Next WingNuts Chapter Meeting: ***Sat. May 14, 2022 10 AM We will meet at the Lewisburg KLUG Airport instead of - Hunter International Air-Field***

Next VMC Club Meeting: ***Tues. May 24, 2022 6:00 PM - Hunter International Air-Field***

WINGNUTS PLANE TALK

Chapter 1321 / South Middle Tennessee

Our Chapter Home Page: https://chapters.eaa.org/eaa1321

INSIDE THIS ISSUE	

PRESIDENTS CORNER:

Hi everyone,

It's been a few months since I've been to our meetings

I'm looking forward to seeing all of you this Saturday at the Lewisburg Airport. We are planning our next meeting to be a fun day of flying our members that aren't able to fly themselves. That's why we're all in this organization and being able to get out and actually fly can be nothing but fun for all.

Plus, what else could make it an enjoyable day? FOOD! That's right, and so we will be having hamburgers for lunch. All you need to bring is a chair to sit on. We will provide the rest.

The only thing that is needed is for the guys with the planes to be there and for the weather to cooperate. And for the pilot's information I will have the extra insurance in place from the EAA like we are holding an Eagle Flight Day. But no matter what we will have the hamburgers ready to go rain or shine.

See the Details on the next page.

See you all Saturday,

Glen Smith
President

“Fly The Members Day”

Saturday May 14th 10 AM – 2 PM

Our May Chapter Meeting will be held at the Lewisburg Airport

The day will include

The opportunity for those in the Chapter that do not have an airplane to fly with other Chapter Members in their aircraft

A Cookout at Bob Johnston’s Hanger

Camaraderie, Hangar Flying, and Story Telling

See Address, Directions, and other pertinent information below

Lewisburg Airport (Ellington Field) is located at
1877 Franklin Pike
Lewisburg, TN

From the North

65 South to EXIT 37, TN-50 toward Lewisburg/Columbia.
Turn left onto New Lewisburg Hwy/TN-50. Continue to follow TN-50.

In 6.22 miles Turn left onto Franklin Pike/US-431 N/TN-106.

In 1.38 miles Ellington Airport (LUG), is on the right.

From Columbia

Start out by heading East on James Campbell Blvd/TN-50

Continue to follow TN-50 for 13.67 mile

Then Turn left onto S Berlin Rd

In 2.46 miles Turn right onto Franklin Pike/US-431 S/TN-106

In 0.20 miles Ellington Airport (LUG), is on the left

Once Arrived

Park in FBO Parking Lot (GREEN Area)
Walk through the Building to the Ramp
Proceed to Bob Johnston's Hangar - E 8 See Arrow on Photo

AHH, The Technology!!!!!!

Reports are that the driver of a Tesla was using the car's automatic summon feature, which has the car drive itself to the location of the summoner.

In the video, (Click the Link Below) the Tesla drives itself (apparently) at very slow speed into the tail section of the single-engine jet.

https://twitter.com/i/status/1517507755162148864

Summer, with its combination of High Temperatures and High Humidity, will soon be here!!!

This Is Why You Calculate Density Altitude Before Takeoff

Click the link for the Video

https://www.boldmethod.com/blog/video/2015/03/remember-to-check-your-density-altitude/

Don't be this guy!!

If you haven't seen it, click this link for an article in "Air Facts Journal" describing your editor's own brush with Density Altitude

https://airfactsjournal.com/2022/03/low-hot-and-humid/?trk_msg=71HECII42F0KL5CD67K4OPQAU0&trk_contact=1HD4L78GQ4E4RFB64JDNPD0D3G&trk_sid=89DET1V54N5G8B6O335QSNDTB8&trk_link=C09FV379Q7QKJ32VR8Q02EOCQ8&utm_source=listrak&utm_medium=Email&utm_term=READ+MORE&utm_campaign=F22034A&utm_content=Nexrad+Tips+From+Mac+McClellan+%2b+Air+Facts+Archives+Article

Following is some refresher information concerning Density Altitude

What Is Density Altitude?

Density altitude is pressure altitude corrected for nonstandard temperature. As temperature and altitude increase, air density decreases. In a sense, it's the altitude at which the airplane "feels" its flying.

How Will High Density Altitude Affect Flight?

On a hot and humid day, the aircraft will accelerate more slowly down the runway, will need to move faster to attain the same lift, and will climb more slowly. The less dense the air, the less lift, the more lackluster the climb, and the longer the distance needed for takeoff and landing. Fewer air molecules in a given volume of air also result in reduced propeller efficiency and therefore reduced net thrust. All of these factors can lead to an accident if the poor performance has not been anticipated.

Technical Information

Tips for Flying in High Density Altitude Areas

- Fly in the evening or early in the morning when temperatures are lower.
- Call a local instructor at your destination airport to discuss density altitude procedures at that airport.
- Before flying to a high-elevation airport, know whether your aircraft climbs more efficiently with the first increment of flaps. Many aircraft do, but results vary and that first notch of flaps may add more drag than lift.
- Be sure the aircraft's weight is below 90 percent of maximum gross weight.

- Don't fill the tanks to the top (see previous tip).
- Fly shorter legs and make extra fuel stops (tough suggestion to accept, but it results in less exciting takeoffs).
- Be ready to ferry one passenger to an airport with a lower density altitude, then come back for the other. If you are unsure of conditions, fly around the pattern once alone without baggage to test your aircraft's performance.
- Have 80 percent of your takeoff speed at the runway's halfway point, or abort. That means having 48 knots IAS in a Cessna 172 at the halfway point.

Read the full article at this Link

https://www.aopa.org/training-and-safety/active-pilots/safety-and-technique/weather/density-altitude

As most are aware, AOPA provides many services, but you may not know that within AOPA's "Air Safety Institute" there are Safety Centers which contain interactive courses, etc

https://www.aopa.org/training-and-safety/air-safety-institute/safety-centers

Tap into ASI's Safety Centers, which make it a breeze to find ASI's free aviation safety education programs, neatly arranged by subject.

