Tips from Comanche *Flyer* magazines Feb 1973 – Sep 2012

CHAPTER FOUR

ELECTRICAL SYSTEM (BATTERY ISSUES, CABLING, ELECTRONIC CIRCUITRY/WIRING, CONTROLS GENERATOR)

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Electrical Master Solenoid Water Damage

Our Comanche 260 B had been parked 4 days at New Orleans, Lake Front. With IFR flight plan in hand, we started to load our baggage. I discovered the gyro & green light was on. OH! OH!, I thought, dummy − you left the master on again. How could it be working after this length of time? Well its too late. The battery must be about dead. To my surprise the master switch was off, then why the gyro & green light? The engine fired up like it was ready to go, so we did.
We landed at Dexter, MO, and had lunch. Wouldn't you know it, when we came back to the plane, the light & gyro was on. We arrived back in Rockford and the plane was hangared with the battery disconnected.

I finally decided to take a look at our faithful bird. Mind you it has been sub zero weather and no heat in the hangar. You guessed it, the light was there, but nothing worked when the master was turned on. Now what? After consulting with the people who know, I began to remove the master solenoid. That turns out to be a tough job on a B model Comanche, if you don't remove the cowling.

When removing the solenoid. water kept dripping from somewhere. I found by removing the 2 small nuts on the bottom cover, it exposed the contacts. The cover is dished and will hold water or condensation, if it gets in. How is anybody's guess. Water had provided a weak circuit and when I wanted to start. It had frozen. Cleaning the cover put us back in business.
The local shop came up with a price of $86 plus installation for a new one. Of course the new solenoids have 2 small holes in the cover. From now on, removing the cover during the annual will be added to the list.

Dead Battery

I have noticed a number of letters in the Flyer referring to problems with the electronics of the Comanches. A short while ago I had a problem with my PA−39 which is probably common to most aircraft.

I found that when the aircraft had not been used for two or three weeks that the battery was either flat or very weak and would not start the engines. However, after recharging, the battery capacity tests showed that the battery was in good condition. My aircraft is kept in a hangar which is unlighted, and I noticed on a number of occasions what I thought was a glimmer on the alternator charging light. However, whenever I attempted to investigate it, the light had gone. Switching of the master switch on and off did not reproduce this warning light indication when the master switch was off. I got to the stage of disconnecting the battery whenever I was parked to prevent discharge. Somewhere in the system there was a continuous drain on the battery which I could not identify. After one frustrating trip from Luton to Barcelona to Lisbon and back, in which we had repeated problems with the battery, I was determined to find out what the problem really was.

With the battery disconnected and using a volt / ohmmeter, I found that there was a very small current drain with the master switch off. The only solution, therefore, was to work back up from the battery to determine what was taking the small current. On disconnection of the output cable at the master switch solenoid, I found that the problem had disappeared, the current drain was in fact in the master switch solenoid. Checking the solenoid coil showed that there was no leakage from that source. However, on stripping the unit, I found that the main contacts were heavily contaminated with a brown powder which, even with the contacts in the open position, was sufficiently conductive to cause a leak of current enough to cause the battery to be flattened over a period of a few days. By simply cleaning the switch contacts and reassembling the solenoid, the problem had gone away.

I suspect that the magnetic field generated by the solenoid, which is continuously energized, causes small magnetic particles to be attracted from the atmosphere and which 3 progressively build up around the poles of the magnet. My PA−39 was built in 1971 and I have noted that on later Piper aircraft which use the same Cutler−Hammer solenoid the contacts 3 have been sealed with some form of epoxy putty, presumably to prevent the ingress of such magnetic dust. A very crude method of sealing, which is presumably effective as I have not heard of problems of this type on later aircraft.

If you have an early model aircraft and experience problems of flat battery, it would be well worth checking this master switch solenoid before buying a new battery or replacing components of the charging system.

Water in Master Solenoid

Edward Pencosky, ICS #09571, had a problem with his '260C. It seems that after leaving it for a few days or a week with the master switch in the off position, the battery would be dead. On one occasion, the personnel at the airport called to advise that the navigation lights on his '260 were on, even though the master switch was off.

With the battery charged up, a test was made for voltage with the master switch off. On the battery side of the master solenoid, this was 12V, same as the battery. Then the tester was put on the other side of the solenoid and this should have been a zero reading, but the reading was 9 to 10v.

Ed took the solenoid off and examined it. This is the type where the bottom can be removed. And much to his surprise, he found it full of water. As water is a conductor, this caused the current to flow through the open points. To date, we have not figured out how the water got to or in the solenoid, but it seems that nothing is impossible.

Battery Charging

With regard to charging the battery through the external power receptacle, this should not be done. The battery must be removed from the aircraft for charging. There would be a dangerous buildup of hydrogen which is very flammable and explosive. When the battery is being charged in flight, through the design of the battery box, it is being vented to the outside.

Electrical Failure

Our problems first started during an IFR flight over the mountains of Pennsylvania when we had a complete electrical failure. The ammeter wasn't showing a charge, however by switching the master off then on reset the system and the electrics came back to life.

We had the system checked and could find nothing wrong but we replaced the regulator and the overload breaker. The problem persisted periodically but after resetting the system it worked OK. We installed an alarm to notify us when the alternator was off line. Then one day the system would not reset no matter what we did.

We replaced the alternator to no avail. We then went thru the system piece by piece until finally we by passed the radio filter between the regulator and the over voltage relay. Eureka – we found our problem, we replaced the filter and our troubles were gone.

Voltmeter

A voltmeter can be a useful instrument in assessing the health of the electrical system. I have one installed in my aircraft and it helped fix a problem I had been having.

Over a two year period I had been plagued by either the radios going dead on short finals, the panels lights going brighter than normal at times, and the starter motor not operating at times.

I replaced the battery, regulator and starter solenoid but the problem still plagued me.

