Radio Controlled Soaring Digest

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Front cover: Sailplanes waiting in line to be towed at the aerotow event in Vipava, western Slovenia. This issue of *RCSD* features Uros Sostaric's "Aerotowing in Slovenia" (translation to English by Gorazd Pisanec) starting on page 4.

Back cover: 15 year lease on a plot of land as beautiful as any soaring spot in the world... $50,000. Composite RC sailplane, radio and related flying gear... about $3000. An incredible, sunny, 24 degree afternoon flying with a great friend in a boomer thermal... PRICELESS!! (Don't let anyone tell you there's no lift in winter.) Rick Helgeson and his Supra Pro at Camp Korey, Carnation Washington, flying field for the Seattle Area Soaring Society on December 7th. Photo by Mark Vance. Apple iPhone 5S, ISO 40, 1/1520 sec., f2.2

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In the Air

While an elliptical span load is considered most efficient, it does produce adverse yaw with aileron deflection. But things are different if span constraints are relieved and a bell-shaped distribution can be used; the wing twist can then be tailored to reduce induced drag and produce either neutral or proverse yaw with aileron deflection. This was shown by Ludwig Prandtl (and Robert T. Jones using a different methodology).

Back in 2002 and 2003 we wrote a series of "On the ’Wing..." articles dedicated to twist distributions for swept wings. Our primary source of information on the subject was Al Bowers, Associate Director for Research, NASA Dryden Flight Research Center. A few days ago, Al wrote a message through the *nurflugel* Yahoo! group about PRANDTL-D, a student project carried out at NASA Dryden FRC. Al provided a link to a YouTube video, "Proving Prandtl - With A Twist" <http://www.youtube.com/watch?v=Hr0I6wBFGpY>.

The Prandtl name is actually an acronym for Preliminary Research for AerodyNamic Design To Lower Drag -or– PRANDTL-D. The wing twist on the PRANDTL-D follows the Horten sin^2.5 approximation. Onboard data logging is through ArduPilot with an additional card to handle some analog inputs. Launches in the video are via old fashioned hi-start with 45 pounds pull for the 15 lbs. airframe.

While critics have argued the Prandtl and Jones solutions lead to a "point" design, the PRANDTL-D wing has proven to be just the opposite. Proverse yaw is consistent over a wide range of elevon deflections and coefficients of lift.

Time to build another sailplane!

Aerotowing in Slovenia

Uros Sostaric
translation to English by Gorazd Pisanec

Aerotowing in Slovenia? Slovenian people have very long tradition in aviation. Parallel with aviation, modelling has been evolving through aeroclubs, competitions and various gatherings. Aerotowing is therefore only one part of a wider spectre of aeromodelling which is becoming more and more popular. It combines soaring and motor power flying and therefore connects various pilots who have different tastes of flying.

Aerotowing in Slovenia has been present for more than 25 years now. First attempts go back to the 1980s and 1990s. Pioneer beginnings were more or less exactly that: beginnings without any prior experiences that were later gained from neighbouring countries and among model pilots themselves. A bigger step forward was done at the beginning of this century. At that time, there were only a few towing planes and sailplanes.

Aerotow meeting in Krsko on a hot August day.

Aerotowing was held in only three aeromodel clubs (Divaca, Ljubljana and Lesce). According to today's standards, all towing planes were very small and underpowered (for example Turimaster, Citabria, Bully, Swiss Trainer). Sailplanes were mostly made by domestic manufacturers with wingspan from 3.5 to 5.5m (like DG 600, DG 300, Ventus 2c, Discus 2b, Pilatus B4).

The first two aerotow meetings with pilots who had a grow passion for aerotowing were organised in 2008. There were about 10 to 15 pilots with two or three tow planes. On these meetings an idea was given to start organising this event on a bigger scale. The idea was to have these meetings to share experiences, have fun and socialize with other aeromodel pilots. These first meetings were a starting point to further development of this young and growing discipline.

Next meeting was in 2009 in Vrhnika, organised by aeromodelling club Vrhnika which is now a traditional aerotow meeting. What followed next was the meeting in Krsko with co-organisation of Alpine model club and model club Krsko. The focus there was on DG 600 4,25m and DG 1000 5m sailplanes produced by Vlado Kobilica. At that meeting, there were 25 sailplanes and around eight tow planes making around 27 pilots altogether which was record-breaking for

Upper left: A Wilga towplane in Livno, BiH. Upper right: The living legend of Slovenian model hobby, Dr. Prof. Rafael Cajhen with his Swiss Trainer towplane. Lower left: Starting a Citabria. Lower right: The Citabria takes off.

Slovenia at that time because of the high number of pilots. First telemetry modules produced by RCelectronics came on the market that year. These modules made thermal soaring longer and more enjoyable.

Because of excellent company and well organised meetings the year 2009 became ground breaking for aerotowing in Slovenia. The number of participants was growing and stronger tow planes were introduced for towing even larger sailplanes.

In the year 2010, Alpine model club took over all aerotow organisations and prepared the first calendar for aerotow meetings. Meetings were organised all over Slovenia (seven locations) with more than 60 pilots. Meetings with the highest number of participants were held in Vrhnika and Krsko. The meeting in Krsko was well above expectations because more than 39 pilots joined with over 30 sailplanes and about 10 tow planes. Even pilot friends from Italy came to join our meeting.

In this year several new tow planes were introduced, like Piper Super Cub in size 1/3, Bellanca Decathlon in size 1/2.95, Pilatus Turbo Porter 1/5, Wilga, Hektor and Miss Morava. Sailplane models grew bigger, from 1/5 and 1/4 to 1/3 and 1/2.5 in size. Even oldtimers such as Minimoa, Habicht DFS, Sperber Junior, Moswey, Orlyk, Foka, Weihe, Ka6, Kranich, SZD Czapla participated at the meetings.

Alpine model club organised its first aerotow camp in Livno, Bosnia and Herzegovina in 2010. Six pilots with two

Cirus HS-62 in Livno, BiH aerotow camp.

tow planes (Piper Super Cub, Pilatus Turbo Porter) and nine sailplanes (DG 1000, DG 300, DG 600, Ventus 2ax, Ka6, LO100, Pilatus B4) joined the camp. Livno is famous for its excellent soaring conditions, especially thermal soaring. We must not forget about the excellent Balkan food and hospitality of people. The location of the airport is perfect and offers carefree flying. More to come in the next article.

In 2011 we launched our own home page <http://www.aerozaprega.si> where you can find plenty of information about aerotowing in Slovenia. The site is a good starting point for anyone searching for information regarding how to start in aerotowing or wants to join the next meeting. We have written a safety manual regarding safe flying for aerotow meetings with which we want to achieve safe flying for all participants as well as spectators and to raise the quality of flying.

The meetings are now traditional and take place from March to October at different locations around Slovenia. Thanks to the geographical diversity of Slovenia we can have meetings from early spring till late autumn. This is possible because we have a seaside with warm temperatures.

We have organised nine aerotow meetings at already established locations (Vipava, Ajdovscina, Novo mesto, Moravske Toplice, Vrhnika, Postojna, Krsko, Celje, Ptuj). We also had our second camp in Livno and this became one of our favourite destinations. Some

Skobec, a beautiful vintage sailplane (Rhonsperber from 1936).

Take me high above the hills!

of the meetings have changed into two-days events which made even better accessibility, sociability and tons of fun.

We didn't forget about our vintage sailplanes and we organised vintage sailplane meeting in Celje which only broadened our category. We have now more than 75 pilots with different model planes attending our aerotow meetings.

In 2012 and 2013 we put two new locations on our aerotow map in the eastern part of Slovenija, Cerkvenjak and Radlje. For the third and fourth time in a row we organized an aerotow camp in Livno with an even higher number of participants.

With new technologies and growing number of participant pilots, we are now able to afford better models. At the moment there are over 20 tow planes in scale 1/3 and engines from 100 to 150 ccm. Tow planes with 30 ccm are considered as smaller tow planes and they can pull a 6 kg sailplane without a problem. A lot of tow planes were upgraded with stronger engines and silencers.

Sailplanes are also growing thanks to new moulding technologies and more and more are now in 1/3 scale. We now have in our hangars new modern planes like the Arcus, Swiss trainers, 4m Citabrias and also scale model Apis from the Slovenian manufacturer of real sailplanes. Apis will be presented in one of the future articles.

An Arcus with beautiful mountains in the background.

Pilots are trying to improve their sailplanes to give them a scale look just to feel the real thing. That is why take-offs and landings are now in a scale touch. The trend these days is towards having an FES system where the model can take-off without a tow plane.

We are pleased to see that more and more pilots decide to build tow planes and sailplanes from scratch. It is becoming very popular to build vintage sailplanes by Slovenian constructors.

A Minimoa being towed.

Cirus HS-62 in nice flyby.

SZD-10 Czapla with beautiful wing decals.

Pilots in good thermal conditions can reach heights over 1000m and hours of soaring.

Good thermal conditions contribute to friendly competition and to a desire for better flights as well as aerobatics. If there are good thermal conditions, we can notice a crowd on the field as well as in the air. In this case the meeting is held on two airfields to allow more pilots to fly. A flying coordinator is always present at our meetings and this makes all these take-offs and landings safe. You would probably agree that if there are good thermal conditions, everyone wants to fly. A part of the blame is put on RCelectronics, a domestic manufacturer of telemetry systems which offer quality data receptions as well as the later PC analysis.

With years of organising aerotow meetings you gain experience. This is why the meetings are now excellently coordinated and brilliantly organized. They are now running smoothly and we began to look abroad to organise aerotow meetings in our neighbouring countries. In October this year we organised a meeting in Osijek, Croatia. Aeromodelling club in Osijek is very big and has a very good F3J team. Our goal was to present the beauty of aerotowing as they don't have this kind of category.

We have participated in two GPS Euro Cup meetings in Italy and were so thrilled that we decided to organise our own GPS Euro Cup in Ptuj on the 21st and 22nd of April 2012.

At the moment, aerotow meetings are the meetings with the richest participation of more than 30 pilots. Thanks to some great people, our meetings are very well organised and all this makes them even more popular, visited and enjoyable. For next year (2014) we already have 12 meetings marked in our calendar event. To just name a few: GPS Euro Cup in Krsko, family flying camp in Osijek, Croatia, and a 5th camp in Livno, Bosnia and Herzegovina.

You can find more information on our web page <http://www.aerozaprega.si> and also on our Facebook page. For further info you can contact us by e-mail at info@aerozaprega.si.

Aerotow team welcomes you to join our next event.

1:4 scale

Grunau Baby IIb

Alessandro Villa, filotto78@gmail.com
Maiden flight pictures by Stefano Corno and Alberto Restelli
Review of translation by Andrew Bodary

After years and years of foam and full fiber gliders, I finally decide to take the plunge and I come back to the “classic” building!

When I was young, I remember that I passed by my local shop window and I saw little boxes that boded wingspans very difficult to imagine. Yet, inside them, there was all the wood needed to build “giant” wings and fuselages.

Then, little by little, those boxes vanished and they were replaced by increasingly larger boxes with increasingly smaller models.

The ARF and RTF era arrived. And now we still have significant difficulty finding all-wood kits, especially if we want to build gliders.

Therefore, I started the research of one of these kits. I discarded the glider below 3 meters wingspan (since I had to work hard, I would at least like to build something not too small) and above 4 meters. The price of the kit only should be below $400, easy to find and buy, if possible already built by some other modeler, must be a vintage glider that allows me to participate to some dedicated meetings here in Italy. And obviously, it must be pleasing to me.

After considering these criteria, few models remained available. Finally, the Grunau Baby IIb 1:4 from Krick Modellbau was my choice.

While I was searching for a shop to buy it, an ad for this kit appeared for sale on a website. It's destiny, I trust in these kind of things…

After a phone call and two days, the kit was at my home. The first question I made to myself was the same of 25 years ago: 1,7 meters of semi-wing but the box is only 1 meter long. I have to resign myself to this.

Being used to the big RTF boxes, this time the box seems to me very heavy. Once opened, I understood why.

It was completely overfilled with several kinds of wood. The smell I can sniff is exciting, and it takes back my memories when I bought my first balsa kits. I gained 25 years is a slight of hand. Cool!!!

Let's start by giving a glance to the box contents.

All the parts made of 3 or 2 mm balsa or 1 mm plywood are punched, while parts that come from 3 mm plywood are CNC cut.

Then, we have two big bundles of spruce, balsa and obeche strips, a bag with all metal parts (steel and brass), and another bag filled by all the small hardware needed.

Two big drawings must be joined together and instruction sheets (in both, German and English) complete the contents.

It's probably that the knowledge of one of these two languages isn't mandatory if you are a very skilled builder, but if you are reading this piece, it means that you haven't any problem with at least one of them.

Let me give you some little personal suggestion before the building. In order to familiarize with the contents of the kit, I had an accurate reading of the part list that is enclosed to the instruction sheets, and I began to check all the contents, piece by piece, trying to classify it.

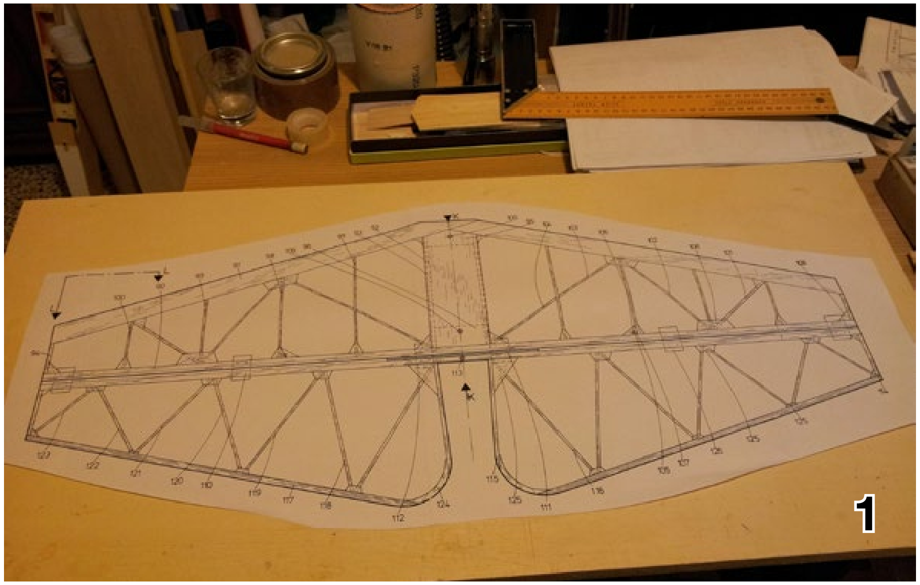
Then, with a small copy of the drawings, I started to read all the instructions and imagine all the building sequences, where all the pieces should go, and possible modifications to do. This stage took almost a week, but in my opinion, it's very helpful and it's a good time investment to prepare for the next months.

