# ***HANDY INFORMATION FOR GENERAL AVIATION PILOTS***

10/02/2014 supersedes all previous

-Remember the golden rule: physically flying the aircraft has priority over *every other* task you must do as a pilot

**"If in doubt, fly it out"**

-If you have to make an off airport landing, statics show that HOW you land can be more important than WHERE you land. Do NOT sacrifice control of the aircraft to try and fix a problem when at low altitude. FOCUS on the landing to a complete stop, wherever that might be…

-before you fly remember **"I-M-SAFE"**
**I**llness? **M**edication? **S**tress?
**A**lcohol? **F**atigue? **E**ating?
Check yourself before each flight

-**DECIDE**
**D**etect the need for a decision
**E**valuate your decision options
**C**hoose the option that best meets your goals
**I**mplement that decision
**D**etect the change(s) as a result of your decision
**E**valuate the results and your need to make further decisions

For inspections and currencies – remember the mnemonic "one who **EATS ARROWS**, **P**lease, **P**lease **B**e **C**are **F**u**L"**

-required inspections - **"EATS"**
**E**LT inspection - required every 12 months, requires an entry in the airframe logbook or other retained record for the aircraft. FAR 91.207
**A**nnual inspection - required every 12 months. **100 hour inspections** are required if carrying persons for hire. Flight instruction in an aircraft owned by the student or rental of an aircraft to a private pilot not carrying persons for hire does not require 100 hour inspections. Flight instruction in an aircraft provided by the instructor or the flight school does required 100 hour inspections. FAR 91.409
**T**ransponder inspection - required every 24 months; includes inspection of the altitude-encoding device (if installed). FAR 91.413

**S**tatic system and altimeter inspection - required every 24 months. Required to operate IFR, not required for VFR flight. FAR 91.411

-preflight the paperwork: **"ARROWS"**

**A**irworthiness certificate (FAA form 8100 series)- no expiration date. Must be in the aircraft and displayed near the entrance to the aircraft. FAR 91.203

**R**adio station license - not required for any aircraft operating within the United States. An aircraft must have an FCC station license (FCC form 605, Schedule C – expires every 10 years) and at least one crew member in the aircraft must hold an FCC restricted radiotelephone operator permit (FCC form 753 – does not expire) to use a VHF radio in Canada, Mexico, the Bahamas and British Virgin Islands. Ground based transceivers (UNICOMs, FBOs, etc.) must hold a radio station license. Hand held VHF transceivers do not require a radio station license when used in an aircraft..

**R**egistration certificate (FAA forms 8000 series)- changes with ownership. Must be in the aircraft. Must be renewed every three years.

**O**perating limitations - may be a Pilot's Operating Handbook (POH) for make and model of aircraft (aircraft built before 1976) or an Aircraft Flight Manual (AFM) which is airframe specific and will include any supplemental type certificate information or notes required to operate any additional equipment, such as the autopilot. Some aircraft built before 3/1/79 only require placards posted at specific points in the aircraft instead of an AFM or POH. Must be in the aircraft. FAR 91.9

**W**eight and balance - this is airframe specific and must be the most recent measured or calculated W&B. PIC must prove W&B was calculated for the flight. FAR 91.103

**S**tate registration (some states only – not required in Texas)

- requirement to <u>act</u> as PIC - "**Please, Please Be Careful (P-P-B-CFL)"**

**P**hoto ID – carried when serving as a crew member or CFI - FAR 61.3a(2)

**P**hysical - current & correct class for the type of flying. FAR 61.23
(note: balloon, glider, ultralight and light sport aircraft crewmembers are not require to hold medical certificates)

**B**iennial flight review - completed within the last 24 months. FAR 61.56

**C**urrency - 3 takeoffs & landings if carrying passengers or in a multi crew aircraft. Instrument currency within the last 6 months to file and fly IFR. FAR 61.57

**F**lying endorsements -tailwheel/complex/high performance/high altitude, as required. FAR 61.31

**L**icense - correct category, class and type rating or type specific training for the aircraft to be flown. FAR 61.31

-VOT check points: remember "Cessna 182". Center the OBS needle on the 180 degree bearing with a "to" indication.

-on the runway before takeoff - check your directional gyro with the runway heading. Remember **lights-camera-action -** landing / recognition **lights** on for takeoff, **camera** - transponder on, **action** - mentally review departure instructions and abort procedures. Check engine performance via engine gauges early in the takeoff roll - do not analyze, abort for any abnormal indication.

-50-50 rule – use ½ of the takeoff or landing distance over a 50 foot obstacle and add this to the POH value for the takeoff or landing distance contemplated. Example: You anticipate an obstacle-free approach and landing on a short runway. The POH no obstacle landing distance is 1240 feet. The landing distance over a 50-foot obstacle is 1650 feet. Take ½ X 1650 = 825 feet + 1240 feet = 2065 feet. Consider this your minimum runway length – allows for unforeseen factors.

-70-50 rule for short field takeoffs - you must attain 70% of your fly off speed by 50% of the runway length. If not, abort the takeoff

-rule of 60 - 1 degree of arc equals 1NM at a distance of 60 NM

-reciprocal headings - add 200, subtract 20 / subtract 20, add 200

-know your speed in miles per minute:
60 KGS = 1 mile / minute  180 KGS = 3 miles / minute
120 KGS = 2 miles/minute  240 KGS = 4 miles / minute
you may interpolate between these values

-cross winds - winds 10 degrees off runway heading – divide velocity by 5 for direct X/W velocity. Winds 20 degrees off runway heading – divide by 3. Winds 30 degrees off runway heading – divide by 2. A wind 45 degrees to the runway heading has a direct X/W velocity equal to ¾ of the total wind velocity. Wind gusts – you may practically use a value of ½ of the gust value to estimate wind velocity. Example – a wind of 15 knots gusting to 25 knots – this is 25-15 = 10 knots. ½ this value is 5 knots + 15 knots steady state wind = 20 knot wind.

-an approximate conversion from Celsius to Fahrenheit - double the Celsius value and add 30. 15 Celsius equals 59 Fahrenheit: 15 Celsius X 2 = 30 + 30 equals 60 Fahrenheit. Note this is only an approximation. A more accurate method - double the Celsius value, subtract 10% of this and add 32. 15 Celsius X 2 = 30 - 10% = 30 - 3 = 27 + 32 = 59 Fahrenheit.

-the difference between your IAS and TAS is approximately 2% of your IAS times your pressure altitude. 120 KIAS at 6,000 pressure altitude - 120 x 2% = 2.4 x 6 = 14.4 + 120 = 134.4 KTAS.

-if the wind aloft is 10% of your TAS, you need a 4 degree drift correction angle for a wind 45 degrees to your nose or tail. You need a 6 degree drift correction angle for a wind 90 degrees to your nose or tail.

-standard rate turn: use a bank angle equal to 15 % of your TAS. 120 KTAS x .15 = 18 degrees of bank.

-enroute descents: for a 500 FPM descent, double your altitude and begin descent that many minutes from destination. Cruising at 6000 AGL, begin descending at 500 FPM when 12 minutes from destination (6 x 2 = 12).

**-"pitch + power = performance"** determine and learn power settings and pitch angles for each phase of flight - climb / cruise / descent / maneuvering / landing.

**-"time, turn, tune, throttle, talk"** passing any checkpoint consider:
time - start clock timing?
turn - to next required heading
tune - new com or nav frequency, GPS waypoint change?
throttle - reset power and pitch angle to climb or descend?
talk - (or listen) to ATC / UNICOM / CTAF / ATIS / AWOS / EFAS
perform these tasks in this sequence.

# Fuel Tips

The rules (FAR 91.151) require you PLAN to land with a minimum of 45 minutes fuel remaining at night, 30 minutes fuel remaining day, 20 minutes fuel remaining for helicopters.

-Fixed wing accident statistics show running out of fuel and fuel mismanagement (fuel onboard but not routed to the engine) are significant factors. Therefore, increased awareness planning may prevent unknown or unplanned circumstances causing a fuel emergency. Consider the following as a sample personal standard for fuel management:

- ✓ Plan to land with **1 ½ hours fuel** on board for flights beyond the traffic pattern but when maximum range is not necessary (local area flights; short cross countries). Refuel as necessary to insure this reserve.

- ✓ Plan to land with **1 hours fuel** remaining for long cross country flights.

- ✓ Only plan to land with **45 minutes fuel** on daytime cross country flights when the weather is well above VFR minimums and you have one or more alternate landing sites along your route of flight, you are

experienced in the aircraft, and you know the accuracy of the fuel indicators in THAT aircraft.

- ✓ Always on-load the maximum amount of fuel your aircraft can legally carry, considering weight and balance and performance needs. The price of fuel at any given location must not influence your decision to limit fuel.

-fuel usage: remember **time in your tanks** - when flight planning, the most significant element is the time aloft, *not* trip length. Regardless of the distance traveled, find a suitable airport when you have flown the time out.

-**fuel management:** feed the right fuel tank when the minute hand of the clock is between 12 and 6. Feed the left fuel tank when the minute hand is between 6 and 12.

-fuel awareness: when topping the fuel tanks, estimate the number of gallons you will take on. If the actual fuel load varies by 10% or more than your estimate, investigate.

-visually inspect the fuel in the aircraft *every* time you fly. Look in the tanks, measure the quantity with a dip stick (available from pilot shops) or learn to accurately visually estimate the fuel in the tank. Check the condition of the fuel caps and seals. If you get water or other contaminates, continue to drain until the fuel is pure. Check all drain valves are closed and not leaking.

-the most reliable field method to check for jet fuel or other contamination in avgas is to take a piece of white bond paper, drizzle a few drops of fuel onto the paper, allow to air dry. ANY stain, ring, or discoloration indicates jet fuel or other contamination. NOTE: some auto fuel additives will cause a stain.

-100 Low Lead avgas is blue. Avgas mixed with any other fuel grade, such as auto fuel or jet fuel, will result in a yellow-to-straw color.

-fuel planning: you may allow ½ gallon of consumption for each engine cylinder for start, taxi out, run up, and takeoff roll. For most 4 cylinder aircraft, allow 2 gallons for STTO (start, taxi, takeoff).

-fuel systems: Study the fuel system in your aircraft. Know the *usable* fuel load. Often you can not use all the fuel in the tanks. Do not solely rely on the fuel gauges. General aviation aircraft fuel gauges are not required to read accurately until empty - many older gauges are very inaccurate between full and near empty.

**Auto Fuel and Aircraft:** You may use auto fuel in an aircraft under certain conditions. The aircraft must have a Supplemental Type Certificate (STC) issued to THAT particular aircraft or the aircraft must be licensed in a category, such as

experimental, amateur built, in which case FAA issued STCs are not required. Some good practices on the use of auto fuel:

The owner or operator of the aircraft is responsible for the correct fuel use.

Read and know the requirements of the STC. Typically, you must only use auto fuel that meets ASTM (American Society for Testing Materials) requirement D-4814. Major name brand fuels meet this requirement. Call the fuels supplier to confirm. If you hold an STC issued by the EAA, you may review the STC requirements by viewing www.eaa.org/ or www.autofuelstc.com/ if the STC is issued by Petersen Aviation.

If you refuel from other-than airport fueling systems (such as hand containers or vehicle or trailer mounted containers), follow safety codes and procedures. Be aware that publically owned airports may charge a flowage fee on fuel you bring onto the airport.

Auto fuel is less stable than 100LL. Additives in the fuel can settle out and cause gum deposits in the fuel system. Purchase auto fuel from a high volume supplier just before you intend to use it. Auto fuels vary in composition and some fuels are more stable than others. As a rule of thumb, do not store auto fuel more than 6 months before use.

Reformulated Gasoline (RFG). Certain high density areas in the USA must sell only RFG. Reformulated gasoline burns with a lower pollutant level, but there are consequences. The specific power of RFG is lower that non RFG gasoline. You must comply with the specifics of your STC as to fuel grade, type, & content. You may purchase a vapor pressure tester (Hodges Volatility Tester) and / or an alcohol tester from Petersen Aviation at 984 K Road, Minden, Nebraska 68959 phone 308/832-2200, fax 308/832-2311, or see www.autofuelstc.com/. More information is available in FAA Special Airworthiness Information Bulletin CE-07-06, Alcohol (ethanol or methanol) present in the automobile gasoline on any General Aviation airplane (10/27/06).

Auto fuel will vaporize more easily than 100LL fuel. Auto fuel allows easier starting in cold weather but is more susceptible to fuel system vapor lock. Follow the specific guidance in your STC. Note that most auto fuel sold in the colder climate areas is more volatile to promote cold starting. Use caution when using cold climate auto fuel in a hot climate area, particularly during takeoff, climb out, descent and landing. If you do not have specific STC guidance, such as in experimental aircraft, consider reserving one fuel tank for 100LL fuel only for these flight profiles.

You may mix auto fuel and 100LL fuel on subsequent refueling.

# Airport and Aircraft Security

Call **1-866-GA-SECUR**(E) or 1-866-427-3287 to report any security breech or suspected security breech on an airport. Call local authorities, such as municipal or airport police or county sheriff if time is of the essence, before you call GA SECURE. See www.aopa.org select AOPA's Airport Watch.

If you are seeking your initial pilot rating, instrument rating, or multiengine rating you are required by federal law to show the flight school or independent flight instructor proof of your citizenship. Your current passport or birth certificate and a current government issued photo ID are required.

If you are not a US citizen and seek the above initial ratings then you must go through a clearance process with the Transportation Security Administration (TSA) before any training. See www.flightschoolcandidates.gov (Title 49, Code of Federal Regulations, Part 1552).

# The Airspace System

The airspace system in the USA is the result of a series of adjustments that have taken place over many years. The airspace is a compromise to meet the needs of the user, the requirements of the air traffic control system, and the definitions of the International Civil Aviation Organization (ICAO). Very broadly, the US airspace system is divided into controlled and uncontrolled airspace. A "working definition" can be as follows:

**controlled airspace** - airspace in which ATC may *legally* provide sequencing, separation, or other services to aircraft.

**uncontrolled airspace** - ATC may *not* normally provide services as above.

In both of these cases, there are degrees of flexibility. Different ATC facilities around the USA provide different degrees of service, particularly in respect to uncontrolled airspace. An example of one common scenario that may cause confusion is: an IFR arrival at an airport in class G airspace. ATC will terminate radar service prior to landing, however this IFR flight remains on a procedural IFR clearance until the flight plan is closed or cancelled.

This concept is important because it is the main reason we have surface based controlled airspace (class B, C, D, E surface areas) the Continental Control Area (class E airspace above 14, 500 'MSL) transition zones (class E airspace starting

at 700 ‘AGL) and keyway extensions to surface area airports with instrument approaches. A key point: aircraft carrying people for hire (such as FAR 135 / 121 operations) must remain in controlled airspace from takeoff to landing or hold a waiver from the FAA for this requirement. If you study the way the US airspace system is organized with the idea in mind that controlled airspace is mainly there to accommodate air carriers, the structure of controlled airspace makes more sense.

If you call for ATC services while you are in provide services. For example: ATC - *“Cessna 1234ME, climb to 4000, squawk 4546, enter controlled airspace heading 260.”* This may at first appear as if ATC is providing services while you are in class G airspace. In fact, ATC anticipates you to climb into controlled airspace (class B, C, D, or E) and then abide by any additional instructions given (“enter... heading 260”). ATC will not refuse to provide radar service, but will place you in controlled airspace so they may provide radar service.

A comment about airspace altitudes:
**Most** (but not all) **FAR’s regulating airspace** are **written reference to AGL**.
**Altitudes displayed** on **aviation charts are MSL** unless noted otherwise.

The following can help learn the letter designations:

## **Class A** - **a**ll **a**bove (18,000’ MSL to FL 600)

All aircraft must have an IFR clearance. Soaring aircraft and other special cases may open temporary VFR windows in class A airspace. Additionally, some MOAs extend into class A airspace by letter of agreement between the military and ATC.

## **Class B** - **b**iggest and **b**usiest airports

An inverted “wedding cake” starting at the surface around the primary airport(s) and going to (usually) 10,000’ AGL. All aircraft, IFR or VFR, must have a clearance to enter and will receive positive separation and sequencing from other aircraft. The minimum weather in class B airspace when you are VFR is 3 SM visibility and clear of clouds. Speed is limited to 250 KIAS in class B airspace; 200 KIAS in VFR corridors through class B airspace or class D, E, or G airspace directly under class B airspace. ATC may waiver any of these speeds on a selective basis.
Note: **VFR aircraft** entering **class B, class C, or class D** airspace may **fly any heading and altitude** unless a heading / altitude is assigned by ATC. If ATC does assign a heading / altitude / speed, **you must then comply**. You may wish to inform ATC you are changing heading / altitude, but you are not required to do so unless these are specifically assigned by ATC or you are requested to inform ATC of any heading / altitude change.

## **Class C** - **c**ommon **c**ommercial airports

An inverted “wedding cake” with the inner ring a 5 NM radius from the primary airport, surface to 4,000” AGL. The outer concentric ring is from 5 NM to 10 NM from the primary airport, 1, 200’ AGL to 4,000’ AGL referenced to the elevation at the primary airport. You must only communicate with ATC to enter class C airspace. You must be acknowledged by call sign or N number and not specifically denied entry. For example: *“Cessna 1234ME, standby”.* If you (N1234ME) receive this reply from ATC as you call to enter, this does constitute communication with ATC and you may enter the class C airspace. On the other hand - *“Cessna 1234ME (or all aircraft on this frequency) remain clear of the class C airspace”.* You (as N1234ME) must remain clear of the class C airspace until otherwise authorized by ATC to enter. Only IFR aircraft will receive separation and sequencing. VFR aircraft will be sequenced for landing and will receive separation from other aircraft as ATC’s work load permits.
**Outer area -** from 10 NM to (usually) 20 NM concentric to the class C airspace. The approach control for the class C airspace will handle all participating traffic within this (outer area) class E airspace. This arrangement is done through a letter of agreement with the adjacent Air Route Traffic Control Center (“ARTCC”). Additionally, although not designated as part of the outer area, the airspace directly above the class C airspace to (usually) 10,000 ‘ AGL is handled by the class C airspace approach control on letter of agreement with ARTCC. In effect, this makes the working airspace for the class C approach control out to 20 NM and up to 10,000’ AGL. The difference is, when you are VFR in this outer area or above the class C airspace, you need not talk to approach control, but you may. If you are within the class C airspace, you must talk to approach control and not be denied entry into the class C airspace.

