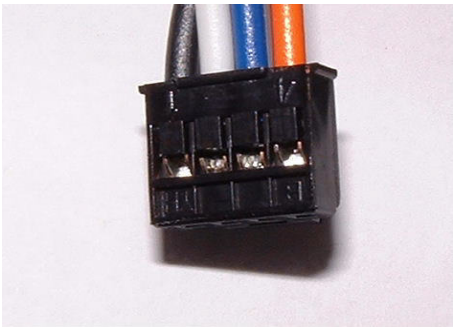
Battery Report

The Thunder Power 2000mAh 3 Series Battery Pack

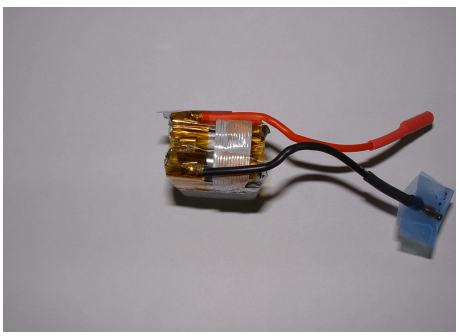
Date: 29th May 2005
Battery Type: Thunder Power Li-Po 3 x series 'Pro-Lite' Lithium-Polymer battery pack
Weight: 125g
Dimensions: 64mm x 49mm x 20mm
Manufacturers Rating: 11.1V 2000 mAh, max discharge current: Believed to be 10-12C
Note: All tests are carried out in a controlled 24C ambient for consistency.
Author: Mark Hopkins

Mechanical.

The battery is in a 3 x series Li-Po configuration, with the cells stacked horizontally on top of each other, and covered with heatshrink. The two out-put wires (+ve & -ve) exit from one end, and appear quite adequate for small model helicopter use without too much of a problem. Thunder Power connect their cells to each other by spot or US (Ultra Sonic) welding. As mentioned in previous reports of other batteries, there was no protection circuit fitted to the pack to protect from over voltage, under voltage, over current, over/under temperature, cell imbalance, etc. All three cells are stacked with no air gap for the middle cell, this cell will consequently be more prone to heating during use, and would most likely to be the first cell to fail in this pack.



The Balancing Connector



A view of the inside of a Thunder Pwoer battery (Taken from the 1320 mAh 4 Series)

Electrical

The voltage of each cell was measured before commencing charge and the pack was found to be well in balance. The pack was then charged to 12.6V (4.2V per cell) with a current limit of 1200mA, in a 24C ambient, and with a termination current of 100mA at 12.6V. At end of charge the cell pack was still well balanced. The pack was discharged at C rate (2000 mA) with a 8.5V cut-off voltage. The capacity at this rate was 1.96Ah, 22Wh, the cell pack reached a maximum temperature of 32.4C. The battery was then charged as before then discharged at 10A and 20A respectively, the following results were recorded:

At 10A the capacity was 1.96Ah, 20Wh, the cell pack reached a maximum temperature of 58.7C.
At 20A the capacity was 1.61Ah, 18Wh, the cell pack reached a staggering temperature of 69.5C.
At the end of the discharge tests the cells exhibited the following voltages after a 10 minute rest:

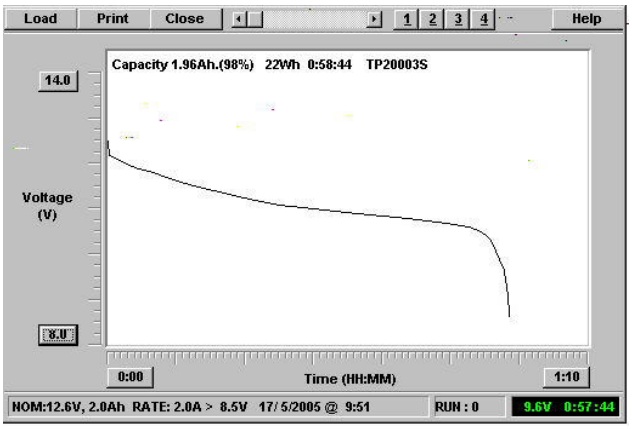
Cell 1 - 3.50V
Cell 2 - 3.49V
Cell 3 - 3.49V

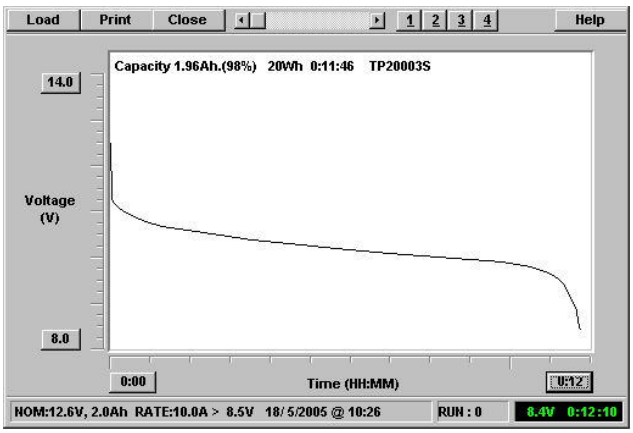
Very well balanced.

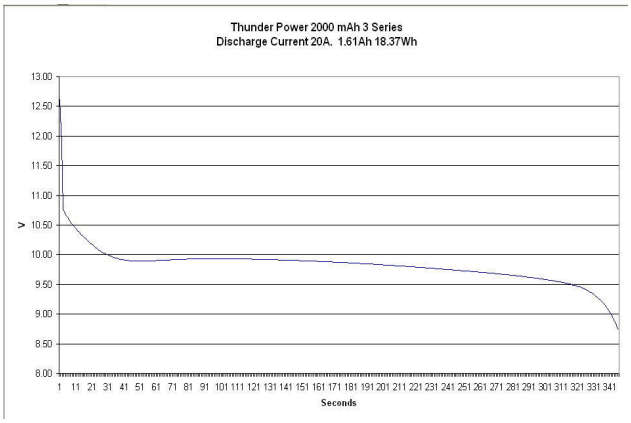
Pack Performance at a Glance

Current	Capacity (Ah)	Capacity (Wh)	Gravimetric Energy Density (Wh per kg)	Max Temp/ Comments
2.0A	1.96	22	176	32.4C ok
10A	1.96	20	160	58.7C ok
20A	1.61	18	144	69.5C Borderline

Discharge Graphs







Conclusion

As usual no protection is fitted, and as usual I have to mention this. The cell in the middle of the pack could fail early if used at excessive current levels, although it can be difficult to achieve these currents on the 'Micro-Heli's'. The battery performed ok at C rate and the voltage held up well at 10A, with the temperature staying within acceptable parameters. At 20A constant, the battery struggled a little with a slight voltage lag noticeable, however the temperature stayed below 70C, although this may not be the case in a warmer environment (mid summer etc). The battery under test performed well at 10A, and fair at 20A. The 10-12C constant discharge rating could be achieved under certain conditions, although these levels are rarely reached throughout an entire pack discharge, in actual use in a Micro-Heli.

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