- Aerodynamics
- Aeromedical
- Aeronautical Decision Making
- Aircraft Ownership and Maintenance
- Aircraft Systems and Avionics
- Back to Your Roots
- Collision Avoidance
- Emergency Procedures
- Flight Instruction
- Flight Planning and Preflight
- Fuel Management
- Icing and Cold Weather Ops
- IFR Procedures
- Operations at Airports
- Radio Communications and ATC
- Runway Safety
- Rusty Pilots
- Student Pilots
- Survival Safety
- Takeoffs and Landings
- Thunderstorm Avoidance
- Transitioning to Other Aircraft
- VFR into IMC

These safety centers include courses, accident case studies, real pilot stories, quizzes, videos, and publications relevant to each topic.

Taken from the Safety Center for Aircraft Ownership and Maintenance

Review the following Quiz to test your knowledge of Owner Performed Preventative Maintenance. Use the link at the end to select answers and see your score

Quiz "Safety Quiz: Preventive Maintenance"

Question 1:

While talking with a friend, you tell him that your A&P showed you how to change the oil in your aircraft and let you do most of the work while he supervised. Your friend says that his aircraft is due for an oil change, but he does not want to pay an A&P to do the work. Are you allowed to do the oil change for him as a favor?

- No, only an authorized mechanic can perform an oil change
- No, you may only perform preventive maintenance on an aircraft you own or operate
- Yes, as long as you are not receiving payment for your services

Question 2:

Which items pertaining to landing gear are considered preventive maintenance?

- Servicing shock struts
- Replenishing hydraulic fluid
- Changing landing gear tires
- All of the above

Question 3:

During a fuel stop on a cross country flight, you notice the left position light that was previously working has since burned out. Night is beginning to fall, and the line service technician informs you the mechanics have gone home for the night. He does, however, offer to sell you a light. Are you allowed to change the position light?

- No, you may not change the position lights without A&P supervision
- Yes, changing a position light is preventive maintenance
- No, you are not a mechanic and, therefore, cannot perform any maintenance

Question 4:

One of your side windows is scraped up and worn out; it is time to replace it. Are you allowed to do so?

- Yes
- No

Question 5:

Which of these activities is considered preventive maintenance and, therefore, does not require an authorized mechanic?

- Replacing Safety Wire
- Calibration of radio equipment
- Straightening propeller blades
- Painting the ailerons

Question 6:

Your airplane just had a 100-hour inspection at the same time it was due for its annual. Can the 100-hour inspection be counted as the annual inspection?

- Yes
- No

Question 7:

During preflight, you notice a small ding in the leading edge of the propeller of your aircraft. Are you allowed to file out the ding?

- No, you cannot file a dinged propeller; it must be replaced
- No, propeller repairs are not considered preventive maintenance
- Yes, propeller repairs such as filing and straightening are preventive in nature
- Yes, because flying the aircraft with a ding in the propeller is unsafe it is your responsibility as pilot in command to fix the ding

Question 8:

After performing preventive maintenance, you decide to go flying. Are you authorized to return your aircraft to service?

- Yes
- No

Question 9:

Which item is not required to be entered into the aircraft logbooks after performing preventive maintenance?

- Location
- Date of Completion
- Description of work

- Name
- Certificate number

Question 10:

Even though it is not maintenance in the traditional sense, flying your aircraft is one of the simplest forms of preventive maintenance and can help keep problems from occurring because of inactivity.

- TRUE
- FALSE

Use the following link to take the Quiz and see your score
https://elearning.aopa.org/client/app.html#/quizzes/passing/100086?quizResultId=454170&embedded

Editor Note: As I continue to research information for the Newsletter it dawned on me that besides articles on piloting, I should look for and include Maintenance information from time to time.

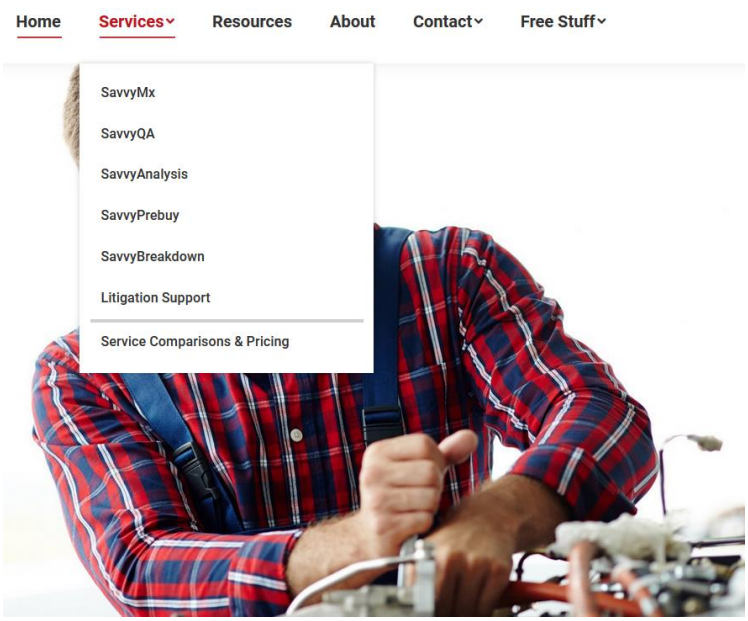
To that I end I found and recommend this website. It contains a wealth of Maintenance information whether you purchase any of his services or not.

https://www.savvyaviation.com/?_ga=2.195393836.1634836793.1649098120-1404523971.1649098120

Savvy Aviation is the brain child of General Aviation Maintenance Wizard, Mike Busch. Savvy has assembled the most experienced and talented team of general aviation maintenance experts in the industry.

Mike is a renowned aviation writer, teacher, aviation type club tech rep, aircraft owner advocate, and entrepreneur. He has been assisting aircraft owners with their maintenance problems through his lectures, articles, and books.