Consider the following: to **enter class B** airspace, you must receive a specific **clearance to enter from ATC.**

To enter **class C airspace**, you must only communicate with ATC and not receive a **clearance limit <u>not</u> to enter from ATC.**

## **Class D** - **d**ialogue required with the control tower

The requirement to enter class D airspace is similar to class C airspace. You must be acknowledged by call sign and not specifically denied entry into the class D airspace. The tower controller will not provide radar service and is only responsible to visually sequence aircraft for takeoff and landing. The control tower must be open for the class D airspace to be in effect. When the control tower is closed, this becomes class E airspace. If the keyway extension for the class D airspace is a blue dotted line on the sectional map, this is class D airspace. If the keyway only is magenta, this is class E airspace; you may enter

the keyway without necessarily communicating with the tower. The class D airspace and the keyway are controlled airspace; you must meet cloud clearances and visibility for such or obtain a special VFR clearance / IFR flight plan to enter.

## **Class E** - **E**very other controlled airspace

This is general controlled airspace starting at 700' AGL, 1,200' AGL, or as otherwise marked. All airspace is class E starting at 14,500' MSL (exception: if you are 1,500' AGL or less and at 14,500' MSL or higher, you remain in class G airspace). Currently, certain portions of northern Michigan, a portion of the big bend area of Texas, Alaska, and some areas in the western USA only have class E airspace below 14,500' MSL along airways and in the vicinity of air carrier airports. This structuring is a clue to the basic purpose for general controlled class E airspace. You may consider class E airspace as two varieties: **class E aloft** and **class E surface areas.** Class E airspace aloft starts at (generally) 700' AGL, 1,200' AGL, or as otherwise marked. Terminal radar service areas, **TRSAs**, are class E aloft airspace. Radar coverage is provided, but participation is optional. TRSAs surround class D airspace. ATC may provide radar service all the way down to an airport within a class E surface area. A key difference between class E airspace at the surface and aloft is, you may ask for and receive a **special VFR** clearance in a class E (as well class B, C, and D) surface area, but may not operate special VFR in controlled airspace that does not start at the surface. However, while in controlled airspace aloft, you may request and receive clearance to enter surface based controlled air space.

## **Class G** - **g**eneral, uncontrolled airspace

Any airspace not otherwise classified as controlled airspace. Mostly the airspace below 700' AGL, 1,200' AGL, or as otherwise marked. Additionally, if you are at or above 14,500' MSL and within 1,500' AGL, you are in class G airspace. Notice that on sectional charts class G airspace is not specifically marked, but is implied below 700' AGL (magenta tint) or 1,200' AGL (beyond the magenta tint). When class G airspace extends above 1,200' AGL, a blue tint will be used to mark this from the area where class G airspace stops at 1,200' AGL. Class G airspace is uncontrolled in the sense that ATC may not legally provide sequencing or separation services. However, all of the rules within FAR 91 and other pertinent regulation apply equally in uncontrolled as well as controlled airspace. Controlled airspace is defined in FAR part 1 as "airspace of defined dimensions within which air traffic control service is provided to IFR flights and VFR flights in accordance with the airspace classification". ATC handbook 7110.65 defines uncontrolled airspace as..."airspace in which ATC has neither the authority nor responsibility for exercising control over air traffic."

**Airspace hierarchy** - when two or more classes of airspace seem to overlap, the following rules apply: class A airspace preempts all other airspace/ class B preempts C, D, E, G / class C preempts D, E, G / class D preempts E and G / class E preempts G. In no case may two classes occupy the same airspace at the same time. The same airspace may change class, but may represent only one class of airspace at a time.

# Special Use Airspace (SUA)

Special use airspace is controlled by various agencies of the federal government and imposes varying limits on flight therein by civil aircraft. When you are IFR, ATC assumes responsibility to keep you clear of any SUA.

**Prohibited areas** - marked on Sectional, ONC, WAC, and low IFR charts. No flight into prohibited areas except for those flights specific to the purpose the prohibited area was established. Prohibited areas are almost always continuous and are not released to the adjoining FAA ARTCC. Do not enter prohibited areas.

**Restricted areas** - marked on charts as above. The controlling agency may or may not release restricted areas to ARTCC. Review the legend on the sectional chart, NACO low IFR charts or on the map adjacent to the SUA on Jeppesen low IFR charts. Note many restricted areas are active intermittently. You may ask ARTCC if the restricted area is "hot" (active) or "cold" (inactive). If inactive, you may fly through the area. Restricted areas noted as "no a/g" (no air to ground communications) are not released to ARTCC and must be considered "hot" at all times.

**Alert areas** - marked as above. Areas of (usually) intense military activity, such as student pilot training. No restriction to operate through these areas VFR. ATC usually does not monitor specific activity in these areas.

**Warning areas** - marked as above. These are outside the 3 NM limit of U.S. airspace. They are over water areas wherein activity may be as sever as restricted areas, alert areas, or MOAs. No restriction to operate in these areas VFR. Check with ATC before entering; they usually are aware of activity in these areas. Note: some (but not all) warning areas have military controllers know as Fleet Area Control and Surveillance Facilities (FACSFAC) that monitor the warning areas. Ask flight service or ARTCC for a VHF frequency for a specific warning area.

**Military Operating Areas (MOAs)** -marked as above. MOAs are designated for military training. All MOAs top out at 18,000 feet MSL. Some MOAs do extend up into class A airspace on letter of agreement between the military and ATC. There

is no restriction to operate in MOAs VFR. IFR traffic may be routed through MOAs on request if separation standards can be guaranteed. Usually you must request a direct off airways clearance to proceed through a MOA when you are IFR. Call ARTCC, ask for activity in the MOA. All military operations in MOAs are IFR and must talk to ARTCC while in the MOA.

**Temporary Flight Restrictions** – are established by NOTAM and authorized by FAR 91.137 through 91.145 (see). The area of coverage of a few select TFRs is shown on aeronautical charts and all TFRs are activated and designated by FDC NOTAM. Information on TFRs is available from Flight Service (ASK for any TFRs in the vicinity of your flight), via DUATS, or <http://tfr.faa.gov> This FAA site updates frequently and has both maps and texts. Note that a charted Prohibited or Restricted area may be temporarily enlarged in width and height by a TFR.

**National Security Areas -** NSAs vary in size; they are at locations where there is a requirement for increased security and safety of ground facilities. You are requested to voluntarily avoid flying through the depicted NSA. NSAs may become TFRs by FDC NOTAM. NSAs are marked on sectional charts with dashed magenta lines and are accompanied by text of dimensions and / or height limitations.

**D.C. special Rules Area** – FAR 91.161 (see) requires one time training for pilots operating VFR within 60 NM of the DCA VOR/DME. This VOR is located at the Regan National airport (KDCA). This one time training is available at www.faasafety.gov (Activities, Courses & Seminars).

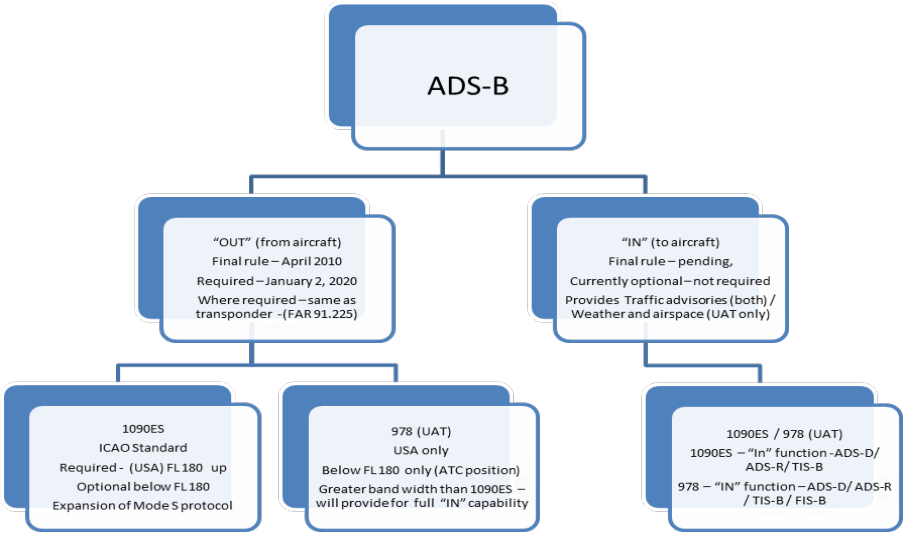
**Controlled firing areas** - generally unmarked military areas used for limited ground to ground shooting practice. A ground observer will cease firing operations if an aircraft enters the area. These areas are mostly small firing ranges. They are not marked on aviation charts.

**Military training routes (MTRs)** - low flying routes used by military aircraft for training. MTRs are marked on sectional and NACO low altitude IFR charts. Military aircraft operate at speeds up to 600 knots TAS and at altitudes between 100' AGL to usually not higher than 1,500' AGL. Routes labeled "IR" may be flown IMC and VMC on an IFR flight plan. VR routes may be flown VMC only. Military aircraft entering MTRs will advise flight service of their point of entry, time of entry, speed, height, estimated time and point of exit just prior to entry in an MTR. You may call flight service to inquire if any aircraft are flying along a particular MTR. Additionally, there are low speed, low level routes used by some (mostly training) military aircraft. These routes are only flown VMC and speeds do not exceed 250 k indicated. These low speed MTRs are not marked on aviation charts.

# Next Generation ATC (NextGen)

NextGen is several development programs to modernize the ATC system. For pilots the most important is the Automatic Dependent Surveillance and Broadcast (ADS-B) system. The ADS−B system is composed of aircraft avionics and ground infrastructure. Onboard avionics determine the position of the aircraft by using IFR WAAS GPS and transmit this position along with additional information about the aircraft to ground stations for use by ATC and other ADS−B services. This information is transmitted at a rate of approximately once per second. ADS-B OUT is the aircraft transmitting its position to ATC and other aircraft. ADS-B IN is data link from the ground or other traffic to the aircraft. ADS-B OUT supplies ATC with the aircraft's ID, position, speed, heading, and vertical velocity similar to radar. ADS-B IN provides three sources of aircraft traffic and one source of flight information such as weather, NOTAMs, and special use airspace.

OUT and IN are referred to as <u>functions</u> in this document. Either of these functions can be accomplished by one of two available frequencies as the carrier wave. These frequencies and associated equipment, 1090 Extended Squitter (1090ES) and 978 Universal Access Transceiver (978 UAT) are referred to as <u>protocols</u> in this document:

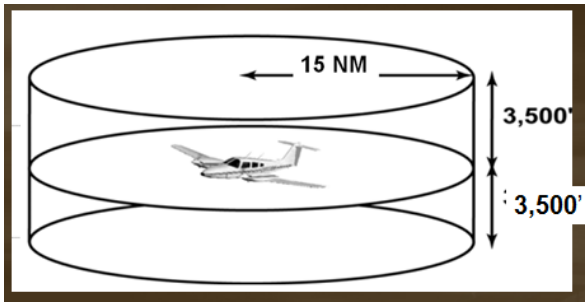



Note that the OUT function is required by FAR 91.225 on 1/2/2020. This means as a minimum you must be capable of transmitting a position derived from a WAAS enabled IFR certified GPS to ATC using either protocol. The 1090ES protocol is required in class A airspace or outside of the USA at any altitude. The IN function is not required by FAR, however IN will provide traffic near your aircraft by three methods:

**ADS-Direct -** If you have at least the receive capability (IN function) using either protocol then you may display in your cockpit traffic within line of sight range that is transmitting (OUT function) using the same protocol as your IN function.

**ADS-Rebroadcast –** If you have at least the receive capability (IN function) using either protocol then you may display in your cockpit traffic that is transmitting (OUT function) on the protocol opposite to your receive protocol (i.e. you receive 978, traffic transmits 1090 or vice-versa). This is by means of an immediate retransmission by an FAA operated remote ground site. These ground sites relay aircraft OUT information to ATC as well as IN information back up to aircraft. Ground sites will rebroadcast aircraft positional information on opposite protocol (i.e. 1090 is rebroadcast as 978 and 978 is rebroadcast as 1090). Note that the OUT aircraft and your IN aircraft must be within line of sight and in range of the same ground site for ADS-Rebroadcast to work.

**Traffic Information Services-Broadcast (TIS-B) –** TIS-B lets you display in your cockpit the same radar traffic picture ATC sees. TIS-B should not be confused with TIS, which is the original display of traffic in the cockpit using only mode S transponder information. You must be both OUT and IN equipped using either protocol to see a relevant traffic picture. To create a valid traffic area for your aircraft, you must first query ("ping") an FAA ground site with your OUT function which includes your aircraft ID. This ground site will then display only that traffic which is within the area show in this diagram:




Note your aircraft is always centered on this "wheel of cheese" shaped airspace that moves with your aircraft. If you have the IN function only (no OUT capability) you will see random traffic based any other OUT / IN aircraft in range. This random traffic you see will NOT be based on your position in the sky but the position of other OUT / IN aircraft near you. To receive a useful and complete traffic picture via TIS-B, you need both the OUT and IN functions, using either protocol.

**Flight Information Services-Broadcast (FIS-B) –** Aircraft equipped with the IN protocol operating on 978 MHz may display in the cockpit weather and airspace products at no cost. Note FIS-B is only available to the 978 protocol. The following products are data linked to aircraft using the IN protocol on 978.

Aviation Routine Weather Reports (METARs).
Special Aviation Reports (SPECIs).
Terminal Area Forecasts (TAFs) and their amendments.
NEXRAD (regional and CONUS) precipitation maps.
Notice to Airmen (NOTAM) Distant and Flight Data Center.
Airmen's Meteorological Conditions (AIRMET).
Significant Meteorological Conditions (SIGMET) and Convective SIGMET.
Status of Special Use Airspace (SUA).
Temporary Flight Restrictions (TFRs).
Winds and Temperatures Aloft.
Pilot Reports (PIREPS).
TIS-B service status.

# Weather Minimums for VFR Flight (FAR 91.155)

Note: student pilots have different minimums. See FAR 61.89 (a) (6) (7). Sport Pilots or any licensed pilot operating to Sport Pilot limits have different minimums. See FAR 61.315 (c) (12) and (13).

Basic VFR in controlled airspace below 10,000' MSL is 3 SM visibility and your aircraft 1,000' above, 500' below, 2000' horizontal from clouds. Additionally, within **surface based controlled airspace, you must have at least a 1,000' ceiling.**

Remember **"3 Cessna 152s"** or **3-152**: **3** statue miles visibility and cloud clearance of **1,**000' above, **5**00' below, and **2,**000' horizontal.

Basic VFR in controlled airspace above 10,000' MSL is 5 statue miles visibility and 1,000' above, 1,000' below, and 1 sm horizontal from clouds.

Remember **"5 F-111's"**: **F**lying above 10,000'MSL, **5** statue miles visibility and **1**,000' above, **1**,000'below and **1** sm horizontal from clouds.

The above requirements apply specifically to:

Class A air space: all aircraft are on an IFR flight plan, the requirements for cloud clearance and visibility do not apply. Exception: gliders, balloons, and other aircraft with prior permission may enter a specific window in class A airspace VFR while communicating with ATC. In this case, these aircraft must maintain cloud clearances and visibility for controlled airspace above 10,000' MSL.

Class B air space: 3 SM and clear of clouds. All traffic, VFR or IFR, in class B air space receives sequencing and separation service from ATC. Thus, you need

not maintain a minimum distance from clouds to have time to see other traffic, ATC is providing separation services. However, you are always the final authority for collision avoidance when you are in clear air, VFR or IFR, in any air space.

Class C and class E air space below 10,000' MSL: 3 SM and 1000' above, 500' below, 2000' horizontal

Class E air space at or above 10,000' MSL: 5 sm and 1000' above, 1000' below, 1 SM horizontal

(Note: the following applies to all aircraft except helicopters)

Class G airspace **within 1200'** of the surface: **day:** 1 SM and clear of clouds. **Night:** 3 SM and 1000' above, 500' below, 2000' horizontal.

Class G airspace **above 1200'** AGL and **below 10,000'** MSL (both conditions must be met): 1 SM and 1000' above, 500' below, 2000' horizontal.

Class G airspace **above 1200'**AGL and **at or above 10,000'** MSL (both conditions must be met): 5 SM and 1000' above, 1000' below, 1 SM horizontal.

**In summary** Fixed wing: you are legal VFR with 1 SM visibility and clear of clouds only when 1200' AGL or less in class G airspace, day time, or night time only when within ½ mile of a runway. Rotary wing: ½ SM daytime, 1 SM nighttime unless within ½ SM of the runway / helipad, then ½ SM visibility OK (effective 4/22/2015).

**Special VFR: (FAR 91.157)** Case by case permission to operate in surface based controlled air space when the weather is below VFR minimums. Some class B and class C air space prohibit special VFR for fixed wing aircraft. Refer to the airport / facility directory and on sectional charts, look for the term "NO SVFR" near the primary airport. You must be at least a private pilot to receive special VFR. You may request and receive a special VFR clearance immediately before entering or immediately before taking off from within surface based controlled air space. ATC will not offer special VFR, you must ask for it. ATC will not issue a specific altitude but may require you to remain below or above a given altitude. You are responsible for terrain clearance per FAR 91.119 (see). Example: *"Cessna 1234ME is cleared out of the class C air space. Maintain special VFR. Maintain at or below 3000 until clear of the class C airspace."*

**Special VFR flights** to/from **non towered airports** that have ASOS or AWOS weather reporting should advise the controlling ATC agency they have "one minute weather" and state their intentions prior to operations in controlled airspace. Notice that special VFR may only be used in controlled air space that is surface based. **You may not operate special VFR in any controlled airspace**

**that does not start at the surface**. You must exit the surface based controlled air space into class G airspace and have 1 SM visibility and clear of clouds (fixed wing) or request and receive an IFR clearance, or meet the weather minimums for controlled airspace aloft. Also note that you may operate special VFR **within the lateral boundaries of surfaced based controlled air space up to 10,000' MSL**, even if the upper limit of the surface based air space stops below 10,000' MSL.