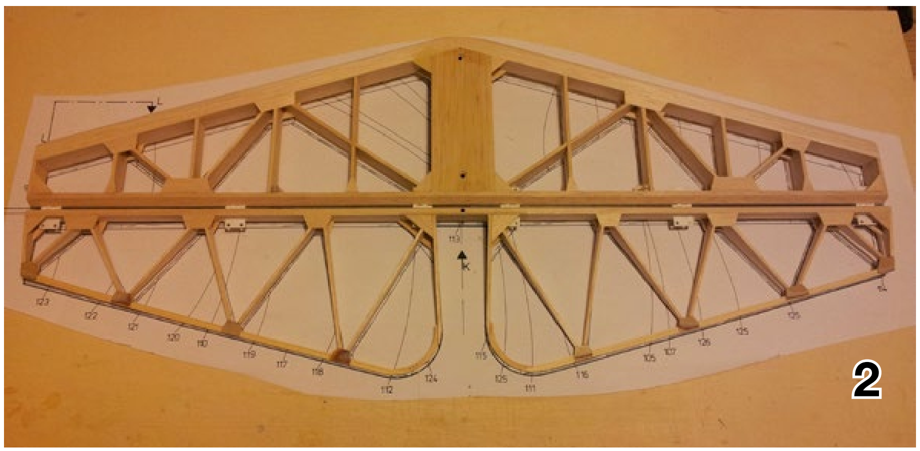
A little clarification about the glues I used. I started by using only fast curing vinyl glue, then by chance I tried the polyurethane glue and it was love at first sight!

For joints that need to be very strong, I used the usual epoxy slow curing (UHU Plus). Then, I also tried the Epoxy Steel through the HobbyKing store, which in despite of its name is a polyester resin!

If you could deal with its tremendous smell, the fact that brass becomes green when it comes in contact with it, and that it becomes opaque when it's cured, this glue is good enough considering also its small price. Pay attention to not use it on Styrofoam, it will melt down!

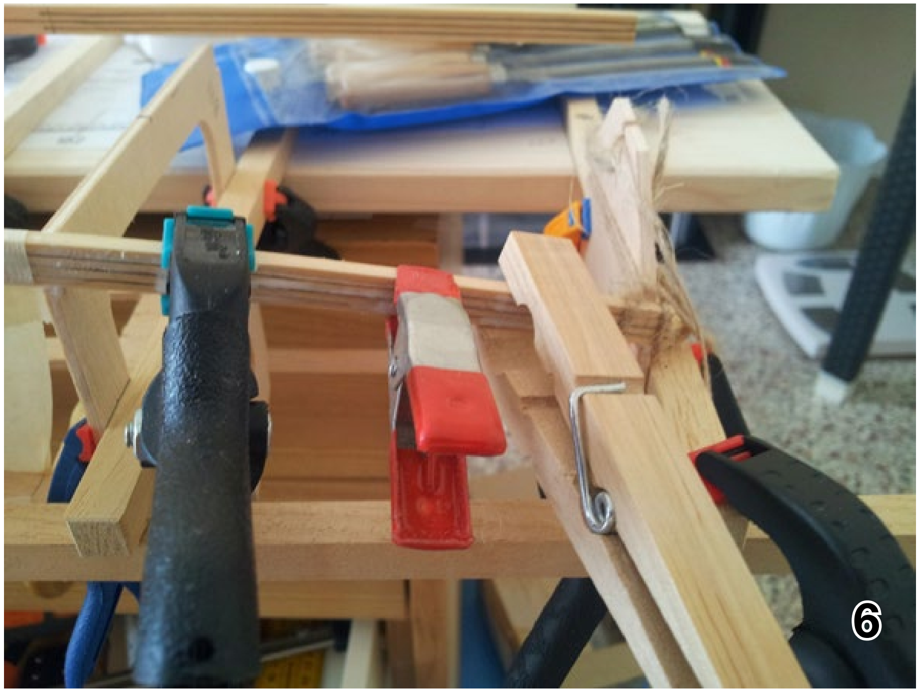
The instruction sheets suggest starting with wing building, but I prefer to warm-up with elevator and stabilizer. The drawing is lying down on the building bench, properly protected by cellophane tape (pic 01). Except for two small plywood pieces, all the stab is built by strips that must be cut at the right length, as well as its ribs that come from 2x20 mm balsa strip that must be cut out from balsa planks provided. The only modification I made on the tail was the thickness of its ribs. Instead of 2 mm, I preferred to use 3 mm since I already had in my workshop. 2 mm seems too thin to me. (pic 02)





Then, I started the fuselage by conveniently fixing all the bulkheads on a flat building board through obeche strip (pic 03 and 04). Once aligned at right height and distance, I glued the four fuselage spars that run through all its length. (pic 05)

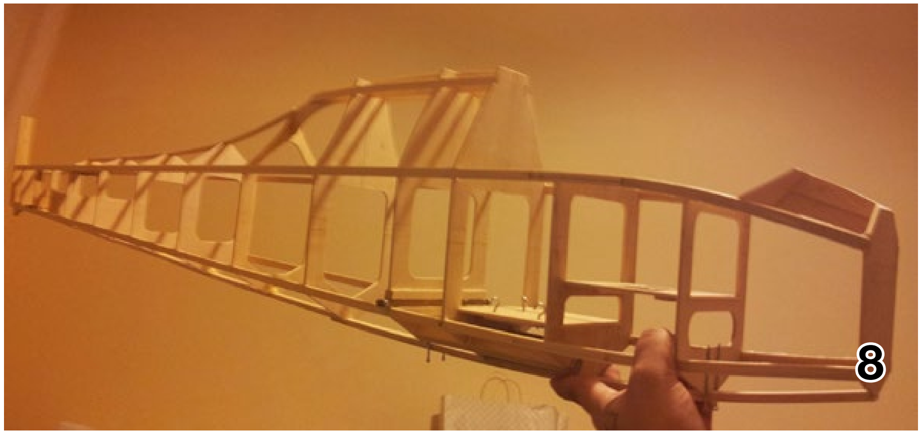
These spars are quite straight except for the last segment near the nose of the fuselage where they must be strongly bent. In order to do this, I cut this last



portion longitudinally and then I glued them to the bulkheads in order to follow the fuselage contour. (pic 06)

Now it's time to install the frames for servos and receiver. If you don't provide it now, it won't be possible later. This means that at this stage you must already choose the servo size and position. (pic 07)

Now the fuselage frame can be removed and you can begin to appreciate your model that takes shape. (pic 08)

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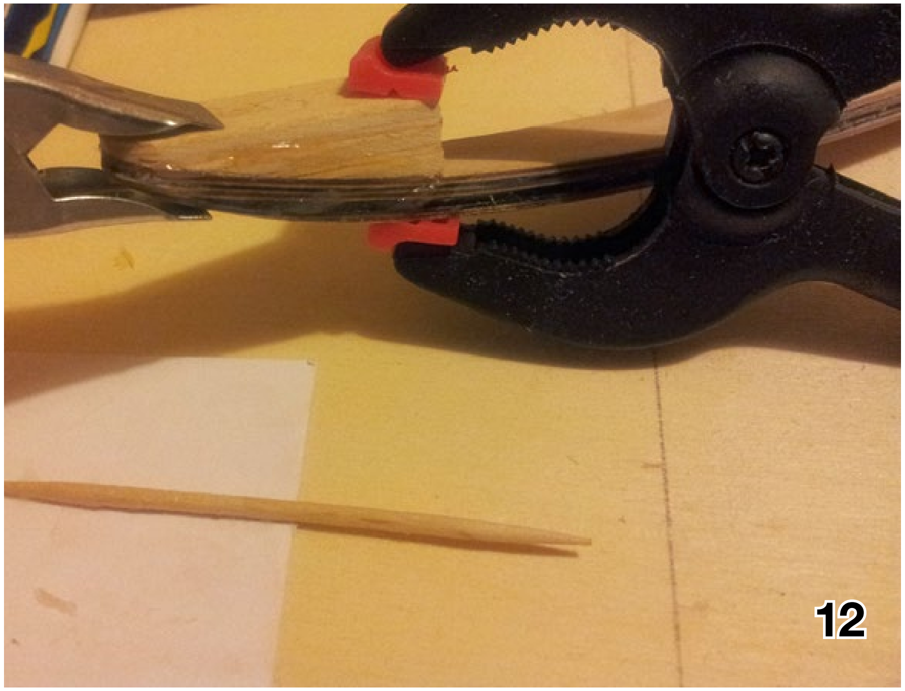
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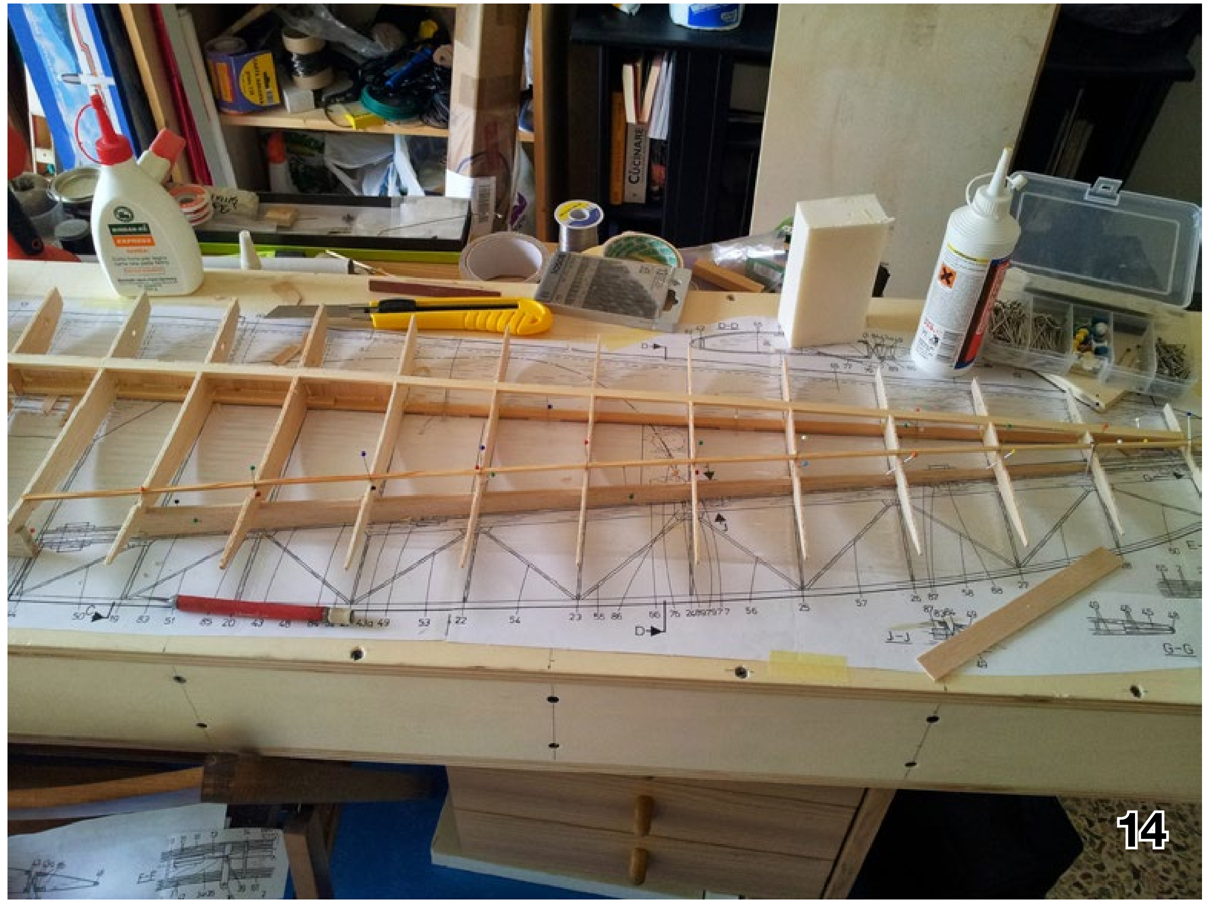

The fuselage building continues by adding its sides and bottom planking (pic 09, 10 and 11). In the meantime, I proceeded to assemble the front skid. The plan foresees to lay up 4 pieces of 1 mm plywood in a way of giving the correct shape. Another modification: between each piece of plywood I put a thin layer of unidirectional carbon. Perhaps it's not needed, but I prefer to have it. (pic 12)

Rudder and fin building time has come. No problems were met on this stage by following all the instruction sheet steps. The fin can now be glued to the fuselage. (pic 13)

At this point you cannot go on with the fuselage without having the wings available.

Let's take heart and lay out the drawing on the building board.

Each spar cap is made with three pieces of spruce.

The wing has to be built upside down. In order to give the correct inclination to every wing rib, two jig strips must be shaped and fixed on the building board. The outer jig will provide for correct wing washout. Wing building goes much faster than I thought, also thanks to the fast curing of polyurethane glue. (pic 14 and 15)

Concerning the wings, nothing to mention, except two little things.

First one is the technique used to bend the aileron trailing edge because its camber is very big near the wing tip. How to do it? Instruction suggests making a longitudinal cut on the trailing edge, soaking it in boiling water for around 10 minutes, and then letting it dry on a template that I cut out from 10 mm economic plywood. The same template will be used to glue it after drying. (pic 16, 17 and 18)

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Second one is a modification that I made on ailerons and spoilers control.

The plan suggested installing two standard servos near the wing root, one for aileron and one for spoiler.

Both servos would have been fixed inside the rib nose before its closure. Sorry, but I don't like this solution and personally I hate the impossibility of replacing servos in the future or batteries without performing a surgical intervention.

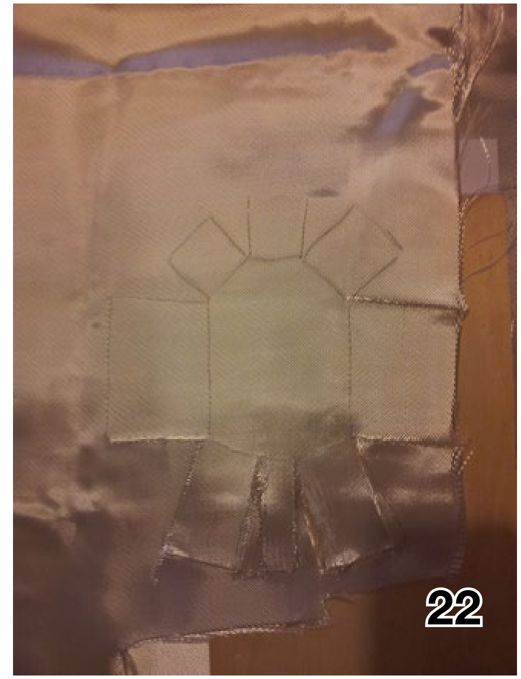
For the spoiler servo, I proceeded to make a servo mounting door from 2 mm plywood. On this door, I directly glued the servo. (pic 19)

Furthermore, I don't like the solution of the aileron servo with more than 1 meter of bowden.