One day after I had fitted the voltmeter the starter would not work, the voltage before I engaged the starter was 12 volts but when I engaged the starter the voltage dropped to 2 volts and stayed there even after the starter was disengaged. Banging the solenoid would bring the voltage back to12 volts. Remember this is a new solenoid so it should be OK, also note that it is fitted on the side of the battery box.

Further investigation showed that a battery box attachment point which was the same point that the earth strap was bolted to the airframe was badly corroded. It appears that this corrosion was caused by fumes from a nearby battery box vent. This connection was sometimes good giving the full 12 volts sometime open circuit giving nothing or high resistance giving low voltage.

Without the voltmeter in my panel it would have been much more difficult to find the cause of my problems.

Starter Maintenance

Last week while flying my Comanche on a short vacation to northern Idaho, I ran into a problem not experienced before − the starter wouldn't engage. Although the starter has only about 200 hours on it since installation, one 'chief' mechanic wanted to tear it down to lubricate a pin, or perhaps replace a broken pin. "There's an AD out on that, you know, and Lycoming has had a lot of trouble, etc. etc."

That kind of news doesn't help make schedules (unfortunately, I schedule vacation time, too). My luck hadn't run out, however. Before the mechanic assigned to do the fixing could begin to remove the cowl, etc. (that was going to run into overtime, after 4:30 and union shop), I decided to turn the engine over by hand. After a couple of turns, I heard a metallic click and thereafter it started − four or five times in a row. When the union mechanic arrived, he did a non−union thing − squirted some lubricant on the starter gear, said it was probably hung up due to dirt, and walked off − no charge.

When I returned to the Ft. Collins roost, a friend confirmed the dirt theory, sprayed the gear and area with solvent and a light lubricant.

ED: A squirt of silicone lubricant will work on this program. Also, silicone does not attract dirt as oil does.

Battery Box Vents plugged

Here is a story that might interest Comanche owners. Mine had a low battery a couple of months ago, so it was removed and recharged. After letting it cool for about one−half hour, it was reinstalled and the lid clamped down. After about 15 minutes of flight, a loud bang shook the plane.

After the pilot recovered from his heart stoppage and he realized that everything was still working normally, he landed at the nearest airport to find out what had happened.

When inspection of the exterior and engine compartment showed nothing, the tailcone was opened up and the trouble was found. The battery box had exploded. The box was puffed up like a balloon and the hold−down brackets ripped off. The cover was lying across the control cables. The battery was undamaged and still connected through the bent box.

Total damage: One battery box totalled, one small dent in skin where hold−down screw had impacted. The reason was the battery box vents were clogged with dirt, possibly an insect nest. Where the spark came from, we haven't figured out yet.

MORAL: When you take out your battery for charging, or at annual, be sure vents are clear.

Missing Engine Ground Strap

One word of help that might be significant for the writer who was having starting difficulties. Shortly after we secured our plane, we noticed that the engine never did turn over very fast, and simply would not start when hot. We finally discovered that, for some reason, the ground strap on the engine was missing, thereby requiring the engine to ground itself through the cables, connections, etc. This had resulted in one burned out generator and, as you might suspect, caused very low current to the starter which gave us the starting problems. We have had no problems since the grounding strap was replaced.

Alternator

Two members reported trouble with alternators. In the first one−thousand hours of flying N9345P, we had three (3) failures. The third one was in light IFR over Cheyenne, WY, on a flight from San Francisco to Baltimore. The mechanic at

Cheyenne's Piper dealer showed me the problem. The brushes get dirty and jam in their plastic tracks! Wham − when one brush hangs up, the alternator quits! Sooo − at one−hundred hour intervals ever since. I insist that the mechanic take the back plate off the alternator (while it's still bolted to the engine) and clean and blow out the brush tracks. Do you know what? We have not had another failure in the next 1,015 hours! I was convinced, and you will be too, once you take that back plate off and see all the crud that accumulates around those tracks.

Voltage Regulator

I have had a recent experience from which others may be able to profit. As owners of older Comanche's are only too aware, these aircraft suffer lots of voltage loss by the time the "juice" gets to the starter, resulting in very slow cranking speeds. As explained in the Feb. '78 issue of the Flyer, some of these very early aircraft have aluminum cables which are part of the problem. As recommended in the aforementioned article, I changed the cable from the starter solenoid to the starter, with good results. Good that is until I had a top over haul done and cold weather set in. Then it was back to the same old symptoms − it would start cold, but turn only about 12 blades when hot.

The problem was the voltage regulator! It's output was only about 11 volts instead of the necessary 14 volts. Volts being electrical pressure, put the generator at a definite disadvantage trying to keep the battery charged. Once the regulator points were burnished and its output adjusted to 14 volts and 50 amps my problem has been solved. Now the ammeter shows 35 amps during gear retraction instead of it's previous 20 amps.

Electrical Failure

We were returning in our trusty 180 from a wet Thanksgiving in St. Croix (U.S. Virgin Islands) to San Juan Puerto Rico to clear customs. Everything appeared normal including the ammeter that was about in the center as it is when the battery is full. I have all solid state avionics and the current drain is minimal and I assume that some time after take off the generator control unit stopped delivering. Undetected by me.

All radio communications were normal and I was cleared over San Juan International toward Isle Grande (the second and small airport). At this point, I turn on my landing lights for better recognition but also the radio starts to go scratchy and a minute later stops. I had not got a clearance to land so I continued west bound and attempted to lower the gear which only went part of the way. This was a wonderful way to be. No radio, gear half out and I have to land to clear customs.

I figured the customs people are meaner that the FAA so we continued. At this point my wife helped out by flying the plane in slow circles at 90 KTS while I checked circuit breakers and other things. No choice left but to slow it down a bit more and follow the emergency gear extension procedure. It works great. And the now very faint green light indicated down and locked. We did a no radio approach and landed normally. Customs was cleared and I started to check the aircraft. Generator belt was on, all electrical connections were good and tight, battery was cool, and the points on the voltage regulator appeared OK (but I didn't see everything).