**Day: 1 SM** visibility (reported ground visibility, if available. Otherwise, flight visibility) and **clear of clouds.**

**Night: 1 SM** visibility and **clear of clouds.** The PIC must be **instrument rated** and current; the aircraft must be **instrument capable** and current**.**

# Weather for Flight

FAR 91.103 states the pilot in command is required to become familiar with all available information, including weather and forecasts, when IFR or flying beyond the vicinity of an airport. The nature of flight is such that no single guideline easily applies concerning how much weather information you should have and how good (or poor) weather conditions will affect your flight. The following are proven methods to safe flying concerning weather.

**Check the weather before <u>every</u> flight. Check the weather on each leg of a trip and in flight as often as necessary.**

A local flight in the vicinity of an airport may need nothing more than a considered visual scan of the sky and check of the wind sock. This often is an adequate weather briefing for the type of flying contemplated. Other flights deserve a more formal weather briefing. Think of weather for aviation as a cycle - you start with an overview (big picture) <u>before</u> a decision to go, receive a formal briefing of detailed information to permit a final go/ no-go decision; acquire updates in flight to permit a timely decision to continue to destination, divert enroute, or reverse course and return to the point of departure. Finally, you consider actual versus forecast weather encountered during flight to complete the cycle.

**The National Weather Service (NWS) and the FAA:** The NWS is responsible for weather products for flight. The FAA is charged with disseminating weather products via Flight Service Stations (FSS), Aviation Weather Observation Systems (AWOS), Aviation Surface Observation Systems (ASOS), Automatic

Terminal Information Services (ATIS), Enroute Flight Advisory Service (EFAS or "flight watch"), and other outlets. FSS and EFAS specialists are trained by the NWS to make short period forecasts. Otherwise, all weather *forecasting* is a direct function of the NWS. Direct User Access Terminal (DUAT) is contracted to private companies directly by the Department of Transportation.

## THE BIG PICTURE ----FORMAL BRIEFING ----UPDATES

| | | |
|---|---|---|
| Weather Channel | *DUAT standard briefing | *EFAS (122.0) |
| Internet wx sites | *private aviation weather | *ARTCC |
| *FSS outlook briefing | service briefing | PIREPS |
| *Private service wx maps | *AFSS phone briefing | AIRMET/SIGMET |
| *DUAT maps | | AWOS/ASOS/ATIS |
| Aviation Digital Data Service | | Inflight link (XM / FIS-B) |

The above lists are the most common ways to complete the weather cycle for each flight. The steps marked * will establish a record by N number that you have received weather information.

**The Big Picture** - You must know what major weather fronts are affecting the continent and your area before you can appreciate a formal briefing. You will receive a weather synopsis as part of a National Weather Service (NWS) standard briefing; however a textual description of the major weather fronts is difficult to visualize. You should seek a visual depiction of the major fronts at the surface *and aloft* to gain a firm grasp of what weather features will affect you. The Aviation Digital Data Service (ADDS) http://adds.aviationweather.noaa.gov/ is an excellent source here. Ideally, you may start a review of the big picture 24 hours prior, but you should also review this again within 8 hours of the proposed take off time.

**Formal Briefing** - If you get a telephone briefing from FSS, tell the briefer the following up front: your call sign / IFR or VFR / departure airport / destination airport / departure time / route of flight / initial altitude / time en route. If you are a student pilot, so state. The FSS specialists will provide you a standard briefing in the following sequence: adverse conditions (AIRMETS and SIGMETS and other severe weather warnings) / VFR flight not recommended if, in the briefer's judgment, the weather is such / synopsis of the "big picture" affecting weather for your route of flight / current conditions / en route forecast / destination forecast / winds aloft / NOTAMs / ATC delays (if any). If you receive a Direct User Access Terminal (**DUAT**) briefing**:** This federally funded program currently has two providers - CSC (www.duats.com) and DTC (www.duat.com). DUAT will provide a FAA approved briefing and is retained to establish that you received a weather briefing prior to flight. Either the FSS or DUAT will ask you if you want a **standard**, **abbreviated**, or **outlook** briefing.

**Standard briefing** - the most complete briefing. You will receive, in sequence, those items listed above.

**Abbreviated briefing** - You will receive only those weather reports you ask for. The abbreviated briefing is intended as an update to follow a previous standard briefing.

**Outlook briefing** - You will receive a forecast of conditions beyond 6 hours of the time of briefing. The outlook briefing is best used as a big picture tool before you receive your standard briefing.

**Updates** - Update briefings are received inflight or at intermediate stops on a cross-country. Inflight, contact EFAS on 122.0 (below 18,000 '). When should you update? Every time the weather is not as forecast enroute; any time you need to make a weather related decision about the progress of your flight, each time you approach a cross country destination (approximately one hour from destination), and as many times as necessary to have a full understanding of the weather picture and what the weather will do in the short term.

**Weather Data Link** – You may receive data linked weather in the cockpit. Systems are either transmitted from ground stations from FAA contractors (FIS-B) or from satellites. XM Corp. provides XM WX through vendors to several receiver options, along with other satellite private service vendors. See www.xmwxweather.com/aviat

**Automatic Dependent Surveillance and Broadcast (ADSB) Weather –** Flight Information Services-Broadcast (FIS-B) Aircraft equipped with the IN protocol operating on 978 MHz may display in the cockpit 12 weather and airspace products at no cost. Note FIS-B is only available to the 978 protocol. (see previous, NextGen).

# Unintended VFR Flight from Visual Conditions to Instrument Conditions

General aviation statistics show many accidents involving unintended VFR into IMC. Pilots who are not instrument rated or are not instrument current are at greater risk than current instrument rated pilots. Guidelines that can be used in the event of inadvertent VFR into IMC in normal category aircraft include:

Your FIRST goal is to ensure control of the aircraft on instruments; so...

- ✓ Transition immediately to the instruments. Go to the attitude indicator and level the wings. Trust what you see, ignore what you feel.
- ✓ Center the slip-skid ball. Note your heading.
- ✓ Stop the rate of climb or descent. The vertical speed indicator will give you instant pitch trend information.
- ✓ Set power for low cruise speed (the low end of the green arc is fine).
- ✓ Trim for level flight.
- ✓ Engage the autopilot (if available) for straight and level flight.
- ✓ Apply carburetor heat (carburetor equipped engines) or alternate air.

Your next goal is to avoid spatial disorientation.

- ✓ Do not move your head rapidly. Look at the instruments. If you drop something, ignore it and fly the aircraft. If you are task loaded, ignore the radio. Remember, you must FLY THE AIRCRAFT first.

Your final goal is to exit back to VMC

- ✓ Assess your situation. One of several options are available:
- ✓ Fly straight and level on instruments until you to return to VMC, OR,
- ✓ A climb or descent may put you into VMC. Wings level, raise or lower the nose of the aircraft on the attitude indicator – ½ to no more than 1 dot width up / down. You are targeting for no more than a 300 to 500 FPM climb or descent, ball centered. Do not attempt to turn and climb / descend at the same time. Turn / climb or descend separately. OR
- ✓ A careful turn to reverse course may return you to VMC conditions. Note the heading at the bottom of the DG. If you turn, make only ½ standard rate turns – typically 5 to no more than 10 degrees of bank, ball centered. Do not attempt to turn and climb / descend at the same time. Turn / climb or descend separately.
- ✓ If you enter a diving spiral (increasing airspeed and increasing bank) level the wings FIRST then raise the nose to control speed. Lower landing gear and / or go to high RPM (controllable propeller) to help slowing. In some aircraft, partial flap extension will add enough drag to assist in slowing the aircraft.

When you exit to VMC conditions, return to a landing and assess your situation.

This list is not all inclusive and is intended only as an example of the serious nature of VFR into IMC. When able, consider declaring an emergency with ATC so you can receive priority handling and assistance. Note: you may practice these procedures in VFR flight. Wear a vision limiting devise and have a safety pilot to clear traffic. You need not be an instrument rated pilot to practice this in this manner.

## Avoid VFR into IMC in the first instance…

# In Flight Icing and the GA Pilot

The General Aviation (GA) pilot, operating as a FAA part 91 rules flight, may make the decision to fly into the vicinity of forecast icing condition. However, NTSB judges have shown through their findings that it is a violation of the regulations to fly where icing is forecast if the Pilot's Operating Handbook or Aircraft Flight Manual contravenes flight into "known icing conditions." More specifically, violations have been found in previous NTSB cases under Section 91.9(a), which prohibits operations inconsistent with the limitations set forth in the POH / AFM.

A FAA icing forecast constitutes "known" icing unless you have better and contradictory information available. However, previous NTSB cases have shown that PIREPs of no icing do not mitigate a current area icing forecast. On the other hand, one NTSB ruling determined that PIREPS of icing did constitute "known" icing conditions. The over-arching constraint is that GA pilots must exercise good judgment and avoid operations that are "careless" or "reckless." A GA pilot might, for example, plan a flight IFR or VFR into an area of forecast known icing conditions where icing is forecast only in clouds and in precipitation. The pilot plans to remain in clear air only and at an altitude where the temperature is forecast to be well outside of the range conducive to icing. If the flight is successful, no FAR relating to icing has necessarily been violated.

***As a guideline only, you might operate in an area of potential icing conditions if:***

- ✓ You are instrument current and the aircraft is instrument capable (when VFR)
- ✓ You are experience in the aircraft, such as 100 hours or more in type as PIC
- ✓ There are no mechanical faults that might limit the aircraft's performance
- ✓ The icing forecast, supported by PIREPs, shows a routing and altitude that should avoid icing
- ✓ There are several suitable divert airports all along the route of flight
- ✓ You are NOT in a designate mountainous area
- ✓ The aircraft is below maximum weight and has an acceptable performance margin, such as the ability to climb right after take off at least 750 FPM.
- ✓ The flight can be made in daylight
- ✓ You plan to arrive at the destination with a generous fuel reserve, such as 1 ½ hours

***If you encounter airframe icing:***

- ✓ Change you altitude immediately. Advise ATC you will accept any heading to climb or descend out of icing conditions – declare an emergency if necessary.

- ✓ Disconnect the autopilot – hand-fly the aircraft.
- ✓ All anti icing systems on, if not previously selected.
- ✓ Check surfaces frequently, every five minutes – icing can accumulate quickly
- ✓ Consider a no flap landing on a long runway – tail stall may be a greater danger than wing stall – flaps can aggravate the loss of lift on the tail.

This list is not inclusive nor is it vested in the regulations. Rather, it is a sample of the serious decision making required before flight.

# If you are unsure of the flight, DO NOT GO.

# Meteorology

-In the Northern Hemisphere, winds move clockwise around **H**igh pressure zones and counter clockwise around **L**ow pressure zones. Additionally, visualize the wind moving inward to a low and outward from a high.

-You may estimate the standard Celsius temperature at altitude thus: double your altitude - divide by 1000 - subtract 15. Above 8000 feet, the temperature is a minus value.

-A standard atmosphere decreases in temperature by approximately 2.2 degrees Celsius per 1000 feet of altitude increase. This rate promotes a relatively stable atmosphere. Note that this rate of change is simply a base line reference rate. Many physical conditions determine the actual rate of change.

-If the temperature decreases at a lesser rate than the standard atmosphere rate as the altitude increases, then the atmosphere is more stable. This leads to strata type clouds and obstructions to visibility such as haze (low moisture in the atmosphere) or drizzle (high moisture in the atmosphere). Warm fronts are associated with a more stable atmosphere.

-If the temperature decreases at a greater rate than the standard atmosphere rate, this makes the atmosphere less stable. This leads to cumliform type clouds and clear air between clouds (low moisture conditions) or rain showers / thunderstorms (high moisture conditions). Cold fronts are associated with an unstable atmosphere.

-Clouds form in the atmosphere at the level where the temperature and dew point meet. Ground fog is a cloud at the surface.

-Compare the national surface weather chart with the winds aloft for 18,000 feet (500 millibar). Winds at this level influence movement down to the surface. If a surface low is supported at 18,000 feet, the low will most likely strengthen.

-A low pressure area aloft that is a complete loop (closed) will strongly influence the weather below. Poor weather is usually to the east –northeast of the aloft low and this low will slow frontal movement at the surface.

-Compare the temperature and winds aloft to the forecast. If significantly different, the forecast weather for the trip will most likely be incorrect. Get an update. Note that if the wind is more southerly and stronger than forecast the weather is often worst than forecast.

-If you are flying VFR on top and are flying toward a frontal zone or intense low pressure area, plan on the cloud tops becoming higher as you approach the front. As you fly away from a front or low area, the tops will lower.

-Airframe icing is often found in the most recently formed clouds and often on the north and east side of a warm front. Icing in cumuli formed clouds is more often found in the tops of the clouds.

.-If the temperature and dew point are within 5 degrees f  (2 degrees c) of each other, the surface winds are calm or less than 5 knots and there are clear skies, there is a good chance of ground (radiation) fog forming. Forecasts of the breakup of fog conditions are difficult to make accurately. Use caution when flying to a destination with these conditions. File or plan for an alternate and allow appropriate fuel reserves.

-Wind 25 knots or greater at the surface will create mechanical turbulence that includes some up-down eddies as well as horizontal sheer.

-Wind 40 knots or greater perpendicular to a mountain or hill will create wave turbulence. Avoid the lee (down wind) side of the mountain to avoid down drafts.

-Without on-board weather avoidance equipment, you must be able to see weather development. Do not fly in thunderstorm areas at night or if thunderstorms are embedded, day or night, when you fly IFR. Realize the radar presentation available via XM services or FIS-B may be up to 15 minute old.

-Avoid thunderstorms by at least 20 NM. If you pass between two thunderstorms, you need at least 40 NM between cells.

-Do not try to out climb a thunderstorm: do not try to out run a thunderstorm, i.e. land at or take off from an airport in front of a fast moving thunderstorm or a thunderstorm within 5 SM of the airport. Severe wind shear will be encountered in clear air on all sides of a thunderstorm.

-If you accidentally enter a thunderstorm or extreme turbulence- tighten seat belts/ disengage the auto pilot/ note the temperature, descend if necessary to avoid icing / wings level on the attitude indicator - let the altitude and airspeed vary if necessary/ pitot heat and carburetor heat or alternate air on/ slow to maneuvering speed or weather penetration speed/ do NOT try to turn around - use radar or ask ARTCC for the shortest path out of the storm/ secure all loose items/ if dark, turn up full cockpit lights to prevent flash blindness from lighting.

# Sport Pilot, Light Sport Aircraft

Light Sport Aircraft (LSA) may be certificated as Special (factory built ready-to-go) or Experimental (built by an individual). Sport Pilot (SP) is a rating level. A few LSA and SP facts:

If you are a private or higher rated pilot, you MAY act as PIC in a light sport aircraft (LSA) using a valid state drivers license if you do not hold an FAA medical certificate and if you do NOT have any pending FAA medical issues.

If you act as PIC using a driver's license as above, you are limited to (FAR 61.315):

- Day time only; visibility of 3 SM and visual contact with the ground at all times
- Surface to 10,000 feet MSL or above 10,000 feet MSL when within 2,000 feet AGL
- No flying for compensation or for business
- Only one passenger
- If you are rated at the SP level only, you may not enter class B, C, or D air space without additional training (FAR 61.315)

- Ultralight flyers who received a SP license based on experience must receive additional training to fly LSA that have a cruise speed greater than 87 knots IAS (FAR 61.327)

- Aircraft certificated in the normal or experimental, amateur built category that DO meet the limits of a light sport aircraft *(Maximum takeoff weight of 1320 Lbs – 1430 pounds if on floats, maximum stall speed of 45 knots CAS, maximum cruise of 120 knots CAS speed in level flight with*

*maximum continuous power, two place maximum, single, non turbine engine, fixed gear – repositionable for seaplanes and fixed pitch or ground adjustable propeller)* may be flown by private or high rated pilots with only a valid driver's license to the above limits.

Previously unlicensed ultralight pilots that will operate aircraft that exceed FAR 103 limits should have registered as Sport Pilots on or before January 31, 2007 (FAR 61.329)

Ultra light aircraft that cannot meet the limits of FAR 103 *(less than 254 pounds empty weight, maximum fuel capacity of 5 U.S. gallons, maximum cruise of 55 knots IAS at full power in level flight and power-off stall speed of 24 knots IAS or less)* should have registered with the FAA aircraft Branch by August 31, 2007 as experimental LSAs.

CFIs may given instruction and perform checkouts in LSAs for which the CFI holds category and class privileges, such as airplane, single engine land (FAR 61.415)

A & P mechanics are authorized to do maintenance on LSAs with no specific additional training.

See <www.sportpilot.org> for extensive information on this topic.

# The Pilot, the FAA, and the Law

Just as preflight is a prevention and preparation process, a working knowledge of the airman appeal process is useful.

If you receive a written notice from the FAA of an alleged violation you have committed or if you are approached in person by a FAA official, you are best served if you comply with any reasonable request.

If notified in writing and you choose to respond, do so in writing within the allowed time. Do not rush your reply, think carefully first. Do not admit or confirm any allegation made until you have conferred with legal council. If ATC requests you call a telephone number after you land, understand you are not legally compelled to call. If you think this request is the result of an honest mistake on your part or there was some confusion about a clearance, you may be best served by making the call. Realize that the call may be recorded and anything you say could be used against you in further proceedings.

**Pilot's Bill Of Rights –** A bill passed by Congress in June of 2012 strengthens the pilot's right of access to information. A short description:

- The FAA must advise you if you are being investigated. This includes application for a new rating.
- If you do not respond to a written request from the FAA, this may not be held against you.
- Anything you tell the FAA may be used against you.
- A pilot may petition for all evidence in an incident or accident, including ATC tapes, controller statements, flight data, FAA investigation reports, and all similar information.
- The NTSB proceeding rules (title 49 CFR, part 821) must now conform to federal civil rules of procedure and evidence to the maximum extent possible. This may permit a pilot to carry an NTSB ruling into civil court, if desired.
- The FAA must act to clarify NOTAM information, distribution, and storage.
- The FAA must act to clarify and add useful guidance to medical standards to pilots. Additionally, the FAA must revise FAR part 67 medical standards to more closely align with current accepted medical judgments and practices.

This is not a complete description of the PBR. See www.faa.gov .

