

As we enter the countdown to a new millennium, winter has arrived with a vengeance, great for the ski crowd, but daunting for the wheeled aviation crowd.

Nonetheless, a couple of our members, Garry Fancy and Rod Neufeld have been busy keeping the main taxiway clear, and hopefully flying to justify their hard work.

First Flight

I am happy to report **Roly Acorn** had a successful first flight in his Murphy Rebel. Congratulations, Roly, we look forward to hearing details at a future meeting, or in an article to complement Dave Stoud's.

Nov. 19th Meeting

Our feature speaker was **Perry Casson**, who shared his early experience with the Stoddard Hamilton **Glastar**. The Glastar video was very well done and left many of us with a real appreciation for the versatility, and excellent flying characteristics of this bird. I was impressed with the quality of the Glastar components, and the forgiving nature of its flight characteristics.

RV-8 Flight

On Boxing Day I was treated to a flight in Charlie Douma's fabulous RV-8. I was visiting relatives in Brampton over Christmas, and on a visit to Brampton airport for breakfast, Charlie twisted my arm and I was forced to relent and hop in the back seat.

The winds were gusting around 20 knots as we lined up for takeoff on runway 26, behind a Beech Baron. The 200 HP Lycoming IO-360, coupled with a constant speed prop had us at circuit altitude by the time we reached the end of the runway, and as I looked for the twin, I found it some 500 ft below and to the right of us. Talk about performance!

Charlie gave me the controls for a while, and I was impressed as usual by the excellent control harmony common to all RVs. Pleasantly surprising was the much stronger directional stability due to the larger tail; it felt very solid, particularly in the strong mechanical turbulence we were experiencing. All in all, it felt like a much larger, more heavily loaded aircraft, even though the weight was only 50 pounds heavier than the RV-6, due mainly to the larger engine and CS prop. I can see why the RV-8 is so popular.

ELT Rip-off Alert

Those who have been following the 406 MHZ ELT debate in COPA are encouraged to make your concerns known to Transport Canada, COPA, and EAA. What particularly bothers me is the manner in which we seem to meekly adopt ICAO positions, whether they make any sense or not. The problems I see are:

1. The cost of new ELTs is projected to be in the \$3,000 to \$4,000 range, mainly because of

more stable frequency control needed to reduce the circular error of the outmoded Doppler shift technology used by the current system.

2. The new system means major investment in obsolete technology for minor improvements in accuracy when vastly superior alternatives are becoming available.

3. As the Iridium satellite chain providing global communications nears completion, and GPS receivers in a watch are introduced, surely we can piggyback on this new technology to design a vastly superior system offering pinpoint accuracy, and immediate notification.

I believe costs can be contained by viewing aircraft ELTs as a small subset of a much larger market for emergency notification. The only significant difference is the need for a G switch activation capability. Think of it as a global 911 service.

More on the possibilities in a future article.

Thursday Jan. 21st Meeting

Our featured speakers for our next meeting at the National Aviation Museum will be **Barney De Schneider** and **Frank Hendrickson** who will update us on the restoration of their **Aeronca Chief**. I look forward to meeting you there.

Gary

The Tale of an Alternator

by Mike Busch

This article originally appeared in the July 1998 issue of Cessna Pilots Association Magazine

In my roles as a frequent contributor to AVweb's maintenance section, and as a member of the technical staff of the Cessna Pilots Association, I spend a good deal of time helping other aircraft owners to troubleshoot and fix problems with their airplanes. From time to time, however, I have to deal with glitches on my own airplane.

A good case in point was the charging system problem that I encountered recently on my 1979 Cessna T310R. There was nothing particularly unusual about this problem or how it was ultimately resolved, but I thought some of you might find it interesting to read about the thought processes that one maintenance-involved aircraft owner (me) went through in troubleshooting the problem and dealing with it.

The problem first arose during a 4,000-NM cross-country trip in early April that took me from my home base at Santa Maria, Calif. [SMX], to Champaign, Ill for three days of simulator-based recurrent. The flight from SMX to CMI was mechanically uneventful-luckily, since the flying weather was simply awful-and the training at Recurrent Training Center went well.

My itinerary for the return flight westbound included stops at Wichita, Kan. [ICT] (to visit with some folks at Cessna), Independence, Kan. [IDP] (to see how things were going at Cessna's single-engine plant), and Tulsa, Okla. [TUL] (for a meeting with Lowrance Electronics) before finally heading back to California.

