - Altitude above Mean Sea Level (MSL).
- **Absolute Altitude** - Altitude above ground level (AGL).

Aeromedical Factors

- **Hypoxia**
  - A condition of the body in which the tissues are starved of oxygen.

    Hypoxic Hypoxia: Insufficient oxygen available to the body as a whole.

    Hypemic Hypoxia: Occurs when the blood is not able to take up and transport a sufficient amount of oxygen to the cells in the body.

    Stagnant Hypoxia: Results when the oxygen-rich blood in the lungs is not moving, for one reason or another. Blood is not moving, so oxygen is not delivered to the tissues.

    Histotoxic Hypoxia: The inability of the cells to effectively use oxygen.

  Solution: *Don an oxygen mask if one is available and descend immediately to the lowest practical altitude.*

- **Hyperventilation**
  - The excessive rate and depth of respiration leading to abnormal loss of carbon dioxide from the blood.
  - Symptoms of hyperventilation are similar to those of hypoxia. It is important to correctly diagnose and treat the proper condition. But when in doubt, treat it as hypoxia and get to a lower altitude as soon as possible.

  Solution: *Slow your breathing and increase carbon dioxide intake by breathing into some kind of bag.*

- **Carbon Monoxide Poisoning**
  - Exposure to a colorless, odorless, tasteless deadly gas caused by the combustion of carbon based materials. Usually airplane exhaust getting into the cabin.
  - Symptoms usually start with drowsiness and come on quickly.

  Solution: *Turn the cabin heat off, ventilate the cabin as much as possible, open a window if you're able, land as soon as possible.*

Types of Medicals *§* 61.23

- **First Class Medical:**
  - Required for Airline Transport Pilot
  - Valid for **12** calendar months if the pilot is **under age 40**
    - It then reverts to **3rd** Class privileges
  - Valid for **6** months if the pilot is **40 and over**
    - It then reverts to **2nd** Class privileges for **6** months
    - After that **6** months lapses, it reverts to **3rd** class privileges

- **Second Class Medical:**
  - Required for Commercial Pilot Certificate
  - Valid for **12** calendar months regardless of age
  - Once this time period lapses, it reverts to **3rd** class privileges.

- **Third Class Medical:**
  - Required for Private Pilot, Flight Instructor, or Student Pilot
  - Valid for **60** calendar months (**5** years) if the pilot is under age **40**
  - Valid for **24** calendar months if the pilot is **40** and over

- **BasicMed:**
  - Alternate way for pilots to fly without holding an FAA medical certificate as long as they meet certain requirements;

    Eligibility Requirements:

    - Possess a U.S. Driver's license, have held a medical after July 14, 2006
    - Get a physical exam with a state-licensed physician, using the Comprehensive Medical Examination Checklist
    - Complete a BasicMed medical education course

    Aircraft Requirements:

    - Any aircraft authorized under federal law to carry not more than 6 occupants
    - Max certificated takeoff weight of not more than 6,000 pounds

    Operating Requirements:

    - Carries not more than five passengers
    - Operates under VFR or IFR, within the United States, at less than 18,000 ft. and not exceeding 250 knots.
    - Flight not operated for compensation or hire

Spatial Disorientation and Illusions

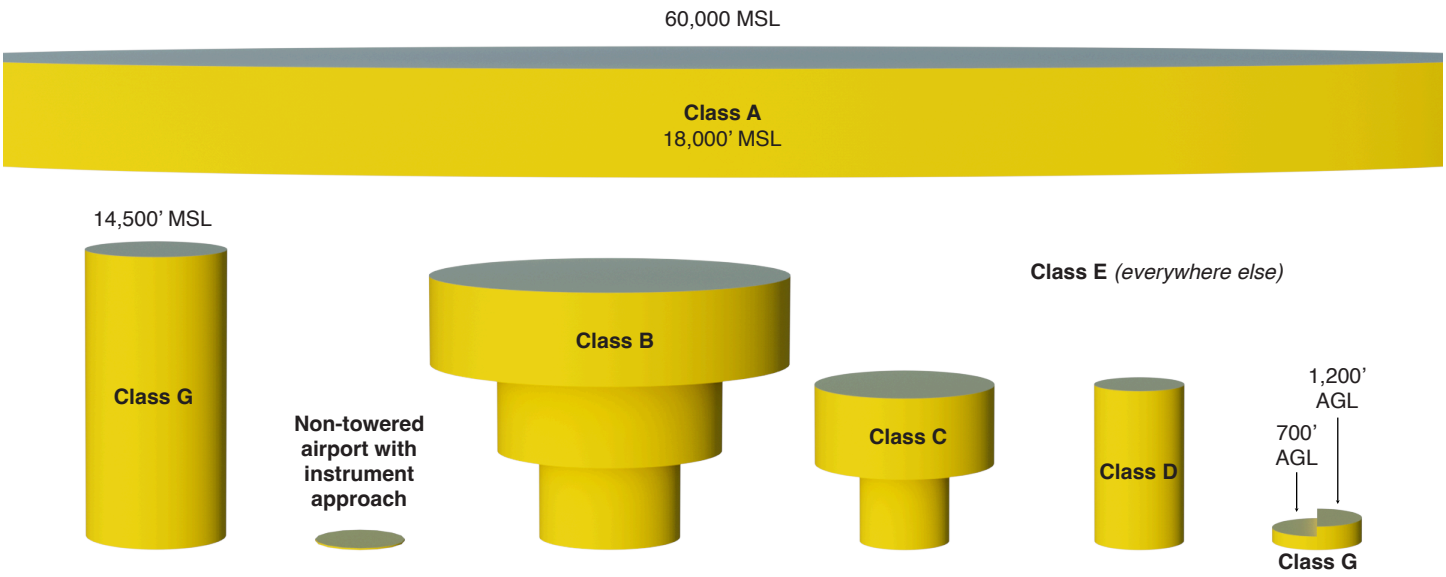
- **The Leans**
  - Most common illusion during flight.
  - Caused by a sudden return to level flight following a gradual and prolonged turn that went unnoticed by the pilot.
  - The pilot may lean in the direction of the original turn in a corrective attempt to regain the perception of a correct vertical posture.
- **Coriolis Illusion**
  - Occurs when a pilot has been in a turn long enough for the fluid in the ear canal to move at the same speed as the canal. This creates the illusion of turning or accelerating on an entirely different axis.
  - The disoriented pilot may maneuver the aircraft into a dangerous attitude in an attempt to correct the aircraft's perceived attitude.
- **Graveyard Spiral**
  - Occurs in a prolonged coordinated, constant-rate turn. As the fluid in the ear settles, the pilot forgets they are turning.
  - When the disoriented pilot recovers to level flight, the pilot will then experience the sensation of turning in the opposite direction. The pilot then returns the plane to its original turn, losing altitude in the process.

- **Somatogravic Illusion**
  - A rapid acceleration, such as experienced during takeoff, creates the illusion of being in a nose-up attitude.
  - The disoriented pilot may push the aircraft into a nose-low or dive attitude.
- **Inversion Illusion**
  - An abrupt change from climb to straight-and-level flight can create the illusion of tumbling backward.
  - The disoriented pilot may push the aircraft abruptly into a nose-low attitude, which may intensify the illusion.
- **Elevator Illusion**
  - An abrupt upward vertical acceleration, as can occur in an updraft, can create the illusion of being in a climb.
  - The disoriented pilot may push the aircraft into a nose-low attitude.
- **False Horizon**
  - Attempting to the align the aircraft with either a sloping cloud formation, an obscured horizon, an Aurora Borealis, a dark scene spread with ground lights and stars, or certain geometric patterns.
  - The disoriented pilot may place the aircraft in a dangerous attitude.
- **Autokinesis**
  - When flying in the dark, a stationary light may appear to move if it is stared at for a prolonged period of time.
  - The disoriented pilot may attempt to align the aircraft with the perceived moving light, potentially causing them to lose control of the aircraft.

Effects of Alcohol

- **Regulations**
  - Part 91 requires that blood alcohol level be less than **.04 percent** and that **8 hours** pass between drinking alcohol and piloting an aircraft. “8 hours bottle to throttle.”
    - Alcohol can greatly impair the efficiency of the human body.
    - As little as one ounce of alcohol can decrease the speed and strength of muscular reflexes, lessen the efficiency of eye movements while reading, and increase the frequency at which errors are committed.
    - The body requires about 3 hours to rid itself of all the alcohol contained in one mixed drink or one beer.

National Airspace System



VFR Cloud Clearances

Class A			**None**	**None**
Class B			**3 SM**	**Clear of Clouds**
Class C			**3 SM**	**500 ft. below 1,000 ft. above 2,000 ft. horizontal**
Class D			**3 SM**	
Class E	**Less than 10,000 MSL**		**3 SM**	
	At or above 10,000 MSL		**5 SM**	**1,000 ft. Above, 1,000 ft. below 1 statute mile horizontal**
Class G	**Up to 1,200 AGL**	**Day**	**1 SM**	**Clear of Clouds**
		Night	**3 SM**	**500 ft. below 1,000 ft. above 2,000 ft. horizontal**
	More than 1,200 AGL Less than 10,000 MSL	**Day**	**1 SM**	
		Night	**3 SM**	
	More than 1,200 AGL And at or above 10,000 MSL		**5 SM**	**1,000 ft. Above, 1,000 ft. below 1 statute mile horizontal**

Airspace	Entry Requirements	Equipment Required	Minimum Pilot Requirements
A	ATC Clearance	IFR Equipped	Instrument rating
B	ATC Clearance Must hear the words "Cleared into the Bravo"	Two-way radio, transponder with altitude reporting capability *Note:* Most Class B's have a Mode C veil which requires an operable radar beacon transponder with automatic altitude reporting and operable ADS-B Out equipment.	Private Pilot Certificate - or - Recreational Pilot Certificate if all *§ 61.101* requirements are met - or - Sport Pilot Certificate if all *§ 61.325* requirements are met - or - Student seeking Private Pilot or Recreational/ Sport Pilot certificates if all *§ 61.95* or *§ 61.94* are met
C	Two-way radio communication prior to entry Must hear your tail number or callsign	Two-way radio, transponder with altitude reporting capability	No specific requirement
D	Two-way radio communication prior to entry	Two-way radio	No specific requirement
E	None for VFR	No specific requirement	No specific requirement
G	None	No specific requirement	No specific requirement

Additional ADS-B Out Requirements

- Class E airspace at or above 10,000 feet MSL, excluding airspace at and below 2,500 feet AGL
- Within 30 nautical miles of a Class B primary airport (the Mode C veil)
- Within and above Class C airspace (Not required below a Class C shelf)
- Class E airspace over the Gulf of Mexico, at and above 3,000 feet MSL, within 12 nm of the U.S. coast

Missing or Broken Transponder

- Prior to operating an aircraft **NOT** equipped with a transponder in Class B airspace, a request for a deviation must be submitted to the controlling ATC facility at least 1 hour before the proposed flight.
- If the transponder fails during the flight in Class B airspace, a request must be immediately made and a transponder requirement deviation may be issued to allow the flight to continue through the airspace.

Electronic Devices

§ 91.21

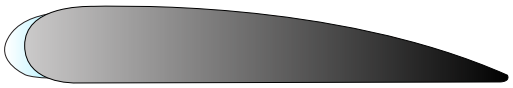
No person may operate, nor may any operator or pilot in command of an aircraft allow the operation of, any portable electronic device on any civil aircraft:

- Does not apply to -

1.) Portable voice recorders
2.) Hearing aids
3.) Heart pacemakers
4.) Electric shavers
5.) Any other portable electronic device that the operator of the aircraft has determined will not cause interference with the navigation or communication system of the aircraft in which it is to be used.

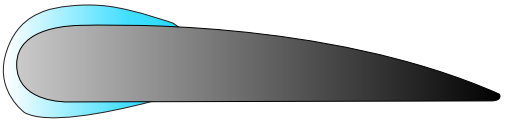
Types of Aircraft Icing

- **Rime Ice**
  - Rough, milky, opaque ice.
  - Formed by the instantaneous or very rapid freezing of super cooled droplets as they strike the leading edges.
  - Rough surface can decrease aerodynamic efficiency, but it is lighter than clear ice.



