



EAA602 Log Book

Adirondack Chapter Newsletter

April 2009

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HOMEBUILDERS



From The Presidents Desk

by *Tim Cowper*

In a few weeks, with luck and some dry weather, the local grass strips will be ready, and the 2009 flying season will be under way. Despite the hard economic times, we have a lot of aviation fun to have this year.

With the stimulus money we'll all be getting, I'm sure we'll have plenty of extra cash to spend on AvGas, so.... prioritize people! Since my Zodiac is in the shop, it looks like I'll be starting lessons in Doug's, I mean Judy's Cherokee. I'm not sure I can handle a "real airplane," but I'll find out as soon as 1F2 dries out. Fortunately, with my black cloud, the Cherokee has full hull insurance. :) I'm also hoping to get some tail-dragger time with John and Graham, so hopefully I can get enough practice to make it through my practical, because I am determined to get my PPL this year. There are a few of us that need to get our licenses so



lets make the commitment together, ok? Lets follow Daryl and Kevin's lead and JUST DO IT! This includes you Pete... 54 years of flying on endorsements must end!

In less than 2 months

we kick off 2009 with our Annual Poker Run. In order to have a great season of events we need everyone's help. Attend our events, and get involved. It'll be fun! And please work hard and get your projects out of the shop/hangar and in the air so that this year will be the best ever.

This month's meeting is at Edinburg Community Center, on March 30th at 7pm. I'll be in Denver on Monday so I won't be there, but I'm pretty sure that, after the club business, Pat is going to lead an interactive builders discussion. It should be a great time. Be there, and participate! See you in April!

Tim

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The Meeting This Month Will Be At:

Edinburg Community Center @ 7pm on Mon. March. 30th



Season Finale

by Tim Devine

I knew that the 2008-2009 ski flying season had come to an end, when as I taxied back towards the hanger at Edinburg the skis slid off the ice and sank into two inches of mud.

Fortunately this happened as I was completing a great day of flying in beautiful weather. Earlier in the week Roger Johnson had posted an email looking for anyone interested in flying down to Mariaville Lake for lunch. He had made a solo trip the week before and said that there was plenty of ice and the sandwiches were good.

It was still cold enough for the ground to be frozen in front of the hangar when I departed, so I was able to easily roll the Champ out and on to the snow. There is still about a foot of hard pack snow on the runway so taxi and take off have become routine. I headed down to Johnson's for a 12:30 rendezvous and I am amazed that on this beautiful 50 degree day the lake is completely deserted. Last weekend it was a bee hive of activity with ice fisherman everywhere. I am assuming that the season has come to an end and it was time to get their shanties off the ice before the big thaw starts.

A low pass at Johnson's reveals that much of the snow down in front of the hangers is gone or has turned to ice. I make my touchdown up near the tree line where the wind hasn't scraped all the snow off and then taxi up behind Roger's house. Roger has his Champ pulled out of the hanger, but it looks like he has had to move snow in front of his hanger with his tractor.

I follow Roger and his Wife Doris as we taxi back down the runway turn into the wind and take off and turn south towards Mariaville. Its only nine miles distance from Johnsons to Mariaville so we're circling over the lake in no time. I remain at altitude as Roger does a low

pass to check out the winds and surface conditions. We decide to land to the west and stay on the north side of the lake away from the motorcycle ice racing track and some ice fisherman. We're not going to taxi up to the store as it sits right next to the outlet of the lake and you can see that the ice is thin there.

We both land without a problem and taxi over to park. The ice is covered with a thin layer of slush, so even at low idle the airplane just keeps gliding. I finally have to shut down to get the Champ to stop. Right after we land and dismount, Tim from Bennington Vermont in his super cub lands followed by Glen from Cooperstown. Both Tim and Glen have already taken their skis off as the snow at their home fields has melted and the ground is ready for tires.

As we stand out on the ice waiting for Skip from Cooperstown to show up the sun feels great and we attract quite a crowd of on lookers and drive by's all enjoying the beautiful day.

Its submarine sandwiches all around and good flying conversation, but eventually it's time to head home. Winds are still calm and we're back to Johnson's in no time. I make a low pass over Art's place and then on to Edinburg. Landing and taxi are a piece of cake but then that brings us back to the beginning SPLAT! Stuck in the mud. Thank goodness for my nifty ski dollies with the big tires and Doug's strong back and we are able to extricate the Champ from the swamp and get her back in the hanger. I'll let the mud dry out and then with a little elbow grease I will

clean them up and put them away for the season.

I've ordered new main wheel bearings and as soon as they arrive I will get the Champ back on wheels. I also need to replace the rocker box cover gaskets to try to stop a pesky oil leak. That will give me some things to do to get through the mud season and get ready for spring flying. I'm just hoping that the next time that I go flying that there's plenty of radio traffic from 602 members getting back in the air.

Tim





Notes From Your Editor

by Doug Sterling



Looking out the window as I type away on my well worn keyboard I see the sun shinning over the mountain again today. Glorious!! All we need now is some consistent warm days and nights with a little warm rain and Edinburg Airport will be cleared for flight. Maybe a week or two and the skies the limit or whatever cliché you want to use will send me back into the air. Can't wait!!