First sign of trouble

As I started engines at CMI for the leg to ICT, I noted that the amber "Right Alternator Fail" light did not extinguish. After muttering the obligatory expletive, I confirmed the indication by shutting off the left alternator and using the cockpit volt/ammeter to verify that (a) the right alternator output current was zero, (b) the battery was discharging, (c) the bus voltage was 24 volts (rather than 28), and (d) the red "Low Voltage" light came on. Clearly, there was a problem with the right alternator. [From engine start to confirmed diagnosis of charging system failure took perhaps ten seconds...probably less time that it took you to read this paragraph.]

At this point, I had to decide what to do. The most conservative decision would have been to shut down and find a mechanic. That also would have been the FAA-approved thing to do, since both alternators are required equipment and a twin Cessna with one non-functioning alternator is technically unairworthy.

On the other hand, this would probably mean that I'd have to cancel or reschedule my appointments at ICT,

IDP and TUL. Furthermore, Wichita seemed like a much better place to deal with a mechanical than Champaign, since ICT has one of the best twin Cessna shops in the country (Yingling Aircraft), not to mention the world's best supply of twin Cessna parts. The weather between CMI and ICT was severe VFR, so I didn't consider a flight with one alternator inop to be even slightly risky, even though it would have been technically illegal.

Transient anomaly?

As I was wrestling with all these go/no-go considerations-it was now perhaps 30 seconds since engine start-something quite unexpected happened that simplified my decision making considerably. The "Right Alternator Fail" light went out! I quickly repeated my volt/ammeter confirmation procedure and there was no question about it: the right alternator was working just fine now. This made my decision a no-brainer...I'd fly to Wichita and sort things out there.

As fate would have it, the right alternator performed flawlessly for the balance of the three-hour flight to Wichita. Two days later, I fired up the airplane once again for the short 30-minute hop to Independence, and again the right alternator seemed just fine. It was also fine on the leg to Tulsa. And on the following day, during the eight-hour flight back to Santa Maria, Calif. (with a fuel stop in Albuquerque), it never once hiccuped.

I've developed a term for problems like this that appear briefly and then go away without explanation. I call them "transient anomalies." I've encountered lots of them in my 30 years of aircraft ownership, and I've learned not to let them keep me awake at night.

My theory about the best way to deal with most "transient anomalies" is quite simple: sit tight, wait awhile, and see what happens. It's next to impossible to make good maintenance decisions about a transient anomaly in its "transient" phase, because a mechanic can hardly be expected to troubleshoot a problem that he cannot reproduce.

If you ask your mechanic to fix such a problem, about the best he can do is to use a "shotgun" approach: make a guess at where the problem might lie, replace the suspected component, and hope the problem goes away. If it doesn't, he'll take another guess and replace some other component. (Traditionally, the first component to be replaced is the most expensive one.)

On the other hand, if you just sit tight and wait awhile, one of two things is likely to happen: either (1) the problem will get worse, or (2) the problem will go away and may not recur for years (or perhaps ever). If the problem gets worse, it's a lot more likely to be reproducible and therefore amenable to troubleshooting. If the problem goes away, it's not worth worrying about (although it's undeniably aggravating that the cause remains unknown).

Now although this "sit tight and wait awhile" philosophy has served me well over the years, I hasten to point out that it's appropriate only when dealing with problems that are clearly non-life-threatening. For example, if you observe major fluctuations in engine oil pressure for 30 seconds, after which everything returns to normal, I would definitely NOT recommend taking the "sit tight and wait awhile" approach. Prudence would demand landing at the first opportunity and inspecting the engine oil filter and propeller governor gasket screen for the presence of metal. Transient oil pressure fluctuations are most often caused by a chunk of something getting caught in the oil pressure relief valve and interfering with its ability to regulate oil pressure, and must be considered a Very Bad Thing. But I digress. We were talking about my transient alternator anomaly, weren't we?

Sure enough, it got worse!

After returning to California, I didn't have occasion to fly the airplane again for nearly three weeks. By now, it was the second week of May and I needed to fly to Tucson, Arizona, for the Cessna Pilots Association convention.

When I fired up the airplane, the right alternator did not come on-line...seemingly a replay of the scenario I'd faced at Champaign. I waited for a minute to see if the alternator would "cure itself" as it had before. Then I waited another minute. No dice.

Once again, I weighed my alternatives. I knew that there's an excellent shop at Tucson where the problem could be worked on while I gave my seminars. I also knew that there was no chance anyone had a replacement Prestolite 100-amp alternator on the field at SMX.

