

Denny's Stuff

Getting Old!!!

Years ago, or decades ago, we used to be able to go up a flight of stairs, two at a time, and think nothing of it. Little bit of math, and you'd find you were exerting one or two horsepower in the process. Now, we take those steps one at a time, and sometimes even need the hand rail to make certain we got up to the next floor safely.

It takes the same total amount of energy to climb up to the next floor, but in getting old, that ability to double step up the stairs is long gone, along with the ability to put out one or two horsepower for a few seconds.

What's that got to do with our model airplanes??? Turns out, it's the batteries we use for receiver power. When those batteries are brand new, they work fairly well, assuming the proper battery has been selected for the application. Like, don't use a four cell "AA" Nickel Hydride battery for receiver power in a 30 cc gasser model. **Especially on 2.4 Ghz radios.**

As has been pointed out many times in this newsletter, IMHO, even a 5 cell Nih "AA" Nickel Hydride battery pack can be marginal in operation when flying large models using high powered servos and the high currents they can pull out of your receiver battery. Not to mention those digital servos.

So, what else do we have to work with? And, what happens when these other type batteries get old?

The information below is based on about a number of receiver packs of various type batteries that your editor has performed tests on over the few years.

Next up the line is those A123/LiFe and the LiPo batteries.

Lets start this discussion with the Nih cells. All of our batteries have what is called internal resistance. That is directly comparable to a two inch diameter fire hose, with a one inch diameter nozzle. Compare that to the same hose with a 1/4

inch nozzle. The 1/4 inch nozzle has far higher "resistance" than the one inch unit, and as a result will be very limited in its ability to send a lot of water out of it.

Same type of thing with the Nih batteries (And every other type of battery for that matter). Generally, the larger the battery, the lower its internal resistance, and the higher the capability to handle heavy servo loads.

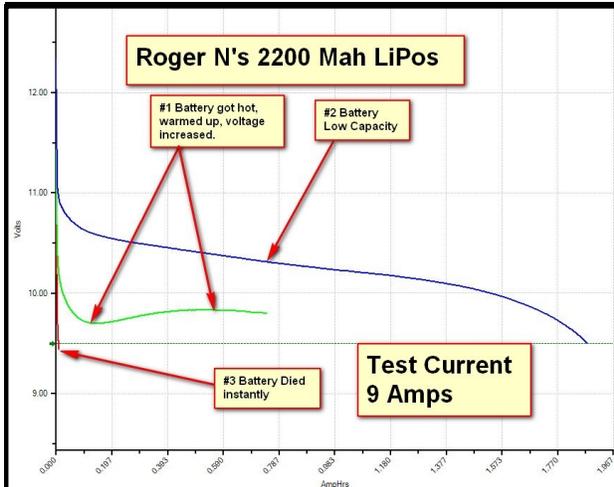
So, what happens to those Nih batteries when they get old? That internal resistance **INCREASES**. So, what was a quite capable battery when it was brand new, has less reserve ability with larger models when it is two, three or more years old. And, with these 2.4 Ghz radios, that is not a good thing. Along with the higher internal resistance, their milliampere hour capability starts to fall to less than their name plate value.

How about using the LiPo batteries as receiver power? LiPo's generally have very low internal resistance, and are quite capable of delivering high currents on demand to the larger models power hungry servos. Problem is, when LiPo batteries get old, their internal resistance also increases.

And, again, their milliampere hour rating drops off. Should you accidentally leave your receiver on for a long time, you can kill your LiPo battery, and not know it until the next flight. If you ever run a LiPo (or A123) receiver battery down, **DO NOT USE IT IN A MODEL** until its been checked out on a battery analyzer.

Unless your servos are rated for 7.2 Volts DC, you also need a voltage regulator in between the LiPo battery and the receiver/servos.

But, much worse, those LiPo batteries can develop very high internal resistance when they fail, resulting in a real problem while flying your model. In fact, in www.wattflyer.com, someone reported a total loss of a \$\$\$\$ wet turbine model after one cell in the transmitters LiPo battery open circuited during the flight.



Note #3 battery in above battery analysis. It died instantly.

One other issue with LiPo batteries as used in transmitters. Several web sites, including www.wattflyer.com have indicated that storing a LiPo battery at full charge can damage them or shorten their life.