When this kit was designed, it's probable that only standard servos existed, but today this solution makes no sense. Now, you can have a torque of 4 or 5 kg·cm in very little servos, hence I moved the position of the servo to in front of the aileron, between two ribs where balsa coverings were already foreseen on both upper and lower airfoil surface. (pic 20)

Now, the fuselage can be finished. I encountered some difficulties in gluing the top planking because its shape starts flat, then it became convex below the wing trailing edge and then still flat until the stabilizer. Some fixtures are needed, nothing that a modeler brain can't create… (pic 21)

Some words about the aero towing release device. I want to put it in the same position of the full size glider, which is exactly in the fuselage nose tip. I bought a commercial standard one, but it's too short. I need a very long device which can start at the tip of the nose and go back to the first fuselage bulkhead (that I already provided to reinforce with medium weight fiberglass fabric). (pic 22)

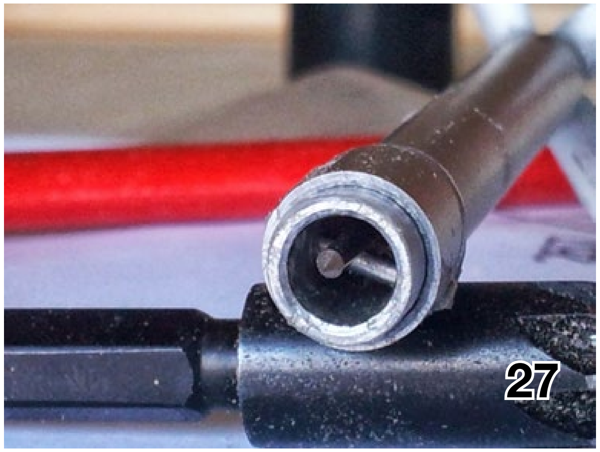


I thought that it should not be too difficult to build one of these devices, isn't it? Let's try!

A glance to my "pantry" and the following ingredients are available: aluminum tube, beech round rod, brass tube, and steel round rod. (pic 23)

I cut the aluminum tube to the right length, then I made four longitudinal cuts of around 1 cm at the end of this tube and I bent the four anchoring wings. (pic 24)

Then I drilled the beech round rod and I cut it diagonally in order to facilitate the positioning of the towing cable. I



glued the brass tube inside the beech rod and then inside the aluminum tube that I drilled in order to put the steel rod transverse.

Aero towing release device: done (and functioning!) (pic 25, 26, 27 and 28)

Finally we arrived at the finishing stage.

After several tests done with several grades of wood stain, I chose the mahogany color diluted with 5 parts of alcohol brushed on all wooden part of the model, then I gave several layer of classic nitro sealer primer. (pic 29, 30 and 31)

The wings, rudder, elevator and stabilizer have been covered with Oratex Antik (pic 32, 33, 34 and 35) while the outer fuselage has received two layers of gloss neutral finishing varnish.

In order to simulate the seams, I added on each rib a little strip of Oratex cut with pinking shears (pic 36)

Shock absorbers for the skid are made of two pieces of gum tube. This is ok except that the color is a strong yellow, completely “out of vintage”! I fixed it with the help of black silicone. Why silicone? It is elastic compared to the normal paint. (pic 37)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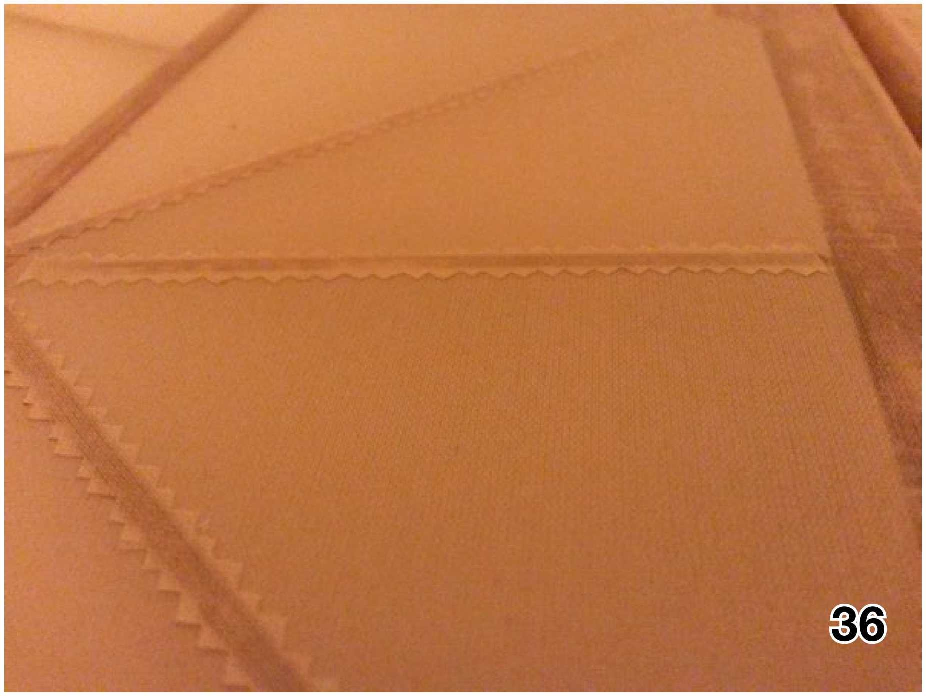
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Now, a glance to electronic equipment. I want to immediately tell you that it is oversized compared to what is required by the model, especially concerning the battery size.

Hitec HS85MG for ailerons, HS5485HB for elevator and rudder, HS625MG for spoiler and a Turnigy TGY 5101 with a torque of 15 kg·cm tow release.

On a glider, I think that the only servo that cannot fail is the tow release one, because if my servo and the servo of tow plane fail, we are both finished playing and start crying...

Two lipo batteries 2S1P 1800 mAh in parallel and a switching regulator, a Castle Creation CC BEC PRO 20A (pic 38) (After first flights I noticed that one battery would have been enough.)

Still some fuselage detail: pitot tube and aluminum tape used to hide the bonding of the windscreen to the fuselage (pic 39 and 40)

Cagily, I set the center of gravity slightly ahead of the suggested position.

After having set the surfaces throws following my experience and deciding to set a big amount of aileron-rudder mix, the model was ready for maiden flight.

It took place in the middle of September at Ghisalba flight field. I was supported by my friends Stefano Corno and Alberto Restelli and the legendary Fiore who towed me during the first flights.

That day was the maiden flight day. Even Stefano tested his Slingsby T-21, another great model!

My last aerotow was around 4 or 5 years ago, and I was much more worried for climb rather than the flight itself. Fortunately, all went well.

After a few meters my model left the ground and, perhaps thanks to the fact that wing dihedral is close to zero, the oscillations were null.

When I reached a not so high altitude I decided to release. Personally, during the first flights, I prefer to fly down because in this way I can better evaluate its attitude.

Fiorello reduced the throttle and I released. My Baby needed very few corrections, only some trim points.

Then, I decided to try the spoilers because I wanted to have some meters of air below me if something goes wrong. In fact, I realized that I mixed too much nose down with spoiler.

After few seconds, I landed without using the spoilers.

The maiden flight went well. It was a great thrill and my legs continued to shake for some time after landing.

(pic 40, 41, 42, 43 and all what you want)

During the other flights, I moved the center of gravity backward in order to have a slightly faster flight and have some margin to act on elevator before the stall came, especially in a thermal.

At the end of September with this model, I participated at the 4th Scale Vintage Glider Meeting in Cremona. *RCSD* has published the report in November issue.

Through the nine months of building (from January to September 2013), I had a lot of fun and had the opportunity to learn and test new building techniques. I was never a good builder, and if I was able to build it that means that anybody can do it. The trick is to have a lot of patience and don't be in a hurry to do the things. Take your time, and if something goes wrong, remember that in the wooden kit nothing is irreparable.

Why all these pages to describe the building and only a few lines to speak about the flight?

Sure! The true challenge is the building, not the flying that is almost suitable for every modeler with a minimum experience.

I don't want to blame anyone who loves ARF or RTF models. There are modelers who like to fly, like to build and like to do both of these two things. Personally, I have more fun building.

My next project could be the design of a new vintage glider, perhaps an Italian one, perhaps that nobody has already reproduced, perhaps a CVV2 “Asiago”...

Thanks to my friends Alberto, Stefano, and Fiorello for assisting with the maiden flight and a special thanks to my wife who allows me to use a room of our home as SkyLab!

Have nice flights and happy landings!

— Alessandro

Walk-around

Grunau Baby IIb N20GB

Mark Nankivil, nankivil@covad.net

Owned by Leland and Lee Cowie of Jonesburg, Missouri, this Grunau Baby IIb was built from captured parts at the end of World War II for the Royal Naval Gliding and Soaring Association at RNAS Fleetlands. Sold to the civilian market in the '60s, it was brought to the U.S. in the early '90s, the Cowies being the second U.S. owners of this sailplane.

Grunau Baby IIb Specifications:

Wingspan	13.57 meters
Length	6.125 meters
Empty Weight	160kg
Airfoil	Gottingen
Max L/D	17:1


20GB


GRUNAU BABY IIB
VW744


GRUNAU BABY IIB
ROYAL NAVY
VW744
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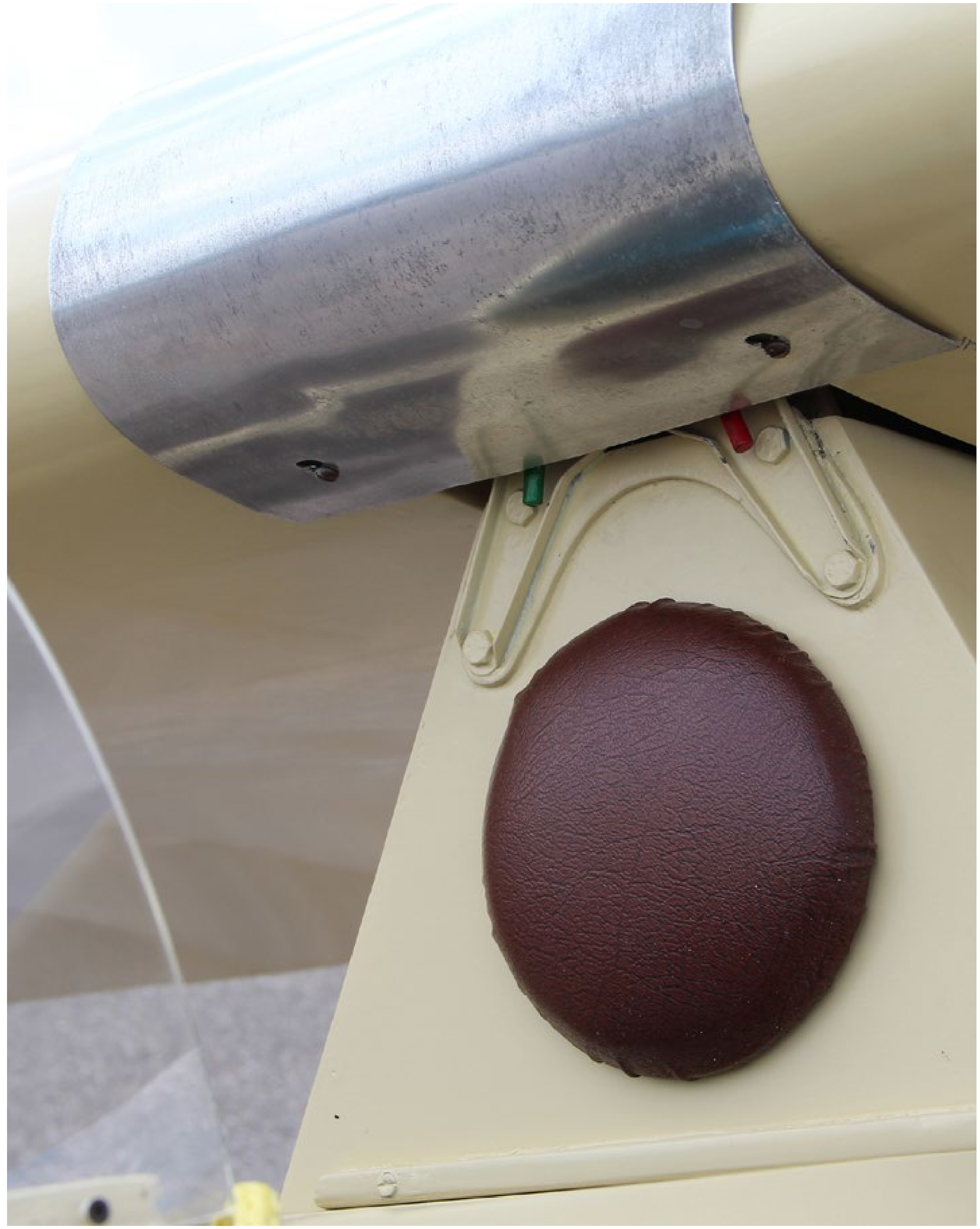
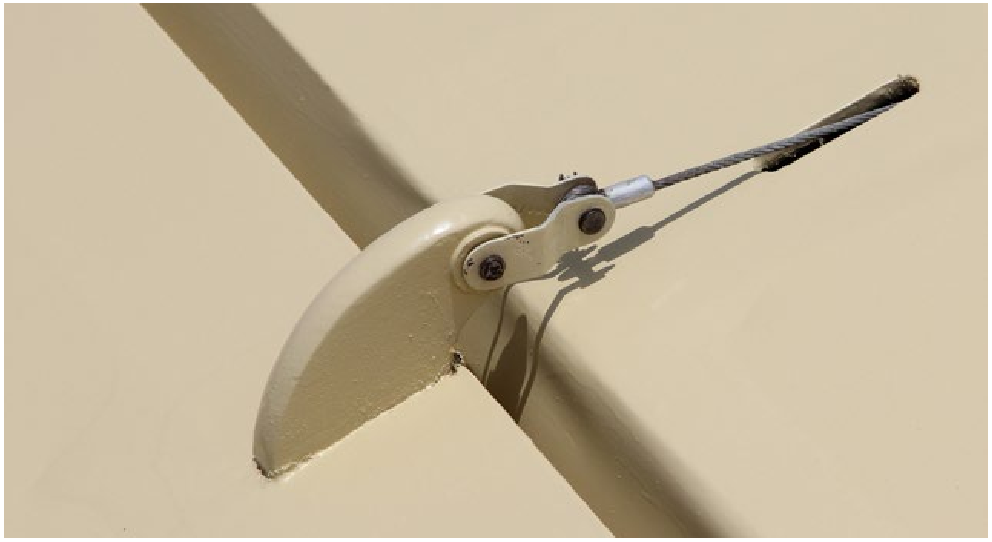
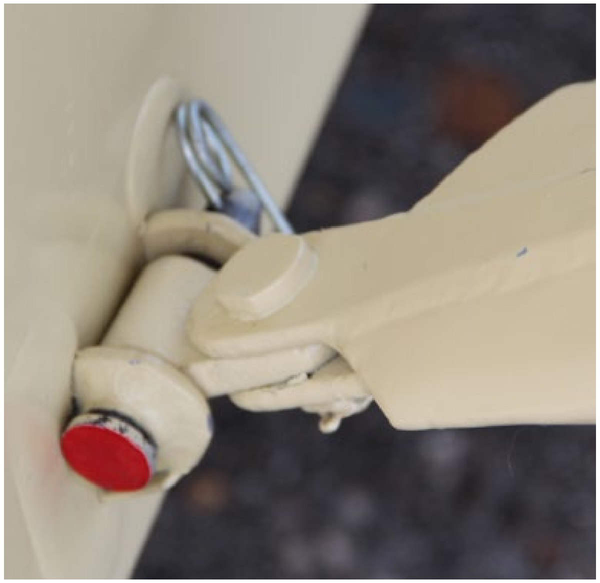







