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Annual Report 2013

CIAMFlyer
The Introduction to the Modelaircraft World
FAI AEROMODELLING COMMISSION
No. 1-2013

Flying in an Unbelievably Blue Winter Sky

For many years, model airplanes have been flown in wintertime on the frozen lake in Davos in the Swiss alps. The conditions may be a bit special but are not nearly as nasty as aeromodellers in warmer hemispheres may think.

Thermals when flying in Winter?

"These are less likely in midwinter – but ridge and wave soaring from the bottom of the valley are possible," says a local model pilot, "but the stable weather conditions bring high-altitude winds in which we can sometimes – keeping a safe distance from the mountain – fly to very high altitudes with lift continuously increasing with altitude". A variometer is useful for these flights but not essential, as visibility is excellent. The pilots of large model gliders point out that visibility depends more on wing width than span and give an approximate value for an altitude that still allows for good visibility of 4000 times the wing width. Thus, a glider with a wing width of 20 cm can be easily controlled at altitudes of up to 800 m. Sometimes it can be dead calm on the lake while snow is blowing off the summit ridges. Such snow banners are not to be feared – on the contrary – the glider has to get there first! Thermals over the continuous covering of snow usually start occurring in March. They often become detached over the first snow-free wooded areas and become more powerful with increasing altitude. Local model glider pilots say a big weather risk that has to be taken seriously is presented by cirrus clouds (altostratus). "Locally, they can develop with tremendous speed and if you are flying at 800 m with a purely white glider, you will very suddenly have a visibility problem", explains one of the pilots; "...and that caused me to lose a large glider last year," sighs his friend. But this is clearly outweighed by the advantages: for one, there is the soft blanket of snow which has saved any number of models. It covers the entire landscape like a single foam carpet and if you're lucky it will absorb even vertical impacts to a degree that no or only little damage occurs.

The effect of the cold

Local model flyers comment that many can't understand how surprisingly warm it sometimes feels. They explain that body heat is not dissipated by air but only by moisture in the air. "One winter, the air in our high mountain valley had only 4% relative humidity at a temperature of -16 °C – this corresponds to a water vapour content of 0.02% RH (!) at +25 °C. Such dry air can hardly be generated technically" claims one of them and adds, "on that day, we were flying without gloves". At other times, it can also be remarkably warm as long as winds remain light (which, in winter, is often the case in the valleys) as the surrounding walls of snow additionally reflect the sunlight. However, standing in the snow for hours on end does lead to cold feet. Fur-lined waterproof boots are recommended.

Altostratus can develop with tremendous speed

Snow is blowing off the summit ridges

There's nothing quite like it

"After seeing your snow-white glider being towed up into the deeply blue sky for the first time, you'll be hooked", says one of the pilots and adds, "For us alpine aeromodellers, flying in wintertime has become almost more important than ridge soaring, although we are surrounded by locations with excellent ridge soaring conditions".

Cold and dry air -16 ° C flying without gloves

Flying with skis

Photographs: Bertram Radelow

Editor: Emil Giezendanner
editor@modellflugsport.ch

Preparation on the model aircraft

Taking off and landing with floats works well in deep powder. On a compacted snow surface or even ice, floats with a hard surface must be used. Balsawood with foil is immediately abraded and EPP also suffers. Two variants are recommended for skis: Shorter ones with poorer directional stability for scale models and long narrow skis for the remaining models. The latter can be the tips of downhill or cross-country skis. A large model with a 200 cm^3 engine has even been equipped with complete downhill skis. Towing on snow is like flying on water. Snow will enter the fuselage through unbelievably small gaps and pool on the bottom of the fuselage, which is why moisture-sensitive components such as receivers or controllers should not be mounted on the bottom of the glider fuselage body. On gliders with retractable landing gear, the landing gear openings must be sealed off with fabric tape. Tail wheels must also be well taped off, otherwise they can act like small shovels that soon fill the tail tube with snow. Experienced alpine pilots also advise against using nickel metal hydride (NiMH) batteries for powering receivers and instead recommend lithium polymer (LiPo) or lithium iron phosphate (LiFePO) batteries, with the latter causing no problems. Batteries for the propulsion unit are brought along in an insulated box equipped with hot water bottles.