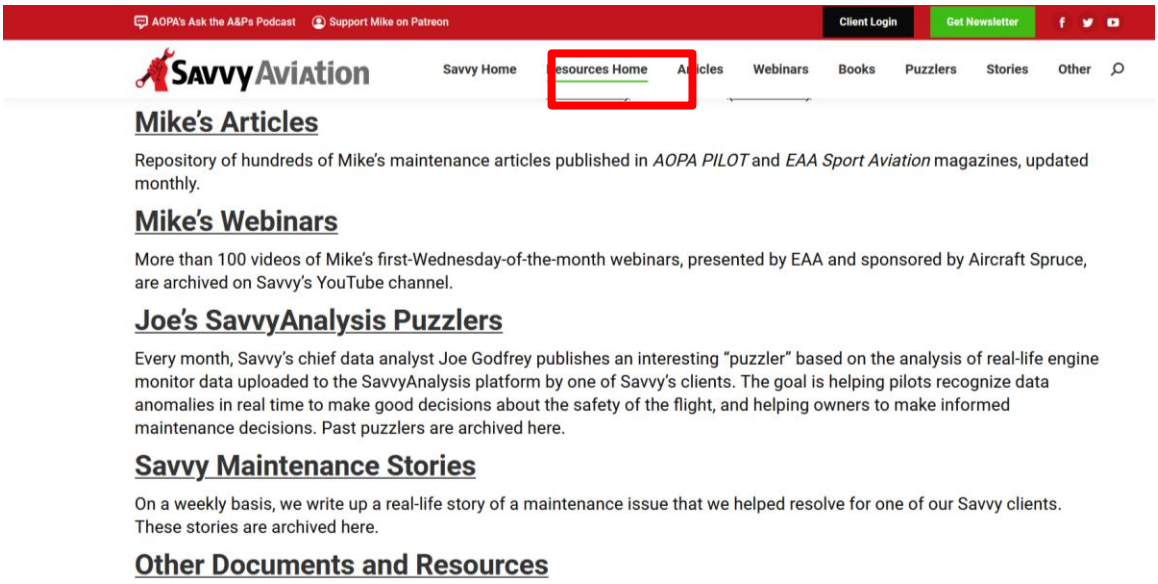
He began the company to provide pilots with a “one stop shop” for their Maintenance needs.

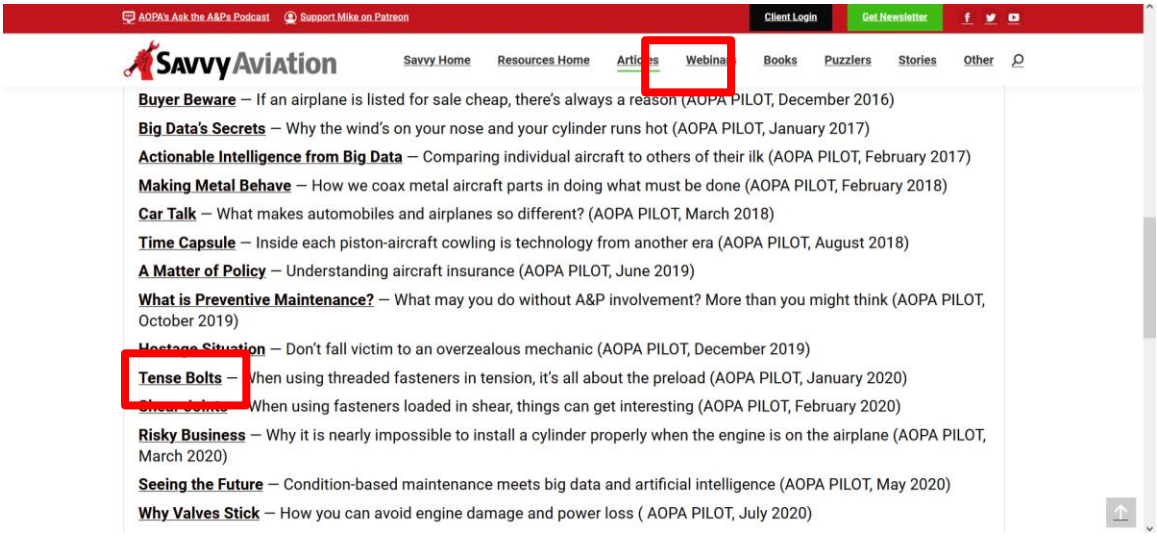


And, if needed, guide them through an unexpected Maintenance Nightmare. Either concerning an issued with the Shop or issues with an aircraft.

He also supply’s us with many “Free Resources” including well written articles detailing Aircraft Maintenance Topics. **See a full listing at this link**

https://resources.savvyaviation.com/





As home builders and those that also perform a portion of your own maintenance it is important that you know and use good basic maintenance practices. Which would include the types, purpose, and proper use of the different hardware you would find used on your aircraft.

Here are excerpts from one article concerning Hardware - **Tense bolts**

THREADED FASTENERS are ubiquitous in aviation. Look at any GA aircraft and you'll find hundreds of them, if not thousands. They attach wings to the fuselage, cylinders to the crankcase, connecting rods to the crankshaft, and instruments and avionics to the panel.

They hold on cowlings, fairings, inspection plates, floorboards, and just about anything else that might need to be removed to gain maintenance access. They're so numerous and so familiar that we tend to take them for granted

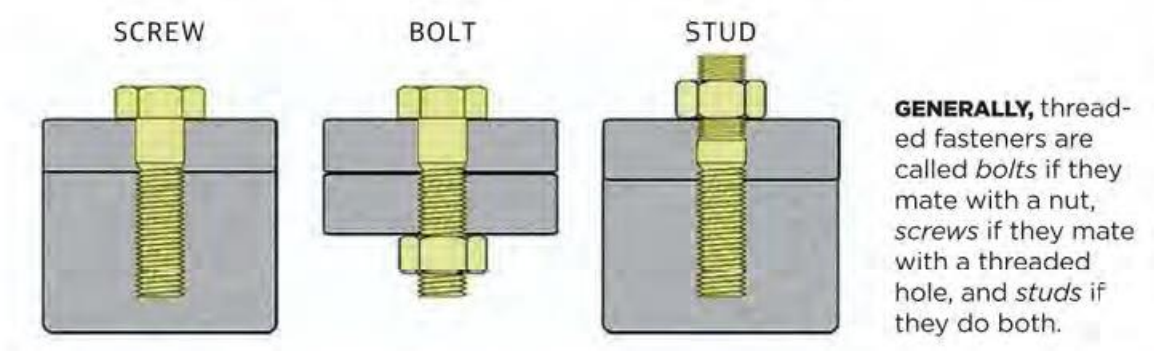
But, when used in safety-critical high-stress applications-such as holding on wings, cylinders, and connecting rods- **there's a complexity to threaded fasteners that often is not well understood or fully appreciated so these critical fasteners don't get treated with the respect they deserve.**

