Bücker Jungmeister

Appeared on FlyOff

HISTORY

Carl Clements Bucker was born near Coblenz in 1895. He was a sea-plane pilot for the German Imperial Navy during world war one and in 1921 moved to Sweden where he founded the Svenska Aero AB which became later the current SAAB. In 1933 Bucker went back to Germany togheter with the young engineer Anders Andersson, and six months later, on April 27 1934, the test pilot Joachim von Koppen flew the Bucker Jungmann, two seater biplane that in 1936 was chosen by the Luftwaffe as basic trainer. A large production was made under licence by the swiss branch of Dornier and the Spanish C.A.S.A., who built almost all the planes exisisting today .
The Bul 33 Jungmeister version, aerobatic single seater, was achieved by downsizing the two seater Jungmann and replacing the 80 HP in line engine with the 160 HP radial Siemens.
A true thoroughbred of the world aerobatic was born and it dominated the contests for over twenty years.
The model that I reproduced is on display in a museum in the USA and features the look of the Bucker flown by the great rumenian pilot Alex Papana, who performed outstanding aerobatics flying inside the stadium at the 1936 Berlin Olimpics.

The aerobatic pilot Alex Papana next to his Bucker Jungmeister

THE PROJECT

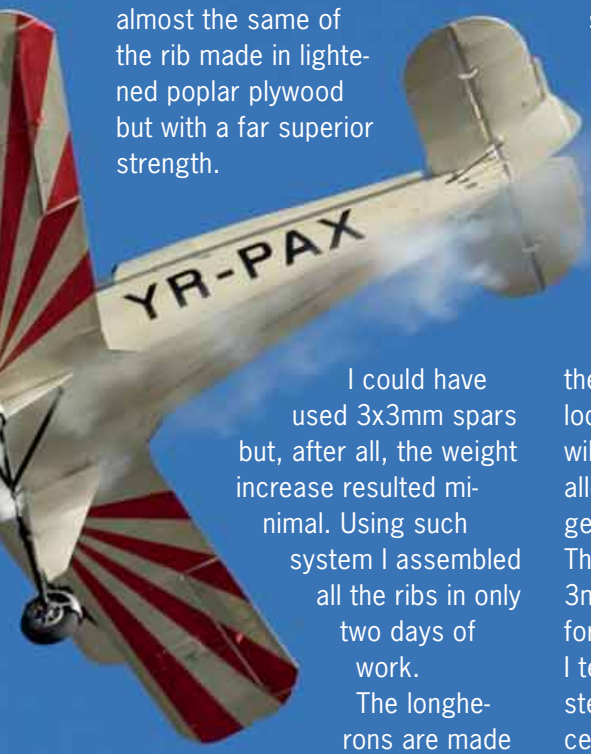
The project was planned so as to result in a structure identical to the one of the full scale Bucker: fuselage and tailplane framed up with stainless steel tubes welded togheter , wooden wing and fabric cover, aviation type plywood and aluminum, except the engine cowl that for obvious reasons has been planned to be in fiberglass.
The 1:2 scale resulted in a model having a wingarea of about 3 sq.mt, estimating an approximate weight of 20/25 kg., the wingload would have been only 65/85 g/sq.dm. Based on this calculation it could have weighted two times as much, but as we know, being light is never a problem.