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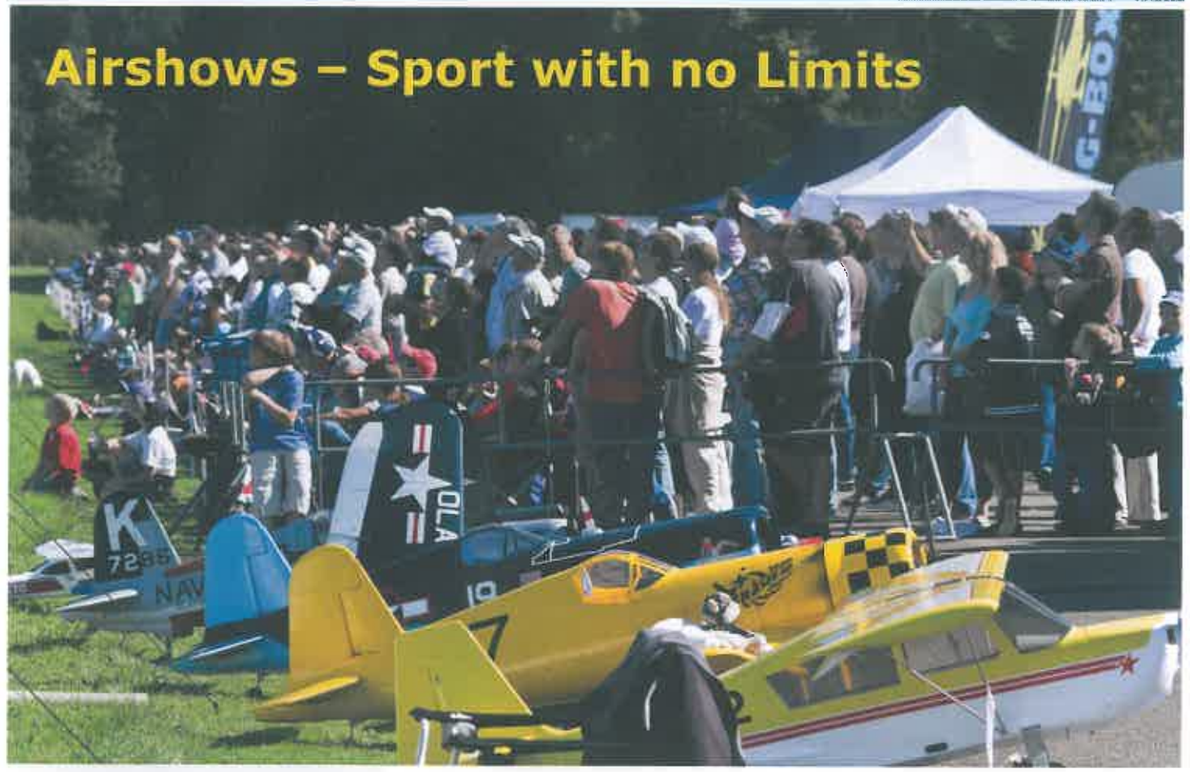
Airshows – Sport with no Limits



It is often thought that aeromodelling only ever involves seconds, metres and performing geometrically precise aerobatics manoeuvres as accurately as possible. In our modern society, this limited perception of the term "sport" is no longer relevant. On the contrary – in this day and age, the sport of "aeromodelling" has to be understood much more broadly. It can involve anything from aerobatics with a simple and cheap ready-built model to the creation of the most imaginative and elaborate aircraft designs.

Airshows attract spectators

Every year, there are numerous shows with aircraft controlled from the ground. At these events, pilots control their machines with the same professional skill as their colleagues sitting in real cockpits. These airshows provide excellent insights into the variety and unlimited scope for imagination of aero-modelling. Unlike official World Championships and other competitions, such shows are able to attract tens of thousands of spectators who are not only interested in flying but always show great enthusiasm for the creativity and tremendous spectacle being displayed. The versatile entertainment schedules don't just consist of scaled-down and very realistically reconstructed old and modern aircraft but also include performances with assorted amusing and sometimes even weird flying machines. These include limbo, air racing, fox hunting and balloon bursting, which frequently draw collective exclamations from the crowd.

