Batteries for RC model

All our models rely on batteries to power their receiver, the ignition module if we are using one, and any other electricity driven devices on the model.

Batteries are like bucket of water and a hose, suspended from a wire at a certain height above the ground.

- The height of the bucket is analog to the voltage of the cell. It is expressed in Volts units (V).
- The diameter of the hose or dirt in the hose is analog to the internal resistance of the cell. It is expressed in Ohms units . The larger it is, the lower is the capability to supply large currents. It transforms electric energy in useless heat.
- The water flow rate is analog to the current. It is expressed in Ampere units (A).
- The size of the bucket is analog to the capacity of the battery. It is expressed in Ampere Hour (AH) units or Miliampere Hour (mAH).

Discharging the battery is like opening the spigot of the bucket. Charging is pumping water back up into the bucket and filling it.

One more important characteristic of the battery is its "C" rating. It is a number which when multiplied by the battery capacity, gives us the maximum current the battery can safely handle. For instance, a 2000mAH battery with a 30 C rating can safely deliver up to 60 A. The C rating of the battery is closely related to its internal resistance.

For us modelers, the critical factor of a battery is the amount of energy stored or the capacity and the weight of the battery. Since many disciplines, such as laptops and cars, have the same critical factors a lot of money is invested in research and development of new battery technology.

There are currently 2 main technologies and chemistries of batteries we use, each one is further subdivided.

Lithium is the more modern alternative. It includes Lithium Polymer (LiPo), Lithium Ion (LiIo) and Lithium Iron (LiFe).

The older technology is the Nickel type, and it includes the Nickel Cadmium (NiCd) and the Nickel Metal Hydride (NiMh).

The table below summarizes the specifications of the different batteries used in RC.

Technology	Nominal voltage per Voltage	Typical internal Internal resistance	Charging technique
NiCd	1.2 V	High	Delta Peak
NiMH	1.2 V	High	Delta Peak
LiPo	3.6 V	Very low	CC-CV
LiOn	3.2V	High	CC-CV
LiFe	3.3 V	Low	CC-CV

In order to get the voltage we need for our receivers, which is typically 4.8 to 6 Volts, we connect in series (+ to -) several cells. Cells in series add their voltage.

Cells in parallel (+to +, - to -) add their capacity while maintaining their voltage. However, since the voltage of the cells is never exactly the same, batteries in parallel can discharge into each other.

CHARGING TECHNIQUES

Delta Peak

Used in Nickel based batteries. The battery is charged under constant current. As the battery capacity is replenished, the voltage raises, until a certain point when the battery is charged, and the charging current is converted into heat. This cause a slight drop in the voltage, and the drop is detected by the charger. We are talking here of a very slight drop, 5mV/cell on NiMH and about 8mV/cell on NiCd.

Although the battery can be slow charged with a wall charger with a constant current for 12-16 hours or overnight, it is much better to use a specialized charger, with which the current is determined by the user, and which will monitor the voltage and automatically stop the charge when the delta peak point is reached.

CC-CV

Used in Lithium based batteries. The charger feed the battery with constant current (CC) while monitoring the voltage. When a certain voltage, dependent on the exact chemistry, is reached, the charger starts dropping the current so it just maintains the preset constant voltage (CV). When the current drops to almost zero, the battery is charged.

Charge monitoring and logging.

It is recommended not to leave batteries while they are fast charging. Heat can build up in the battery and causes the battery to outgas. In LiPo batteries it is absolutely forbidden to charge the battery while unattended, since they can explode and cause a fire.

When charging a battery after use, note down the amount of mAH you put into the battery. You can use this figure for future reference and comparisons.

A new battery should at least be cycled twice on the charger, at 1C, this should take no more than about 2 hours, but will tell you the exact capacity of the battery (which is never what is written on the label).