

The Electric Motor's Long Road to F3A Aerobatics

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FAI F3A World Championships as the launch aid for electric flight

It was at the F3A World Championships from 15th to 19th September 1971, at the Central Bucks County Airport in Doylestown, Pennsylvania: In front of a large crowd of spectators, Fred Militky showcased the first radio-controlled electric model glider. This was the real beginning of electric flight



Awarding Ceremony at 1971 FAI F3A WCH in Doylestown USA where the first RC-electric powered model airplane of Fred Militky was demonstrated.

Graupner's recipe for success

Nowhere else would Fred Militky have been able to present his RC electric model glider SILENCER with more media coverage than at what was then the only World Championships for radio controlled models (F3A). Even prior to 1971, experiments with radio controlled electric model aeroplanes were conducted

at various locations, namely in England, Germany and the USA. Space agency NASA was also involved in developing various successful projects. However, a real breakthrough could only be achieved through model kits with popular appeal. Fred Militky, head of development at Graupner in Germany, was well aware of this. It

was only a year later that the first kit hit the market: a lightweight wooden model (1.9 kg) with a span of 2.3 m. The key to its success was the fact that all parts, from propulsion to radio control components, were specifically tailored to the model. This eliminated the cumbersome search for parts, a significant advantage, especially in this

early stage of the "silent revolution".

A first step

At the time, the achievable output of electric motors was far too low for F3A aerobatics. Lightweight model gliders were therefore standard in the early stages. A significant step towards aerobatics was made possible by German physicist Heinz Keller with a new generation of motors using permanent magnets made from rare earths. These motors were much more powerful and efficient, and aerobatics with simpler and lighter models suddenly became possible.



Keller Motor with permanent magnets made from rare earths

Nevertheless, it still took more than 20 years for the first electric F3A model to appear. At the 1993 FAI F3A World Championships in Nötsch, Austria, the young Dutchman Dennis van Loog was the first to compete with an electric model.



F3A Team of Netherland 1993 at FAI WCH in Nötsch, AUT: Left Dennis von Loog, first Competitor with electric powered F3A model.

Unfortunately, gusty wind and rather cold weather put him at a disadvantage. The model, equipped with heavy nickel-cadmium (NiCd) batteries did not have the reserves required for such conditions but the young aeromodeller should still be congratulated on his courage.

Heinz Keller developed motors with Cobalt Samarium (SmCo) magnets.



F5A electric aerobatic models as an intermediate solution

Despite all these difficulties, many electric pilots were not to be put off aerobatics. The heavy batteries required very lightweight construction methods – mostly wood in those days and less often GFRP. As a consequence, new rules had to be established for aerobatics competitions, that enabled fairly impressive manoeuvre programs, even for models with less powerful propulsion. Numerous electric aerobatics competitions were held throughout Europe as early as the mid-1980s, even two European Championships. This class was later designated F5A in the FAI classification system. Models

became increasingly sophisticated and optimised, initially being launched by hand but soon equipped with landing gear. In short, these F5A models evolved more and more towards F3A aerobatic models thus creating an important pool of experience for later F3A developments.



Typical very light F5A aerobatic model 1980.

Transition accomplished

Following the not particularly encouraging attempt at the 1993 FAI F3A World Championships, electric motors for the 2 m F3A models were off the agenda for a long time. It was not until the late 1990s that Michael Ramel from Germany newly launched the electric motor for F3A aerobatics. His model "E-Factor" consisted of an extremely lightweight wooden structure. The energy for the Lehner motor was supplied by a battery pack of 30 nickel-metal hybrid (NiMH) cells. The model weighed 4.4 kg and competed successfully at various competitions around Europe. However, these models soon reached their limits in stronger winds. It was only the introduction of lithium polymer batteries that made the model more competitive.

Electric powered F3A-model "E-Factor" of Michael Ramel, GER (1999). 30 NiMH-Zellen 1800 g.

Breakthrough after 32 years

The real breakthrough for electric propulsion in the F3A aerobatics category came in 2003 at the F3A World Championships in Poland. Jason Shulman, USA, used a Hacker C50 electric motor with transmission in his Rhapsody model by Lorenz (GER) and reached 5th place (USA took 1st place in the team rankings).