Sergio Filippini in the usual shot before the maiden flight

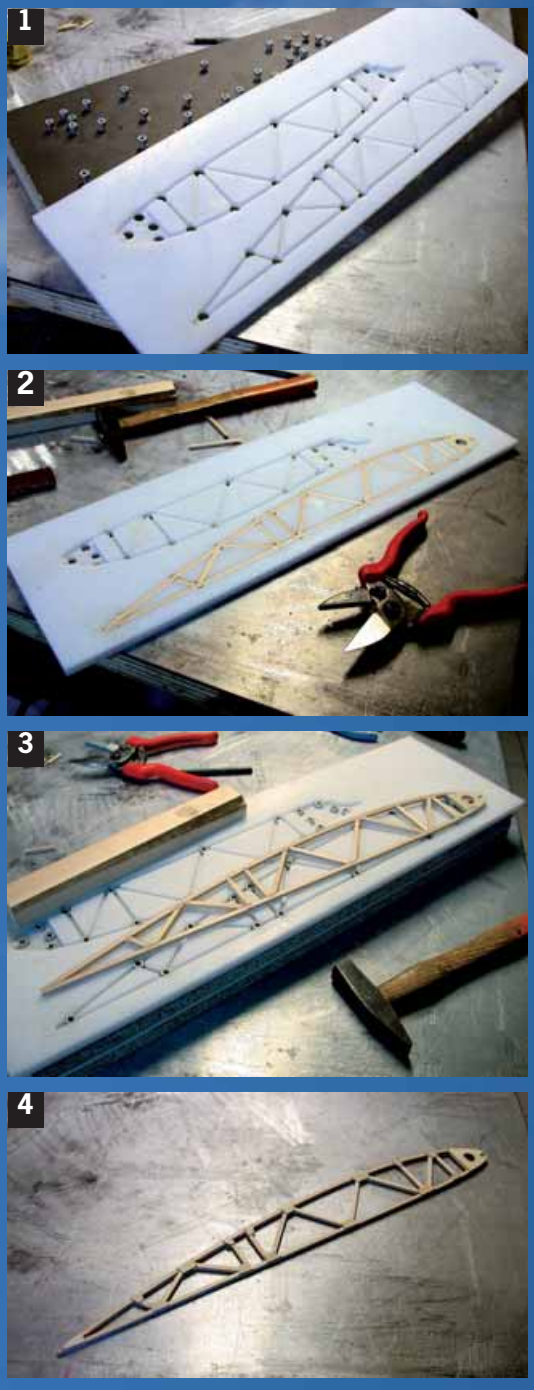
THE WING

For the construction of the wing I decided to try out the built up ribs design like in the real plane. After some unsucessful attempts with plywood templates I discovered a very functional and quick system. I cut out a template, using my CNC Stepfour pantograph, from a food grade 10 mm thick nylon sheet: I milled a piece of 4x4mm reproducing the rib structure, I then drilled a 10mm hole at each intersection of the structure. I made then a sort of extractor screwing on a piece of chipboard some 6mm screws ,having hexagonal head, so to match the holes on the nylon templates (picture 1).
To build the rib I inserted 4x4 lists the cut outs , top and bottom are lime tree, obeche for the cross braces and for the front of the rib I used 4mm poplar plywood cut on the pantograph.
The whole thing is pushed all the way down precisely into the template, then I dripped some drops of CA on each intersection of the structure, using also the 10mm holes so to add some CA drop from the bottom (picture 2). After few minutes I layed the template on

the extractor and by hammering the nylon slightly the rib came out of the template perfectly glued. (picture 3).
The addition of 0,6mm birch plywood plates has even overstrengthened the whole part. (picture 4).
The weight of each rib is almost the same of the rib made in lightened poplar plywood but with a far superior strength.



I could have used 3x3mm spars but, after all, the weight increase resulted minimal. Using such system I assembled all the ribs in only two days of work.
The longherons are made of cedar, "U" milled, with a 4 mm poplar plywood sheet in between. The points of connection to the wing and the struts are reinforced with 3mm birch plywood. The wing features also strong steel wire cross braces tightened to the limit with drilled head screws. The leading edge is made of 0,8mm birch plywood steam bent. The same plywood is used for the trailing edge and the capstrips. The hardware used to connect the wire struts is 1mm stainless steel ,laser cut. The end portions are a stainless steel tube with a 6x5,5 inner diameter. The ailerons are the only parts that do not reflect the original construction : as matter of fact I preferred to use some 10x10mm balsa spars wearing a carbon sox. I have been using this system for years and provide a great sturdiness and rigidity.
The hinges and the right angle squares are made out of 2mm glass sheet cut on the CNC pantograph.
I glued an additional lightened 3mm birch plywood rib to the connecting rib. The wing is not built with plug in tube nor connections but only two short steel dowels having 5mm diameter to keep the alignment. It will be entirely locked in position with wires that will break loose if a crash occurs allowing the wing to detach without getting damaged.
The wires connections are regular 3mm steel clevis more than enough for the application.
I tested it hanging the whole system connectors,clevis,wire to the ceiling and it supported my weight (88kg). In any case it's extremely important to make sure that the clevis pin goes firmly in the small hole and then lock the clip with a 6mm inner diameter ring. The wing struts are a drop shaped tube built on a home made rollers extruder. I inserted a 5mm screw at the end of each strut. Unscrewing these screws the struts extend and tighten the wires that lock the wing.
The wing, same as the other parts, is covered with Dacron. , a fabric used on the real planes. It gets attached using a specific glue and it shrinks using an iron and a cellulose based fabric shrinker.
The result is amazing.