As most of you now know, our president Tim has agreed to partner with me in the Cherokee. Hopefully he can now work on getting his pilot license instead of spending his time working on a plane. Now I won't have to listen to his whining about not being able to fly. Not to say he is getting off scott free. I have him scheduled for a maintainece weekend on the Cherokee as soon as the weather clears the runway. She could use an good annual go over. Change the oil and filter, change air filter, clean plugs, check all the fluids, reline the brakes and give it a good spring cleaning wash & wax. Boy I love having free help with my work. He might even be able fly it to Oshkosh this year if he really works hard on getting his license. The trip shouldn't be a problem as the Cherokee has been there three times before and knows the way. By the way - if anyone else is thinking about going to Oshkosh, let me know. I think we are going to have a great crew going and it's a blast having a group from home camping together. Looks like we are going to have Bill S. from Glens Falls, Darryl & Aaron, Judy and me, Tim C., and maybe talk Kevin into it also. If the weather cooperates and I can bring the GlaStar we can do a little flying around and

check things out from the air. This will be a blast!

The GlaStar has been in my garage through the winter being gone over very closely (love those folding wings). I found a few important things that needed attention and a few things I didn't like and redid them to my liking (boy I really love experimental). This is the time we all should give our steeds a REAL GOOD go over for safety sake. An annual is not an FAA requirement as much as it is a smart safety idea. Any mechanical contraption can fail and the more we keep an eye on our moving parts the less likely they will give us grief at a less oportune time.

I just got a bore scope and aviation engine timing rig from my loyal spouse for Christmas. Some might think she is concerned about my safety for selfish reasons, could be. I also purchased a compression tester and a set of aircraft scales (not certified but really made for aircraft). Anyone who wants to use them, let me know and we can arrange to give your flying machine a time, compression test, a peek inside or weight and balance.

Pretty soon we will be starting the flying season with our annual poker run. I hope to increase the number of places to go to this year to make it more interesting. Also remember that we will have a BBQ at the end of the run at Edinburg. Bring a dish to pass and we'll have hamburgers, hot dogs and drinks supplied by the club. Everyone is invited to come weather they fly or not - just come as you are. If anyone has any other ideas to improve its operation, let me know.

Enough for now - think Spring and think flying!!

Fly Safe, Doug

**Come see the our club pictures on
our web page in living color at:
www.eaa602.org**



Alternator Selection and control

by Paul Messinger

As mentioned by Tim in the November 2008 newsletter I have been working with auto engine conversions since 1994. Briefly I am an aeronautical and electronic engineer with more than 30 years industry experience. EAA TC and FA.

Certificated production aircraft universally use an externally regulated alternator (most likely because it's already approved and there is no compelling reason to change). Experimental aircraft, on the other hand, sometimes use the externally regulated alternator, but often use the widely popular internally regulated ND alternator in the 60 amp size.

Alternator regulators can fail in a "full on" mode where the alternator will produce its full current and the voltage is set by the load in the aircraft. If the aircraft load is less that the current being produced by the alternator the alternator voltage increases until the aircraft load can accept that current. Generally this results in an excessively high voltage that must be controlled and prevented from destroying components of the electrical system. Prevention techniques are a separate subject.

A case can be made to be able to turn the alternator ON and OFF when the engine is running. The only case we know about that can be considered "required" is when there is smoke in the cockpit or other signs of an electrical fire.

In that case the pilot typically will open the master power switch to disconnect the battery(s) from the electrical system.

In the traditional way most aircraft are wired this does not remove the alternator as it is connected to the electrical power bus on the system side and not the battery side.

In the modern electronics design the alternator is connected to the battery side of the main power switches. This eliminates the need for an "in-flight" alternator control of ON and OFF. If the alternator regulator fails in the high voltage mode, an over voltage protection circuit is needed to shut the alternator down. The type of circuit depends on the type of alternator used.

Externally regulated alternators and many types of Nippon Denso internally regulated alternators can be turned ON and OFF simply by switching the field or IGN lead (assuming the internal regulator has not failed). Many other brands of internally regulated

alternators "latch-up" in the ON condition as soon as they start producing power and cannot be turned OFF with a simple external switch.

An Unsafe Alternator Over-voltage Control

Some popular designs use a crowbar approach to open a circuit breaker (CB) in the external regulator power line. The series CB typically has a 5 amp rating. Very high currents can be produced if the OV trips the crowbar that shorts the power and the CB is then shorted to ground across the system wiring and the battery. The current can exceed 400 amps based on both actual circuit testing and a system worst case design analysis.

Modern batteries can have internal resistances one-half to one-fourth the older flooded cell batteries of years ago. Crowbar wiring resistance can vary as well as the minimum resistance of the typical 5 amp circuit breaker. This can increase the often stated 100 amp crowbar short current to as high as 400 amps or more.

