FAI AEROMODELLING COMMISSION

CIAM Flyer

Annual Report 2014

CIAMFlyer

Introduction to the Model Aircraft World

FAI AEROMODELLING COMMISSION

No. 1-2014

To compensate the assymetrical forces

Around the era of 1950 some single engine fighter planes were fitted with two contra-rotating coaxial propellers in order to compensate the serious troubles caused by the assymetrical forces of their extremely powerful piston engines, normally swinging just one huge propeller. Mostly the late production Spitfires, determined to operate from aircraft carriers, were powered that way and are a nice example for this development.

Forgotten completely

Although the concept could really resolve the problems it was aimed to in quite a few projects, success was limited to the insufficient rigidy of the complex gearboxes, while the tremendous forces caused by the two propellers plus the destructive vibrations from the piston engine just loved to shake such drives apart. Moreover at those times, jet engines were coming-up widely and high performance piston engines were dropped from the wish lists finally. The coaxial drive wasn't forgotten completely though, since in later years a few multi-engine aircraft employed contra rotating props combined with turbo-prop engines while taking advantage of the higher efficiency over single prop systems. Finally, contra rotating rotors are a quite popular answer to the specific requirements in helicopter design.

F3A Application

As an active F3A-competition pilot always eager for higher scores, technical refinements must help me to compensate what skill can't achieve. My experiences with electric drives in F3A finally lead to the idea to pick- up the contra-rotating propeller (coaxial drive) system with the target to improve in-flight appearance and to facilitate model airplane control as much as possible from the propulsion's side. In this article I avoid to bore readers with the full history of crucial experiences , the numerous hours invested in CAD-design, component machining and test flying with an almost uncounted variety of propeller combinations. Instead I will concentrate on the basical technique and significant properties of my coaxial drive system, named „E-Factor E-F-503".

Technical Set-up

One brushless electric motor (Hacker C50 modified) matched to a double stage gearbox

(E-Factor) with two coaxially positioned output shafts, driving two contra rotating propellers (E-Factor) of 22" diameter.
System mass including two propellers and spinner (less ESC): 875 g Propeller rpm each at max. power static: 3.800 rpm Input current at max. power static: 85 A. With this fact in mind, it just seems logical to ideally seek for a propulsion which works as symmetrical as everything else is doing in F3A model airplanes: A coaxial drive propulsion. But does it really work symmetrically? Is the rear propeller able to produce the same thrust as the one in the front? And if so, do they rotate at the same or at least almost same rpm? All these questions can be simply answered with „yes". To explain a complicated and not linear science like aerodynamics is too much for here, but to imagine that the the front propeller accelerates or compresses the air in a spiral stream backwards and that the rear propeller runs right into that in the opposite direction, deliveres a vital coherence of the systems' function. Of course, the mechanical layout of the gearbox had to be designed to produce upon conditions and to sufficiently resist the forces created by the mighty 22" propellers and the powerful motor. Also, the drive had to be designed in a way the two propellers would not work against eachother, which would result in significant loss of efficiency.

Particular effects of a coaxial drive in aerobatic flight

Due to the equal share of torque between the two contra rotating propellers, no torque (or counter torque) is transferred from the motor to the model airplane.

Propeller Airstream

The spiral airstream around the longitudinal axis of the fuselage normaly created by a single propeller is compensated and straighted here by the second propeller. As a matter of fact, there is no side thrust necessary, the motor is installed absolutely straight into the fuselage. All that results in a smooth and straight propeller airstream, in parallell to the fuselage and delivering a practically symmetrical air flow as well as along fin and rudder.

Gyro Effect

When an airplane with a single propeller system is pulled or pushed into a loop the propeller's gyro forces yaws it to one side, applying some rudder resp. elevator deflection. With a correctly operating coaxial drive, the gyro forces from the two contra rotating propellers are compensated to zero.

P-Factor

In most flight conditions the model airplane doesn't head exactly in parallel to the environmental air movements, i.e. under crosswind influence or pull/push or yaw conditions. As a result, propeller blades going through one radial sector of the propeller disk work with a higher induced pitch than the blades going through the opposite sector at the same time. With a single propeller this creates an assymetrical pull force tending the model airplane to deviate from the ideal flight path. With a coaxial drive, this effect is compensated by the second propeller.