Indoor airshows are conquering the world

In the last few years, indoor meets have become increasingly popular. New and

cheap materials along with the miniaturisation of electronic components have led to an almost explosive acceleration of creativity – especially among younger people. The weight of modern efficient propulsion systems, consisting of motor, power supply and propeller is only 20 to 30 grams. The receiver also weighs only a few grams. Foam materials are easy to work with and mostly minor damage due to crashes is easily repaired. We can think of little that is more attractive and meaningful than young people showing enthusiasm and using their imagination to explore the limitless world of aviation. Artistic expressiveness combined with delicate craftsmanship is always something to marvel at. Then there is the art of flying itself, where many attempts result in setbacks that have to be overcome and which requires complex considerations of flight mechanics and aerodynamics. All these aspects of aeromodelling cannot be appreciated enough and make an excellent change and complement to computers and other screens and purely intellectual work.

Freestyle aerobatics pilots are artists

Freestyle aerobatics demonstrations accompanied by music are a relatively new phenomenon in aeromodelling and are particularly popular with young people. Similarly to other freestyle sports, many of them clearly want to distance themselves from the traditional competition aerobatics and avoid even the most casually organised competitions in favour of informal meets. Breakneck stunts accompanied by wild music with changing tempos are popular. Demonstrations during airshows or freestyle events – frequently with spectator appraisals – are among the main attractions on offer from the youngsters in aeromodelling. It cannot be emphasised enough that these aircraft are built with very modest financial investment – unlike those used in outdoor freestyle aerobatics where the pilot has to spend far more on propulsion and aircraft. However, most 3D planes built from wood and covered with foil, are generally much cheaper than specialised aerobatics machines. Freestyle demonstrations accompanied by music – including as part of airshows – are very popular with spectators and frequently trigger spontaneous applause.

You will find rules for freestyle aerobatics in the FAI Sporting Code, Volume F6 Airsports Promotion (F6A Artistic Aerobatics and F6B AeroMusicals) **www.fai.org/ciam-documents**

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Electric jets – an interesting contradiction

Aeromodellers have long ago implemented a concept that is – at least to date – not possible in people-carrying aviation: faithful reproductions of jet aeroplanes with electric ducted fan, EDF

The ducted fan principle – as old as jet aeroplanes

The desire to build model aircraft that externally resemble people-carrying jets as closely as possible is probably as old as the invention of the first aeroplanes with jet engines nearly 75 years ago. Thus, the idea of placing the propeller in a tubular housing and integrating the assembly in the fuselage of the model aeroplane was fairly obvious. The concept of the "intubed propeller" was developed in the 1930s by Italian aircraft engineer Luigi Stipa (1900 to 1992) and trialled in practice from 1932 with various bizarre-looking Caproni-Stipa experimental planes. To this day, the principle is considered an important step in the development of the jet drive.

Bizarre-looking Caproni-Stipa experimental plane

The ducted fan principle →

It started with combustion engines

The first jet models were equipped with either JETEX or Pulso engines, both of which had multiple drawbacks. Long before electric propulsion became established in model aviation, the impeller principle had achieved remarkable technical sophistication and had become very popular. Interest in scale reproductions of military and civil jet aeroplanes was significant. In the United States, U.S. Navy jet carrier pilot Bob Violett began building ducted fan jets with combustion engines as early as the late 1970s. As these engines were initially less efficient than conventional propeller engines, his models were built to be extremely lightweight. In 1980, the company Byron USA launched a beautiful F-16 which, in a short time, also made ducted fan flight popular in Europe.

Electric motors become the obvious choice

With the emergence of electronically commutated (brushless) motors (the first ones that could be used in aeromodelling were made in 1994 by Aveox, USA) the use of combustion engines for impellers became increasingly rare. They had too many disadvantages compared to electric motors, such as problems with starting and also cooling.

Aeromodellers began to build their own electric ducted fans

Modern electric motors have low vibration, start at the push of a button and can easily cope with the rotational speeds required for ducted fan. Even more than ten years ago, aeromodellers who had experience with electric propulsion systems began to build their own electric ducted fans.

