Building your own packs

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Prebuilt battery packs can get expensive if you fly enough. One cost effective way is to purchase individual cells and build your own. Can you save some money by building your own? Yes, it is roughly 50% cheaper. Is it easy? Absolutely. The only specialized piece of equipment that you need is a soldering iron. If you can, find at least a 40Watt soldering iron at your hardware or electronics store. You can generally pick one up for around $5US-$10US. It should be at least 40Watts, so if you have a nice 20W that you use for electrical PC board work, save that one for your PCB's and get a new one of 40W. Nothing fancy, in fact the cheaper the better. The higher wattage tends to eat the tips a bit quicker than normal, so grab some extra tips if you can. You'll use them eventually.

Here are several battery cell vendors and all of them are excellent, reputable vendors.

- eFlightPacks
- TNR Technical
- SR Batteries

There have been great debates on soldering packs versus spot welding them. What it comes down to is this. If you need high current output from your packs, generally 30A and above, you might want to consider soldering your packs in a configuration called end-to-end. A direct solder connection between the cells will minimize any resistance induced by wire, braid, etc. **Be aware that you potentially run the risk of exploding or damaging a cell during the solder construction.** If you are quick and careful you can usually build your own packs without any problems. On the other hand, Mr "Red" Scholefield does know what he is talking about and you might want to read his quick treatise on the matter of soldering your own packs. Okay, you read it? Still here and want to try it? Good, let us begin.

Building your own packs is easy if you follow a few simple rules.

- **Always** use discharged cells for building packs
- **Always wear safety glasses when soldering (no joke)**
- Use at least a 40W soldering iron. Do not go above 60W.
- Use 60/40 rosin core solder (not plumbers acid core solder)
- Lightly sand the ends of each cell and lightly pre-tin them with minimum solder.
- Understand the rule that quick but intense heat with 40W is better than prolonged contact with a 20W iron. You want to get in and out as fast as you can and this is where a 40W or 60W iron really helps.

If you have never soldered before, it is easy but it will be worth your time to play around and practice a bit with some scrap wire. Here is a quick reference page and another one here to help get you started.

A quick refresher on voltage and cells. Each cell typically carries 1.2 volts when fully charged. If connected in series (positive to negative) the voltage adds according to the number of cells that you have. For example, a 10 cell

pack will yield 12 volts (10 x 1.2v) while an 8 cell pack gives you 9.6 (8 x 1.2v). Still confused? There is more in the Battery section which might help.

This will be a 10xCP1300 pack so I need 10 individual Nicad batteries. I want them arranged as a long pack to fit on a Wing so I have elected to arrange as two sticks of 5 cells each taped together.

This a cheap 60W Hobbico soldering iron that you can find at TowerHobbies. You can purchase a hammer-head tip which helps with soldering packs, or simply find a bolt which fits into the end of your soldering iron.

Hobby-Lobby sells the hammer-head tips (part #HLKM52HT) but a hardware store bolt works as well. A copper bolt works even better.

Please get (and wear) some safety glasses. I have seen what hot solder does to an eye and it was rather unpleasant. When you push the cells together, there is a good chance of flying solder balls coming out. These things are hot.

(And be prepared for an exploding cell. It has never happened to me, but people claim it has to them)

Take some 200 grit sandpaper and lightly sand both ends of each cell. You want to see some scratch marks on it, then wipe the end clean. You want to remove any finish or dirt from it.

With your soldering iron, tin the end of the cell but be very quick about it. You do not need much solder. When you press the cells together, all you need a very thin coat of solder between each cell.

(there is actually way too much solder on these cells)

As you tin each of the cells, put them in front of a small fan to help cool the cell down. Remember that heat is your friend for the solder, but can be deadly for the cell itself.

This will be a 10xCP1300 pack so I need 10 individual Nicad batteries arrange as two sticks of 5 cells each.

Although you can purchase soldering jigs, it is easy to make your own jig from two wood dowels taped together. If your mate goes to the store you can grab the broom and whack some off although they may whack something off of you, so it is probably best to find some dowels at the hardware store.

Tape something at the end so you can push a cell against it.

With the hot iron between two cells, quickly press them all together then remove the iron and push the cells together. Practice makes perfect. You have about 100ms (1/10 of one second) before the solder becomes hard again so don't play around.

As you solder each cell, make sure you are doing positive to negative. Wide end to button end. Do not rely on the printing on the side for orientation. Look at the cell. If in doubt, measure it with a voltmeter. Slowly build up a stick one cell at a time.