Method and step by step construction to make the framed up ribs

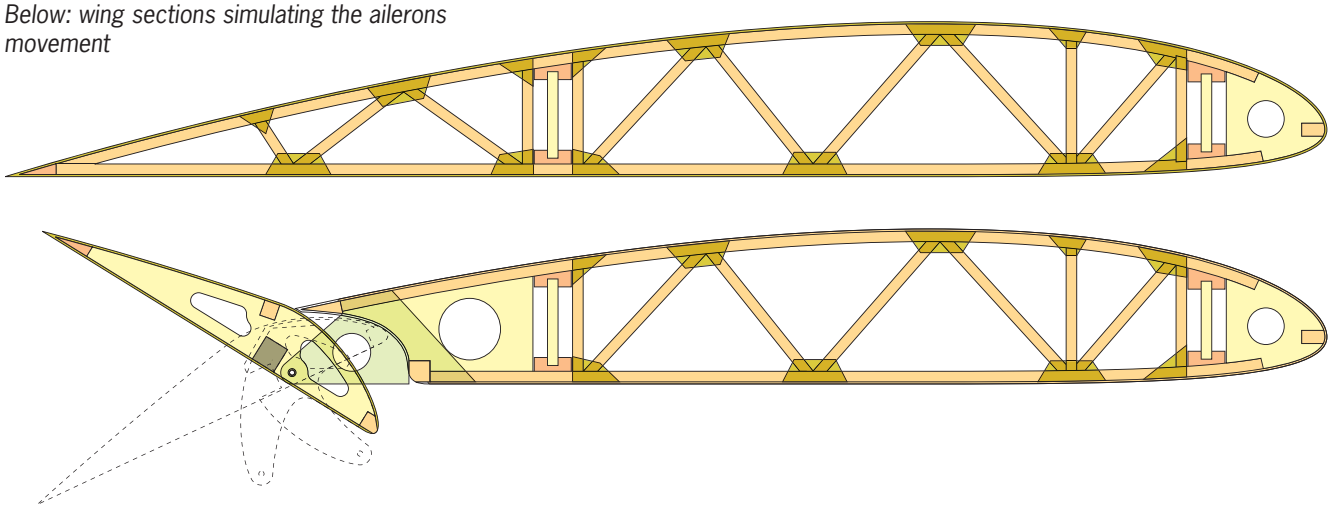

BÜCKER JUNGMEISTER

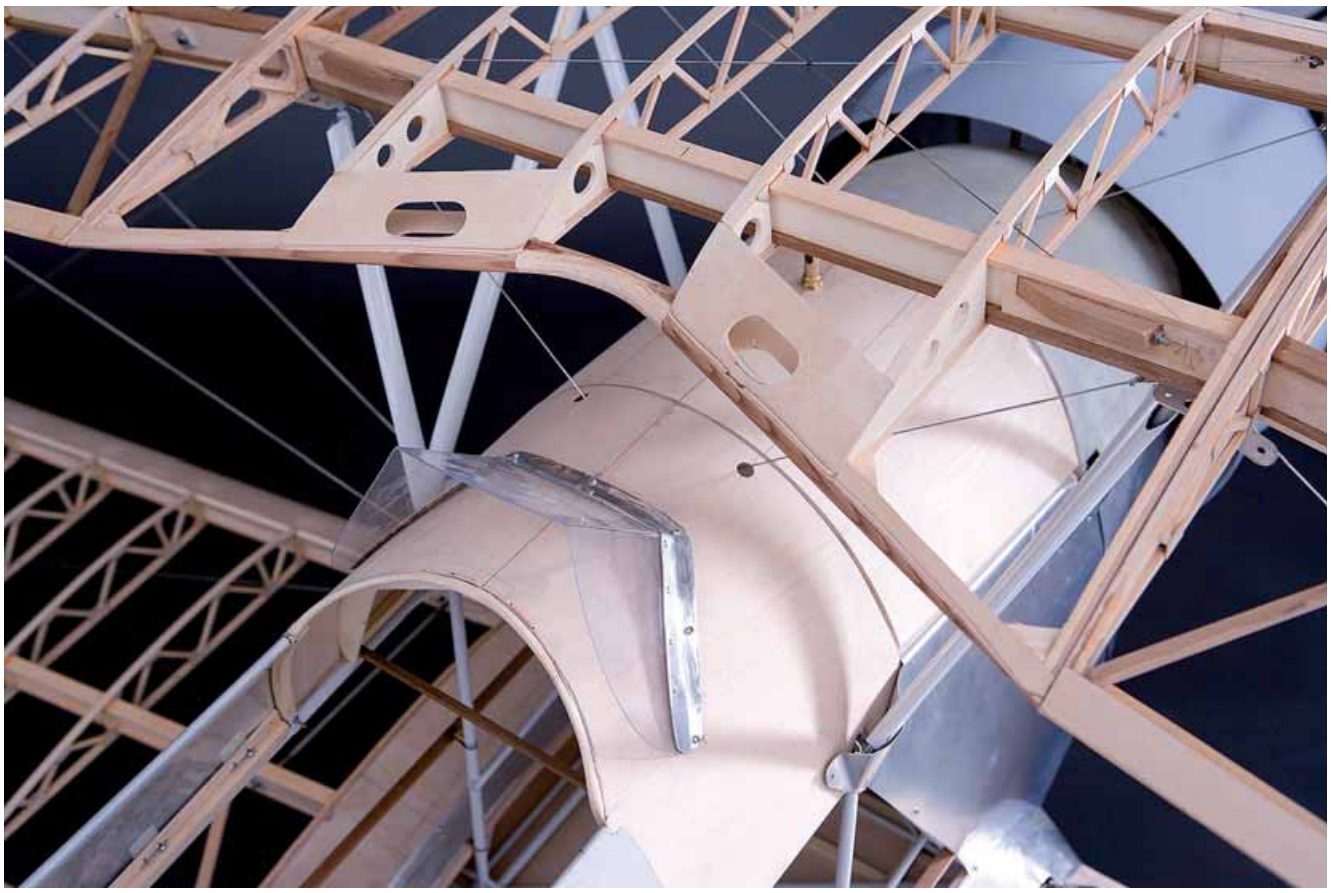