- **Clear Ice**
  - Glossy, transparent ice formed by the relatively slow freezing of super cooled water.
  - Denser, harder, and sometimes more transparent than the rime ice.
  - Harder to remove than rime ice.

- **Mixed Ice**
  - Combination of clear and rime ice.
  - Roughness and weight can have an effect on aerodynamics.



- **Frost**
  - Ice crystal deposits formed by sublimation when the temperature and dew point are below freezing.
  - Usually forms in clear, stable air with light winds.
  - Needs to be removed from all airfoils before takeoff.
    - A heavy coat of hard frost can cause a 5 to 10 percent increase in stall speed.
    - Even a small amount of frost on airfoils can make it impossible to become airborne at normal takeoff speed.

Icing Intensities

Trace	Light	Moderate	Severe
Icing perceptible. Not hazardous unless encountered for an extended period of time.	Icing clearly visible. Anti-icing/deicing equipment removes/prevents accumulation.	Even short encounters can be hazardous. Anti-icing/deicing equipment must be used, or diversion.	Rate of accumulation is such that deicing/anti-icing equipment fails to reduce the hazard. Diversion is mandatory.

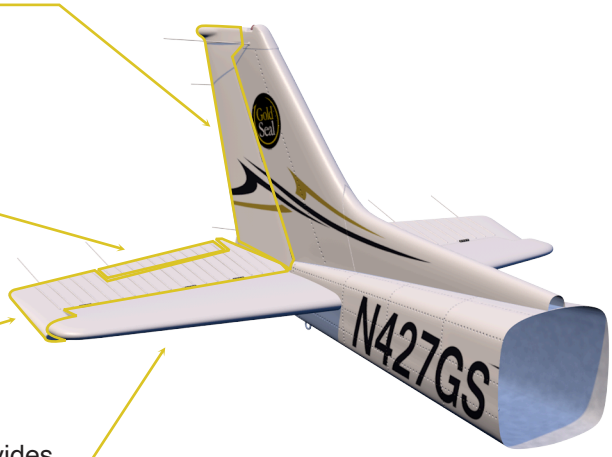
Anatomy
Of An Airplane

Rudder
Primary flight control surface that controls rotation about the vertical axis. “**Yaw**”

Trim Tab
Adjusted by the pilot to relieve elevator pressure

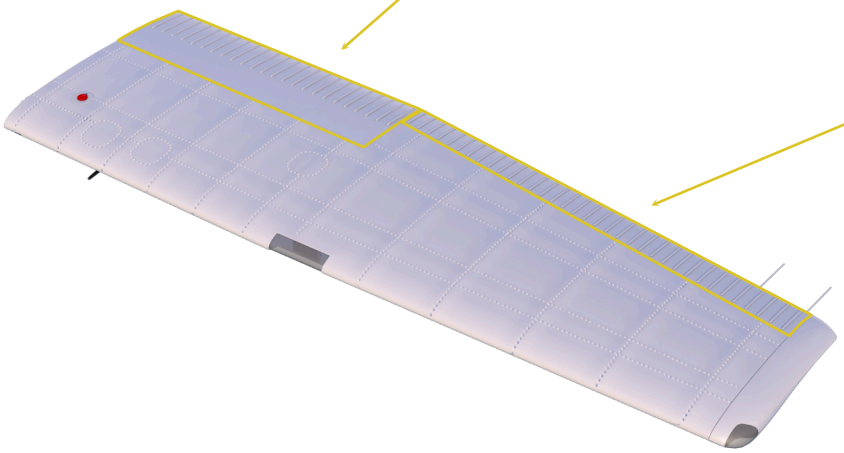
Elevator
Primary flight control surface that controls movement about the lateral axis. “**Pitch**”

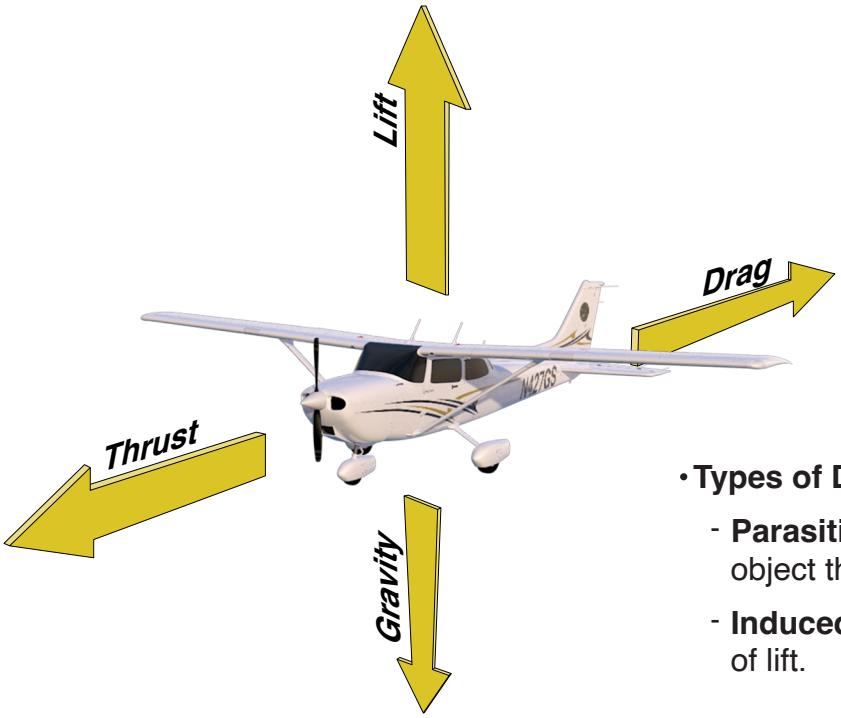
Horizontal Stabilizer
Fixed wing section that provides Stability for the aircraft.



Flaps
High-lift device used to reduce stall speed of an aircraft wing at a given weight.

Ailerons
A movable part of the airplane wing that allows the aircraft to roll around it’s longitudinal axis. “**Roll**”

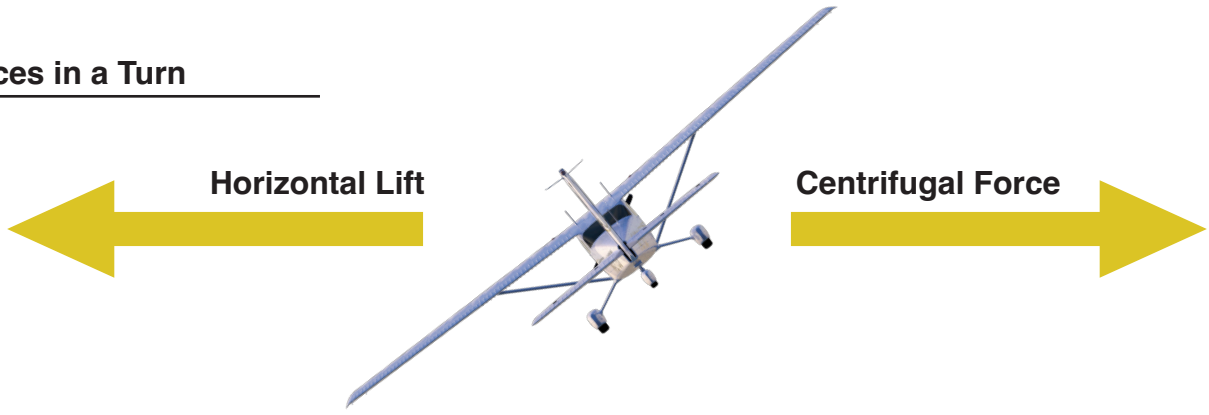


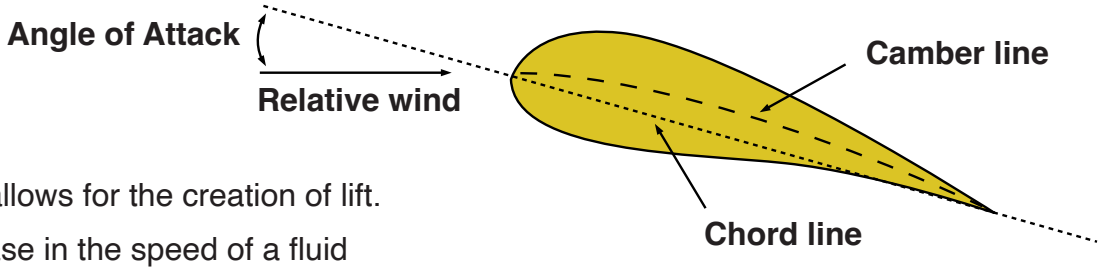


Four Forces Of Flight

- **Types of Drag**
  - **Parasitic:** Drag produced by the motion of an object through a fluid.
  - **Induced:** Drag that arises from the development of lift.

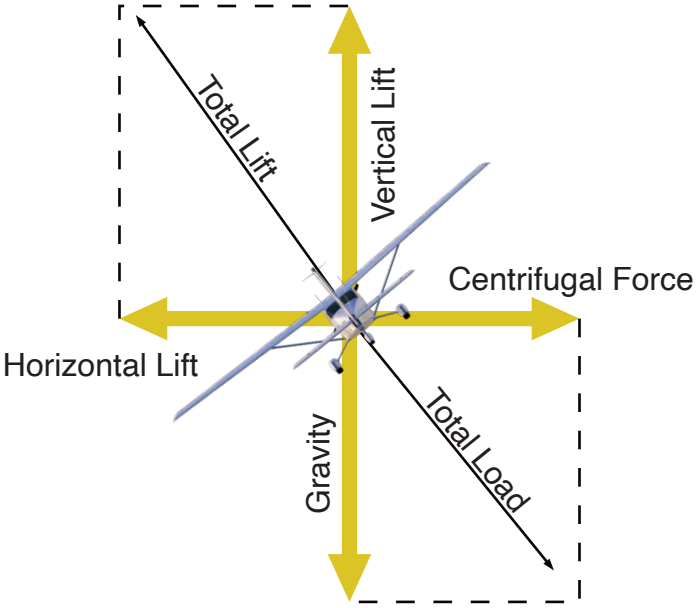
Forces in a Turn





(Elements of an airfoil)

- **Bernoulli's Principle**
  - Basic principle that allows for the creation of lift.
  - States that an increase in the speed of a fluid occurs simultaneously with a decrease in pressure or a decrease in the fluid's potential energy.
  - As air passing above the wing accelerates, it creates an area of low pressure above the wing. This pressure differential pushes the wing upward.
  - The pressure difference creates an upward lifting force.