The system voltage drops during this event and the high current can overstress the CB as well as the shorting components in the OV unit. In an aircraft with a steel tube cockpit this high current can magnetize the structure and cause magnetic compass errors of 30 degrees or more. Mooney aircraft experienced this (compass error) with the much lower currents simply from normal load switching and the routing of the CB wiring on the instrument panel. The factory published a service bulletin and supplied modification kits to solve the problem. We know of a Mooney pilot (personal friend) whose aircraft experienced a 30 degree compass error from this wire routing issue. While this problem was discovered 40 years ago it points up the need to keep switched currents away from steel structures and in the case of the OV design that uses a crowbar approach, the unadvertised extremely high currents can have unexpected results.

Simply opening a relay in the event of an OV event eliminates the high current transient and the normally included warning light alerts the pilot.

The same circuit design is often used when the alternator is internally regulated. The only way to disconnect the failed alternator is to disconnect the alternator output B-lead with a power relay or contactor.

Regardless of the alternator regulator location the circuit breaker is mounted on the instrument panel bringing the high current from the crow bar method close to other potentially sensitive instruments and steel support structure in some aircraft.



Picking up where the circuit breaker opens, the B-lead contactor starts opening and it is delayed by the use of a common diode across the contactor coil. This gives the alternator time to try to recover from the low voltage and high current demand and even a good regulator will command full output. A 50 amp alternator can have over 70 amps output at full regulator demand.

As the contacts open (and bounce) the alternator sees multiple load dumps. Furthermore there is only the regulator load to prevent extremely high load dump peak voltages. The contactor or most any normal relay rated for under 35Vdc is unable to break any contact arcing where the voltage driving the arc is higher than around 40 V. Once the contact opens it will not allow arc to start with higher voltages. The key is to prevent the arc voltage from getting above about 35V until the contacts are fully open. The alternator no-load voltage can exceed several hundred volts.

There are fundamental design issues here. There is no (other) design application we can find anywhere in the world where a crow-bar is used to open a circuit breaker when there is a high energy battery supplying the bus as excessively high current are created that overstress both the OVP unit and the circuit breaker. This also produces a large negative transient on the system bus from the high current surge. There is a safe way to disconnect the alternator B-lead where an internally regulated alternator has a regulator failure that results in the alternator going to full power output (which results in an over-voltage condition on the aircraft electrical bus).

It makes more sense to have the OVP unit simply open the contactor and make the OVP unit only trip if the OV has reasonable time duration so it's not false tripping from a switching transient.

This means that there must be some way to clamp the alternator output from the start of the failure to the time the contactor is fully open.

The contactor "time to open" must be as short as possible so a bidirectional transient voltage suppressor (TVS) replaces the common diode across the coil reducing the opening time by a factor of 5 or more. This is the industry wide recommended "best choice" approach and the simple diode is the worst choice for relay coil transient control. The next step is to clamp the alternator output long enough for the OV to be detected and the contactor fully opened.

This is done with a set of 1.5kW TVS with one device for every 10 amps of alternator current plus 2 to cover the non-rated real higher current capability.

The TVS's will burn out if the failure is real but the system is protected.

These TVS's also protect the aircraft electrical system while the OPV detects and opens the contactor.

Under Voltage Warning System

While the OVP safely removed the failed alternator or the alternator simply failed on the off mode the aircraft now is flying only battery power. In traditional aircraft there is no low voltage warning light to notify the pilot the alternator has failed and the aircraft is now depending on the battery to power the instruments etc. In the case of an electrically dependent engine this can be critical as flight time is now based on battery power not fuel supply.

Relying on the pilot to notice a negative system current or a system low voltage on a gauge is unreliable. Further relying on estimated battery charge remaining has resulted in several off field landings as a result.

The best way to notify the pilot of a critical system failure (the alternator) is a flashing red light. In a fancy system there may be an annunciator fault panel to specify what had failed. In a simple system a simple flashing red light gets the pilots attention and its left to the pilot to determine the cause of the warning.

Many recommend a simple device that detects a low bus voltage and blinks a red warning light. This satisfies the need for alternator failure warning.

The flight duration left under battery power is a much more complex issue as the battery power left is very dependent on the battery load in amps and to a lesser extent the battery temperature.

The battery rated capacity in amp hours is assumed to be constant by the uninformed. For example a 20 amp hour battery is incorrectly assumed to be able to support a 2 amp load for 10 hours or a 20 amp load for 1 hour. Unfortunately as the load increases the rated 20 amp hour capacity drops off to as little as 50-60% of rating which means the 20 amp load can drain the battery in as little as 1/2 hour. This has also caused several off field landings as well as in-flight emergencies when the electrical system failed before the pilot expected.

In the next installment I will introduce my approach to a modern system design using real currently available parts.

Questions are welcome paulm@olyphen.com
Paul

but you can pay them anytime now for this year

Name _____ EAA Number _____ Exp Date _____

Address _____ City _____ State _____ Zip _____

Home Phone _____ Cell Phone _____ Work Phone _____

E-Mail _____ Ratings _____

Experience Years _____ Hours _____ Aircraft Owned _____

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If you have any aircraft related stuff that you don't need anymore or anything you need, list it here. You may help someone who might need it or may find it at a reasonable price.



EAA602

**819 North Shore Rd
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GOD BLESS AMERICA
September 11, 2001
We will never forget.

April 2009

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