

One Man's Opinion on Safe Lipo Use

By Randy Reynolds

First, I am not an expert on batteries or electronics...but I am pretty cautious and also a reader. So when I came back into R/C soaring and started with electric launch I started to research what those who are expert in the field recommended for using the various components in this mode of launching a sailplane.

To be clear I am not going to emphasize how to save money as I generally believe in buying quality, after all it's a hobby and if I can't afford it, I'll head in another direction. Of course, if I had any real technical know how I might be tempted to take a DIY approach.

Let's focus on Lipo battery care and use:

First, before anything, acquire an excellent Charger with management features experts recommend. Two measurements you will watch will be the balance in volts and internal resistance of each cell. Wait, how do you know who is an expert and if they know actually what they're talking about? Ordinarily, you can listen to club experts on most matters however when it comes to these potent little bundles of energy called LiPo batteries you should get a second opinion as well. How to do that? Go to RCG Forums and read all you can in the "Batteries and Chargers" Forum. <https://www.rcgroups.com/batteries-and-chargers-129/> Here you need to use your own judgement as to who and what to believe. It's not hard nor risky as we tend to use this kind of judgement constantly in our daily lives. From there you can follow links to many informative resources.

Please note that I am not suggesting that our clubmates won't give good advice, it's just that this is a subject where you need as much information as you can handle. As many will note, you can't believe everything you read....still that doesn't mean you shouldn't read.

So you've bought a good charger that will not let you do uninformed things, then you have also learned that your choice of connectors runs through what you use on the charger, batteries and the ESC. Currently the XT-30 and XT-60 connectors are the most popular and indeed most batteries now come with those connectors. You can also order readymade charger leads with connectors already soldered on from several suppliers.

Now you have made the purchase of your chosen batteries and hopefully you have selected a high quality maker. Spend a little more time to make sure that the batteries have been made with reliability in mind. While it is clear the "C" ratings tend to be marketing nonsense, lower quality batteries tend to have the lower "C" ratings...not always true but something to be aware of

Then it is a good idea to ask your charger to run a few break-in cycles on each new battery before trusting your sailplane to take to the air with them.

You can read a lot about safely charging your batteries. The best advice is to not leave your batteries while they are being charged. This is because if these little powerhouses have a problem it usually can come during charge or discharge. Things are more peaceful and safer while they are at storage charge. This is where the dilemma comes...it is too tempting to ratchet up the charge rate to cut down the time it takes to charge a battery. Also, it is tempting to leave the charging area to tend to other matters. While it is rare for a LiPo battery to catch fire during charge.....if they do, you will not believe the hellfire that even small batteries can produce. Also the smoke coming from a LiPo fire is toxic and very dense. Finally a LiPo fire is very difficult to extinguish and most experienced people suggest that sand in a large quantity is the most effective in controlling the fire. Obviously, if you choose to charge the battery in your model, well, your model will be reduced to ashes as a result as well as everything else in the vicinity.

Then there are ideas for “safe” charging areas. One recommendation is to not charge indoors (!) Perhaps those folks might not live in our climate where it gets really cold and often snows or rains? However if you can figure out a way that is best....maybe using an old BBQ grill might work. Dave Laude reports that he uses a fireplace and that’s not a bad idea. Jim Shoon reportedly uses a fireproof safe however I have heard that the dense smoke from a large lipo battery fire can make an entire house uninhabitable. The Flite Test guys use a cinderblock on a concrete floor with a plastic sandbag on top of each of the cells. The idea there is that if a fire starts it will burn through the bag and release the sand into the cell. That’s pretty clever but it doesn’t always solve the toxic smoke problem.

There are a couple of commercial options, One is to always use a Lipo Bag to charge in and the other is to charge and/or store in a Insulated metal box called the “Bat-Safe”. You Tube carries several videos on this product. Also on You-Tube you will find several other videos both on the dangers of LiPos and suggestions for minimizing their dangers.

Again, I will repeat that Lipo fires are rare but really bad things can and do happen. It makes sense to take the safest road in managing your batteries rather than taking the most convenient practices for your own purposes. What are the most conservative practices?

- 1.) – Buy a really good smart charger that won’t let you do stupid things. If you are a contest flyer and need to leave early in the day with several charged batteries, then buy a charger that can charge more than a single battery. Additionally, think about getting a field charger and a gell cell battery as a power source. That is possibly the safest of all options.