Airspeed Potential

To achieve best propeller efficiency, the diameter should be large and to achieve a high flying speed, especially in strong wind conditions, a high pitch is necessary at reasonable rpm. With a single propeller system the increase of diameter and pitch would simply increase all the upon mentioned disturbing assymmetrical influences, but with a coaxial drive the compensation of all the nasty propeller forces allows to employ much larger diameter and pitch.

Airbrake

The coverage of the propeller disk is doubled by the blades of the second propeller, and in combination with large propeller diameters this results in a significantly increased brake effect in vertical downlines. A very nice feature to achive a constant speed flying style.

Soft Sound

The combination of large diameter, high pitch propellers, operating at relatively low rpms produces a low and soft sounded propulsion, rather suggesting a multi cylinder piston engine installed than an electric.

The Coaxial Drive in F3A Competitions

The first time I used a prototype of the E-F-503 coaxial drive set-up in the competitions to the German Championships 2006. It was installed in my unique „Excalibur", personally built by Günther Ulsamer for me. I was lucky to finish 8th, 12th, and 5th that year.
In 2007 I employed a refined prototype in an ZN-Line „Oxalys", however, flying was very limited that year due to my job committments.
Among the world's top pilots it was the Italian Champion Sebastiano Silvestri, who had smartly discovered the potential of my coaxial drive that same year and it was an exiting experience to have it installed in his SebArt „Angel" and to see him very successfully finish 5th at the 2007 F3A World Championship in Argentina.

What Came Next

Based on these great results, my cooperation with Rainer Hacker and Sebastiano Silvestri resulted in the production version of the E-F-503 and it is a pleasure to see the system being used by an increasing number of F3A competition pilots year by year. Meanwhile it helped Sebastiano and a number of other pilots to succeed splendidly in various competitions and championships like young pilots Marco Mazzucchelli or Robin Trumpp to finish German F3A Champion twice in 2012 and 2013 and settling among the top ten at the F3A World Championship in South Africa. F3A World Championship in South Africa.

By Michael Ramel, active F3A competition pilot having introduced electric propulsions in 2x2m F3A models in year 2000, currently Chairman of the FAI/CIAM Subcommittee F3 R/C Aerobatics comprising classes F3A, F3M. F3P, F3S.

