A TALE OF LITHIUM ION

Rod Dilkes

I have a Suzuki Mighty Boy, the tinyest ute known to mankind. About three years ago I converted it to electric and have been driving it ever since. It is a standard conversion using the Advanced DC 8 inch motor and a Curtis 1231C 144V nominal controller. It has a Zivan NG3 charger and originally had 12 x Trojan 27TMH lead acid batteries. Thats where my story begins...

After about 12000 km the batteries started to get weak. These batteries proved to be a bit small for traction applications. The original pack had cost $2000 so I got about 17c per km out of them. Add about 3c/km for off-peak electricity and it comes to about 20 c/km. This is pretty close to but not better than driving a petrol car. So I started looking for alternatives. Many hours on the internet later the search had come down to a few choices. Nickel Metal Hydride would have been great but large format cells are not available due to **patent sitting by Chevon/Texaco-** no accident that they are an oil company. The only other choice was Lithium Ion or Lithium Polymer batteries.

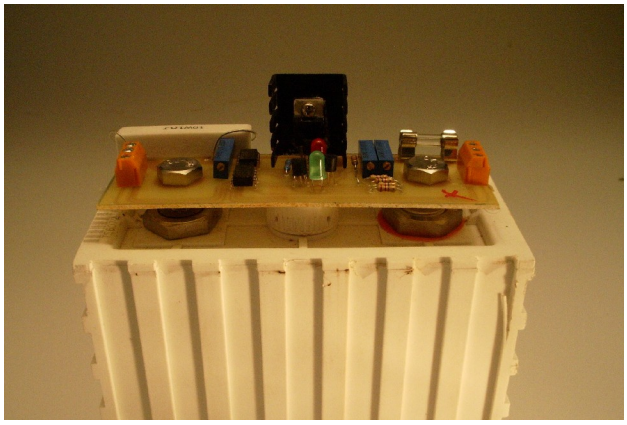
The most promising Lithium Polymer producer is Kokam. They produce very light weight cells for the radio controlled model industry. However their larger format (>60Ah) cells proved extremely expensive and hard to get. Their lifespan was also limited.

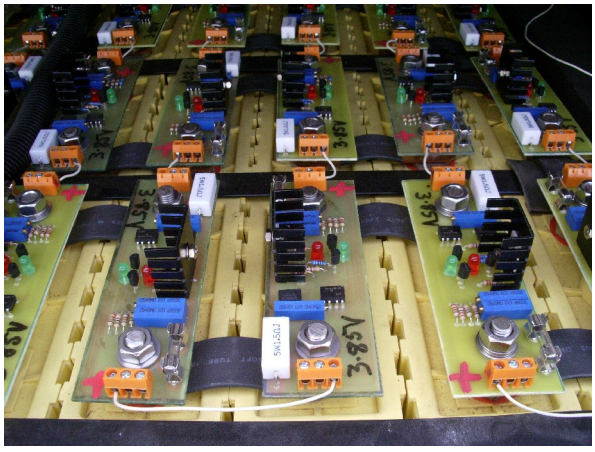
An interesting alternative was the A123 systems M1 battery. These are about the size of a C cell and can store 2.3Ah. They can deliver 70 Amps continuous and will do more than 1000 cycles. These also are hard to get and expensive. They would have to be paralleled together and that would take time and expertise. These are the ones to look out for in future.

For some time I had been watching Thunder Sky, a Chinese Lithium Ion manufacturer that produces large cells. The problem was the cells they produced had limited cycle life and dreadful low temperature voltage sag under high currents. At about the time I was going to bite the bullet and go for A123 batteries I got an email from an agent about the new Thunder Sky LFP Lithium Iron

Phosphate series. The 90Ah cells could handle 270 Amps continuous and at 3.2V nominal weighed just 3kg per cell. That would make my pack almost 200kg lighter! They claim 1500 cycles minimum. So I went for it and ordered 45 cells for about $10,000 (it was a tough decision).

Now you might think that is the end of it, but... Lithium Ion batteries do not take kindly to being overcharged or overdischarged. In fact they show their displeasure by dieing with smoke and flames. A battery management system (BMS) is the order of the day. Fortunately I had been doing quite a bit of research and development on the A123 batteries and had a circuit design worked out. The BMS required making a small circuit to go on top of each cell so I set to work and made 45 of them. That was a long week! They connect up to a master module which controls the Zivan charger and the Curtis controller. The system is **Fail Safe** in that each cell module has an active output which connects to the next cell and ultimately the master module. So if there is any problem of any kind I can't drive or charge the car until its fixed, which is highly preferable to it exploding into flames.





The first time I installed the BMS it worked! And it continues to work after dozens recharges. I halved the weight of my battery pack, increased the performance and doubled the effective range of my little EV to 60-90km. The battery lifetime? Well that is to be determined. It now has done several thousand km on the LiIon pack with no signs of ageing. I would hope for at least 50000km useful life. Of course the system costs about five times as much as Lead Acid but I for one will never go back.

So if you are thinking of buying batteries consider Lithium Ion and if you are considering Lithium Ion consider Thunder Sky LFP series. And if you are considering that please let me quote on your BMS.

Regards,
Rod Dilkes
www.ev-power.com.au