ROYAL NAVY
VW744

Asiago 1924, International Gliding Competition in Italy

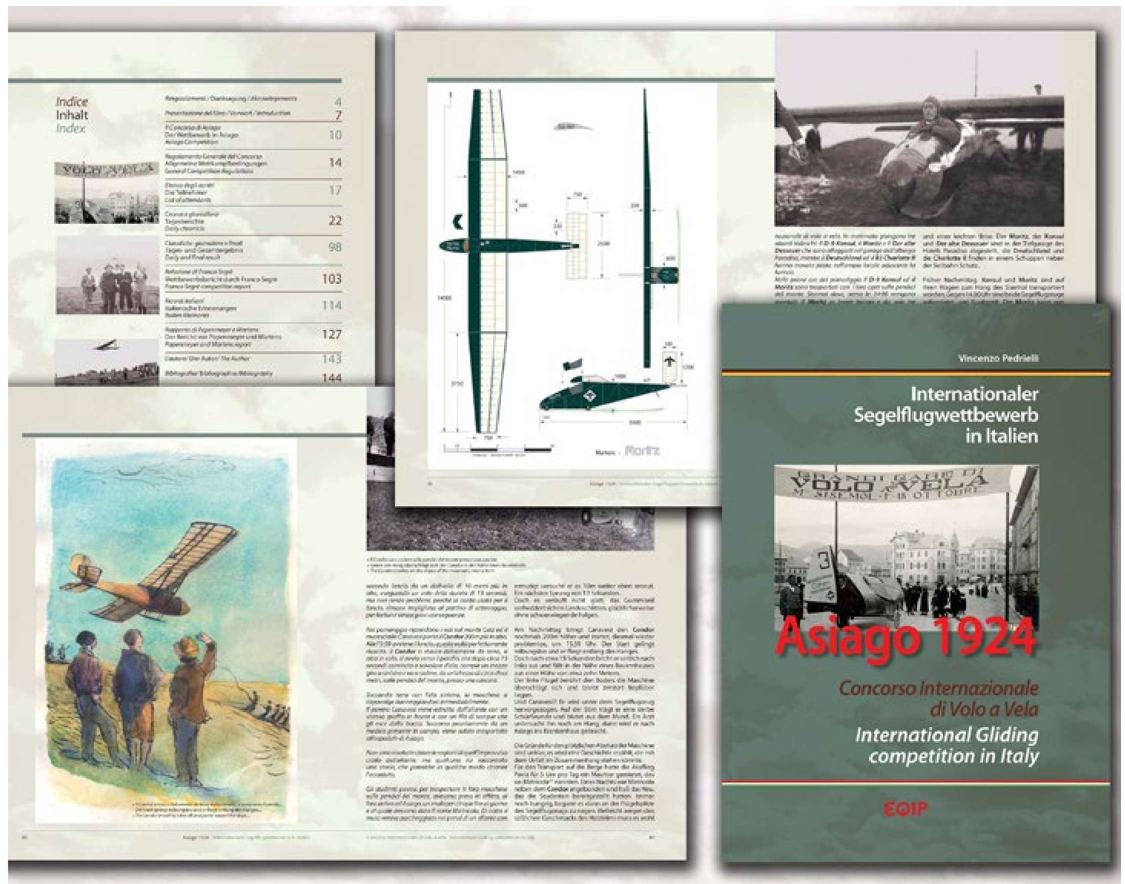
a book by Vicenzo Pedrielli

During the Rhön competition in 1924 in the Wasserkuppe, among the visitors and guests, there was a member of the Italian Embassy of Berlin. This gentleman came up to some German pilots and asked them if they would have been interested to participate in a competition in Asiago, from 1st to 15th October 1924, to introduce the Rhön gliding in Italy.

Of course some pilots gladly accepted and with them went Arthur Martens with his Moritz. and the two-seater Deutschland. The Akaflieg Darmstadt decided also to join with their D-9 Konsul and the Akaflieg Charlottenburg wanted to participate with their flying wing B3 Charlotte II.

During the Rhön meeting the Der alte Dessauer had performed as the best sailplane in the competition and then it was ready to move to the "sunny south."

The gliders were put on the train and Otto Fuchs, Arthur Martens and Fritz Papenmeyer traveled to Munich first and then to the Brenner, to continue to the final destination Asiago.



German team auto towing glider components.

The arrival of Goliardia.

The International Competition in Asiago.

Oskar Ursinus speaks to the competition participants.

Punctually, on the first of October, they arrived together with the service people and the official member of the German Air Authority, Civil Engineer Oskar Ursinus.

Unfortunately, they had to wait several days for the sailplanes to be released by the customs officers, suspicious of some irregularity. Eight days later, the machines finally arrived and the competition could start.

Martens was the first to take off. To the great astonishment of everyone around and to cries of "evviva" from the crowd, he succeeded on his first attempt with a nice flight, lasting a few minutes and landing in a small meadow outside Asiago, near the hotel Paradiso where they were staying. Before starting, a flight officer asked Martens where he was expecting to land and Martens had replied: At the Hotel Paradiso, to get a coffee..." Good Lord, he made it!

Martens takes off from Mount Sìsemol.

On the same day, Papemeyer flew the D-9 Konsul. He made a very nice flight and landed north of Asiago on the Mount Catz. The Italians were completely thrilled and getting into spontaneous applause, for a flight which for the German pilots was very normal. Actually, it was the first time that the Italians saw flying machines without engine and propeller.

The Asiago competition was rather a flying demonstration from the German pilots, than a real international competition and the university students of Pavia, keen participants in Asiago and representing Italy, learned a lot from the Germans, who were not new to this kind of activity.

Before the competition ended, Arthur Martens established a new world record of distance, flying from Monte Mazze to Dueville. A very adventurous flight, which Martens describes minute by minute in this book written in English, German and Italian: "Asiago 1924, International Gliding Competition in Italy," "Asiago 1924, Internationaler Segelflugwettbeverb in Italien," "Asiago 1924, Concorso Internazionale di Volo a Vela".

This book of 144 pages, hard cover, with 90 original photos, the 3-view drawings of Vincent Cockett and the watercolors of Werner Meyer, is available through the publisher EQIP <http://www.eqip.de>.

WHAT HAPPENS IN A STALL?

Comments on Leon Dommelen, Ph.D's stall simulation series, with a few additional circles and arrows

by Philip Randolph, amphioxus.philip@gmail.com

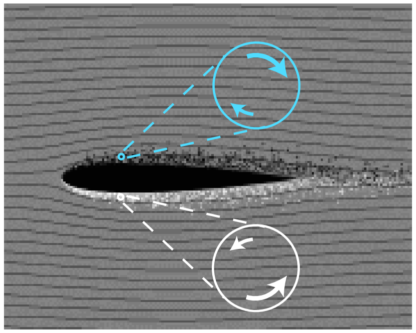
A few years ago I was riding with pilot Erik Utter as he demonstrated power stalls in his Beech Bonanza. At 7000' he slowed and then tipped the nose up while giving it throttle. It felt a bit like riding a jackhammer. The wings were going thud-thud-thud, several times per second. I said into the headset, "Oh, they're shedding von Kármán vortices." These are wake vortices of alternating rotation.

Recently I ran across an excellent stall simulation series which makes what happens in a stall much more explicit. The series is by Leon van Dommelen, Ph.D., FAMU-FSU College of Engineering, Tallahassee, Florida, and is used with his permission. I have added my comments and have colored in a few streamlines and vortex rotations. Please see his original images and explanations at:

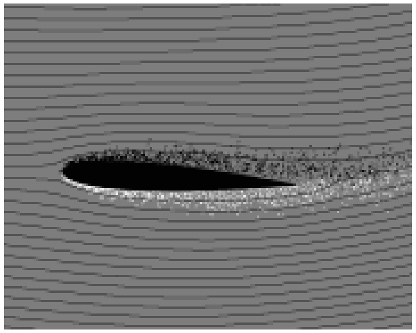
<http://www.eng.fsu.edu/~dommelen/research/airfoil/airfoil.html>

The gist is that the loss of lift in a stall is an average of pulses of lift and loss of lift. Much of the time during stall there is still lift, even while large vortices are forming atop a wing. In Dr. Dommelen's simulation you can tell this because the streamlines exit downward. As Frederick Lanchester explained in his 1907 *Aerodynamics*, lift is from reversing upwash ahead to downwash aft. Pressure gradient forces bend flows down across a wing. The curving flow centrifuges the pressure gradient that makes it curve. The inward part of this pressure gradient is the lowered pressures on a wing's upper

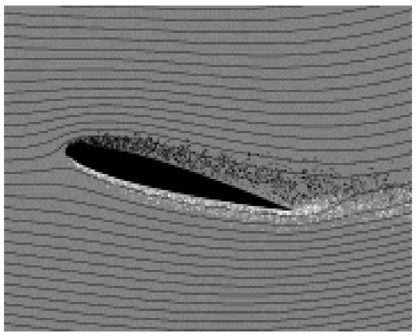
Figure 1: Von Karman street vortices above a wing in a flat spin, a fatal form of stall. Flat spins are generally unrecoverable, as there is little flow across control surfaces. To be certified, airplanes have to be resistant to flat spins. The stalls pilots practice, including normal, steeper spins, do have flows across airfoils, and are recoverable. A von Karman street is a common wake of vortices of alternating rotation. The term is eponymous of the great aerodynamicst, Theodore von Karman (1881 – 1963).



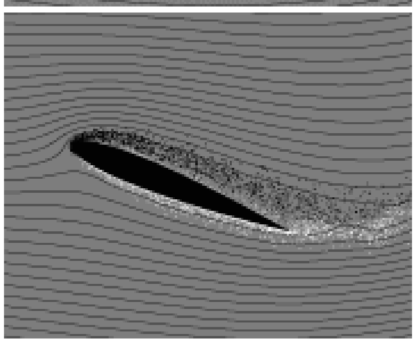
T = 1.00: Dr. Dommelen writes, “In the simulation, the boundary layer is represented as vortices (miniature tornadoes, which are displayed as black or white dots, depending on direction of rotation.)” Real turbulence is more chaotic.



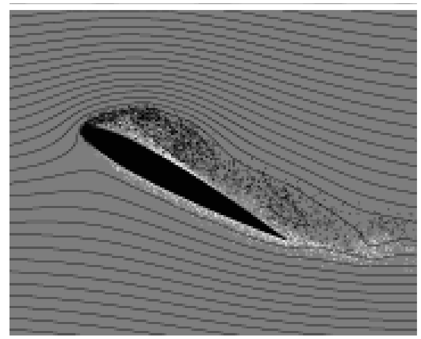
T = 2.00:



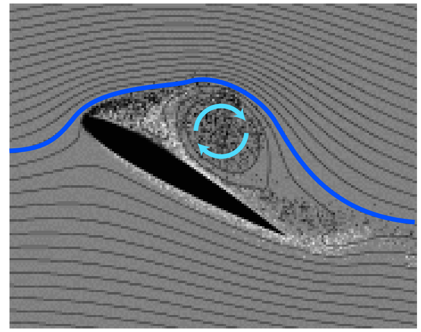
T = 3:.00



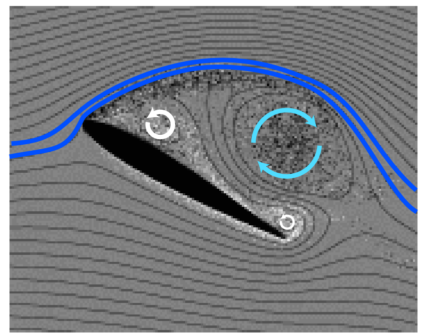
T = 3.50: Upper boundary layer is beginning reverse -- it is turning white, indicated by counter-clockwise turbulence elements.



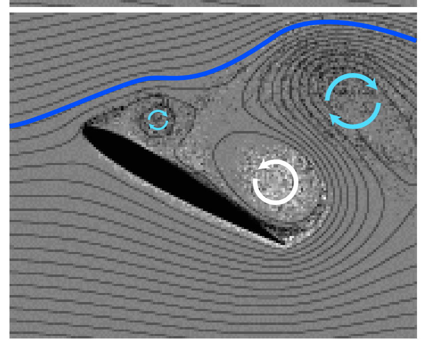
T = 4.25: Clockwise vortex begins to form



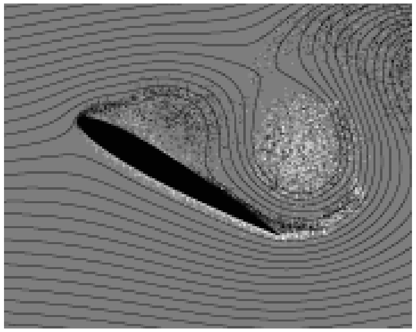
T = 5: 00: Clockwise vortex formed. Counterclockwise vortex forming. Even with a CW vortex formed, upper streamlines still curve down, indicating lift, though with high drag.



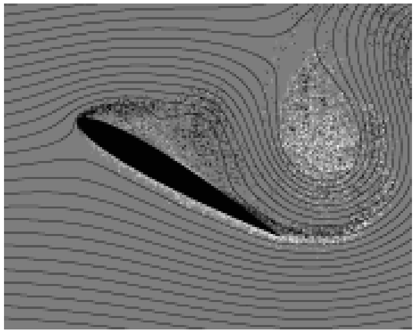
T = 6: 00: Counterclockwise vortex formed. Trailing edge CCW vortex forming. CW vortex is about to be shed. Streamlines still curve down, indicating lift.