We got a boost with a ground power cable and made a normal take off and flew gear down 60 miles back to home base of Borinquen. (Former Ramey Air Force Base, Puerto Rico).
Now the Piper maintenance manual comes in very handy for those who do not know it all and a complete examination on the bench with good light indicated that the points on the voltage regulating section had excessive pitting and build up. This was filed down, as well as a general dressing on the other points.

After installation, it charged normally. The only problem was the output voltage was a bit low. Probably as a result of filing. About a quarter turn on the adjusting screw brought the voltage up to 13.75 VDC. The lesson I have learned is to check thoroughly the points on a more regular basis. Now this little incident has not convinced me that I need an alternator, in fact I am firmly convinced that the generator will provide more reliable service. There is a certain beauty in the simplicity of a '48 Chevy generator that every automobile parts store has the brushes for $1 a set.

The second item learned is the need for a voltage meter which is now on order.

Battery Box Ground

During a period of about six weeks we had the following intermittent electrical problem with our bird, As soon as the key was turned to engage the starter the entire

electrical system would quit. You could move the cables from the battery to the solenoid and ground and get the electrical system back, only to lose it when you tried to start the bird. Attempting to jump from another battery to ours would produce the same results. Battery voltage measured in the cabin was less than 11 volts and the battery was only about 10 months old.

The ground to the airframe was immediately suspect. The vent hose from the battery box to the outside air was broken and we reasoned that the fumes had corroded the ground connection. We cleaned it and the aircraft returned to normal (for two or three starts) then back to the electrical system failure. During the six weeks we tried several other solutions; change the aluminum cables from the battery to the ground and solenoid, cleaned the ground connection several times, checked the solenoid. Each "fix" would correct the problem for the next few starts, but then the gremlin would again appear.

My father, who has never seen the insides of an aircraft, found the problem. The battery ground strap was attached to the top of the flange which is part of the battery box. This flange rests upon the frame, through which the bolt was fastened. However, a piece of the frame the size of a quarter was missing and the cable really only attached to the flange of the battery box. The only ground the aircraft was able to get was through the remaining bolts holding the battery box in place. Looking from the top of the battery box you could not see the missing piece of frame. We grounded it properly and the problem has has gone away.

Oil Temperature Gauge High Reading

I have noticed several complaints about the oil temperature gauge reading high.
This is a two coil meter movement with the ground through the back of the meter. If the ground connection is open, the meter will read full scale. Any resistance in the ground circuit will result in an erroneous reading on the high side.

Battery Box Ground

After owning my 1961 Comanche 250 for twelve years, recently I experienced complete electrical failure, to my thanks on the ground.
The problem, water had been leaking through the rotary beacon seal which is right over the battery negative ground strap. A chemical action formed which could not be seen from on top, but upon removal of the strap, the metal to the frame work was almost completely eaten away.

Electric Trim Replacement Cable

This past summer, during a complete panel and control wheel update, I had occasion to remove the original trim switch and the coiled cable from the original wheel to the panel. I was shocked by the condition of the cable when I cut it to remove it. All the rubber insulation had been reduced to powder on the inner conductors, even though the outer sheath appeared to be in fine shape. This incidentally, is quite common with rubber insulated wire of the age of our airplanes. Obviously, had the cable been pushed in just the right way, the wires could have shorted together causing the 'runaway trim' condition that Mr. Mack described.
I have been in the electronics business for about 25 years and have used switches of the same or similar types to the ones that are used for the electric trim. I have not to my recollection ever seen one of these fail in the "on" mode. If they failed at all, they failed so as not to make contact at all. I firmly believe that any 'runaway trim' would be caused by the cable itself.

Piper has a replacement cable containing 7 wires available under the Part No. 26934−00.

Landing Light Lamps

A member called requesting a method to improve the landing lights.

All models use the GE No. 4509 lamp which is Piper No. 472− 661, and this is a 100 watt unit. With the help of Rex Nelson from GE, I found the information which follows. All of these lamps mentioned are 13 volts.

Lamp	Watts	Expected Life	Area Covered [°]	Candle Power
No. 4509	100	25 hrs.	Vert. 6 / Hor. 12	110,000
No. 4519	100	25 hrs.	Vert. 7 / Hor. 40	30,000
No. Q4631	250	500 hrs.	Vert. 12 / Hor. 13	80,000

The No. 4519 and Q4631 will fit the same as the No. 4509 as they are identical in size.
The No. 4519 requires no change in the electrical system but note that the horizontal coverage is 40 instead of 12 which would give a wider view but not as far in front of the aircraft.
The No. Q4631 is a halogen lamp and double the vertical with about the same on the horizontal and with a greatly improved service life.

According to the Piper Service Manual,
all PA−24's have a No. 14 wire. To use the Q4631, change all wiring, bus bar to lamp, using a No. 10 wire as well as a stronger circuit breaker. Check the landing light switch(s) for ampere rating and change if necessary.
On PA−30's, S No. 2 through 1716, install two stronger circuit breakers and install No. 10 wire from each circuit breaker to each landing light switch. Check each landing light switch for ampere rating and change if necessary.
For PA−30's S No. 1717 through 2000 and all of the PA−39's change both circuit breakers to stronger ones and check each landing light switch for ampere rating. Change if necessary.
All of this information is based on intermittent use of the landing lights with a maximum of two minutes.
Note that No. 4509 and 4519 lamps use approximately 7.5 amps each and that Q4631 uses approximately 17.6 amps.

Piper probably selected the best lamp which was available at the time of manufacture. To learn if one of these would do a better job, you would just have to give it a test. If it is superior in your opinion, your AI could do whatever is needed to return it to service, obtaining FAA approval. Be sure you have cleared this path before completing anything other than testing.

Twin Nose Wheel Taxilight

On the PA−30/39, there is an STC approval for a taxi light on the nose gear. This is No. SA13415W and you need to contact J.W. Miller, Marble Falls, TX 78654, telephone number (512) 598−2556.
By adding a taxi light, this might take care of the dark triangle from the nose to where the landing lights come together.