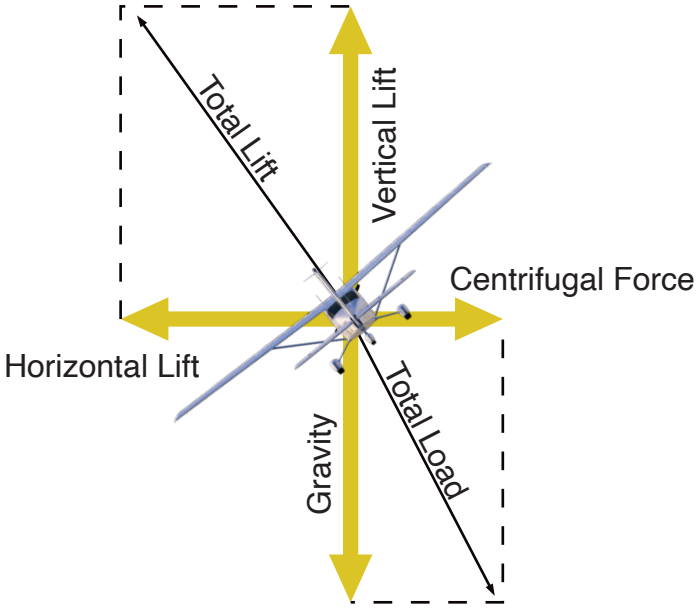


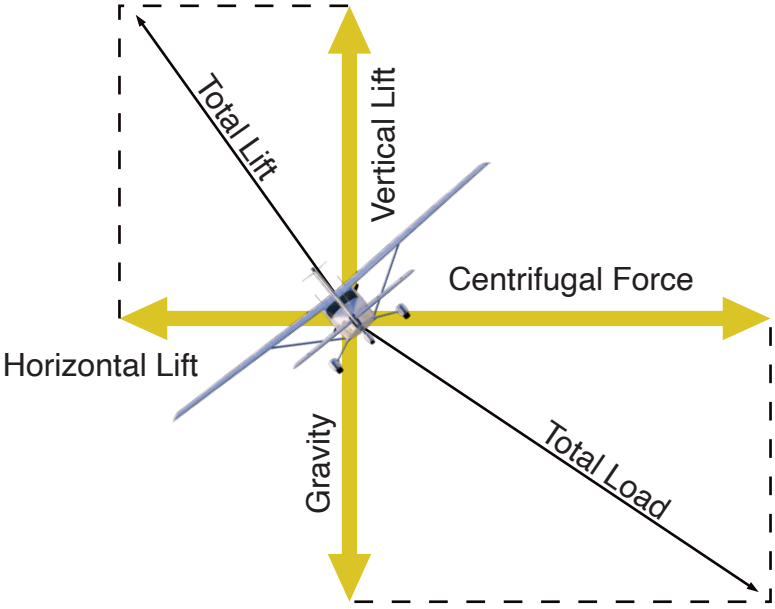
Normal Turn

Centrifugal force equals horizontal lift

Slipping Turn

Centrifugal force is less than horizontal lift





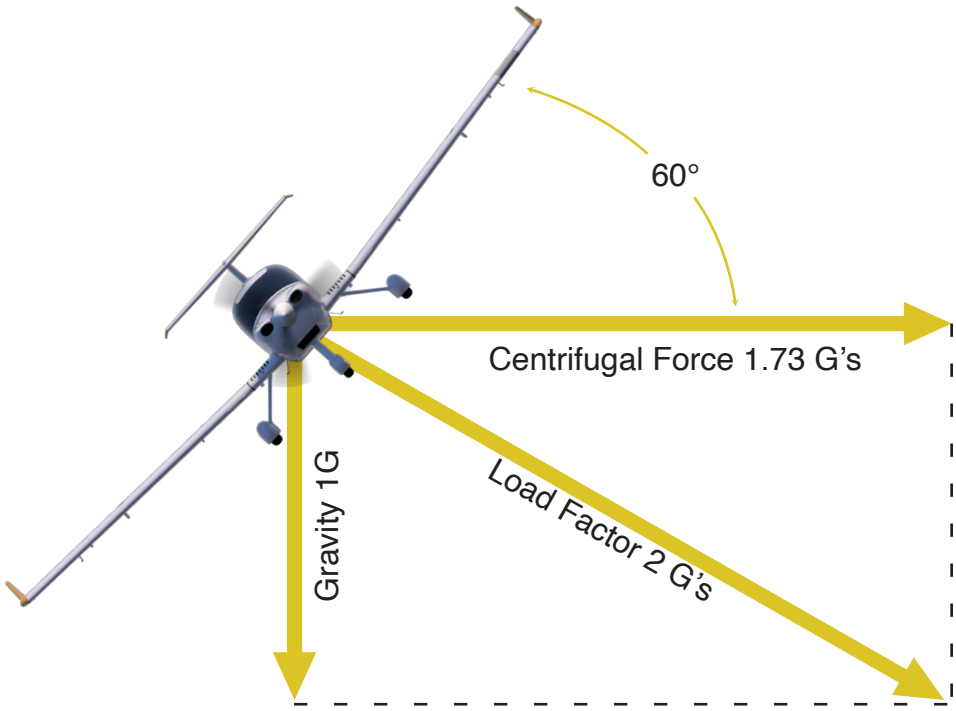
Skidding Turn

Centrifugal force is greater than horizontal lift

Load Factor

- Load Factor is the proportion (at a given bank angle) between lift and weight in a level turn.

- It is measured in Gs, which is a unit of force equal to the force exerted by gravity on a body at rest and indicates the force to which a body is subjected to when it's accelerated.



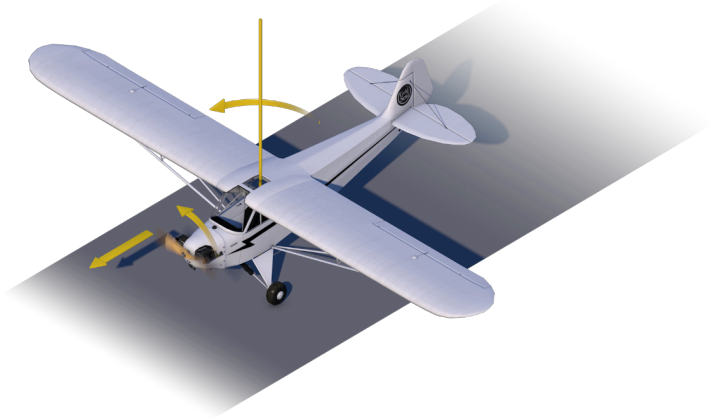
4 Left Turning Tendencies

1.) Torque

- As the airplane's propeller turns to the right (clockwise), the plane rotates around the longitudinal axis to the left.
- On the ground, especially on takeoff roll, the rotation puts pressure on the left landing gear.

2.) Gyroscopic Precession

- This mostly applies to tailwheel aircraft
- A force applied to a gyroscope manifested 90° ahead in the direction of rotation.
- The propeller acts as a gyroscope when it Spins.
- This results in a force on the right side *(90° ahead)* pushing the nose to the left.



3.) Spiraling Slipstream

- The prop wash from the propeller spirals around the airplane in a corkscrew pattern, eventually hitting the vertical stabilizer.
- This causes a yawing motion to the left.

4.) P-Factor

- A propeller is an airfoil and creates lift like a wing.
- When increasing the angle-of-attack (like in a climb) the right side of the propeller creates more lift than the left side.
- This causes the plane to yaw to the left.

Stalls

- **Definition of "Stall"**
  - A rapid decrease in lift caused by the separation of airflow from the wing's surface brought on by exceeding the critical angle of attack. It can occur at any pitch attitude or airspeed.
- **Stalls in Different Flight Situations**
  - There are 3 different flight situations in which the critical angle of attack is most commonly exceeded:

    Approach (Power Off) : As airspeed decreases, the angle of attack must be increased to retain the lift required for maintaining altitude. Eventually, an angle of attack is reached which results in the wing not producing enough lift to support the aircraft.

    Departure (Power On) : Critical angle of attack can be reached at any speed. An example of this would be trying to out climb an obstacle at the end of the runway. Speed does not Matter, when the critical angle of attack is exceeded a stall is imminent.

    Turning: Since angle of attack must be increased as bank increases, the plane gets closer to exceeding it's critical angle of attack.

    Accelerated Stall: A stall that occurs at an airspeed higher than normal because of a higher load factor imposed on the aircraft.

Aircraft Stability

- **Static Stability**
  - Initial tendency, or direction of movement, back to equilibrium.

    Positive Static Stability: Initial tendency of the aircraft to return to the original state of equilibrium after being disturbed.

    Neutral Static Stability: Initial tendency of the aircraft to remain in a new condition after it's equilibrium has been disturbed.

    Negative Static Stability: Initial tendency of the aircraft to continue away from the original state of equilibrium after being disturbed.

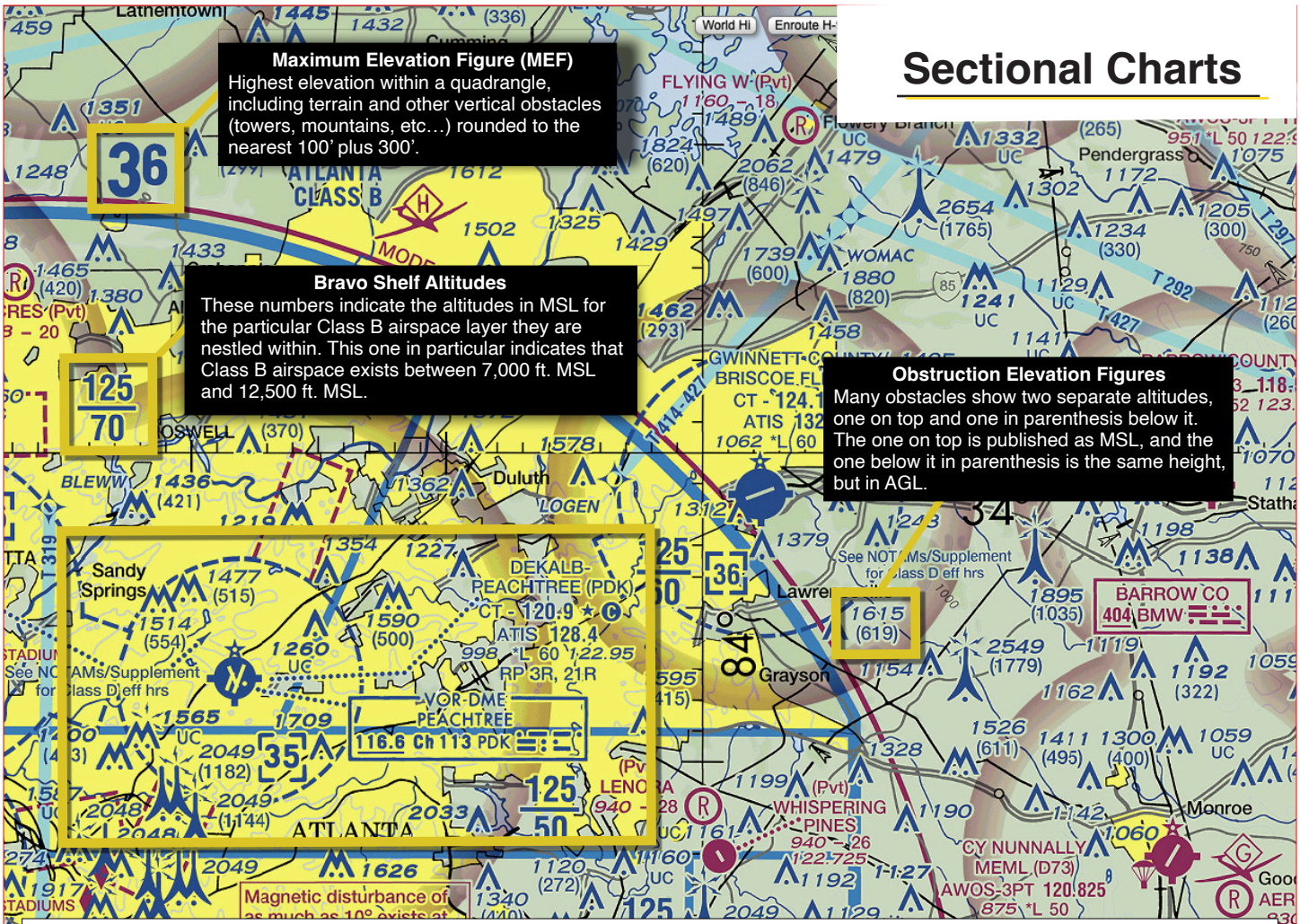
- **Dynamic Stability**
  - Initial tendency to return to equilibrium that the aircraft displays after being disturbed from its trimmed condition.