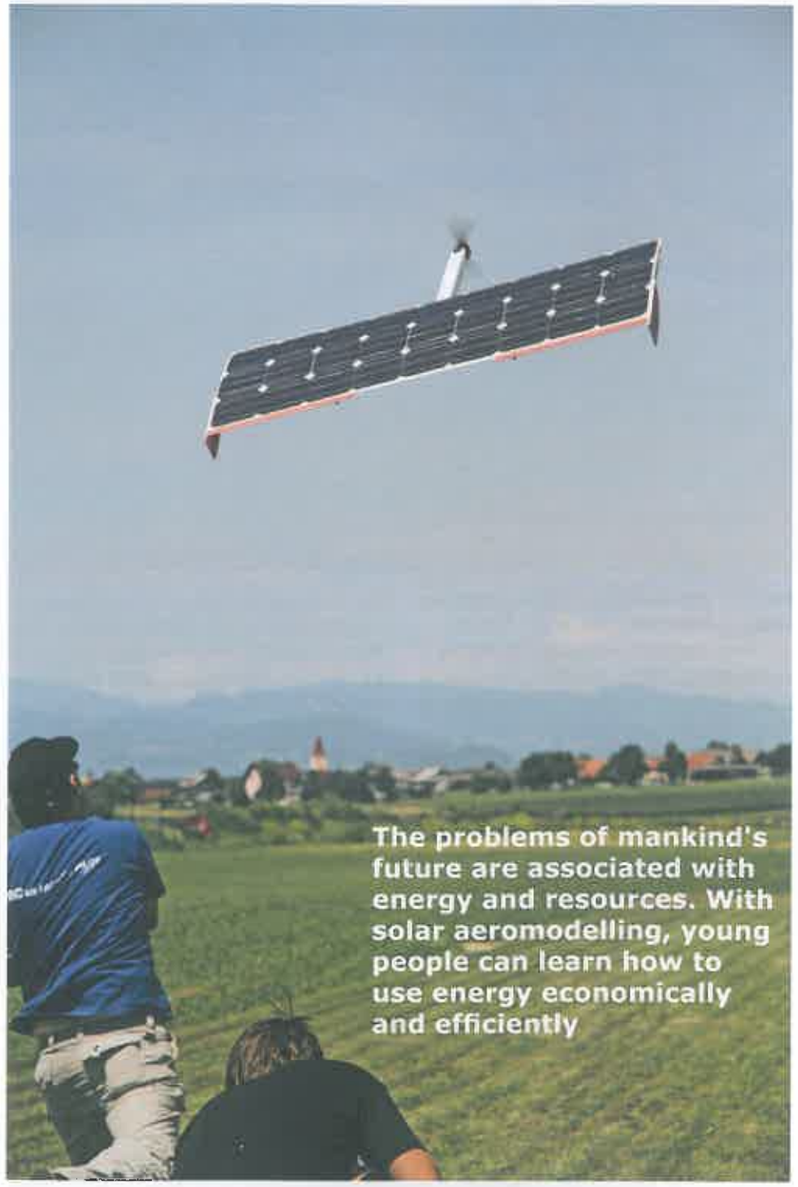
Public Letter 1/2014
www.fai.org/aeromodelling/ciamflyer
Editor: Emil Ch. Giezendanner
editor@modellflugsport.ch

FAI AEROMODELLING COMMISSION

CIAMFlyer

Introduction to the Model Aircraft World

No. 2-2014



There's nothing wrong with theory, especially when it can be experienced in practice

Designing and building solar-powered model aeroplanes requires in-depth understanding of the energy differential for the entire propulsion system and the issues associated with the aircraft structure. Dedication to lightweight construction is required in combination with static solutions that allow the strongest design possible.
Students at the Vega college of electrical engineering in Slovenia have built a solar-powered model aircraft. They observed the regulations of FAI category F5E ELECTRIC SOLAR MODEL AIRCRAFT (maximum surface area: 75 dm2; max. voltage 42 V).

Students of the Vega College, Slovenia

Aeromodellers as pioneers of aviation

Flying with solar energy will occupy us over many more decades to come. Aviation history teaches us that many aviation pioneers were aeromodellers and the development of solar-powered aeroplanes is no exception. The basis for this was provided around 1905 by Albert Einstein, when he discovered the photoelectric effect which can now be experienced by youngand old when designing and building solar-powered model planes

The propulsion system must be powered only by photovoltaic cells while the remote control unit may be powered from a separate battery. Roman Lozar, who was involved in the project has written about it: „As far as I am concerned, our efforts were a pioneering feat and we were able to prove at the Vega college that it is possible and practical to build solar-powered aeroplanes in future. Of course we will continue with our work. We have made a film about our project which was broadcast by RTV Slovenija (national TV station) under the title „Sončne Sanje" (Solar Dream)".

Aeromodellers never stop learning

Last winter, 14 young and not so young aeromodellers responded to an invitation from the aeromodelling association to build a solar-powered flying wing model. They worked hard from 9 a.m. to 5 p.m. on three Saturdays and completed all models so they were ready for flying. These models have a small lithium-ion storage battery as well as a charge/discharge controller. Small LEDs indicate when the sun is charging the battery. The models were constructed from lightweight foam and flew splendidly. One of the pilots was pleased to report a flight of more than an hour's duration with an initial battery charge of 82% – and after landing the battery charge was more than 90%. His theoretical considerations have thus been confirmed in practice, which is always hugely satisfying, especially for young people.

