
# Rubber Motor Model - Tuning

## *Westland Lysander [distributed] by G.K.B.-Best*

**The G.K.B. Best GMBH of Bielefeld distributes in Germany, amongst others, models of the company "Easy Built Models" whose catalogue is a veritable treasure trove of unusual models that are typically built entirely out of balsa wood. The Lysander awakened my special interest, as I had never seen a model of this type anywhere.**

The Westland Lysander was one of the few planes that were conceptualized from the beginning as a supply and liaison plane. The prototype flew in December 1936. The first machines were delivered to the Royal Air Force in mid 1938, and later deployed in several war zones in Europe, the near and far East. During many missions as supply and provisions plane, reconnaissance, and light bomber, the vulnerability of the relatively slow machine showed itself. Withdrawn from service at the front, the Lysander fulfilled diverse roles, to begin with as a target towing plane or in the Sea-Rescue Service before their special talent was discovered by Special Operations. Its excellent quick start and landing properties made it the ideal delivery plane for equipment and agents, predominately in night deployment.

### Kit Construction:

The Lysander is a traditional rubber motor model and falls, with a wingspan of 1.219 meters (48 inches) into the category of "Jumbo Scale Models". The construction kit contains the required building materials with very good quality wood: printed boards for framework and ribs, various balsa spars in sufficient number and a bit of planking material. A suitable propeller, the rubber motor, wire for the wheel-struts, tissue in two colours, and plastic for the wind shield are also included. What one still needs are glue, tools, and skill.

### And now let's go for it!

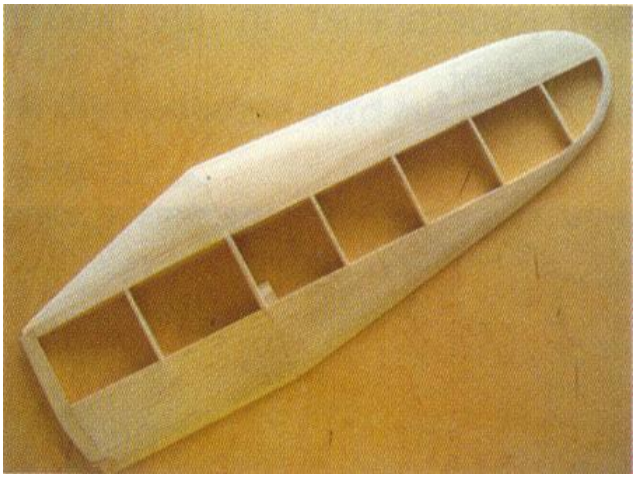
With the motto "building today – flying tomorrow", you are on the wrong track with the Lysander. One must bring along a little bit of patience if one wants to see this model in the air. First wing assembly is built, and for this the longest spars will be needed.
In the free flying version,

the wings of the Lysander have an open rib construction and two staggered wing spars. The wing halves will be directly glued to the cabin structure without support pegs. This is only possible because the Lysander, as a free flight model, is as light as a feather and because the wing struts are not only meant to be a decorative feature but are functional parts too. This Lysander however is meant to be remote controlled and fly with electric motor. Therefore it has to contend with a few modifications.

**Conversion to the RC-Version:**
In spite of the smallness of the components, the remote control Lysander weighs considerably more than the free flight model from which it was constructed. A strengthening of the wing structure is therefore necessary. Furthermore, access to the RC receiver, servos and motor has to be created. Here it is practical to make the gigantic cabin hood detachable, even though the wings will be connected to it – a combination that one would assuredly think about twice, in a larger model. There are also modifications to the tail unit, whose rudder flap is reinforced with additional strips and is fastened to the stabilizer with small fabric hinges.

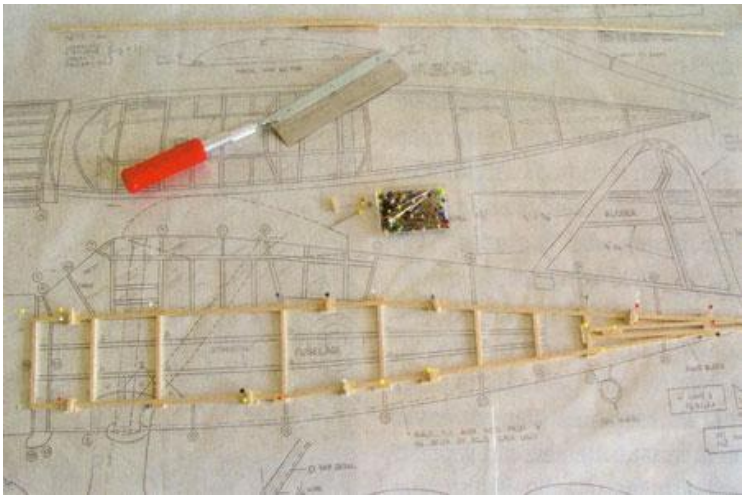
The motor and the servos are intended to be built into the fuselage. (These and the receiver can later on be packed somewhere in between, for there is ample space.) Finally the placement of the landing gear will be pepped up a little. The landing gear wire can remain; the model isn't going to be all that heavy.