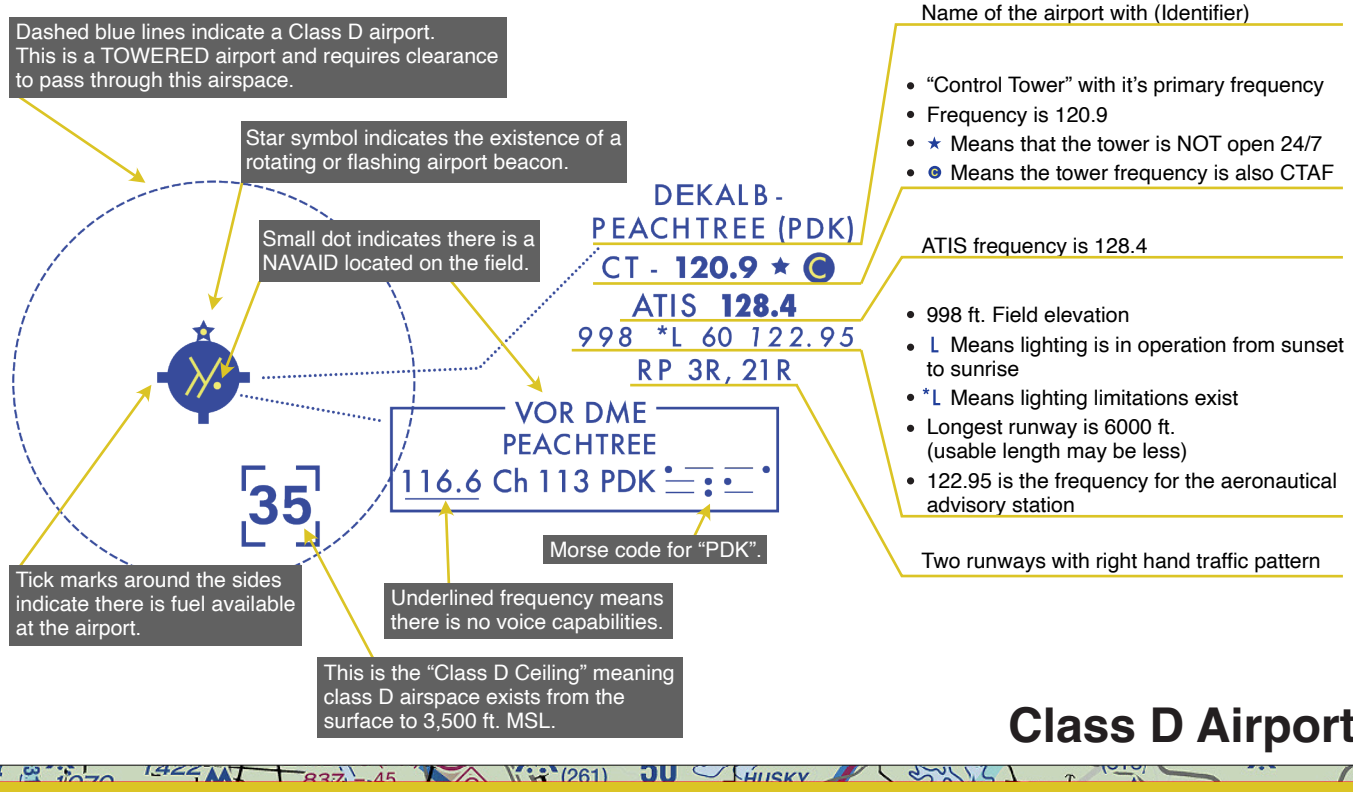
    Positive Dynamic Stability: Over time, the motion of the displaced object decreases in amplitude and, because it is positive, the object displaced returns toward the equilibrium state.

    Neutral Dynamic Stability: Once displaced, the displaced object neither decreases nor increases in amplitude. A worn automobile shock absorber exhibits this tendency.

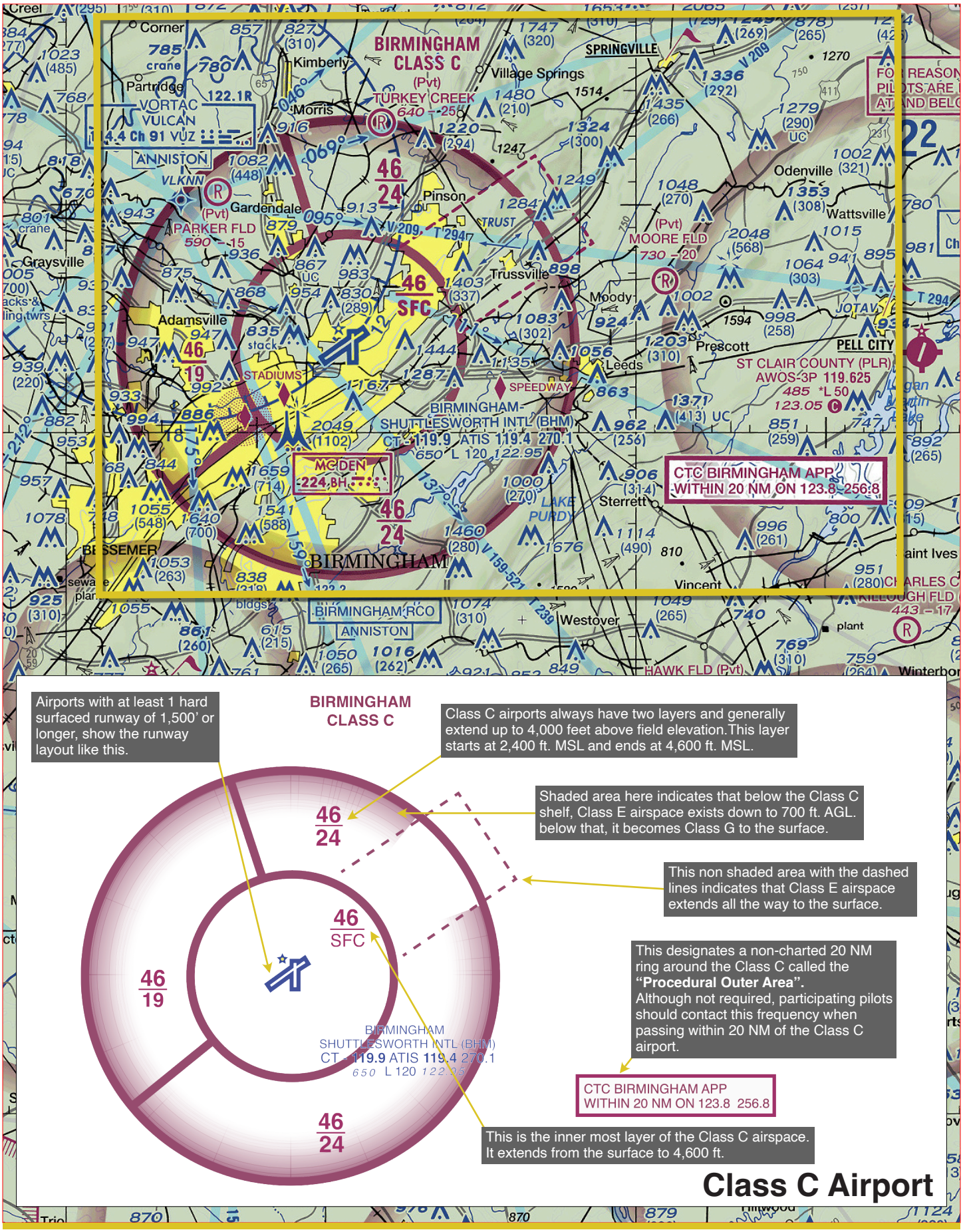
    Negative Dynamic Stability: Over time, the motion of the displaced object increases and becomes more divergent.