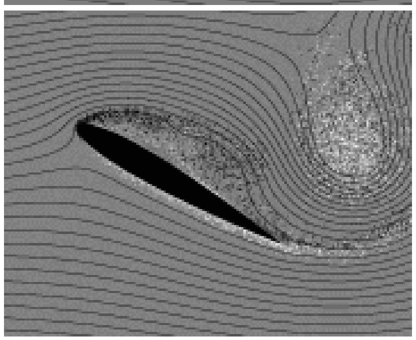
T = 7.00: Clockwise vortex shedding. Streamlines are no longer curved downwards, indicating loss of lift. A new CW vortex is forming at the leading edge.



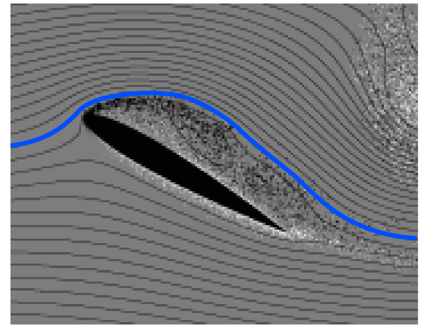
T = 7.50: The CCW vortex is being shed. Streamines show loss of lift.



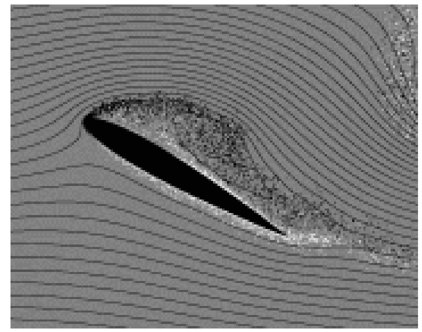
T = 7.75: Bubble reattachment. The shedding CCW vortex is still disrupting lift.



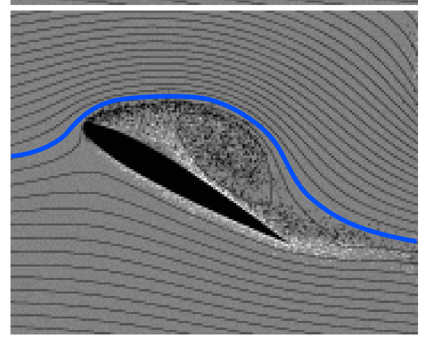
T = 8.00:



T = 8.50: The CCW vortex is far enough into wake so that streamlines over the wing again exit downward, indicating a new pulse of lift.



T = 8.75:



T = 9.00: A new clockwise vortex has formed. Streamlines are still exiting downwards, indicating mid lift pulse. The cycle of lift pulses will repeat untill angle of attack is lowered.

Figure 2: Simulations by Leon van Dommelen, Ph.D. Comments and colored arrows by P. Randolph

surface. The difference between those low pressures above and slightly raised pressures below a wing is lift.

But during the brief time when a pair of vortices is shed, the simulations show streamlines exiting upwards. That's a loss of lift.

So a stall is a pulsing of lift and loss of lift. The average is insufficient lift for flight. (Unless you're a bumble bee, or a hummingbird, or a rowboat. The wing beaters use lift from vortices formed on downstrokes.)

Stall drag is another story. Partly it has to do with the high angle of attack, where any net force on the wing has a strong rearward component – drag. Partly it has to do with the kinetic energy that goes into making the swirl of vortices.

Dr. Dommelen includes plots of coefficients of lift, drag, and pitching moment over time. The Cl plot shows the first pulse of lift loss. If the graph extended over more time it would show repetitive pulses. The Cd plot shows that as vortices are shed drag doesn't drop proportionally to lift. Stalls are high drag affairs.

Note that even during vortex shedding upwash ahead of the wings is maintained. The curve of flows over the front of the wing remains concave downward. The front portion of the wing is generally not stalled, and continues to lift.

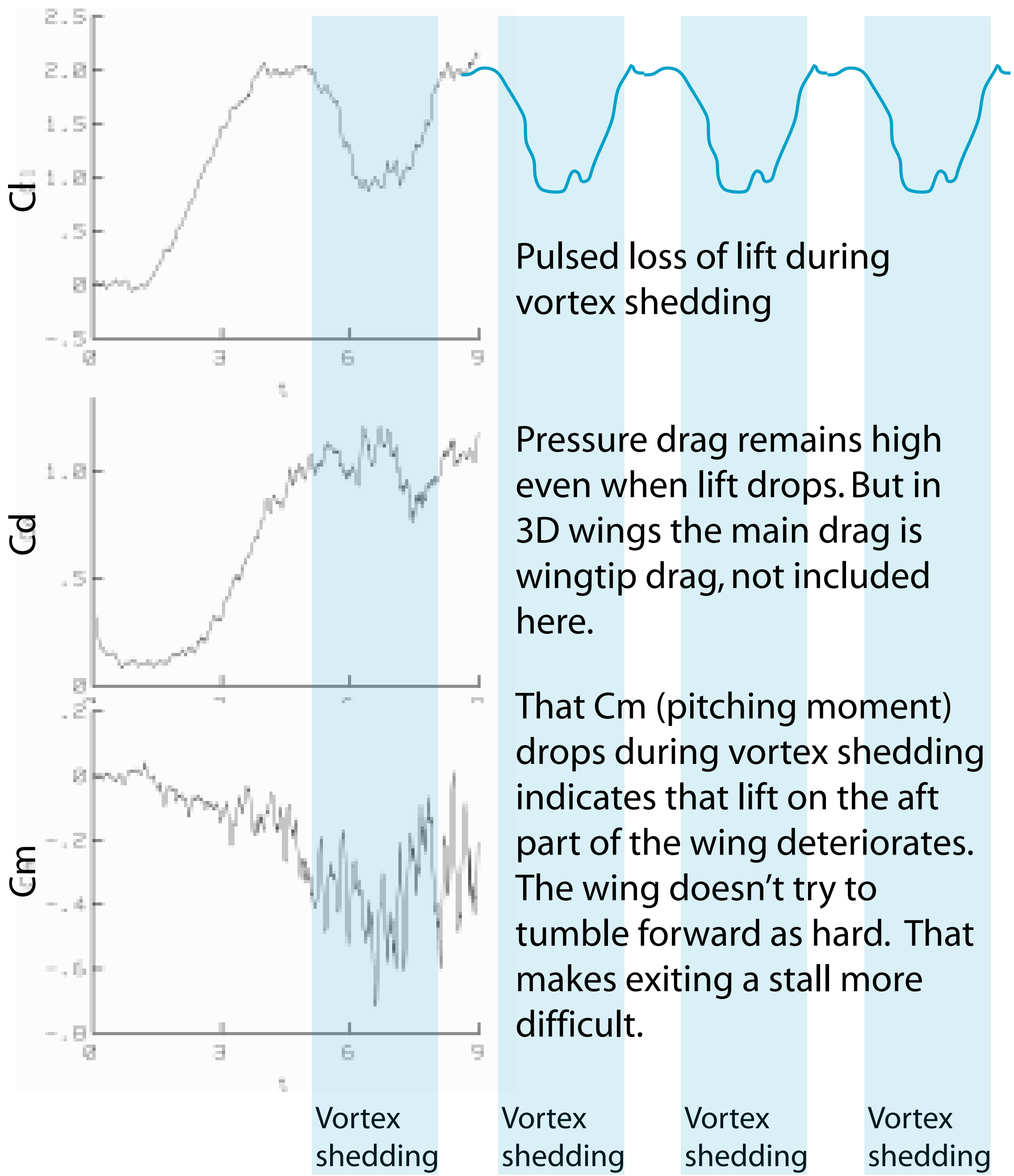


Figure 3: Cl, Cd, Cm

The Cm plot shows that during vortex shedding it is the aft part of the wing which disproportionally loses lift. The result is less pitching moment – the wing has less of a tendency to tumble forward. That is why in many airplanes stalls are inherently stable. In a stall the wing mostly stops helping to tip the nose down. That's at least part of why in some airplanes it is difficult to tip the nose down to exit a stall.

How small imperfections in shearing laminar flows escalate into turbulence and a matrix of alternating micro-vortices.

The instability and unevenness of shearing flows allows vortices to form, rather than remaining perfectly laminar. Shears initially create small vortices of similar rotation. The vortices conflict with each other, increasing turbulence and forming vortices of opposite rotation.

See Figures 4 and 5.

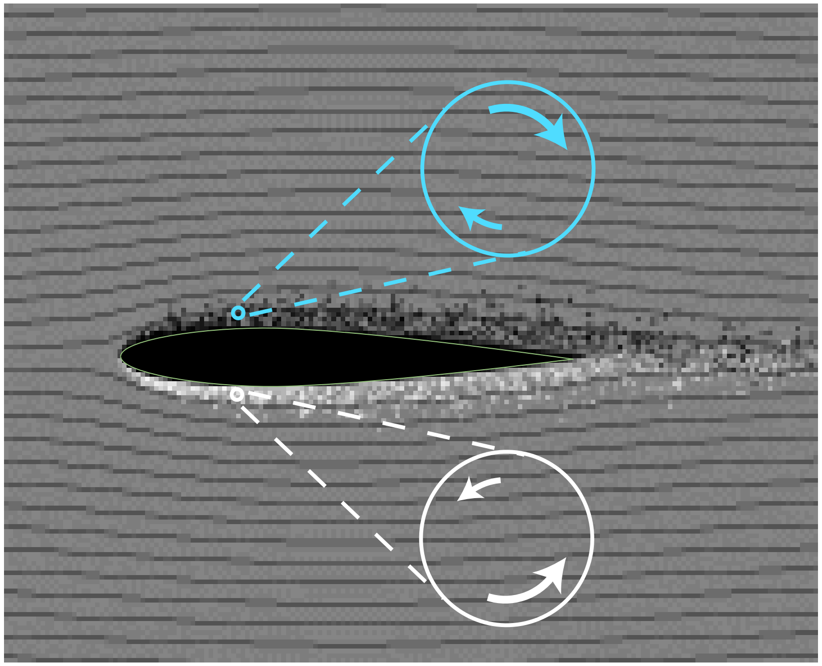


Figure 4: T = 1.00 of Dr. Dommelen's simulation series. Dr. Dommelen writes,
"In the simulation, the boundary layer is represented as vortices (miniature tornadoes, which are displayed as black or white dots, depending on direction of rotation.)"

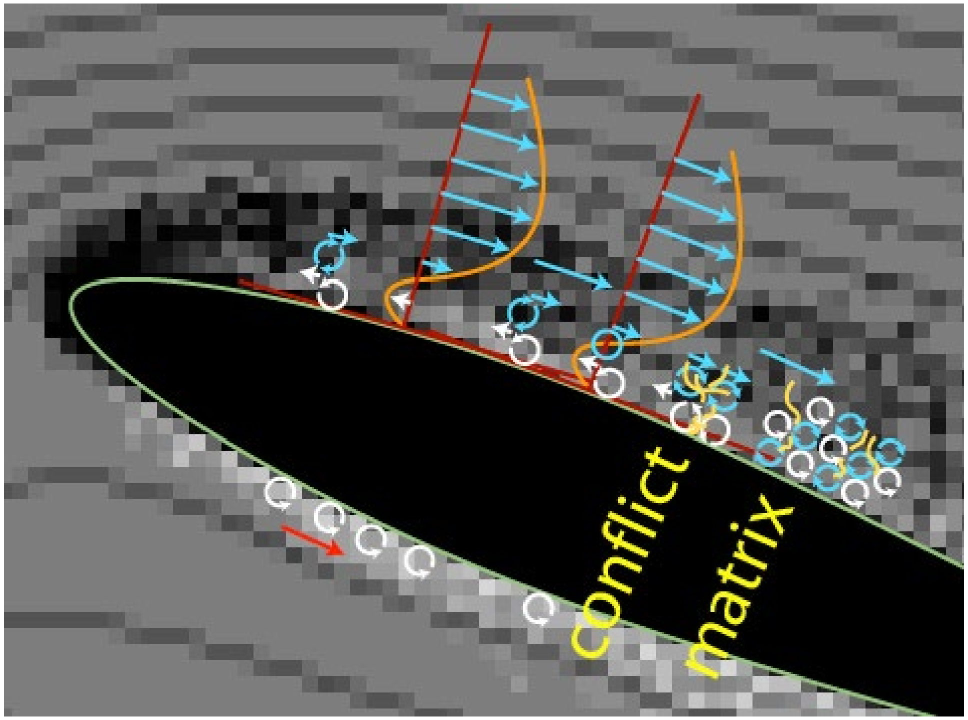


Figure 5: T = 3.50: Upper boundary layer is beginning to reverse. Velocity profiles in a reversed flow boundary layer were sketched by Ludwig Prandtl. The sheer of the reversed upper boundary layer with the wing surface initially makes micro-vortices with counterclockwise rotation (white). The sheer of upper flows with the reversed flow makes vortices of clockwise rotation (black, blue). As vortices of similar rotation collide, chaos erupts, mixing micro-vortices into a turbulent matrix of alternating vortices. The turbulence and vortices further mix momentums of sheering flows. The result is that from leading to trailing edge turbulence and boundary layer thickness increases with distance from the leading edge. The turbulence will accelerate the boundary layer, fighting the effects of the pressure gradient that made the reversed flow. In stall this contributes to pulses of vortex formation, vortex shedding, and flow reattachment.

The simulation presents fairly uniform fields of either white or black dots. The white dots are a field of counterclockwise rotating micro-vortices. The black dots are a fairly uniform field of clockwise rotating micro-vortices. This represents the limits of an otherwise excellent simulation's ability to represent reality. The truth is that shear forces do create vortices of similar rotation. The falsity is that fields of micro-vortices of similar rotation are instable. Another truth is that adjacent vortices tend to alternate in rotation. A third truth is that real turbulence is more chaotic. Let's put it all together.

First, as we've seen in the full stall series, large-scale wake vortices alternate in rotation. But here we'll look at the micro-vortices and turbulence produced by shears.

The forces of shears add kinetic energy to boundary layers. If flows were perfectly laminar, even at a molecular level, layers of air would slide over each other without friction. That's never the case.

The unevenness and instability of laminar flows starts with the random movement of air molecules. At a molecular level no flows are laminar. Additionally, most air is filled with tiny vortices and streams, at least. Much of the atmosphere contains larger scale turbulence, especially on sunny or windy days near the ground or around cumulous clouds. Turbulence generally increases wherever energy is added to an airflow, whether from solar radiation, convection heat sources, or physical pushes and disturbances.

The micro disturbances in air mix momentums between flows. Equivalently, they mix momentums down into the boundary layer near a wing's surface. Some of that mixing is chaotic turbulence and heat. Some goes into surface wave formation – Kelvin-

Helmholtz instability waves form between shearing flows. And some energy goes into forming micro-vortices.

A shear between two flows tends to create vortices of similar rotation.

See Figure 6.