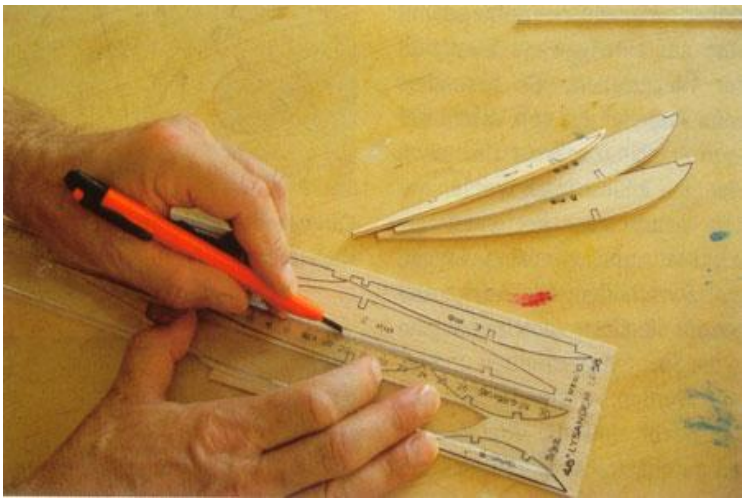
**Wings:**

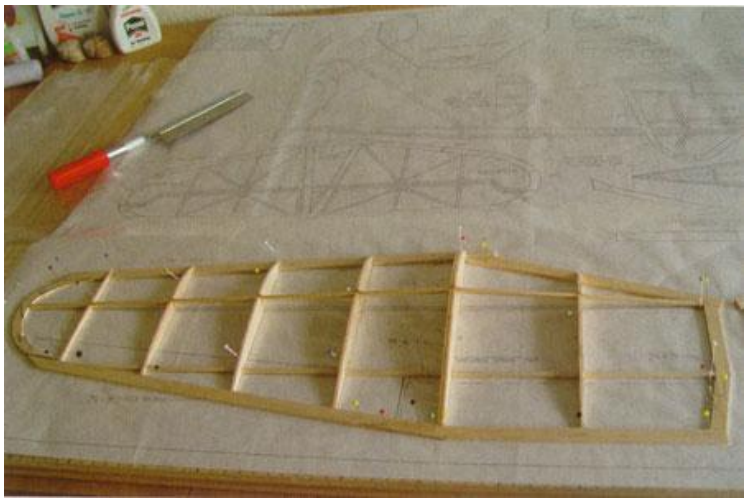


The wings can be built on the protected blueprint thanks to the straight under sides of the ribs. The construction of the free flight version was principally adhered to. In order to increase the strength of the wings, however, the areas from the leading edge to the front strut, and from the rear strut up to the trailing edge above and below, were planked with 1 mm balsa. Rib planking cemented on, above and below assure extra strength and a good attachment surface for the covering. Into the root rib area a sort of hinge was built in, made of parts of Bowden light weight tubing, with which the wings are securely attached to the reinforced cabin frame. This way the wings are placed with room to move and can cushion the jolting of landing and other influencing stress factors. An immobile connection is out of the question, as the area struts are supported by the legs of the landing gear and pass on every movement.

The points of attachment of the area struts of the wings were also modified. Small solid balsa M2 screw blocks were glued into place, to which later on the struts will be connected. That way the wings and struts are well equipped for the drag and pressure stresses that can be expected.
Note: ISO metric screw threads are designated by the letter **M** followed by the major diameter of the thread in millimeters.