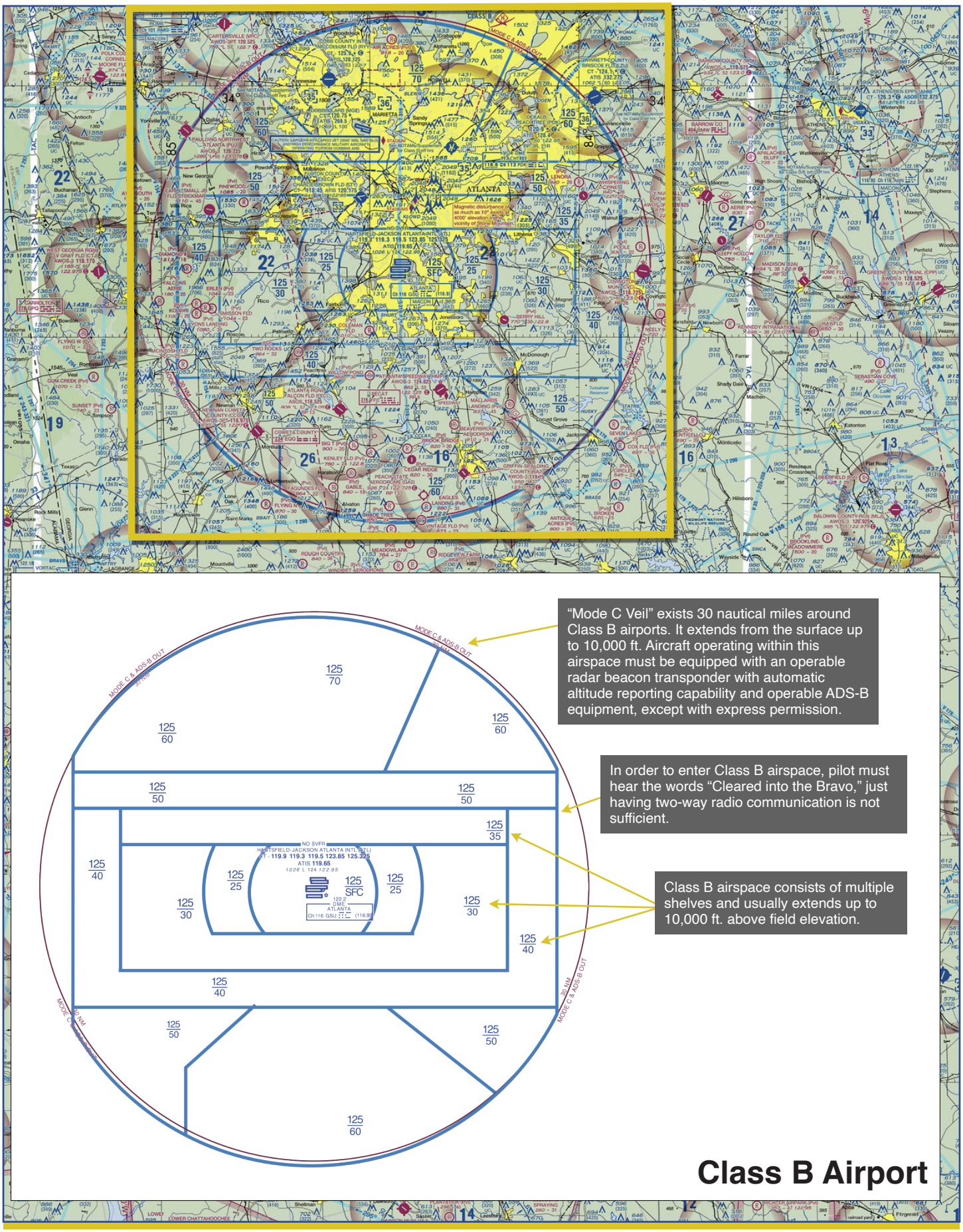
Sectional Charts





Class D Airport



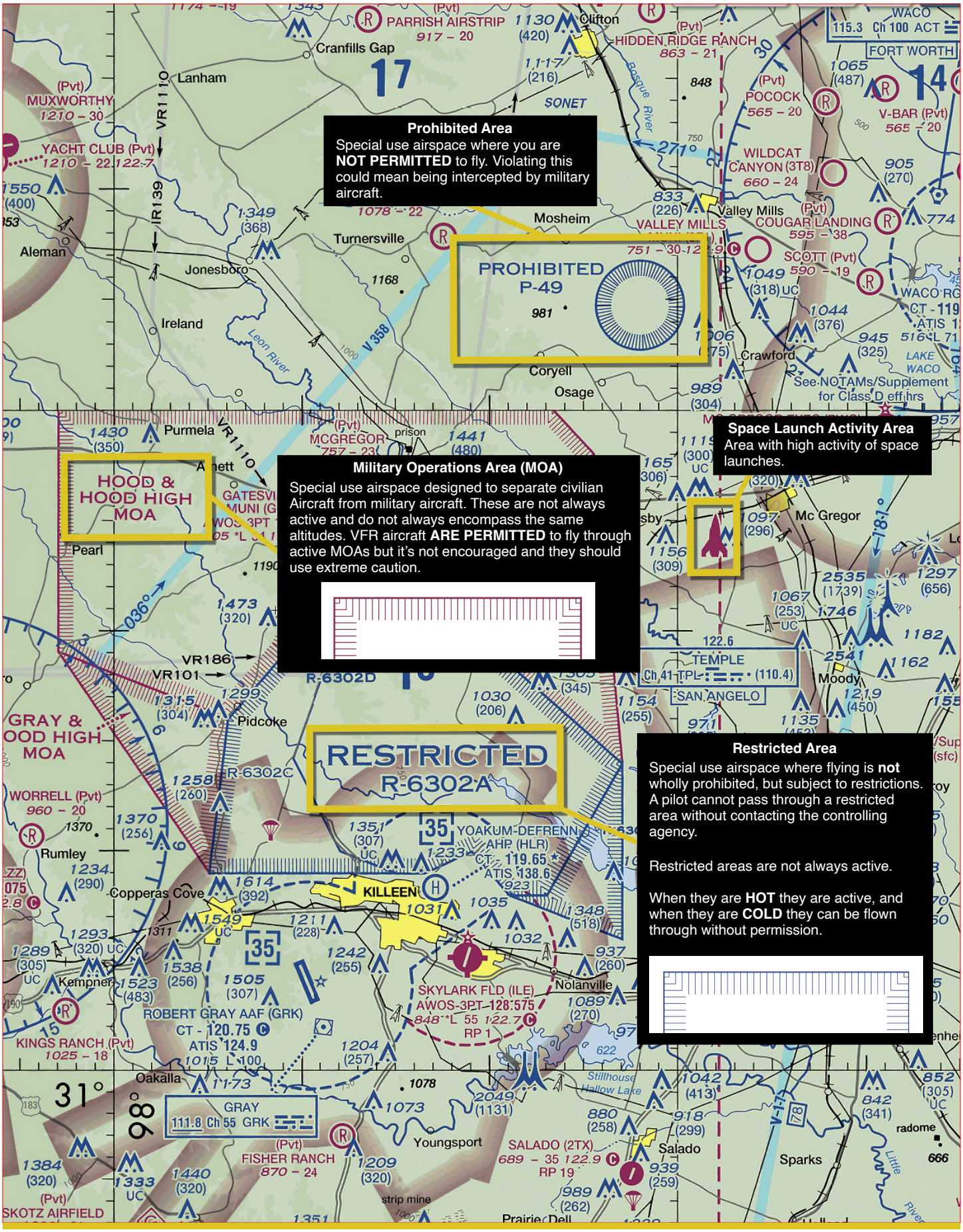


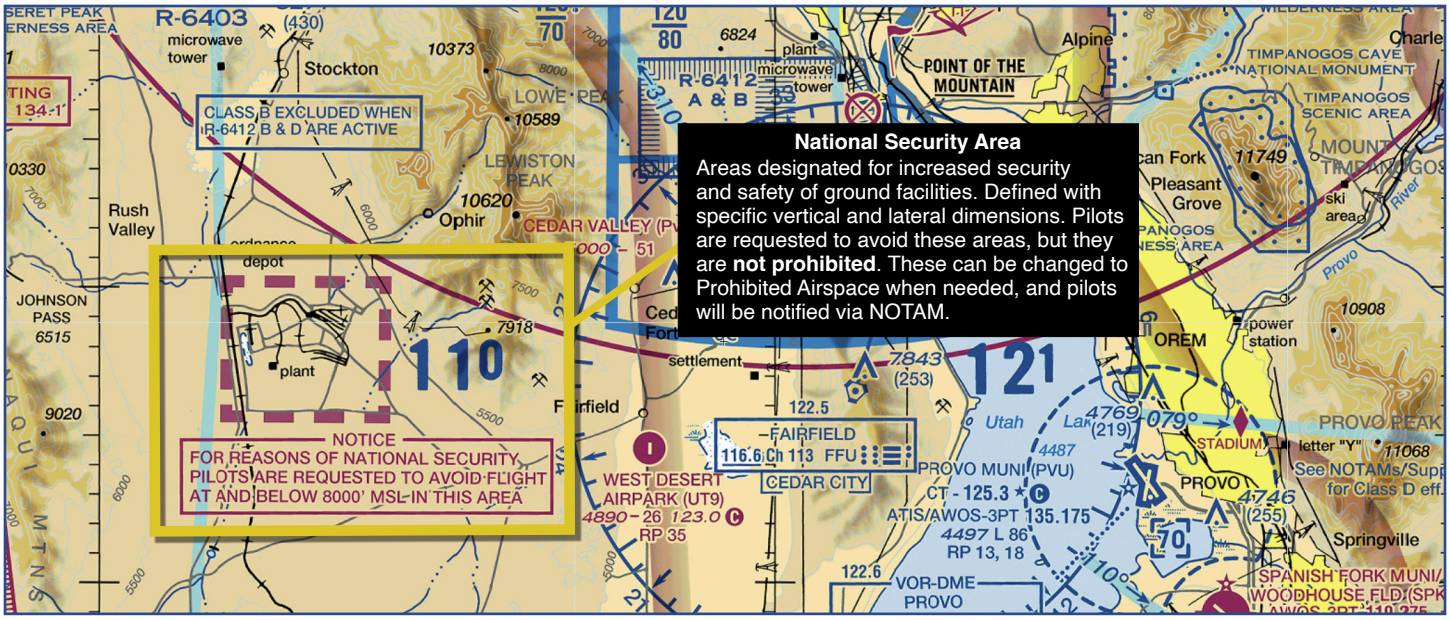
"Mode C Veil" exists 30 nautical miles around Class B airports. It extends from the surface up to 10,000 ft. Aircraft operating within this airspace must be equipped with an operable radar beacon transponder with automatic altitude reporting capability and operable ADS-B equipment, except with express permission.

In order to enter Class B airspace, pilot must hear the words "Cleared into the Bravo," just having two-way radio communication is not sufficient.

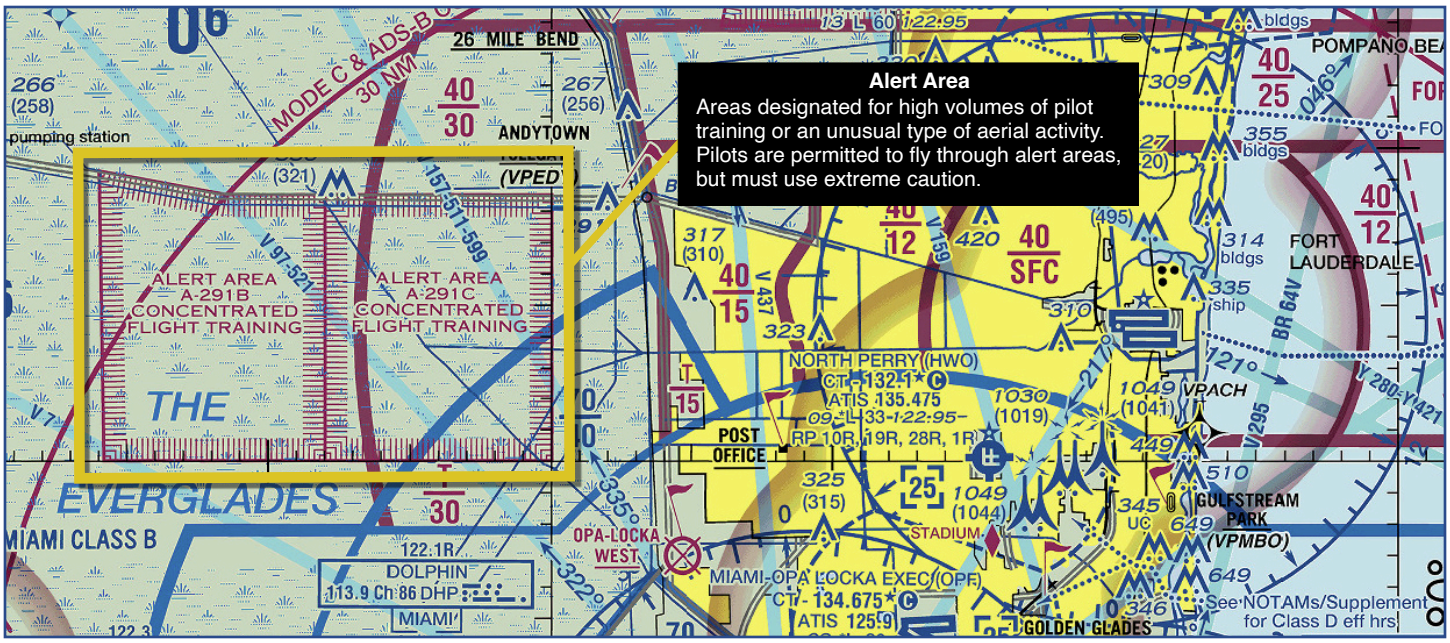
Class B airspace consists of multiple shelves and usually extends up to 10,000 ft. above field elevation.

Class B Airport

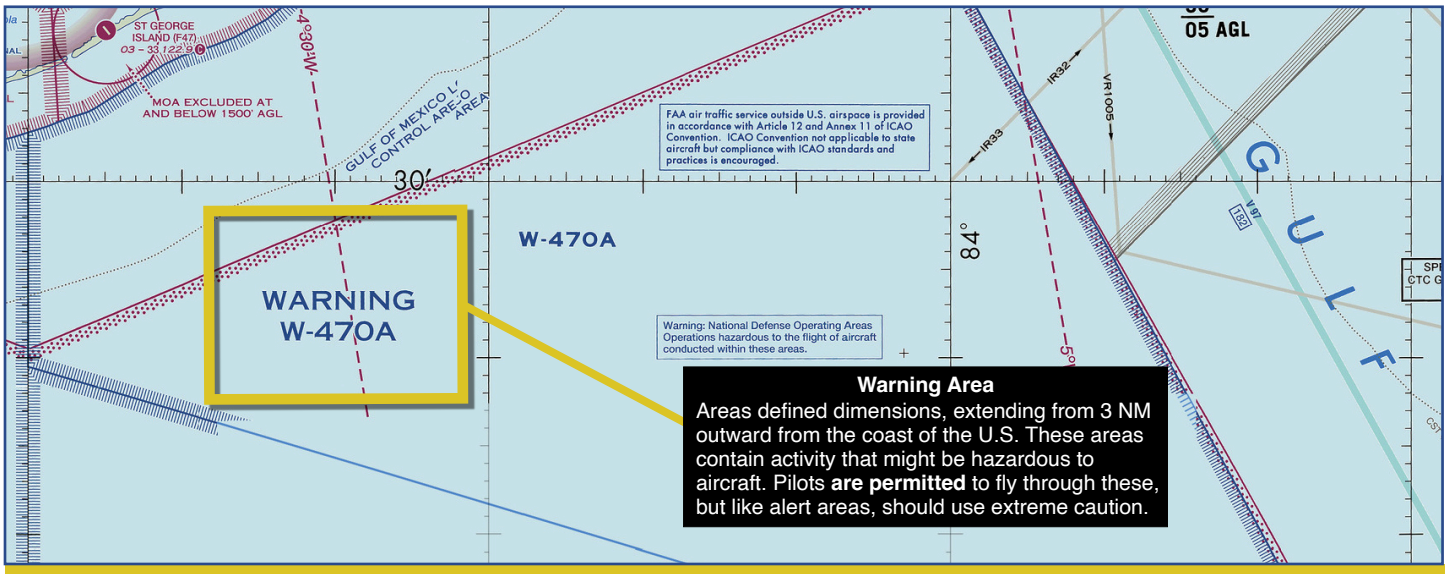




National Security Area
Areas designated for increased security and safety of ground facilities. Defined with specific vertical and lateral dimensions. Pilots are requested to avoid these areas, but they are **not prohibited**. These can be changed to Prohibited Airspace when needed, and pilots will be notified via NOTAM.



Alert Area
Areas designated for high volumes of pilot training or an unusual type of aerial activity. Pilots are permitted to fly through alert areas, but must use extreme caution.



Warning Area
Areas defined dimensions, extending from 3 NM outward from the coast of the U.S. These areas contain activity that might be hazardous to aircraft. Pilots **are permitted** to fly through these, but like alert areas, should use extreme caution.

- **Ignition System**
  - *Detonation:*
    - An uncontrolled, explosive ignition of the fuel-air mixture within the cylinder's combustion chamber.
    - Could be caused by a lower fuel grade than recommended
    - Operation of the engine with extremely high manifold pressures in conjunction with low RPM.
    - Operation of the engine at high power settings with an excessively lean mixture.
  - *Preignition:*
    - Occurs when the fuel-air mixture ignites prior to the engine's normal ignition event.
    - Usually caused by a residual hot spot in the combustion chamber.
    - Causes the engine to lose power and produces high operating temperatures.
  - *Spark Plug Fouling:*
    - Occurs when low engine operating temperatures are coupled with running a rich mixture.