One important consideration regarding “fast charging” ...why would you? Specific to the use of LiPos for electric launched sailplanes is that we use really small batteries compared to many other model events. It takes not long to charge a 450-850 mah battery, c’mon why do you need to fast charge these? Ok, you’ve run out of time and you have to leave in ten minutes so up the charge a bit. Just don’t make a habit of it. Now imagine the use of 2500-5000mah batteries. They can take a good deal on time

and some planning is necessary. If you've run out of time and so you jack up the charge rate from 1C to 5C? Ok, that worked, why not do it always? Such becomes the habit.

Do not charge at more than 1C. Fast charging will degrade your batteries life and reliability. Indeed, current thinking is to not charge LiPos to the full 4.2v but rather just under that, say to 4.1v. While batteries are relatively cheap, a proven, cycled battery is a valuable thing. *“Reducing charge voltage to less than 4.2 V/cell is purported to extend the life:me number of battery charge/ discharge cycles. But be aware that it also reduces (significantly) your flight time on a battery charge.” Milt Woodham*

2.) - Do NOT keep and use puffed batteries. Especially with our small inexpensive LiPos. You can understand when a large \$100-\$200 starts to misbehave why the user wants to do unwise things. There is no reason why a battery will puff and expand if it is treated conservatively. Indeed, fast charging puffed batteries according to many sources is very dangerous. The rule is that a puffed battery is a damaged battery. Given the low cost of a LiPo battery, it is foolish economics to continue to use them when puffed, especially if you are using the relatively small batteries we use in our sailplanes.

– It has been pretty well proven that LiPos should not be stored in a charged state. Many readings recommend to slowly discharge your batteries to a storage charge of 3.8v or slightly less. Most chargers these days will handle that storage level automatically. In fact, there are now small discharge devices that can be carried in your field box that allow you to storage charge your batteries on the way home from a day of flying. *“There are definitely two different opinions on this matter. Experts whom I know personally have told me that there is no proof that storing a charged battery will cause puffing nor will it shorten battery life. The so-called experts whom I reference say that they only discharge to storage voltage level (3.8 V/cell) for long term storage, such as for a long winter or building season.” Milt Woodham* See discussion on this topic later....rnr

3.) – Fast discharging your batteries beyond their specifications isn't a good idea. How can that happen if we are using our smart charger? Think of what is going on in your sailplane during launch. Your motor likes to run at a certain RPM and asks for a certain current to do so. What your ESC is set for can dictate not only how many volts is sent to your radio receiver and servos who have their own requirements but also it monitors how low the battery will be allowed to discharge to. You have to use the devices needed by the ESC to set those specifications. You need to do that correctly and running the battery down to low voltage isn't a good idea. At the field I will usually do two launches in my big sailplanes as that it what discharges my batteries to the storage charge.

Note: Not everyone agrees with items #4 and #5! Here is how club member Milt Woodham responded:

"Randy,

I commend for your reading the LIPO Battery article in March, 2022 MA mag. This little excerpt from page 26 speaks directly to the issue at question. "There is little, if any, value in pursuing a storage-voltage discipline for frequently used batteries. The net benefit might be negative, especially if you discharge your batteries to storage voltage each time you return from the flying field."

...and then, a follow-up:

"I sent the author a question and received an answer. Both e-mails are below. Make of it what you will, I see no "yes or no" answer to the question at this point. Hopefully we will stumble upon some applicable research that has been done.

Milt

On Tue, Mar 8, 2022 at 9:00 AM Milton Woodham <mewoodham@comcast.net> wrote:

Good morning Mr. Buxton:

My compliments on your MA magazine article.

I have a question for which you may be able to provide more information. Our local modeling club (Pikes Peak Soaring Soaring Society) is divided on how to handle battery discharge before storage. Your article seems to argue on the side that says there is no real advantage to discharging a LIPO prior to short term storage. We have on the other hand several club members who are adamant about discharging batteries to storage voltage level after every flying session. Can you offer research supporting one position or the other?

Thanks for your time and assistance, and for an excellent and timely article.

Milt Woodham
Colorado Springs, CO

Begin forwarded message:

From: David Buxton <david.e.buxton@gmail.com>
Subject: Re: LIPO Battery article
Date: March 8, 2022 at 10:40:48 AM MST
To: Milton Woodham <mewoodham@comcast.net>

Hi Milton,

I know of no experiments that directly address your club's debate. There are related experiments that I have drawn from.

If half the club charges to 4.2V and asserts strict storage discipline and the other half charges to 4.1 or even 4.15 w/o storage volts then the second group will come out way ahead.

