

Li-ion Success

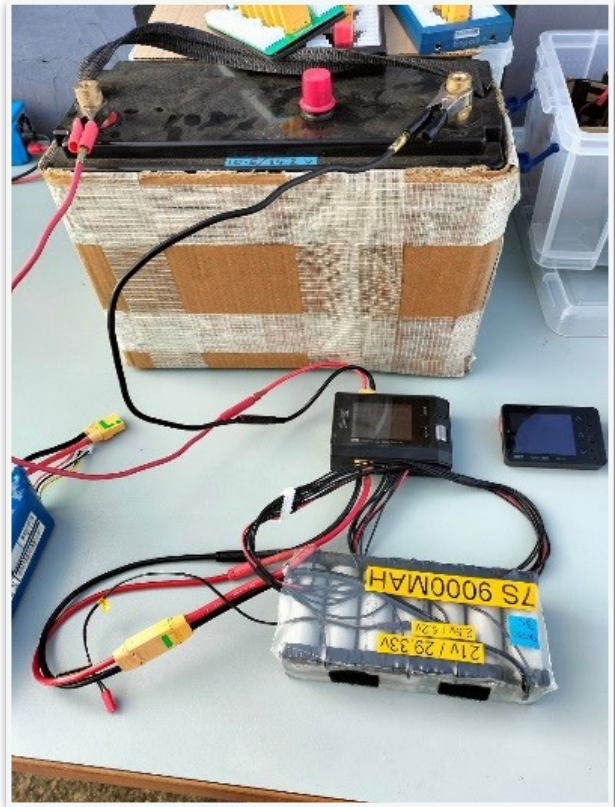
By Mark Allen

After much deliberation I have built and flown my first Li-ion battery. I took great inspiration from Wojtek with his many EDF battery projects.

My intention was to fly this in my FMS Viper 90 (same as the E-flite Viper 90) which is a joy to fly.

Lithium-ion (Li-ion) cells have a characteristic of dropping initial voltage quickly but then holding that value until the cell is almost depleted.

Therefore I had a concern that a 6 cell li-ion battery would suffer from voltage sag and fly like a half charged Lithium-polymer (li-po) keep reading 😊. So I opted for a 7 cell li-ion battery. The FMS esc is rated at 8 cells so no concern there and the Viper is known for being able to carry larger/heavier batteries.



Build

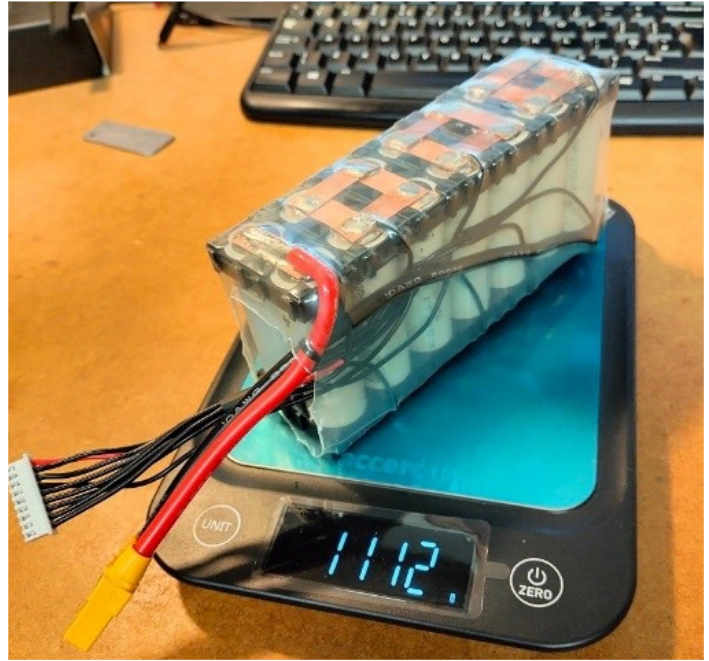
I bought a Sequire SW2 spot welder but being unsure of the amps the flight battery would be pulling I decided on soldering copper strips using my Atten S-100 solder station. The links are made from a 0.6 x 10mm foil strip. With hindsight these strips are probably overkill and I could half their width. Thinner gauge copper foil has already been purchased for my next build.