A uniform field of micro-vortices of similar rotation is inherently instable. The vortices will tend to conflict with each other, making either turbulence or vortices of opposite rotation. The turbulence further mixes the momentums of the shearing flows. Thus turbulence tends to build.

See Figure 7.

See Figure 8.

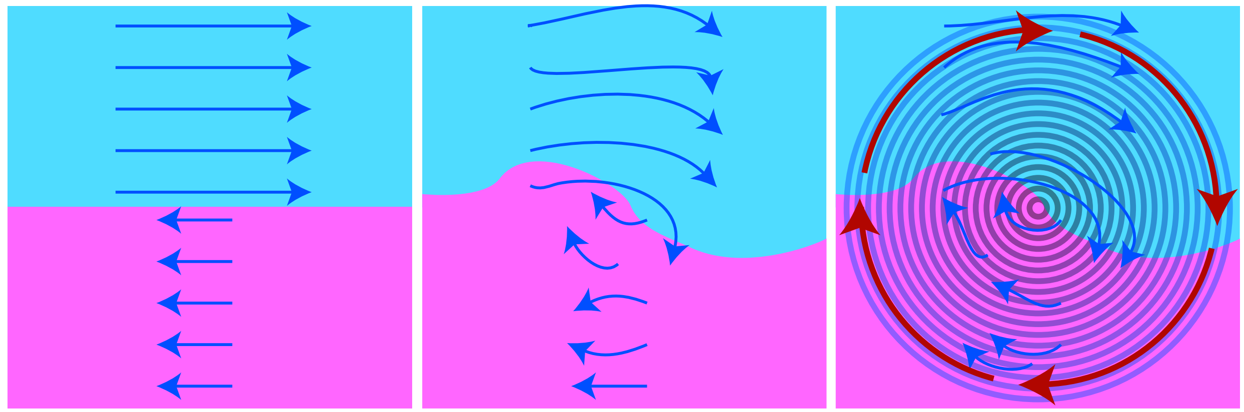


Figure 6: If flows were perfectly smooth, sheers would be frictionless. But there is always random movement of molecules. And air is seldom without disturbances that mix momentums between lamina. The forces of a sheering flow initially create micro-vortices of similar rotation and the waves called Kelvin-Helmholtz instabilities.

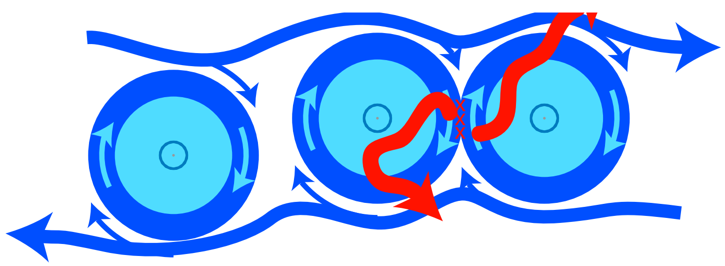


Figure 7. Unevenness in shearing flows can create vortices of similar rotation. When close together they conflict, creating either turbulence (shown) or vortices of opposite rotation.

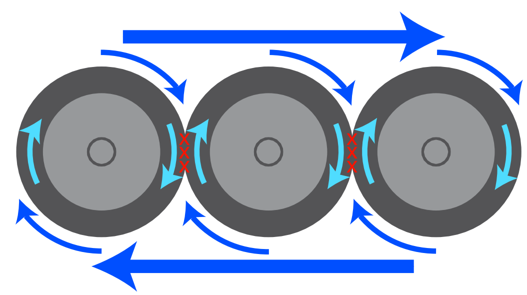


Figure 8: When vortices of similar rotation come close to each other they conflict, like oversize tires on an eighteen wheeler. Trivia nerd tidbit: The historical concept of a 'vortex sheet' was a falsity. As illustrated by the truck tires, any such arrangement of vortices would have torn itself apart.

Vortices of similar rotation will conflict if they are close enough.

See Figure 9.

Vortices tend to form into patterns of alternating rotation. Within a wake large scale vortices form in alternating rotation called ‘von Kármán streets.’ The same will be true for the micro vortices that make up part of turbulence. Turbulence will tend to mix vortices of opposite rotation. And at a micro-vortex level, viscosity is a significant force.

Viscosity between vortices of similar rotational direction will tend to create new vortices of opposite direction. They’ll form into a sort of von Kármán street matrix. Within micro-turbulence viscosity will tend to create ‘lubricating’ vortices of counter-clockwise spin between vortices of clockwise spin. (Or visa versa.)

And perhaps such a matrix is one part of what happens within ‘cottage cheese air,’ air sufficiently filled with turbulence that some wings fly poorly, relative to flying in more calm and smooth air.

Credit: The grayscale simulation image of Figure 3 is by Leon van Dommelen, Ph.D., FAMU-FSU College of Engineering, Tallahassee, Florida.

Circles and arrows and paragraphs to be used as evidence (misquote from “Alice’s Restaurant,” Arlo Guthrie) are by the author.

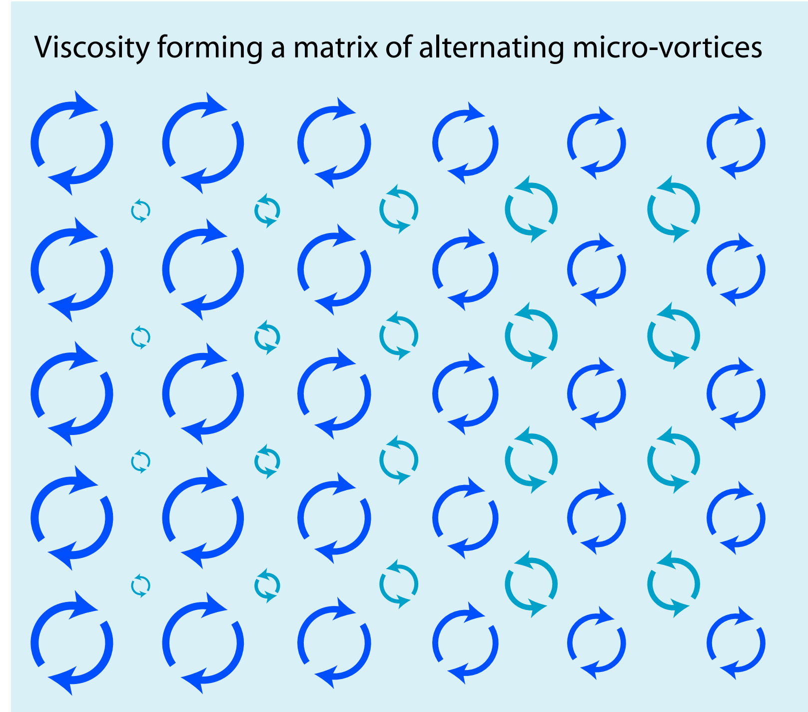


Figure 9: Viscosity forming a matrix of vortices of alternating rotation. A field of vortices of similar rotational direction will tend to transfer energy building lubricating vortices of opposite rotation between them. The result pictured looks stable, but there will generally be enough energy and chaos to create more random turbulence.

2013 PSS Fest Volksrust

Piet Rheeders, pietlewis@absamail.co.za

This year the annual PSS meeting took place on the 30th of November with a record entry of 29 pilots.

The original date of the 9th of November could not be used because of an earlier booking, and the organizer Paul Carnall had to rebook the venue for the 30th. This meant that our chances of rain in the area and therefore misty conditions on the mountain were greater.

Evan Shaw and myself decided to go two days before, hoping to get some flying time in before, and when we left Johannesburg midmorning on Thursday the 28th of November we were greeted with light rain. It was evident as far as we went that the area had good rain with every farm dam on the way filled to brimming with water.

Arriving at Volksrust at around 2 AM, Tamatieberg was covered with clouds. Weather predictions for Friday and the rest of the weekend were promising, however, and Saturday with a good northwesterly wind was spot on. We managed to get some flying in on Friday afternoon.

Saturday and the main day of the event started off misty, but by 11 AM when most participating pilots arrived, the conditions were clear with a good 20 to 25 Km/h wind on the north-west slope.

Once again we had some interesting models apart from years before models like Paul's Cessna Dragonfly, Evan's BD 5 and my Aero Commander.

This year I had a 1/6 Scale model of Howard Hughes' H1 racer. The original H1 broke the world speed record in 1935 at 353 mph, that's just below 600 Km/h. The model flew reasonably well after I had initial problems of setting the CG in the correct location.

Rob Field's giant correx MiG flew well until it picked up some elevator flutter and had to land below the mountain with some damage.

Jochen Schmidt's Tucano was very well finished and flew just as well.

On Sunday the 1st of December Evan and myself after two days of flying decided to return home while some pilots went back to fly on the north east slope and had good flying conditions.

This years winners were 1st Jochen Schmidt with his 2M Tucano (beautifully built & beautifully flown)

2nd tied between Thys Froneman with his Aermacchi MB339 and Norbert Rodolf with his F5A Freedom Fighter

And two hard luck prizes went out to Rob Field and Rouen.

Warren Sheehan produced a video of this year's PSS event. Use the following link to view: <http://www.youtube.com/watch?feature=player_embedded&v=bkKjlofp_GU>

Getting ready for the 300km trip to Volksrust. My Aero Commander and Hughes H1 racing plane readily visible.

Piet Boer launching the Aermacchi MB339 of Tys Froneman (2nd place winner).

Above and above right: Rouen with his swing-wing B-1 bomber.

Right: Rouen's B-1 sits in the grass along with the Geebee, Avro Vulcan, and Fox in the background.

Group photograph of this year's PSS models.

Above: Jochen Schmidt shows off his winning entry, the Tucano, on the way to the flight line.

Left: Jochen prepares the Tucano for flight.

Piet Boer getting ready to launch the Tucano into the slope lift.

Piet's Hughes H-1 racer. As with his Aero Commander, Piet fabricated a landing gear for this model, removeable for flight.

Garin Jubber launching the H-1

Tucano just after launch on maiden flight. Photo by Evan Shaw

Minus the static display propeller and with landing gear removed, the H-1 is incredibly realistic in the air.

A bright yellow Impala.

Airbus 380 of Piet Boer amongst other PSS models.

Rob Field with the giant Correx MiG in the background and a giant Correx Impala in the foreground.

Rouen's bright colored Geebee racer.

Norbert Rudolf’s F5 Freedom Fighter.

Piet removing the wind sock after a good day of flying on Saturday afternoon.

Tom's Tips

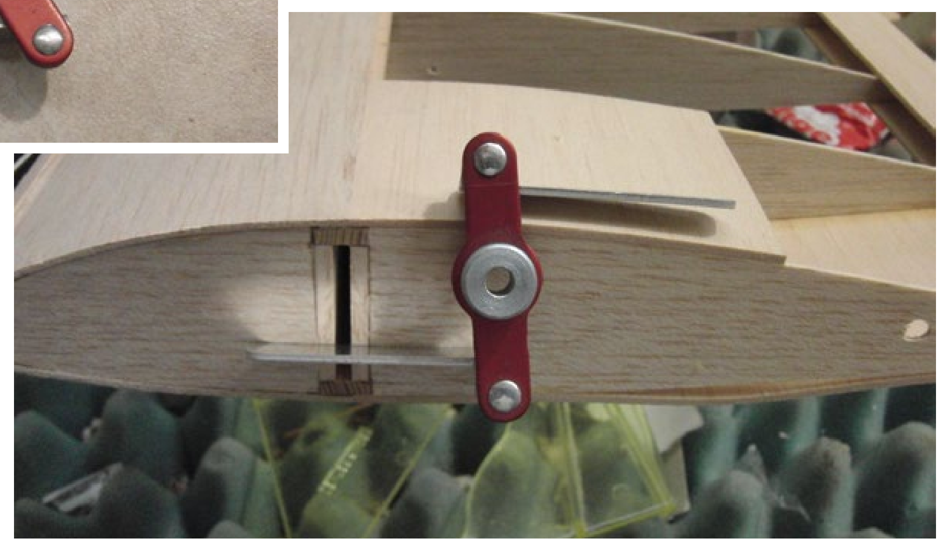
Center Finder

Tom Broeski, T&G Innovations LLC, tom@adesigner.com

I was trying to find the exact center of the root rib on an Aquila XL so I could replace the tiny 1/4" rods with a decent 1/2" carbon joiner. Trying to get the measurement just right with just a rule wasn't that easy.

I had a Robart center finder that has really helped me find centerlines for hinges and such. The only problem is that it is too small for a lot of my needs.

Soooo... I made a quick and simple center marking gauge large enough to fit the thicker ribs on many of my planes.



The Robart center finder is too small for my needs.

Materials:

(2) 1/4 inch by 3/8 inch by 3 inch block
You can vary the sizes however you want.

(1) 5/8 inch by 3 inch block
The longer this block the thicker the thing you want to find the center of can be.

(2) Machine screws

I used 8-32 stainless because that's what I have handy.

(2) Nuts

(2) "O" rings (optional)

(1) Scribe insert (optional)

Assembly:

Step 1: Cut out the blanks and mark for the holes.

Step 2: Drill the appropriate end holes in the three blocks. I counter sunk for the screw heads, but it is not necessary.

Step 3: Assemble the unit. I chose to use knurled nuts and "O" rings to make it work like I wanted.

Above right: Parts from a completed and disassembled center finder. Tom used some really good looking wood for this one.

Right: The complete and assembled center finder. Remember, Step 4 is critical for the placement of the scribe insert , pin, pen or pencil used for marking.

Step 4 is critical to getting the exact center. Scribe in both directions.

Showing the scribe insert...