**NASA Aviation Safety Report System** - This program is intended to keep records of human and system errors relating to flight operations. Note the FAA may investigate any possible violation of which it learns though a source other than ASRS. NASA will not release, nor may the FAA seek, ASRS reports for use in an enforcement action (FAR 91.25). However, if the FAA thus finds a person guilty and this person correctly filed an ASRS report within 10 days of the event, the FAA may not assess a civil penalty nor impose a certificate suspension if:

- The violation was inadvertent and not deliberate

- The violation did not involve a criminal offense, an aircraft accident or action under section 44709 (see below)

- The person filing has not had an FAR violation in the last five years

You may file a NASR as often as you deem necessary. There are limits on how often you may invoke the protection of the NASR system. See FAR 91.25 and AC 00-46E. Obtain copies of NASA form ARC 227 from your FSDO, state aviation division, or P. O. Box 189, Moffett Field, Ca. 94035-0189. http://asrs.arc.nasa.gov

If approached in person, do show any required documents the official (any federal, state, or local FAA or law enforcement person) asks to see. You must

carry your pilot certificate, medical certificate (if required for the aircraft you are flying), and flight instructor certificate (if giving instruction) on your person or in the aircraft. The required documents for flight ("ARROWS") must be displayed in the aircraft. Any other document(s) requested, such as the aircraft maintenance records or your logbook need not be produced on the spot. Previous interpretation of the rules allow that you have reasonable time (to include the following day or longer) to go to the place where the document(s) are kept and show the documents to the official at another time.

Do not permanently surrender any document to the official.* If requested, show the document and insist it be returned at that time. In the vast majority of cases you will find that the official only wants to see that you are in compliance with the rules and that is the end of the matter. On the other hand, if you are accused of a violation, there are five levels of action that can be brought against you:

**-Administrative action** - warning notice, letter of correction, remedial training**
**-Reexamination** - a retest for the pilot certificate you now hold
**-Certificate Action** - suspension or revocation of the certificate you now hold
**-Civil Penalty** - fine of up to $1,000.00 per violation cited
**-Criminal Action** - penalty such as incarceration

A typical flow chart of events is as follows--------one of the five above actions apply: you receive a warning notice or letter of correction and you accept remedial training / you choose to submit to reexamination / suspension or revocation / civil penalty. OR, you request an informal conference with the FAA if you feel there are mitigating circumstances--------You appeal to a National Transportation Safety Board (NTSB) judge--------You appeal to the full NTSB board----------You appeal to the U.S. Board of Appeals. Note that you may accept the FAA or BTSB action or ruling at any point. Very few cases go to the U. S. Board of Appeals, but you do have the right to do so if you choose.

Refer to a more complete enforcement action document such as the Aircraft Owners and Pilot's Association (AOPA) enforcement actions booklet. Call 1-800-USAAOPA (872-2672) or www.aopa.org to join AOPA and get this booklet.

*note: under title 49, U.S. Code section 44709 (formerly section 609 of the 1958 Civil Aeronautics Act), any official can not suspend, revoke, or retain your license on the spot. Rather, the official must follow the above procedures. **Remedial training under 44709 (709 ride, previously referred to as a 409 ride) is NOT the same as reexamination.

## If you have an accident or Incident…….

Your first responsibility is, of course, to take immediate action to protect property and persons. The National Transportation Safety Board (NTSB) is the agency

tasked to investigate accidents. This is confusing sometimes because the NTSB may ask the FAA to conduct a particular accident investigation. Regardless, the NTSB, not the FAA, is the agency to contact in this case. For NTSB headquarters, go to www.ntsb.gov/aviation/report.htm. You will file NTSB form 6120.1/2 within 10 days. See NTSB reg. 830.5 and 830.15.

# Dates

04/15/1991 - Pilot in command time in **tail wheel**/ tail skid aircraft prior to this date or a one time check out with a flight instructor required. See FAR 61.31

04/15/1991- Pilot in command time in **high altitude aircraft** prior to this date or a one time check out with a flight instructor required. See FAR 61.31

3/11/1996 - Aircraft certificated after this date must display **anti collision lights** both day and night. See FAR 91.205

08/04/1997- Pilot in command time required in **high performance** aircraft, approved simulator, or approved flight training device prior to this date or a one time check out by a flight instructor. See FAR 61.31

08/04/1997- Pilot in command time required in **complex** aircraft, approved simulator, or approved flight training device prior to this date or a one time check out by a flight instructor. See FAR 61.31. Single lever FADEC aircraft may qualify as complex aircraft.

09/01/2004 – **Sport Pilot** rule in place. See <www.sportpilot.org>

01/18/2005 – **CFIs** and flight schools must receive **annual security training** starting this date. See <http://download.tsa.dhs.gov/fssa/training/>

08/31/2007 **–** Last day **experimental light-sport airworthiness** certificate will be issued to unlicensed (“fat”) ultra light aircraft that exceed FAR 103 standards

07/24/2008 – **Medical certificate** duration **extended for pilots under 40 years** of age. See FAR 61.23

02/01/2009 – **Termination date** for 121.5 / 243.0 MHz **ELT** satellite monitoring.

02/09/2009 – Pilots on **VFR flights within 60 NM** of the Washington DC VOR/DME (**DCA**) must have **one time certificated training** before flight. See FAR 91.161. Training at www.faasafety.gov (Activities, Courses & Seminars).

03/05/2009 – **Pilot certificates** must state "**English Proficient"** for operations outside of the USA. See www.faa.gov – Licenses & Certificates

03/31/2010 – **Pilot certificates** must be **plastic credit card style** by this date See www.faa.gov – Licenses & Certificates

10/31/2012 – Requirement for certain multi seat **experimental turbojet** aircraft require a pilot **proficiency check** after this date. See FAR 61.58

10/01/2010 to 12/31/2013 – FAA **Re-registration** of all **"N" registered aircraft** rule (FAR 47.40) in effect

03/31/2013 – **Mechanic, Dispatcher, Navigator**, and all other rating certificated issued by the Airman's Branch must be plastic credit card style by this date. See www.faa.gov - "licenses and certificates:" link

01/02/2020 –Date for aircraft to be **ADS-B "out" equipped** in the following airspace - In class **A, B, or C airspace** / the class **E airspace ABOVE** class B or C up to 10,000 feet MSL / Within the **30 NM mode C ring** around hub airports (Appendix D to FAR part 91 - Dallas and Houston Class B airspace for Texas) / Class E airspace above 10,000 feet MSL (excluding any location that is 2,500 feet AGL) / Over the Gulf of Mexico in class E airspace at or above 3000 feet MSL within 12NM of the US coast line

# Time

Note: the following events are **valid to the last day of the month**, regardless of the day of the month of issue: all **medical certificates / flight instructor certificates / flight reviews / instrument currency / instrument proficiency checks**. Other time currency events expire on a given day of the month.

8 hours minimum time from alcohol consumption to flight. See FAR 91.17

48 hours report deviations to ATC instructions (within). See FAR 91.123

10 days file NASA aviation safety report. See FAR 91.25 and AC 00-46
file NTSB form 6120.1/2 for accident report (within). See NTSB reg 830.15

30 days change of address due to FAA (within) / VOR check currency for IFR

60 days report drug/ DWI convictions to the FAA (within) / duration of a FAX or e-mail from the FAA for a physically lost or destroyed license or medical / report motor vehicle action to FAA (within). See FAR 61.15

90 days landing currency to carry passengers (day/ night)/ student pilot solo currency/ duration of a temporary radio station license or temporary aircraft registration/ limit to operate an aircraft with the ELT removed. See FAR 91.207

120 days duration of a temporary airman's certificate / nominal packing currency for most modern personal parachutes

6 months 1st class medical certificate duration for pilot over 40 / VFR sectional chart duration

12 months 1st class medical certificate duration for pilots under 40 / 2nd class medical certificate duration / CFI TSA mandated security training / airframe and power plant annual inspection currency/ ELT inspection currency / World Aeronautical Chart (WAC) duration

24 months 3rd class medical duration for pilots over 40 / flight review duration / duration for a flight instructor's certificate / transponder & altitude encoder currency/ altimeter & static system currency

60 months 3rd class medical duration for pilots under 40

3 years cycle for aircraft Certificate of Registration. See FAR 47.40

10 years duration for an FCC aircraft radio station license. The FCC operator's license issued to the individual does not expire.

# Altitudes (feet)

0 **QFE** altimeter reads on the ground (ICAO)

125 tolerance for **altitude reporting** feature of transponder (24 months test)

300 reporting tolerance for ATC to use **mode C** altitude read out (within)

500 AGL. **VFR traffic separation**/ minimum aircraft height in open areas

700 AGL. lower limit, transition area (**class E** airspace)

1000 AGL. minimum height over **congested areas** (airplanes)

1200 AGL. nominal lower limit, **class E** airspace

1500 AGL. minimum height, **turbine /heavy acft** in **class B, C, D** surface area

2000 AGL. **MEA** in **mountainous areas**/ nominal minimum height over national parks, wild life refuges/ recreational pilot exemption to 10,000 foot altitude limit / sport pilot may operate above 10,000 feet MSL if within

2500 AGL. upper limit, **class D** surface area/ exemption to no mode C 10,000 foot limit

4000 AGL. upper limit of **class C** airspace (referenced to primary airport elevation)

8000 MSL. **recommended** limit, **no oxygen** (night)

10000 MSL. VFR limits change/ maximum height for a recreational pilot/ maximum height for a sport pilot unless within 2,000 AGL/ **mode C** required above

12500 MSL. **oxygen** required for **flight crew** above this height; time **beyond 30 minutes**

14000 MSL. **oxygen** required for **flight crew at all times** / holding inbound leg 1+30 minutes

14500 MSL. **upper limit of class G**; becomes class E airspace

15000 MSL. **oxygen** must be **offered to passengers**

18000 MSL (FL 180), **class A** airspace starts

25000 MSL (FL 250), must operate a pressurized aircraft above for **high altitude endorsement** (FAR 61.31)

29000 MSL (FL 290), Reduced Vertical Separation Minimum (**RVSM**) required above

41000 MSL (FL 410), upper limit for **RVSM**

60000 (FL 600), upper limit for **class A** airspace

# Distances

500 ft minimum non formation **inflight separation**/ min stagger separation between departing aircraft on parallel runways less than 2500 feet apart

1200 ft maximum separation between parallel runways for ATC to issue instrument approach with **side step**

3000 ft (remaining) instrument runway; **center line lights** go from white to white & red/ area to determine touch down zone elevation (first 3000 feet of runway)

4300 ft minimum parallel runway separation for ATC to assign visual approaches with both runways in use

1 SM class G airspace visibility for VFR (day)/ class E, D, C, B visibility (special VFR)/ within ½ NM of runway at night

3 SM minimum class E,D,C airspace visibility for VFR/ minimum class G airspace visibility for night

3 NM nominal IFR lateral separation provided by ATC when co-altitude aircraft are within 40 NM of the ground radar antenna/ minimum separation for successive aircraft on the same localizer/ lateral separation from provided obstructions by minimum vectoring altitudes/ recommended distance to avoid special use airspace when on a direct clearance

3-5 NM nominal day time range for VASI lights

4 NM ATC assigned turbulence separation when co-altitude to 1000 feet below: between heavy jet and heavy jet, small aircraft behind a large aircraft

5 SM minimum visibility for class E airspace (10,000 MSL +)

5 NM nominal IFR lateral separation provided by ATC when co-altitude aircraft are more than 40 NM from the ground radar antenna/ ATC assigned turbulence separation: large aircraft behind a heavy jet / minimum ARTCC lateral separation; co-altitude to 1000 feet vertically

6NM minimum separation, small aircraft behind a heavy aircraft

10 NM max allowable ADIZ reporting point crossing error/ recommended distance from non tower airport to listen and call UNICOM or CTAF/ range of glide slope signal/ limit of outer ring of class C airspace

20 NM limit of designated outer area of class C airspace/ nominal range of VASI system (night)

25 NM range (service volume) for a terminal power VOR

30 NM radius of mode C veil around class B airspace; referenced to primary airport

40 NM range (service volume) for an en route VOR (below 18,000 feet)

100 NM range between altimeter settings when below 18,000 feet

130 NM range (service volume) for en route VOR (fl 180 to fl 450)

199 NM maximum range for DME

# Speeds

200 KIAS maximum in airspace underlying class B airspace or a VFR corridor through class B airspace/ when at or below 2500 feet AGL and within 4 NM of primary airport in class C and class D surface areas/ max turbojet holding to 6,000' MSL

250 KIAS maximum below 10,000feet MSL/ maximum in class B airspace

# Degrees

0.3 Require Navigation Performance (**RNP**) level nominal accuracy for LNAV / VNAV or LPV type approaches. One side full deflection of the CDI is 0.3 NM (2,418 feet) on the approach final segment. See AIM 1-2-1.

1.0 RNP level nominal accuracy RNAV (including GPS) for terminal air space (within 30 NM of departure or arrival airport). One side full deflection of the CDI is 1.0 NM (6080 feet). See AIM 1-2-1.

2.0 RNP level nominal accuracy RNAV (including GPS) for enroute air space (more than 30 NM from departure or arrival airport). One side full deflection of the CDI is 2.0 NM (12,160 feet).

10 maximum VOR OBS angle, center to full deflection/ recommended heading correction increments to capture the localizer before passing the FAF

30 maximum non aerobatic pitch angle

60 maximum non aerobatic bank angle

# Frequencies

108.0 to 118.0 Aviation **navigation** (VOR, ILS)
118.05 to 137.0 Aviation **communications**

121.5 ICAO civil in flight **emergency frequency**

122.7 Common Traffic Advisory Frequency, **CTAF**
122.725
122.8
122.975
123.0
123.05
123.075

122.75 **air-to-air** communications / private airport communications
123.025 **air-to-air** communications **helicopter**

122.9 **MULTICOM** for airports without a designated CTAF

122.925 **MULTICOM** for forestry, fire suppression, EPA monitoring
122.95 **MULTICOM** for airports with control towers

123.3 **Glider, hot air balloons**, aviation instruction (not advisory)
123.5

# Avionics Wisdom

**External preflight**
Do preflight your antennas; keep them clean, wash with mild soap & water as necessary. Oil and grime attenuate signal strength and destroy the antenna coating. When clean, check the condition; is the paint gone or the surface pitted? Antenna efficiency is usually a slow steady loss until it quits altogether. Gently check the antenna mount. If it is loose, have it repaired. Some antennas will not work without a good electrical bond to the aircraft skin. Check the pitot heat periodically. Turn the heat on; the pitot tube should become hot to the touch within 2 minutes. Note: operate pitot heat on the ground briefly for a system check or 5 minutes before take off if icing conditions are possible immediately

after take off. Prolonged operation of pitot heat without air flow through the probe may damage the unit.

**Ground cockpit checks**
FAR 91.171 require a 30 day VOR check to use that VOR in IFR flight. Record:

- ✓ date check performed
- ✓ location of the check (VOR or VOT used)
- ✓ your *signature*

OBS bearing with needle centered when comparing two VORs or bearing error when using a VOT/ surveyed VOR/ inflight airway check

If a piece of equipment is out of tolerance, you may fly IFR as long as you have other equipment within tolerance sufficient to complete the flight.

Do use a VOT any time it is available. Two VORs may be out of tolerance but within 4 degrees on a comparison check.

You may perform a simple test of your ELT. Place an AM band radio next to the ELT antenna. Activate the ELT cockpit switch (inform tower first of your test activation/ activate only in the first five minutes past the hour/ no more than three sweep tones per activation) the sweep tones should be audible through the AM radio. Note: this test demands a stronger signal than listening to the sweep tone with a nearby panel mount or hand held VHF radio. Alternately, place a co worker at least 1/2 mile away with a hand held VHF radio and repeat the test.

Do have all avionics off during engine start and shut down. Anytime an alternator is starting up or shutting down, it can cause large voltage variations which can damage avionics.

Heat kills. Avionics stacks are cooled three ways: radiation, ram air, and cooling fan(s). Radiation cooling is adequate if you have one or two boxes in a stack. With more than two boxes in a vertical stack, you need either ram or fan cooling. With the engine stopped, turn the master and avionics switches on and listen for the cooling fan. If you do not have a cooling fan and have a large stack of avionics, limit the number of boxes on while on the ground for a long period.

As part of your pre takeoff checklist, preset all frequencies, OBS settings, transponder codes, etc.

**Inflight cockpit checks**
Periodically check you avionics inflight. Fly VFR and have a second pilot/ helper along to record the data.

Select the alternate static system. Set power and pitch angles that provide specific indicated air speeds with the primary static system in use. Note any differences in indicated altitude, VSI indications, airspeed indications. Additionally, this periodic check will keep alternate static source lines clear.

slowly check the full width of the CDI - it should be exactly 10 degrees. Do this check on a VOR radial in each of the four compass quadrants. Note any error.

fly a “visual” ILS/ localizer. The above VOR check does not test the LOC/ GS receiver. If the indicator does not match the visual cues, have the unit checked

keep a continuous log of your VOR checks and do a comparison study. Many complete VOR failures occur after a slow deterioration in accuracy.

do listen to the Morse code identifier for every VOR or ILS you receive. Compare signal strength using the ident (continuous wave) filter selected and the voice modulation filter selected. The ident should be stronger with the ident feature selected.

poor radio communication can be difficult to track accurately. Com radios may become intermittent when hot. If you are told your transmitter is bad, immediately try another radio. Often your poor communications may be due to an antenna blind spot, a poor receiver at the other end, or another reason. Keep a log of reported bad reception/ transmission frequencies; this will help the radio shop.

if you have radio communications problems, try unplugging and replugging your headset or microphone. If you use a headset as a matter of routine, do leave the hand microphone in the aircraft and periodically use it to make sure it works. Microphone elements can and do fail.

**Autopilots**

Each autopilot installation is unique to each make and model of aircraft. You are required to carry the operating notes on the autopilot installation in the aircraft (usually with the flight manual). Read these notes carefully. The same make of autopilot will operate differently in a different aircraft.

learn and use the power on preflight procedures for the autopilot. Perform these checks before take off any time you plan to use the autopilot inflight.

learn the switching sequence for operation. Often several switches must be operated in sequence.

learn how to rapidly disconnect the autopilot by several methods and how you are sure the autopilot is disconnected. Identify the autopilot circuit breaker in advance for quick reference in an emergency.

know the minimum altitude your autopilot is certified for operation; know the maximum altitude loss to expect when the autopilot disconnects (for altitude hold function). Understand the relationship between electric pitch trim and the altitude hold function. Improper use of the trim with the autopilot engaged can drive the trim and create very high control forces when the autopilot is disengaged.

