

Electrical Parasites

Parasitic current drain used to be the bane only of boat and RV owners, but it has now entered the world of aviation.

BY LPM STAFF

The parasites are coming—to your electrical system that is. These parasites are small electrical drains on your battery while the aircraft sits in a shut down state. We often hear of such battery drains in boating and RVs, because there is so much extraneous “stuff” less than carefully integrated into the electrical system as well as the harsher marine environment for boats that promotes corrosion.

However, Concorde Battery has recently brought up the concept of parasitic loads in aircraft systems that can operate to the detriment of the battery health. What has changed to make this now an issue for some aircraft is low utilization.

When flying was a regular operation for owners who flew weekly or even more often, the world has changed. Due to expenses, flying is becoming more of a special event, and 50 flying hours a year is now common to the detriment of our aircraft and decrease in our flying skills.

Parasitic loads were really no big deal in the past because any relatively minor parasitic load could not cause much in the way of battery discharge since the plane would be flying frequently enough to not give these loads a chance to deteriorate the battery or discharge it to the point where it would not start. Now that airplanes sit so much it's becoming a bigger deal.

WHAT ARE PARASITIC LOADS?

There are two types. The first are the small electrical loads that bypass the master switch and connect to the battery to run items that need a constant electrical supply such as an electric clock or some avionics or on-board computer gear or entertainment system needing constant but low-level electrical power.

Most electronics experts consider 50 mA as a typical parasitic load, but these can add up to cause a healthy battery to discharge over a few weeks or less. The second type is even more insidious and

befitting of the term “parasite” since it comes from wiring errors or problems where a small amount of current “leaks” from improper connections or internal partial shorts in electrical gear.

These are sometimes called ground faults. They can develop over time or many cycles with deterioration of, say, a master switch. Circuit breakers can deteriorate due to small but frequent current overloads or frequent use as a switch.

One particularly common source of trouble is a flooded type battery that is not properly maintained and conductive electrolyte mist accumulates on the top of the battery via overfilling the cells (top of split ring, no higher) or excessive charge voltage for the temperature. This electrolyte acts as a medium to cause a high resistance short between the battery terminals causing accelerated discharge and sulfation while the plane sits unused.

According to Concord such loads can most definitely shorten a battery life as well as drive the owner nuts trying to figure why a battery—sometimes a new battery—is not holding a charge. These parasitic loads tend to promote sulfation since this battery plate “fungus” forms any time the battery is left partially discharged.

That's why it's recommended to never leave a battery sit even overnight in a discharged (or partially discharged) state. The longer time period that sulfation gets a foothold the harder it is to remove. Even desulfating type battery chargers cannot get rid of long-term sulfation. They primarily act on short term, mild sulfation.

In some cases it's easy to get rid of these electron freeloaders, but in others a slight electrical drain may be part of the design of a piece of gear and more problematic or complicated to solve. If you have a hangar with electric power a battery charger will not eliminate any parasites, but it will generally cure the problem. But it's far better to determine the magnitude of the problem before simply trying to cure the symptom.

HOW TO STOP PARASITES

The most obvious way is to disconnect the ground cable from the battery, but this may cause issues with gear that has a need for constant power such as an electric clock. Boaters and RV types install disconnect switches—not such an easy fix in a plane, and the battery master contactor should be doing its job unless it is purposely or accidentally bypassed.

If you do long term trickle charging Concorde cautions about long-term charger connections and the need for the trickle voltage to not exceed 13.3 or 26.6 volts as excessively high float voltages may shorten battery life as well. We can attest to this critical threshold voltage as well during our many years of battery and charger testing. We have only found VDC aircraft chargers to consistently hit this mark. Others are always set too high.

A second alternative is to use a solar panel charger in the cabin, which is also available from VDC electronics. To properly hook this up to your system requires the help of an A&P for certified aircraft to get to a battery connection independent of the master switch, directly to the battery if you have to penetrate the firewall. You want a solar charger with a regulator to also prevent overcharging.

Another way is to track down the causes of any stray loads using a multimeter ammeter function in the high sensitivity range. That way you can minimize the drain if not eliminate all of it.

I'll explain how to troubleshoot with the meter alone, but if you want a quick and easy way, Concorde is offering a parasitic load test adapter (PLTA) that connects to your multimeter and standard MS3509 quick disconnect plug found with some aircraft battery setups. See the Concorde Web site at www.concorde.com and look for document 5-0409 Rev A.

FIGURING HOW MUCH IS TOO MUCH?

Measure the various sources of parasitic discharge. Here is an example of how to figure the effects: Convert the parasitic drain to amps by dividing the milliamps by 1000 (or just move the decimal place 3 places to the right). Then divide the amp-hour rating of your battery by the total drain in amps. This gives the number of hours for complete discharge of the battery. Multiply this result

times 10 percent, an arbitrary figure Concorde recommends as a point at which action is warranted. It will give you a figure in hours. You will see a drain as small as 50 mA can take 10 percent of a typical aircraft battery capacity in 56 hours.