BÜCKER JUNGMEISTER


PAX


Bücker
Jungmeister

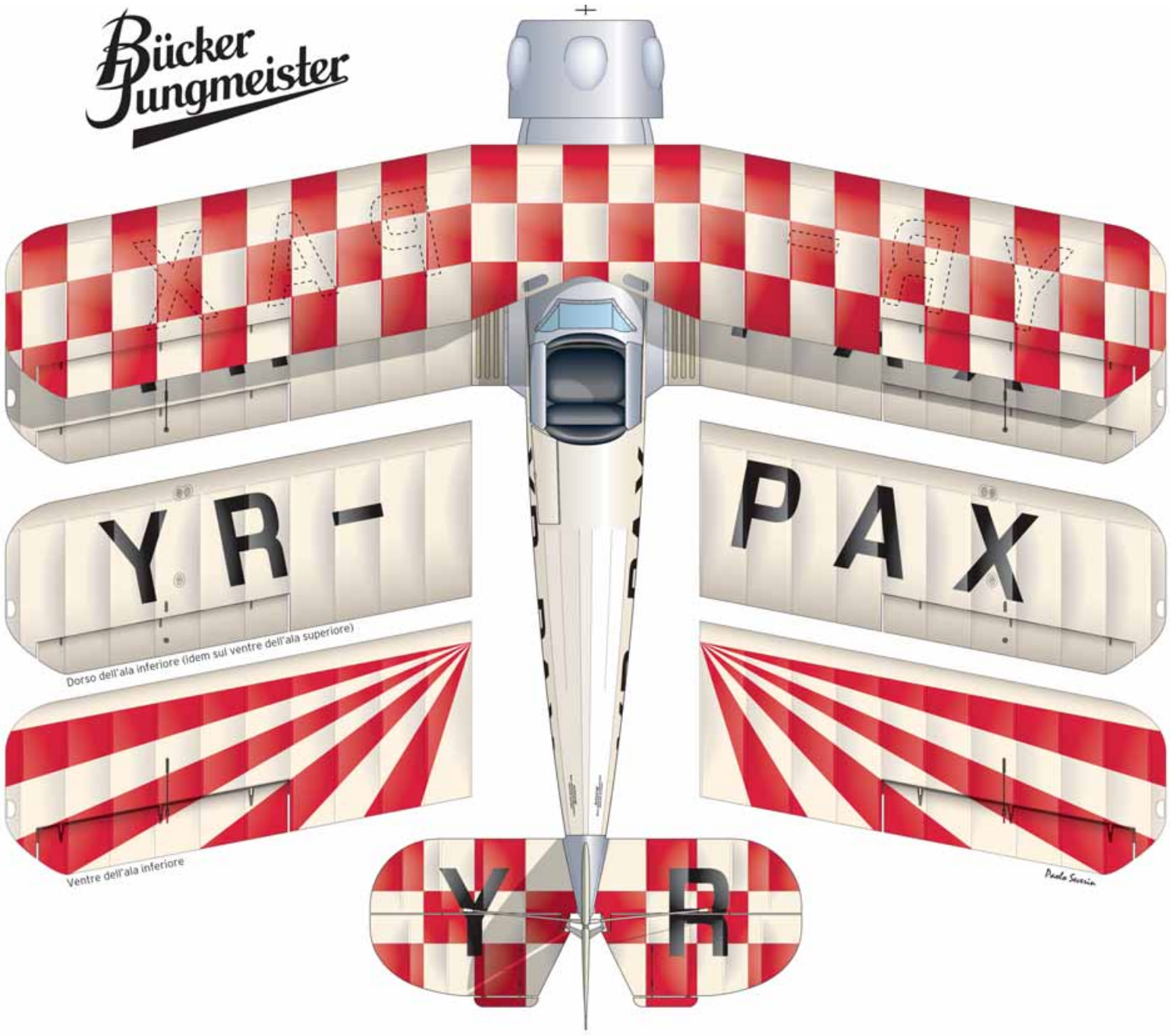
Below: wing sections simulating the ailerons movement