Public Letter 1/2014
www.fai.org/aeromodelling/ciamflyer
Editor: Emil Ch. Giezendanner
editor@modellflugsport.ch

Written by Roman Lozar and Emil Giezendanner
Photographs: Roman Lozar, Hermann Mettler

CIAMFlyer
Introduction to the Model Aircraft World
No. 3-2014

The Oldest Remote Control Method Combined with Modern Technology

Gee Bee 1000 – the control line model with electric motor

The availability of very affordable R/C kits and/or ready-built models from robust EPP material1) make it possible to quickly and easily build simple electric-powered control line models.

Convert an RC model into a perfectly flying control line model

The Gee Bee 1000 is used to demonstrate how quick and easy it is to convert an RC model into a perfectly flying control line model. The propulsion components of motor, controller and timer are designed to be sufficient for a slightly larger model. The converted Gee Bee 1000 can be used as an entry-level model or for basic aerobatics training. With its unproblematic and very quiet motor, the Gee Bee 1000 can be launched from any area with short grass such as a football pitch. With a flying time of 1 minute and using a reduced speed, e.g. approx. 8000 rpm, only a little familiarisation is required to confidently fly the plane. However, the following must be observed:

- Only fly when there is no wind.
- Make sure you have permission to use the site.
- Spectators must remain safely outside the flying circle.
- A pilot with control line experience should be present for the first few flights.
- Reduce speed and do not fly higher than 3 - 4 m.

With EPP models, minor „incidents" do not normally result in a write-off.

Electronic components

Unfortunately, there are not many controllers on the market that come with a selectable „Control Line" mode. This allows operation with a constant controlled speed (Governor or Heli mode). When selecting a controller for larger F2B competition models, this is a basic requirement. To operate the

controller, control line pilots need a special component that generates suitable signals and transmits them to the controller via the 3-core servo cable to power it.

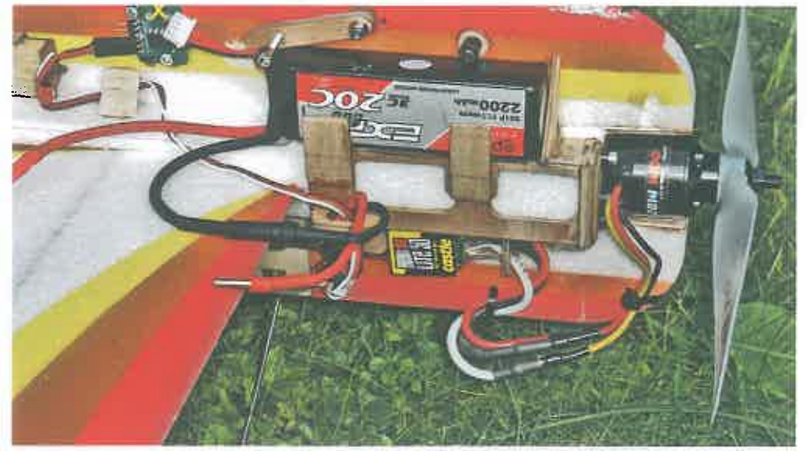
Other special considerations

Many electric-powered aerobatic control line models use left-handed propellers in a so-called „pusher" configuration to benefit from the influences of the airscrew's torque and gyroscopic moment. To compensate for the weight of the lines, a weight of approx. 25 g is attached at the outside wing tip. Levers, axes, etc. for steering control line models are available from specialised internet dealers