Besides, I had no way of knowing whether the alternator was at fault. The symptoms could have just as easily been caused by a bad regulator, a bad field switch, a field fuseholder, or even a fractured wire, loose connection, or cold solder joint. Clearly, some serious troubleshooting was the first order of business.

The weather for the flight to TUS was VFR all the way. Making the flight on one alternator would be perfectly safe, I told myself, albeit technically illegal. I started taxiing out to the runup area, still undecided about what to do. About halfway there, the right alternator decided to come on-line!

That settled it. I took off and flew to Tucson. The right alternator worked fine. "Just as soon as I get back," I vowed to myself, "I simply must troubleshoot this problem and get it fixed." I knew that I had a very long trip scheduled for next month (June) that would take me all the way to Key West, Florida, and then over Cuba to the Cayman Islands (where I'd been invited to give a maintenance seminar at Cayman Islands International Aviation Week). No way was I about to undertake a trip like this with a flakey charging system!

As if to hold me to my promise, the right alternator failed again during the return flight from TUS to SMX, and never came back on-line. I was actually glad about that. It would make my troubleshooting easier.

Troubleshooting time

The next day, I headed down to the airport with my trusty Fluke 77 volt-ohmmeter, a couple of alligator clip leads, and my parts and service manuals. I was determined to get to the bottom of this. I had no idea whether the alternator, regulator, or wiring was at fault, but since the regulator was the easiest component to get at-mounted beneath the copilot's seat-I decided that was as good a place to start as any.

I powered up the aircraft and measured the voltage between the regulator field terminal and ground. It was 24 volts, just as it should be. I then disconnected the field lead from the regulator terminal and measured the field current going to the alternator. It was about 1.75 amps, which once again looked normal.

I concluded that the regulator was probably working okay, and that the fault was more likely in the alternator itself. (This was not the result I'd been hoping for, since the alternator is something of a pain to remove and reinstall, and is quite expensive to replace.)

With the meter still hooked up to measure field current, I got out of the cockpit and walked around to the front of the airplane. I grabbed a propeller blade on the right engine and started to rotate the crankshaft while watching the alternator field current on the volt-ohmmeter. Aha! As I turned the prop, the field current suddenly started jumping all over the place, from zero to 1.75 amps in highly erratic fashion. Clearly, there was a mechanical problem in the alternator field.

Then, as I continued rotating the prop, I heard a funny noise and something caught my eye. I quickly realized that what I was hearing and seeing was electrical arcing visible through the end cap of the alternator. Every time the field current jumped from 1.75 amps to zero, I could see and hear a big spark coming from inside the alternator, in the vicinity of the brushes and slip rings.

Clearly, then, the alternator was at fault, and would have to come off the engine and be repaired or replaced. The troubleshooting phase was complete.

Nothing I can't handle, right?

Removing and reinstalling the alternator seemed like something I should be able to handle myself. On the other hand, since I'm not an A&P and since removing and reinstalling an alternator is not on the list of preventive maintenance items that an owner/operator is permitted to do on his own reconnaissance (FAR Part 43 Appendix A), I was going to have to find an A&P willing to supervise and sign off my work.

I went upstairs to the Cessna Pilots Association office and found Tom Carr, a member of the CPA technical staff who is an experienced twin Cessna mechanic and who served as the IA on my last annual inspection. I explained to Tom what I'd found, and asked him if he'd supervise and sign off the removal and reinstallation of my right alternator. He said okay. I headed back downstairs to the airplane, and about 30 minutes later (with Tom's helpful encouragement) I had the alternator off the airplane and in my hands. Getting it off was easy enough, but in the process I could tell that reinstalling it was going to be a lot trickier.

An ohmmeter check across the alternator field terminals confirmed that the resistance jumped all over the place as I rotated the alternator shaft by hand. Definitely a field problem, probably brushes or slip rings.

Okay, now what? Who ya gonna call?

I checked my maintenance logs to see how long the alternator had been in service. The answer turned out to be only about 400 hours. That's pretty youthful for an alternator that theoretically should last for a full engine TBO.

At this point, most maintenance shops would simply order a rebuilt alternator on an exchange basis. But because my alternators are massive 100-amp Prestolite ALV-9510s (used on most known-ice-equipped twin Cessnas), I knew this would be an expensive way to go. To confirm this, I called Electrosystems in Ft. Deposit, Alabama, and Aero Electric in Wichita, and both quoted me an exchange price of about \$1,000 (plus a hefty core deposit) for a rebuilt ALV-9510.