There have also been reports that storing a LiPo at full charge can result in puffing of the battery pack. LiPos should be stored at about 3.8 Volts per cell, something like 60-70% of full charge. For transmitter use, those LiPo batteries should be topped off on the day you go flying.

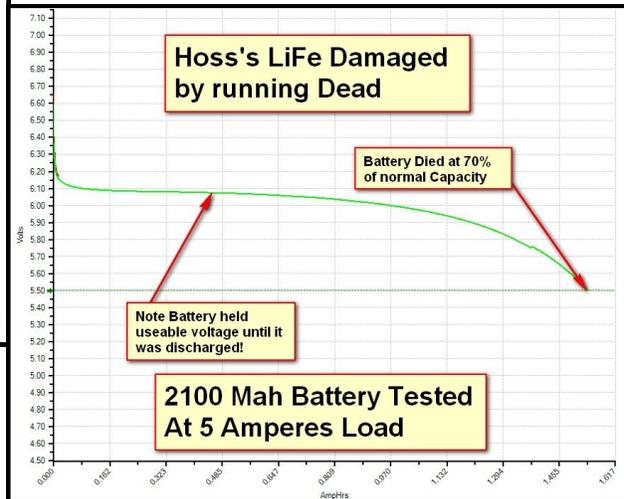
So, that leaves the A123 and similar type LiFe battery packs. Your editors personal preference is the A123 units, first because of a LOT of experience with them, and second, because they have a hermetically sealed aluminum jacket. The LiFe battery packs use a plastic bag to protect the insides.

To my way of thinking, a plastic baggie is less reliable than a metal cover, especially when considering vibration levels present in an engine powered model.

The big question now, is what happens when an A123 battery pack gets old? Or, worse, if you forget, and leave the receiver switch in the on position for two weeks, running the A123 dead?

You get permanent damage. I've run tests on four A123 and LiFe batteries that have been discharged far below the minimum specified 2.0 volts per cell. Those batteries tested now check

out at about 70% of original Milliampere hour capacity. What's interesting, have nearly the same voltage at 5 Amps as a brand new battery. That happened in all four that were tested.



I've got a six year old 12 cell (6S2P) A123 battery pack that now has about 85% of original ampere hour capacity. It's got over 400 flights on it. But, putting that battery pack on my Hacker A50-12S motor with its 15X12 prop, that battery turns the Hacker motor at exactly the same RPM as it did when it was brand new. FYI, the Hacker is putting a 58 Ampere load on that six year old battery. There have been similar results with the many other A123 battery packs in my inventory.

In addition, compared to the LiPo batteries, those A123 cells don't care how they are stored. Full charge, half charge, don't matter much. The best way to handle them, is after the days flying, take the model home, and fully charge it. Then store the model as usual.

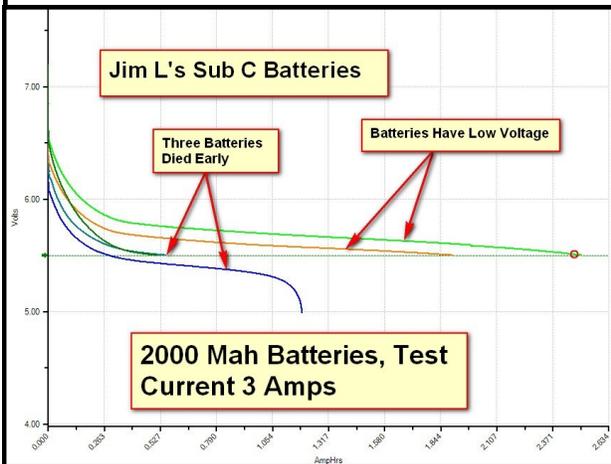
If you have a \$\$\$\$ charger, they can be re-charged in 15 minutes. If you are worried about the battery condition before the next flight a week or maybe much later, just top them off before going to the field.

Any decent charger will show exactly how many milliampere hours it took to top off a fully charged A123 pack. It won't take much, a few milliampere hours. Once each cell in your A123 pack reaches 3.60 Volts DC, its charged. Simple as that. Any decent quality A123 or LiPo charger with an LCD display will show individual cell voltages.

Again, if your receiver is powered by the A123 pack, you can fully charge them at the end of the day, and leave them. They will maintain full charge losing only about 5% after a year.