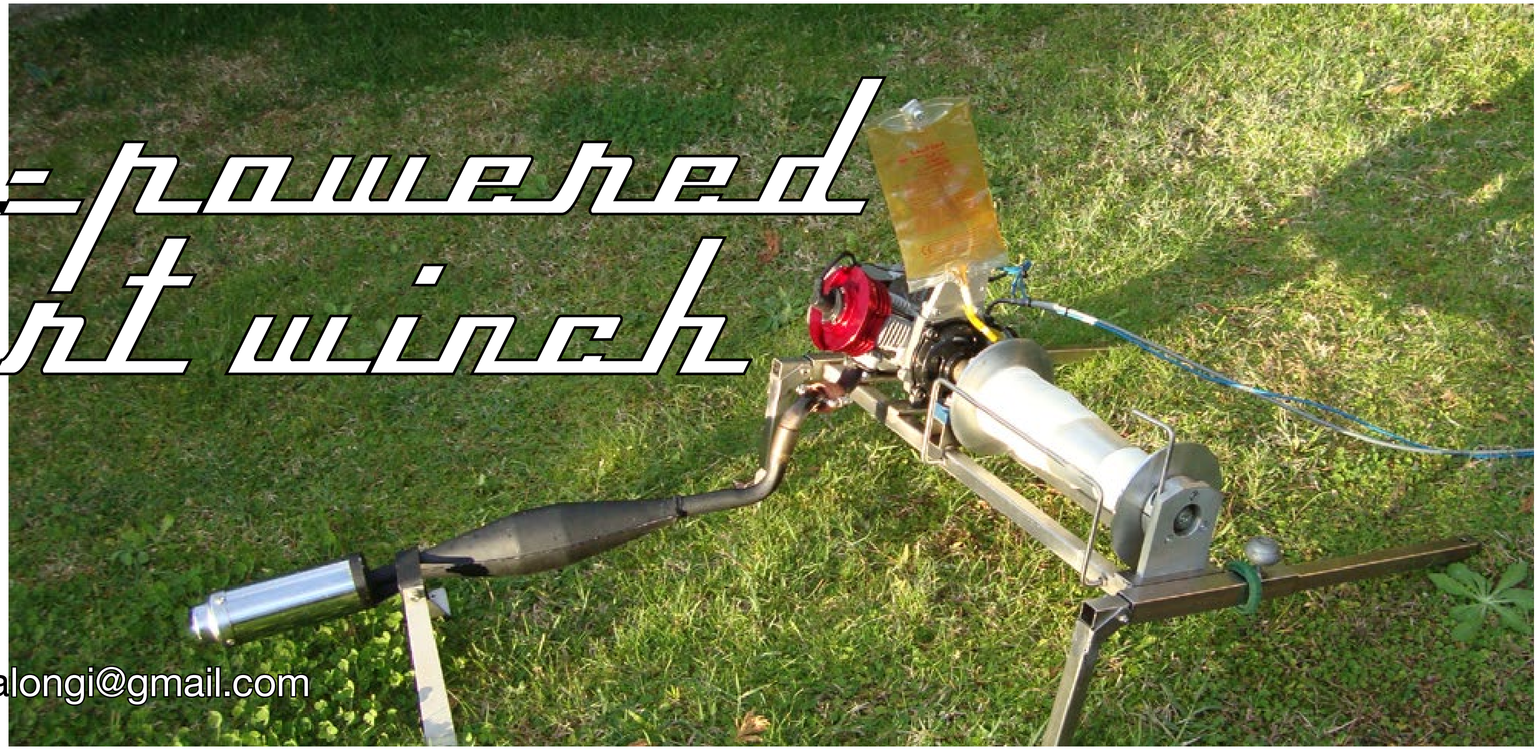
Step 4: This is a critical step to get the exact center. Take and push the blocks together and scribe a line on the main block. Flip the outer blocks the other direction and scribe again. This gives you an “X” right in the center of the block.

Step 5: Drill the center hole. I chose to use a center scribe insert, since I had several in my tool chest, but you can drill a small hole for a pin or a larger one for a pencil.

...and using pen or pencil.

Shown on the root of the Gemini wing.

gas-powered sport winch



Gino Alongi, ginoalongi@gmail.com

A sport winch powered by a gas engine... ...a new toy.

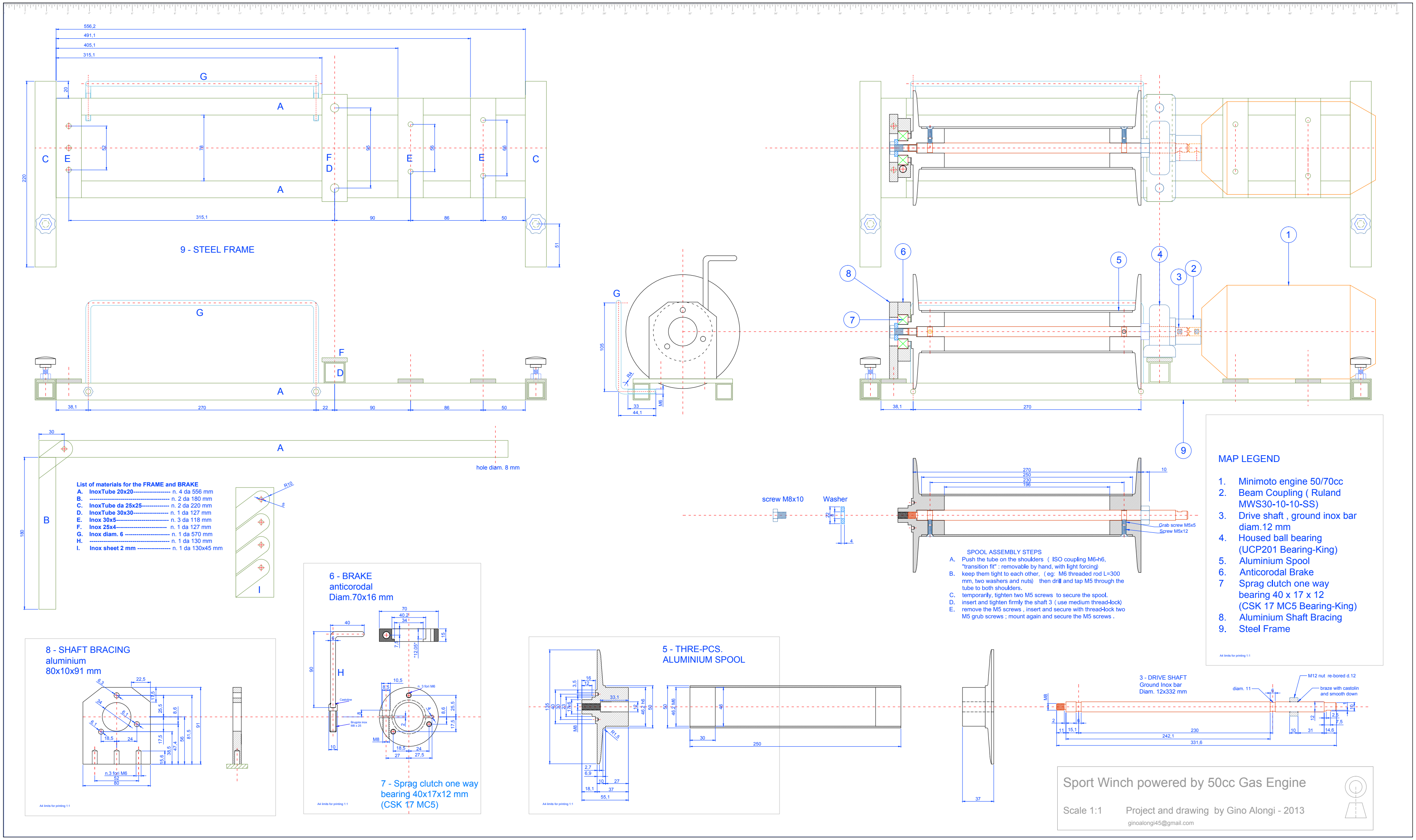
It is one year that I am the Grandpa of a smart baby. Walking around with Mattia, it happens sometimes to hear from other buggies "Today's children are lucky, they have almost everything." Someone replies "…so many toys to fill a wardrobe," and then "Won't that be too much?" This is the point where I usually leave, avoiding to comment, "You should see mine!"

The story of this new toy begins when a friend of mine gave me a 50 cc gas engine for mini-bikes as a Chistmass gift, perhaps thinking it would be useful for a maxi-model. It did not remain too long in the box. My curiosity got the best of me and I unwrapped it before midnight.

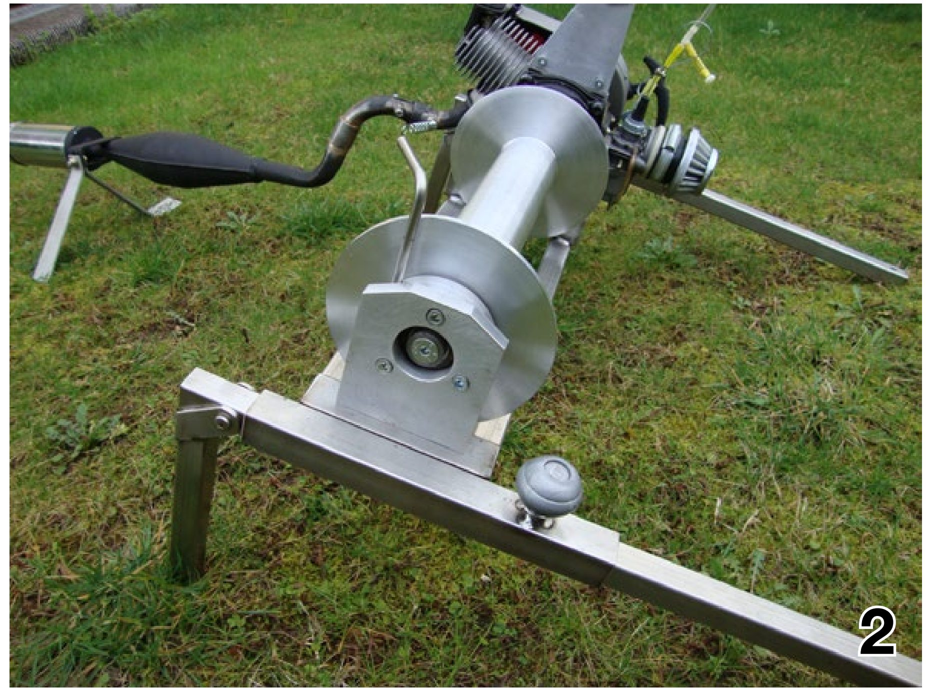
At first glance it was clearly manifested unsuitable for that purpose, though I can't say its characteristics seemed of no significance, as they have sparked the idea to mount a new toy, a sport winch powered by a gas engine.

Pull-on starter, ignition by magneto and centrifugal clutch allow the winch operations to be simple and effective. No heavy batteries to carry at the field. Full operating power lasting all the day through is a peculiarity of relevant importance. The easy control of the towing speed is useful, too.

I had to skill up and involve in my project all the seasoned veterans of my club, Alessio Muro, Maurizio Saracco, Antonio Paladini, Ivo Biancalana, and Paolo Pacini, who enthusiastically described



These plans are available in PDF format from the RCSD web site <http://rcsoaringdigest.com/images/Alongi_50cc_Winch.pdf>



the past tales and the techniques implemented, showing me their equipment still in working order, then confessing that the use of the winch was dismissed years ago because of frequent accidents, or maybe caused by more practical reasons, assuming the common use of towing larger and larger gliders.

Not at all intimidated by this objective reality, it is not my nature, I found myself surprised to rework the project with a greater spirit, knowing that I could rely on the cooperation of my friends and their solid technical basis.

Some photos in the 08.2012 edition of *RCSD* have inspired the architecture of a lightweight winch, removable for transport. I even cloned the dimensioning of the spool, based on 5000 rpm of the engine, which would allow an appropriate towing speed. After a couple of weeks, just long enough to find on the market the information on the bearings and a few other components to purchase, the first draft of the design went together with the first chip from the lathe. (See the CAD drawing. These PDF plans can be downloaded from the *RCSD* web site <http://rcsoaringdigest.com/images/Alongi_50cc_Winch.pdf>)

Referring to the CAD drawing:

One of the steps not so easy was the re-working to the engine pinion which in origin drives the bike chain. With a sharp very hard tool I could smooth down the teeth and get the shaft for the transmission coupling (2). I shall digress to explain the choice of that coupling comes from the fact that I had it already at home, it was in a bottom drawer for years (legacy of my previous activity as a hydro modeler). There are cheaper joints on the market.

To obtain a lower rotating mass I preferred to realize the spool (3, 5) in three pieces. Non excessive difficulties of execution are added. The result is a set lightweight and functional.

The brake (6) and the shaft bracing (8) are processed fast and pertinent. These are the steps I suggest for the beginning: Flatten the two sides of the brake disc (6) and drill three holes M6, copy them (diameter 0.6 mm for the moment) on the plate (8) (cut the plate longer than needed, eg. 100 mm instead of 91 mm); fix the two pieces together with three screws, mount them on the lathe for drilling the hole 34 mm through both pieces. This hole will lead all the references for subsequent processing to both pieces, to ensure a perfect centering of the axis of rotation.

The frame (9) may be assembled by brazing with castoline or, if you prefer, by a few segments of arc welding. Look out for deformations to be straightened where necessary. Check to allow the mounting of components well in line each other.

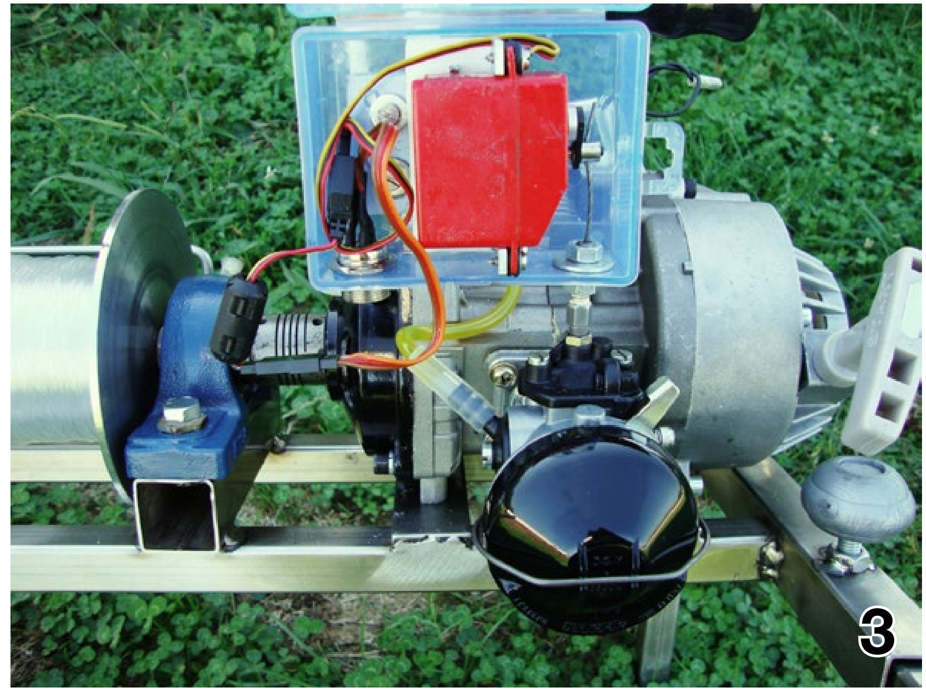
Now comes the time to apply an exhaust pipe, a steel cable for the throttle to pull manually, suspend an infusion bag of 500 cc as a fuel tank, and test the engine plus the spool assembly without the towing cable. (See Photos 1 and 2)

After confirming that everything runs well without excessive vibration, check the carburetor for the idle to be smooth and the tuning at max rpm: it must sound “rich” as the engine is unloaded.

Let us refocus on the throttle control. I have imagined three ways:

(1) The easiest seems to be a wire / sleeve and gas pedal (self-made, starting with a gas knob for a motorcycle). There is maybe a handicap: the cables on the market are short, you will not be far enough from the noise of the engine.

