Springfield Radio Control Flying Club

AIRMAIL

www.springfieldrcclub.com

AMA CHARTER CLUB 394 APRIL 2007 VOLUME 19 NUMBER 4

NEXT MEETING

APRIL 5TH

LIBRARY CENTER

4653 S CAMPBELL

LITHIUM BATTERIES EXPLAINED

Lithium batteries are the preferred power sources for most electric modelers today. They offer high discharge rates and a high energy storage/weight ratio. However, using them properly and charging them correctly is no trivial task. There are many things to consider before using lithium cells for e-flight. But none is more important than safety.

1.Charging/SafteyIMPORTANT! Until you are willing to follow all saftey precautions, DO NOT use lithium batteries. If your a type of person that prefers to push the limits of products, or be haphazard about following saftey requirements. Lithium technology is not for you. Read on to find out why.

Lithium cells must be charged very differently than NiCad or NiMH. They require a special charger specifically designed to charge lithium cells. In general any charger that can charge lithium ion can charge lithium polymer, assuming that the cell count is correct. You must NEVER charge lithium cells with a NiCad or NiMH only battery charger. This is dangerous. Charging cells is the most hazardous part of using lithium batteries. EXTREME care must be taken when charging them. It is important to set your charger to the correct voltage or cell count. Failure to do this can cause the battery to spew violent flames. There have been many fires directly caused by lithium batteries. PLEASE BE RESPONSIBLE when charging lithium batteries.

Here are a few MANDATORY guidelines for charging/using LiPos (Lithium Polymer Batteries).

1. Use only a charger approved for lithium batteries. The charger may be designed for Li-Ion or Li-Poly. Both batteries are charged in exactly the same. Some older cell phone chargers may charge the batteries .1 volt to low (4.1 vs 4.2), but that will not harm the

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2007 Events

April 21	**Field Day**
(April 28	**Alt Field Day)**
May 12	**Fun Fly & Swap Meet & Lady Fly**
June 9	**Fun Scale Contest**
July 28	**Float Fly Practice**
***Aug 11-12**	**Float Fly**
***Sept 8-9**	**Pattern Contest**
Oct 20	**Swap Meet**
Dec 7	**Christmas Party**

*AMA Sanctioned Event

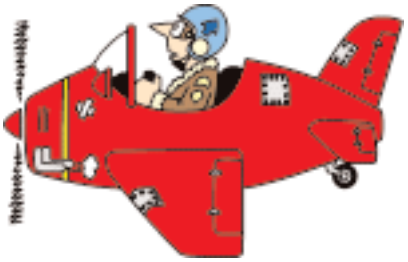
The Presidents Corner

If you get this newsletter before March 31, there will still be time to put some sort of lighting system on a model and fly it at our first Night Fly March 31 (6-9pm).

The deadline for club dues renewal is almost here. Don't let your club dues lapse. The gate combination will be changed Friday, April 6. Beginning on that date, our Field Marshall will not allow field use to anyone without a 2007 club membership card. If you haven't paid yet, send you club dues to our Treasurer, Russ Rhodes. A completed, signed, Membership Form and proof of 2007 AMA membership is required.

The April meeting will center on assignments for the club field day April 21. There are several items needing attention. Show your support for our club by volunteering for a field day task. A lunch will be provided for all field day workers.

As time permits at the next meeting, we will continue the club rules/rulings review. This is your chance to speak up concerning rules you think need changing.



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battery. However, inexpensive lithium chargers are widely available and the use of cell-phone chargers is highly discouraged.

2. Make certain that the correct cell count is set on your charger. Watch the charger very closely for the first few minutes to ensure that the correct cell count continues to be displayed. If you don't know how to do that, get a charger that you do know how or don't charge the batteries.

3. Use the Taps. Before you charge a new Lithium pack, check the voltage of each cell individually. Then do this after every tenth cycle there after. This is absolutely critical in that an unbalanced pack can explode while charging even if the correct cell count is chosen. If the cells are not within 0.1 volts of each other then charge each cell individually to 4.2 volts so that they are all equal. If after every discharge the pack is unbalanced you have a faulty cell and that pack must be replaced.

Taps are provided on most new lithium packs. Taps give you the ability to check individual cell voltages and charge one cell at a time. Make sure and get the appropriate connector to go into your taps. Don't try to stick you volt meter probes in the taps to measure voltage. They could slip and short your cells. Don't try to charge more than one cell at a time from the taps. Unless you have an isolated ground charging system, you'll short your batteries out. Refer to your individual cell maker for tap pin-outs.

4. NEVER charge the batteries unattended. This is the number one reason for houses and cars being burned to a crisp by lithium fires.

5. Use a safe surface to charge your batteries on so that if they burst into flame no damage will occur. Vented fire safes, pyrex dishes with sand in the bottom, fireplaces, plant pots, are all good options.