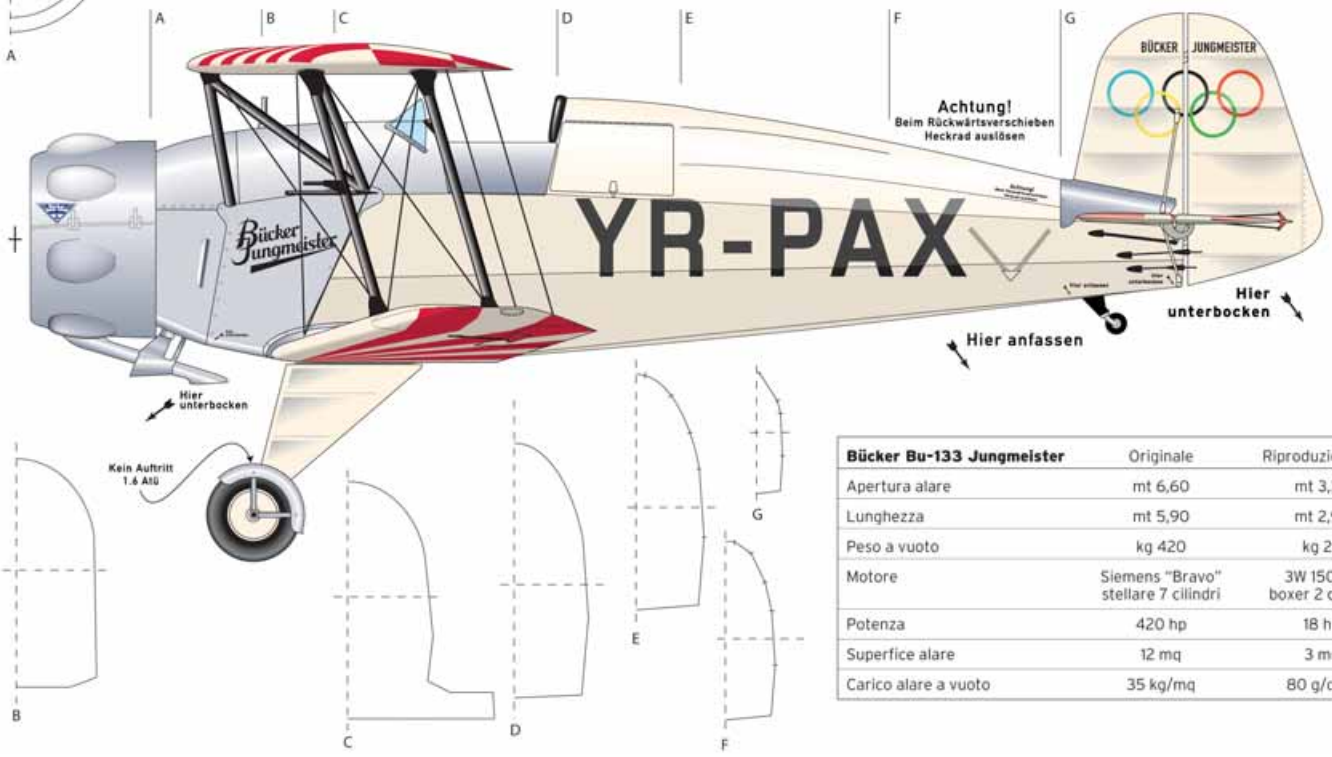


On the left: lower wing structure (the upper one is basically the same)

On this page: structure of the center portion of the upper wing; detail of the cabana strut connection; connection of the wires to the fuselage; detail of the wing servos, located in pair on the lower wing, the upper aileron is moved by wires that come from the lower aileron.


Bücker Jungmeister
YR-PAX
Dorso dell'ala inferiore (idem sul ventre dell'ala superiore)
Ventre dell'ala inferiore
YR
Paolo Severin

BÜCKER JUNGMEISTER



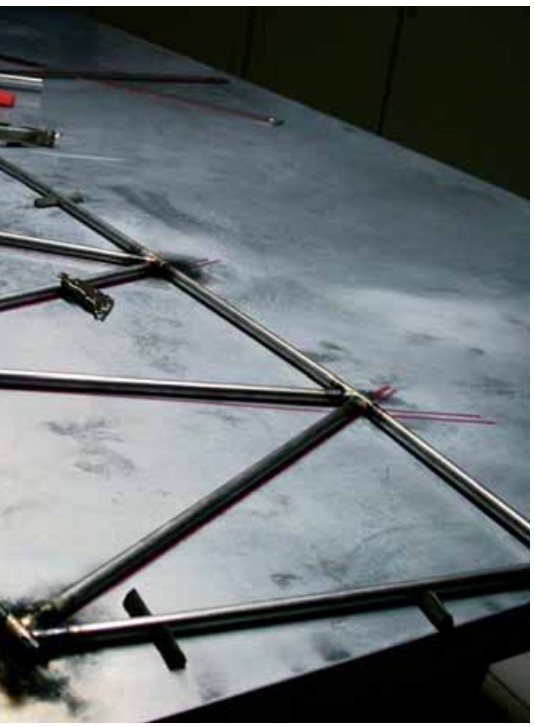
Bücker Bu-133 Jungmeister	Originale	Riproduzione 1/2
Apertura alare	mt 6,60	mt 3,30
Lunghezza	mt 5,90	mt 2,95
Peso a vuoto	kg 420	kg 24
Motore	Siemens "Bravo" stellare 7 cilindri	3W 150 cc boxer 2 cilindri
Potenza	420 hp	18 hp
Superfice alare	12 mq	3 mq
Carico alare a vuoto	35 kg/mq	80 g/dmq

THE FUSELAGE

The main structure consists of a frame made with 4 stainless steel tubes having an inner diameter of 9x8,5 and struts made with tubes having a decreasing diameter that going towards the tail.
The bulkhead, that holds the motor mount, is reinforced with 0,7mm steel sheet plates. The connections for the cabane struts and the landing gear are made of 1mm sheet. The engine stand is made with stainless steel tubes measuring 8x6 diameter internal to the motor mount plate in 2mm stainless steel lightened with holes, and has 4 rubber dumpers to reduce vibrations.
A big ring in stainless steel tube having a inner diameter of 6x5,5 is welded to the engine stand , supported by rods of the tube itself, to work as a support for the engine cowl. I used a small home made bending calendar with rollers to make this ring and also to round up all the other tubes (the rings of the cowl, tailplane edges, wing tips etc).
To build the structure I christened my new 2mm sheet metal top of my workbench. I have to say that is the best way to build this kind of structures, because allows to lock the tubes on the top using powerful magnets (I retrieved them from old PC hard disks) and to weld directly on the top itself. Once I outlined one side on the table with a marker , I then built it in a flash. I built the other side lining up the tubes with the first one using small clamps and magnets. Once I had two identical sides I positioned them on the table with the help of magnets and right angle squares.
After having welded the first cross tubes for which I payed lot of attention to the alignment, the work became easier and quicker. The basic structure took only one day of work. The welding of the stands for the servo tray , the tailwheel stand and the elevator control stand, several reinforcements and the wing connections, the tailplane , the cabane and the landing gear, instead required more time due to the fact that each piece had to be made to measure . The fuselage has been finished with two cedar wooden side spars attached to the frame with obeche spacers tied with nylon string and CA. The top portion behind the pilot- which has only an aesthetic function- is made with 3mm poplar formers reinforced with cross cedar braces and small longerons, in cedar as well. Right behind the headrest

Above: the beginning stage of construction of the fuselage. The first side is welded following the drawing outlined on the metal table. The tubes are locked in position with magnets.

Above: to cover the fuselage I had to become a tailor to apply to the fabric the inspection hinges of the tail leverages.