This seemed to me like an unnecessary waste of money, since my alternator had such low time on it and probably just needed new brushes or something else equally simple. I briefly considered the possibility of opening up the alternator myself to find out exactly what was wrong with it, but after discussing that idea with Tom Carr, we concluded that we didn't have the necessary tools to take the thing apart, nor the necessary parts to put it back together and bench-test it properly.

I decided my best strategy was to find an aircraft accessory shop that was qualified and willing to do an "IRAN" on my alternator. ("IRAN" is an acronym for "Inspect and Repair As Necessary," and is an aviation term-of-art meaning "don't do a full overhaul, just fix what's broken.") I asked my colleagues on the CPA Technical Staff (John, Steve and Tom) if they knew of any shops that would do this for me, but no names came immediately to mind.

CPA has a saying: "if we don't know the answer to a Cessna-related question, we usually know who does!" So I prevailed upon Steve to phone a friend at Tom's Aircraft Maintenance Inc., a well-known Southern California twin Cessna maintenance facility, explained the situation, and

"if this was your alternator, where would you send it?" Tom's suggested a small shop that none of us had ever heard of: Baker Aero Electric (310-539-9789) in Torrance, Calif.

Dave to the rescue

When I phoned Baker Aero Electric, Dave Baker answered. I explained my predicament and asked if he'd be willing to open up my alternator, figure out what was wrong with it, and repair only what needed to be repaired. "Sure," Dave replied. I boxed up the alternator and took it over to the local UPS office. Dave received it the following day and had it repaired, tested, and on its way back to me within 24 hours.

I called Dave to ask what he'd found wrong with my alternator. He said he found the brush holder was bent (something that probably occurred when the alternator was last overhauled), and that the brushes weren't properly aligned with the slip rings. As a result, the brushes gradually developed a "lip" where they hung off the edge of the slip rings. In time, the lip got big enough to touch the rotor and prevent the brushes from making proper contact. The solution was simply to bend the brush holder back to its proper shape and install new brushes. Dave said he also cleaned the slip rings, inspected the rotor, stator and diodes, reassembled the alternator and bench-tested it. He even threw in a new mounting gasket. The tab for all this (including return shipping and insurance) was a mere \$103.00! Gee...don't you just love it when a plan comes together!

Finishing the job

Shortly after UPS delivered my care package from Baker Aero Electric, I showed Tom Carr the repaired alternator and the accompanying maintenance release paperwork, and told him I was ready to reinstall the alternator on the right engine.

The alternator is secured to the engine crankcase with four mounting studs, two of which are very difficult to reach. It took me the better part of an hour to get the nuts started on those two lower studs, but I finally succeeded (and was very proud of myself). I looked up the proper torque for the four mounting nuts, but found that I simply could not get a wrench on either of the two lower nuts, even after exhausting every 1/2 inch wrench in my toolbox (including offset, crow's foot, dog bone, etc.).

I went to Tom for help, and he gave me that "been there, done that" smile. "I've got some special 'trick' wrenches in my toolbox that should make the job much easier," Tom revealed. I prevailed on him to let me borrow his special wrenches (which were obviously non-standard tools that had been ground down and bent just for situations like the one I was facing). Tom's trick wrenches made torquing down those otherwise-unreachable nuts a

piece of cake. Then all that was left was to reattach the wiring harness to the alternator's five screw terminals.

I told Tom that I was done with the installation and ready to cowl up and give the alternator a "smoke test." Tom inspected the installation very carefully, poking here and tugging there while I watched nervously, and finally gave it a thumbs-up. I re-cowled the engine, pulled the aircraft out of the hangar, fired up the engines, and gave the charging system an extra thorough functional check. Everything appeared normal.

I brought my maintenance logs to Tom and told him that I'd finished ground-running the engines, and the charging system seemed to check out 100%. We stapled the Baker Aero Electric paperwork in my right engine logbook, then I made and signed a logbook entry for the alternator removal and reinstallation, and finally Tom made and signed an entry approving my installation work.

Just to make sure, I took the airplane up on a 30-minute test flight. Everything worked exactly as advertised. I was a happy camper.

So what's the point?

My purpose in writing this article is to underscore a few of the ways in which an aircraft owner can benefit by getting more involved in the maintenance of his aircraft. Let's review.

First, in the face of an annoying but intermittent problem (what I call a "transient anomaly"), a maintenance-savvy aircraft owner will consider sitting tight and waiting to see whether the problem gets worse or goes away by itself. If it gets worse, it'll be much easier to troubleshoot. If it goes away, it's not worth worrying about unless and until it reappears.