Threaded fasteners go by a variety of names. As a general rule, they are called

Bolts if they are designed to mate with one or two threaded nuts

Screws if they are designed to mate with a threaded hole in one of the items to be joined

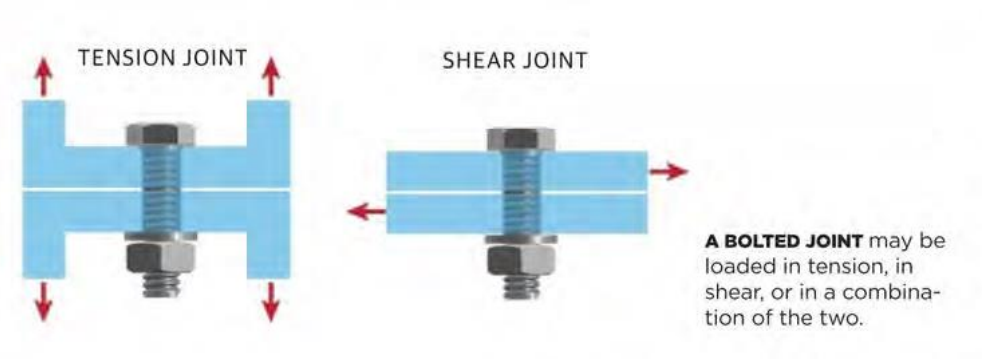
Studs if they are designed to mate with a nut on one end and a threaded hole on the other end



In this article, I'll use the term **bolted joint** to refer to any joint that is held together by any kind of threaded fastener.

Bolted joints come in two basic flavors:

Those where the bolt is loaded in tension (i.e., along its axis)
Those where the bolt is loaded in shear (i.e., at right angles to its axis).



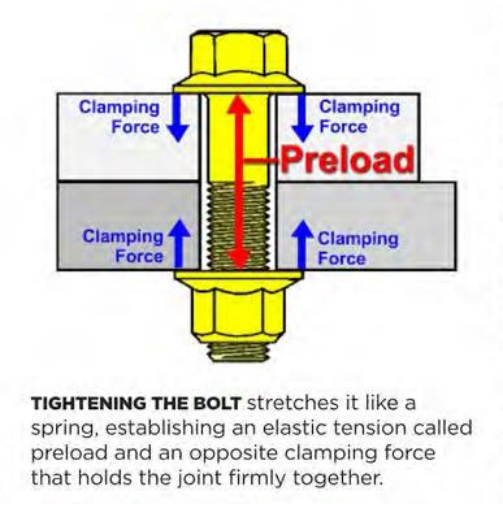
*This article focuses on **tension joints**; we'll look at shear joints next month*

HOW TENSION JOINTS WORK

A bolted tension joint is one where loads are trying to pull the joint apart with forces parallel to the bolt's axis.

The bolt is tightened in order to prevent those forces from separating the joint.

As the bolt is tightened it stretches. The stretching force on the bolt caused by tightening is **called preload and it creates the clamping force** that holds the joint firmly together so that the joined items cannot separate.



TIGHTENING THE BOLT stretches it like a spring, establishing an elastic tension called preload and an opposite clamping force that holds the joint firmly together.

When the bolt is loosened the tension is released the bolt returns to its original shape. The technical term for this property is elastic

However, **There's a limit to how far you can stretch a bolt before it deforms permanently.** If you tighten the bolt too much, it will deform and not return to its original shape due to it being stretched beyond its elastic limit.

So, to make the tension joint as strong as possible, the bolt should be tightened to obtain a preload that is close to but not beyond the bolt's yield point.

Critical fasteners typically have a proof load rating that provides a bit of safety margin below the actual yield point.

WHY PRELOAD IS CRUCIAL

If, the **bolt is under tightened** clamping force isn't enough to hold the joint firmly together. The joint will separate slightly under peak load.

T**he separation will stretch the bolt.** If the load is applied to the joint cyclically then the bolt will be subjected to repetitive stress that could cause the bolt to develop fatigue cracking (typically at the threads) and ultimately fail catastrophically.

Worse still, **the repetitive separation of the joint would likely result in self-loosening of the nut, causing the bolt's preload to be progressively lost and hastening catastrophic failure of the joint.**

That's why **having an adequate preload on the bolt (and therefore enough clamping force on the joint) is so crucial.**

TIGHTENING THE BOLT

By far the most popular method of obtaining the necessary bolt **preload is using a calibrated torque wrench to tighten the bolt to a specified torque value.** This method is simple and well understood by every mechanic.

Always, ensure you are applying the proper torque for the type of hardware and its' application as determined by the manufacturer

The article goes on to discuss other means to ensure that the bolt is under the proper preload

The most accurate way to obtain a pre-dictable preload is to measure the stretch of the bolt.

This is precisely how many Lycoming connecting rod bolts are tightened.

The bolt length is measured with a special micrometer, then the nut is tightened until the micrometer shows that the bolt has stretched by a specified amount.

This stretch method is extremely accurate and virtually guarantees that the resulting preload is spot-on. Unfortunately, the stretch method is impractical for many kinds of tension joints.

However, a third method combines the simplicity of the torque method with an accuracy that's nearly as good as the stretch method. **Known variously as the torque-turn or torque-angle method, it's widely used for** tightening critical fasteners on everything from race cars to diesel locomotives.

Tightening a fastener using the torque-angle method involves two steps.

First, a torque wrench is used to tighten the fas-tener to a specified "snug torque" to ensure that the joint is in metal-to-metal contact.

Second, the fastener is further tightened by rotating it by a specified number of degrees to obtain the final preload,

something that's easy to do by using an inexpensive torque-angle gauge.

This step results in a precise amount of stretch that is completely independent of friction, and therefore vastly more accurate than using torque alone.

MORE ON TORQUE

In the event that a manufacturer does not provide a torque value for a given installation, The FAA provides guidance to aircraft mechanics for choosing the proper torque values in Advisory Circulars

Advisory Circulars AC 43.13 1B and AC 43.13 2B
ACCEPTABLE METHODS, TECHNIQUES, AND PRACTICES INSPECTION AND REPAIR

TABLE 7-1. Recommended torque values (inch-pounds).