(2) A servo that actuates the carburetor, which is subject to the replacement of the return springs with much softer ones. Driven by a new receiver. One channel and one slide control in your transmitter must be free... Mmmm, too many needs to meet, it is not my case.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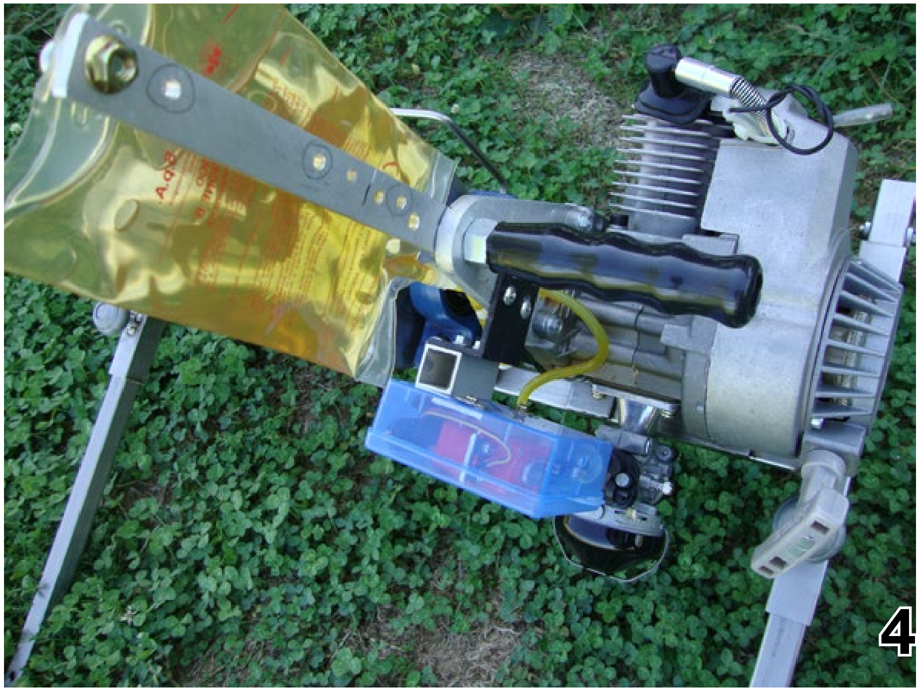
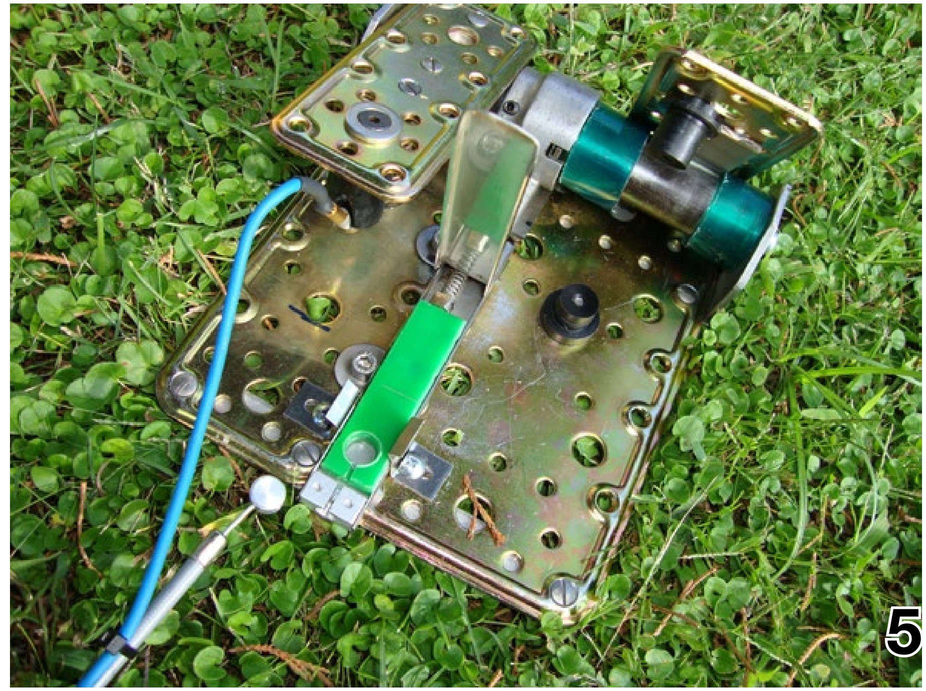
(3) A servo as above actuated via electric cable from a servo testing circuit mounted in a pedal!

This solution, suggested by our President Maurizio Saracco who made the electronics, seemed the most suitable. After struggling with the interference caused by the unshielded magneto ignition unshielded (spark plugs of that type do not exist), the system was finally working. (pictures 3, 4, and 5)

Last May in the field for the first take-off! The engine running OK, 500 meters of 1 mm nylon cord loaded on the spool, the return pulley placed 200 meters away (to cut the time, it was borrowed by Ivo Biancalana).

The model to be potentially immolated during the test was an old glider with a wingspan of 2.8 meters, 2 kg of weight. After





an animated joint discussion we found the point where the hook should be mounted. The model was on the runway, ready for takeoff. On that occasion I assigned my transmitter and the gas pedal to an expert F3J pilot, Alessio Muro. A tear at the starter, full throttle and the model glided on the grass for 3 to 4 meters, then took off assuming the classic climbing rate of these launches.

On the vertical, with the gas reduced, the glider came loose and the same throttle was enough to retrieve the cable held in tension by the parachute. Then, gas at idle, the cable stopped running and someone cut-off the engine to follow the flight in silence.

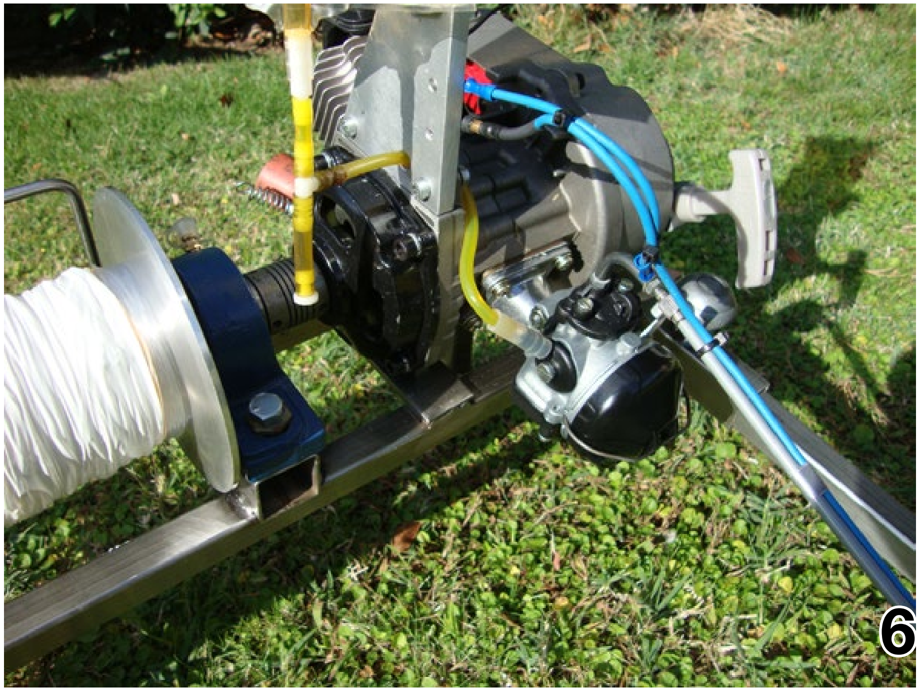
Next time it was my turn at the transmitter, assisted by Alessio at the gas control. A new positive experience, less difficult than I supposed!

In the following weeks, three more flying sessions with full controls in my hands, a total of about 25 launches gave me the self-confidence with the system even if some electronic troubles affected again the reliability of the gas control.

This malfunctioning can be really dangerous, so I went back to Maurizio for a solution. Meanwhile I developed the mechanical gas control (See Photos 5-6), in order to be ready for the future flying sessions.

The opportunity to test it occurred shortly thereafter when I invited to our camp some modelers from another club for a day dedicated to testing the winch and aero-tow flight. You can see the video on YouTube <http://www.youtube.com/watch?v=rMhV7h-n0AU>

The interest in the event brought a dozen models to the runway. Favored by great weather we enjoyed a long session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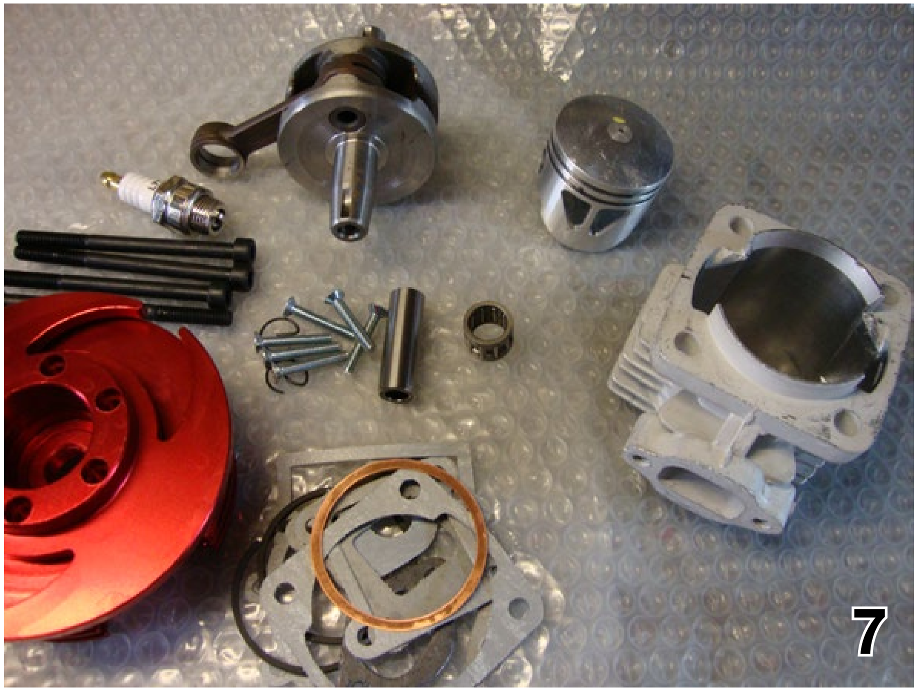
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of launches that finally closed in the late afternoon with the satisfaction of all of us. Moreover, the event stood as one further verification of the system and the opportunity to have new experiences.

This was the point I wrote my emotions to Bill last September. Imagine my pride and joy receiving back words of interest and the idea for two new targets leading our coming activity: 1) the maximum height a glider can be lifted, 2) the size / weight limit for a safe take-off from the ground.

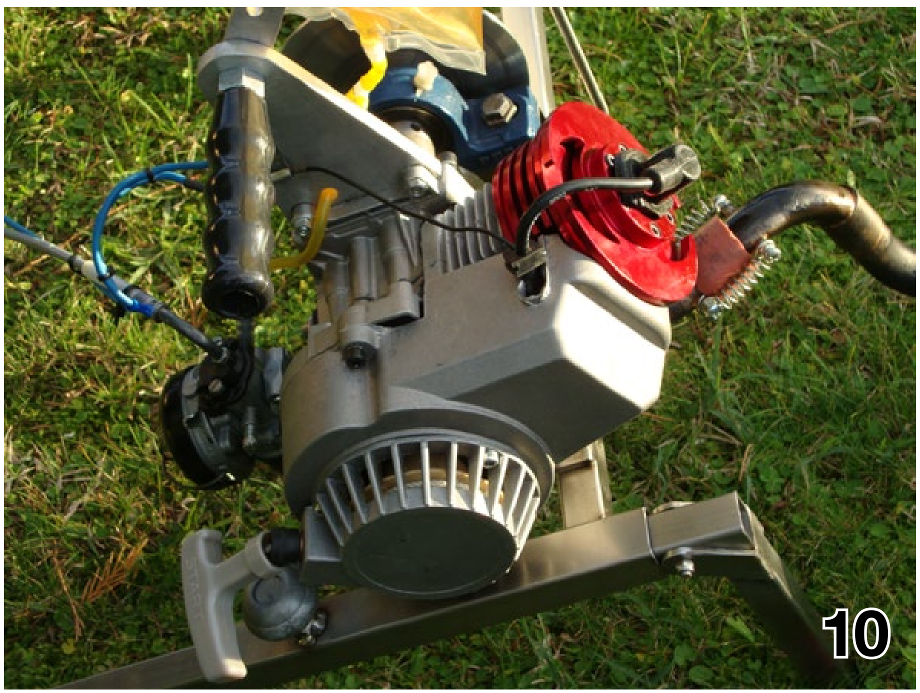
The first test is easy to organize, the spool has been loaded with 700 meters of nylon wire. The outer diameter has not grown too much on the spool, it should keep the appropriate towing speed range. The height data will be gathered by the Multiplex telemetry and a vario/altitude sensor settled onboard the model.

The second test will require the cooperation of modelers who can convert a suitable glider ready for the winch towing. At the moment, six teams will participate in the coming flight test I am arranging as soon as the gliders are modified. I am quite sure that it will take time before we are all ready.

Waiting for the “ X” day I was looking back to the experiences of the last meeting.

Sometimes, the winch engine seemed at a low key when towing the larger models, so I decide to take advantage of this pause for a review. What a surprise to find out the displacement is not 50 cc but only 38 cc. Just a call to minibike retailers and they confirm that mine is one of the first versions of the imported engines.

That is the reason for the large offer on the web promoting the “Big Bore Kit” (See Photo 7), an upgrade for minimoto engines.



Fortunately, we are not speaking of a high price. I do not miss a good opportunity on Ebay, and the brand new Big Bore Kit stands sparkling here on my workbench. Finally I get a sense of a true 50 cc! After an hour or so it is assembled.

“Mamma mia!” the Chinese passed me the hot potato! The piston touches the top of the cylinderhead. The gasket is too large and does not copy the dome shape of the piston. The combustion chamber is measuring 2.1 cc. Do the math yourself, the compression ratio would be 25 / 1. What a mess!

This is not a situation to adjust with some shimming gasket, so I roll up my sleeves and uncover my lathe for re-shaping a fully functional cylinderhead (Photo 8 and 9). The gasket now has a thickness of 0.6 mm, and the compression ratio is 11.5 / 1. Nothing special, just the minimum action to tune up the engine.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Fit back together all the pieces, having to admit I cannot wait for the moment I could turn it on for breaking in.

Finally a sunny day, so I run outside to check the expected improvement. (Photos 10 and 11). See the video at <http://www.youtube.com/watch?v=5fTH0sNaWdo>.

The start without hesitation, the ease of reaching the higher rpm, and no whim at all during the breaking-in let me say that we are ready for the planned upcoming events.

I will tell you the size of the models and the heights reached by towing in a follow-up article.


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