Battery Cables

I recently replaced the solenoid−to−starter cables in my PA−30 per Piper's Service Bulletin 836A. These jobs are always easier the second time, so I'm passing along the following "first time" experience.

First the cable. SB 836A calls for either #4 or #2 wire, depending on whether you are replacing AL−1 or AL−00. The PA−30 Service Manual neglects to call out what is used in the "old" PA−30's (fig. 11−66), but claims it's AL−1 in the "new" ones (fig. 11−66a). I "eye−balled" my cable (the size was not printed on the old cable) and all I could tell was it looked pretty fat, so I ordered #2. It turns out it was, in fact, AL−1, so #4 will satisfy the SB, and it's cheaper. However, the fatter the wire, the faster the prop turns.

Next, the length. My old cables, measured hole−to−hole, were 15' 1−1/2" (left) and 11'4−1/2" (right). Maurice Taylor reported another owner used 32 feet total (Dec. '86 Flyer). My airplane has the battery in front, and the solenoids at about

station 40, lower right−hand side; older models with the battery in back may require more cable, but it's not obvious from the parts catalog.

Finally, the terminal lugs. The generators used 5/16", bolts, and the solenoids used 3/8" bolts so in an unmodified airplane you'll need 2 each. I had replaced one starter solenoid with a 12V unit (see the March '86 Flyer, p. 16), which had a 5/16" bolt. I think the C models came with 12V solenoids.

Incidentally, this is a great time to replace your solenoids, run wires for multi−probe EGT's and CHT's, fuel flow systems, etc.

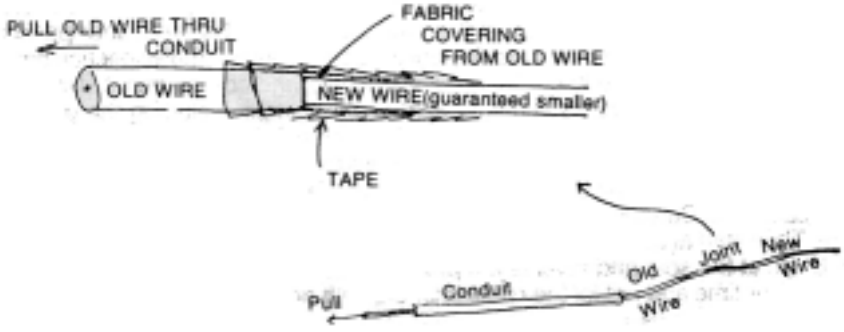
At last, down to work. If I were doing it again, I would remove the front seats and rails, front floorboards, left sidewalls, and right front sidewall before starting. As it was, I wound up with seats, floorboards, etc., piled all over the airplane in a continuing vain hope that I wouldn't have to take anything more apart. The inspection plates on the top of the nacelles come off. On the left engine, remove all but the lower cowling; on the right engine, only the inboard cowl panel need be removed, if you've got medium to tiny hands.

With everything exposed, it is pretty obvious what needs to be done. I didn't cut the old wires, but it would be a lot easier to cut like mad and just take out pieces, rather than having to snake the old wires out (they're pretty stiff) and snake the new wires in. The only dicey part is getting the new wire through the conduit from the wing root to the nacelle. Mine went easily, but there wasn't much in the conduit. If you've already got EGT and CHT wires, fuel flow wires, etc., that conduit is pretty crowded. But there's an easy way: cut the old wire, then push the outer fabric insulation back a couple of inches and cut the inside part again. Then butt the new wire up against the stump, run the insulation down over the new wire, and tape the whole thing up smoothly (see sketch). Then the old wire can be pulled out of the conduit, and it will drag the new one through behind it. This is the only part where it really helps to have 2 people.

Maneuvering the crimper around in a crowded area is impossible, so crimp the lugs on before routing the cable ends to their final destination. Don't forget to put grommets and cable hoods on before the lugs. Also, don't solder the lugs − solder sets up a rigid boundary in the cable which is subject to fracture under vibration−crimping is enough, but you must use the proper tooling.

When all is done, merely put the airplane back together, and complete the log entry. This constitutes a minor repair, so of course has to be written off by an A&P. You may have to update the weight and balance (my fat copper wire added about 3 lbs. to the empty weight).

My old wires showed no signs of excessive heat, although I had previously replaced the battery solenoid to starter solenoid cable, which was a real mess, and showed a 3V drop all by itself when starting. Nevertheless, I'm glad I did it, even though it was a long, hard, dirty job − probably a 10 man−hour job at a good shop. Cranking speed has clearly improved, but I haven't made any precise measurements.



Battery Cables

In a recent Flyer, I talked about changing from aluminum to copper cable in the PA−30's. A member brought to my attention that the PA−30 service manual for S #30−2 to 30−1716 does not show what wire size is used from the battery to the starter. It is shown for the others through S #30−2000 as AL−1 aluminum. There is no schematic drawing for the PA−39. The same problem exists in the PA−24 service manual. The wire size is shown only for the 260 S #4783 and S #4804 and up. This shows as AL−1 aluminum wire. There is no wire size shown on other PA−24 models.

I went to Ron Maynard of Piper Aircraft for help on this and thank him for the following information. He advises that all used the AL−1 wire so you should replace with AN4 copper wire on all aircraft, battery to starter. See SB 836.

Please note that if larger AN2 has been used, it is all right. You would have a little less voltage drop and more weight than is necessary.

Battery Cables

Replacing the long cable in a 1959 type Comanche 250 is not a hard job. It takes some time and patience. Before trying to replace mine, I wrote ICS and received the article by Carl Carlsen.

Mr. Carlsen said he had the drill pointed at the first rivet. This is enough to frighten some would−be mechanics. There was not one rivet to drill in my airplane. My regular mechanic agreed with me that pulling the cable out as Mr. Carlsen did was not practical in my case. He suggested that my son, Robert, (who always helps with the annual) start exposing the cable and he (the licensed mechanic) would take over from there. Robert started the work and I acted as "gopher". The cable was quickly exposed, so we decided to remove the old one. This was accomplished before the mechanic got to us, so we proceeded to install the new one. After about six hours, it was ready for inspection. Since it was time for the annual, we did not replace the one from the solenoid to the starter until later when the cowling was off. I ordered my cables already made up from Bob Weber (WEBCO).