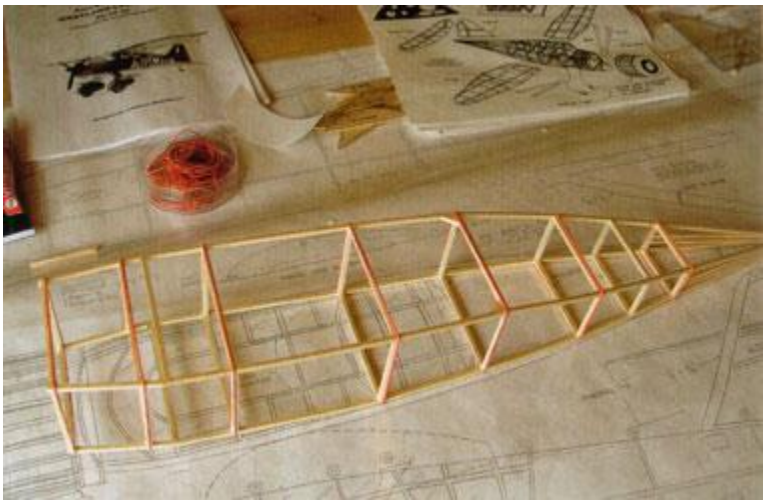


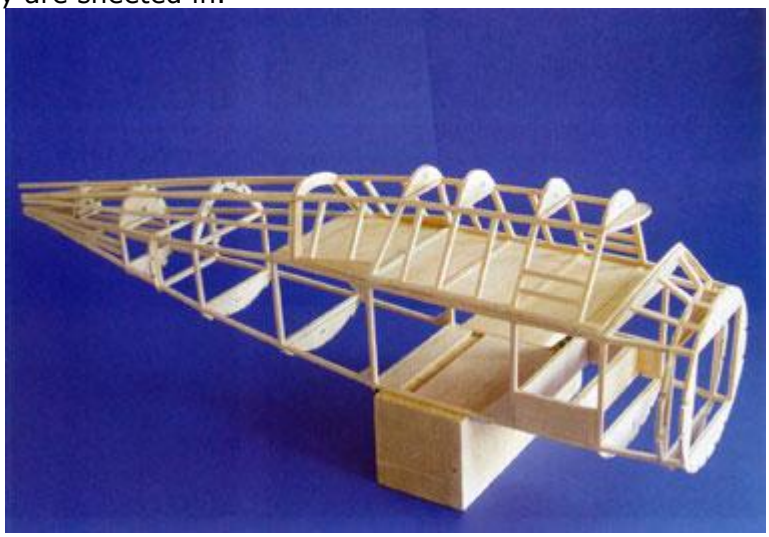




**FUSELAGE:**
The fuselage of the Lysander is really a box-fuselage; the full form is only achieved when the half parts and formers are connected to the completed box-fuselage. First of all the two fuselage halves are built directly onto the model-plan, protected with wax paper. During this the 3 mm thick stringers are held in position by small balsa blocks, for they are too thin to be held in place by pins. You get identical side pieces if you build the two fuselage halves on top of each other, divided by wax paper. Then starting at the tail suitable cross-struts are put into place between the side pieces. The top view of the fuselage serves to control and assures the exact alignment of the struts and lateral parts. The glued parts are secured section by section with rubber bands, until the glue has dried completely. Those who are in a hurry can use instant [cyanoacrylate] glue that dries in seconds, but thereby sacrifices a certain elasticity of the glued sections that is especially advantageous for the building of the fuselage framework.

Up to this point everything goes to plan. The half transverse formers are cut out of the printed boards and sanded roughly before being built in. The notches for the stringers should only be cut and sanded for the transverse ribs when the sides are glued in and the glued points are well dried out. Depending on the precision used when working, the notches might be misaligned, possibly the ribs are not printed quite so exact, onto the wood. While the fuselage is gradually taking shape, one must start thinking about the placing of the RC components (preferably, where the center of gravity is expected to be): Firstly in order to assure reinforcement of the fuselage in this region, secondly for the placement of the push rods that now have to be able to bear a little more than planned, and thirdly for the attachment of the detachable cabin hood or some other access opening to the RC-components. It is not necessary to stick to a predetermined sequence, for all the areas of the open fuselage construction are easily accessible until they are sheeted in.

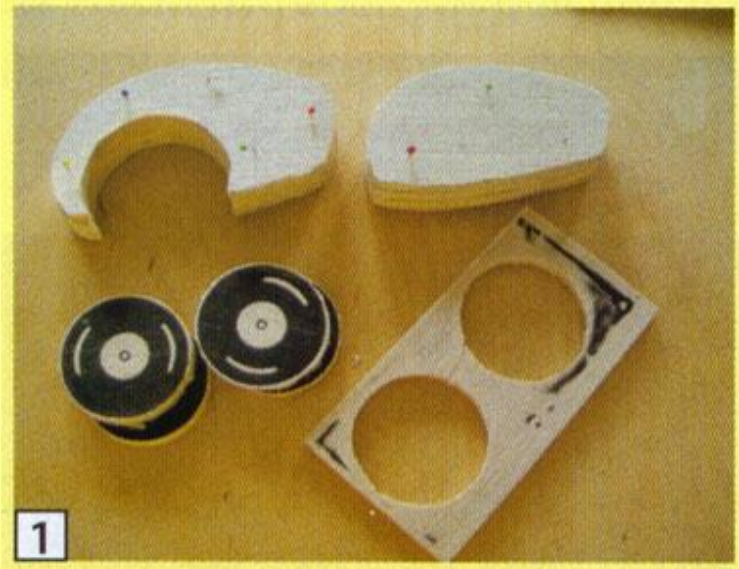




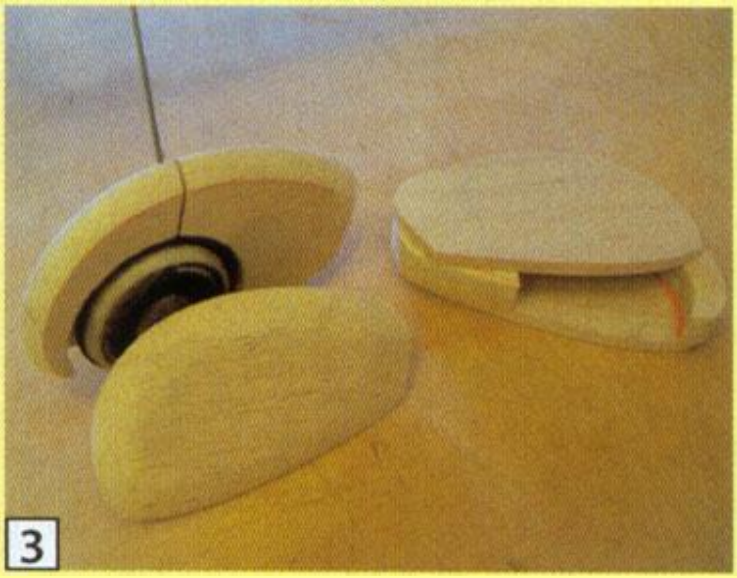
**The steering mechanism:**
Flaps and rudder will be built mainly according to plan. There are only a few additional supports in the side flaps, and apart from that balsa triangles were glued into the rudder to take the tiny GFK rudder-horns. Only when the tail unit has dried out completely are the rudder flaps removed and the leading edges beveled. A very easy and secure fastening of the rudder that is also hardly noticeable is that of very thin fabric/material hinges that are set into the upper surface of the spar and glued in with instant glue or a drop of epoxy resin.

