The Dead Stick Flyer

Newsletter of Swan Harbor RC

Volume 32, Number 4, April 2021

www.swanharborrc.com

President/Treasurer: Steve Snyder (410) 638-2895
VP/Newsletter: Ron Lazzeri (443) 425-9006
Secretary: Dale Davis (410) 459-0399
Safety Officer: Tom Insley (443) 876-2886
Webmaster: Stephen Slotnick (908) 403-0273

Members at Large/Directors:
Jae Jang (443) 910-2439
Lewis Fillinger (443) 243-4141
Bob Bartell (443) 945-5709

The April 2021 issue of the Swan Harbor RC Newsletter

Tech Corner – LIPO Battery Internal Resistance & Balance Charging

***Internal Resistance of LIPO Batteries** - What is the Internal Resistance (IR) of a battery and why does it matter?*

When a battery is made, the manufacturer designs the battery to have a specific voltage, amperage capacity, and amperage discharge rating ("C" rating). Most batteries also provide a constant and burst "C" rating (like 35C-45C). All the internal components of the battery are designed and tested to provide the best power delivery for the rated amperage capacity and voltage. However, over time the battery's internal electrical components degrade and the battery does not perform as well as it once did when it was new.

This is where Internal Resistance comes into play. First, you will need a battery charger that can read and provide the IR of a battery. Note all batteries (LIPO, LIFE, A123, LION, NICAD, and NIMH) all have Internal Resistances and can be tracked with a qualified battery charger. If you plan to track the IR of your batteries, it is good to do so from the beginning, so you have a good starting baseline to monitor the life and degradation of the battery. Keeping a simple chart would also be helpful.

As the battery ages, its internal components and ability to retain and discharge its stored capacity changes and degrades. The best way to monitor the degradation of the battery is to monitor the IR of each cell in the battery (or the battery's IR if the individual cells cannot be monitored like that of a NICAD/NIMH 4 or 8 cell battery pack).

Let us look at an example of a 3S LIPO battery pack and compare the IR readings of its cells over 3 readings to see how the IR degradation can be monitored and catch a failing battery pack:

Internal Resistance Chart

Day 1	*Cell 1: IR = 10*	*Cell 2: IR = 10*	*Cell 3: IR = 12*
Year 2	*Cell 1: IR = 10*	*Cell 2: IR = 12*	*Cell 3: IR = 13*
Year 3	*Cell 1: IR = 10*	*Cell 2: IR = 12*	*Cell 3: IR = 21*

Note that in year 3, the IR for Cell 3 has jumped to 21. This is a good indication that the battery has degraded and is likely to fail. The battery case may swell which is a physical sign of the battery beginning to fail and it is time to think about replacing this battery. You should take IR readings on a regular basis weekly, monthly, semi-annually, or yearly whichever interval fits best into your routine if you decide to do this maintenance.

Here are some basic IR rules of thumb to rate the health of your batteries:

- *IR values of 1-10 are GREAT*
- *IR values of 11-15 are GOOD*
- *IR values of 15-20 are POOR*
- *IR values over 20 are BAD and the battery should be replaced*

Monitoring Internal Resistance and Balance Charging – the Dynamic Duo:

Monitoring the Internal Resistance of a battery pack's cells goes hand in hand with balance charging the battery and monitoring each of the battery's individual cell voltages. All multi-cell Lithium batteries should be balance charged on every charge cycle. This will help to ensure and guard against the following:

#1 Reason: Balance charging multi-cell battery packs helps keep any one cell from getting over charged, getting hot, swelling up, and possibly catching fire or exploding. The charging process is probably the most vulnerable time period for a battery to fail, catch fire, or explode. It is critical to set up the correct charge settings and charge rates for the type of battery (LIFE, LIPO, A123, NICAD, NIMH) you are charging.

- ***Note the charger will do its best to monitor and keep each cell's voltage as close as possible to each other before the charging process is complete. Not all chargers complete the balance charge function the same. Most chargers do not fully complete the balancing of the battery's cells until the last phase of the balance charge cycle. So, if you stop the balance charge process before the cycle is done, the battery pack may not be getting perfectly balanced.***
- ***Monitoring the IR of a battery's cells can help detect any potential problems about to occur like in the 1st example. As shown in the chart above, cell 3 has the potential for not accepting a charge properly, failing during the charge cycle, and catching fire and exploding.***
- ***Also, it is best not to fly your airplane constantly at full throttle or beyond the discharge capacity of the battery as this will eventually cause the battery to heat up, swell or puff up, and degrade prematurely.***
- ***If you find that your charger is not perfectly balancing your batteries when the balance charge cycle is complete, then there are several possible reasons for this:***
    - ***#1 Reason: Your charger's settings may not be configured properly to do balance charging, in which case, you should double check the charger's settings and make sure it is set up correctly.***
    - ***Check the IR of the battery to see if any cell is out of line and may be failing.***
    - ***If you own an RC Battery Voltage Checker/Balancer, try to balance the battery pack manually. Put it back on the charger and discharge it a little bit, then start the balance charge process over to see if that helps.***
    - ***Try balance charging the battery on another charger to see if the current charger may be faulty, in which case, that charger should be replaced before an unwanted mishap occurs.***
    - ***If all else fails and you cannot determine why it is not working correctly, check with another flyer at the field. Maybe they can provide some assistance and insight as to what may be going wrong.***