Stan/Eval Newsletter
CIVIL AIR PATROL
UNITED STATES AIR FORCE AUXILIARY
105 S. Hansell Street
Maxwell AFB, AL 36112

February 2022

Tire Pressure Revisited (Maj L. Helsten)
(Editor's Note: The Jan 2022 Edition of the National Stan/Eval had an article on Tire Pressure. Maj Helsten graciously offered to rewrite the article to correct and improve it. Many thanks to Maj Helsten!)

Proper tire inflation is critical to flight safety and tire longevity. This article will discuss the proper (pilot conducted) preventive maintenance, tire life span (consequences of not properly performing this maintenance), and common pilot fallacy.

Preventive Maintenance
The following steps ([2] pp. 20–22) should be performed during sortie pre-flight by the pilot.

1. Pressure is checked before first sortie of day (IAW CAPR 130-2 paragraph 11.3) with a pressure gage (recommended to be accurate to ±2% by the FAA ([1] p. 4).
    1. Tires must be cold — 3 hours must pass from last taxi or landing for tire to be considered cold.
    2. Minimum cold tire pressure shall be the tire pressure from the POH, AIF Coversheet, or CAP Checklist — in that order.
    3. Maximum cold tire pressure is minimum cold tire pressure plus 5%.
    4. If the tire is cold, then the tire pressure may be checked with gauge before subsequent sorties.
2. Checked tire pressure shall be recorded in Aircraft Flight Time Log.
    1. If tires are not checked (not first flight of day) then tire pressure blocks are to be left blank.
3. If cold tire pressure is outside the cold tire pressure range, then tire should be serviced.
    1. If tire is serviced, then the "SVCD" checkbox will be marked.
    2. HOT TIRES SHALL NOT BE SERVICED BY EITHER ADDING OR REMOVING PRESSURE.

When the checked pressure is less than the required minimum pressure then the following table should be consulted ([1] p. 7 and [2] p. 22). This table assumes that the aircraft tire pressure has been checked within the previous 72 hours.

Cold Tire Pressure	Recommended Action
100% – 105% of minimum tire pressure	**None**
95% – 100% of minimum tire pressure	**Reinflate**
90% – 95% of minimum tire pressure	**1. Inspect tire/wheel for cause of pressure loss 2. Reinflate & record in logbook 3. AMRAD discrepancy and refer to AMF if pressure loss greater than 5% and reoccurs within 24 hours**
0% – 90% of minimum tire pressure	**AMRAD discrepancy and refer to AMF for evaluation/replacement prior to next flight**

Preventive Maintenance Process Example:

1. Assume the first sortie of the day and that the last sortie was completed more than 3 hours previous.
2. Assume the aircraft is a Cessna 182T with manufacturer specified main tire pressure of 42 PSI and nose tire pressure of 49 PSI.
3. Using an appropriate tire gauge that has a maximum reading greater than 60 PSI check the pressure of the main tires and nose tire.
4. Record the tire pressures in the AIF Aircraft Flight Time Log.
5. Compute the tire pressure range by adding 5% to the minimum tire pressure.
    1. Main tire is 42 PSI + 2 PSI = 44 PSI.
    2. Nose tire is 49 PSI + 2 PSI = 51 PSI.
6. If either main tire pressure is below 42 PSI or the nose tire pressure is below 49 PSI, then service the tire to be within the computed range, indicate that tire was serviced in the AIF Aircraft Flight Time Log.
7. If either main tire is above 44 PSI or the nose tire pressure is above 51 PSI, then release pressure in tire to be within the computed range and indicate that tire was serviced in the AIF Aircraft Flight Time Log.

Tire Life Span Consequences

Tire life span may be seriously reduced when operating with an under-inflated tire.
Goodyear Aviation tested ([2] pp. 49–50) under-inflated to determine the impact on life span. Using multiple tire types, they taxied an aircraft with a fully inflated tire until the tire failed and used this as the normal life span. Goodyear then performed the same test with a tire under-inflated by 5% and by 10% (for one of our C182T that would put the main tire pressure at 40 PSI and 38 PSI respectively). Although these tests did not specifically use a C182 the results would be qualitatively the same if not quantitively.