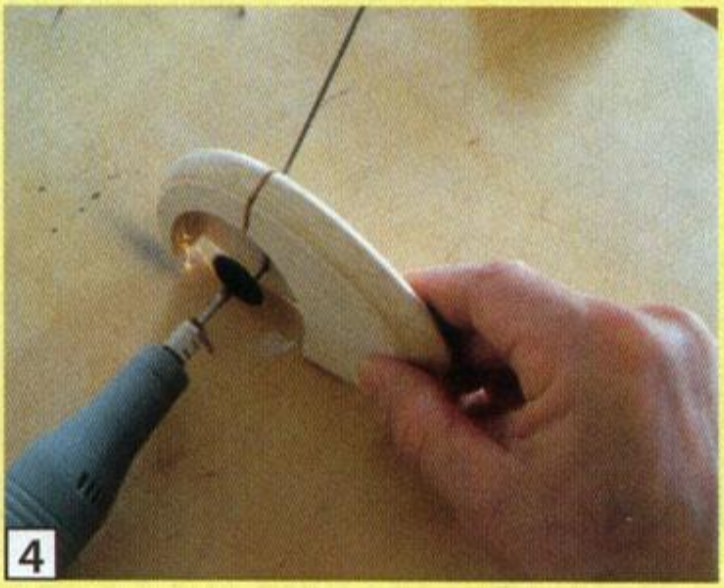
## Wheels and Spats out of Balsa

The wheels and the mighty spats of the Lysander will be manufactured completely out of balsa wood. Here's how: The wheels are made of two 6mm balsa sheets that are glued to each other, the grain turned 90 degrees. Fitted with a central axel-bore, they are placed onto a



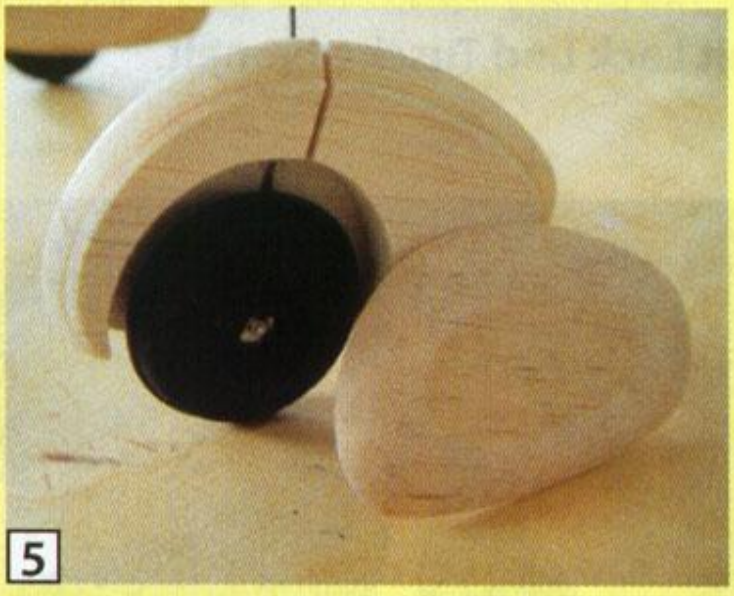




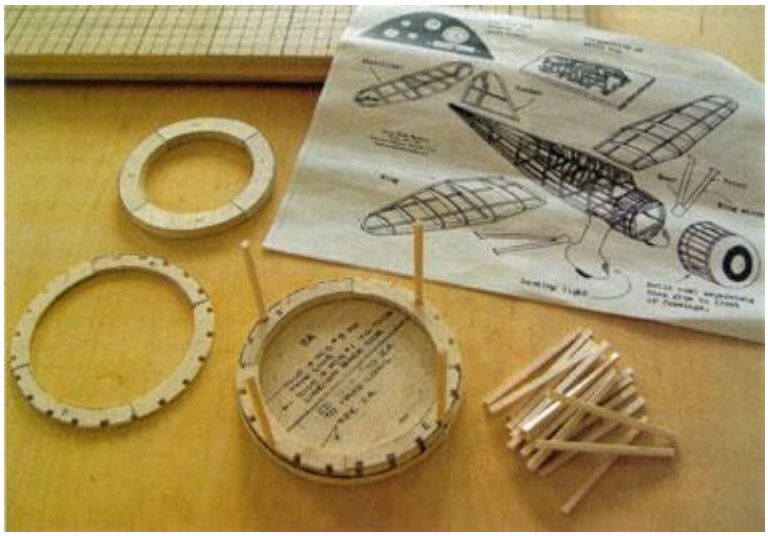




long M3 screw for the sanding the contour of the wheel, and for best results, fitted into a standard drill. Of course the completed wheels are very light, but also very fragile. In order to make the running surface more durable, a 2mm nut is fretted into the wheels and later a suitable O-ring is placed on top. This is almost invisible on the black lacquered wheels, but it improves the running capacity and protects the delicate balsa wood.

1. **The wheels and parts of the spats are cut out according to the plan and roughly sanded.**
2. **At the outer edge of the wheels a notch is made for the o-ring.**
3. **All the parts except the outer covering are glued together. The covering is tacked on and removed again for the attachment of the wheel.**
4. **The axle is shortened to the breadth of the wheel.**
5. **The preformed wheel covering can be glued on.**