- **Propellers**
  - *Fixed-Pitch:*
    - Blade angle is built into the blade itself.
    - Once the propeller has been built, the angle can't be changed.
  - *Constant-Speed Propeller:*
    - Controllable-pitch propeller whose pitch is automatically varied in flight by a governor.
    - Two controls: The throttle and the propeller control.
    - Once an RPM is selected, a governor automatically adjusts the propeller blade.

- **Magnetos**
  - An electrical generator that uses permanent magnets to produce periodic pulses of alternating current.
  - Generates an electrical current completely independent of the aircraft's electrical system.
  - Operates whenever the crankshaft is rotating.

Note:

Even with the ignition switch in the **OFF** position, if the ground wire between the magneto and the ignition becomes disconnected or broken, the engine **could accidentally start** if the propeller is moved with residual fuel in the lines.

- **Fuel-Air Mixture**
  - The ratio of the "weight" of fuel to the "weight" of air in the mixture to be burned.
  - Leaning the fuel mixture at cruise altitude promotes optimal engine performance.
  - Leaning before taxiing prevents spark plugs from fouling.

Preventative Maintenance *§* 43.3 (g)

- Definition:

  Simple or minor preservation operations and the replacements of small standard parts not involving complex assembly operations.

- Part 43, Appendix A, Part C:

  Contains a list of appropriate actions the pilot is permitted to do themselves

- The pilot is allowed to perform preventative maintenance, so long as it is NOT being used for Part 121, 123, or 135 operations

- **Life Limited Part**
  - Any part for which a mandatory replacement limit is specified in the type design, the instructions for continued airworthiness, or the maintenance manual.
    Example: Wing bolts on a King Air 200 are limited to 15 years

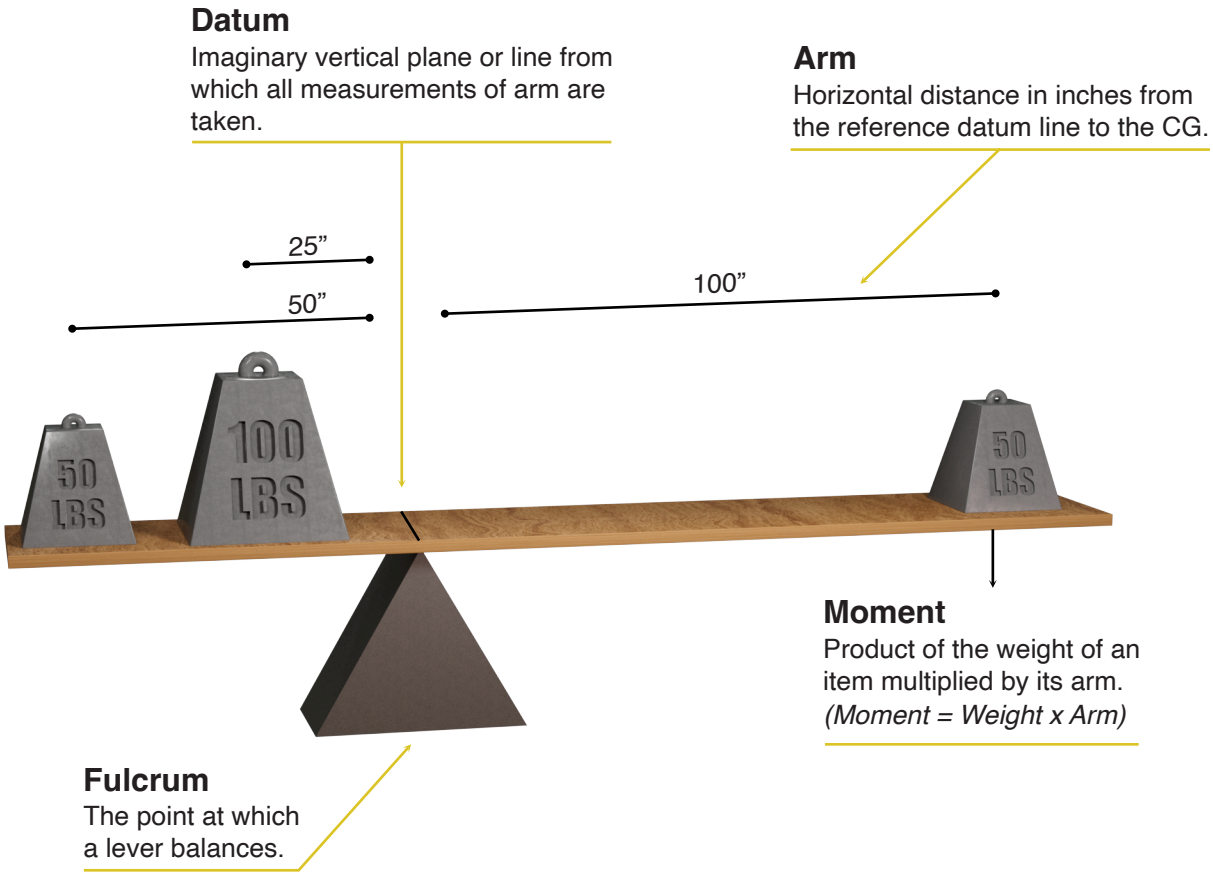
- **Minimum Equipment List (MEL)**
  - A document and method aircraft operators use to obtain relief from FAA regulations requiring that all equipment installed on the aircraft be operative at the time of flight.
  - Aircraft-specific and spells out which pieces of equipment may be allowed to be inoperative along with any procedures that are required.

Flying with inoperative equipment

- **Flying WITHOUT a minimum equipment list: Missing/ inoperative equipment must NOT**
  - Be part of the VFR-day type certification instruments.
  - Be indicated as REQUIRED on the aircrafts equipment list, or on the equipment list of the flight operation being conducted.
  - Be required to be operational by an airworthiness directive.

- **The inoperative instruments and equipment must be:**
  - Removed from the aircraft, the cockpit control placarded, and the maintenance recorded.
  - Deactivated and placarded “inoperative.”
  - If deactivating it requires maintenance, it must be logged.

Weight and Balance



Types of Weights

- **Standard Empty Weight**
  - Weight of an empty airplane INCLUDING it’s unusable fuel, operating fluids, and engine oil
- **Basic Empty Weight**
  - Standard Empty Weight + operational equipment. *(this is the starting point of weight and balance)*
- **Useful Load**
  - Total usable fuel, cargo, passengers, and drainable fuel
- **Max Ramp Weight**
  - Maximum allowable weight for ground operations
- **Max Takeoff Weight (MTOW)**
  - Maximum allowable weight for takeoff
- **Max Landing Weight**
  - Maximum allowable weight for landing. *(Usually a structural limit and is often lower than maximum takeoff weight)*

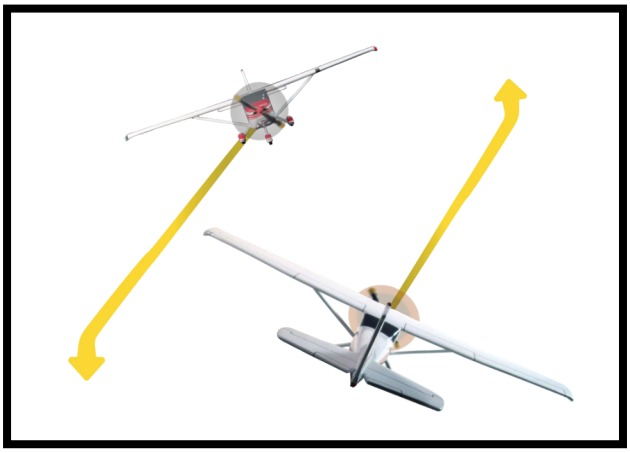
Effects of Forward vs. Aft CG

- **Forward CG**
  - More stable (longitudinal stability)
  - Less fuel efficient (more drag)
  - Higher stall speed (higher angle of attack)
  - Good stall recovery characteristics
- **Aft CG**
  - Less stable (longitudinal stability)
  - More fuel efficient (less drag)
  - Lower stall speed
  - Bad stall recovery characteristics *(more difficult spin recovery)*

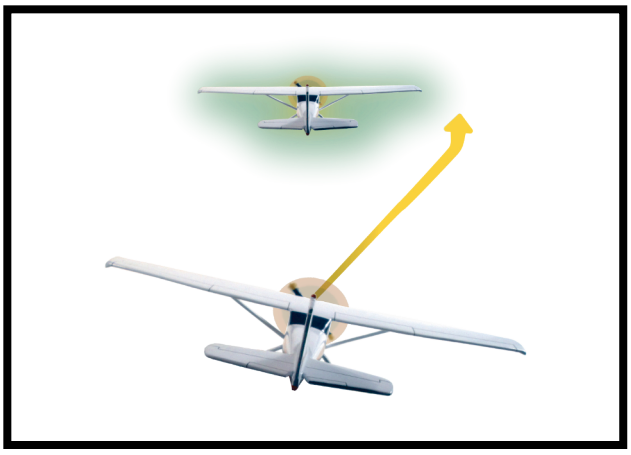
Right of Way Rules

§ 91.113

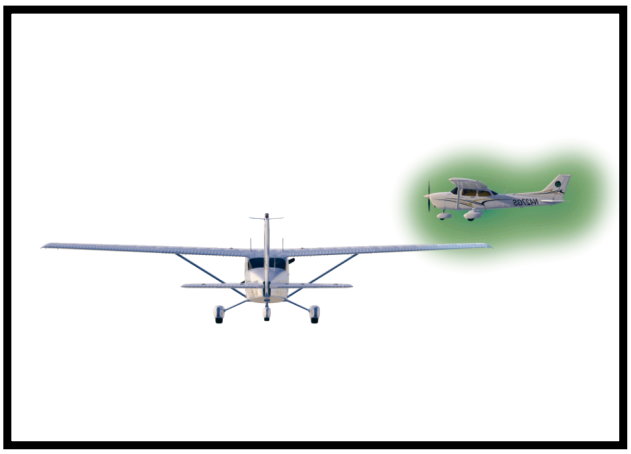
- **Catch all:**
  - Regardless of flight rules, vigilance shall be maintained by each person operating an aircraft so as to "see-and-avoid" other aircraft.
- **In Distress**
  - An aircraft in distress has the right-of-way over all other traffic.
- **Head ON**
  - Each pilot shall alter course to the right
- **Overtaking**
  - The aircraft being overtaken has the right-of-way.
  - The aircraft overtaking must alter course to the right to pass well clear
- **Landing**
  - Aircraft on final or landing have the right-of-way over all others
  - When two aircraft approaching the same runway, the plane with the lower altitude has the right-of-way
- **Converging**
  - Aircraft of the same category, (except head on) the aircraft on the other's **RIGHT** has the right-of-way.
    - A balloon has the right-of-way over any other category aircraft
    - A glider has the right-of-way over an airship, powered parachute, weight shift control aircraft, airplane, or rotorcraft
    - An airship has the right-of-way over a powered parachute, weight shift control aircraft, airplane, or rotorcraft
    - An aircraft towing or refueling another aircraft has the right-of-way over **ALL** other engine-driven aircraft



Head On



Overtaking



Converging

All of these briefings can be obtained by calling a Flight Service Station (FSS) at **1-800-WXbrief** or by visiting **www.1800WXbrief.com**

Standard Briefing

- Used any time you are planning a flight and have not received all the required flight information.
- Once you give the briefer your flight Information, they will provide the following information in this sequence.

1.) Adverse Conditions
- Significant weather that could potentially alter or cancel the flight.

2.) "VFR Flight Not Recommended"
- They will use this phraseology if conducting the flight under VFR is unlikely. This is advisory in nature and the final decision to fly rests with the pilot.

3.) Synopsis
- A brief statement of weather movements and weather systems along the route.

4.) Current Conditions
- Reported current weather conditions from METARs, PIREPs, and other sources.

5.) En Route Forecast
- Forecasted weather along the route in order from departure, en route, and descent.

6.) Destination Forecast
- Forecasted weather for your ETA. Any significant changes within the last hour as well.

