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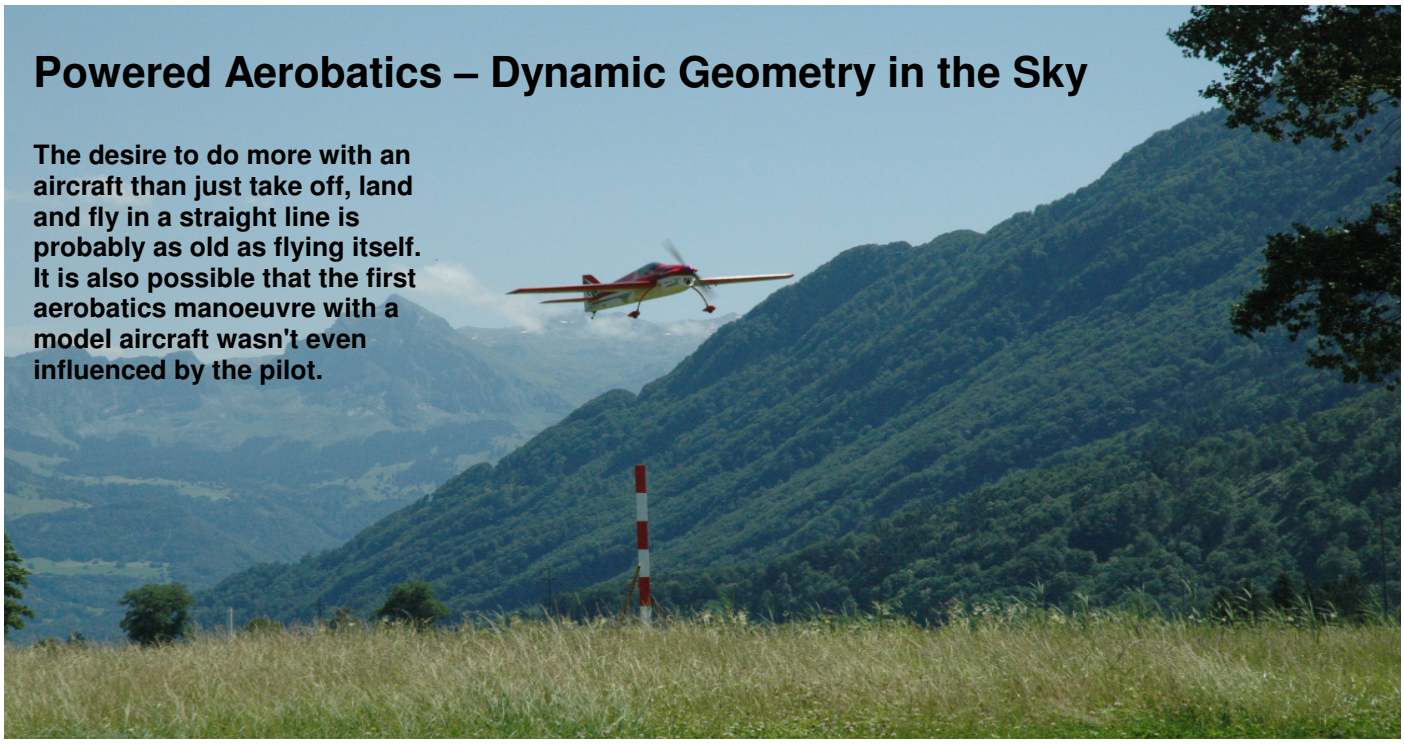
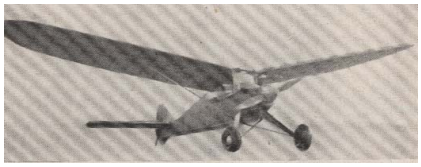
Powered Aerobatics – Dynamic Geometry in the Sky



The desire to do more with an aircraft than just take off, land and fly in a straight line is probably as old as flying itself. It is also possible that the first aerobatics manoeuvre with a model aircraft wasn't even influenced by the pilot.