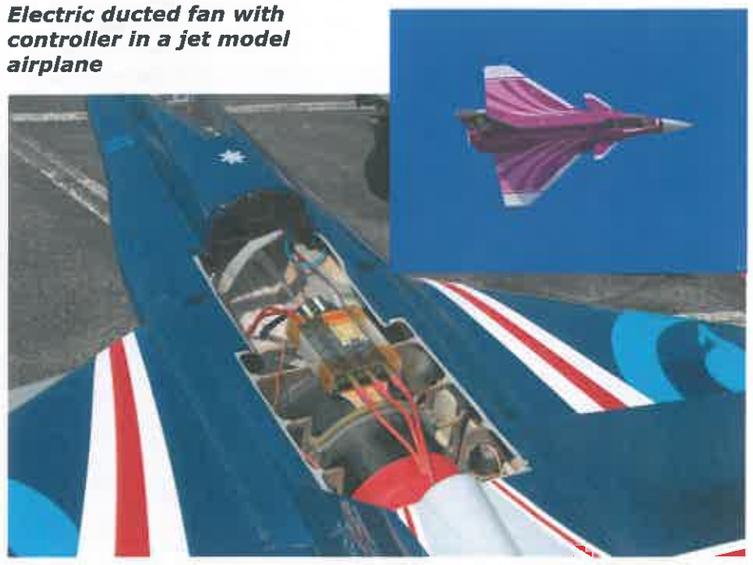
In addition to carbon fibre reinforced plastics, wood and metal were also used for both turbines and stators. It took only a few years for a large international community of electric jet aeromodellers to emerge. The term "EDF" for electric ducted fan was adopted by the numerous manufacturers of propulsion systems and jet models.

High tech ducted fans conquer model jet aviation

Improved ducted fans are continuously being developed by various manufacturers around the world. Improvements include not just power increases but also reductions in noise – modern jets running at speeds of 20,000 to 40,000 rpm only generate a pleasant humming noise.
With a ducted fan weight of less than 1.5 kg, static thrust can be as high as 100 to 150 N. This means that electric turbines can match gas turbines in terms of power and weight. Although there is still a large difference in the power densities of batteries and kerosene, EDF propulsion systems are becoming increasingly popular due to their easy handling. There is hardly a jet plane that hasn't been reproduced. The spectrum ranges from small mini jets weighing only several hundred grams to large multi-engine machines weighing 10 to 20 kg. The world of electric jets has no limits – do you want to be part of it?

Potographs
D. Schuebeler
H. Mettler

Electric ducted fan with controller in a jet model airplane



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How aeromodelling can boost a career

The realisation that hobby and career can benefit each other is not new. Aeromodelling as a highly technical hobby and demanding sport presents a particularly large number of synergies with career and work. Many remarkable examples can be found in the technical trades and professions, one of which is CNC operator, Rogers.

CAD system showing the strut support of the SR-71 main undercarriage on the screen.

Design and construction of a model airplane provides motivation for learning

When the company that employs Rogers as a CNC operator acquired a completely new machining centre, they supported Rogers through an intensive training course: During working hours he designed and manufactured workpieces such as turbine blades. After work and on weekends he was able to use the same manufacturing process to make components he needed for his model airplane. Creating solid models of workpieces with complex shapes is a very challenging task for any designer. To familiarise himself more with this demanding subject, Rogers designed numerous new assemblies for his SR-71 such as undercarriages, frames, battery holders, etc. – plus a fully equipped transport trailer with custom-made racks. All this work carried out in his free time let Rogers acquire impressive in-depth skills and know-how in a much shorter time than normally expected.

A win-win situation

The benefits of this collaboration for both sides are obvious. The company has gained a qualified employee who is capable of independently carrying out the entire manufacturing process from electronic drawing board to a complete machined workpiece. With this background knowledge, the Kaplan blades for three turbines for a small hydroelectric plant could be manufactured in a short time. Thus, the customer, the company and Rogers benefited from this very special kind of co-operation. And Rogers as an aeromodeller had an ideal opportunity to design the complex mechanical components often required for scale models himself and manufacture them in the highest quality.