## Gyroscopic instruments

(Electro – mechanical) Vacuum source: in most general aviation aircraft, this is an engine driven dry vane type pump. It is this dry lubrication feature that can cause sudden failure. Dry pumps lubricate by using graphite impregnated vanes; these vanes slowly wear and give up graphite to lubricate the pump. The composite nature of these vanes makes them brittle; they can shatter, jam the pump, and shear the pump drive shaft. These pumps can fail without warning, but often there are warning signs. Additionally, a well maintained vacuum system is very reliable and will last many hours. Note that some pumps are designed to operate in one direction only. Do not rotate the propeller backwards on preflight if you have a uni-directional vacuum pump.

Keep a record of the vacuum readings at 1000 RPM and full throttle. Modern vacuum pumps are capable of 9 inches of vacuum or more and must be regulated down to the normally desired 4.5 to 5.2 inches. If the vacuum reading is lower (particularly at 1000 RPM) than previous readings, there is a good chance there is a vacuum leak in the line or a clogged filter under the instrument panel or the vacuum pump is near failure. Leaks or a clogged filter causes the pump to work at full capacity, overheat, and eventually fail. If you notice a drop of approximately one inch of vacuum or more from previous readings, have the vacuum system checked. Tobacco smoke tar will seriously clog the gyros; this smoke is not trapped by the under panel filter(s). Do not allow anyone to smoke in the airplane. The vacuum pump can not tolerate any contamination to the pump vanes. Do have the under panel filters changed as often as necessary. Moisture in the air passes through the filter into the cold vacuum instrument case causing condensation inside the instrument. Corrosion can form inside the instrument case. Do warm the cockpit when necessary, not only for your own comfort, but to warm your gyro instruments and purge any moisture from the cases. At engine start, gyros take 3 to 5 minutes to spin up to their operating speed of 15,000 to 20,000 RPM. If you need to taxi immediately after engine start, taxi slowly and minimize sharp turns.

If you have duel vacuum sources, such as in twin engine aircraft or singles with a back up system, operate the system separately to ensure both sources are available and the check valve(s) between the systems operate normally. See the POH or back up system supplemental data on how to do a system check.

Gyro instruments usually give adequate warning before they fail internally. With the engine stopped, turn on the master switch and listen for the electric gyro in the turn indicator/ coordinator. If the sound is uneven, or is grinding, especially after power is removed, have the gyro tested. For vacuum gyros, pull the circuit breaker for the electric turn indicator/ coordinator 5 minutes before engine shut down. Shut down the engine and immediately listen to the vacuum gyros. If you hear a grinding or uneven sound, use a long plain tipped screwdriver as stethoscope; place the tip on the glass at the edge of the case and place handle directly on your outer ear. If in doubt, have the gyros bench checked. Non slaved heading gyros should not precess more than 3 degrees in 15 minutes once spun up. Attitude gyros are self-erecting and it can be more difficult to notice impending attitude gyro failure. Another indication is after initial taxi out. The attitude and directional gyros should come and remain erect, given you have adequate vacuum. You may have your gyro instruments removed and bench checked by an instrument shop approximately every two years; the shop can tell if the instrument is performing correctly.

## Electronic Flight Information Systems (EFIS)

“Glass panel” displays in technically advance aircraft have minimal maintenance requirement from the pilot's consideration. However, display systems vary widely; you must learn how to use any given display system and any system checks required. Periodic use of backup system and display switching to insure proper operation, particularly before IFR flights, is recommended. There are cases of partial failures and false information displays. When initiating an attitude change on the electronic attitude indicator, cross check the attitude display with the heading card and VSI display – all three must agree. Additionally, scan the backup electro-mechanical display to verify all are in agreement. Recent changes to NTSB rules require reporting of partial or full EFIS displays. If you have any EFIS display abnormalities, contact your avionics shop to assisting in reporting the problem.

## Updating Electronic Navigation Databases

FAR 43, Appendix A, item C provides for preventative maintenance pilots may perform without a specific maintenance rating. Item # 32 permits pilots to update their GPS navigator data base for IFR operations. VFR only GPs systems that are not IFR certified do not necessarily require a maintenance entry if updated.

# Engine Tips

There are several universal tips that will help you operate and preserve your Lycoming, Continental or Franklin aircraft engine. **Read the pilots operating handbook for your aircraft.** Follow the recommended procedures for engine operation for your aircraft. **No statement in this synopsis supersedes the recommended procedures in the pilots operating handbook or engine manufacturer's operating manual.**

The operating temperatures within an air-cooled aircraft engine are extreme and critical. For example, the typical exhaust gas temperature (EGT) of a normal aspirated engine, as measured in the exhaust pipe 2 to 4 inches below the exhaust port, is 1300 to 1500 degrees f (typically 1650 degrees f maximum for a turbocharged engine, measured at the turbine inlet). Aluminum pistons in the cylinders will fail above 700 degrees f and melt at 1200 degrees f. Spark plugs will lead foul and/or fail at temperatures above 1300 degrees f. Exhaust valves must operate at temperatures of 1000 to 1200 degrees f (Lycoming) and 1200 to 1450 degrees f (Continental). The temperature of the exhaust gases in the cylinder during the power stroke approaches 4000 degrees f. How then do all of the parts in the engine remain at their respective operating temperatures? Your engine and engine installation is carefully designed to transfer heat away from the pistons, valves and spark plugs by air cooling, excess fuel cooling and oil cooling.

The factors you as a pilot can control are the air flow through the engine by proper use of cowl flaps and maintaining adequate airspeed when the engine is developing high power, the ratio of fuel to air (mixture), and the quantity and quality (through frequent changes) of oil in the engine, and the rate of change of the operating conditions for the engine.

**Frequent flyer:** aircraft engines do best when flown at least once a week. The oil must reach 170 to 180 degrees f indicated long enough to vaporize water collected in the oil (20 to 30 minutes after warmed up). Note that the peak oil temperature in the engine is typically 30 to 40 degrees f higher than the indicated temperature. Left undisturbed, this water will combine with other contaminates from combustion, form acids, and eat the engine internally. Condensation will collect in the cylinders and form rust. Ground running rarely raises the oil temperature to 170 to 180 degrees. Do change engine oil while the oil is warmed to operating temperature. Change the oil every 25 flight hours if only a pressure screen-filtering unit is fitted or every 50 hours if a full flow replaceable

filter is fitted. Note that there are recommended time limits as well as hour limits on oil changes. Change your oil every 6 months (Continental) or 4 months (Lycoming) or the above-recommended time limits, whichever come first.

**Preflight:** Besides the normal engine preflight items, check the following:

Use a flash light to examine the push rod tubes - they should all be straight and aligned (Lycoming engines often may be examined on routine preflight as the push rods are on the top of the engine. Continental engine push rods are on the bottom of the engine and are usually only visible with the cowling removed). A push rod tube that is bowed means a bent push rod and most likely a sticking valve. This is cause to abort the flight and have the engine inspected.

Inspect the baffle seals - they must be complete, in good condition, and curved inward so high-pressure air entering the engine compartment forces the seals against the top of the cowling and prevents air escaping. The airflow through your engine is critical; poor baffle seals will create local hot spots on the cylinder heads, valves, and cylinder barrels. You will often see no rise in operating temperatures due to the local nature of the air leak. However, you are allowing a condition that often leads to valve or piston failure in one cylinder. If your aircraft is equipped with individual cylinder head temperature probes (CHT) keep the CHTs below 400*F in cruise. Unless the manufacturer specifies otherwise, the ideal CHT range for cruise id 350 to 380*F.

Oil inspection – Do check the oil level before flight. Note that most engine dip sticks read correctly only after the engine is stopped for 30 minute or longer to permit all of the oil to drain back into to sump. You may also note the following simple checks – if the oil color is jet black (not brown-black) you may have leaking piston rings. Hold the dipstick up in strong sunlight and examine the oil closely. If the oil “sparkles” in the sunlight, this is evidence of contamination in the oil, possible bronze or other metal particles. Non metallic oil will not sparkle. Consider an oil analysis to detect high metal content.

Oil level - You may operate your engine with the oil level 1 to 2 quarts below the maximum shown on the dipstick. Use full oil levels with high ambient air temperatures, high gross weights and long climbs at low airspeed and high power setting, such as long cross country trips. Maximum oil fill levels tend to raise the engine internal pressures slightly, and oil may be lost through the crank case breather system. FAR 33.39, engine certification, requires all wet sump reciprocating aircraft engines operate normally with only ½ the maximum indicated fill level; this requirement is responsible for the greater than necessary maximum oil capacity level.

Oil leaks - The engine oil circulates at the rate of approximately 8 gallons per minute. Therefore, all of the oil in the engine circulates completely two to four times per minute. Any serious leak can empty all of the oil in only a few seconds.

Oil leaks between the cylinder barrel and the cylinder head indicates the barrel and the head are separating. This is a grounding item. Oil leaks along the split line on the crank case may indicate the case is fretting (moving against each half) or excessive oil temperatures and requires the engine case be split open to repair. Oil streaks along the base back side of the propeller blades indicate a leak from the controllable pitch propeller hub. Leaks around the front of the crankshaft may mean a front seal is ruptured. Leaks on an otherwise unexplainable area of the crankcase may indicate the case is cracked or has a hole in it. Other oil leaks may be less serious, but should be promptly repaired. Check that the crank case breather line is unobstructed. This is usually on the aircraft belly in the vicinity of the cooling air outlet. If this line is plugged with the engine running this can cause ruptured oil seals and a loss of engine oil.

Use a hard rubber or wooden hammer or stick to strike your metal propeller leading edge from the tip to the propeller root. Use a sharp rap; strike the leading edge of the prop (not the trailing edge) about every six to eight inches along the length of the blade. Listen for a clear ringing tone. If you hear a dull tone or thud, you may have a cracked propeller.

Carefully examine the exhaust system. There are many temperature cycles on this system and this can cause otherwise secure parts to loosen, crack, or fail. Exhaust leaks will appear as white stains. Exhaust leaks will erode any aluminum around the leak. Look for leaks all along the exhaust system, the spark plugs where they enter the cylinder heads, and the cooling fins in the exhaust valve area of the cylinder head. Check the color inside the end of the exhaust pipe; it should be uniformly gray to gray black. A rich black sooty color indicates a too rich fuel to air mixture, a white to light gray discoloration may indicate a too lean fuel to air mixture.

Look for fuel leaks - look for blue stains and/or any smell of fuel. Every leak, no matter how small, needs to be investigated.

**Starting and taxi:** If your engine starts and runs rough for the first few minutes, then smoothes out, it is possible you have a sticking valve(s) in one or more cylinders. This is grounds for abort.

Hot weather - follow procedures in the pilot's operating hand book / aircraft flight manual (POH / AFM) for hot starts. If the engine is reluctant to start, do not operate the starter more than 10 to 12 seconds, cease cranking and let the starter cool. If your aircraft has an STC for auto fuel, note that auto fuel will vaporize more readily than 100 LL and may make starting in hot weather more difficult. Conversely, auto fuel requires less priming and usually provides for easier starts in cold weather.

Cold weather - unless otherwise stated in the POH / AFM, preheat your Lycoming engine any time the temperature is +10 degrees f (except 76 series

engines, preheat 76 series engines when +20 degrees f) or colder. Continental engines must be preheated when exposed to +20 degrees f or colder for two hours or more. Notice you may be able to start the engine at these low temperatures even without preheat. However, you are causing serious wear to the engine and will shorten the life of the engine or cause premature failure of the engine in flight.

Do not over prime a cold engine. Excess fuel in the cylinders can dilute any remaining oil coating on the cylinder walls. Always allow a minimum of 2 to 3 minutes warm up on any engine, longer in cold weather. There should be a slight rise in oil temperature and the oil pressure should be steady and no higher than the top of the green arc. A positive operation of the throttle from idle to full power (2-3 seconds from idle to full) without the engine stumbling or stalling are indications that the engine is adequately warmed up.

Do open the cowl flaps for engine start and taxi out, even in cold weather. Open cowl flaps make only a small difference in cylinder head temperatures at idle, but allows the prop blast airflow to keep engine accessories (ignition wires, magnetos, fuel and vacuum pumps) from overheating. After the engine is running and the oil pressure has come up within limits, maintain at least 1100 RPM. This permits the cold engine oil to properly splash lubricate the cylinders, pistons, cam, and cam followers.

After engine start, a prolonged time at idle (below 1100* RPM) may cause the spark plugs to foul. At low idle, the spark plug tips drop below 800 degrees f, which causes lead and/or carbon deposits to form. Maintaining an 1100 RPM idle permits higher spark plug tip temperatures and will normally prevent fouling.
Additionally, you may lean the mixture after engine start. At idle and taxi RPM, aggressively leaning the mixture will not harm the engine and may prevent fouled spark plugs. The fuel/ air mixture at idle is adjusted to be slightly richer than optimum combustion with the mixture knob in the full rich position. You may easily test for this correct rich idle mixture; while maintaining 1000 RPM, slowly pull the mixture to idle cut off while carefully watching the RPM. You should get a momentary 20 to 50 RPM rise as the mixture passes through the optimum fuel to air ratio before stopping. Additionally, ensure your engine will idle smoothly with the throttle fully closed and full carburetor heat applied.

*note: the actual desired minimum idle RPM to prevent plug fouling varies by source. All sources agree 1000 to 1200 RPM is desired.

**Pre takeoff checks:** do face the engine inlets into the wind; this will help with cooling, not only through the air inlets but preventing a strong wind from creating pressure in the engine air outlet area. As you taxi up, look for and avoid loose gravel, dirt, anything that could be sucked into the prop at run up. Perform magneto checks at 50% to 65% power (e.g., if 2700 RPM is 100% power, 50% to 65% would be 1350 to 1755 RPM), this permits sufficient temperatures and

pressures in the cylinders to give a valid check of the magneto and spark plugs. During the check, the RPM should remain within the allowable range (typically a maximum drop of 150 RPM, with a maximum difference between the magnetos of 50 RPM) and the engine should run smoothly. If you leaned the engine for taxi, you must enrich the mixture for smooth running before the check.

Because the factory limits for magneto checks are stated as a maximum allowable RPM drop, we are often trained to only look for a RPM drop within limits. A more telling indication of magneto and/or spark plug health is the **rate of change** in the RPM drop from flight to flight. For example, a given magneto may have a 50 RPM drop on one flight and a 125 RPM drop on the next flight. If the allowable limits are a 150 RPM drop maximum, this dramatic but admittedly within limits change might be ignored. It should not be, the magneto/ spark plugs are warning of a problem.

You should see a drop in RPM (typically 50 to 200) when applying full carburetor heat. Most general aviation aircraft do not filter this heated air; use carburetor heat only long enough to perform a proper check. A proper check constitutes operating long enough with carburetor heat full on to determine it works and no ice has formed on taxi out. At outside air temperatures between 20 and 90 degrees f with high humidity levels, ice may have formed in the carburetor on taxi out. You need to apply full carburetor heat long enough to melt any ice that may have already formed in the induction system (typically ice first forms on the throttle butterfly plate, which is the flow control device you are moving with the cockpit throttle lever. If the throttle seems stiff, you may have ice on the throttle plate). Full carburetor heat for 30 seconds minimum should start to melt any ice that may have formed. If you have ice and it starts to melt, the engine may rise again in RPM if there is a small amount of ice present or may surge in RPM (if a larger amount of ice is present) as the water from the melted ice goes into the engine. Maintain carburetor heat full on until smooth engine power at run up RPM is reestablished. Note that Continental and Franklin engines may be more susceptible to carburetor ice as the carburetor is not warmed by the oil sump as with Lycoming engines. If you fly in icing conditions, you may add a 0.15% concentration of EGME (sold as Prist low flow additive) to the fuel to help prevent persistent carburetor icing. If your engine is fuel injected, open the alternate air source (if controllable from the cockpit) to observe no change in RPM/ MP. Note that an alternate air source is not necessarily a source of heated air to the induction system, rather it is another source of engine air in case the induction filter is clogged, such as by ice/ snow.

Exercise constant speed propellers after the engine is fully warmed up. Engine oil needs to be at operating temperature before checking the propeller so warm oil flows into the hub. This not only checks the operation of the governor and prop hub, but helps keep sludge build up out of the propeller hub. Reduce the propeller lever to permit a 300 to 500 rpm drop, then advance the lever to full

RPM. In cold conditions, cycle the prop sufficiently until the prop responds smoothly and rapidly. Return to high RPM for take off.

**Take off and climb out:** In cold weather; the oil temperature should be at the minimum on the oil temperature gauge (typically 75 degrees f) and the engine should be able to accelerate smoothly from idle to full power in 2 - 3 seconds. Always use full throttle or maximum allowable power (for turbocharged engines) for take off. Most normally aspirated engines enrich the mixture mechanically with full throttle selected. This extra-enriched mixture helps prevent overheating of pistons and valves during high power and low airspeed experienced in the takeoff roll and climb out. Consider the following:

Cowl flaps: should be open for take off and initial climb out. Cowl flaps may need to be partially closed in cold weather when in an en route climb to bring oil or cylinder head temperatures up to the normal range.

Carburetor heat: do not use carburetor heat for take off unless there is evidence of icing in the carburetor on taxi out. At temperatures of approximately 20 degrees f or less, moisture is frozen in the air and will pass harmlessly through the carburetor and engine. Applying carburetor heat when air temperatures are 20 degrees f or less may melt incoming frozen moisture and allow this to refreeze in the carburetor. Carburetor heat enriches the mixture and reduces available power by 10 to 13%. If you use carburetor heat for takeoff due to evidence of carburetor icing, the POH take off performance figures will not be correct due to reduced engine power.

Mixture: always use a full rich mixture for take off unless the **density** altitude is high enough (5,000' or higher density altitude is a general guide line) to permit only **75% power or less** with full throttle (normally aspirated engines). Calculate the density altitude and refer to POH performance data to determine if you will have 75% power or less on takeoff. The temperatures and pressures inside the engine, when it is developing more than 75% power, are extreme enough to require an enriched mixture of vaporized but unburned fuel to carry away excess heat and prevent detonation damage. These higher temperatures and pressures combined with reduced airflow through the engine during climb make the requirement for an enriched mixture critical. On the other hand, if the engine will only develop 75% power or less with full throttle, the temperatures and pressures in the engine are less critical. However, the reduced airflow during climb will require a slightly enriched mixture. Without an EGT gauge, lean to engine roughness, enrich until smooth and enrich further a small amount. With an EGT gauge, lean to peak EGT and enrich to at least 100 degrees cooler than peak EGT. In this case, you may run up to full power and adjust the mixture prior to brake release. Aircraft with fuel flow gauges may have the % power marked on the gauge face to assist adjusting the mixture. Watch oil and cylinder head temperatures, if approaching the top of the green arc, increase climb speed or level off temporarily to restore normal temperatures.