Aerobatic trainings

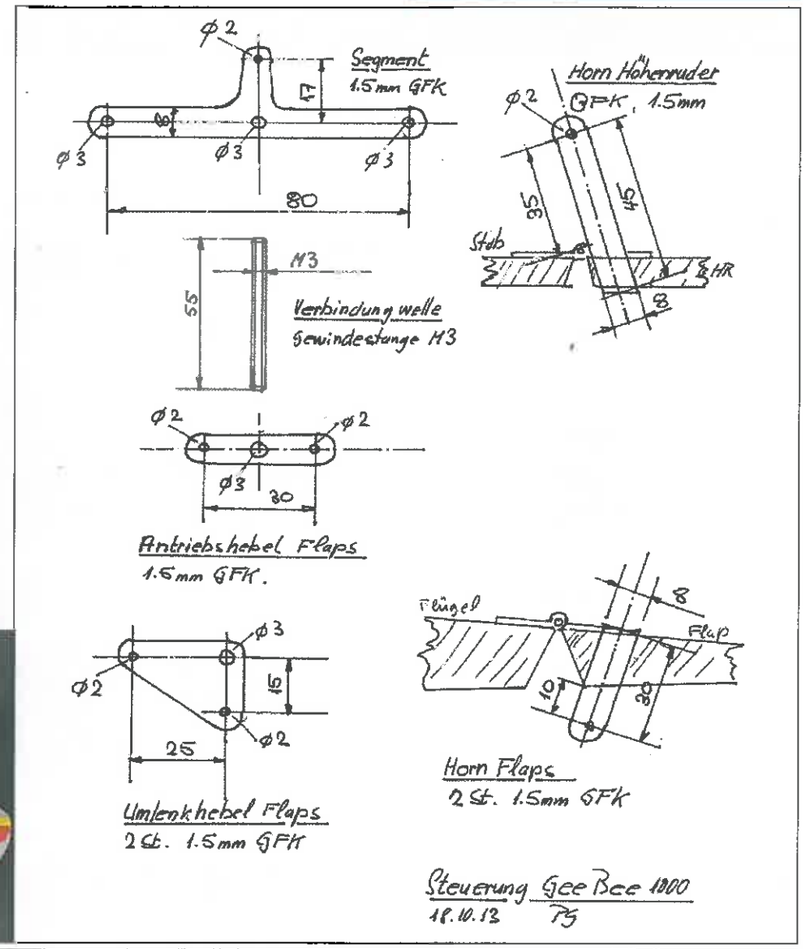
For the first few flights, it is advisable to limit the flying time to 1 minute and to adjust the motor speed to achieve lap times of approx. 4.7 - 5.0 sec of horizontal flight at an altitude of approx. 2 m. This way, a fully charged 2200 mAh battery provides enough power for four flights. A speed of 4.8 sec per lap allows tidy and well-controlled execution of all F2B aerobatic manoeuvres. To repeatedly practice individual manoeuvres, a maximum flying time of 4 min is sufficient. This is also the case when flying at entry-level competitions. The approaching end of the flying time is indicated by a brief drop in motor speed. In windier conditions, flights cannot always be well controlled and for F2B competitions a flying time of at least 5 minutes has to be possible. This requires a battery with a capacity of approx. 3000 mAh.

By Peter Germann, active control line aerobatic competition pilot



Public Letter 3/2014
www.fai.org/aeromodelling/ciamflyer
Editor: Emil Ch. Giezendanner
editor@modellflugsport.ch

1) Expanded polypropylene (EPP) is a polypropylene-based granulated foam plastic

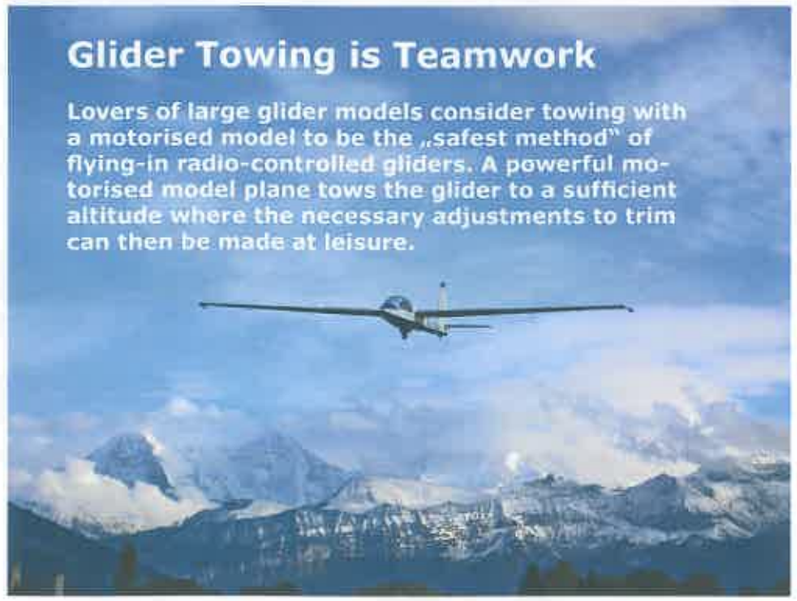


FAI AEROMODELLING COMMISSION

CIAMFlyer

Introduction to the Model Aircraft World

No. 4-2014



In terms of performance, large glider models cannot quite keep up with the specialised competition models – be it in speed and distance flying or in thermal flying, but they do have an elegant flight silhouette very much like the originals.