Jason Shulman, USA, first successful electric powered F3A-model 2003.

This huge success was made possible in particular through the use of lithium (LiPo) batteries. These new batteries feature a higher



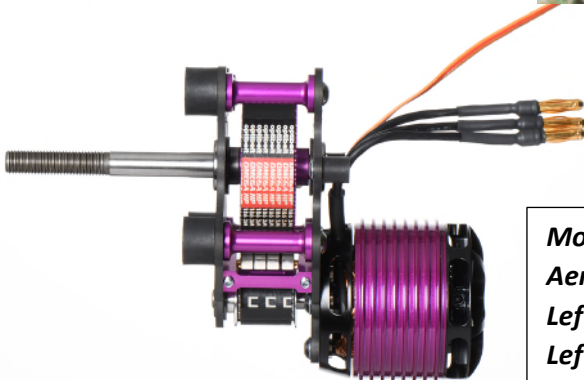
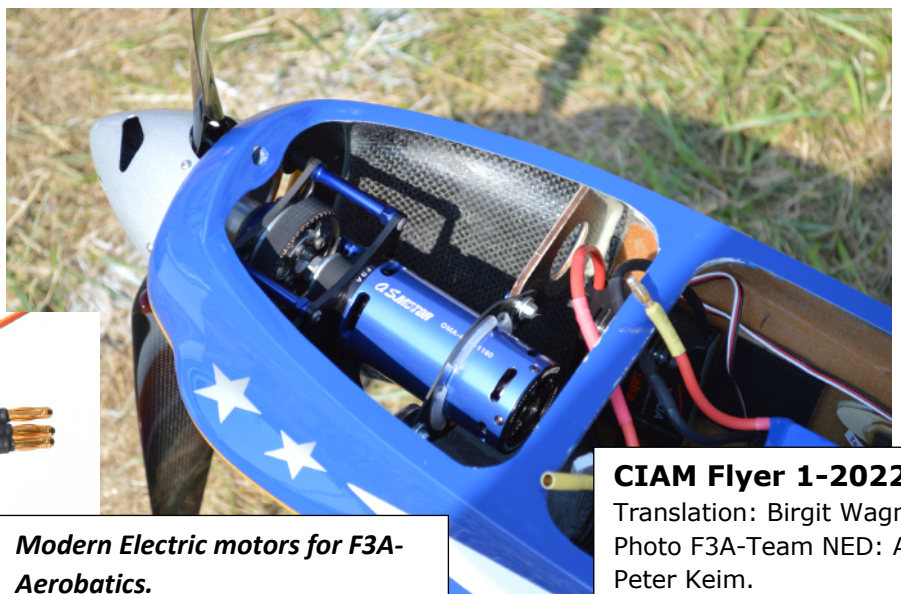
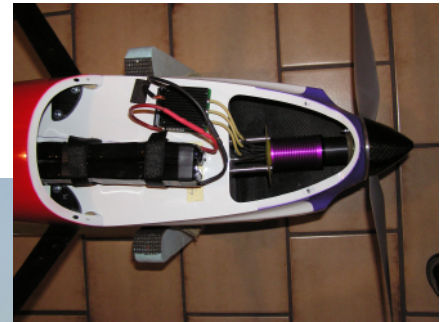
energy density and can store almost the same amount of energy at half the weight compared to NiMH cells. Further successes with electric F3A models followed only a year later: Roland Matt of Liechtenstein became European Champion in Portugal in 2004 and Wolfgang Matt took third place. Since then, the proportion of electric models at F3A World Championships has increased to probably over 90 % today.

E-motors today

Motors with collectors were motors standard until 1994 at the FAI World Championships for F5B electric gliders in Australia. The American Jerry Bridgeman, USA with his

brushless Aveox motor had clearly beaten the Europeans. The way for electronically commutated motors was clear from 1995. They were more efficient. Replacement of the carbons was no longer necessary.

Roland Matt, Winner of 2004 FAI F3A European Championships in Portugal with electric powered F3A-Model Lazulit.



Modern Electric motors for F3A-Aerobatics.

Left top Outrunner.

Left and above: F3A-motors with toothed belt gear.

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