Proceed as follows: Disconnect the battery at both posts. Remove the seats, as directed in the owners manual, and remove the carpet. After removing seat rails, carpet may be folded back; it is not necessary to remove the carpet from the aircraft. Take off the center section on top of the instrument panel. The front floor panel on co−pilot's side can be removed by taking out the screws, as can the inspection panels down the right side of the floor. The floor of the baggage compartment also has to be removed. Now you can see all the hold−down clamps, including the grommet where the cable goes through the firewall. (Note carefully how each piece should go back.) Remove the cable from the firewall solenoid and straighten the 90 degree end for easier pull through. All clamps should be removed before trying to pull any part of the cable out. Carefully work the firewall end back until it is clear of the instrument panel. Then start at the main spar and work each end to this point. With the old cable out, begin at the spar and reverse the procedure with the new one. Just remember to take your time and not let the cable interfere with any other components such as radios, control cables, etc.

Replace exactly as the original was installed. Remove and replace the short cable from the battery to master relay. Connect both ends and then the ground strap at the battery. Now turn on the master switch and look for normal operation.

The result will be well worth the trouble and expense. If I had known how much difference the copper cables make, I would have changed mine long ago. The other Comanche based here is a newer model with a battery in the engine compartment. The owner says he has no starting problems and does not plan to change his cables. I suppose the difference is in the length of the cables, the longer one causing much more resistance.

Starter Solenoid Modification

I read of a problem a few months ago in "Comanche Flyer," regarding the possibility of the starter solenoid remaining engaged and the possible damage that can occur. This got me to thinking (a dangerous condition for me) and I came up with an idea, and have installed it in our 260B.

I have taken the small indicator light, which is part of the "AUTOVAC" instrument auxiliary vacuum system that I manufacture, and connected it to the starter side of the starter solenoid. The operation is quite simple − when the starter switch is engaged, the indicator light will illuminate, indicating power to the starter. Upon engine start or disengaging the starter switch, the light will extinguish. Should the starter solenoid fail to disengage, the light will remain "ON" indicating power going to the starter. This is the time to shut down and investigate.

This system can be installed on any aircraft requiring only a log book entry by an A&P. We are going to add this little item as a product available from A&I Products, Inc., complete kit ready to install for only $8.50.

Generator Polarizing

Read in the Flyer regarding generator polarizing with interest. I'm sure it works, as it cured Jon's problem. There is a simpler way to accomplish the same result and it is done without the engine running.

Let me quote from the Piper Comanche Service Manual, page 9−13: "Momentarily connect a jumper between the "GEN" and "BAT" terminals of the regulator. This allows a momentary surge of current to flow through the generator which correctly polarizes it."

I no longer use my Comanche during the harsh winter months. Over this several month period the residual magnetism deteriorates, making it necessary to re−polarize the generator.

I use a piece of #14 solid insulated wire about 6" long to do the job. Works well, and takes only a fraction of a second to accomplish. Another thing I do is remove the regulator and take it home for this several month period of non−use. This eliminates the problem of oxidizing contacts in the regulator.

Battery Cables

STARTER SOLENOID MODIFICATION SB 852A does not mention the original equipment sheath. The replacement Specification cable is of very high quality and many have argued that the sheath is not necessary. But there is a very easy way to have new cables on the PA−24 and retain the sheath protection also.

Forget about pulling the cable through the sheath. Buy 14 feet of new 3/4" spaghetti and pull the new cable through the new sheath before installing. Thread heavy stiff wire through the sheath, attach and lubricate the cable, and hold the sheath with pliers while pulling.

I cut my old cable out in sections with a cable cutter in about 10 minutes, but pulling the old cable out (sheath and all) with a nylon cord attached is probably the better method. The new cable goes back as a unit almost without effort. The problem is removing seats and floorboards and there is no shortcut for that. Do it on the annual?

Battery Maintenance

Want a more trouble free battery on your Comanche, car, boat, or any lead−acid battery application? Who doesn't? I picked this idea out of a Midwest agricultural magazine, which proves the man who submitted it was anything but a dumb farmer. And it will cost you only two cents.

First, clean the top surface of the battery, the posts and strap leads thoroughly. Next, take two new pennies and using a few drops of black rubber or gasket cement, glue down one penny one−half inch away from the positive post and the other penny one−half inch away from the negative post. Be sure you do a neat, firm job, leaving the pennies top surfaces clean and free of cement.

Any traveling electrons that tend to accumulate at the posts will gather at the sacrificial pennies, leaving your posts and leads free from buildup. The theory, of course, is simple − copper is higher on the electromotive series than lead. I also throw out the iron nuts that come with my battery and use stainless wing nuts from the hardware store. They'll cost you maybe a dollar. If and when your investment of two cents gets corroded, glue down two new pennies. I'm on my second

two−cent installation, which is as good or better than greasy felt washers or chemicals, although a LIGHT spray of silicone on the posts won't hurt anything. The whole process is quick, easy and effective and one of the few bargains in aviation.

Electrical Voltage

I have a suggestion that may save one or more of our members a moment of distress. Recently I experienced a slightly low voltage condition while in flight. The momentary cure was to turn off some equipment and that seemed to solve the problem. Once on the ground, I turned on everything and all appeared to be normal. My first thought was that perhaps the brushes had hung up, but I decided to look further once the engine cooled down. While everything looked normal, when I touched the output wire, it disconnected itself from the alternator as if it had never been connected. I was surprised to find that the wire (size 6) had separated from the connector right at the crimp. After I removed the connector and could examine it closely, I could clearly see that this wire had been broken for some time and that it had broken from the inside out. That is to say, the inner strands broke first (they were black) and then finally the outer core (they were shiny). When I mentioned this to another aircraft owner whose plane was slightly newer than mine, he told me that he just experienced the same problem.