Active followers in various countries

Lovers of radio-controlled big gliders meet regularly in various countries. Such meets can be in the form of competitions, such as in aerobatics or GPS flying, or companionable events where experiences are exchanged.

What is a big glider?

Large glider model enthusiasts consider them to be model aeroplanes that are very similar to or very accurate scale reproductions of manned gliders. The technical term for such models is Semi-Scale or Scale model. Spans range from 3.75 (1/4 of the 15 m class) to 7 metres and more. They can be broadly divided into four categories:

- Vintage model gliders – from the time of wooden construction
- Modern high-performance planes in composite construction
- Aerobatic gliders
- Motor gliders

Vintage model glider – from the wooden time

Modern big glider composite construction

The larger meets are held in mountainous and hilly areas. In these centres of ridge soaring, even the largest models are launched by hand and landed near the launch site whenever possible. Using telemetry, even the weakest updrafts can be located, no matter how far beneath the launch site they are.
At meets held in the lowlands, on the other hand, large gliders need either a towing plane or are equipped with engines (very often folding engines) which make them autonomous, i.e. they can take off on their own.

Even the largest models are launched by hand

There is a lot to learn about towing

For towing operations on model flying fields, motorised planes of varying power are used, depending on the size and weight of the gliders. Towing planes with electric motors are also very well suited, although there are difficulties, especially regarding the batteries, when motors of more than 3 to 4 kW are required. Smaller motors are sufficient for effectively towing gliders of up to 10 kg. Modern and quiet combustion engines (very frequently boxer engines), however, can easily tow model gliders of 20 kg and more.

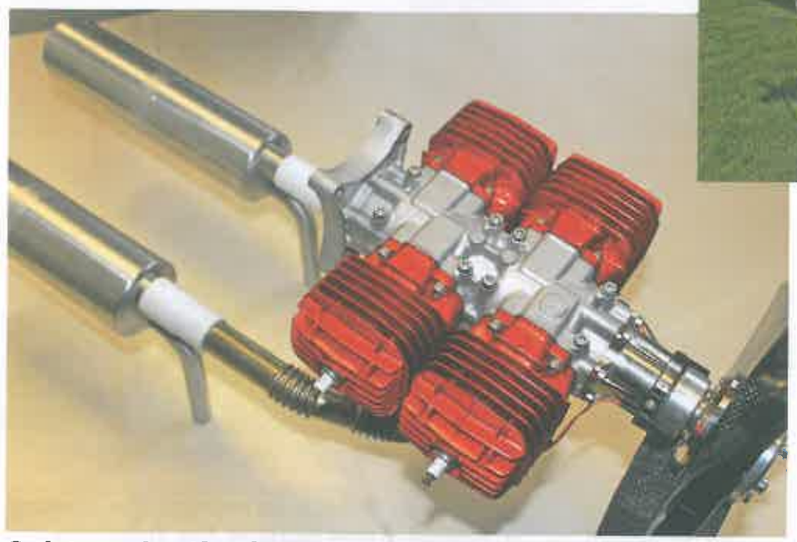
Winch to retract the towing line built in the fuselage

Very trendy: Big glider with electric motor

To prevent the towing lines from getting caught in an obstacle on landing, they are either dropped during a low-altitude fly-by or retracted using a winch installed in the fuselage. Only slow towing planes may be used for towing vintage gliders. Older aeroplane types such as the Piper are best.