Constant speed propeller: use maximum rated take off RPM. Remain at this maximum RPM until at least 1,000 feet AGL or you have completed the take off checklist, which ever occurs last. Reduce to the recommended climb RPM, typically 2400 to 2500 for GA aircraft engines, until level off for cruise.

**Cruise:** maintain climb power and RPM until cruise speed is attained. Adjust power to cruise setting and then adjust the mixture approximately five minutes after setting cruise power. This permits the engine temperatures to stabilize. Close the cowl flaps or adjust as necessary to maintain cylinder head and oil temperatures in the desired range. If the cruise power setting is 75% or less, you should lean the mixture as provided for in the POH. Generally this will be peak EGT or a 50 to 150 degree decrease from peak EGT by enriching the mixture. Engines with float type carburetors do not distribute the fuel/ air mixture evenly to all cylinders. This is due to the uneven length and bends in the intake manifold and the throttle plate that disrupts the flow of fuel/ air when it is partially open (less than full throttle selected). Aircraft with float type carburetors will have the best fuel/ air distribution and a smoother running engine with more even temperatures with full throttle selected. When possible, select a cruise altitude that will permit 75% power or less with full throttle selected.

**Descent:** plan descents so you make changes in engine temperatures smoothly. Either descend with cruise power or reduce power in stages. A guideline is to reduce power in increments of 2” of MP or 200 RPM. Realize that some engines, such as high power turbo charged engines, have a much greater need for gradual power reduction in descents than lower power normally aspirated engines.

Leave the mixture at the cruise setting and increase the mixture in stages in the descent. Close cowl flaps for the descent (given that CHT / oil temperature remains within limits). If you know you will make a rapid descent due to ATC or other considerations, reduce power and slowly open cowl flaps at altitude approximately five minutes before anticipated descent. This permits the engine to cool slowly in anticipation of the descent. When descending, close the cowl flaps and always carry some power in the descent. Extend retractable landing gear, flaps, or speed brakes to control airspeed in the descent. If the power is reduced to idle with a high descent airspeed, the propeller is driving the engine; this can cause piston ring flutter and damage the engine. Additionally, reducing power to idle for the descent will not generate sufficient heat for the carburetor heat system should application of carburetor heat be necessary in the descent. Short periods of idle power in the landing pattern, at slower airspeeds, are OK.

Carburetor ice inflight: your first indication is usually a loss of RPM or manifold pressure with a constant throttle setting. If you suspect carburetor icing, immediately apply full carburetor heat and leave carburetor heat full on until you change altitude or otherwise fly out of the conditions producing carburetor icing.

Only use partial carburetor heat if you have a carburetor temperature gauge. You may experience RPM/MP surges as ice melts and water passes through the engine. Carburetor heat applied in the landing pattern is a good procedure and may prevent carburetor icing during a critical phase of flight.

**After landing:** allow the engine to idle at 1000 to 1200 RPM for two to three minutes before shut down. This permits engine temperatures to stabilize and cleans the lead from valve faces and stems to reduce the chance of valve sticking. Turbo charged engine usually have specific guidelines for idle down after landing and before shut down. Often, the taxi from the runway to the parking spot will be sufficient. If you are experience lead/ carbon fouling on the spark plugs, run the engine to 1800 RPM for 15 to 20 seconds, reduce to 1000 RPM, and shut down. Accessories temperatures will peak approximately 15 minutes after shut down. Do park into the wind. If the ambient air is warm and you anticipate flying again within 30 minutes, you may open the oil filler access door. On many aircraft, this is mounted high on the cowling and this opening lets rising heat “chimney” out of the engine accessory compartment.

**Special considerations for training aircraft:** aircraft use mostly for training fly at lower altitudes, slower speeds, and richer mixtures than other general aviation aircraft. For low altitude training in the practice area and multiple landing patterns: use a full rich mixture unless a **full throttle** setting will only produce **75% power or less** due to high density altitude. In this case, lean for smooth operation at full throttle and leave the mixture at this setting while training. After each flight run the engine to 1800 RPM for 15 to 20 seconds, reduce to 1000 RPM, and shut down with the mixture control. Engine sump oil levels should be kept as high as practical to maximum cooling and cleaning for the engine.

Multi engine trainers: some simple engine operation techniques will help multi engine trainers to reach factory engine TBO. Single engine work: with all safety factors considered, simulate sudden engine failure with the mixture control. Leave the throttle open while the engine stops. Two considerations; the engine will pump air through the induction system and cushion the engine as it slows down and prevent piston ring chatter. Engines that have counter weighted crankshafts (such as some of the larger displacement engines) must have gradual power changes to prevent the weights from striking the crankshaft or engine case. Again, the airflow through the engine with the throttle open will cushion the engine as it stops. If you feather a propeller as part of training, do so at least 3000 feet AGL and within single engine or gliding distance of a suitable airport. You may have difficulty restarting the engine, or the propeller may not fully feather if the propeller dome pressure is low. When you need to simulate engine failure with the throttle, reduce power to idle smoothly.

# FAR SYNOPSIS

**THE FOLLOWING IS A SYNOPSIS OF SOME OF THE FARs WHICH AFFECT YOU AS A PART 91 GENERAL AVIATION PILOT. THIS SYNOPSIS IS NOT A SUBSTITUTE FOR A COMPLETE REVIEW OF THE FARs. REFER TO THE FARs FOR ALL INFORMATION AFFECTING FLIGHT. (www.faa.gov)**

**43.3 [g] and Appendix A[c]** Authorizes private pilots or higher to perform specifically listed **preventative maintenance** items on aircraft they own or operate and are not flown commercially. See also FAR 91.403.

**61.1 Aeronautical experience** means pilot time obtained in an aircraft, flight simulator, or flight training device for meeting the appropriate training and flight time requirements for an airman certificate, rating, flight review, or recency of flight experience requirements of this part. **Cross-country time** means time acquired during flight conducted by a person who holds a pilot certificate; conducted in an aircraft; includes a landing at a point other than the point of departure; and involves the use of dead reckoning, pilotage, electronic navigation aids, radio aids, or other navigation systems to navigate to the landing point. Commercial, ATP, and certain military pilots may fly 50 NM from point of departure & return to point of departure with no intermediate landing to gain cross county time. Cross county time to qualify for a rating – see FAR 61.101. **Pilot time** is time in an aircraft for which you are rated, simulator, or flight training device. To gain pilot time you must act as a required crew member or give training as an authorized instructor.

You may **not exercise the privileges** of a certificate, rating, or endorsement if it has been surrendered, suspended, revoked (by the FAA), or expired.

**61.3** You must carry on your person or have readily available in the aircraft your **photo ID** (driver's license, passport, military ID, state issued ID) **pilot certificate** and **medical certificate** (if required) when you are acting as a required crew member.

**61.15** Notify the FAA: AFS-760, P.O. Box 25082, Oklahoma City, OK, 73125-0082, or < www.faa.gov – Licenses & Certificates – Medical Certification – DUI/DWI Program > within **60 days of any motor**

**vehicle action.** Any conviction, ever, involving **illegal drugs** may suspend or prevent issue of a pilot certificate for up to one year.

**61.19** A **student pilot certificate** is **valid** for 60 months after the month in which it was issued for persons less than 40 year old when issued for airplane, helicopter, and powered lift and valid for 60 months for all persons for glider and light sport aircraft. A student pilot certificate is valid for 24 months for persons 40 years old or older for airplane, helicopter, and powered lift.

**61.23 Medical certificates**: 3rd class -valid for 24 months. For persons less than 40 years old (at time of issue), 60 months. 2nd class - valid for 12 months. 1st class - valid for 6 months. For persons less than 40 years old (at time of issue), 12 months. No medical certificate is required to act as a **glider pilot, balloon pilot, light sport pilot or flight instructor** in the same**.**

**61.31** To act as Pilot in Command (PIC) in any **high performance aircraft** (more than 200 HP per engine) or to act as PIC in a **complex aircraft** (retractable gear, flaps, controllable propeller; flap and propeller only for seaplanes) you must receive flight instruction from an authorized instructor. These are one-time requirements and are good for all high performance / complex aircraft that do not otherwise require a type rating or FAA mandated type specific training. Pilots who have logged PIC time in high performance or complex aircraft prior to **8/4/97** are "grandfathered" and exempt from these requirements. To act as PIC in any **tail wheel** (includes tail skid) or, to act as PIC in a **high altitude** (pressurized, capable of operations above FL 250) aircraft, you must receive flight instruction from an authorized instructor. Pilots who have logged PIC time in tail wheel or high altitude aircraft prior to **4/15/91** are "grandfathered" and exempt from these requirements. Note these are separate requirements.

**61.51 Logging pilot time**: You must log that time necessary to obtain a license or rating or to show currency. All other flight time may be logged for your own records. Your log book (any written or electronic form acceptable to the Administrator) must include: date/ total time of flight and or ground instruction/ place of departure and arrival (simulator or FTD location)/ type of aircraft and identity (N number)/ type of pilot time (PIC, SIC, dual from a flight instructor. Note you may log both PIC and dual on a flight if you qualify in both categories)/ flight conditions (day or night, actual or simulated instruments), and the name of the safety pilot for simulated instrument flight. **Pilot in Command** : As a private or commercial pilot, you may log as PIC only that time you are the sole

manipulator of the controls of an aircraft for which you are rated or when acting as PIC in an aircraft that requires more that one pilot. **ATPs** may log PIC when operating on a flight that requires an ATP rating. **Flight Instructors** may log PIC when giving flight instruction. **Second in Command** (SIC): flight time in an aircraft for which you are rated wherein the type aircraft or company regulations require more than one pilot. **Safety pilot** for another pilot flying wearing a vision limiting device may be logged as PIC or SIC time. Note that there is a clear distinction between **acting as PIC and logging PIC.** To act as PIC, you must meet all requirements for currency (**P**hoto ID, **P**hysical (if required), **B**iennial flight review, **C**urrency – 6 month instrument and 90 day landing, **F**lying endorsements or "grandfathered" for high performance / complex / high altitude / tail wheel, **L**icense – appropriate category and class). You may log PIC if you are the sole manipulator of the controls in an aircraft for which you are rated or are the sole occupant of the aircraft (no other requirements necessarily need be met). **With the exception of multi crew aircraft, ATPs, and flight instructors, only the person manipulating the controls may log PIC time. Log books**: you must present your log book (or any other required document) to the FAA, NTSB, state or local law official, and in many state, the airport manager, upon reasonable request. This has been interpreted to mean you have reasonable time to go to the place where the document is kept and then present it. Additionally, you do not have to surrender any document at that time. **Student pilots** must carry their log book and any other required documents with them on solo cross county flights to show evidence of required endorsements. **Recreational pilots and Sport Pilots** must carry their log book on any flight that requires a specific endorsement.

**61.53** You may not act as a required crew member any time you know or have reason to know you have a **medical deficiency** that prevents you from meetings the minimum standards of your **medical certificate** or operating an aircraft that do not require a medical certificate or only require a **driver's license** in a safe manner for those operations.

**61.56 Flight Review** (FR) Required every 24 months to act as PIC. Note that you may fly in another crew position without a flight review. The FR requires a minimum of 1 hour of ground instruction and 1 hour of flight instruction (see requirements for gliders) from an authorized instructor(s). You must review the contents of FAR part 91 and any other areas deemed necessary by the conducting authorized instructor. The ground and flight portions of the FR may be given at separate times by separate instructors. The instructor giving the FR

does not have pass / fail authority; you either receive a flight review endorsement or duel flight instruction given if the FR is not completed. A successful check ride for any pilot or instructor license, rating or privilege given by the FAA, Designated Examiner, or US armed forces check airman will act in leu of a FR. The completion of the basic phase of the **FAA Wings program** (see www.faasafety.gov) will also act in leu of a FR. The FAA considers that a FR given by a flight instructor does constitute flight instruction. To this end, FR may not be given in single seat aircraft. Aircraft with single flight controls** or "throw over" single yoke controls may be used for a FR only when the applicant can act as PIC for the flight.

**Wheel brakes are not a flight control in this context. Wheel brakes are not required for the instructor administering the FR.

**61.57 Flight Currency:** Three takeoffs and landings every 90 days as the sole manipulator of the controls to act as PIC if you are carrying passengers or if you have a safety pilot (or other required pilot crew member) with you. This must be in the same category (airplane, helicopter, etc.) and class (single engine land, multi engine land, etc.) and type, if so required. **Night PIC currency** requires three takeoffs and landing to a full stop within the period of one hour after sunset to one hour before sunrise. Note also that **tail wheel aircraft** require full stop landings for currency as above.

**Instrument currency:** within the last six calendar months you must fly six published instrument approaches (any type), enter one turn in holding, and capture and track a NAVAID bearing or radial in the category of aircraft you intend to fly. Alternatively, you may use an FAA approved simulator or flight training device representing the same category of aircraft you intend to fly. Fly an approach - capture and track any portion on the approach document to get credit for an approach. Holding - cross a holding fix and fly at least one turn in the holding pattern. Track NAVAID - flying an approach will satisfy this requirement. Note you have a total of 12 calendar months to self renew for currency. After the 12$^{th}$ month, you must take an instrument proficiency check in the category of aircraft (simulator, or flight training device) you intend to fly with an instrument flight instructor, an FAA examiner or designated examiner, a company check pilot for FAR 121, 125, or 135 operations, or a U.S. armed forces check pilot.

**61.60 Change of Address:** within 30 days of moving your permanent mailing address, send a change of address notice to: FAA, Airman Certification Branch, AFS 760, Box 25082, Oklahoma City, Ok 73125. Include your name, date of birth, airman certificate number and new address. A plain post card is acceptable. You may make a change of address on line at <www.faa.gov - Licenses & Certificates>. If your new address is a post office

box, rural route, or anything other than a “drive up” street address, include a signed and dated map to your new address. New airman certificates will not automatically be issued for address changes only.

**61.303 Sport Pilot:** Sport pilots, recreational pilots, and private pilots and higher may **act as PIC** in an aircraft that meets Light Sport Aircraft (LSA) criteria using either an FAA medical or a **valid U.S. drivers license**. Recreational or private pilots or higher that have unresolved medical issues from a previously issued FAA medical certificate must resolved these issues to be able to use a divers license in lieu of a medical certificate. A special issuance medical certificate is considered a resolved issue and is not outstanding with the FAA aeromedical branch.

**61.315 Sport Pilot Limits:** Sport pilots may **not act as PIC** in an LSA for hire or compensation (this includes any compensation, such as barter) / to further a business / to demonstrate an aircraft for sale if a sales person / carry a passenger for a charitable organization / carry more than one passenger / in class A, B, C or D airspace, to or from an airport in class B, C or D airspace / at an airport with an operating control tower (see also 61.325) / above 10,000 feet / at night / when the inflight or surface visibility is less than 3 SM / without visual reference to the surface of the earth. Note also you may not act as PIC if there are limits placed on your driver’s license that would prohibit operation of an aircraft.

**61.325 Sport Pilot Added Privileges:** Sport pilots may **receive additional training** from an instructor to be able to act as PIC in class A, B, C or D airspace or to / from an airport in class B, C or D airspace or at an airport with a operating control tower.

**91.3** The person **acting as PIC** is the final authority for the operation of the aircraft. In any inflight emergency requiring immediate action the PIC may deviate from any rule to the extent required to meet that emergency.

**91.7** The PIC is responsible for determining if an **aircraft is in a condition for safe flight**. This includes mechanical condition, required inspections, maintenance endorsements, and required documents on board the aircraft.

**91.9** The PIC must ensure that the **Pilot’s Operating Handbook** or **Flight Manual** is in the aircraft for flight.

**91.13** No person may operate an aircraft in a **careless or reckless** manner so as to endanger the life or property of another.

**91.15** The PIC may not permit any **object to be dropped** from an aircraft that creates a hazard to persons or property.

**91.17** You may not act as a crew member within eight hours of consumption of **alcohol**, if you are under the influence of alcohol, or if your blood alcohol content is.04 percent or higher, by weight.

**91.19** You may not carry any narcotic **drug**, marihuana, depressant, stimulant or and other substance defined in federal or state laws as illegal.

**91.25** The FAA may not use reports submitted to the **NASA Aviation Safety Reporting Program** in any enforcement action except accidents and criminal offenses wholly excluded from the ASRP program.

**91.103** **Preflight actions** required before flight: FOR ALL FLIGHTS - review the runway lengths at the airports of intended use; calculate the take off and landing distances from the aircraft flight manual or other reliable information relating to the aircraft performance under the expected flight conditions. FOR ALL IFR FLIGHTS or FLIGHTS NOT IN THE VICINITY OF AN AIRPORT- become familiar with all information concerning the flight; weather reports and forecasts, fuel requirements, alternate airports when the flight to the planned destination can not be completed, known traffic delays when advised by ATC. "Advised by ATC "implies a review of distant (D) and Flight Data Center (FDC) NOTAMs are required, as well as any delay advised in an ATC clearance.

**91.105** Required flight crew members must keep their **seat belt** fastened at all times they are at their flight crew station. If so equipped, **shoulder harnesses** must be fastened for take off and landing.

**91.107** The PIC may not allow the aircraft to taxi, take off or land until each person on board is notified to fasten their **seat belt** and **shoulder harness**, if installed. Persons less than two years old do not require a seat. The floor of the aircraft may be used as a seat when carrying individuals involved in **sports parachuting.**

**91.109** Flying **simulated instruments** requires a vision limiting device and a safety pilot. The **safety pilot** must be at least a private pilot with the appropriate category and class license and a current medical and current

flight review. The safety pilot must be seated in the other control seat, have adequate forward and side visibility, and have duplicate, full functioning controls or a "throw over" yoke. "**Throw over" yoke aircraft** may only be used when in single engine aircraft and the pilot flying is at least a private pilot with appropriate ratings (no student pilots). A CFI may only give instrument instruct in a throw over yoke single engine aircraft; if the CFI is at the controls is qualified to act as PIC on that flight, and has 25 PIC hours in that make and model of aircraft.

