



FLIGHTLINES

Newsletter of the Texins Flying Club

July, 1999

CALENDAR OF EVENTS

7 July (Wednesday): TFC Board Meeting. 6:30 PM, TKI's terminal. All members are welcome.

10 July (Saturday): Member/New Member meeting, donuts at 8:30am, meeting at 9:30am.

4 August (Wednesday): TFC Board Meeting. 6:30 PM, TKI's terminal. All members are welcome.

14 August (Saturday): Member/New Member meeting, donuts at 8:30am, meeting at 9:30am.

11 September (Saturday): PACE Program, details later.

Congratulations on these Member Achievements!

Member	Event	Date	Instructor
James Teng	1 st Solo	5/9/99	Richard Klein
Kendrick Baker	1 st Solo	5/22/99	Dick Stephens
Jim Burrows	COMM	6/4/99	Sherman Ratliff
Nick DeJesu	1 st Solo	6/8/199	Betsy Parrott

Highlights from June Board Meeting

Board Members in attendance: Ash Collins, Art Jones, Jim Burrows, Bob Moran, Ed Beaver, Steve Aughinbaugh, Micah Koons, Scott Mitchell, Don Essenpreis. (Harold Margan was absent due to having to work an extended shift). TFC Members in attendance: Jim Lewis, Dan Short, Mike Hance

Jim Burrows is working to plan and schedule the 1999 WINGS/PACE events. It looks like Jim may be able to schedule a PACE program in September or October. He has been talking with FW ARTCC and they are about ready to start doing Operation Rain Checks after their move to new facilities.

Jim Lewis presented a letter to the board requesting that the board reconsider the decision not to send any business to Rockwall until further notice.

The board discussed Jim's request and this is documented in the June 99 Board Meeting minutes. Anyone that wants a copy can contact me at 972-927-5593 or saughinbaugh@ti.com and I will send it to you. The board appreciated Jim's expression of his opinion and welcomed his input, but at this time has not elected to reconsider the decision. The earlier motion to stop sending club airplanes to Rockwall remains in effect

Officer reports:

Operations VP: N150TM and 68K completed 100-hr last month.

Trainer Maintenance: We have had a couple of cases of needing "away from home base" repairs. The current dollar amount limit in the Operating Regulations is \$50. The board discussed this and by unanimous vote agreed to raise the limit to \$200. So the regulation now reads:

MAINTENANCE AWAY FROM HOME BASE.

Members may purchase maintenance or repair work away from home base (up to a maximum of \$200) if needed to return a club operated aircraft to airworthy condition and be reimbursed for the expense by the club. All maintenance or repairs in excess of \$200 total cost must be authorized by a club maintenance officer or any two other Board members in order to be assured of reimbursement.

Membership VP: 250 club members, 1 left and 4 joined last month. →

Paperwork Makes an Airplane Fly

By Jim Burrows

Flying is a government-regulated activity and of course nothing associated with the government can be done until the necessary paperwork has been completed. As pilots we are exposed to some of these requirements in our training. All of these requirements have been enshrined into law by the Federal Aviation Regulations. Many of these requirements are not only laws but are good operating practices that significantly add to flight safety.

During your initial training for your private pilot license you may have been introduced to the mnemonic ARROW. The letters remind you of the requirements for the Airworthiness Certificate, Registration Certificate, Radio Station License, Operating Limitations and Weight and Balance information to be on board the plane. Now this mnemonic is a little out of date (the Radio Station License is only required for operations outside of the U.S.), but it will help you to remember the basics and thus still is of value.

Lets look at each one of these requirements in a little more detail. The A is for airworthiness Certificate and comes from FAR 91.203 which states in part that "... no person may operate a civil aircraft unless it has within it