CAUTION
THE FOLLOWING TORQUE VALUES ARE DERIVED FROM OIL FREE CADMIUM PLATED THREADS.

	TORQUE LIMITS RECOMMENDED FOR INSTALLATION (BOLTS LOADED PRIMARILY IN SHEAR)		MAXIMUM ALLOWABLE TIGHTENING TORQUE LIMITS	
Thread Size	Tension type nuts MS20365 and AN310 (40,000 psi in bolts)	Shear type nuts MS20364 and AN320 (24,000 psi in bolts)	Nuts MS20365 and AN310 (90,000 psi in bolts)	Nuts MS20364 and AN320 (54,000 psi in bolts)
FINE THREAD SERIES				
8-36	12-15	7-9	20	12
10-32	20-25	12-15	40	25
1/4-28	50-70	30-40	100	60
5/16-24	100-140	60-85	225	140
3/8-24	160-190	95-110	390	240
7/16-20	450-500	270-300	840	500
1/2-20	480-690	290-410	1100	660
9/16-18	800-1000	480-600	1600	960
5/8-18	1100-1300	600-780	2400	1400
3/4-16	2300-2500	1300-1500	5000	3000
7/8-14	2500-3000	1500-1800	7000	4200
1-14	3700-5500	2200-3300*	10,000	6000
1-1/8-12	5000-7000	3000-4200*	15,000	9000
1-1/4-12	9000-11,000	5400-6600*	25,000	15,000
COARSE THREAD SERIES				
8-32	12-15	7-9	20	12
10-24	20-25	12-15	35	21
1/4-20	40-50	25-30	75	45
5/16-18	80-90	48-55	160	100
3/8-16	160-185	95-100	275	170
7/16-14	235-255	140-155	475	280
1/2-13	400-480	240-290	880	520
9/16-12	500-700	300-420	1100	650
5/8-11	700-900	420-540	1500	900
3/4-10	1150-1600	700-950	2500	1500
7/8-9	2200-3000	1300-1800	4600	2700

The above torque values may be used for all cadmium-plated steel nuts of the fine or coarse thread series which have approximately equal number of threads and equal face bearing areas.
* Estimated corresponding values.

TABLE 7-2. Minimum prevailing torque values for re-used self-locking nuts.

FINE THREAD SERIES	
THREAD SIZE	**MINIMUM PREVAILING TORQUE**
7/16 - 20	8 inch-pounds
1/2 - 20	10 inch-pounds
9/16 - 18	13 inch-pounds
5/8 -18	18 inch-pounds
3/4 - 16	27 inch-pounds
7/8 - 14	40 inch-pounds
1 - 14	55 inch-pounds
1-1/8 - 12	73 inch-pounds
1-1/4 - 12	94 inch-pounds
COARSE THREAD SERIES	
THREAD SIZE	**MINIMUM PREVAILING TORQUE**
7/16 - 14	8 inch-pounds
1/2 - 13	10 inch-pounds
9/16 - 12	14 inch-pounds
5/8 - 11	20 inch-pounds
3/4 - 10	27 inch-pounds
7/8 - 9	40 inch-pounds
1 - 8	51 inch-pounds
1-1/8 - 8	68 inch-pounds
1-1/4 - 8	88 inch-pounds

Also, in case you weren't aware even aircraft tubing connections have a required torque value. The example below is for Aluminum and Steel Tubing. There are also tables for torquing Copper and Plastic Tubing

TABLE 9-2. Tube data.

Dash Nos. Ref.	Tubing OD inches	Wrench torque for tightening AN-818 Nut (pound inch)						Minimum bend radii measured to tubing centerline. Dimension in inches.	
		Aluminum-alloy tubing		Steel tubing		Aluminum-alloy tubing (Flare MS33583) for use on oxygen lines only			
		Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Alum. Alloy	Steel
-2	1/8	20	30	75	85	--	--	3/8	--
-3	3/16	25	35	95	105	--	--	7/16	21/32
-4	1/4	50	65	135	150	--	--	9/16	7/8
-5	5/16	70	90	170	200	100	125	3/4	1-1/8
-6	3/8	110	130	270	300	200	250	15/16	1-5/16
-8	1/2	230	260	450	500	300	400	1-1/4	1-3/4
-10	5/8	330	360	650	700	--	--	1-1/2	2-3/16
-12	3/4	460	500	900	1000	--	--	1-3/4	2-5/8
-16	1	500	700	1200	1400	--	--	3	3-1/2
-20	1-1/4	800	900	1520	1680	--	--	3-3/4	4-3/8
-24	1-1/2	800	900	1900	2100	--	--	5	5-1/4
-28	1-3/4	--	--	--	--	--	--	--	--
-32	2	1800	2000	2660	2940	--	--	8	7

PILOT'S TIP OF THE WEEK

What To Include In A PIREP

What really matters when filing a Pilot Report (PIREP) and how should you state it?

Subscriber Question:

"I realize the benefit of filing PIREPs, but I'm not sure what I'm supposed to tell Flight Service, especially with regards to turbulence." — Randy K.

Scott:

"Many pilots get hung up on the order of the data that you should report. The (Flight Service) Specialist will prompt you for the information if you've left something critical out.

My suggestion is to first write down the report before you call them so you don't leave something out. **After the initial contact, make sure that you at least report your location, altitude, and aircraft type along with whatever other information you think is appropriate.**

Reports of cloud tops, turbulence, and icing are the most critical. And remember, don't feel bad if you are only reporting those severe clear conditions. They're very important, too.

Pilot reports are very subjective and often depend on the aircraft type and the pilot's perception of the event.

Here are some general guidelines for reporting turbulence. Imagine holding a cup of coffee that is nearly full.

In light turbulence, you can usually avoid spilling the coffee.

In moderate turbulence, the coffee will slosh around a lot and will spill out quite frequently.

In severe turbulence, the entire cup of coffee ends up on you with a very brief loss of control of the aircraft.

And extreme turbulence … well, you've got more to worry about than some cup of coffee."