Picture on the side:
Vacuum forming of the fairings attached later to the polyurethane foam matrix covered with scotch tape and treated with a detaching agent

The engine cowl primed and ready for painting. The ring to make the framed up ribs

The pilot to speak:

Finally! Paolo Severin made a decision: the Bucker Jungmeister was born! The aeromodellistic junction of Paolo and myself has been a true winning move. Our points of view never collided with each other , we have debated only three points: 1) The wing airfoil flat/round, as the original one, does not allow negative aerobatics such as inverted loop or inverted flat spin. I would have preferred a biconvex asymmetric airfoil. 2) I would have increased the ailerons area, thinking of the full scale Bucker that was slow rolling 3) I would have used lighter wheels because the ones used that you find on the market despite of a lightening treatment were still weighing 600gr. each.

The debate was quickly solved because Paolo was simply adamant about it:" It's a reproduction and such must be."

I have to aknowledge that facts proved him right. The model, started in half 2006, has been tested on May 1st 2007. The test was amazing. Five meters at full throttle and the Bucker takes off nose up almost vertical pulled by the 18Hp of the 3W 150. Six clicks down on the trim, throttle back and the model straightens up quickly, (later we adjusted mechanically the stab incidence so we could fly with neutral trim setting.). My experience as a pilot of real planes and giant scale models allowed me to be usually calm during the maiden flight, but I swear this time my heart was up my throat. I was not testing a giant scale model, I was fying a real Bucker without being on it.! An unforgettable and exiting sensation. In just few flights I could appreciate the reliability of the project. Now , after almost twenty flights, I am no longer afraid of a model so imposive; it comes natural to enjoy all the sweetness , the quick response to the controls and the easyness in performing classical aerobatics , very contained and precise. In a time where aeromodelling is

swamped with little models, little helicopters, little gliders, little electrics, and every model performs 3D aerobatics, it's light for the eyes to have the possibility to admire the traditional aerobatics performed by a model so impressive and so realistic. The most common compliment that we have received at the airshows was : finally we see the true aerial aerobatics!"

Now our Bucker is tuned up to a truly satisfactory level with all the moving parts without trimming.

I put 50% esponential on the tailplane, while I used 40% inverted (faster on the fisrt portion and slower at the end) on the ailerons, so to be quicker on the rolls. The dual rate settings range from 30% to 45% on all the moving parts.

We took part in many shows , where we earned a very rewarding success, and we received many invitations even for important shows abroad.

After 29 years of full scale airplanes (I have not been flying for the last 8 years) and 51 years of modelling (I am retired and 65 years old) I can relive the feeling and the adrenaline of those contests, that excited me so much, thanks to Paolo Severin , who sent me back in time giving me as a present, for a modeller, a "nice shot of youth"

Sergio Filippini

Big picture: the finished structure before being covered, the tubes are painted with epoxidic paint

Small picture: The latest version of the landing gear with chrome molibdenium tubes.

Right page: All the hardware, despite the look, weighs 5 kg.

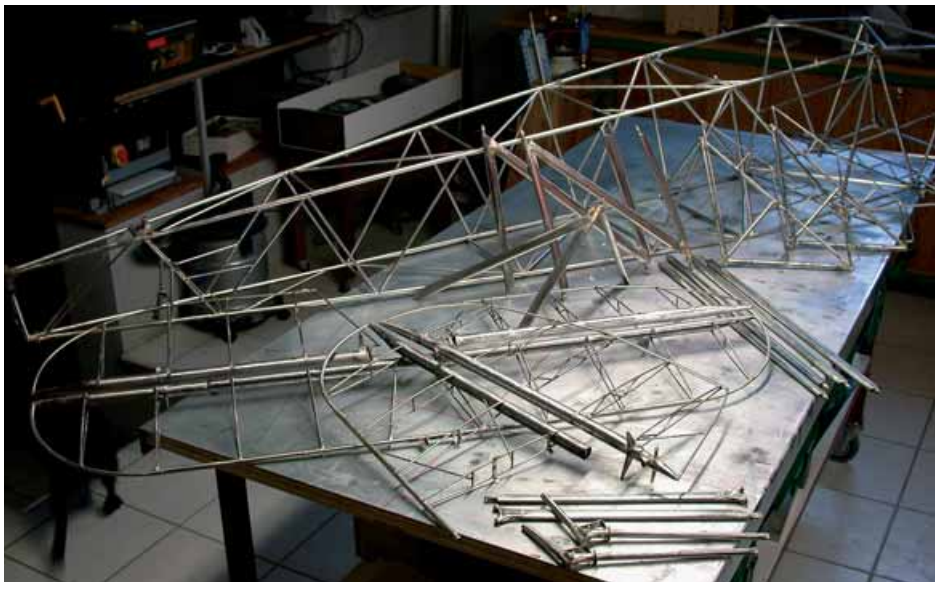
has been reproduced the trunk door using a lithoplate. In the end, incredible but true , the finished structure weighed in at less than 2 kg, sturdy and warpproof. The fuselage has been covered with fabric from the pilot seat to the tail, the front side is covered with aluminium panels made from lythoplate. As I said the engine cowl is in fiberglass, made with the system of "loose Styrofoam". The matrix was made rotating a pile of poliuretan discs glued together with a big drill so to sand them, this created a mountain of terrible dust. The matrix was then covered with scotch tape heated up with a blow dryer to stick better. The seven fairings made from Styrene sheets, vacuum formed same as the canopies, have been attached to the matrix. The whole package was then coated with resin including the front ring with the 6mm tube tristar which makes the whole thing very sturdy. The cowl is attached to the above mentioned ring through seven steel squares.

