Lithium Polymer Capacity.

By Bob Smith

Everyone who has used LiPo flight packs knows that we sometimes get inexplicable failures. At least some of these problems originate in the fact that the technology of these batteries is still relatively new and we have not completely sorted out the best and safest way to use them. Some of these failures are, well, catastrophic, by which I mean that the pack is virtually destroyed within a short period of time. Others, probably the majority, are gradual in nature with the pack capacity and performance reducing progressively to the point where it becomes obvious that all is not well. We then have to decide whether to dispose of the pack and replace it immediately, or to continue using the pack and accept that it will deteriorate to lower and lower performance. If it is in use as a flight pack on a particular model then such reducing performance may well be unacceptable, but there may be other applications which are less demanding.

I had a letter from an electric flyer the other day in which he detailed his own experience with one particular pack and suggested a possible remedy of sorts. The writer was Robin Wilkin and he told me that he had checked out one of his LiPo packs, a 2S 1300 mAh pack which was fairly old and had limited performance, by discharging it at very low loads. He quoted 0.5C (or 6.5 amps in this case) and said that when discharged at this rate the pack exhibited the full original capacity. He then went on to use it in a transmitter, where it is subjected, of course, to relatively low loads.

I decided that I needed to check out what Robin had told me so found an old Flightpower 3S 1800 mAh pack which I knew was in poor condition. This pack was rated for a maximum of 25C load continuous but I felt that a full 25C load was a bit cruel and subjected the fully charged pack to a discharge current of 36 amps (20C) and obtained the results shown in Graph 1. You will see from the voltage curve and the capacity value (1276 mAh is only 70% of the nominal 1800 mAh rating) that the pack is indeed on its last legs, but at least I had a starting point. The next stage in the process was to repeat the discharge but at a very low load. I chose a discharge current of 1.2 amp (0.67C) and again the result of the test is shown on the graph. This time the voltage values are much better but the capacity, although increased, is still only 1373 mAh (76% nominal).

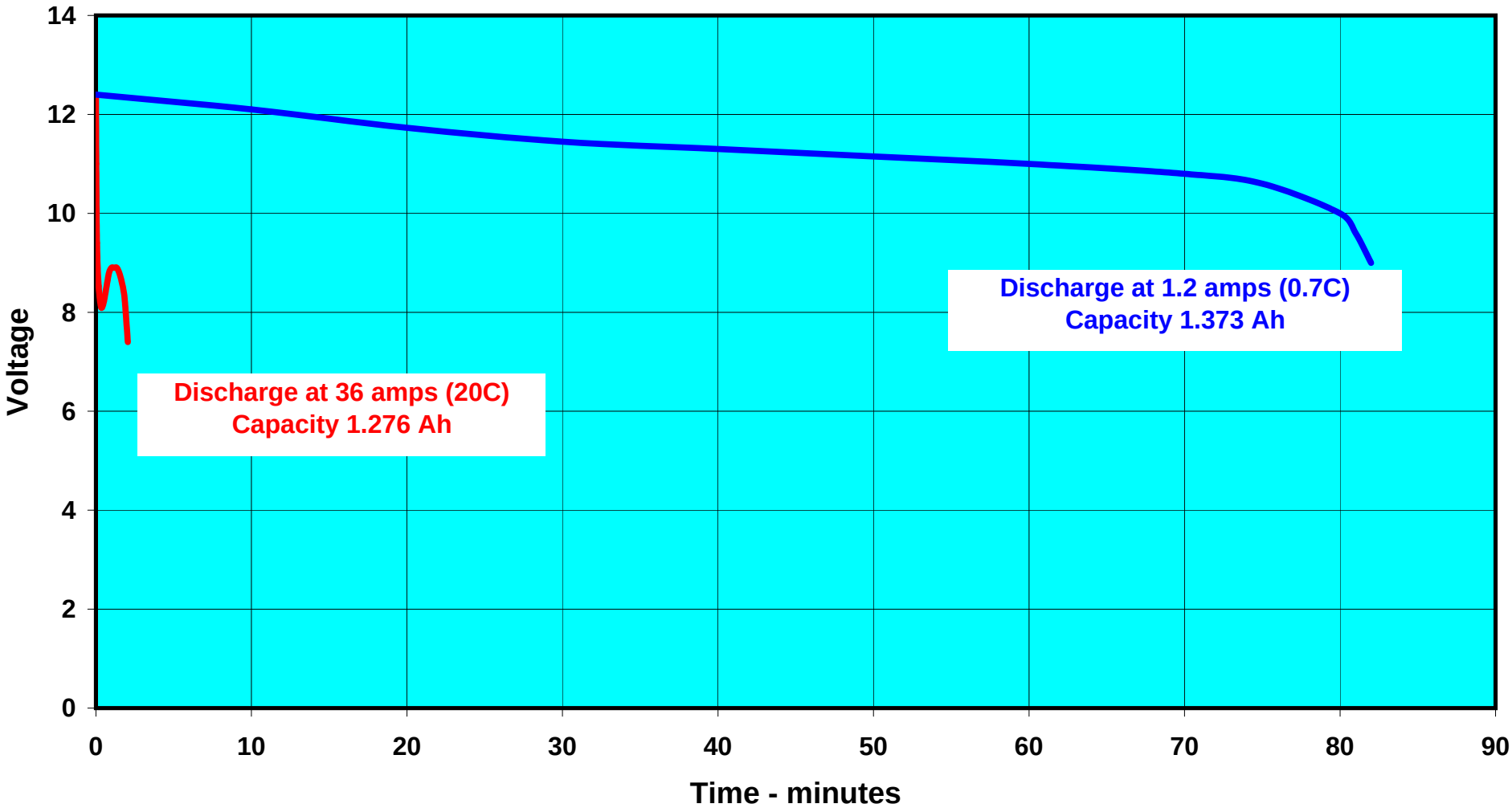
I felt that this first test had perhaps been too severe in that the pack used had been in excessively poor condition, so repeated the process with another, somewhat better, pack, a 3S Model Power 2150 mAh 20C. The details and results of this second test are shown in Graph 2, with the same values calculated to allow comparison with those in Graph 1. Even here, although the capacity increase is more significant (1584 mAh or 74% nominal to 1895 mAh or 88%), it is nowhere near the original capacity.

The outcome of this little experiment is therefore fairly clear in that neither of the two packs tested were able to deliver anything near to their specified capacity even when the load was reduced to a very low value, but this is a very small sample which is certainly not sufficient to discredit Robin's original experience. There are some additional points to make regarding this, and these are that firstly, the performance of any battery changes as the load changes. If we assume that a new pack should deliver the full specified capacity if tested at loadings below 1C, then it is a simple fact that both the capacity and the voltage will decrease if the load is increased, with the magnitude of the reductions depending on the magnitude of the load. The better cells and packs should minimise the reduction but it will always be there.

The second point is with regard to safety. If we assume that reduced capacity of a LiPo pack (compared to its nominal capacity) is an indicator of general deterioration in the pack, then the pack is clearly past its best, and I would personally be careful about using such a pack in what might be thought a critical application. I would be happy to use it in one I considered non-critical, but that kind of decision is for the individual modeller to make.

Bob Smith

Graph 1 - FlightPower Evo 3S 1800 mAh 25C pack.



Graph 2 - Model Power 3S 2150 mAh 20C