the following: (1) An appropriate and *current* airworthiness certificate”(italic added). How does an airworthiness certificate stay current? To answer that question we must refer back to FAR 21, Subpart H where the requirements for the issue of airworthiness certificates are listed. In 21.181 it tells us that standard airworthiness certificates are effective “.... as long as the maintenance, preventive maintenance, and alterations are performed in accordance with Parts 43 and 91 of this chapter and the aircraft are (yes, the grammar stinks, but that’s the way they wrote it) registered in the United States.” Now we are getting close to an answer. In fact we have our answer but it is not a simple one. Part 91 subpart E lists several requirements and many details on how these requirements are to be met. In particular 91.405 tells us that each owner/operator of an aircraft will insure that four things happen. First, he shall have his airplane inspected as required (annual and 100 hours as needed or a progressive inspection program) and between these inspections will have discrepancies repaired that are not permitted to remain. Second, he shall ensure that maintenance personnel make the required entries in the maintenance records indicating that the airplane has been approved for return to service. Third, he shall have any inoperative instrument or item of equipment, permitted to be inoperative (that is a whole other article) repaired, replaced, removed or inspected at the next required inspection. And finally he shall ensure that a placard has been installed as required by 43.11 on any inoperative instruments or equipment. Additionally we have hidden away in 91.403 the requirement that the aircraft must be in compliance with all Airworthiness Directives. As you can see, making sure you meet the requirements embodied in the A of ARROW is more than just looking for a piece of paper in the cockpit!

Next is the first R, which stands for registration. This is a pretty clear requirement spelled out in 91.203 that the effective certificate must be on board the plane. Of course the plane must be registered to keep its airworthiness certificate effective.

The second R stands for the Radio Station License, which is required by the Federal Communications Commission. In the old days it was always required. Currently it is only required if you will be operating the plane outside of the United States.

Now we come to the O for operating limitations. Operating limitations are spelled out in the current, approved Airplane Flight Manual, approved manual material, markings, and placards, or any combination thereof. FAR 91.9 require that these be on board the aircraft in order for it to be operated. What about that “any combination thereof” phrase? Not all planes have an Airplane Flight Manual. FAR 21.5 require all aircraft with no flight time prior to March 1, 1979 to have an AFM. Prior to that date it depends on the airplane type certificate. Beware of the airplane owner’s manual trap. Cessna and Piper both provide a publication that is typically titled as an Owner’s Manual. This is NOT the approved AFM. If in doubt, check the first few pages of

the manual for the phrase “FAA approved data” or words to that effect. As for the markings and placards that are required to be in place, they are listed in the airplane type certificate data sheet or in the AFM. The proper installation of these placards and markings is checked during an aircraft’s required inspections.

And finally we get to the W for weight and balance information. Often you will find this information in the AFM. Remember that there are two parts to this information. First, are the aircraft limits. These will be provided by manufacture and approved by the FAA. These are part of the airplane type certificate data sheet and are dependent on the design of the aircraft. Except with a major alteration, they do not change. The second part is the airplane empty weight data. This is originally provided by the manufacture of the plane, but changes as equipment is added and removed. When this happens the empty weight information must be revised. This means that the agency that performs the changes will update the empty weight information. Be sure you use this revised data for your computations. →

Leaning your engine... EGT not by EAR

By Jim Cavanagh

What’s the most expensive thing on your airplane? The little red knob marked “Mixture.” Why? Well, if you don’t use it enough, you waste both fuel and money and possibly foul your spark plugs. It could cost you a gallon or more an hour and in a year’s time it will waste a couple of hundred bucks, even for ramp queens. If you use it too much, you could burn up cylinders or even trash your exhaust system. I don’t have to tell you how expensive this can be.

A Complicated Air Pump

We know the engine is nothing more than a complicated air pump. As air is pumped in the carburetor or injection system it mixes a certain amount of fuel with the volume of air that is being used, and this is ignited with the spark. Subsequent firing of the other cylinders then pumps this burned up gas out through the exhaust system.

The temperature of this exhaust gas is the only way to tell how the engine is doing regarding performance. True, manifold pressure and RPMs determine engine output, but they are relative to the efficiency of the combustion. Only when this efficiency is achieved by a proper fuel/air mixture can the engine achieve optimal performance.

All engines are set up to run naturally rich. At the carburetor, an idle mixture control is adjusted to set the first parameters. This is usually adjusted to provide a brief 25 rpm rise immediately prior to engine stoppage when the mixture is pulled for shutdown. Normally this is set either at the field elevation where you keep your plane or by a shop where the carburetor is overhauled. Only by judicious leaning can an engine begin to achieve

that delicate balance that provides both cooling and power.

Mixture Control

Leaning your engine isn't an art, rather pretty basic stuff. The mixture control is the pilot's interface with the engine's intake system. Whether a push pull-type or a screw-type Vernier, this control is the pilot's best friend they know how to use it.

Remember the first time your instructor showed you how to lean back when you were taking lessons? It was probably the first time you climbed above five thousand feet and while you were cruising along, he or she reached over and began to fiddle with that knob that shuts down the engine! With a befuddled look directed to your right, the instructor responds by telling you that you have to lean the engine to save gas. After pushing and pulling for a while, they smile and say, "There, that's it. Hear it?"