Intention or Coincidence?
Even more than half a century ago, uncontrolled model aircraft – with or without engines – have performed some sort of capers in the sky – often to the dismay of



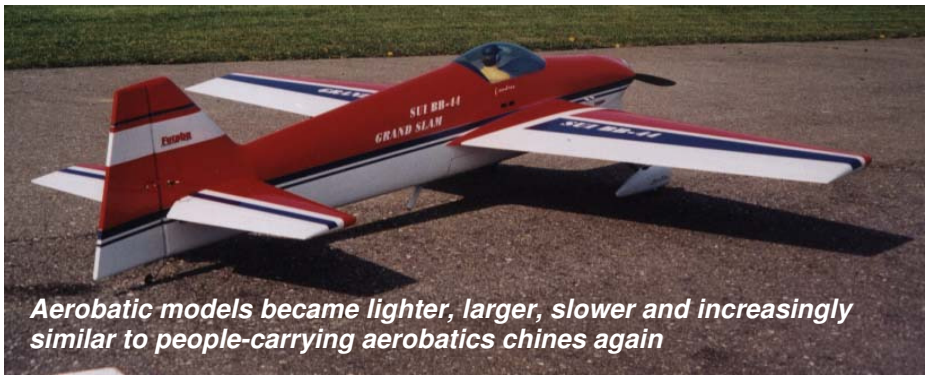
Free-flying powered models unintentionally performed aerobatics manoeuvres

the builder and probably to the delight of the non-professional public. When control-line flying was later introduced, the first loop was apparently also a surprise – no one knows for sure. In any case, the first official powered aerobatics category was created for control-line flying which is still hugely popular around the world.

Aerobatics with control-line models enjoy huge popularity

The Influence of RC Remote Control
The first radio-controlled aerobatics models could be admired in the nineteen fifties. However, RC equipment at the time was relatively unreliable, so that only the pilot himself would know whether a just-performed manoeuvre was really controlled or came about "by accident" due to a failure of the RC system. The first World Championships in RC aerobatics were held as early as 1960 in Dübendorf, Switzerland. The model airplanes were purely purpose-built, in most cases designed and built by the competitors themselves. As engine performances were a fraction of what they are today, the aircraft were built to be as lightweight as possible using balsa and plywood. Individual manoeuvres were flown slowly and gently and due to low engine performances were so small, that they would be judged as unattractive by today's standards.

Orion, typical aerobatic model airplane 1960



Aerobatic models became lighter, larger, slower and increasingly similar to people-carrying aerobatics chines again

The Jet Look
This changed hugely in the seventies, when engines became more powerful: The aerobatics machines got faster and faster, the manoeuvres got larger and the entire flying space was almost half a kilometre in length. The manoeuvres were performed in the middle of the airfield in front of points judges while the left- and right-hand ends were used for generous dives to pick up speed in a big way. In time, the flying style increasingly resembled that of jet airplanes and ultimately the models being used were also built to look like fast military jets. Plastics were increasingly used in the construction of these planes. The models tended to be heavy and had the severe disadvantage that they accelerated massively during vertical downwards manoeuvres. More or less successful attempts were made to counteract this with braking flaps of all kinds and variable pitch propellers.

Three fast "Jet Look" aerobatic model airplanes 1975 - 1985

The Solution
The development described above brought with it so many disadvantages, that in the mid-eighties the responsible committee of the International Federation FAI decided on a new way forward for this powered aerobatics category, that was classified as "F3A": Instead of flying only one manoeuvre in the middle of the flying space, the turning manoeuvres at the left- and right-hand ends were also defined and included in the scoring. In addition, the flying space was severely restricted. With these changes, the fast and heavy machines no longer had a chance and models became lighter, larger, slower and increasingly similar to people-carrying aerobatics chines again. Engines that achieved their performance not due to high speeds but through torque – these include four-stroke engines in particular – became more and more popular.

The Quiet Revolution
Although the revolution in aeromodelling by the electric motor had already started more than thirty years previously, it is only in the last few years, that this quiet and clean means of propulsion has become properly established in powered aerobatics. The main reason was not to do with the performance of electric motors but the duration of an aerobatics programme of eight to ten minutes and was thus a problem for the energy store. For flights of this duration, the weight of the batteries would have been at least five times that of liquid fuels. The crucial turnaround was only achieved with the new generation of batteries. A modern battery pack with lithium cells for an aerobatics model only has approximately twice the weight of corresponding liquid fuel. Most electric motors are lighter than combustion engines and have no need for a complex silencer system.

New generation of F3A aerobatic model airplanes

Thus, the electric motor has now become a firmly established element in powered aerobatics. Beside low noise emissions and cleanliness, aerobatics freaks deem it to have further significant advantages such as its ease of operation, finely controllable power during manoeuvres as well as high torque which lets the aircraft be accelerated more or less from a standstill. The models themselves have been perfected over the last few years and have mutated from copies of large aerobatics machines to pure purpose-models.

You will find more informations on www.fai.org/aeromodelling/f3a