At 5% under-inflation the life span of the tire was reduced by 55% and at 10% under-inflation the life span was reduced by 70% (Fig. 1 Fatigue Due to Under-inflation). From this it is clear that just taxiing with an under-inflated tire results in significant reduction in tire life span and increases CAP maintenance costs. Take-off and landing are even harder on an under-inflated tire. At just 10% under-inflation (remember that for our C182T that would be at 38PSI) failures occurred with just 7 take-off cycles.

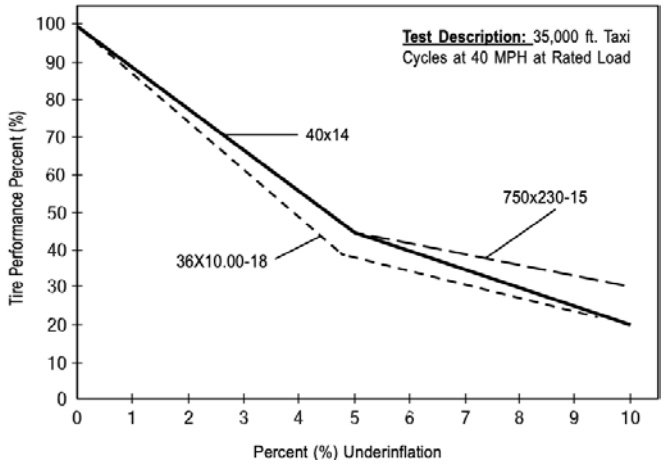


Fig 1: Fatigue Due to Under-inflation

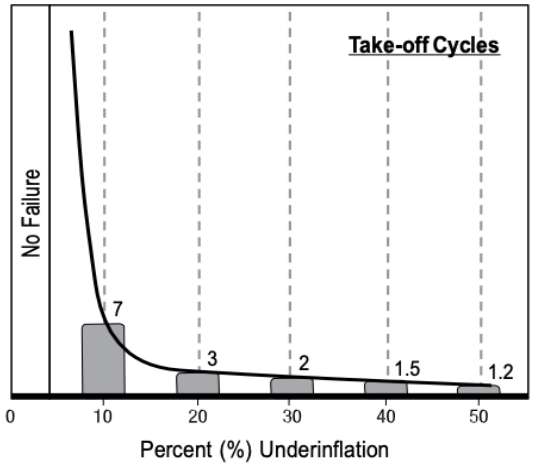


Fig 2: Cycles to Failure

So, as we can see a tire that is under-inflated by as little as 4 PSI (using our C182T example) may result in severe damage to the tires, and we should avoid even taxiing the aircraft in this condition.

Pilot Fallacies

Many pilots think that they can just look at an aircraft tire and see that it is under-inflated. Not true. Any pilot, who thinks they can look at an aircraft tire and see the under-inflation is challenged to perform the following experiment.

1. Take a picture of a cold tire that is properly inflated.
2. Release pressure until the tire is 10% under-inflated.
   - For a C182T main it is 38 PSI and nose it is 42 PSI.
   - For a C206T main it is 38 PSI and nose it is 42 PSI.
   - For a C172S main it is 38 PSI and nose it is 41 PSI.
3. Take a picture of the same tire that is now under-inflated.
4. Service the tire until it is in the proper service range.
5. Compare the two images to see if you can detect as little as a 10% under-inflation. Good luck!

References

[1] Federal Aviation Administration (FAA). AC 20–97B Aircraft Tire Maintenance and Operational Practices. Sep 2018. Available**:**
https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_20-97B_CHG_1.pdf
[Accessed: 14 Jan 2022].

[2] Goodyear Aviation. Aircraft Tire Care & Maintenance. Jan 2020. Available:
https://www.goodyearaviation.com/resources/pdf/aviation-tire-care-2020.pdf
[Accessed: 14 Jan 2022].

Back to basics – Oil

Engine oil is something we don't think about too much, but it is an integral part of engine operations. On preflight we do check to ensure that there is sufficient oil for flight, and we may notice its clean or dirty but that's about it. Make sure you know what level is acceptable for the airplane you are flying.

Engine oil performs several critical functions in an engine:

- It lubricates reducing wear, heat, and friction
- It cleans the engine
  (which is why we need to change the oil frequently)
- It seals the engine
  (for example there is a thin film of oil between the cylinder and the cylinder walls)
- It cools the engine
  (our engines are air cooled but the oil does some of the cooling with or without an oil cooler)
- It leaks out on the belly making the airplane slippery and increasing airspeed
  (ok I haven't verified this one yet)
- For an airplane with a constant speed prop, the oil may also be used to drive the pitch, but we'll ignore this for now.

