ELECTRICKERY

…experiences in electric flying

Hi! This is the first in a series of articles where I will attempt to pass on some of the things I have learned about flying electrically powered aircraft over the past couple of years. I certainly don't claim to be an expert in this field, unlike some of the magazine columnists who really know their onions, but I have had a fair degree of success with electric aircraft and if my experiences encourage or help you along with your own electric projects then the objective will have been achieved.

I'm going to split things up into several areas, such as batteries, radio gear, motors and speed controllers and things that have worked (or not!) in my own aircraft but, for now, I thought the best idea would be to start with the basics.

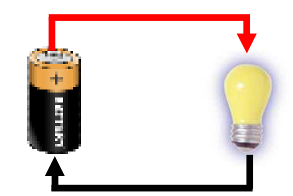
As with any new branch of the hobby, there are always some basic terminology and concepts you have to learn before you can reasonably expect to understand what's happening with your plane. When you first start learning to fly an R/C aircraft, there's a whole new dictionary gets thrown at you – fuselage, ailerons, empennage, CG, downthrust (is that kinky?), etc. If you are a dedicated 'glider guider' wanting to get into power for the first time, the mysteries of ccs, hot plugs, eleven by sevens, "10%" and so on are waiting to trap you. It's no different with electric so I'm going to start by trying to unravel some of the terminology and principles you'll need for successful electric flying.

Electrics 101

Anyone who hasn't been at school for a while, like me, or who missed out on Physics O-Level (that's the 'playing with wires and things' bit in Science for our younger readers…), may be a bit hazy on how electric motors work or even how electricity gets from the battery to the motor so I'm going to start there.

There are two types of electricity, the stuff that comes out of a battery, called DC or direct current, and the stuff that comes out of the wall which is called AC or alternating current. In Diagram 1, there's a very simple electric circuit with a battery, a lamp and some wire.

Diagram 1

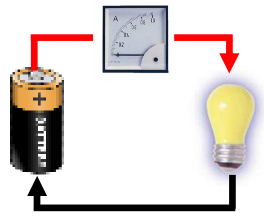


Electricity flows around this circuit from the battery to the lamp and back again and, in a DC circuit, it flows in one direction, as shown by the arrows. In an AC circuit, the electricity changes direction about 50 times a second – I'll talk more about AC when I cover brushless motors later in this series but for now, let's concentrate on DC because it's easier to picture, I find.

After a time, the battery in this circuit will go flat so we can think of the lamp as having used up the electricity that was stored in the battery. It would be nice to know how long it would stay lit so it's important to know how much electricity is being used by the lamp (current) and how hard the electricity is being pumped round the circuit (pressure). These two measurements will tell the circuit designer the power that is being pushed through the lamp and therefore how bright it will be. Current is measured in amps and the pressure is measured in volts. These two values multiplied together give the power which is measured in watts.

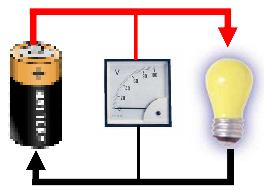
Measuring and Formulae

Diagram 2



Let's have a look at how we can measure these values. Going back to our simple circuit, Diagram 2 shows how we would connect a meter to measure the current. Notice that the ammeter has the wire going in one side of it and out the other, in other words, the ammeter forms part of the wire in the circuit and the current flows *through* it.

Diagram 3



The meter that measures pressure in the circuit, the volt meter, is connected slightly differently, as shown in Diagram 3. Notice that this time, the meter is connected *across* the wires. This is because it is measuring the pressure difference (voltage) between the electricity as comes out of the battery compared with the pressure as it goes back in.

Let's put those readings to some practical use and assume that the lamp in the diagrams is a car headlight. Typical voltage and current readings (note "current", *never* "ampage"!) would be 13.8**v** and 4.3**A**. We want to know the power being consumed by the headlight so we multiply those two figures together and get 13.8 x 4.3 = 59 watts (59**w**). In other words, volts x amps = watts.

As with many things mathematical, if you know two things you can usually work out the third so let's take another example. Let's say that we have a 100w household light bulb. How much current does it take to power it?

230v × ? = 100 therefore ? must be 0.43A (check it on the calculator!!)

These are the formulae you will need:

Watts = Volts x Amps
Volts = Watts ÷ Amps
Amps = Watts ÷ Volts

Power and Aeroplanes

Watts are important to the electric flyer because they give a good indication of how well an aircraft is likely to fly. As a rough rule of thumb, 50 watts per pound of aircraft weight will make the plane fly but the performance will be so-so. 70 watts per pound will give good, trainer-like performance and 100 watts will ensure excellent aerobatic performance.

Watts/Pound	Aircraft Performance
30	Barely get off the ground
40-50	"Sunday" flyer, sport gliders and old-timers
60-70	Mildly Aerobatic
80-100	Aggressively Aerobatic
100 plus	Ducted Fans, Competition gliders and E-3D models

Coming next…

Next time, we will go into the different types of batteries on the market, their pros and cons, charging, connectors, balancing, and we'll dispel a few myths about Lithium technology in particular!