I do have one A123 cell from years ago that completely open circuited. It came from a 36 Volt Dewalt battery pack, that was pulled apart for its A123 cells. During that process, the uncovered cells moved to close, and arced over. It sounded like my 180 Amp arc welder located in the garage. That burned a hole right through the side of the one of the battery cells. That cell still worked OK. But after a year, enough internal electrolyte escaped to kill that cell.

OK, now down to club member Jim. Jim brought over five 2000 Mah Nih Sub C five cell battery packs for analysis. These battery packs are three to four years old. All five were checked out on my Western Mountain Radio CBIII battery analyzer.



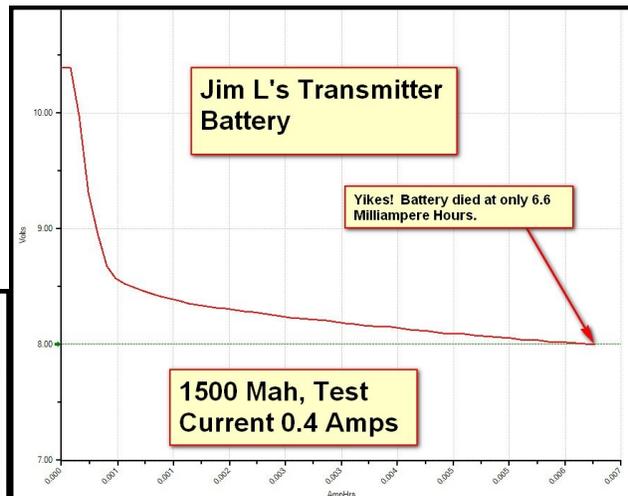
All five battery packs showed higher than normal resistance, dropping below 5.5 Volts under a load test in less than half of the batteries milliampere hour rating. Two of them only had 25% capacity. Those packs could have cost an airplane. I advised Jim not to use any of them in a model airplane.

Jim has ordered seven A123 two cell receiver packs for his model airplanes. Total cost was over \$100 less than the Sub C Nih packs.

The original primary/backup Sub C type battery pack weighed 30 ounces for the two battery packs. The new two A123 packs have the same milliampere hour rating as the Sub C batteries.

They weigh 11 ounces for the two battery packs, with greater output performance at high currents, compared to the Sub C Nih packs.

So, what happened to Jims transmitter battery that caused the total loss of a giant scale airplane? This was a very strange failure, in that every one of the 8 Nih cells developed high internal resistance. So high, that the pack could only power the transmitter for a few minutes. The battery voltage dropped off so fast under the transmitter load, the transmitter didn't have time to issue a battery failure alarm.



This transmitter battery pack died in only a few seconds at 0.4 Amps (400 milliamperes) An attempt was made to recharge this pack at a constant 150 Milliamperes. The result was the battery voltage increased immediately to 12 Volts DC, with little current flowing into the battery pack.

Jim is replacing his transmitter battery with one of those Eneloop battery packs. IMHO, those Eneloop batteries work very well with transmitter use, and don't have any of the hassles of the LiPo transmitter batteries. The Eneloop batteries hold their charge for many months. *(Do not use those Eneloop batteries for receiver use! They don't have the high current capability required for giant scale model servos.)*

Having checked out thousands of Nicad battery packs at work before retiring, their usual mode of failure is one or two cells go bad, with the remaining cells still functioning. Their internal resistance increases, but with the low load cur-

rent pulled by the transmitter, that higher resistance is not to critical.

Every cell in Jim's transmitter battery essentially open circuited. This failure suggests that the battery had been overcharged for a long duration of time, resulting in the battery losing its internal electrolyte. Jim did indicate he was using a "Maintenance" charger on the transmitter battery which apparently did the battery in.

So, what to do with transmitter batteries? Especially if its been sitting a long while? Charge the battery up, put it by your side, turn the transmitter on, and leave it run for 5 or 6 hours. If your transmitter keeps going without setting off an alarm, or showing low voltage, your transmitter

batteries are OK. It's also a good way to check on the transmitter electronics.

This five hour running test is also a good idea on a brand new transmitter battery. Just in case.

Obviously, be sure to recharge your transmitter batteries before using it for flight. It would not hurt to do the transmitter powered up thing for 5 or 6 hours once or twice a year.

If you have any questions, just drop an email to your editor.

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