(Hick? What in the world does this mean and why?? -Randy)

Some people have a highly disciplined personality that will eagerly latch onto the storage voltage discipline even if the net benefit was zero. Others have a personality that does not put up with hassle factors. Storage voltage discipline can be a big hassle factor that some thrive on and others won't put up with.

Thanks for writing,
-Dave

Ok, then I went searching for some hard research regarding the advantages of discharging batteries to a recommended level for reasons of safety and longevity/reliability of your LiPo batteries. For my research I went to Batteries and Chargers Forum on RCG Groups:

<https://www.rcgroups.com/batteries-and-chargers-129/>

(Apparently RCG Groups isn't read very much by PPSS club members, but I have been an avid follower of various sailplane forums for years and find it a great source of information on anything you might want to know) If you want to go there and read for yourself, you might want to try the search feature which admittedly isn't user friendly but it is massively helpful for topics like this one. You will need to register to use it....otherwise it's a read only thing.

What I found is that taking batteries to storage charge is a given. I found no one who disputes this nor is there any research on the matter as it seems self-evident to almost everyone. Here is a link to an interesting website that I found on RCG and it addresses the matter extensively:

<https://www.rcgroups.com/batteries-and-chargers-129/>

I will comment on the MA article that I generally agree with....the author comments that you don't need to storage charge frequently used batteries. I think you can't always tell if a battery is going to be used actively or not and if you lose track which is easily done then what? I think it is best to develop a habit of taking batteries to a storage charge of 3.75 volts as recommended by many. He also comments that some people just won't put up with the "hassle" of maintaining storage charge discipline. I suspect if you use these little bundles of potent energy you need to have some discipline or place yourself in some danger.

What if we want to carry a fire extinguisher....what is the best type to use?

Jim Shoon comments that in pilot training they are instructed to use a class D extinguisher on lithium fires while Bill Stevens pretty much is in agreement suggesting an ABC dry chemical extinguisher. Meanwhile my search query on RCG had this response:

[mcrabby311](#) Registered User 1001 miles from you in USA, IN, Greenwood Joined May 2002 351 Posts *Lithium is a water reactive flammable metal, and can produce a flammable gas when exposed to water while burning. So, USE NO WATER when attempting to extinguished a flammable metal fire. According to North American Emergency Response Guidebook for hazardous materials published for U.S.D.O.T. A dry chemical extinguisher should be used...some alternatives would be dry sand, soda ash or lime. Please keep in mind the key word here is DRY!!!*
Mark
Pike Twp Fire Dept. Indpls, In

Doing a search on the Interweb will find a number of recommendations on controlling a LiPo fire. Here are a couple I found:

level 1

[Mattquist](#)

· [6 mo. ago](#)

Aircraft firefighter here, and delt heavily with lipos in my primary job and my hobby. An extinguisher that will deal with burning metals (lithium in this case) is way more than you are going to want to spend and bigger and you want to carry around. Sand, or just relatively clean dirt to smother or bury the burning battery is just as effective as an extinguisher and is less likely to cause damage to and salvageable parts after the fire is out. Most but not all extinguishers are destructive in nature due to the chemicals that are in them. Small shovel is all you need or a tub of play sand.

level 2

[BraveFPV](#)

· [6 mo. ago](#)

Yes...this the way to go! Keep the sand in a thick plastic bag with an knife taped to it and you can get that lipo smothered super fast.

I have a bag that lives right next to my charger for this exact reason ☐

· [6 mo. ago](#)

Came here to say this.

My buddy is a fire suppression system engineer. Builds systems for big buildings. I brought up LiPos and he said bury it if you need to put one out.

Regular extinguishers won't do it and LiPos make their own fuel+ox so they can sustain burning in a purged environment.

Buck o sand.

I did check on the price for a class D extinguisher and they are very expensive . It's undetermined if an ABC dry chemical type is what is needed and there are those who recommend having a bucket of water nearby. It's confusing but there doesn't seem to be any controversy regarding Sand or salt.....so, till I know better I'll keep a bag of sand for the shop and perhaps carry a bag of sand in my vehicle.

One control you have over the health of your system is the choice of propeller and using a too large diameter prop and or pitch can run the amp draw higher than your ESC is rated for. Using a Watt meter to measure these numbers is a good idea as we want everything to run reasonably cool in flight and a watt meter can help you to understand those conditions. Motors, batteries and ESC devices can overheat and we don't want that. Sooo...if you don't have a watt meter...*Get one! The second step is to learn to use one.*

There is a lot more that could be said here but that is enough for a start. I realize that knowledgeable club members may have different ideas or suggestions that would be useful for those inquiring minds....so good luck!