Second, a maintenance-savvy owner will always make a real effort to investigate and troubleshoot a problem so he can tell his mechanic exactly what's wrong ("the right alternator has an intermittent field, with electrical arcing visible through the end cap as the propeller is rotated by hand-probably bad brushes") rather than offer only a general description of the problem ("the right alternator fail light is coming on intermittently"). This is especially important for problems that cannot easily be reproduced on the ground.

Third, a maintenance-savvy owner can frequently save a lot of money by researching lower-cost alternatives to expensive parts replacement. In this case, by making a few phone calls, I was able to resolve the problem with a \$100 repair instead of a \$1,000 overhaul/exchange. This is an area in which one phone call to the Cessna Pilots Association technical support line can easily repay your membership dues a dozen times over. CPA can usually suggest the most cost-effective way to resolve almost any Cessna maintenance problem...and if we don't know the answer, we know who knows!

Finally, a maintenance-savvy owner who is so inclined can perform virtually any sort of maintenance or alteration to his own aircraft, provided his mechanic is willing to supervise and sign off the owner's work. If you enjoy swinging wrenches on your airplane, it pays to develop a relationship with an A&P who is comfortable in dealing with owner-performed maintenance, and then work to earn his trust by showing him that (1) you won't start swinging wrenches without his prior approval, (2) you have reasonable mechanical knowledge and aptitude, and (3) you know when it's time to ask for help.

Keep in mind that you probably won't save a lot of money by doing your own work, particularly if you place a high dollar value on your time. I'm sure, for example, that any professional twin-Cessna mechanic could have removed and reinstalled my alternator in half the time that I took to do it. On the other hand, if you're interested in learning more about the mechanical aspects of your aircraft, there's simply no better way than to jump right in and get your hands dirty.

Maintenance Corner by Charles Gregoire

Well I decided to forgo winter flying this year. As a result I had to prepare the plane for storage (i.e. ensure that it would be well preserved until Spring).

The first thing was to "pickle" the engine. I used AeroShell Fluid 2F for this job. I was able to buy it locally from Red Sutton who runs the AMO at Rockcliffe airport. You can get more information on what Fluid 2F is on the Internet at URL:

http://www.shell-lubricants.com/Aviation/av_products.html

With tax it cost me around \$29.00 for 3 Litres. Essentially it is 100W oil specially formulated for preserving engines during storage. It can be used like a regular engine oil (i.e. you can fly with it). I don't recommend this because it's expensive. When you're ready to fly in the Spring, drain it out and put in your regular oil. You can reuse the preservative oil for a few seasons (maybe two or three). By not putting any flying hours on the oil, there will be relatively little build-up of combustion by-products which tend to increase the oil's acidity (i.e. Carbonic Acid comes to mind). The prescribed procedure for changing the oil is as follows:

drain your regular oil out in the usual way by first running your engine for about 5 to 10 minutes and then draining.

Put the preservative oil in (you don't need to use as much since you're not going to flying. Most of the people I talked to use 1 to 2 litres. I used 3, to account for the oil filter, and ran the engine (1000 RPM) for around 15 minutes.

Besides using preservative oil I did the following:

Removed the top spark plugs and put in desiccant plugs (i.e. these are plastic spark plugs with desiccant in them to help absorb any moisture that may accumulate in the cylinders). You can order these from Aircraft Spruce.

Removed the air intake filter (had a bit of a struggle with the Bracket style since it is stuck on, i.e. I'll need to buy a new gasket for next Spring) and block the intake at the carburetor throat with a piece of foam wrapped in soft plastic.

In a similar manner plug exhaust tail pipes, and the breather tube (don't forget the ice hole on breather tube).

Removed the battery to store it at home over the winter. Put it on a battery charger once a month.

Took the opportunity to service it by replenishing the cells with distilled water. After recharging I check the battery's status by measuring the specific gravity of the electrolyte in each of the cells. Bought specific gravity checker at Canadian Tire.

Removed the radios, including the ELT, and store them at home. This saves on the extreme temperature cycles the radios might see if left in the plane.

That's about it. I put my wing covers and cowl cover on. Because I have a C150 (i.e. with tri-cycle landing gear) and I tie down outside, I put a log under the tail to keep it from going down and getting frozen into the ground. This happens when too much snow collects on the wings and fuselage. It is often enough weight to cause the tail to teeter down onto the ground.

Another good thing to do, which I meant to do but didn't seem to get around to, is to cover the tires.

Tires will deteriorate due to UV exposure (i.e. another reason to get around to finishing the paint job on my wheel pants and installing them next spring).

Classifieds

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Ads will run for three months with a renewal option of two more months.

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