So, oil is essential for proper engine operation, and it must be the correct oil. First let's chat briefly about viscosity, which is oil's thickness. The viscosity is of the thickness of oil at a given temperature. As temperatures go up, the viscosity goes down and when the temperatures go down, the viscosity goes up. If it's too thin (lower viscosity), it won't be able to lubricate properly. If it's too thick (higher viscosity), the engine won't be able to produce max power due to increased friction and must be able to withstand high temps without breaking down. The aircraft POH specifies the correct oil to use but most aviation grade oils are acceptable if they are the correct weight. Our Cessna aircraft can use both single weight and multi-weight oils where weight really isn't how heavy it is but measures the viscosity (thickness) of the oil.

Single weight oils are a single viscosity. In the winter, we might use a lighter weight oil (say 30W) to facilitate starting the engine and in summer, a higher weight oil (say 50W) when the engine is operating at higher temperatures. In days bygone, single weight was the only available choice.

Today we have the option of multi-weight oils. They have a similar designation but with a range. For most of our fleet, 15W-50 or 20W-50 oil may be appropriate. What this means is that in cold weather the oil acts more like the lower end (15W or 20W), whereas, in hot weather it acts more like the upper end (50W). 20W-50 has a base oil of 20W but through the magic of chemistry, polymers are added that gives it the added viscosity as the temperature goes up. CAP's preferred engine oil is Phillips X/C 20W/50; Aeroshell 15W/50 can also be used if this is not available.

There is no consensus on whether single weight or multi-weight oil is "better" with having good arguments on both sides. Single weight oil is generally cheaper, but both do a good job when used properly. Single weight oils are also used in a new engine or after a cylinder replacement to help "seat" the rings. There are also some semi-synthetic oils on the market that can be used. Fully synthetic oils cannot be used in most aircraft engines because of some unfavorable chemistry.

For our Cessna and Gippsland aircraft, the oil lives in the oil sump which is a reservoir at the bottom of the engine. When you start the engine, an oil pump drives the oil through an oil filter under pressure and throughout the engine lubricating every moving part in the engine. The oil filter is normally changed when the oil is changed. Just like your car, oil gets dirty and so must be changed. Typically, the oil and filter are changed every 50 hours of engine operation. But you may have to change oil more frequently if operating in very dusty conditions.

Our Cessna's have both an oil pressure gauge and an oil temperature gauge which need to be monitored. Low or zero oil pressure indicates a pump failure causing the engine to self-destruct quickly. You have the option of either shutting the engine down to try and prevent damage or just letting the engine shut down itself when it self-destructs (go for option 1 if possible). There will be

zero oil pressure when you first start the engine but after starting you should see the pressure build immediately. The rule of thumb is to shut the engine down after starting if the oil pressure hasn't come up within 30-60 seconds (see your POH). In any event, always keep the RPMs low (< 1000 RPM) until the engine has warmed up sufficiently to ensure the oil is properly circulating (see your POH). High RPM on a cold engine ensures excessive wear on the engine and premature failure. There are cases where oil pressure can be too high indicating an oil pressure relief valve is stuck. Although this is not as catastrophic as no oil pressure you need to shut the engine down as soon as possible and get it fixed.

Equally important is the oil temperature gauge. When the oil gets too hot that means the engine is too hot and damage will occur if not taken care of. But before shutting the engine down, try things like opening the cowl flaps, reducing power, and enrichening the mixture to see if you can get the temps down. If not, you need to land and shut the engine down. Often high oil temps indicate a loss of oil so check your dipstick. You may have a leak. On engine startup, the oil temps will be cold. We like the temps to be in the green before takeoff or whatever the POH recommends. On our Cessna's it is not required that oil temp be in the green IF the engine run up went smoothly but it can't be pegged at zero. It must have moved off the lower limit if not in the green. If it's cold outside and the engine oil temperature is just not moving, try closing the cowl flaps and see if that helps.

One other problem with high temps is that conventional non-synthetic oil starts to break down about 240 degrees F. Beyond that it will turn into sludge and not lubricate properly. Your only option is to get an oil change at that point.

If you see during flight that the oil temps are increasing and the oil pressure is falling, you are about to have a catastrophic engine failure (don't ask me how I know this). You need to find some place to land ASAP and expect it to be without power (and oil streaming on the windscreen). If you are in a twin, shut the offending engine down immediately lest you trash it.