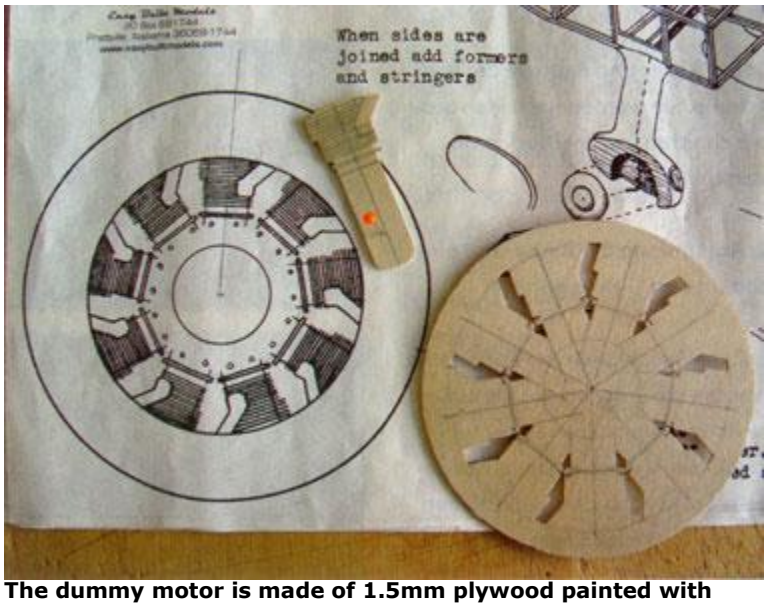


**The engine cowl:**
The engine cowl is built out of printed balsa parts and a multitude of square strips. Four of the pre-measured supports will be glued into the front ring - frame and angled absolutely perpendicular to the base of the plan. When the glued parts are dry, the structure is glued into the rear of the ring frame, and one gets a cylindrical motor-cowling. Then one by one the other strips are glued in.

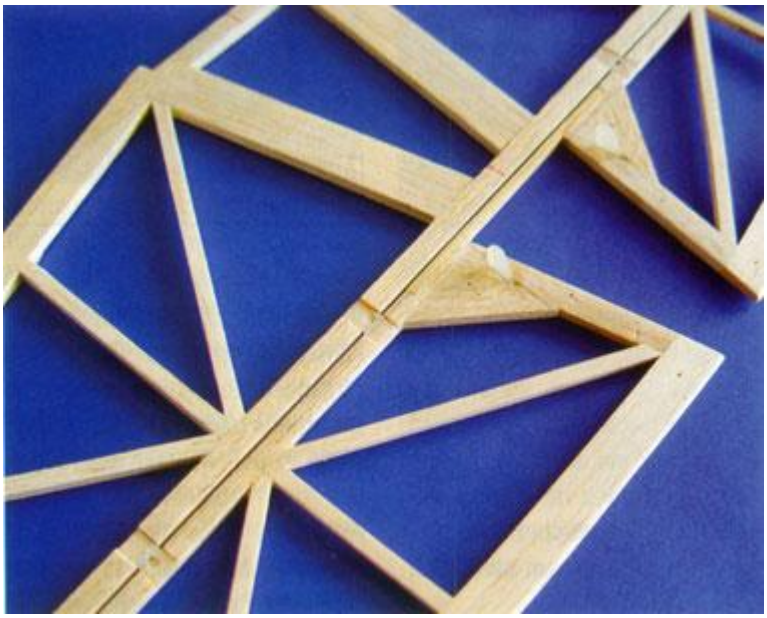


**The motor cowling is made of ring-formers & balsa strips.**

For the sanding, the completed motor cowling is best fitted into an upright drill with the help of an M6 or M8 screw and plate, and worked with a high number of revolutions with a very light touching to the sanding block until the contours match the pattern. The intended propulsion decides on the further procedures, for the attachment of the motor must be prepared for, before the motor cowl is glued to the fuselage. A detachable motor cowl would have meant an unwanted weight increase, and in this case did not appear to be necessary. For visual and practical reasons (motor-cooling) a model motor was fashioned out of 1.5mm plywood and put in place of the original balsa-plate. Cooling air gets through the gaps between the cylinders to the motor and speed control and is released through the opening in the covering on the tail of the model.




**The dummy motor is made of 1.5mm plywood painted with lacquer and paint.**



**Narrow strips of material set into the upper surface of the spars serve as rudder flaps.**

**Drive:**
With a lift off weight of around 430g (with LiPo cells) and the quite large wings, we can easily make do with propulsion of about 40 Watt. I also had a Bienchen motor with 4:1 gear, (only 50g) that fits into this category and worked in its favored range with seven cells. Further advantages of this motor are its low weight and the slim gear box that can be fitted unobtrusively through the dummy motor. At the front of the gearbox the busy little motor is simply secured with a suitable O – ring, the rear section is rested in a supporting brace built into the motor-cowling. Thanks to the slim planetary - drive of the Bienchen and the long motor-shaft, the attachment of the propeller is no problem. With any other motor the method of attachment must possibly be altered so that the propeller-shaft reaches far enough past the motor cowl.

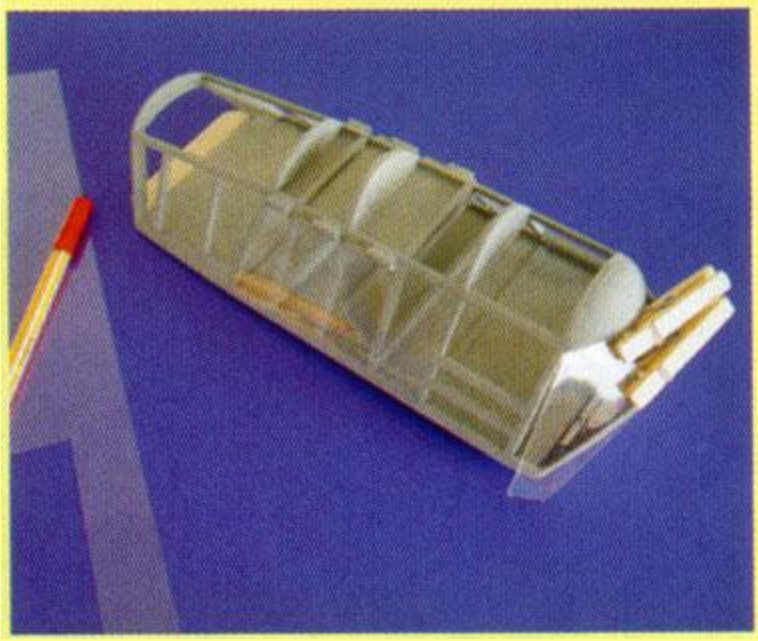
**Finish:**
The Lysander was completely covered with yellow 12 g. tissue and represents a target towing machine. The kit contains other suitable colored tissue; I personally prefer the yellow coloration. Code lettering and emblems were also cut out of tissue and doped on with acetone. You will read more about the covering of the plane on [page 10 of this translation].