6. DO NOT CHARGE AT MORE THAN 1C unless specifically authorized by the pack vendor. I have personally had a fire in my home because of violating this rule. Todays highest discharge batteries can supposedly be safely charged at greater than 1C, however so far in all cases doing so shortens the life of the pack. Better to buy 3 packs than to try to charge 1 pack 3 times quickly. This may change in the future but as of Winter 2005 1C is still the recommended charge rate.

7. DO NOT puncture the cell, ever. If a cell balloons quickly place it in a fire safe place, especially if you were charging it when it ballooned. After you have let the cell sit in the fire safe place for at least 2 hours. Discharge the cell/pack slowly. This can be done by wiring a flashlight bulb of appropriate voltage (higher is voltage is ok, lower voltage is no) up to your batteries connector type and attaching the bulb to the battery. Wait until the light is completely off, then throw the battery away.

8. If you crash with your lithium cells they may be damaged such that they are shorted inside. The cells may look just fine. If you crash in ANY way carefully remove the battery pack from the aircraft and watch it carefully for at least the next 20 min. Several fires have been caused by damaged cells being thrown in the car and then the cells catch fire later and destroys the car completely.

9. Charge your batteries in a open ventilated area. If a battery does rupture or explode haz-

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Springfield RC Club Minutes for April 2007. Ray Niles, Secretary

March 2007 Springfield R C Club Meeting:
President Harper opened the meeting at 7:05 PM. There were 18 members and no new guests present.
The February minutes were accepted.
Treasurer Rhodes presented the treasurers report and it was accepted.

Old Business:

After a short discussion a motion was made and approved to invest $4000 in a 10 Mo Certificate of deposit and $2000 in a longer term C D.
The club web site is up and running again after a brief technical difficulty.
Jeff Schmidt was appointed to the Board of Directors to replace a board member who had not renewed his AMA or club membership.
The Pilot Training program was discussed further without any final decision concerning its future.
There are a number of tasks to be completed on the annual work day. The gate, pilot barriers and the bleachers need paint. The site for the bleachers may need to be treated with a pesticide/sign replaced herbicide product to help keep it tidy and comfortable. The fence line along the road needs to trimmed out. The gate needs to have a new sign showing the Flying Hours, the Street Address and GPS coordinates for emergency purposes.
The Frequency Pins need to be replaced. The membership approved an expenditure and Doug Bennett will obtain them. It was noted that we need to post a notice requiring flyers using Spread Spectrum transmitters to use Spectrum Pins, which we will provide, to indicate their presence on the field as well as their membership status.
All Pilots are reminded that all batteries and especially LiPo types are a fire hazard. Pilots charging LiPo batteries at the Club Field are advised to use battery charging bunkers; pilots are liable for damages from fires.
The discussion on club rules was continued with various situations addressed and clarified.
The May meeting will be held at the Kansas Expressway North Station Library. All of the other regular meetings for the year will be at the South Campbell Library.
The meeting was adjourned at 8:20 PM

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ardous fumes and material will spew from the battery.
10. Keep a bucket of sand nearby when you are flying or charging batteries. This is a cost effective way to extinguish fires. This is very cheap and absolutly necessary.
11. It can happen to you, do not think to yourself that “it won't happen to me” as soon as you do that it you'll be trying to rescue your kids from your burning house or car. I'm very serious about this.

Now that we have covered that important topic let's move on to lighter matters:

2. Lithium What?

Lithium Polymer batteries are used in many electronic devices. Cell Phone, Laptops, PDA's, Hearing Aids just to name a few. Most, if not all, lithium polymer batteries are not designed for RC use, we use them in different applications than they were designed for. They are similar to Lithium Ion batteries in that they each have a nominal voltage of 3.6 volts, but dissimilar in that they do not have a hard metal casing but rather a flexible material encloses the chemicals inside. The "normal" lithium polymer batteries are thin rectangle shapes with two tabs on the top one positive one negative. The reason we use Lithium cells is that they are significantly lighter than comparable NiCad or NiMH batteries, which makes our planes fly longer and better.

3. Voltage and Cell Count:

LiPolys act differently than NiCad or NiMH batteries do when charging and discharging. Lithium batteries are fully charged when each cell has a voltage of 4.2 volts. They are fully discharged when each cell has a voltage of 3.0 volts. It is important not to exceed both the high voltage of 4.2 volts and the low voltage of 3.0 volts. Exceeding these limits can harm the battery.
The way to ensure that you do not go below 3.0 volts while flying is to set the low voltage cutoff (LVC) of your electronic speed control (ESC). It important to use a programmable ESC since the correct voltage cutoff is critical to the life of your batteries. Use the ESC's programming mode to set the LVC to 3.0 volts per cell with a hard cutoff, or 3.3 volts per cell with a soft cutoff. If your ESC does not have hard or soft cutoff, use 3.0 volts per cell. You will know when flying that it is time to land when you experience a sudden drop in power caused by the LVC.
If your ESC has an automatic lithium mode. Use it, it will correctly sense the number of cells