On preflight, don't just check the dipstick for the right oil level but look for oil outside on the fuselage. Although oil on the belly is not unusual, a prodigious amount of oil or oil sprayed in a new place could presage an engine failure. Often a cracked cylinder or other such damage first manifests as an oil leak.

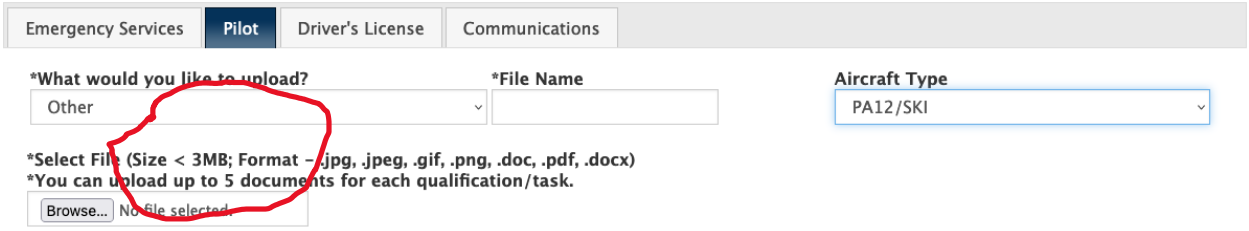
As a practical matter, it is unwise to "top off" the oil. Most GA airplanes will run just fine down a quart or two. When you fill up the oil, the first quart of oil will get deposited quickly on the belly. So, make sure you have enough oil but don't top it off unless you like to waste oil.

Towbars

We have had several incidents where aircraft have started engines with the towbar still attached. That usually ends up with a prop strike, engine tear down and embarrassment for the flight crew. We had one case where the tow bar stayed attached, there was no prop strike, and the crew successfully completed a long cross country with the tow bar still attached on engine shutdown. They were a lucky crew. If the towbar had come off in flight, it could have turned out badly. These self-induced incidents are completely avoidable. The usual cause is the flight crew being distracted during preflight. A good practice to avoid such incidents (and a lot of others – don't ask me how I know this) is to do a last-minute walk around by one of the crew after everyone else has strapped in. In case you never thought this happens to Part 121 operators click here.

Problems Uploading Files?

Occasionally, I get a call from someone who can't upload their Form 5 or Aircraft Questionnaire or some other file. They hit the upload button and nothing happens. The problem is usually that the file they are trying to upload into Ops Quals is > 3MB. There is a limitation on file sizes (see below). Unfortunately, Ops Quals doesn't give you an error or any indication that anything is wrong. It just stares at you while you stare back. So, if you are having problems, check your file size. Taking a photo of your F5 with your iPhone almost always creates a huge file. Do a .pdf instead. You can usually control the resolution of the .pdf with the software provided.



Let's go fly!

Well maybe not. Enjoy this brief YouTube movie of weather in Arizona. Click here

New Unleaded Fuel for CAP Aircraft in San Francisco Bay Area (SM Ashish Goel)

(Editor's Note: This article first appeared in the San Francisco Bay Area's Group 2's excellent "On Guard" Newsletter. Just want to emphasize that CAP aircraft in general cannot use UL94 fuel. Since this article was published, there was a one-week disruption in the availability of UL94 at the start of the new year, but the initial kinks have now been largely worked out. Photo's courtesy 2d Lt Ilia Shabalin.)

On Nov 18, Civil Air Patrol (CAP) completed the paperwork required to use unleaded fuel in its Cessna 182T aircraft based at Reid-Hillview Airport of Santa Clara County (RHV - San Jose, CA). This is the first aircraft in CAP's approximately 560-aircraft fleet to make the transition to unleaded aviation gasoline. The switch comes less than a month after Textron Aviation, which manufactures this model of aircraft, announced that this aircraft was approved to use unleaded fuel.

Reid-Hillview joins San Carlos Airport (SQL - San Carlos, CA) and Watsonville Airport (WVI - Watsonville, CA) as one of a small but growing number of airports in the country to have unleaded general aviation fuel available, commonly referred to as UL94. UL94 is a replacement for 100LL traditionally used in general aviation aircraft. 100LL contains up to 2 grams of lead per gallon, on par with automobile fuel in the 1970s. Concerns about the presence of lead in the vicinity of the airport have grown over the last decade, leading to a unanimous vote by the Santa Clara County board of supervisors to convert RHV and San

Martin Airport (E16 - San Martin, CA), another county-managed airport, to lead-free fuel in the new year.