In view of the fact that there is no way to inspect the wire inside the connector and that the majority of planes flying in our fleet are over twenty years old with many being closer to thirty years old, my suggestion is that before you experience the same difficulty, cut off the connector on this wire and install a new one. It is not a big job. You will need a heavy duty connector, which is designed for a number six wire and either a heavy duty crimper or a soldering device hot enough to enable the joint to be soldered.

I probably wouldn't rush right out and do this, but if you have occasion to have the cowl off (like an annual inspection), I think I would take the opportunity to change this connector. You might not need it now, but if it lasts as long as the first one did (32 years), it will sure be worth the effort and expense. In my case, 10 cents for the connector and about 15 minutes of work. Good luck and "Keep em flying."

In Field Report: Combining Accessories

Gordon L. Graham, ICS #02219

A note of warning to others: there is a potential problem with combining a couple new accessories.

First, a reminder about the need to replace the battery cables. I used a piece of Power Company feed cable, copper stranded, about 1/2" diameter (3/0?), from the battery box to the starter solenoid on the firewall. From the firewall to the starter, I recently replaced the "standard" #4, factory made, cable with a length of aviation 1/0 copper wire. This because I could not get the engine to go through the first cylinder's compression with the new Sky Tec starter. Sky Tec examined the starter and declared it to be fine and "putting out 2.2 HP." Even with jumper cables, off my Chevy's battery it would not turn the hot engine. It sucks the voltage down to about 8 volts. My mechanic told me that the Tiger he had just finished a MOH on wanted one of the starters and he would swap me for a Prestolite he had rebuilt. It spun the 0−540 with no sweat, HOT or cold.

The Sky Tec had no real problem with the 0−360 Tiger. This is the airplane we put the LASAR Mag system in during the post MOH flying. The reason for this letter is that the Tiger just came back. Those wonderful LASAR Mags were failing regularly. Failing to find a reason, we called the LASAR Tech people. Their first question was whether we had a Sky Tec Starter installed. Answering "Yes," brought us the news that we needed to modify the installation to include a breaker for the LASAR mags that would allow resetting it after start. It seems that the Sky Tecs pull so much current that the LASAR thinks there is a problem, and trips out. Now I remembered that Sky Tec said that my starter put out 2.2 HP when I complained it wouldn't turn the engine. That means it must pull at least 136 amps, not counting the initial "locked rotor" surge.

So if anyone is planning to add the LASAR system to their airplane with a new type starter, get the mechanic to talk to LASAR first. There was no notice in the original installation manual. (There may be now.) Compensating for the problem during the initial installation could save some labor costs and prevent a problem away from home. (Cycling the Master switch can also reset the Mags.)

SKY−TEC Responds to Gordon Graham

Gene Chiappe, ICS #7875

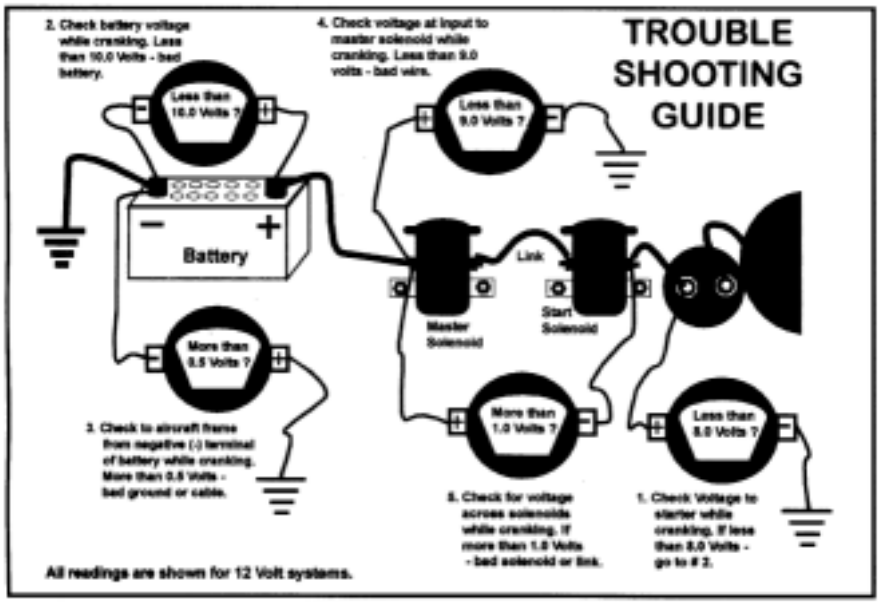
In Mr. Gordon L. Graham's article, "In Field Report: Combining Accessories" (Comanche Flyer, September 1998), he tells of replacing the original aluminum cables with copper (3/0?) from the battery to the starter solenoid on the firewall and 1/0 copper from the firewall to the starter is recounted. Mr. Graham mentions problems turning over the IO540 with a Sky−Tec starter, but doesn't make clear whether the problem was before or after the wire change.

If the battery and grounds are good, the Sky−Tec starter will have no problem cranking the IO−540 in a Comanche with wire as small as #2. Mr. Graham's letter says that the starter was pulling the voltage down to 8 volts during cranking. Unless the battery is weak, or there is a bad connection somewhere in the system, the voltage will not go down that far. Mr. Graham's attempt to use jumper wires from his ground vehicle to try to crank the engine is not conclusive. The "alligator" clips on the ends of ordinary jumper cables will not carry enough current.

Mr. Graham says, that when swapped into a Tiger, the starter cranked fine. This reveals more about the condition of the aircraft electrical system than the size of the engine. The newer Tiger has a relatively short run of wire between the battery and the starter and it is good #2 copper.

Yes, there are potential problems with the LASAR system. If the system voltage drops below about 9 volts while cranking, the LASAR will disable itself. That is why Unison suggests a method of resetting the LASAR. This drop can, and will, happen with ANY starter, depending on the wiring condition and the charge state of the battery. The Sky−Tec draws about 30% more current than the original equipment Prestolite, so the LASAR problem shows up sooner. It would be a better solution if Unison disabled the low voltage detection during cranking. We do not understand why they have not done so.