THE LANDING GEAR

The landing gear features two steel tubes triangles, the main triangle is made in chromemolibdenium, hinged to the lower longerons of the fuselage. The two triangles are covered with a light structure made of 3x2,5 stainless steel tube formed by two ribs and a trailing edge, while the leading edge is the main leg of the triangle itself. The structure is covered with fabric. The legs of the landing gear are fully sprung by two strong springs. The wheels are kept in line by two small arms, made with a section tube, hinged at the top end of a section tubes pyramid . It's interesting to notice that the three arms of the pyramid are not simetrically connected to the fuselage : two are connected near the hinges of the left side landing gear and one near the front hinge of the right side landing gear. This may seem an antiaesthetic design, but it proves to be very rational and eliminates all the unecessary weight. As matter of fact, in order to connect the rear arm of the piramyd to the center of the fuselage, it would have been necessary to reinforce such point of connection , while done as it is the existing points of connections have been used. The scale wheel are obtained from the wheel of a barrow to which the tread has been worn out using sand paper and lot of patience, making them turn on a drill. The fenders are in fibreglass.

THE TAIPLANE

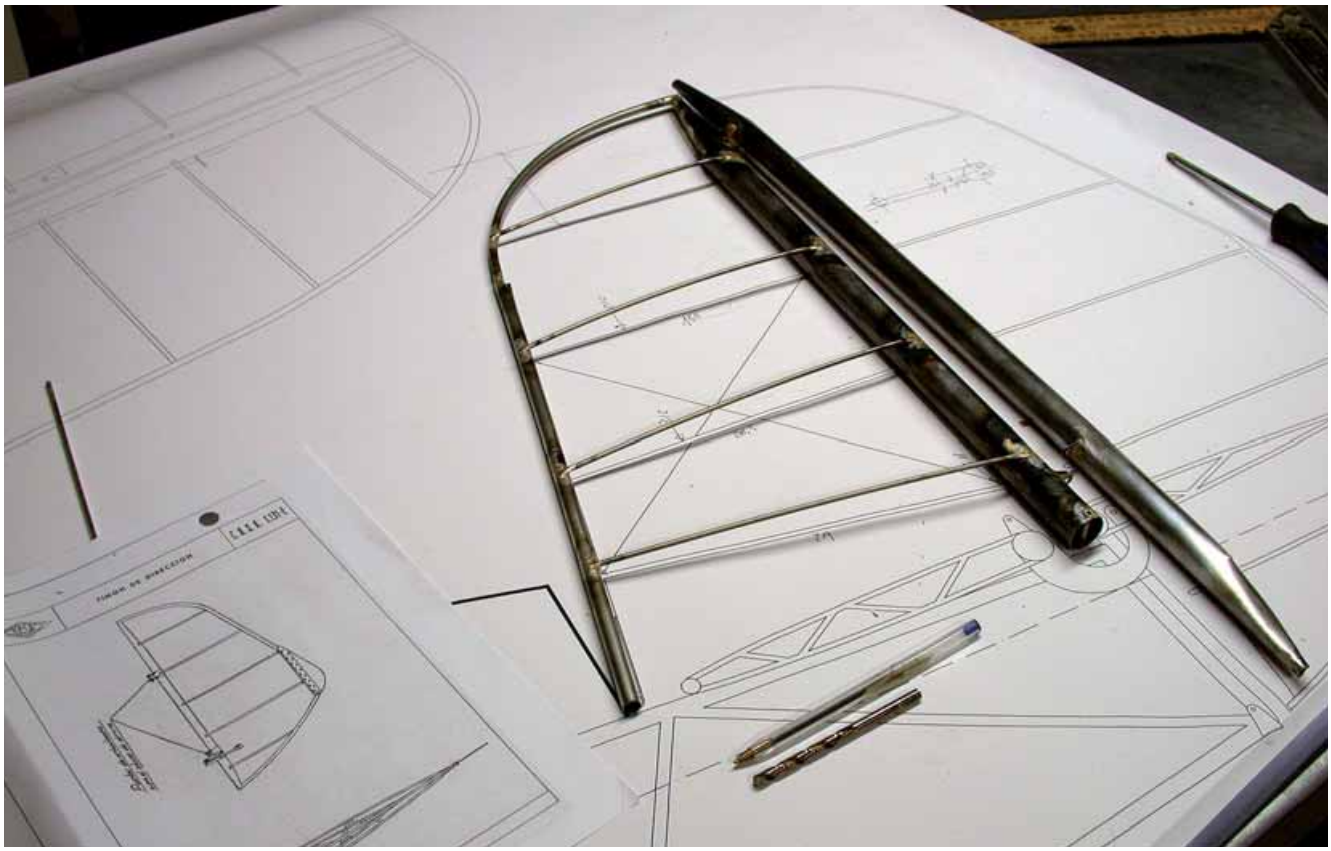
The tailplane has a structure made with 0,25mm stainless steel tube,