A few hundred hours later you might begin to understand and hear/feel what the instructor was hearing/feeling. And it is considered an aviation tradition to be able to lean an engine by ear. Today, though, this is a somewhat archaic way to attempt to achieve proper mixture. It is a lot easier with an EGT.

EGT Developed

The Exhaust Gas Temperature method of leaning an engine was developed for aircraft application by Al Hundere in 1962. Al began flying in 1950 and having majored in Internal Combustion Engines the connection between engine efficiency and exhaust gas temperatures hit him after returning from two years in Brazil. He started a company called ALCOR (Al's Corporation, also the name of a star) and developed and patented a system for piston aircraft engines. Since then nearly 200,000 aircraft have had an EGT installed.

Today, the company is owned by Al's son, Michael. The San Antonio based firm has a catalog offering seventeen different instruments, a variety of probes and sensors and a Vernier Mixture Control assembly that is PMA'd and approved on virtually every general aviation aircraft. They also offer a testing and calibration unit, the ALCAL 2000, which is used by shops across the country to troubleshoot leads, probes and calibrate meters.

Basic EGT System

A basic EGT system consists of a Thermocouple probe, lead and a panel mounted meter or gauge. The thermocouple is installed in the exhaust system riser two to three inches from the cylinder. This location is optimal for heat, access and interference with the cylinder. A thermocouple is a device that uses two dissimilar metal wires joined at one end that when heated produce an electric current. This current is measured in millivolts and is transmitted to the meter by an extension lead of a specific length. Probes can be either grounded or ungrounded depending on the meter being used.

The meter is a simple analog dial with a needle and scale. A built in potentiometer allows adjustment to set the needle to a specific mark. This calibration is facilitated by an adjusting screw in the back. Usually adjusted to peak EGT at 65% power, the dial is marked with an asterisk for reference. The temperature is of course relative, the true temperature of the exhaust is compromised by a number of factors and is, in essence, moot. From an engine management perspective, the relative mark is the simplest method.

Not a Temperature Gauge

Don't confuse an EGT gauge as a temperature gauge. The dial is intended for relative values. There are a number of multiple probe systems on the market that provide actual numbers, usually in a digital numerical presentation. These are called Combustion or Engine Analyzers. While they suggest actual numbers, the truth is that they are still relative values. True temperatures vary considerably due to firing pulses swirling in the exhaust riser, the location of the probe, condition of the spark plugs and electrical anomalies. With four or six cylinders to observe, ALCOR decided that the individual temperatures were too confusing and have based their product line on the analog presentation. Their arc dial (on multi-probe systems vertical sliding scale units) provide an instantaneous trend of individual cylinders.

Managing Your Engine

But I'm getting ahead of myself... The key to managing your engine with an EGT system is being able to adjust the mixture while observing an instantaneous temperature change on the gauge. This can only be accomplished with a fast-response EGT sensor. Al describes it this way, "As long as excess fuel is present, the EGT increases with the mixture leaning until no excess fuel exists." At below peak temperatures, the combustion temperature of the mixture is cooled by the excess fuel. At peak, the engine is developing the maximum energy output (horsepower) for the available fuel. This isn't an engine design, this isn't a fuel thing... it's simply physics and the way things are.

If you continue to lean past this point (where the needle hesitates), temperatures will begin to fall, but this is because an excess of air is cooling the system. Almost immediately you will feel and hear roughness as pre-ignition/detonation begins. Detonation is when the fuel/air vapor explodes, rather than burns and the force of these minute explosions are focused on pinpoint areas of the cylinder, melting and pooling the face of the aluminum piston. Engine failure could result in mere seconds!

Power and Range

Aircraft operators should be concerned with two primary areas with regard to EGT: Power and Range. Most aircraft engines will provide varying rates of power up to around 7,500 feet where approximately 75% power is achieved. Above this altitude, there will be roughly a 2% decrease in power for every thousand feet. (Check your POH!) It is foolish to lean your engine during any power operation below 7,500 feet. Not saying it can't be done,

but the extra fuel used to cool the engine is a minute amount and is a small price to pay considering the alternative.

Likewise, when you are cruising below 7,500 feet and need to climb, an enriched mixture will ensure adequate cooling as the additional fuel/air volume is increased to provide full power, relative to your altitude.