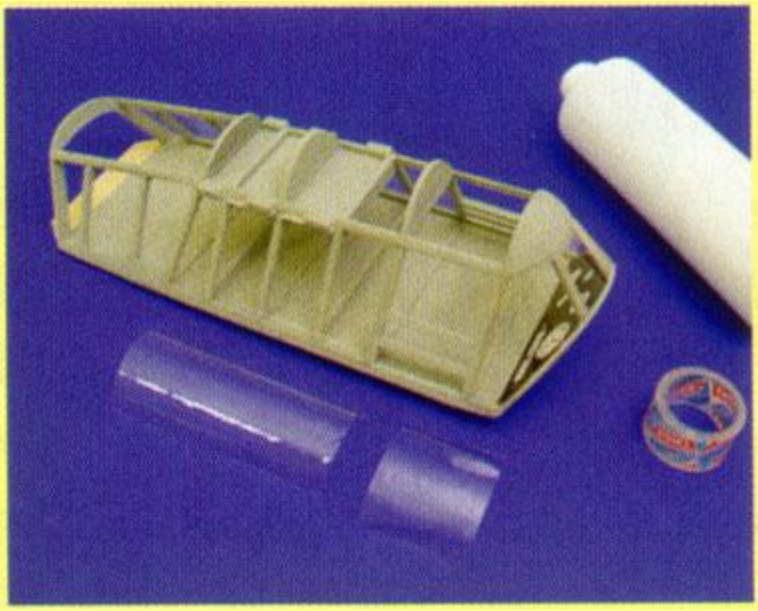
## Forming the Canopy

The kit includes clear plastic material for the glazing of the huge cabin. The wind screen and the two small side panes for this are best cut out and glued on individually, the glazing of the large side panels is no problem either if one just cuts with great precision.

More difficult is the arched cabin cowling, especially because thanks to the fitting of surfaces to be glued one does not have at ones' disposal a great expanse of surface to be glued. In order to make the gluing of the cabin cowling easier the plastic can be made more malleable by heating.

**The pre-cut material is affixed to a plastic bottle with sticky tape.**





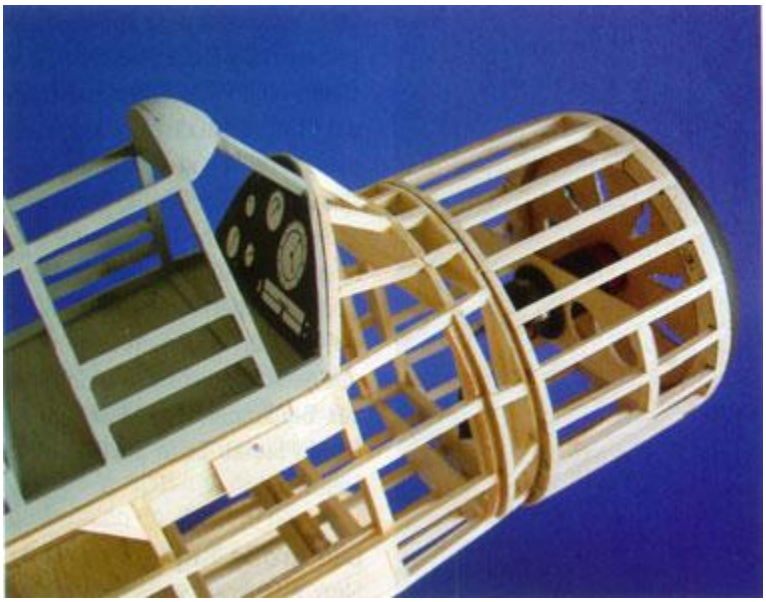
**The frontal side panes are glued into the frame in two steps.**

A hair dryer or hot air blower is not suitable because of the uneven warming of the thin plastic. Kinks and bulges would be too easily created. It is better if the pre-cut material is wrapped around a glass or plastic bottle, and tightly fixed in place with cello tape. It is of utmost importance that all the edges are glued on tightly. Any sections not tightly held in position are inclined to warp and pull out of shape.

Fill the bottle with very hot water and let it cool. That is how you get a pre-formed, tension free cabin cowl that is easily glued onto the frame. If you are not sure of the properties of a plastic substance, test it using a small left-over piece to ascertain which temperature is right for yours.