San Jose Senior Squadron 80 is responsible for CAP aircraft based at RHV. According to their commander, Capt Richard West, “Civil Air Patrol has operated from Reid-Hillview Airport for nearly 80 years serving our nation, state and local community. Transitioning our aircraft to use unleaded aviation gasoline addresses an expressed concern of our local community and does not impact our operational capabilities.

All those connected to the aircraft, from the pilots to maintenance personnel, take great pride in being the vanguard for transitioning Civil Air Patrol’s entire fleet of aircraft to using this safer, environmentally friendlier fuel. Feedback from aircrews since we started fueling with UL94 has been nothing but positive.”

Lt Col Shawn Lawson commands a group of ten CAP squadrons spread across the San Francisco Bay Area, including Squadron 80. According to Lt Col Lawson, this is part of a larger vision: “From both a resource management and social responsibility perspective, moving from 100LL to UL94 is a win-win. We rely heavily on the collective relationships our units foster and develop with the community to be able to continue executing our missions. We do so as responsible stewards of appropriated funds. As availability of UL94 increases, so will our drive to transition the fleet.” CAP operates the largest class of general aviation aircraft in the US.

What Aircrews need to know about using UL94 (Capt Keith Breton)
(Editor’s Note: This article first appeared in the San Francisco Bay Area’s Group 2 excellent “On Guard” Newsletter. Just want to emphasize that CAP aircraft in general cannot use UL94 fuel.)

In case you haven't been following...the Aviation Fuel (Avgas) landscape is changing. Our current standard, known as 100LL, contains Lead (LL = low lead). This is problematic for a whole host of reasons but suffice to say, efforts have been under way for years to develop "no lead" and "very low lead" replacements. Turns out
there were/are significant technical hurdles to overcome.

After this long wait, the initial rollout has begun.


FAA APPROVED

AIRPLANE FLIGHT MANUAL SUPPLEMENT

OR

SUPPLEMENTAL AIRPLANE FLIGHT MANUAL

FOR

Airplanes Listed on STC SA01757WI

For our CAP non-turbocharged aircraft, conversions are under way to allow (some or all) of them to use a new fuel known as UL94 (unleaded). The conversion consists of paperwork and applying placards to the aircraft.

Here is what you need to know...

- Do NOT use the new UL94 fuel unless the aircraft has an appropriate placard specifying UL94, which should be near the fuel filler caps.
- There should also be an AFM (POH) supplement in the aircraft.
- VERY IMPORTANT: The new UL94 fuel is clear. This will wash out the blue color of 100LL. Unfortunately, Jet Fuel (which our planes will NOT run on) is also clear.

- As recommended in this AOPA article: https://blog.aopa.org/aopa/2016/01/11/misfueled/ there are at least two good ways to distinguish kerosine-contaminated Avgas:
    - One is by odor: Jet A has a very distinctive odor that is detectable even in small concentrations.
    - The other (and probably best) is by using the paper-towel test: Pour a sample on a paper towel (or even a sheet of white copy paper), let it evaporate, and see if it leaves an oily ring.
- DO feel free to mix UL94 and 100LL fuels on placarded aircraft.
- As of the 1st of January 2022, 100LL fuel will NOT be available at RHV (Reid-Hillview, CA) and E16 (San Martin/South County, CA). Expect other airports to follow this trend so plan ahead.
- In CAWG, as of this moment, only CAP445 (N445CP) has been converted to utilize UL94 fuel.
- There may be some upcoming changes to oil type requirements. For AMOs, there may be an additive required during oil changes. Stay tuned for further information.

More info on UL94 fuel is available Here... https://www.swiftfuelsavgas.com/faq

Articles for the National Stan Eval Newsletter:
These articles have been written to present ideas, techniques, and concepts of interest to CAP aircrews rather than provide any direction. The articles in this newsletter in no way should be considered CAP policy. We are always looking for brief articles of interest to CAP aircrews to include in this newsletter. CAP has many very experienced pilots and aircrew who have useful techniques, experiences, and tips to share. Please send your contribution to stephen.hertz@vawg.cap.gov. You can view past issues here.