**91.113 Right-of-Way** rules: The least maneuverable aircraft (balloon) has the most right-of-way; the most maneuverable aircraft (helicopter) has the least right-of-way. An aircraft in distress has right-of-way over all other traffic. Towing aircraft have right-of-way over all other engine driven aircraft. When aircraft are on crossing paths inflight, the aircraft to the right has right-of-way. Aircraft will alter course to their right when approaching head on. If overtaking an aircraft, the overtaken aircraft has the right-of-way. When landing, the lower aircraft has the right-of-way and a landing aircraft has reasonable right –of-way over landed or not yet departed aircraft. Anytime you are VMC, the PIC has final authority and responsibility for the **separation of aircraft.**

**91.117 Aircraft speeds:** below 10,000 feet MSL and within class B airspace, 250 KIAS maximum. Note that ATC may authorize a higher speed in controlled airspace. In the airspace directly under class B airspace or a VFR corridor through class B airspace, 200 KIAS maximum. Within 4 NM of the primary airport in class C or D airspace when at or below 2500 feet AGL, 200 KIAS maximum.

**91.119 Minimum safe altitudes, airplanes:** Except for takeoff and landing, do not fly lower than a height from which you can make an emergency landing without undue hazard to people or property on the surface. Do not fly within 1000 feet vertically and 2000 feet horizontally of the highest obstacle when over congested areas. Do not fly lower than 500 feet AGL when over other than congested areas. Do not fly within 500 feet of any person, vessel, structure or object when over open water or sparsely populated areas. **Helicopters and powered parachute / weight shift LSA:** Helicopters may operate at less than 500 feet in congested areas or within 500 feet in non-congested areas undue hazard to people or property on the surface.

**91.121 Altimeter setting:** below 18,000 feet MSL, use the altimeter setting reported by ATC or received by a station along the route of flight and within 100 NM of your aircraft. When departing from an airport that does not have an approved altimeter source, use the setting received from ATC or the

field elevation. At and above 18,000 feet, use 29.92 inches of mercury (1013 millibars).

**91.123 ATC clearances**: When you have received an ATC clearance, you must comply with that clearance. You may deviate from your clearance only in an emergency or in response to a Traffic Alert and Collision Avoidance System (TCAS) resolution advisory. Tell ATC you are deviating from your clearance as soon as possible. If you are uncertain as to the meaning of a clearance, request clarification from ATC. If you deviate from an ATC clearance you must submit a detailed report on the circumstances within 48 hours only if requested to do so by ATC*.* If you request **VFR flight following** radar services from ATC or sequencing from an ATC tower do understand which services ATC will provide. If you receive a discreet transponder code and radar flight following, this in no way alters your status as a VFR flight. ATC will provide traffic advisories and other services on request. You are responsible for terrain and special use airspace clearance and are the final authority for the separation of aircraft. Unless ATC states specific headings, altitudes, and airspeeds, you may maneuver your aircraft as you desire. This is true when in class C, D or E airspace. Advise ATC of changes only if they ask you to. When communicating with an **ATC tower**, you will receive sequencing services. You must remain VMC if you are VFR and you are responsible for the separation of aircraft. You must comply with ATC instructions. The tower controller must separate traffic at the runway as well as sequence traffic in the surface area, but you, the PIC, are the final authority for the separation of aircraft.

**91.126** When landing at **non towered airports** in class G, class E, or **91.127** class C airspace, make all turns to the left unless light signals or **91.129** visual markings indicate right turns. Helicopters will avoid the flow **91.130** of fixed wing traffic. **Tower controlled airports** in class D or C airspace: you must establish communications with the tower prior to entry into the class D or C airspace. “Establish communications” has been interpreted to mean the appropriate ATC facility acknowledges you by call sign. You must comply with the instructions issued by the tower (see 91.123). In the event of **radio failure**, you may land at the tower controlled airport if the weather is at or above basic VFR minimums, visual contact is maintained with the tower, and a clearance to land (light signal) is given. When approaching to land on a runway served by a **visual approach slope indicator,** you must remain at or above the glide slope until a lower altitude is necessary for a safe landing. When departing non towered satellite airports in class D or C airspace, establish communications with the primary airport tower or appropriate ATC facility as soon as practicable after takeoff.

**91.131** You must be at least a private pilot to operate without restriction in **class B airspace.** Student pilots and sport pilots (no other pilot rating) must have specific ground and flight training in class B airspace and current log book endorsements from a flight instructor to operate in that class B airspace (student pilots) and operate from any airport in the class B airspace. See FAR 61.95 and 61.325. The minimum equipment to operate in class B airspace is a two-way VHF radio and a transponder with altitude reporting. VFR, no specific navigation equipment is required; a VOR, TACAN, or RNAV receiver is the minimum required when IFR. If your transponder or altitude encoder is inoperative, you may receive clearance to enter / operate in class B airspace from ATC. See FAR 91.215(d).

**91.133** You may enter **Prohibited** and **Restricted areas** only with permission of the controlling agency for that area. See Airspace, previous.

**91.137** **Temporary flight restrictions** near **disaster / hazard areas** will be announced by FDC NOTAM. Do not operate into or through these TFRs unless ATC routes you through or directly to / from an airport within a TFR. If there is no other clearly practicable means to operate VFR to and from an airport within this TFR, including limitations imposed by terrain or weather, you may operate VFR in the TFR with ATC approval. You must notify the FSS or ATC facility listed in the NOTAM prior to flight and receive advisories on any other operation within the restricted area and you must not hamper any official operations within the restricted area. You may not exercise this privilege simply to observe disaster operations within the temporary restricted area. See http://tfr.faa.gov

**91.139** The FAA may **limit the air traffic control system** operations to meet the level of safety and efficiency required by using emergency air traffic rules**.** FDC NOTAMs will be filed for these conditions.

**91.141** **President and other party TFR** You may not operated an aircraft over or in the vicinity of any area to be visited or traveled by the President, Vice President or other public figures. FDC NOTAMS will establish restrictions. See <http://tfr.faa.gov>

**91.146** **Charity Flights** You may act as PIC for a charity flight only four times in a calendar year. See the full text of 91.146 for additional information. **Young Eagle** flights are exempt under certain conditions.

**91.151 Fuel reserves**, **VFR** – daytime. You must plan, considering the known winds aloft and any known ATC delays, to fly to the first point of intended landing and be able to fly for 30 minutes thereafter at normal cruising speeds. Night; as above but you must plan to have fuel to fly for 45 minutes thereafter. Rotorcraft operating VFR (day or night) must plan for 20 minutes fuel. Note: you must PLAN for these fuel reserves. If winds are not as forecast or you encounter previously unknown ATC delays, you may legally land with less than the above reserves if there was no suitable airport available at the time the above reserves were reached.

**91.153** If you file a **VFR flight plan**, you must cancel this flight plan with Flight Service or ATC facility upon completion of the flight.

**91.155 Weather minimums, VFR** - see weather minimums section, previous.

**91.157 Special VFR** - see weather minimums section, previous.

**91.159 VFR enroute altitudes** when in level flight and more than 3000 feet AGL, maintain the following altitudes: On a magnetic course (NOT heading) of 000 to 179 degrees any odd thousand foot increment plus 500 feet (5,500, 7,500, 9,500, etc.). On a magnetic course of 180 to 359 degrees, any even thousand foot increment plus 500 feet (4, 500, 6,500, 8,500, etc.). This applies up to 18,000 feet MSL. Below 3000 feet AGL or when climbing, descending, or in a holding pattern of two minutes or less, you may fly at any altitude.

**91.161 VFR flights with 60 NM of DCA** require one time certificated training. See <www.faasafety.gov> search for “DCA SFRA”.

**91.203 Required certificates** - a current airworthiness certificate and appropriate certificate of registration. The airworthiness certificate must be carried in the aircraft and displayed near the entrance in view of the aircrew and passengers. If a fuel tank is installed in the cabin or baggage compartment, you must carry a FAA form 337 in the aircraft documenting the tank installation. Note: see FAR 47.40 for **re-registration of aircraft.**

**91.205 Minimum standard equipment** required for flight operations – powered civil aircraft. FOR ALL FLIGHTS: airspeed / altimeter / magnetic compass / tachometer for each engine / oil pressure / oil temperature for each air cooled engine / coolant temperature for each liquid cooled engine / manifold pressure for each turbo charged or supercharged engine / fuel gauge for each

tank / landing gear position indicator for retractable gear / approved safety belt for each occupant over two years old / shoulder harness for each front seat (small aircraft manufactured after July 18, 1978) / emergency locator transmitter (see FAR 91.207) / anti collision light (required for day and night operation in aircraft certificated after March 11, 1996. Aircraft certificated prior require for night operations only). The following is additionally required for NIGHT OPERATIONS: approved position lights / approved anti collision light *(QV)* / landing light (aircraft for hire only). The following is additionally required for all IFR OPERATIONS: a two way radio and navigation equipment appropriate to the ground facilities to be used. / gyro rate of turn / slip - skid indicator / sensitive (adjustable) altimeter / clock with hour, minutes, seconds display / generator or alternator of adequate capacity / artificial gyro horizon / directional gyro / DME or suitable RNAV equipment for flights at or above FL 240.

Note: not stated in FAR 91.205, but by policy, the FAA does not dictate what kind or currency of aviation aids (maps) you carry in the aircraft for FAR part 91 VFR flight operations. The acting PIC is responsible for the safety of the flight; however you may not be remanded for carrying **old aeronautical charts** in the aircraft. Reference: 8-9/97 *FAA Aviation News.*

**91.207 Emergency Locator Transmitters:** You must have a properly installed ELT in the aircraft. ELTs must be inspected every 12 months and an airframe log book endorsement made. The following exceptions do not require an ELT on board:

-single seat aircraft
-training flight within 50 NM of the departure airport
-any non turbojet aircraft operated under FAR part 91 - for 90 days maximum, provided the aircraft log book is endorsed for the removal of the ELT and a placard is placed in view of the PIC showing “ELT removed”

Note: as of February 1, 2009, COPAS – SARSAT satellite no longer monitor 121.5 or 243.0 frequencies. You may continue to fly with a VHF (121.5) ELT installed. Other ICAO countries now require 406 MHz frequency ELTs. Short term flights to the Bahamas, Mexico, or Canada does not currently require 406 MHz equipment for US registered aircraft.

**91.209 Position lights**: You must display position lights (red/green/white) between sunset and sunrise. You must display position lights or well illuminate an aircraft if parked or being moved on the ground in dangerous proximity to night flight operations areas.

**91.211 Oxygen** requirements: When the CABIN altitude is above12,500 and at or below 14,000 feet MSL, the required crew member(s) must use supplemental oxygen when at these altitudes for more than 30 minutes

STARTING with the 31st minute. Above 14,000 feet, the required crew must use oxygen at all times. At 15,000 feet and above, the crew must offer oxygen to passengers (use of oxygen is optional). In pressurized aircraft above FL 250, regardless of cabin altitude, the crew must provide a 10 minute supply of oxygen to each person, in the event of loss of cabin pressure.

**91.213** **Inoperative equipment** and instruments: You must either have an approved Minimum Equipment List (MEL) for the aircraft and you follow the directives therein OR you may remove or deactivate and placard inoperative equipment and instruments in small (less than 12,500 # CERTIFIED take off weight) rotor craft or non turbine airplanes and the equipment is NOT:

-Part of the day, VFR type certificated equipment or instruments required by the type certificate data sheet for the aircraft
-Indicated as required in the aircraft's equipment list for kinds of operations conducted
-Required by FAR 91.205 (minimum standard equipment for flight operations) or any other rule in FAR 91 for the specific kind of flight operations being conducted
-required to be operational by an air worthiness directive

**91.215** **Transponder** requirements: If you have a transponder and it meets the 24 months system check, you must operate the transponder and altitude reporting feature on the code assigned by ATC. Transponders with altitude reporting are required in class A, B, and C airspace; within 30 NM of the primary airport(s) in class B airspace and when at and above 10,000 feet MSL (except when you are at/above 10,000 feet MSL AND within 2,500 feet AGL). If you do not have altitude reporting capability, or it is inoperative, you may request a waiver to enter airspace requiring such at ANY time. If you have a transponder but it is inoperative, you may request a waiver to enter airspace requiring such at ANY time. If you do not have a transponder on board, you must request a waiver at least one hour before the proposed operation.

**91.217** The **altitude reporting** feature of your transponder must be tested to an125 foot accuracy. Note: when ATC asks for your altitude read out, ATC must see an encoded altitude within 300 feet that which you verbally report. If you report an altitude greater than 300 different from your readout, ATC may not use your altitude reporting function for separation purposes. (ref: ATC hand book 7110.65)

**91.221** If your aircraft is equipped with an approved, operable Traffic Alert and Collision Avoidance (**TCAS**) system, you must operate that system inflight.

## 91.225 Automatic Dependent Surveillance Broadcast OUT

After 1/1/2020 ADS-B OUT (aircraft to ground) is required for all aircraft to operate in Class A, within 30 NM of, and in, class B, Class C airspace, at and above 10,000' MSL, class E at and above 3000' MSL, the Gulf of Mexico, and within 12NM of the coastline.

**91.303 Aerobatic flight:** Defined as any intentional maneuver involving an abrupt change in an aircraft's attitude, an abnormal attitude, or abnormal acceleration not necessary for normal flight. You may not perform aerobatic flight if: over a congested city, town, or settlement / over an open air assembly of persons / within the lateral boundaries of surface based class B, C, D, or E airspace designated for an airport (note: this does not include the concentric, non surface based rings to class B or C airspace) / within four NM of the centerline of an airway / below 1,500 feet AGL / when flight visibility is less than three SM.

**91.307 Parachutes:** If carried for emergency purposes, they must be FAA approved and repacked as required. Refer to the specific make parachute for packing currency (specifies 180 days and / or 60 day limits for certain types of materials). If carrying another person (other than a crew member) you may not exceed 60 degrees of bank or 30 degrees of pitch unless all occupants of the aircraft are wearing a current, approved parachute. Exceptions: a flight test for a certificate or rating / spins and other flight maneuvers performed by an ATP instructing an ATP candidate or a flight instructor instructing a student for a certificate or rating. Note: further clarification was published in the Federal Register referencing FAR 91.71 (now 91.307). "…regardless of what certificate or rating the applicant is seeking, an aerobatic maneuver required for any pilot certificate or rating (even one not presently sought by the applicant) may be performed **without parachutes** when done by, or at the direction of, a certified flight instructor.

**91.319 Experimental aircraft:** No person may operate an experimental certificated aircraft for other than the purpose for which the certificate was issued. For a newly certificated aircraft, you may not operate outside of a designated area until it is shown that the aircraft operates normally and has no hazardous operating characteristics or design features. You must operate day VFR only and may not operate over densely populated areas or on a congested airway unless so authorized in the special operating limitations. You may not carry persons for compensation or hire. *Note: The FAA has granted EAA, NAFI and SAMA an exemption from FAR 91.319(a). This exemption allows owners of experimental "crew training" (FAR 21.191(c)), "exhibition" (FAR 21.191(d)), amateur-built (FAR 21.191(g)) or kit-built (FAR 21.191(h) aircraft to rent, or lease their aircraft to other rated pilots for the purpose of providing aircraft specific transition training and flight reviews (FAR 61.56)*

You must notify control towers you are an experimental aircraft. Note: experimental aircraft, by convention, use the term “experimental” on initial contact to all ATC agencies. Normally, a letter, “experimental operating limitations” (FAA form 8130-1) accompanies the special airworthiness certificate (FAA form 8130-7) issued. The above letter states the conditions and limitations for operations for the aircraft.

**91.403** The owner or operator of an aircraft is primarily responsible for maintaining that **aircraft in an airworthy condition**. Only individual authorized in FAR part 43 may work on aircraft (mechanic or repairman) except for specific preventative maintenance which may be performed by the aircraft owner. See FAR 43.3. You may not fly an aircraft that has not complied with all manufacturer’s required inspections, parts repair, or replacement.

**91.405** The owner or operator of an aircraft must ensure the aircraft receives the required **maintenance inspections**, and the person performing these inspections makes appropriate entries to return the aircraft to service in the airframe, engine, and propeller log books. The owner or operator is responsible to have inoperative equipment removed or placarded before flight. See FAR 91.213.

**91.407** The owner or operator on an aircraft may not fly that aircraft after maintenance, alteration, or rebuilding unless it has been approved for **return to service** by a person authorized under FAR 43.9 or 43.11. If an aircraft receives alteration that may have appreciably changed the flight characteristics or substantially affected its operation in flight, only crew members may fly for an operational check of the aircraft. The PIC must be at least a private pilot. If the aircraft is ready, the PIC makes an entry in the maintenance log book(s) to return the aircraft to service.

**91.409** No person may fly an aircraft unless and **annual inspection** was performed within the last 12 calendar months. No PIC may carry a person other than a crew member for hire and no person may give flight instruction in an aircraft he / she provides unless the aircraft has a current **100 hour inspection**. 100 hour inspections may go 10 hours over the 100 hour limit if the aircraft is enroute to a place where the 100 hour or annual inspection can be performed.