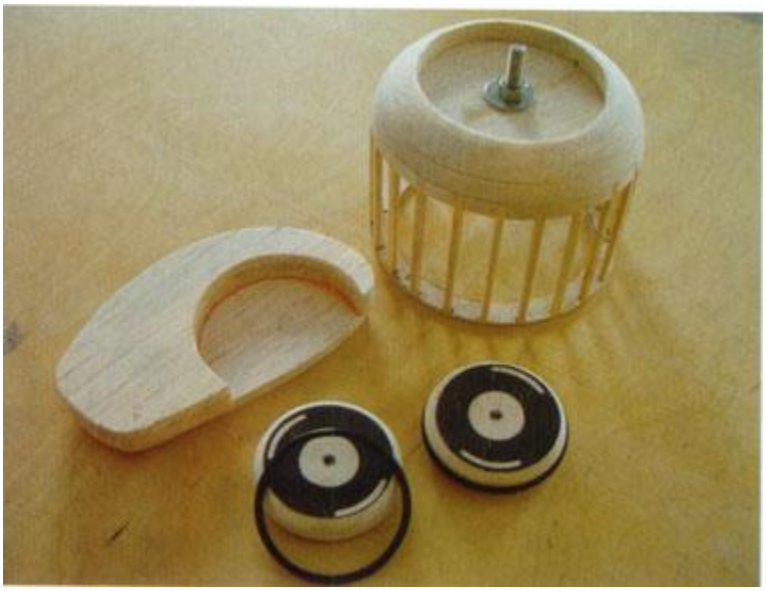

**Most suitable for the gluing, are hard set or instant glue.**

**Strips of black tissue, glued on with dope imitate the cabin supports and make the glued joints invisible.**



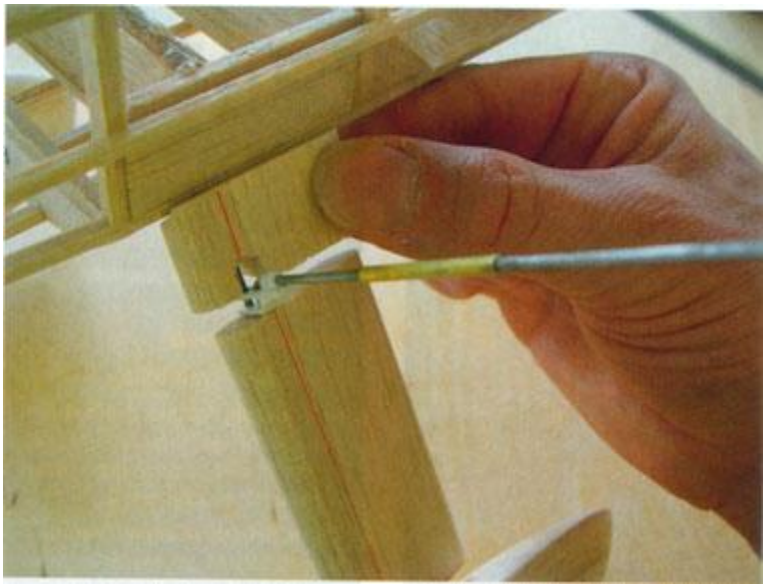
**The motor cowling is glued to the fuselage, the motor is in the dummy star-motor, and a helping former placed in such a manner that it can be pulled from the inside out into the motor hood. Visible too are the connections of the cabin cowling.**

The yellow covering with the black stripes give a good contrast against the blue sky, but that is not important, for the flight characteristic is recognized in this model without any problems.
The unusual shape of the wings, the support struts and the gigantic undercarriage already see to that. In spite of it powerful middle section, the little machine buzzes through the air with great agility and lets itself be controlled easily. A little extra are the light reflections flashing off the huge cabin that make the model look especially life like.



**The wheels with notch and O – ring and a half completed spat. Next to it, the sanded motor cowling.**

**The Big Day:**
Now it had finally arrived. The two batteries were fully charged and secured in the fuselage with Velcro. Rudder function and movement were carefully assessed, and the weather just about ideal. Only the slightest breeze blew along the runway. Now then, start the motor, slowly warm up to working temperature and roll onto the runway. One last check of the rudder, trimmed again, and already the Lysander zooms off with the unharnessed power of the barely 50 watt starting power that the Bienchen (busy little motor) is able to muster for a short time along the track and immediately lifts off! AHA! It really is a scale model! You can throttle the gas back right away and the Lysander still rises at a pleasing angle into the blue yonder.



**The bracing struts are clipped onto the upper portion of the undercarriage legs through an opening in the landing gear.**

Some might ask themselves, whether it is really worth it to put so much time and effort into such a small model. Well, that's a matter of opinion. For me, part of model flying is the skill and pursuit of craftsmanship and of course the aspect of individuality. And that simply isn't achieved with the choice of two colors of tissue. Anyone who sees it like this will find a rewarding project in the Lysander. In any case, the Lysander makes the majority of snow white Depron [Styrofoam] bi-planes on the model field look pretty skimpy even if you cannot torque with her at all.

Tissue paper is used by hard core static modelers [and rubber powered fliers], the majority however use the more durable nylon material [Monokote] as a basis for true to prototype model painting. But there are areas where tissue still has advantages over the other covering materials.

**In the large fuselage, there is ample room for the receiver and servos.**

**For the threading of the control rods, balsa is set into the spaces between the stringers**.

**A light electric motor and 2 LiPo cells enable the Lysander to attain a pleasing duration of flight.**

## The properties of tissue:

Tissue is available in different qualities that is expressed in the weight per sq. metre and the fibre (grain) structure and can be selected appropriate to the size of the model. In comparison to some other materials, tissue is relatively affordable, even if you take the dope that is necessary for the attachment and sealing of the tissue into consideration.

A disadvantage of tissue is its delicacy in the face of pointed objects, in this case some other materials, with their elasticity do better. On the other hand tissue gives the firmness to open rib constructions or partly planked areas that can not quite be attained with film, and can only be surpassed by silk. Tissue does not bubble or wrinkle under the influence of temperature, and does not sag. Once it is applied correctly, it almost never happens that the tissue lifts off the background, not even in models that are powered with diesel-motors.