For a more in-depth discussion, use this link to an AOPA PIREP Article

https://www.aopa.org/training-and-safety/online-learning/safety-spotlights/pireps-made-easy/creating-a-pirep

The attached pdf form can be used for creating a PIREP and provides information to aid in decoding them

PIREP_Form(1).pdf

Editors Note: As a continuation of last months "boldmethod" article concerning Pitot Static Failures I decided to expand on a question it posed….

What to do in the event of "Pitot-Static Failures"

If you attended April's VMC Meeting you will recognize the following information

Depending on where in the Static System the problem is, not only could it affect the Airspeed indication, but the Altimeter and VSI as well.

If it is an Altimeter problem you may be able to reestablish Altitude Information by Selecting "Alt Air" If your aircraft is equipped –

IF not, You could chose to break the glass in the VSI. In either case the resultant Altimeter reading will be less accurate than normal.

As presented in last months "boldmethod" article –

"So you've recognized that something has gone wrong with your pitot-static system.

If you're in visual flight conditions, use your outside references and make a plan to land.

If you don't have airspeed indications, or you suspect they're inaccurate, ***rely on your standard pitch and power settings to descend at a safe speed."***

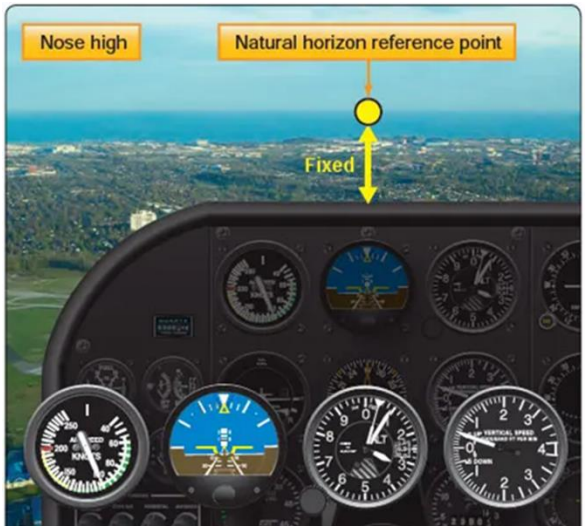
But, the article didn't expand on that last statement.

"Rely on your standard pitch and power settings"

What did they mean??

In order to rely on pitch and power settings you must understand and fly the Aircraft based on its' Attitude.

The basic premise of **Attitude Flying** is that for any given flight regime,
Climb/Cruise/Descent



There is a ***standard pitch*** (Attitude) ***and power setting*** (RPM) that will result in a given airspeed for each of these phases of flight

When flying in "Visual Conditions" your **attitude will be determined using the actual Horizon**

When familiar with a particular aircraft type
It becomes easy to distinguish the different "look" of the aircraft's attitude in cruise, climb, and descent

Cruise Attitude

In a **tricycle gear airplane the "horizon/nose sight picture"** that the pilot sees when the aircraft is **on the ground is similar to what he will see in cruising flight**

In cruise flight, the aircraft maintains a constant airspeed and altitude which is the result of a constant pitch attitude and aircraft power setting

The sight picture associated with cruise flight, will result in the horizon appearing a given distance up your windshield. **NOTE: This windshield position will be different for everybody, dependent on your height, seating position, etc**

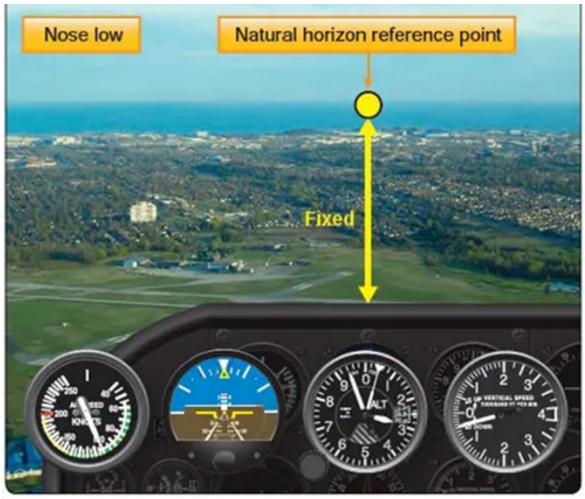
Nose-Up (Climb) Attitude

In a **Tailwheel airplane the "horizon/nose sight picture"** that the pilot sees when the aircraft is **on the ground is similar to what he will see in Take-Off Climb**

To make an aircraft climb, *raise the nose* to get a sight picture where the aircraft nose appears to be on or *just slightly below* the horizon.

Become familiar with the "sight picture" that equals the Pitch Angle that will result in a climb at either

Max Angle Vx
Max Rate Vy



Nose-Low (Descent) Attitude

In a descent, the nose will appear a greater distance *below* the horizon

NOTE: It is important learn and understand the "numbers" for your aircraft

Commit to memory: the sight picture for each attitude, the RPM to maintain that attitude, and the Indicated Airspeed for that attitude and RPM

NEXT MONTH We will Discuss a process that will allow you to determine your height in the Traffic Pattern when experiencing erroneous Altimeter Indications

Remember this Guy??

FAA Revokes YouTuber's Pilot Certificate Over "Egregious and Intentional" Crash

From the Archives of

Editor Note: This is a very indepth, lengthy discussion so I will present the highlights and break it into installments. Here is the link to the full article

https://www.avweb.com/features_old/pelicans-perch-18mixture-magic/

Pelican's Perch #18: Mixture Magic

This is the 7th and final Installment of an article discussing Engine Fuel/Air Mixture

This month in this extensive discussion concerning the leaning of an engine and its effects on engine operation. We will look at "Some Old Wives Tales" and finally "What we can do to safely operate our engines at a power setting that gives us the greatest fuel economy"

First, here are Some Old Wives' Tales (OWTs)

OWTs, all with a modicum of truth.

"Never run lean of peak!" That's right, you can't in most flat engines, because their uneven mixture distribution causes them to run too rough.

"Leaner is hotter!" That's true only up to the point of maximum CHT, which occurs at around 35°F to 50°F ROP for most engines. Leaning beyond that point makes 'em run cooler.