Peak EGT

ALCOR studies have shown that peak EGT at 65% can be considered the maximum allowable EGT. Data from hundreds of test flights have determined that an engine operated at 65% power can run continuously at peak EGT and in no way affects the TBO of the engine. In fact, peak EGT at 65% gives the best range for your airplane. At any power setting greater than 65% however, a richer mixture is mandatory. They have determined that the maximum EGT for any power operation is 100°F rich of peak at 65% power. To make this easier to understand, ALCOR has marked their gauges so that when properly calibrated, the reference asterisk is at peak EGT at 65%. When power is increased above 65%, the mixture should be enriched to 100°F to the cool side. Under a power loading higher than 65%, the absolute hottest EGT should never be higher than 100°F cool of the asterisk. If you apply power and the needle starts to creep past this value, its time to move that red knob towards the propeller.

Where a pilot could run into trouble is being too miserly and trying to save fuel on takeoff and during enroute climbs. At most altitudes below 5,000 it is best to operate at a full rich or slightly leaned mixture. This will guarantee enough cooling to protect the exhaust valve. Advancing the throttle without adding fuel can quickly destroy an engine below 7,500 feet.

Taking off at altitude is always a concern for flatlanders. Fortunately, most airports at altitude are quite long, but if you're not used to this kind of flying, certain anxieties arise. I'm certain that I burned up a valve because of mismanagement of my mixture while on a trip to Tucson a while back. Loaded to the gunnels, I felt I needed absolute power operating out of airports ranging from 5,000 to 7,000 MSL. I wish I'd known then what I know now.

When taking off at altitude, lean to peak, which is your maximum horsepower for that altitude. To properly cool the engine, come back 100°F on the rich side. If you feel you need all the power you can get, well you might be in the wrong place and may need to either unload something or wait until its cooler. Once you get to altitude, only then do you begin to lean.

It is comforting to know that there is no black magic associated with leaning an engine. Once you realize that it is only physics at work, it takes a lot of anxiety out of cockpit management. For this reason alone it's easy to justify an EGT system in your airplane.

The Value of a Single Probe System

Back to the system itself, there are a lot of questions as to whether or not a single probe system is valuable. After getting past all of the opinions, what it boils down to is that a single probe EGT is all you need, provided you have determined the cylinder that peaks first on your engine. This sounds simple but may be difficult. A well equipped shop can determine this for you.

Often a mechanic will look at an engine and decide that a particular cylinder may run hotter, typically number 3 or 4 on a Lycoming, for example. While this may be true for that engine, the more important consideration for single probe EGT installation is the cylinder that peaks first. This is the cylinder that has the best flow characteristics and will provide the most instantaneous information to the meter. After all, a conservative pilot will normally run 100°F cooler than peak, and most cylinders will be within 50°F of each other at any given moment. This still allows a 50°F margin of error on the conservative side, negligible when it comes to performance and efficiency.

A multiple probe system certainly provides more information, but unless this dictum of finding the quickest peaking cylinder is used, the system is no better than having just one probe.

There are multiple function systems, which as analyzers perform a number of functions. Multiple Cylinder Head Temperatures (CHT) are excellent for diagnosing engine cooling problems, and multiple EGT's can help you determine the faster reacting cylinder. Both are invaluable in troubleshooting a rough or questionable engine and in this respect provide valuable information. Unfortunately, the cost of these systems is much more than a simple EGT and other than being a diagnostic tool add little to managing the engine. →

Destination Glen Rose, TX

By Steve Aughinbaugh

We flew to Granbury, TX (F55) which itself is a nice destination with about 25 bed-n-breakfast places and five golf courses nearby. But our destination was about 15 miles south of Granbury.

The Inn-on-the-River at Glen Rose is great Bed N Breakfast. See <http://www.innontheriver.com/>. This is the first time that I have stayed at a Bed 'N Breakfast. The room was great with comfortable antique furniture and a feather bed. We had one of the three suites with a sitting room. All of the 22 rooms have private baths. I guess some of these are the result of the history of the Inn which was a Drugless Health Sanatorium in the past

The Inn is on the Paluxy river. One of our favorite activities (or maybe it was a anti-activity) was sitting in the lounge chairs on the back porch in the cool breeze alternately looking over the far river bank under the canopy of red oak trees or closing your eyes and just day-dreaming. We got a couple glasses of ice tea to sip on from the dinning room on the way to the porch.