Big glider towing model airplane can tow easely gliders of 20 kg and more

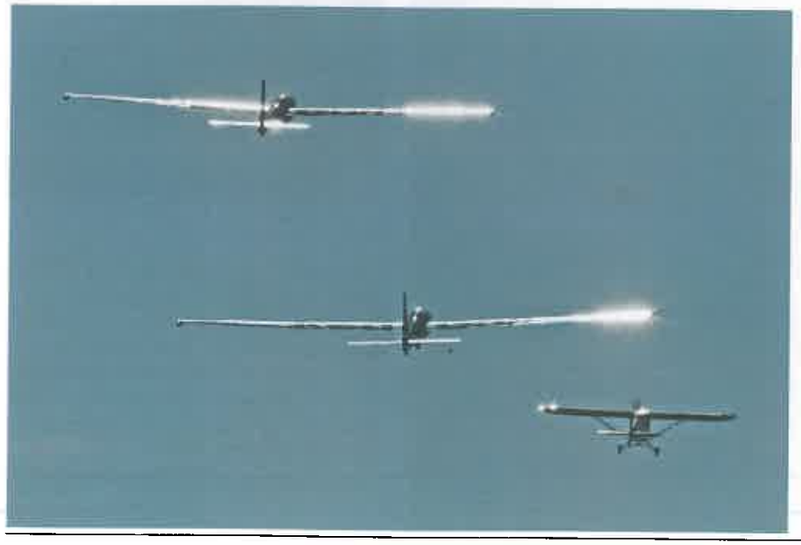
Only slow towing planes may be used for towing vintage gliders



Quiet combustion boxer engines for towing big gliders with silencers

Glider towing is also attractive for spectators

At large glider meets or at air show events, glider towing is always one of the most attractive demonstrations for spectators, who will appreciate a skilful start followed by a climb. Such events often include competitions for spectators, such as estimating the altitude at which the glider is released.



Double towing for a simultaneous aerobatic flight for spectatators

Public Letter 4/2014
www.fai.org/aeromodelling/ciamflyer
Editor: Emil Ch. Giezendanner

editor@modellflugsport.ch

CIAMFlyer

FAI AEROMODELLING COMMISSION

Introduction to the Model Aircraft World

No. 5-2014

Control Line Electric Speed Flying – a category for all those keen to try something new

In most modelling disciplines where models have lately been propelled with combustion engines – be it model cars, model boats or, of course, model aircraft – there is now an electric alternative. The emergence of brushless motors powered by lithium-polymer batteries has, no doubt, been a turning point in the development of propulsion motors in aeromodelling.

Class F2D, Combat – where two pilots fly simultaneously, each towing a ribbon with the goal of cutting the opponent's ribbon with their propeller piece by piece – competitions with electrically powered models are also already being held. And in Control Line Speed, the new class Control Line Electric Speed (F2G) was created two years ago. I would like to use the following story to raise the profile of this class.

Example of a model suitable for practising speed flying

Canard model with pusher prop

New class

• Class F2, Control Line Flying, has not been exempt from this trend. Many competitors in Class F2B, Aerobatics, have already converted to electric motors. In Control Line Electric Speed, where 10 laps with a radius of 15.92 m or 9 laps with a radius of 18.69 m with a radius of 18.69 m have to be flown, is slowly becoming more popular. In Switzerland, France and Germany, competitions have been held for the last two years. There are projects for F2G competitions in Brazil, Poland and England.

Introduction to F2G

Simple and quickly built models that are easy to control and suitable for an introduction to F2G are available (see contact details at the end of this article).

At 200 km/h and with a line length of 15.92 m, the model achieves lap times of 1.8 seconds. The flying time of a judged flight is between 35 and 40 seconds. To master this speed, the pilot has to acquire the necessary skills: controlling the speed model, holding the specific positions during speed flight, leaving the trolley („whipping"), entering and leaving the pylon fork and stabilising horizontal flight. To get a „feel" for speed flight and to practise a pilot's moves, the model should only be flown at about 1 to 3 metres above ground.