Rogers's workplace is a modern five-axis machining centre. This is where he designs and manufactures many Blackbird components in his free time.

Product of profession:
Kaplan turbine for water power

LED rings imitate the afterburners.

Impressive model of the twin-engine SR-71 Blackbird

Product of hobby:
All components for the undercarriage test rig as well as the mounted undercarriage were made using the machining centre

The SR-71, an exceptional aircraft

The SR-71 Blackbird was built in the 1960s by Lockheed in the USA as a fast reconnaissance aircraft and even the original was an exceptional aircraft. The replica is no less special. Rogers's model is over three metres long and weighs nearly 20 kg. It is equipped with two BF-300 turbines that provide the model with a total thrust of 60 kg. LED rings at the outlet simulate the afterburners. This long black flying tube impresses lay persons and experts alike.

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Facts and photographs: H. Mettler
www.fai.org/aeromodelling/ciamflyer
Editor: Emil Ch. Giezendanner · editor@modellflugsport.ch

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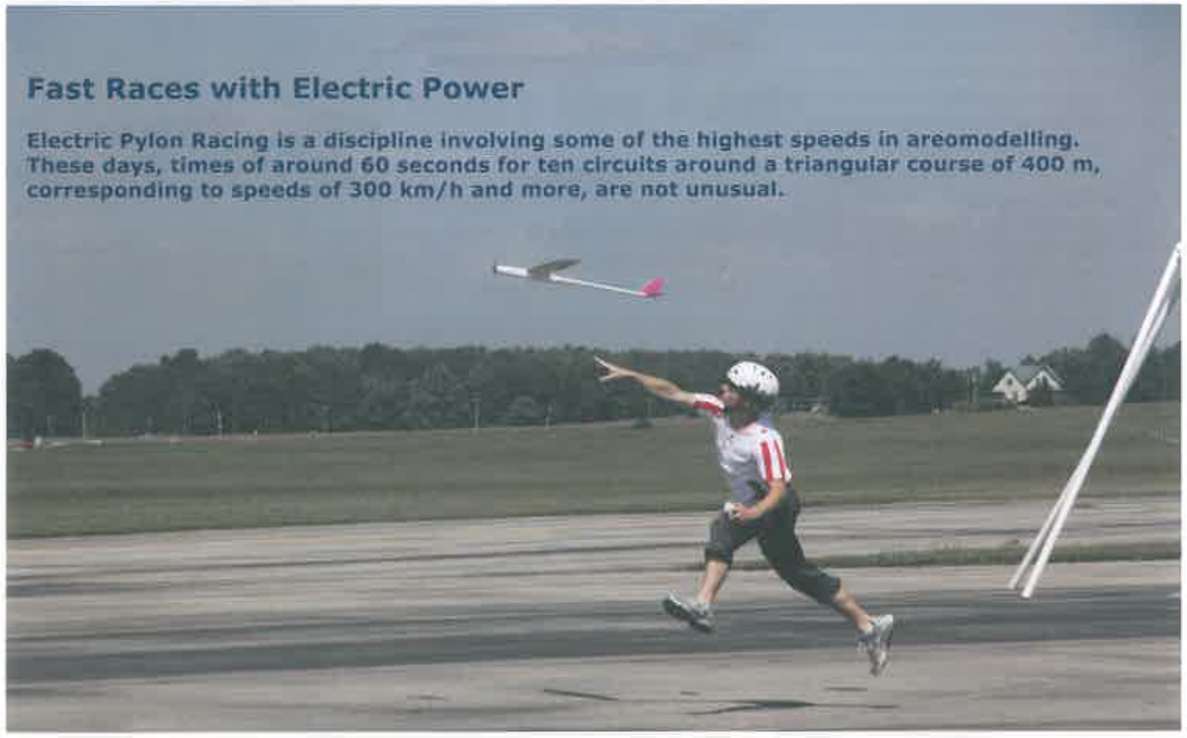

Fast Races with Electric Power

Electric Pylon Racing is a discipline involving some of the highest speeds in areomodelling. These days, times of around 60 seconds for ten circuits around a triangular course of 400 m, corresponding to speeds of 300 km/h and more, are not unusual.