In conclusion, there are hundreds of Sky−Tec lightweight starters installed in Comanche 250 and 260 aircraft − cranking them at twice the RPM of the original equipment Prestolite starter and saving 10 pounds. To quote a popular author of the 1960's, "There ain't no such thing as a free lunch." To crank the engine twice as fast, the Sky−Tec starter produces 2 Brake−Horse Power − versus 1.4 for the original−equipment starter. This takes more current. When a higher current starter is installed in an aircraft with known wiring problems, such as the Comanche's original aluminum cable, it may take more than just swapping wire to get the desired performance. Careful voltage measurements made using the free Sky−Tec troubleshooting chart will find and fix the problems every time.



A Skip in Time

Jerry Gardner, ICS #12841

Over the past two years, (approx.), I have noticed a miss in the engine when at altitude and in cruise. It didn't concern me too much at first. I would adjust my mixture and sometimes it seemed to change or stop. Other times I would even change my power settings and it would stop. But it persisted on every trip and only at cruise settings. I would ask my mechanic about it and he said it could be my air mixture to the carburetor or could even be caused my exhaust. At one time, I pulled my exhaust system and repaired it, just in hopes it would correct this problem. I did find a few breaks in the pipes that needed to be repaired anyway, so it wasn't at all a lost effort. I asked my mechanic if I should replace my spark plug wiring harness, in case that was causing it. He said no, mine was fine.

Recently, I was on a trip to Dallas and after about 20 minutes at cruise, she started a very bad miss. I decided to test my mags while in flight. Very carefully I turned one off and then the other. My right mag was really rough, felt like it was going to shake off the mount, and the left was smooth. I turned back to my home field. I found a friend who was an AP and we checked my mags. They both were fine! But he did find that my wiring harness on the right side was bad with several breaks in the wires. You couldn't see them but they were there. I ordered a new set of the Champion `red' wires and we installed them.

That solved all my problems! She flies smooth as silk at altitude and at every power setting. This harness made all the differences in the world. I wish I had done it when I suggested it to my mechanic, two years and two hundred and fifty hours ago.

The Saga of the SKYTEC Starter

Chuck Moore, ICS #12215

This is an interesting article of my quest to gain full performance from the SkyTec starter and should be read by anyone contemplating a new installation or experiencing difficulties with the currently installed SkyTec starter.

I installed the SkyTec starter at the same time I installed the 3 bladed McCauley prop (previously reported). Initially, the starter performance was lackluster to say the least. FYI − N6019P has copper #2 cables installed. It was necessary to run the starter to the compression stroke and then let it bounce back and hit it again. Indeed the crank was twice as fast as advertised. A series of voltage checks resulted in the determination that there was a 1 volt drop in the cables to the starter solenoid, 0.5 V across the solenoid, 1 V from the solenoid to the starter and 1.5+ V in the ground cable from the battery to airframe. While cranking the battery voltage was 10.5 V (this means the battery is good). The result was that there was only 6.5 volts at the starter. THIS IS NOT SUFFICIENT.

The problem was compounded by insufficient grounding from the engine to the airframe. While cranking, a sharp eyed FBO pilot who has a habit of watching the AE's work, noticed the Plead shields had a trace of smoke coming from them. Further investigation by an electronic wizard, who is also a local airport bum and a friend of mine, resulted in finding a very poor ground strap that connected the engine to the airframe. We changed this wire and the starter worked as advertised. Herein lies the moral of the story: CHECK THE GROUNDS FIRST. What is conducting the current? Perhaps the P−leads are. This is very bad and can lead to a premature termination of a flight if they short the mags. CHECK THE VOLTAGE DROP IN THE P−LEAD SHIELDS TOO.

I intend to change the cable from the solenoid to the starter the next time I have the cowl off so that an aging battery will not leave me stranded or the cold weather results in low voltage and increased cranking resistance. A word of wisdom would be to not expect to install the new starter and have it function properly the first time. However, I do know that a little sweat equity results in better starts and lighter weight up front so it is worth the effort. I also conclude that the starter functions as advertised.

An interesting side issue is that we found the original coarse thread mounting bolt (my original starter had 3 studs and a bolt) threads were too short and the bolt would not tighten up properly. The new starter has a thinner mounting base, and even though it tightened, giving the appearance of being tight, the washer was freely rotating. This resulted in the starter deflecting and skipping over the ring gear teeth making a very bad sounding noise. Since we caught it early, no damage was done. It pays to keep your eyes open when installing after−market equipment.

I will be happy to discuss troubleshooting techniques for voltage and other experience gained with any Comanche member. I can be contacted via e−mail at csjmoore@gte.net (preferred) or by telephone at (219) 4755187 weekends (Fax (219) 475−5022).

Overvoltage Condition (Jun 2004)

Q I have a PA-39 and occasionally experience an over-voltage condition on my left engine. What is causing this and how do I remedy it?

A The cause is likely a faulty or sticking voltage regulator. Your twin should have over-voltage relays which are designed to protect the battery and other electrical components from an overvoltage condition. I say “should” have because it has been discovered that some generator to alternator conversions have not had the over-voltage relays installed. Most electrical systems on the twins have the over voltage relays installed separately from the regulators and often in a location not easy to get at. Over-voltage for a battery and avionics can be a serious condition. Today’s modern avionics are designed for 12 or 28- volt input and the 17 volts or more the alternator puts out if the voltage regulator fails will not harm them. However, older avionics will not tolerate high voltage, and your battery will not last long with an over voltage input. A battery can boil over in just a few minutes and can even explode.

I strongly recommend refitting your aircraft with modern solid-state voltage regulators available from Zeftronics which are available with built-in over voltage protection. I recently installed R15VON Alternator Control Units on my Twin. They are installed under STC Number SA8431SW which also covers the PA-24-260 Comanche.