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and set the auto cutoff appropriately.
If you have previously been flying with NiCad or NiMH batteries, switching over to lithium polymer will result in a different number of cells being used. If you had 6 to 7 round cells then 2 lithium polymer cells will correctly duplicate the voltage of those cells. If you had 10-11 cells then 3 lithium polymer cells would be right for you. There are a lot of 8 cell flyer's out there that are stuck between 2 and 3 cells. In my experience the best option is to determine how many watts you were using before and duplicate that with your LiPos, Motor, and Prop. For example. If you were running 8 cells (9.6volts) at 10 amps on a speed 400 airplane, then you have 9.6 x10, 96 watts. So if you went with 2 lithium polymer cells (7.2 volts nominal) then you'd need to change your prop such that you used 13 amps. If you went to 3 LiPoly's (10.8 volts nominal) then you'd need to reduce the amperage to 8.9 amps. These estimates are approximate, and some experimentation is required for best results but conserving Watts is a good way to start.

4. 10C from 3S4P?
Naming conventions explained.
How fast a battery can discharge is it's maximum current capacity. Current is generally rated in C's for the battery. C is how long it takes to discharge the battery in fractions of an hour. For instance 1 C discharges the battery in 1/1 hours or 1 hour. 2 C discharges the battery in ½ or half an hour. All RC batteries are rated in milli Amp hours. If a battery is rated at 2000 mAh and you discharge it at 2000mA (or 2 amps, 1 amp = 1000mA) it will be completely discharged in one hour. The C rating of the battery is thus based on its capacity. A 2000mAh cell discharged a 2 amps is being discharged at 1C (2000mA x 1), a 2000mAh cell discharged at 6 amps is being discharged at 3C(2000mA x 3). All batteries have limitations on how fast they can discharge. Because of this many LiPoly batteries are put in parallel to increase the current capacity of the battery pack. When 2 batteries are wired positive to positive and negative to negative they become like one battery with double the capacity. If you have 2 2000mAh cells and you wire them in parallel then the result is the same as 1 4000mAh cell. This 4000mAh cell has the same C rating as the original 2000mAh cells did. Thus if the 2000mAh cells could discharge at a maximum of 5C, or 10 amps then the new 4000mAh cell can also discharge at 5C or (4000mA x 5) 20 amps. This method of battery pack building allows us to use LiPoly batteries at higher currents than single cells could produce.
The naming convention that allows you to decipher how many cells are in parallel and how many are in series is the XSXP method. The number in front of the S represents the number of series cells in the pack so 3S means it's a 3 cell pack. The number in front of P means the number of cells in parallel. So a 3S4P pack of 2100mAh cells has a total of 12 cells inside. It will have the voltage of any other 3S pack since the number of cells in series determines the voltage. It will have the current handling of 4 times the maximum C rating of the 12 individual cells. So say our 3S4P pack had a maximum discharge of 6C. That means that it has a nominal voltage of 10.8 volts (3x3.6) and a maximum discharge rate of 50.4 amps (2100mAh x 6Cx4P).

5. Which battery should you buy?
With so many choices out there it is difficult to decipher what is marketing hype, what is brand loyalty, and what is outright lies. Battery manufacturers are constantly trying to one up one another. While capitalism can drive prices down, it also can give cause to false claims about products.
One great way to find out what the best battery is, is to look at graphs of the batteries performance. Looking at how low the voltage of the cell drops at various amperages will give you a metric to compare that battery to similar size/weight batteries.
If graphs aren't your thing then simply look at what other people are using in successful setups that are similar to your application. If a lot of people are reporting long flight times and lots of power from airplane X, with power system Y, and battery Z and you do the same, then if your setup is similar the same battery will probably work well for you.
It pays to learn something about Watts, Volts, and Amps. Understanding these concepts is beyond the scope of this document, but can serve you well in not only figuring out what battery is best but also in your electric aircraft hobby.
I'm not convinced that a 30C battery is really any better than a 10 or 20C battery. Sure a higher C rating means it can discharge faster. But at the same time a battery discharged at 20C continuously will be empty in 3 minutes. Do you really only want to use the battery for 3 minutes? I love having burst power in helicopters and boats, but in almost all other applica-

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tions actually running a battery at or above 20C is useless to me. I prefer to run batteries at 8-10 C and have a little headroom if I need it.

A final note on choosing a battery. Don't cheap out. Confirm that your batteries are capable of running that the amperage level you plan to use them at. Running a cell at a higher C rating than the battery can handle can not only damage your batteries, but it can also damage your speed control. Castle Creations has an excellent article on how using a weak battery can destroy a perfectly good speed control of any brand. Better to buy a bit better battery than you need than to destroy your electronics.

6. Dealing with temperature.

Lithium batteries like heat, but not too much. In the winter time, try to keep your batteries from the cold as much as possible. Leave them in the car while your flying, or keep them in your cargo pants... etc. At the same time don't let them heat up too much. Try to keep your batteries from reaching 160F after use. This will prolong the life of the cells. A good way to measure temperature is a handheld IR meter, they can be found for around $50.00 at most hobby shops.

Jim McPherson

Sparky and his new Four Star Forty