Sipping ice tea and sitting on the porch in a cool afternoon breeze - now that was very relaxing and enjoyable.

The dinner was wonderful. A nice spinach salad, a lobster pasta appetizer; the main course was a sliced beef filet in brown gravy with some of the best mashed potatoes that I have ever had along with some broccoli and red pepper slices. The meal was topped by creme brulee for desert. They do not serve alcohol, but they will and did chill the wine that we bought at the local Albertson's. Dinner was served in a nice picture-windowed porch overlooking the river.

Of course we had the breakfast part of the Bed 'N Breakfast. A pretty normal but well done breakfast fair of scrambled eggs, crumbled sausage, diced potatoes, pica de gallo with a couple of tortillas with fresh-squeezed orange juice and a selection of hot teas or coffee. Oh, I almost forgot. Breakfast did start off with fresh fruit. The day we were there we had grapefruit and passion fruit.

We went to three nearby attractions, Dinosaur Valley State Park, Fossil Rim Wildlife Center and Comanche Peak Steam Electric Station (I guess they don't like to call them Nuclear Power Plants anymore). You could skip Dinosaur Valley State Park unless you want to swim or wade in the river. The tracks are not very interesting and most are under the water.

On the other hand Fossil Rim Wildlife Center is a must see. We spent about hour and a half there and could have spent two or more. It is a drive-through wildlife center with a great variety of animals including giraffes wondering about. Of course all of the animals expect to be fed. We did not get any food for the first half of the drive. That was a mistake, we should have. Fortunately at the midway point there is a stop at a scenic overlook where you can buy animal food. They have a petting zoo, gift shop, restaurant and half mile nature trail there. The view of the valley and rolling grounds was very nice from the deck of the restaurant.

The second half of the drive was as much fun as the first part. On this part we got to see the giraffes. Boy are they tall! Especially when they are standing right next to the car. During the drive you can listen to a cassette that describes the animals and notes points of interest. You need to get one of these. There were several babies and youngsters including a baby giraffe. The baby Axis Deers were cute.

At the end of the drive near the entrance there is another nature walk around a pond. The pond is just full of turtles. At first that is all we thought were. We had some food left and were throwing that to the turtles when we noticed a coin operated fish food dispenser. Boy do the fish respond to having a handful of that thrown on the water. It looked like an instant thunder-shower hitting the water when several dozen fish break the surface going after the food pellets!

On the way back to Granbury we drove up hi-way 56 and stopped the Comanche Peak Power Plant. This was one of the last nuclear power plant completed in the US. I believe they told me that 5 are still under construction in the US. This plant has two reactor facilities and produces enough electricity to power all of the Dallas area. It is connected in the power grid that serves Texas and the surrounding states. We did not get much of a tour because we happened to pick a day when they were conducting an alert drill. They had the media there and we were able to get a van ride around the facilities, but were not able to get into the control room simulator training area nor any of the other areas that you normally can see. The exhibits that we did see were interesting and informative. I was amazing at the sample containment building wall. The wall is over 5 feet thick laced with re-bar that is as big as my arm! That is one very strong and heavy wall.

On the way back to Aero Country, we flew into Hicks Airfield (T67). We taxied to the north end of the field and stopped at Rio Concho Cafe for lunch and pie. I have been told by many pilots about the great pies that they have at Hicks. We did not try them all, but the chocolate pie that we did have was pretty good. The prices were reasonable and the food was good. It is also an interesting field to land at with the railroad track right next to and a bit higher than the runway. No problem, but interesting. The 14 runway has a displaced threshold because of the nearby railroad.

All in all, this was one of the better airplane trips that I have made. I would recommend Glen Rose/Granbury as a destination for pilots or drivers if you want to get away for a bit. And also, the pies at Hicks Airfield are as good at the say, stop in sometime.

Fleet Usage Statistics

Month	Hours Flown	Member Flights	Total Flights
May	346.2	134	251
June	274.3	137	237
July	319.2	130	274
August	287.3	139	260
September	225.5	131	183
October	210.8	118	184
November	133.3	92	132
December	137.4	67	104
January	168.1	94	152
February	200.9	97	181
March	154.86	99	153
April	176.38	94	163
Average	221.49	112.02	191.42

These statistics are collected by the Controller and will run a month or two behind. The Member Hours column is the total number of billable hours flown by all club members. The member flight column is the number of different members that have flown at least once during the month. The Total Flights is the total number of flight log entries for the month. ➔

