CIAMFlyer
The Introduction to the Modelaircraft World
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Top Performance with Limited Amounts of Energy

Motor of the Graupner Silentius was the Faulhaber Micro T03 with 1 : 15 gear.

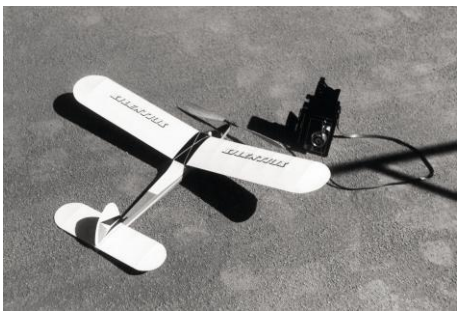
1971: Fred Militky and Wolfgang Schwarze demonstrated the RC model „Silencer" at the F3A World Championships in Doylstown, USA.

Electric Flight World Championships on a Level Playing Field

Huge power increases in electric model aircraft propulsion in the last few years have caused the relevant subcommittee of the International Aeromodelling Commission of the FAI to once again impose power limits in electric flight competition categories – mainly for safety reasons.

In the Beginning they Could Barely Remain Airborne

Fred Militky began developing his first electric powered model aircraft in the 1950s and the company Johannes Graupner employed him in 1956 to develop model aircraft. He achieved his breakthrough as early as 1959 with the electric free-flight model FM248 which was able to remain airborne for 23 minutes. The model – with further improvements – was then launched by Graupner in 1960 as a kit called „Silentius". Three years later, Militky achieved a successful trial with a radio-controlled electric model plane. The big breakthrough came in 1971, when Fred Militky and Wolfgang Schwarze demonstrated the RC model „Silencer" to an astounded audience at the F3A World Championships in Doylstown, USA. First electric flight competitions were held as early as 1973 – among them the Militky Cup in Switzerland.



Silentius, electric powered freeflight model airplane of Fred Militky. This was a Graupner kit 1960.

Power Increase through Competition

The now emerging competition scene led to a tremendous optimisation of electric propulsion power. At the first World Championships for electric model gliders 1986 in Lommel, Belgium, large aircraft with wing spans of 3 m were used. Their power was delivered by battery packs of 30 to 60 NiCad cells weighing approx. 1.5 kg. Only two years later models thus equipped, climbing at a rate of about 20 m/s, could disappear from sight within just a few seconds thus increasingly causing safety concerns. The international committee therefore began limiting the power on model gliders in several stages. It was not long before the number of cells and battery pack weight were reduced.

Launching of an electric motorglider at competition

The Battle of Batteries

Limits on weight and/or cell number made competitors go to great lengths to select the best and most lightweight NiCad and later NiMH batteries. Cells were selected not only for weight and discharge characteristics, each individual cell was additionally activated or "pushed" with current impulses. When pushing a NiCad cell, a very high current has to flow for a very short time. This huge current changes the crystal structure of the electrode causing a reduction of the cell's internal resistance which, in turn, allows very high currents to be drawn during flight.

Battery pack of 16 NiMH cells as standard power source for the electric powered glider class before 2008

Although this made tremendous performance possible – electric model gliders achieved climb rates of 50 m per second and more – battery life was greatly reduced. Cells were overloaded and would get very hot, often causing them to explode. Whoever was able to obtain the most cells would have the most powerful propulsion. The "Battle of the Batteries" had begun.

Folding propeller of an electric powered motor glider

Common Sense Prevailed

More and more competitors were fed up with the huge expenditure for batteries. The recruitment and support of young enthusiasts also became nearly impossible. The responsible body knew that the path taken so far would inevitably lead to a dead end. Limits on weight and size of batteries, current limits, limits of engine running time or regulations for motors were not being considered. It was much more elegant to limit the amount of energy used.

Example of a small instrument, weighing only several grammes, that can be used to determine the energy at which the motor automatically shuts down

Multiplying voltage, current and time yields electric energy. The unit for electrical energy in physics is Joule (Watt-second Ws) and when measuring energy consumption in electric power engineering, Kilowatt-hours kWh is commonly used. For electric model flying, Watt * minutes have proved very practical and for F5B Electric Gliders 1750 Watt-min are available per flight and 1000 Watt-min for F5D Pylon Racing models. Once the energy is used up, the motor shuts down. This requires sophisticated tactical behaviour from competitors. Somewhat simplified, they may decide, when gliding, to cover as many laps as possible with very high power but then have no energy reserves left for continuous flying. Depending on meteorological conditions, such decisions may have to be made at very short notice. Limiting power also increases battery life. This rule has turned the battle of the batteries into a competition of efficient energy use combined with tactical and flying skills.

Sensor for current measurement

Motor with speed controller and the (red) sensor for the current on the right

FAI European Champion 2009 in the electric powered glider class F5B Reno Frattini, Italy. He won with limited emounts of energy