7.) Winds Aloft
- Provided using degrees of a compass, and the briefer will interpolate wind directions and speed between levels to supply the most accurate prediction for your planned altitude.

8.) Notices to Air Missions (NOTAMs)
- "D NOTAMs" which pertain to navigational facilities that are part of the National Airspace System (NAS). This where you will get updated on Special Use Airspace (SUA) along your route.
- There are many more types of NOTAMs that should be reviewed before conducting a flight. Pilots are encouraged to check all NOTAMs at **www.NOTAMS.aim.faa.gov.**

9.) ATC Delays
- Any known traffic delays or flow control advisories.

Abbreviated Briefing

- Used any time you need to update a previous briefing, get supplemental information, or when you only need one or two specific items.
- Tell the briefer what information you already have and let them know what you're looking for specifically.

Outlook Briefing

- Used any time you are getting a briefing for a flight six or more hours in the future.
- The briefer will provide available forecast data.
- This is for planning purposes only, you should STILL obtain a standard or abbreviated briefing prior to departure.

Inflight Briefing

- Used any time you are in the air and need an update to the information you currently have.
- Contact the nearest Flight Service Station (FSS) by radio.
- You can get any type of briefing here and en route advisories are available upon request.

Note:
Remember that these are real people and are here to help you. After you get a briefing, it is encouraged to ask any questions you may have about flight information along your route. They will help you make sure nothing gets overlooked.

Flight Planning & Navigation

Definitions:

- **Pilotage**
  - Navigation by using visual landmarks
- **Dead Reckoning**
  - Navigation by estimated ground speeds and timing from a known point
- **Position**
  - A known geographic spot, determined either visually or by electronic means
- **Direction**
  - An angular distance from a reference point
- **Course**
  - The aircraft's intended path
- **Track**
  - The aircraft's actual flight path over the ground
- **Time**
  - Elapsed or as the time of day in "Zulu Time"
- **Speed**
  - Velocity of the aircraft
- **Heading**
  - The direction the aircraft is pointed
- **Drift Angle**
  - Difference between the course and heading

Tools Needed:

- Navigation Charts (Sectionals)
- Plotter
- E6B Flight Computer
  (or electronic flight computer)

FLIGHT PLANNING
Step-by-Step

Day Before

1. Spread out charts and determine your route:

   Route: Direct is best *(but sometimes it doesn't make sense for the flight)*

   - If possible, use victor airways, obvious visual landmarks, and navigational aids like VORs whenever possible
   - Mark and consider identifiable checkpoints along the way

   Airspace: Avoid restricted/ prohibited airspace or special use airspace (when possible). mark all airspace classes you'll be flying through and plan accordingly for altitudes.

   Terrain: Consider all terrain along the route of flight. Make sure you have at least 2,000 feet of clearance above obstacles and terrain. Also make sure the terrain and obstacles along the route does not exceed the service ceiling of the aircraft.

   Airports: Check all airports along the route of flight. Asses them for fuel availability, runway lengths, and NOTAMs.

   Fuel: How much are you landing with? What airports along the plan have fuel services and are they 24 hours? What fuel indication would you divert for?

   Emergencies: Check for all suitable landing sites along your route in case of emergencies. Avoid long distances over lakes, heavily wooded areas, or open water.

   Night: If you're planning a flight at night, use easy to see landmarks like highways and cities. Pack a flashlight, extra batteries, and emergency supplies. Pay special attention to mountainous terrain, weather, emergency landing sites, airport lighting, and bodies of water. *(Water is particularly hard to see when the moon isn't bright or there is an overcast layer above)*

2. Use a pencil and plotter to draw your intended flight path.

3. Start to fill in your navigation log.
   - Start with your departure airport
   - Weather will be added later with the most current information

4. Mark first checkpoint on sectional chart
   - Should be easily identifiable and about 10-15 miles from departure airport
   - Usually coincides with the "Top-of-Climb" (TOC)
     - TOC is where the airplane will reach its cruising altitude
     - Determined by the climb performance calculated from charts in the POH
     - You will mark winds and temperatures for this later with updated information

5. Mark each of your next checkpoints along the route.
    - These should be evenly spaced
    - Should have clearly visible land references
    - Should have a checkpoint every 15-20 miles or so
    - If the checkpoint can be identified by Nav Aids:
        - Mark the name of the Nav Aid and it's frequency
        - Mark cross radials
        - Mark OBS settings
        - Whether it will be a "To" or "From" indication

6. Check communication requirements and write them down.
    - Airspace communication requirements and frequencies
    - Flight service frequencies along the route
    - Make sure you know who you'll be in contact with at all times

7. Mark each altitude you plan to cross your checkpoints.
    - Your altitude should be chosen in regard to the direction you'll be traveling
    - East = odd altitude + 500
    - West = even altitude + 500
    - Other altitude considerations
        - Winds aloft
        - Airspace
        - Duration of flight
        - Performance
        - Terrain
        - Emergencies

Note:
This is called the "Hemispherical Rule" and only applies when flying above 3,000' AGL

8. Use your plotter to mark the true course for each leg.

9. Use your plotter to find the distance between checkpoints and enter the value in the "leg dist." box.

10. Use the chart to find the Magnetic Variation for each leg.

11. List airport information and draw a small diagram.
    - Mark any NOTAMs such as runway closures or taxiway closures
    - Mark the traffic patterns for each airport

Day Of

1. Go to aviationweather.gov and request a “standard briefing.”
2. Use METARs, TAFs, and Winds Aloft to calculate takeoff, climb, en-route and descent performance.
3. Use your gathered weather data to calculate Wind Correction Angles (WCA) and Ground Speed (GS)
    - **Tip:** Winds aloft are given in True Course and in knots. You may need to convert to magnetic course.
4. Use current weather data to determine if the flight can be made safely
    - Consult NOTAMs, TFRs, Area Forecast, Prog Charts, AIRMETs, SIGMETs, Convective SIGMETs, PIREPs *(The MOST accurate of all your resources)*, and TAFs
5. Calculate when/ where TOC will occur and fill in appropriate boxes
    - Ground Speed
    - Time
    - Fuel Burn
    - Magnetic Heading
6. Calculate when/ where Top of Descent (TOD) will occur
7. Using the “Compass Deviation Card” from your specific airplane, calculate your Compass Heading (CH) from your Magnetic Heading (MH)
8. Do your performance sheet and calculate your weight and balance for each leg
9. Finish filling out your Nav Log
    - Groundspeed
    - CH
    - MH
    - Time between waypoints
    - Time en-route
    - Fuel consumption
    - Fuel required
    - Power settings for cruise to set in flight

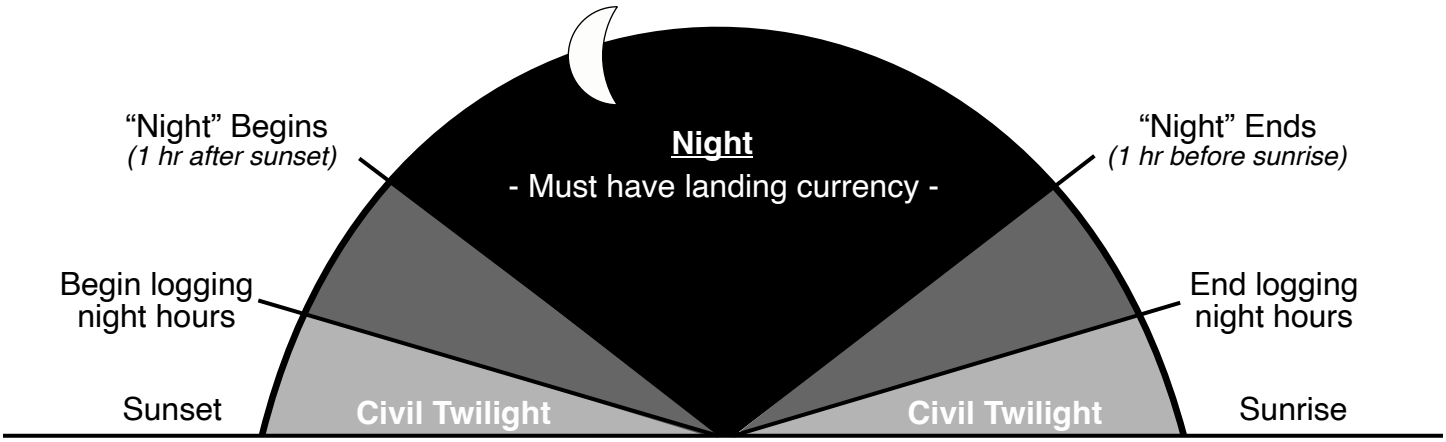
Formulas

- TH = TC +/- WCA
- MH = TH +/- VAR
- CH = MH +/- DEV
- MC = TC +/- VAR

10. Finalize your chart by making the flight plan in color or thick marker and circle your checkpoints.
    - **Tip:** Highlighter works best so that you don’t cover anything up on your sectional chart
11. File your flight plan and obtain a weather briefing
    - Review NOTAMs, TFRs, and all pertinent data

Night Operations

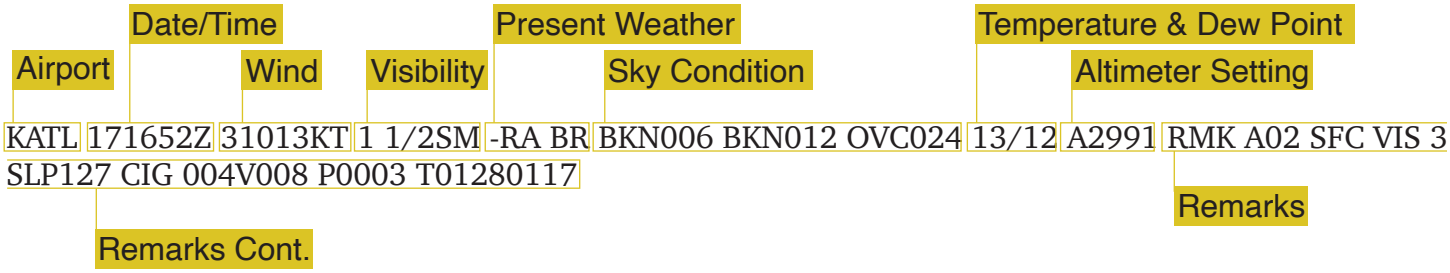
- **Definition of "Night"**
  - The time between the end of evening civil twilight and the beginning of morning civil twilight, as published in the Air Almanac, converted to local time.
- **Definition of "Civil Twilight"**
  - Morning civil twilight begins when the geometric center of the sun is 6 degrees below the horizon and ends at sunrise. Evening civil twilight begins at sunset and ends when the geometric center of the sun reaches 6 degrees below the horizon. Usually between 20-35 minutes after sunset or before sunrise.
- **Definition of "Sunrise and Sunset"**
  - Sunset occurs when the upper edge of the sun - called the "upper limb" - sinks just under the horizon.
  - Sunrise occurs when the upper limb rises just above the horizon.



- **Night Takeoff and Landing Experience** *§ 61.57 (b)*
  - No person may act as PIC carrying passengers during the period of **1 hour after** sunset and ending **1 hour before** sunrise, unless within the preceding **90 days** that person has made:
    - At least **3** takeoffs and **3** landings to a full stop within that time period
    - That person acted as sole manipulator of the flight controls
    - In aircraft of the same category, class, and type
- **Logging Night Flying**
  - You can log night time anytime between the end of evening civil twilight and the beginning of morning civil twilight. Plane must be night VFR equipped.
- **Lighting Rules**
  - From sunset to sunrise position lights and anti-collision lights (if installed) are required to be turned on.

Reading a METAR

- Aviation routine weather reports. These provide snapshots in time of terminal weather.
- Issued every hour, usually :55 - :59 past the hour.