> Naturally, if your engine gets the shakes at lean mixtures because of poor mixture distribution and the resulting uneven cylinder-to-cylinder power, then the only leaning range left to you is on the rich side, and if limited to that area, leaner **is** hotter!

"Leaning too much will burn your valves!" True (at higher powers), unless you continue leaning to the lean side of peak EGT (where leaning makes cylinder heads and valves run cooler), or you operate at sufficiently low power settings that valve temperatures remain acceptably cool even at peak EGT. (This works out to around 60% to 65% of rated power, on most of the flat "big bores".)

These are the kinds of things running through factory tech reps' minds when they scream (as a Lycoming rep did to me awhile back)

"I wouldn't recommend lean-of-peak to my worst enemy!"

Neither would I, in his stock engine with its lousy mixture distribution!

There are, however, some alternatives.

What *Do* We Do about It; What *Do* We Do?

First, if you're going to operate one of these expensive big-bore engines properly, you **must** install an all-cylinder engine monitor, which at least tells you the CHT and EGT in **each cylinder**.

If I had a four-banger, I'd put one in it, too, but that's more for troubleshooting.

I concede that JPI makes a superior engine monitor, in my opinion. Insight also makes a good one that will do the job. I have not yet seen the new Electronics International monitor, but it looks great on paper. Any of these probe-per-cylinder systems with bar-graph displays will do the job.

Once you have that all-cylinder monitor, **limit the hottest CHT to 400°F at all times.**

If it goes over that, increase airspeed (VERY effective!), open the cowl flaps a bit (if you have cowl flaps), or enrich the mixture if it is on the rich side (lean it more, if on the lean side).

Using extra fuel as a coolant should be your last-resort solution after the other things have been tried and fallen short.

So far, most of this column has been discussing **The Ideal Engine**.

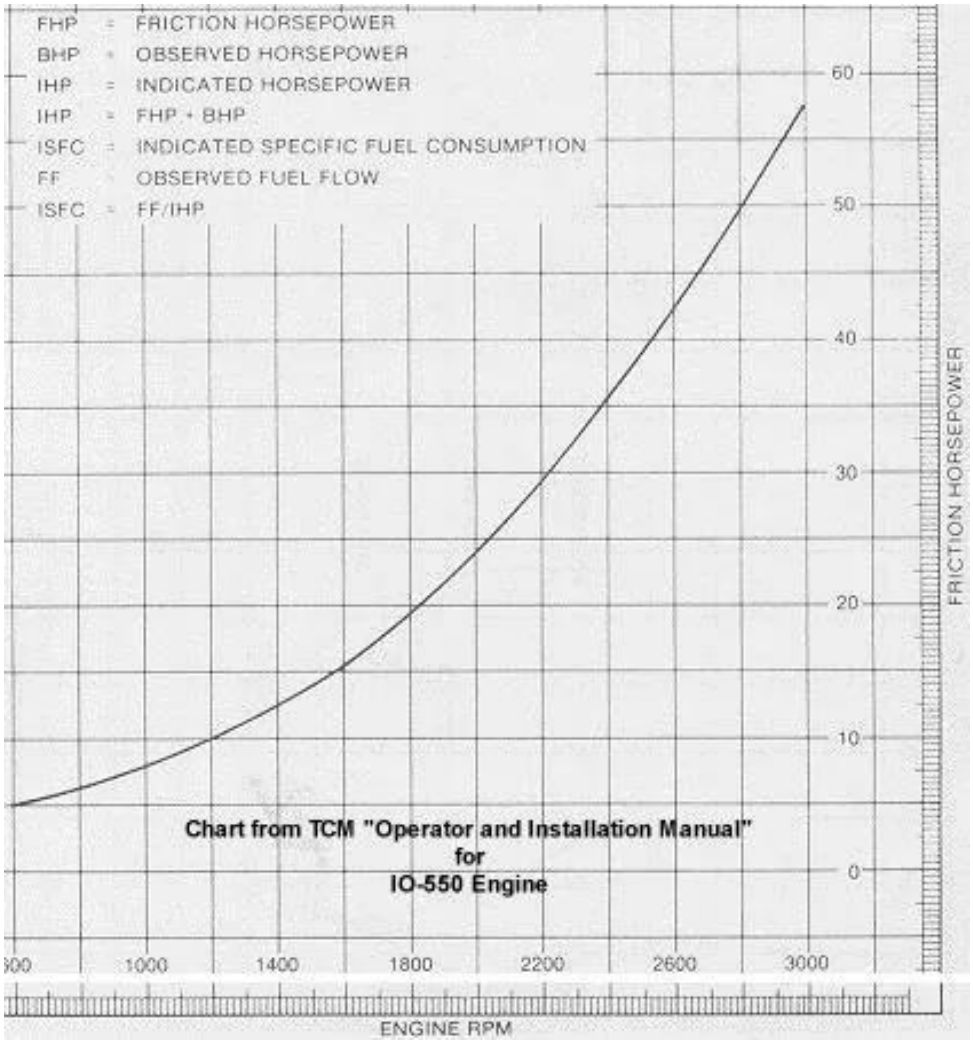
Unfortunately, that doesn't quite exist, yet, and those with carbureted engines are really left out in the cold, except for the above two tips (engine monitor and 400°F CHT limit.)

Here's another tip for carbureted engines, if you're operating high enough to use full throttle, or nearly so.

From the full-throttle position, pull the throttle back until you observe the slightest drop in MP – perhaps a quarter-inch or less.

Leave it there. That will cock the throttle plate a little, just enough to set up a vortex that will cause better atomization and mixing of the fuel and air. **(This is counterproductive in fuel injected engines.)**

In principle, we should all operate at the lowest possible RPM allowable for the MP The following TCM chart shows why:



As you can see, the losses to friction are about 37 HP at 2,500 RPM, and about 27 HP at 2,100 RPM. That's 10 very useful HP, in my opinion.

However, this low RPM stuff must be tempered a little bit, by the fact that decreasing RPM moves the PPP closer to TDC.

Anytime we move that PPP away from that ideal 16 to 18 after TDC, we're losing power, and increasing CHT.

On the other hand, the leaner we run the engine, the more we delay the PPP, getting it further from TDC.

From this we can see that there must be a balance between slower/leaner, and faster/richer.