Back to Basics

Pylon Racing models in the early days of electric flying were built in a similar style as models with combustion engines. They were large heavy lumps weighing 2 kg and more and powered with nickel cadmium batteries (with voltages of up to 45 V). Current rules make for much smaller and lighter models which is an advantage, not only for transport, but also for take-off and landing as these models, unlike corresponding ones with combustion engines, don't use wheels to take off from a runway but are launched by hand. This makes racing events independent of paved airfields.

Official FAI World Championships since 1994

The first World Championships for electric Pylon Racing models were held in 1994 in Australia. At the time, it wasn't so easy to convince aeromodellers that, in addition to the classic Pylon Racing categories, there should be a separate racing category for electric models. For many years, standards were set by competitors from Germany and the USA – not least due to the technical headstart of some manufacturers of electric motors. This has changed in recent years and the situation is more balanced, as the market now offers a wide range of high-performance motors.

The geared motor – the centrepiece of the racing model with folding propeller (as models land on the fuselage) – which makes the models very quiet, the speed controller and the data logger for measuring energy consumption.

High Energy Efficiency

The remarkable thing about this racing category is the fact that it's not about brute force but about lightweight design and energy efficiency. These days, F5D Pylon Racing models, as they are officially called in the FAI rules, weigh only little over one kilogram and a data logger restricts energy consumption to 1,000 Watt*min. Once the energy is used up, the motor stops. This means that prudent use of the available energy is paramount.

A relaxed outfit, tough competition and good comradeship

Pylon Racing with Electric Motors is Increasingly Quiet

When it comes to optimising propulsion systems, improving the propellers plays a vital role. Larger diameter propellers are more efficient but their use is almost impossible without reduction gearing. Larger but more slowly rotating propellers are not only quieter but are also less susceptible to damage as they fold back when the model lands.

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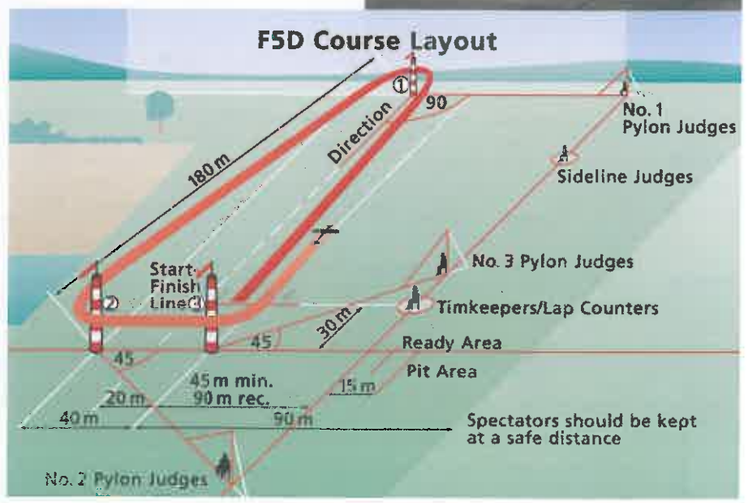
FAI Electric Pylon Racing Rules see http://www.fai.org/aeromodelling

→ Smaller and lighter F5D model airplanes are launched by hand.



Pylon Racing requires lots of space

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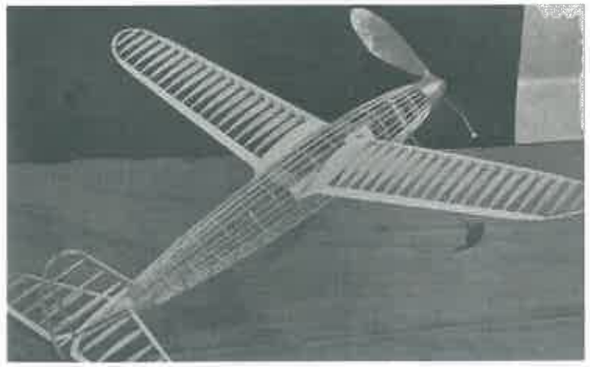
No Future without the Past

Due to its versatility, aeromodelling is in the fortunate position of constantly providing opportunities for attempting new things at relatively modest expense and thus sowing the seed for future developments. It is often forgotten that the foundations for most modern achievements were created many years if not decades in the past.