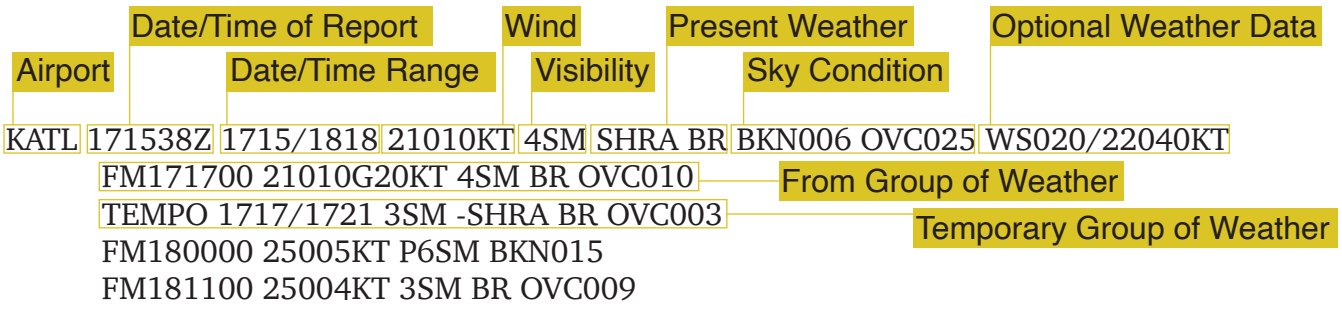


Translated:

- **KATL**
- **17**th of the month at **16:52** Zulu
- Wind is from **310** degrees at **13** knots
- There is **1** ½ statute miles of visibility
- Light rain and mist
- 3 ceiling layers: Broken at **600** ft., Broken at **1,200** ft., and Overcast at **2,400** ft.
- **13** degrees celsius outside temperature and **12** degrees celsius dew point
- Altimeter setting of **29.91** inches of mercury
- ***Remarks***:
    - **A02** - The site is automated and has a precipitation sensor.
    - **SFC VIS 3** - Surface visibility from a predetermined point is **3** statute miles (However, 1 ½ SM is controlling)
    - **SLP127** - Sea Level Pressure in hectopascal. 127 = **1012.7 hPa**
    - **CIG** - Lowest level ceiling layer is **400** ft. but variable to **800** ft.
    - **P0003** - Hourly precipitation amount, **00.03** inches in the last hour
    - "**T**" for temperature (**0** for positive or 1 for negative) **12.8** degrees celsius air temp. / (**0** for positive or 1 for negative) **11.7** degrees celsius dew point

Reading a TAF

- Terminal Aerodrome Forecast
- Expected weather conditions at an airport
- Issued at at least 4 times per day
- Valid for a 24 or 30 hour period



Translated:

- **KATL**
- **17**th of the month at **15:38** Zulu
- Report is from the **17**th at **15:00** Zulu to the **18**th at **18:00** Zulu
- Wind is from **210** degrees at **10** knots
- Visibility is **4** statute miles
- Showering rain and mist
- Ceilings are broken at **600** ft. and overcast at **2,500** ft.
- Low level wind shear at **2,000** ft. from **220** degrees at **40** knots

Weather Change Indications:

- **From** the **17**th at **17:00** Zulu - wind **210** degrees at **10** knots gusting **20** knots, visibility **4** statute miles, mist, cloud layer overcast at **1,000** ft.
- **Temporarily** from the **17**th at **17:00** Zulu to the **17**th at **21:00** Zulu, visibility **3** statute miles, light showering rain and mist, cloud layer overcast at **300** ft.
- **From** the **18**th at **00:00** Zulu - wind **250** degrees at **5** knots, visibility greater than **6** statute miles, cloud layer broken broken at **1,500** ft.
- **From** the **18**th at **11:00** Zulu - wind **250** degrees at **4** knots, visibility **3** statute miles, mist, cloud layer overcast at **900** ft.

Other Codes in a TAF or METAR

Intensity Symbols:

- " - " Light
- "No Sign" Moderate
- " + " Heavy

Precipitation:

- DZ - Drizzle
- IC - Ice Crystals
- RA - Rain
- PL - Ice Pellets
- SN - Snow
- GR - Hail
- SG - Snow Grains
- GS - Small hail/ Snow pellets

Descriptor:

- MI - Shallow
- BL - Blowing
- BC - Patches
- SH - Showers
- PR - Partial
- DR - Drifting
- TS - Thunderstorm
- FZ - Freezing

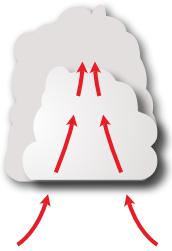
Other:

- SQ - Squall
- FC - Funnel Cloud
- SS - Sandstorm
- +FC - Tornado/Waterspout
- DU - Dust Storm
- PO - Well Developed Dust/Sand Swirls

Obscuration:

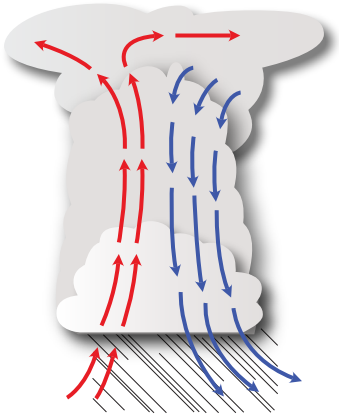
- BR - Mist
- SA - Sand
- FG - Fog
- HZ - Haze
- FU - Smoke
- PY - Spray
- VA - Volcanic Ash
- DU - Widespread Dust

Phases of a Thunderstorm



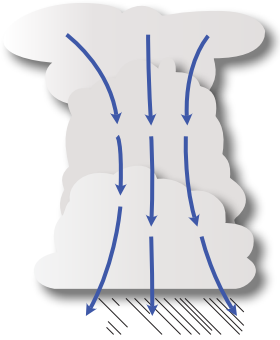
Cumulus

- Air that is warmer than its environment starts to rise.
- As the warm, moist air rises, it cools and condenses to form cumulus clouds.
- Creates strong updrafts.
- If the cloud reaches the freezing level, supercooled water molecules form.



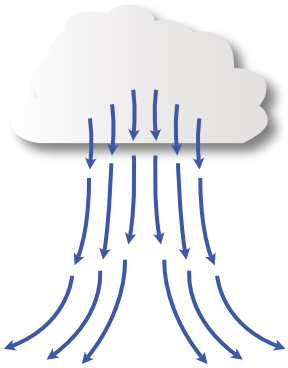
Mature

- Characterized by the presence of both updrafts AND downdrafts.
- The downdrafts cause evaporative cooling.
- When the downdraft hits the ground, it has nowhere to go so it spreads out in all directions.
- Anvil shape forms when water molecules are pushed into the higher parts of the cloud.
- Hail can be formed and intense cloud-to-ground lightning is present.



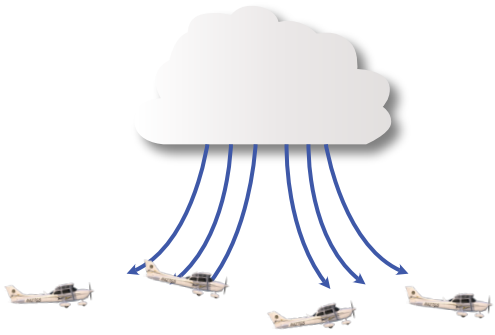
Dissipating

- Downdrafts prominent in this phase.
- Anvil top begins to weaken.
- Towering cumulonimbus clouds turn into wispy, non-threatening clouds.
- Downdrafts of cool air reduce temperature and convection from below.



Microburst

- Localized column of sinking air (downdraft) within a thunderstorm and is usually less than or equal to 2.5 miles in diameter.
- Winds can reach speeds of 100 mph or higher.
- Pilots should avoid these at all costs.



Wind Shear

- A change in wind speed and/or direction over a short distance.
- Causes headwind and tailwind change which quickly alters the flight path of an airplane.
- Most dangerous at low levels near the ground.

Light Gun Signals

	Aircraft on the Ground	Aircraft in Flight	Vehicles and Ground Personnel
Steady Green	Cleared for Takeoff	Cleared to Land	Cleared to cross; Go
Flashing Green	Cleared to Taxi	Return for Landing	N/A
Steady Red	Stop	Give way to other aircraft and continue circling	Stop
Flashing Red	Taxi clear of landing area - or - Runway in use	Airport unsafe DO NOT LAND	Clear the taxiway/runway
Flashing White	Return to starting point on airport	N/A	Return to starting point on airport
Alt. Red and Green	General warning signal exercise extreme caution	General warning signal exercise extreme caution	General warning signal exercise extreme caution

Airport Beacons

Flashing White and Green	Civilian Land Airport
Flashing White and Yellow	Water Airport
Flashing White, Yellow, and Green	Heliport
Two Quick White Flashes One Green Flash	Military Airport

Taxiway/Runway Hold Position

- or -

Runway/Runway Hold Position

Hold short of runway.

Runway Approach Hold Position
Hold short for aircraft on approach.

ILS Critical Area Hold Position
Hold short of ILS Approach critical area.

No Entry
Identifies paved areas where aircraft entry is prohibited.

Taxiway Location
Identifies taxiway on which aircraft is located.

Runway Location
Identifies runway on which aircraft is located.

Runway Distance Remaining
Provides remaining runway length in 1,000 feet increments.

Runway Safety Area Obstacle Free Zone Boundary
Exit boundary of runway protected areas.

ILS Critical Area Boundary
Exit boundary of ILS critical area.

Taxiway Direction
Defines direction & designation of intersecting taxiway(s).

Runway Exit
Defines direction & designation of exit taxiway from runway.

Outbound Destination
Defines directions to takeoff runways.

Inbound Destination
Defines directions for arriving aircraft.

Taxiway Ending Marker
Indicates taxiway does not continue.

Direction Sign Array
Identifies location in conjunction with multiple intersecting taxiways.

Terms and Definitions

A/FD	Airport/ Facility Directory
AAF	Army Airfield
AC	Advisory Circular
ACL	Aeronautical Chart Legend
AD	Airworthiness Directive
ADM	Aeronautical Decision Making
AFB	Air Force Base
AFH	Airplane Flying Handbook
AGL	Above Ground Level
AIM	Aeronautical Information Manual
AIRMET	Airman's Meteorological Information
AME	Aviation Medical Examiner
ATC	Air Traffic Control
ATCO	Air Taxi/ Commercial Operator
AVW	Aviation Weather
AWS	Aviation Weather Service
BHP	Brake Horsepower
CAT	Clear Air Turbulence
CDI	Course Deviation Indicator
CFI	Certificated Flight Instructor
CG	Center of Gravity
ELT	Emergency Locator Transmitter
ETE	Estimated Time En route
FA	Area Forecast
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation
FBO	Fixed-Based Operator
FL Comp	Flight Computer
FSDO	Flight Standards District Office
FSS	Flight Service Station
GPH	Gallons Per Hour

Hg	Mercury
HSI	Horizontal Situation Indicator
IAP	Instrument Approach Procedure
IFH	Instrument Flying Handbook
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IR	Instrument Route
ISA	International Standard Atmosphere
L/D	Lift-to-drag ratio
L/D Max	Maximum Lift-to-drag ratio
Mb	Millibar
MB	Magnetic Bearing
MEF	Maximum Elevation Figure
METAR	Aviation Routine Weather Report
MH	Magnetic Heading
MOA	Military Operations Area
MSL	Mean Sea Level
MTR	Military Training Routes
MVFR	Marginal VFR
NAS	National Airspace System
NM	Nautical Mile
NMAC	Near Midair Collision
NOTAM	Notice To Air Mission
NTSB	National Transportation Safety Board
OAT	Outside Air Temperature
OBS	Omnibearing Selector
PHAK	Pilots Handbook of Aeronautical Knowledge
PIC	Pilot In Command
PIREP	Pilot Weather Report
PPH	Pounds Per Hour

RB	Relative Bearing
RMI	Radio Magnetic Indicator
RNAV	Area Navigation
SD	Radar Weather Report
SFC	Surface
SIGMET	Significant Meteorological Information
SL	Sea Level
SM	Statute Miles
ST	Standard Temperature
SVFR	Special VFR
TACAN	Tactical Air Navigation
TAF	Terminal Aerodrome Forecast
TAS	True Airspeed
TIBS	Telephone Information Briefing Service
UTC	Coordinated Universal Time “Zulu”
VFR	Visual Flight Rules
VHF	Very High Frequency
VOR	VHF Omnidirectional Range
VORTAC	Colocated VOR and TACAN
VOT	VOR test facility
WFO	Weather Forecast Office