For high power, maximum-performance operation, you should run richer mixtures and higher RPMs.

For low power, maximum-efficiency operation, you should run leaner mixtures and lower RPMs.

It would be really nice if we could develop some sort of "super linkage" that ties the prop control and mixture control together into sort of a single-lever power control, but that would be a formidable design task.

It appears to me that running in accordance with the POH will provide good results in the worst possible cases, and TCM probably felt this was their best option.

Fuel-Injected Big Bores

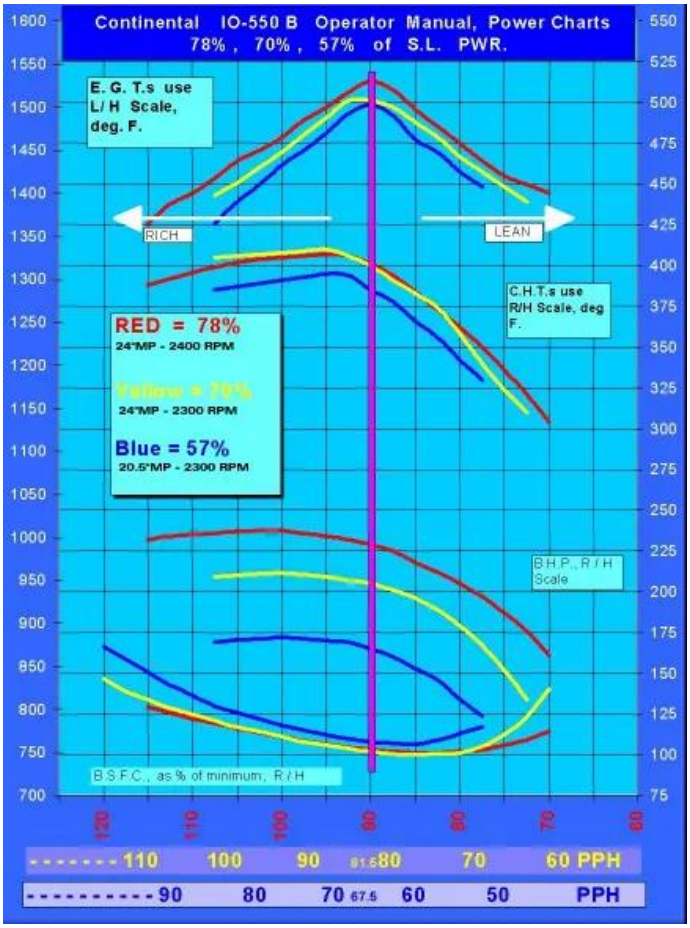
With big-bore fuel-injected engines like TCM 520s/550s and Lyc 540s, we're getting some modern developments that can be of major benefit, and which will pay for themselves in short order. These improvements should also allow safe and efficient operation well outside the suggestions in the various POHs and manufacturers manuals, including much lower RPM, higher MP, and leaner mixtures. At low altitudes, I am routinely running my IO-550 at 2,100 RPM, full throttle, and very lean, perhaps 50°F LOP EGT. That produces about 75% of rated power. The engine appears to love it, runs very cool, makes much less noise, and runs very smooth. However, those settings would be a deadly combination if I enriched the mixture, or even worse, tried running ROP. I also cannot climb at that power setting, because the loss in airspeed causes too much increase in CHT.

Once you have the all-cylinder engine monitor installed, the next best thing you can do for your big-bore flat six is to install GAMIjectors™ from General Aviation Modifications, Inc., in Ada, Oklahoma.

The usual disclaimer: I own no stock, directly or indirectly in GAMI. I wish I did. I do not work for them. I wish I did. I do not benefit in any way from the sales of their products, and I paid full-boat retail for my own GAMIjectors™. The owners have become personal friends, and are men that I admire greatly. I have been very distantly involved with them in some very minor testing and comment.

GAMIjectors™ are custom injectors that match the fuel flows to the air flows in all cylinders. With these, you can quite easily lean your engine right down to starvation levels without roughness. This means you cannot use the old trick of "lean 'till rough, enrich 'till smooth" because the engine never gets rough at any mixture setting. Your engine will run cleaner, cooler, and smoother, and you will be able to use the full range of mixtures, just as the operators of the big old radials did for several hundred million hours in a bygone era. Oh, by the way, there is **no evidence whatsoever to support the OWT that lean mixtures cause corrosion in exhaust stacks.**

When you lean an engine with *GAMIjectors™*, you will see all EGTs rise at the same time. (The absolute temperatures may be different from one cylinder to the next, but that's unimportant.) All should peak at the same time, and all should fall at the same time. This will produce results as in the following chart:



By this simple, one-hour installation, we bring our current engines up to very nearly the standards of "The Ideal Engine" I have discussed at length above.
Going well beyond that, GAMI is currently deep in R&D running test engines. This effort promises to give us all a better ignition system. No, not the junky current "state of the art" automotive style electronic ignition systems for our aircraft, but a simple, safe, **certified** system that will leapfrog all existing technology. For the first time, there will be a system that fully controls what is happening inside the combustion chamber.

I haven't seen this experimental system run yet, but George and Tim at GAMI have invited me to come see it, and have a little Oklahoma BBQ, too. There are rumors that it may even cure/prevent baldness, loss of memory, cancer, and the common cold!

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Interesting and useful websites on the Internet:

NOTE: You may have to copy and paste the address into your browser if the link doesn't work

I have added a few that I use.

If anyone knows of other interesting websites let me know and I will add them to the list

Our Chapter Home Page:
https://chapters.eaa.org/eaa1321

Why We Fly
www.whywefly.org

EAA: Home Page
http://www.eaa.org/eaa

FAA Safety Team FAAST
https://www.faasafety.gov/

FAA Safety Briefing
http://www.faa.gov/news/safety_briefing/

Regular links To Check out:
www.barnstormers.com

www.groundspeedrecords.com

AVweb News:
http://www.avweb.com/
This site also provides daily Newsletters that you can sign up for

www.placestofly.com
www.wheretofly.com
www.100dollarhamburger.com
www.airjourney.com

Little known & Lost airfields:
www.airfields-freeman.com/index.htm