**91.411** The **altimeter** and the **static system(s)** must be inspected every 24 calendar months to operate IFR.

**91.413** The **transponder** and **altitude encoder**, if installed, must be inspected every 24 calendar months.

# AIM EXTRACTS

**THE FOLLOWING EXTRACTS FROM THE AERONAUTICAL INFORMATION MANUAL (AIM) AND OTHER SOURCES WILL ASSIST YOU IN FLIGHT OPERATIONS. THIS IS NOT A COMPLETE REVIEW OF THE AIM. SEE THE AIM FOR ALL INFORMATION FOR FLIGHT OPERATIONS.**

**1-1-19** The **Global Positioning System** is a satellite-based navigation system, which broadcasts a signal that is used by receivers to determine precise position anywhere in the world.... The GPS constellation of active satellites is designed so that a minimum of five are always observable by a user anywhere on earth....The (in-aircraft) receiver tracks multiple satellites and determines a pseudo range measurement that is then used to determine the user location. A **minimum of four satellites** is necessary to establish an **accurate three-dimensional position**. The Department of Defense (DOD) is responsible for operating the GPS satellite constellation and monitors the GPS satellites to ensure proper operation....The GPS receiver verifies the integrity (usability) of the signals received from the GPS constellation through receiver autonomous integrity monitoring (**RAIM**) to determine if a satellite is providing corrupted information. At least one satellite, in addition to those required for navigation, must be in view for the receiver to perform the RAIM function; thus, **RAIM needs a minimum of 5 satellites** in view, or 4 satellites and a barometric altimeter (baro-aiding) to detect an integrity anomaly. For receivers capable of doing so, RAIM needs 6 satellites in view (or 5 satellites with baro-aiding) to isolate the corrupt satellite signal and remove it from the navigation solution. Baro-aiding is a method of augmenting the GPS integrity solution by using a non satellite input source. GPS derived altitude should not be relied upon to determine aircraft altitude since the vertical error can be quite large and no integrity is provided. To ensure that baro-aiding is available, the current altimeter setting must be entered into the receiver as described in the operating manual.... **VFR pilots** should never rely solely on one system of navigation. (VFR only) GPS navigation (systems) must be integrated with other forms of electronic navigation as well as pilotage and dead reckoning. Only through the integration of these techniques can the VFR pilot ensure accuracy in navigation.

**IFR APPROACHES**

You must have a current data base to fly the approach. Note: you may practice a GPS approach with an out of date data base as long as the data has not changed and you do not file IFR. If you ask for an approach, your TSO 129C receiver will look at the data base for the information to move it to the usable

memory. If the data base is out of date, your receiver will retrieve the data, but requires you to acknowledge the data base is not current.

## TO FLY AN APPROACH

To fly a GPS approach - the following steps are common to all IFR receivers: - select the destination from the data base- select the approach function on the receiver - select a specific approach from the approach data base - select a specific Initial Approach Fix / Final Approach Fix (IAF/ FAF) from the approach data base. Note: some newer receivers automatically select the approach and IAF. When you are 30 NM from destination the receiver will arm. The CDI sensitivity will change from 5 NM either side of instrument center to 1 NM either side. This increased CDI sensitivity is called terminal mode. Some receivers require you enter the local altimeter setting; other receivers do this automatically. This action will arm the approach if not otherwise armed. The receiver will guide you to the IAF / FAF and sequence automatically to all subsequent GPS way points to the FAF. Note the FAF may be the first approach waypoint if receiving vectors to final from ATC. When 2 NM prior to the FAF, the receiver will go from ARM to ACTIVE mode and the CDI sensitivity will change from 1 NM either side of instrument center to 0.3 NM either side of center. This final increased CDI sensitivity is the approach mode operation for the receiver. As you arrive at the missed approach point, the GPS receiver will stop auto sequencing. If you select the direct to function, the receiver will default to the missed approach holding fix. If the RAIM feature senses degraded signals such as less than 5 satellites available, loss of signal, or other problems, the RAIM light will illuminate and you will get an off flag on the VOR or HSI. Note: RAIM has different sensitivity settings: if the receiver is in the enroute mode you will get a warning flag in 30 seconds. In the terminal or approach mode, you will get a warning flag within 10 seconds. If you are on the approach and passed the FAF, the receiver will provide degraded navigation information for up to 5 minutes if the RAIM function is lost. This is to permit you to miss or abandon the approach.

**Vertically guided GPS approaches:** LPV approaches are IFR GPS only and may go as low as 200 foot DH and ½ SM visibilities under idea conditions. LNAV/ VNAV approaches may use IFR GPS and other inputs, such as baro-aided vertical guidance. When vertical guidance is part of the GPS approach, **Wide Area Augmentation System** (WAAS) is required. WAAS consists of ground based receiver / re-transmitters and communications satellites that will provide additional accuracy and integrity monitoring. An aircraft conducting an LPV or LNAV / VNAV GPS approach will have a warning flag with 6 to 8 seconds if any part of the GPS system does not meet parameters, using both RAIM and WAAS protection. Additionally, the FAA is planning for **Local Area Augmentation Systems** (LAAS) which could permit precision GPS approaches to very low minimums, including zero ceiling/zero visibility landings. LAAS will consist of a psudolite (false satellite- a precisely positioned ground based GPS receiver/transmitter). This psudolite will receive the same signal as your airborne receiver, correct for all system and transmission errors, and then transmit an additional positioning signal to your aircraft GPS receiver using a VHF frequency.

This will permit three dimensional accuracy to match or exceed ILS category II and III approach minimums.

**1-2-2 Required Navigation Performance (RNP)** is RNAV with on−board navigation monitoring and alerting. RNP is also a statement of navigation performance necessary for operation within a defined area of the airspace. A critical component of RNP is the ability of the aircraft navigation system to monitor its own navigation performance and to identify top the pilot whether the necessary accuracy in navigation is or is not being met. This on−board performance monitoring and alerting capability therefore allows less reliance on air traffic control intervention (via radar monitoring, automatic dependent surveillance, multilateration, or communications) and/or route separation to achieve the overall safety of the operation. RNP capability of the aircraft is a major component in determining the separation criteria among aircraft.

**4-1-9** At **non towered airports**, use the following communications procedures: arrival – listen first when approximately 10 NM from the airport. Then call to request an airport advisory on UNICOM or state your intentions on CTAF. Report entering downwind, base, final, and leaving the runway. The following chart shows recommended radio calls. While it its appropriate to make additional short, direct transmissions for immediate safety of flight (example: “Middle Muni traffic, Cessna 26H is downwind, runway 18, number two behind the red and white Arrow, Middle Muni”). Do not use nonstandard radio terminology.

TBL 4-1-1

**Summary of Recommended Communication Procedures**

| | | | Communication/Broadcast Procedures | | |
|---|---|---|---|---|---|
| | Facility at Airport | Frequency Use | Outbound | Inbound | Practice Instrument Approach |
| 1. | UNICOM (No Tower or FSS) | Communicate with UNICOM station on published CTAF frequency (122.7; 122.8; 122.725; 122.975; or 123.0). If unable to contact UNICOM station, use self-announce procedures on CTAF. | Before taxiing and before taxiing on the runway for departure. | 10 miles out. Entering downwind, base, and final. Leaving the runway. | |
| 2. | No Tower, FSS, or UNICOM | Self-announce on MULTICOM frequency 122.9. | Before taxiing and before taxiing on the runway for departure. | 10 miles out. Entering downwind, base, and final. Leaving the runway. | Departing final approach fix (name) or on final approach segment inbound. |
| 3. | No Tower in operation, FSS open | Communicate with FSS on CTAF frequency. | Before taxiing and before taxiing on the runway for departure. | 10 miles out. Entering downwind, base, and final. Leaving the runway. | Approach completed/terminated. |
| 4. | FSS Closed (No Tower) | Self-announce on CTAF. | Before taxiing and before taxiing on the runway for departure. | 10 miles out. Entering downwind, base, and final. Leaving the runway. | |
| 5. | Tower or FSS not in operation | Self-announce on CTAF. | Before taxiing and before taxiing on the runway for departure. | 10 miles out. Entering downwind, base, and final. Leaving the runway. | |

**4-1-11** Airports that do not have a published UNICOM or CTAF; you may use **multicom** (122.9) to announce traffic intentions. Use 122.75 (airplanes) or 123.025 (helicopters) for **air to air communications** or when operating at a **private airport** not open to the public.

**4-2-3** Contact procedures: When making the **initial call** to any ATC controller or FSS specialists, use the following format:

-Name of the facility you are calling
-Your FULL call sign

-Your type of message or your full request, if it is short
-Term over as necessary, to end your transmission

**4-2-4** Note ATC may **abbreviate** your **call sign** to your prefix and last three identifiers. Once ATC has abbreviated your call sign, you may continue to use this shortened call sign with THAT controller. If another aircraft with a similar sounding call sign comes up on frequency, either you or the ATC controller should initiate use of your full call sign in the interest of flight safety. On initial contact to a new controller, always use your full call sign. Example: *Houston Center Cessna 1234ME four thousand, direct Memphis* (reply from Center) *Cessna 4ME, roger*. Use the “N” prefix to your call sign only when flying outside of the USA. Acknowledge all calls from ATC, either verbally or through actions observable by the controller. Example: *"Cessna 4ME, squawk 4523 and ident"*. ATC will observe your reply via the squawk and ident you give. Always reply verbally if ATC's instructions are not clear. Use of standard abbreviation such as "roger" (I understand your transmission) "wilco" (I understand your transmission and will comply with your instructions) "affirmative" and "negative" are encouraged to reduce transmission time.

**4-3-11** ATC may authorize **takeoffs and landings on multiple intersecting runways.** Takeoff: the tower will issue an intersection takeoff clearance. Example:

*“Cessna 1234ME, intersection Mike, cleared for takeoff runway 14”*

You may request usable runway distance remaining from the tower.
Landing: the tower will a land and hold short clearance. Example:

*“Cessna 1234ME, cleared to land runway 14, hold short runway 03”*

You may request usable runway distance available for landing from the tower. You need not accept a land and hold short (LAHSO) clearance if you are unwilling or unable to comply.

**4-4-1** An **ATC clearance** is NOT permission to deviate from any rule, regulation, or minimum altitude nor conduct unsafe operations in your aircraft at any time. If ATC issues a clearance that would cause you to deviate from a rule or regulation, or in your opinion, would place the aircraft in jeopardy, it is your responsibility to request an amended clearance. If you take action that differs from your ATC clearance, you must inform ATC accordingly.

**4-4-4** You may request an **amended clearance** from ATC if you feel you have information that would make a different course of action more practicable

or if you equipment or operating limitations make prohibit compliance with the clearance issued.

**4-4-6** **Special VFR** clearances: see Special VFR in “Weather Minimums for VFR Flight”, previous.

**4-4-7** **Pilot Responsibility upon Clearance Issuance** Write down your **clearance** when received from ATC. When you receive an initial clearance, read back the complete clearance. Airborne aircraft should read back those parts of an ATC clearance containing altitude assignments and / or headings. It is your responsibility to accept or reject an ATC clearance at the time it is issued.

**4-4-9** **VFR/IFR Flights** A pilot departing VFR, either intending to or needing to obtain an IFR clearance en route, must be aware of the position of the aircraft and the relative terrain/obstructions. When **accepting a clearance below** the **MEA/MIA/MVA/OROCA**, **pilots are responsible for their own terrain/obstruction clearance** until reaching the MEA/MIA/MVA/OROCA. If pilots are unable to maintain terrain/obstruction clearance, the controller should be advised and pilots should state their intentions.

**4-4-13** **Runway Separation:** Tower controllers establish the sequence of arriving and departing aircraft by requiring them to adjust flight or ground operation as necessary to achieve proper spacing. They may "HOLD" an aircraft short of the runway to achieve spacing between it and an arriving aircraft; the controller may instruct a pilot to "EXTEND DOWNWIND" in order to establish spacing from an arriving or departing aircraft. At times a clearance may include the word "IMMEDIATE." For example: "CLEARED FOR IMMEDIATE TAKEOFF." In such cases "IMMEDIATE" is used for purposes of *air traffic separation.* It is up to the pilot to refuse the clearance if, in the pilot's opinion, compliance would adversely affect the operation.

**4-4-14** **Visual Separation** **a.** Visual separation is a means employed by ATC to separate aircraft in terminal areas and en route airspace in the NAS. There are two methods employed to effect this separation:

**1.** The tower controller sees the aircraft involved and issues instructions, as necessary, to ensure that the aircraft avoid each other.

**2.** A pilot sees the other aircraft involved and upon instructions from the controller provides separation by maneuvering the aircraft to avoid it. When pilots

accept responsibility to maintain visual separation, they must maintain constant visual surveillance and not pass the other aircraft until it is no longer a factor.

***NOTE-***
*Traffic is no longer a factor when, during the approach phase, the other aircraft is in the landing phase of flight or executes a missed approach; and during departure or enroute, when the other aircraft turns away or is on a diverging course.*

**b.** A pilot's acceptance of instructions to follow another aircraft or provide visual separation from it is an acknowledgment that the pilot will maneuver the aircraft as necessary to avoid the other aircraft or to maintain in-trail separation. In operations conducted behind heavy jet aircraft, it is also an acknowledgment that the pilot accepts the responsibility for wake turbulence separation.

***NOTE-***
*When a pilot has been told to follow another aircraft or to provide visual separation from it, the pilot should promptly notify the controller if visual contact with the other aircraft is lost or cannot be maintained or if the pilot cannot accept the responsibility for the separation for any reason.*

**c.** Scanning the sky for other aircraft is a key factor in collision avoidance. Pilots and copilots (or the right seat passenger) should continuously scan to cover all areas of the sky visible from the cockpit. Pilots must develop an effective scanning technique which maximizes one's visual capabilities. Spotting a potential collision threat increases directly as more time is spent looking outside the aircraft. One must use timesharing techniques to effectively scan the surrounding airspace while monitoring instruments as well.

**d.** Since the eye can focus only on a narrow viewing area, effective scanning is accomplished with a series of short, regularly spaced eye movements that bring successive areas of the sky into the central visual field. Each movement should not exceed ten degrees, and each area should be observed for at least one second to enable collision detection. Although many pilots seem to prefer the method of horizontal back-and-forth scanning every pilot should develop a scanning pattern that is not only comfortable but assures optimum effectiveness. Pilots should remember, however, that they have a regulatory responsibility (14 CFR Section 91.113 (a)) to see and avoid other aircraft when weather conditions permit.

## 4-4-15 **Use of Visual Clearing Procedures Before Takeoff:** Prior to taxiing onto a runway or landing area in preparation for takeoff, pilots should scan the approach areas for possible landing traffic and execute the appropriate clearing maneuvers to provide them a clear view of the approach areas. **Climbs and descents -** During climbs and descents in flight conditions which permit visual detection of other traffic, pilots should execute gentle banks, left and right

at a frequency which permits continuous visual scanning of the airspace about them. **Straight and level -** Sustained periods of straight and level flight in conditions which permit visual detection of other traffic should be broken at intervals with appropriate clearing procedures to provide effective visual scanning. **Traffic pattern -** Entries into traffic patterns while descending create specific collision hazards and should be avoided. **Traffic at VOR sites -** All operators should emphasize the need for sustained vigilance in the vicinity of VORs and airway intersections due to the convergence of traffic. **Training operations -** Operators of pilot training programs are urged to adopt the following practices: Pilots undergoing flight instruction at all levels should be requested to verbalize clearing procedures (call out "clear" left, right, above, or below) to instill and sustain the habit of vigilance during maneuvering. **High-wing airplane -** Momentarily raise the wing in the direction of the intended turn and look. **Low-wing airplane -** Momentarily lower the wing in the direction of the intended turn and look. Appropriate clearing procedures should precede the execution of all turns including chandelles, lazy eights, stalls, slow flight, climbs, straight and level, spins, and other combination maneuvers.

**4-5-7** **Automatic Dependent Surveillance and Broadcast (ADS-B)** is a surveillance technology being deployed throughout the National Airspace System (NAS). The ADS−B system is composed of aircraft avionics and a ground infrastructure. Onboard avionics determine the position of the aircraft by using the GNSS and transmit its position along with additional information about the aircraft to ground stations for use by ATC and other ADS−B services. This information is transmitted at a rate of approximately once per second. ADS-B OUT is the aircraft transmitting its position to ATC. ADS-B IN is data link information from the ground to the aircraft. (see “NextGen”, previous).

**5-1-1** Preflight - a computer accessed **Direct User Access Terminal** (**DUATS**) session does constitute an FAA approved weather briefing and a record of your weather briefing, flight plan, and pilot’s log will be kept on file.

**5-1-3** **Notice to Airman (NOTAM)** NOTAM information is classified into two categories. These are NOTAM (D) or distant and Flight Data Center (FDC) NOTAMs.

**5-5-1** **Pilot and controller roles and responsibility** The **pilot-in-command** of an aircraft is directly responsible for, and is the **final authority** as to the **safe operation of that aircraft**. In an **emergency** requiring immediate action, the pilot-in-command **may deviate from any rule** in the General Subpart A and Flight Rules Subpart B in accordance with 14 CFR Section 91.3. The **air traffic controller** is responsible to give **first priority** to the **separation of aircraft** and to the issuance of radar safety alerts, second priority to other services that are required, but do not involve separation of aircraft and third

priority to additional services to the extent possible. In order to maintain a safe and efficient air traffic system, it is necessary that each party fulfill their responsibilities to the fullest. The responsibilities of the pilot and the controller intentionally overlap in many areas providing a degree of redundancy. Should one or the other fail in any manner, this overlapping responsibility is expected to compensate, in many cases, for failures that may affect safety. The following, while not intended to be all inclusive, is a brief listing of pilot and controller responsibilities for some commonly used procedures or phases of flight. More detailed explanations are contained in other portions of this publication, the appropriate CFRs, ACs and similar publications. The information provided is an overview of the principles involved and is not meant as an interpretation of the rules nor is it intended to extend or diminish responsibilities

**5-5-8** **See and avoid**: when you are in visual meteorological conditions (VMC) you are the final authority for the separation of aircraft.

**5-5-15** **Minimum fuel advisory**: If you are in contact with ATC, advise them of your minimum fuel status any time you can not accept any delay when reaching destination. Example: *"Approach, Cessna 1234ME, minimum fuel"* Note that this is not an emergency condition, but *advises* ATC you have a mitigating condition. You may not necessary receive traffic priority unless you declare an emergency. If requested state your fuel remaining in minutes. Example: *"Approach, Cessna 1234ME estimates 15 minutes fuel remaining"*

**6-1-1** **Pilot Responsibilities and Authority:** In an emergency requiring immediate action, the pilot−in−command may deviate from any rule in 14 CFR Part 91, Subpart A, General, and Subpart B, Flight Rules, to the extent required to meet that emergency.

**6−1−2** **Emergency Condition− Request Assistance Immediately:** An emergency can be either a *distress* or *urgency* condition as defined in the Pilot / Controller Glossary. Pilots do not hesitate to declare an emergency when they are faced with *distress* conditions such as fire, mechanical failure, or structural damage. However, some pilots are reluctant to report an *urgency* condition when they encounter situations which may not be immediately perilous, but are potentially catastrophic. An aircraft is in at least an *urgency* condition the moment the pilot becomes doubtful about position, fuel endurance, weather, or any other condition that could adversely affect flight safety. This is the time to ask for help, not after the situation has developed into a *distress* condition.