Another worthwhile investment is the Electronics International combination Volt Amp meter. This digital instrument can replace the factory original Piper amp meter, and it is completely accurate. One feature that makes this unit so attractive is the inclusion of high intensity lights to warn of discharge or over voltage.

Alcor Alternator System – Intermittent Charging (Sep 2004)

Q On our return trip from Sun ‘N Fun in April, my Alcor alternator system stopped charging. My ammeter showed zero or a bit negative, so I turned off all unnecessary electrical devices and, with a strong battery, had no problem getting home to Greenville, N.C. Prior to that, there were early warning signs I should have heeded. If the plane sat more than a couple of weeks between startups, it wouldn’t charge right away and at times it would require higher RPM than idle to start charging. But at Lakeland, it had only been idle a couple of days and never started charging after startup. Back home, I checked and there were no disconnected wires around the alternator and regulator. I took out the battery, serviced and charged it, cleaned all terminals, the battery box, removed some slight corrosion from the support bracket, and made sure wires to the solenoid were in good condition. The alternator was removed and serviced with new brushes and bearings. With everything reinstalled, there was still no charge. So during run-up with all electrical switches off, I cycled the master switch and lo and behold; the system started charging. I figured the system had just awakened and the problem was solved. Not so fast, though! Turning on and cutting off any electrical device (transponder, beacon, nav lights, etc.), even keying the mike with the radio off, stopped the charging. But with a flip of the master switch, it starts charging again. My IA and I are perplexed. Any suggestions?

A It sounds as if the alternator is running with high resistance between it and the battery. The problem could be any of several things. The regulator can be malfunctioning and putting out high voltage which is tripping the overvoltage cutout, or the overvoltage cutout itself could be malfunctioning (unlikely). There could also be a loose wire in the regulator circuit (more likely) or a bad ground such as the ground strap between the engine and engine mount. Another possibility would

be the master solenoid. It can sometimes accumulate water inside, and could have bad contactor points but still look okay outside.

Also, if the aircraft has its original aluminum cables, it would be a good idea to replace them with copper. As you've already deduced, the cause may be hard to pin down, but this should help with some suggestions on where to look.

PA 30/39 Alternator System – Failure Potential (Sep 2004)

Q I have a normally aspirated 1966 PA30B with an Inter-Av alternator system that was installed in the 1970s, and one of the alternators was replaced sometime in the 1980s with another brand. Recently, I was told this system can have a total failure when just one alternator quits. I thought the concept of two engines and two alternators was to ensure full redundancy. I'm looking for a little guidance and have three questions:

1. Is this true? Can there be a total failure?

2. If so, is there a better, new alternator system available that would be immune from a dual failure when only one alternator has failed?

3. Do alternators have a life limit like most everything else in the plane (i.e., hour or year intervals for overhaul or replacement)?

For background purposes, I am a mechanical idiot, but I am trying to increase my knowledge, so please use third grade-level technical terminology and I may be able to follow along.

A To answer your first question, while it is highly unlikely, there is a situation that can lead to a failure of your dual alternator system. In some cases, one alternator will put out a higher charge than the other. A few users report differences as much as one-half to one-third between one alternator and the other. In this case, the load is shifted to the strongest alternator. If something should happen to cause the stronger alternator to fail, the load will be shifted to the weaker alternator. If the weaker alternator can't handle the load because of worn brushes or some other reason, it could also fail, resulting in a total failure of the system.

To ease your mind, you can make a simple check when running with an electrical load by switching between alternators and watching the amperage. If one is significantly lower than the other it would be a good idea to have the weaker alternator checked out.

For your second question, we don't know of a better system than the one you have. Our experts speak highly of Inter-Av and have found the folks there to be very helpful. Some, with systems in use for 25 years or more, report zero problems, and with reasonable preventative maintenance you should have an adequate level of redundancy.

For question No. 3, it is recommended the alternator units be checked each 100 hours of use. Take the pulley in hand and wobble it; if there is movement it can mean the bearings are worn and must be replaced. Further, brushes should be replaced every 500 hours and the units at 1,000 hours. You can check for up-to-date information at Inter-Av's Web site, http://www.inter-av.com/Index.htm or by calling (210) 344 2788.

Several members have reported the Inter-Av folks to be very accommodating when ordering brushes and seeking routine maintenance advice. For those with older systems, they also provide parts and technical support for pre-1980 Alcor alternator systems.

To sum up, while your system is not absolutely bulletproof, it is the most reliable we know of. With prudent maintenance, it should give you years and years of reliable service.

Alternator Replacement (Nov 2011)

Q I have a 1962 PA24-250 with a 12-volt/50 amp InterAv alternator that is failing. I want to put on a Plane Power SAL 12/70. Will I need to upgrade my circuit breaker and ammeter to accommodate this new alternator?
Has anyone done this before, or is it just easier to purchase an InterAv alternator again?

A InterAv is a very old style of alternator. I have them on my PA30 and they work quite well. However, if I were replacing them, I would go with the higher output alternator. If you choose the Plane Power alternator, it needs to be balanced.
You can't have a 70-amp alternator and a circuit breaker with a lower amperage value because it would be popping all the time.
Ask Plane Power what they recommend. They have an STC and that will state what breaker size is required, and to conform to the STC you must use that size breaker; it's just that simple.
Remember, someone has to sign it off, and if that someone were me, I'd ask for the STC and check for conformance.
The same applies to over-voltage relay and the regulator. You must use units that are compatible with the output, otherwise you'll be in a mess.
Pat Berry

Wingtip Strobes (Dec 2011)

Q Is it possible to run wires through the wing of a Comanche for wingtip strobes?

A Yes, it can be done. One method is to locate and identify the current Nav light wire, cut it and attach both your strobe wires and a **new Nav light wire** to it. Next pull all these wires through the wing using the old Nav light wire. When you do this, make very sure the wires are securely fastened to the old Nav light wire. You do not want them to come loose in the middle of the wing.
Cliff Wilewski