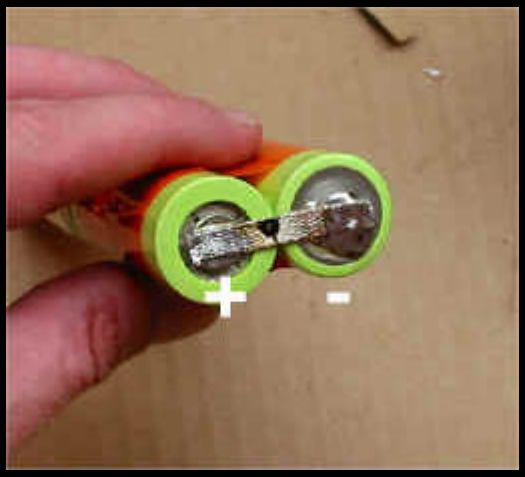
If you totally screw this up, put whatever you have done into your freezer for a few hours, then quickly "snap" them apart. Start over.

When you are finished, check the voltage through the cells. With 5 cells at a rough discharge voltage of 1.1 volt each you should have at least 5V, hopefully a little higher.

This stick is reading 5.51V which is fine. Wiggle the stick around. If you can break it, you want to find out now rather than in the air. Don't try too hard, but make sure each cell is securely soldered to it's neighbor.

De-soldering copper braid is great for connecting cells together at the ends, or across cells. You can pick this up at almost any hardware store or Radio Shack.

It comes in different widths but all of it is essentially the same stuff, just copper braid.



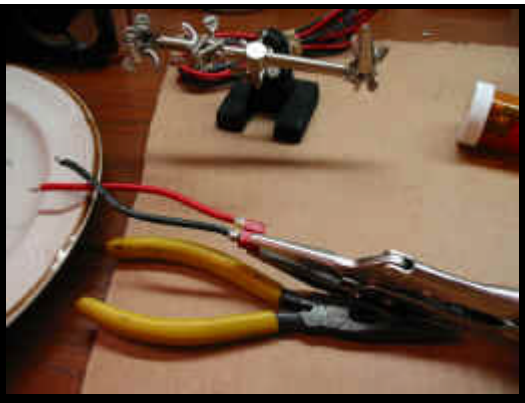
Because of heat concerns, you should tin the end of the braid before attaching it to the cells. This will help minimize the time the soldering iron is in contact with the cells.

Notice that one stick is positive and the other is negative.

For 10 cells connected in series, another voltage check should reveal roughly 11Volts after the two sticks are connected. Some orange tape helps for visibility.

Now create a battery connection for your new pack.

Create the connector first before attaching anything to the new pack.



This helps prevent the problem of having loose wires waving around that could short against each other. That can be very exciting and will generally scare the wee wee out of you.

Again, make sure you tin the ends of the wire first to help minimize the iron contact time with the cells.

Triple check that you have your polarity correct.

A completed female Deans Ultra plug. Several vendors will sell you assembled connectors. Hobby-lobby is one such vendor. The industry standard seems to be putting a female plug on the battery pack side.

At this point, make sure your pack is structurally sound. Wrap strapping tape at the top, middle and bottom of the pack to help hold it together. Some people prefer hot glue down the middle.

For additional rigidity and support, It helps to have some heat-shrink tubing to place the pack in. You can find this stuff in various dimensions and colors at your LHS, Hobby-Lobby, eFlightPacks, etc. TeamOrion has some great pink stuff guaranteed to be found in tall grass!

Cut 1/2" (12mm) beyond the end of the pack to allow it to fold over. You can trim it after you shrink it.

Fire up the hair dryer or heat gun on high heat and shrink away! Remember the heat rule. You are not trying to melt the thing, just shrink it.

(you should do this on a kitchen plate or something, not on the tile floor of the bathroom)

A completed 10x1700 pack destined for a Zagi.

This pack is a 10 cell CP1300 for a ViperTwin. Works great!

Remember to make your packs as visible as possible with some streamer tape or colored tape.

That concludes the lesson in saving yourself some money. I have yet to have a cell explode on me or fail in flight by doing this, but...it can happen so be prepared and **wear some safety glasses.**

There are many different ways you can build a pack in a physical sense. Can you tell which ones are home built? The ugly ones of course, but they are beautiful in the air where it counts!

What is nice about building your own, is just that. It is your own custom configuration.

Once you have completed your pack, it is time to charge it for the first time. The first charge should be done at C/10, or 1/10 of the total milliamp capacity. For example, a 1300SCR pack should be charged overnight at 130mA hour. If you have a charger that shows accumulative amperage, check it and make sure that your pack actually reached it's full capacity during the charge. Do a full discharge and slow charge again one more time. Check both the discharge and charge amperage. Using the 1300SCR example, did you actually discharge 1300mA? Did you really charge it to it's full capacity with 1300mA? It should be close anyways, if not a little bit over. I like the SuperNova 250S because it shows me this stuff. Somewhat expensive ($128US), but a nice charger. A super slow charge may never peak detect, so it is not unusual to charge forever at 50ma.

Please exercise some common sense and wear safety goggles at all times when you are soldering. Teach your kids proper safety and they'll be safe

on their own. Funny how that works...