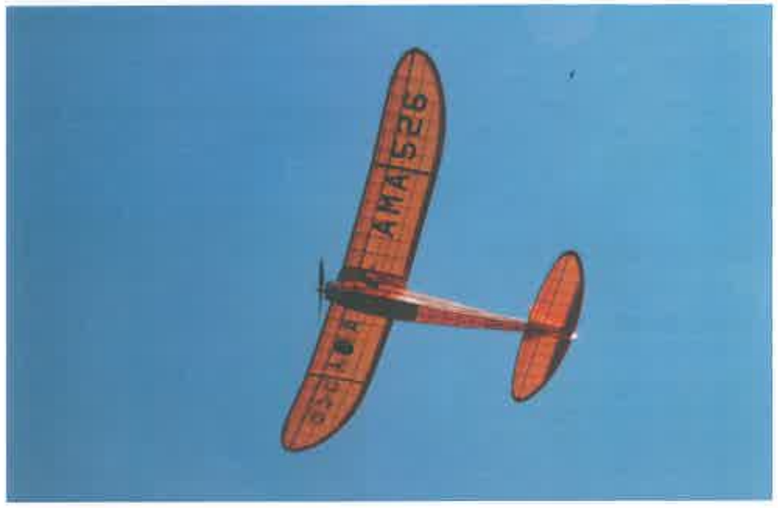


Wakefield rubber powered model airplane 1940

Modern competition model aircraft with extensible motor (Class F1B)

Retro Movement

Amongst other things, the retro movement in aeromodelling should be seen as a counter-movement to ever faster changes. These days, aeromodelling is faced with new technical applications and technologies emerging at an increasing rate. Miniaturisation in electronics and computer technology combined with tremendous increases in power not only make aeromodelling accessible to everyone but sadly also lead to lack of permanence and the throw-away mentality found with other consumer items. It is only logical that this strengthens the desire for permanence and retrospective. It is interesting in this context, to see how creative new ideas keep emerging from past experiences.



Let's look at the classic example of designing and building wooden models.

Competition rules sidelined?

For decades, national and international aeromodelling organisations have been following the sporting "philosophy" whereby flying performance should be achieved mainly through the individual competitor's tactical ability and his skill in controlling his model. The use of technical aids was strictly limited. This policy is finding itself increasingly under pressure, especially in the case of competition regulations that have been maintained with great effort in an attempt to prevent the use of latest technologies. This is questionable when technologies are readily available for anyone at affordable cost. It is of vital importance to cast one's eye back into history, as aeromodelling would never have reached its current high standard if this "prevention strategy" had existed earlier. Aeromodelling had always been more or less in step with technical developments but the latest achievements in electronic sensor technology, stabilising and navigation technology raise the question whether this is still appropriate. There is plenty of scope for heated discussion as to how much and how long technical progress can be prevented in a technical discipline such as aeromodelling.

Encouraging the combination of old and new

The history of aeromodelling provides a huge potential in expertise and experience. Let's look at the classic example of designing and building wooden models. The use of CAD (Computer Aided Design), computer aided cutting of wooden parts or the manufacturing of components using 3D printing ensure that self-building model aircraft is as fascinating as ever. It is a huge opportunity for our generation of computer geeks to swap the screen for the workshop and create something with their own hands. Or let's take a look at young gamers – wouldn't it be great if we could get them to occasionally swap the console joystick for that of an RC transmitter and fly a model aeroplane outdoors and far from the computer screen? We could set up aeromodelling classes where craftsmanship and aerodynamics are taught along with advanced programming skills thus combining the virtual and practical worlds of aviation. Wouldn't that be a great future for aeromodelling?

1960

Model aircraft engines for RC Aerobatics

2000

Computer aided cutting of wooden parts

Get them to occasionally swap the console joystick for that of an RC transmitter and fly a model aeroplane outdoors and far from the computer screen

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Editor: Emil Ch. Giezendanner

editor@modellflugsport.ch