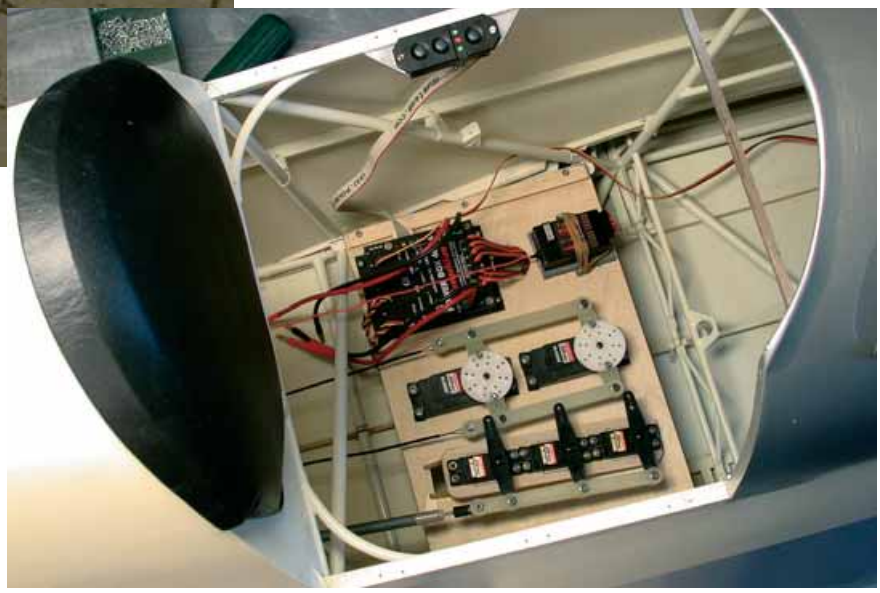


except the main longerons that are broom sticks. Yes, you got that right. Since I was not able to find a tube of large diameter thin enough, I noticed that some broom sticks are made of very thin iron tube and therefore light, covered with a plastic film that can be easily removed. They seem to be made right for the purpose and are also in scale. The ends of the tubes have been cone shaped , cutting them lengthwise and welding them, so to match the leading and trailing edges that have a smaller diameter. The end tubes have been bent as per drawing using a small home made bending calandar. Still outlining the layout on the table and using several magnets I assembled the whole thing. The ribs are made with a 3mm tube slightly shaped so to achieve a decent profile and then have cross braces framed with the same tube.

Looking at some pictures of Buckers being restored and on drawings that I found, I noticed that even on the real plane has been used the same system. The leading edges are tubes of decreasing diameter of 9 and 6mm, welded inserting them slightly in to each other, the trailing edges instead are a 4mm tube. The hinges are 1mm stainless stell sheet and are a perfect reproduction of the original leverage arms, I have also reproduced the elevator and rudder trims. It's astonishing the space between the fix sides and the moveable sides. The elevator, especially, is hinged very far from the leading edge so that when it's operated sticks out quite a lot on the other side acting as a balancer. It's many pilots opinion that this is one of the features that make the Bucker so gentle and plaesant to control. Covering is obviously fabric.

Above and below: construction of the tailplane with steel tube





Pictures on the side: mounting of 3W engine. The stand is made of steel tubes, the firewall is 3mm poplar plywood, the 1 lt fuel thank is suspended with sturdy springs and straps. The removeable aluminium panels grant the access to every area.

The tailplane servos and the control powerbox are located under the pilot seat.

Inside view of the fuselage

THE SET UP

The 3W engine fits perfectly inside the cowl with the two mufflers. Later on was added a very efficient smoke system. The controls features three 12,5kg. digital servos coupled with leverages, made of out of glass sheet , to a carbon fiber bar on the elevator; two 24kg analog servos mated with steel braided wire cables on the rudder; two 12,5 kg digital servos for each pair of ailerons, mounted on the lower wing and connected to the upper ailerons by steel braided wire cables.
The whole package is controlled by a

power box and powered by double LI-PO batteries. The model weighed in heavy at 24kg. with a wingload of 80g./sq.dm.

THE FLIGHT

Sergio Filippini, great expert of the classical aerobatics, tested the model on May 1st 2007, six months after the beginning of the project. We had to use a special made cart to transport the “monster”. Despite an understandable apprehension we had no problems. The airplane was off the ground in just 5 or 6 meters with a little nose up attitude but under control. After a quick trimming Sergio tried a loop and a roll which confirmed that was a true Bucker. I then took the transmitter and felt a plane responsive to the controls but sweet and elegant. During the second flight the model stalled at about 1mt off the ground and one axle of the landing gear got somewhat bent. Later we reinforced the gear, honestly the axles made of 10mm stainless steel tube were a little weak for a 24kg. model. In the following days we tested thoroughly the Bucker trying just about everything. The only problem that occurred was a piece of the landing gear detaching in flight due to the breakage of a wire holding the main legs. After few passes with the wheel hanging down, Sergio decided to stall the plane at low altitude on a nearby corn field and the plane fell on one side of the wing from couple meters off the ground. As planned in the project the tie wires gave in, the wing detached with no damage and the next day we was flying again after having replaced the faulty wires of the landing gear with stronger ones. Later on the landing gear has been totally rebuilt with sturdier chrome molibdenium tubes and harder shock absorbers so to have an easier and safer landing, even the powerplant has been changed with a 250cc radial engine.
After two flying seasons the Bucker is even more beautiful: a slight yellowing of the coating paint with some crack and some natural signs of aging make it look even more real, so as real are the very beautiful classical aerobatics that have filled with enthusiasm the public at the shows.

Paolo Severin
www.paoloseverin.it


YR-PAV
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