The FAI rules are still provisional and are likely to be improved

Extract of FAI rules for F2G

- Maximum supply voltage: 42 Volts, charged
- Minimum projected area of the model: 5 dm2
- Maximum wing load: 100 g/ dm2
- Compulsory take-off from the ground (with trolley)
- Maximum gross weight: 600 grammes
- Line length: 17.69 m (1 km in 9 laps), alternatively 15.92 m (1 km in 10 laps)
- Maximum flying time from beginning of take-off may not exceed 3 minutes

General

- The motor may be started and stopped by the pilot using a 2.4 GHz radio system or by means of a mechanical or electronic timer.
- This may not affect other models.
- Other rules correspond to the FAI rules for class F2A Speed (speed models with combustion engine).

Guy Ducas at the pylon during a flight of 218 km/h at the Grand Prix de France in Landres 2013

Electric Speed trial flights take place in Prangins (5 km from Nyon) on the control line strip owned by the Aeroclub of La Côte, Switzerland.

Access is restricted for safety reasons and prior arrangement with Guy Ducas (see e-mail address) is mandatory.

Videos

Videos of Control Line Speed flying can be found under the following links:
http://youtu.be/xPe3PptvRE8
http://youtu.be/LO2y1I6m1HQ
http://youtu.be/QSTspXOZscw
http://mfmodellmotoren.de.tl/Video-gr-s-.htm

Classic model

Integral asymmetry

Once the flying skills have been acquired, you are presented with all the options for designing the models. Due to the novelty of this category, there is unlimited choice regarding propulsion (controller, motor, propeller) and model geometry. Time to get creative!

Public Letter 2/2014 · www.fai.org/aeromodelling/ciamflyer
Editor: Emil Ch. Giezendanner editor@modellflugsport.ch
Written by Guy Ducas guyducas@me.com
Photograph: Guy Ducas, Daniel Janan, Claudia Kehnen, José Cotterel

CIAMFlyer
FAI AEROMODELLING COMMISSION
Introduction to the Model Aircraft World
No. 6-2014

Creating Aeromodelling Exhibitions

Whenever aeromodellers appear in public, they encounter an appreciative audience. Air shows outdoors, in a stadium or an indoor arena, are among the most important communication instruments. While championships are more likely to be of interest to insiders, the variety presented at an air show can inspire a broader audience. During the colder seasons, during extended periods of strong winds, rain or snow, exhibitions of model aircraft in large indoor spaces will always draw crowds.

Let the public see your model aircraft

These days, model aircraft – be they self-builds or mass-produced – are small engineering miracles. Exhibitions are more or less the only opportunity for a layperson to study such a miniature aircraft in detail from up close. Just seeing or hearing such a model aircraft in flight does not reveal the high level of perfection and detail involved in constructing such a machine. An exhibition gives everyone the chance to get up close and personal with the aircraft.

Be proud of your aircraft

Everyone who is dedicated and successful in their hobby will be able to talk about it with pride. A model aircraft will always have a story, which, when you tell it, comes alive and acquires a human interest. This is important, as otherwise the audience will be left with the impression that aeromodelling is totally exotic and unachievable for anyone other than highly talented heroes. This is why, despite practising aeromodelling in the age of high-tech, we must not forget the simple things. Junior models – ideally not just to be admired, but to be built and flown – help to bridge the distance to the audience, which is particularly rewarding when it provides a meaningful occupation for children and teenagers.

Technical details made simple

Good technical information presented simply, so that it can be understood by everyone, is an important part of the preparations for an aeromodelling exhibition. This always takes a good deal of time and effort, but is well worth it – and all the more effective if aeromodellers can be present to provide information directly and answer questions.

Good information helps ensure goodwill

Everyone who has had the opportunity to admire a model aircraft – regardless of category or type – from up close, will understand that aeromodelling is a very demanding hobby with an extremely steep learning curve. This in turn helps to ensure that not only the general public, but also authorities and decision makers, gain a positive attitude towards model flying and model pilots.

Public Letter 6/2014

www.fai.org/aeromodelling/ciam-flyer

Editor: Emil Ch. Giezendanner
editor@modellflugsport.ch

Photographs: Christian Joos and E. Giezendanner

Model building and flying with children helps to win the public's trust and goodwill. Three generations – father with sons and grandfather building aeroplanes.

Concise and simply presented information is important. Also for vintage models.