USING THE MULTIMETER

There are three tests you can perform—the quick voltage test to tell you if there is a problem and the resistance test to give you the some idea of the magnitude of the problem. The final test is with the meter in the amps function to trace circuits and the exact amount of the current drain.

The multimeter in the voltage function is essentially a foolproof method and one is less likely to harm anything than the more detailed ammeter function to track the problem source and magnitude. In the ohms function you do not want to be directly testing unknown live circuits (such as between battery terminals) as the meter can be overloaded and short circuit. In the ohms function only check as described below, do not get inquisitive in the ohms function or the amps function unless you know what you are doing.

Once again, in the milliamperere or ammeter mode your meter becomes part of the circuit and a if you make a mistake you can cause damage to the meter or your electrical system or even burn yourself if you get careless and cause sparks.

First, place the meter in the voltage function. Most modern meters are autoranging. If not, switch to a manual range that covers your circuit such as 20 volts or 40 volts, not 500 volts. You want maximum sensitivity and the lowest practical voltage setting is best for that.

Second, switch off all equipment, including the master switch, as well as any known power drains such as an electric clock. Note, if you have any sensitive digital gear, check with the manual for how to deal with disconnecting the battery.

Some equipment may need special attention after the battery voltage has been temporarily disconnected when you reconnect. If you have a FADEC system or a system that requires a backup battery as part of the system, you would be better served having an avionics shop do any testing as these circuits can become quite complicated.

If unsure, ask your avionics shop if there is any problem with temporarily dis-

connecting battery power from your avionics and if any special actions need to be done when powering back up. It shouldn't be an issue other than the mentioned exceptions above, but it's best to verify ahead if unsure.

Disconnect the positive lead from the battery and insert the meter leads; the positive one to the positive battery post and the other meter lead to the positive cable (you are staying on the positive side of the circuit). You should see no voltage if there are no parasitic loads.

If there is no voltage reading you are set in this area. If you get a 12 or 24 volt reading then more detailed testing is needed. The leak could be in a leaking power switch or circuit breaker that is "off," but leaking to ground or a circuit that needs power directly from the battery that you are not aware of.

USING THE METER IN THE OHMS FUNCTION

One step up in the detail, one step up in risk of consequences with a mistake, so watch those probe leads carefully. Set the meter with the range in ohms autoranging or lowest manual setting e.g. R x 1.

The connections of the leads are different than before. Now you connect the meter leads between the previously disconnected positive cable clamp wire and the negative battery terminal (to the negative meter lead), so you are now checking for a general idea of the magnitude of actual leaks, but not where they are.

A reading of less than 10 ohms indicates a piece of equipment is on somewhere. If it's 10 to 1000 ohms there is a lower power drain piece of equipment on or a significant short. If it's 1000 ohms to 10,000 ohms (a manual meter may need to switch to R x 100 setting) a minor leak. Anything over 10,000 ohms is negligible.

USING THE METER IN THE AMPS FUNCTION

Another step up in detail and risk of frying something, most likely the meter, but possibly something else if you are not very careful with meter probes and disconnected cables and follow the guidelines.

You can check for the parasitic load's specific magnitude with the multimeter alone in the amp or milliamp range. Most meters have dual jacks; one for up to 10 and sometimes 20 amps and a second very sensitive input for very low, milliamp measurements. Cheap meters usually only

have the millamp range. You can safely check the circuits with a 10 amp rated meter if the resistance drain in the previous test was greater than 1.5 ohms for 12V batteries or 3 ohms for 24V batteries. In the 250 milliamp range you can safely check if the drain was more than 50 ohms for 12V batteries and 100 ohms for 24V batteries..

Be aware that any decent meter will have internal fuses to protect the meter should a short circuit occur, but best not to test this out as the fuses can be both hard to get and expensive—so don't cross any wires—and always wear eye protection in case of sparks. For the same reason, be sure there is plenty of cross ventilation when working around the battery and no power is on to the battery such as from a charger of any type, including solar. A charging flooded battery emits explosive hydrogen gas.

Connect the multimeter in the highest ammeter mode, and connect the ammeter between the negative battery cable and the negative post on the battery. Keep the positive cable connected to provide a return path for the DC current. (Note, you could do the same thing on the positive side, but better on the negative (ground) side as recommended by Concorde.)

When you turn on the meter you may see a minor to a very substantial drain, so it's best to start in the high current range just in case there is more drain there than you thought. Move to the higher sensitivity when you are sure there is not excessive current present. Also, it's essential to not have any devices on that cause current draw on such as master switches.

Less than 1mA is insignificant; up to 10mA is minor; 10mA to 1 amp is a major leak needing repair or resolution as to the cause. At this point a wise owner will bring in an A&P well versed in electrical troubleshooting as finding the offending circuits, switch, or breaker may be quick or more likely very time consuming. It is also a much easier project with two sets of eyes and extra hands to help as well as another person to mull over findings with.

I did all three tests on my truck expecting to get a parasitic voltage from the computer memory and the digital clock (underhood light removed). As expected there was a 12 volt indication, a very high resistance indication and an ultimate reading of 7mA or .007 of an amp, well within an acceptable drain on the battery. **LPM**