Soldering was straight forward and the cells never felt hotter than warm to touch. I wrapped it in heat shrink but will likely 3d print a top and bottom cap to help keep the cells cool in the future (summer).



With 10 AWG wires and an XT90 the battery is ready to fly at 1112g, not much heavier than a decent 6S 50C 5000 li-po (875g).

Note that most li-ion cells can be charged to 4.2v using a normal li-po charger with li-po settings. The initial charge at li-po settings showed all the cells to have roughly 3mOhms impedance. I then discharged it at a constant 15 amps to check everything was good. It took 33 minutes! For comparison my 6S/5000 li-po typically take 6 minutes. Discharges completed using my home-made load bank (modified hair dryer).



Flying

The battery needs to sit all the way back in the bay to achieve CG.



I took off, gear up and went vertical. This has more punch than my li-po pulling 129A. My li-po pulls 116A doing the same manoeuvre. It definitely pulls stronger for longer in the verticals.

An earlier li-po flight pulled a maximum of 2651 watts (not a new battery) the li-ion drew 3001 watts.

The li-po cells dropped to 21.2v and the li-ion to 20.9v.

A li-po flight flew for 7 minutes and the li-ion 9 minutes but it only needed 6000mA to recharge so probably another minute of flying available - didn't want to push my luck with the initial flight test.

The voltage sag is not a concern with 7 cells. Half way through my nine minute flight the battery was still averaging close to a full li-po voltage.

Telemetry shows the cell temperatures reached about 35c, they're rated at 60c so need to keep an eye on them in the summer. The pack was warm and not hot. Test flight ambient temperature was 5c.

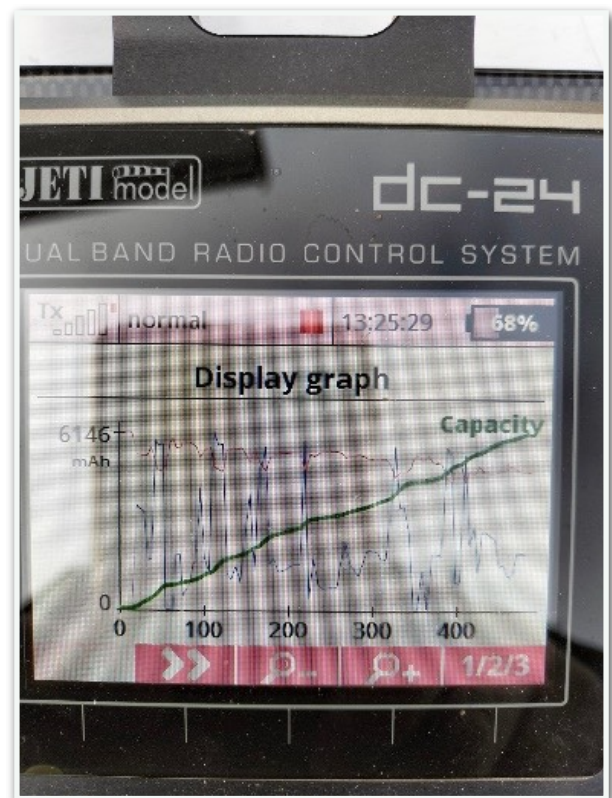
I wasn't flying full throttle for the entire flight because that's not my style but flew most of the time at about 70mph, touched 140mph in a dive This is measured with my home-made GPS unit.

The battery was charged twice at the field, first at 10A and the second 20A.

Very happy with how this has turned out and other club mates were very impressed with the battery performance.

Apparently these li-ion cells provide more power after a dozen or so flights.

Since the initial flights I have flown this new pack a number of times and it's performing very well. I have also conducted an endurance test to see how long a modern 90mm EDF jet can fly. Flying with moderate throttle including some fast 100mph passes I managed a staggering flight length of 15.5 minutes!



Telemetry charts of the li-ion flight showing speed, pack voltage & amps.