**The Lysander is clad with 12 g paper in the colours of a target drag machine.**
**The emblems and insignia too, are made of paper.**

## Usage – Application

Apart from the above listed areas, there is one other that is gaining more and more in importance and that is in the category of "formerly" free flying rubber motor models. "Formerly" we say, because today this class offers itself with its continually smaller, better working, and affordable RC-components and propulsions, above all for the fanciers of true to life remote controlled small-models. And the smaller the models become, the more interesting is also the possibility to cover them with tissue – not only for reasons of weight, but also because of their aerodynamic virtues that is offered in the small and slower flight models.

## Workmanship/finish of covering paper:

The component parts of a model that are going to be touching the covering tissue, should first of all be painted once or twice, with pore-filler, dope, or fast sanding base. The lacquering makes the wood fibers stand upright and protects the lower strata from moisture. After the drying of the lacquer, the individual component parts are sanded over with a fine finishing paper in order to smooth the surface.

The tissue may be dampened before applying it or used dry. Both have advantages and disadvantages. Those who are working with tissue for the first time should do without moistening the tissue, for especially the lighter types of tissue become very delicate when wet.

The tissue is applied either with cellulose-glue (Who doesn't know Graupner's Glutofix [tissue paste]?) {Interpreter's note: anyone outside Germany, I dare say!} or with thinned down dope. After this, there will be, depending on the type of tissue, further coatings of diluted dope until the tissue has the desired tension and surface quality. Undiluted dope should not be used, especially in the case of the smaller models. The tension of the lacquer quickly surpasses the resistance capacity of the wooden structure. The creation of the coloring also depends on colored tissue that will be lacquered onto the covering. Of course a final lacquering is possible with different types of lacquer, with very small models however the weight gain is unwanted. The pictures show the most important sections of work during the covering with tissue. The Westland Lysander is a gratifying subject for it has an unusual wing and a rather demanding fuselage.

**FMT EXTRA:**
**Test –** Data

**Name of Model**: Westland-Lysander

**Usage:** rubber motor model (free flight)

**Manufacturer:** Easy Built Models

**Model type:** balsa wood kit

**Kit content**: printed balsa sheeting, balsa strips, propeller, rubber motor, landing gear wire, tissue paper covering in two colors, clear plastic for the cabin hood.

**Building plans and instructions**: 4 pages, 3 pages with building sketches. No instructions for the RC- equipment, it's a free flight rubber powered model.

**Construction:**
**Fuselage**: box fuselage with formers and stringers, paper covering.
**Wings**: two-part ribbed sections, RC version planking added, paper covering.
**Tail unit:** firm, made from balsa wood in open stick construction, tissue covering.
**Motor cowling:** firm, made from balsa wood in open stick construction.
**Cabin Hood**: transparent, built onto wooden structure, in case of RC- version detachable.
**Motor installation:** placed in the supports of the motor hood.
**Installation of the flight actuators:** Velcro, suitable for 2 x LiPo, 700 mAh, 7 cells.

**Technical Details:**
Wing span: 1219 mm [48"]
Length: 650 mm [approx. 26"]
Weight/ manufacturer states: no specifications.
Basic test model without EC and motor 280g
Flight weight: Test model without flight actuator, 392 g. With 2 x LiPo 700 mAh, 430 g

**Propulsion used in the test model:**
Motor – gearbox, Bienchen,4:1 gears,
Actuators 2 x LiPo, 700 mAh
Propeller APC SloProp, 9 x 4,7 inches

**RC Function and components:** Carson Micro CM -1

**Remote controls**: Multiplex 3010
**Receiver:** Multiplex Picco 4/5
**Rec. Servos:** BEC (1,3 A)

# Covering with Tissue

## A Trip into the Past?

by Michael Bloss

### Covering the Wings

1 The wood grain raises during painting with Polyfilla [cellulose filler] or dope. After drying, the surfaces are smoothed with fine sand paper.

2 The covering tissue is cut oversize to overlap, placed dry onto the under side of the area to be covered, and fixed into position all the way round with dope.

3 Tissue excess is cut off with a sharp knife.

4 Then the edges are smoothed with fine sand paper,

5 and sealed with dope.

6 The covering of the upper surface will be applied in two parts, because of the special shape.

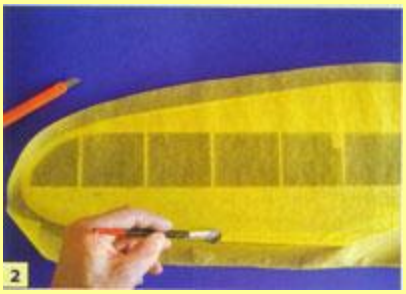
7 At the edges it is pulled down far enough so that the covering slightly overlaps on the under side.

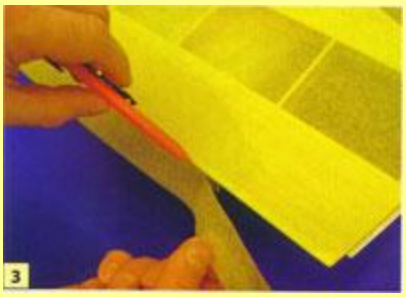
8 The dry covered wing is already almost without wrinkle.

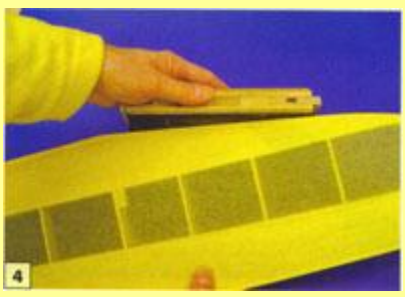
9 Through light dampening with water (spray bottle) the covering first of all sags,

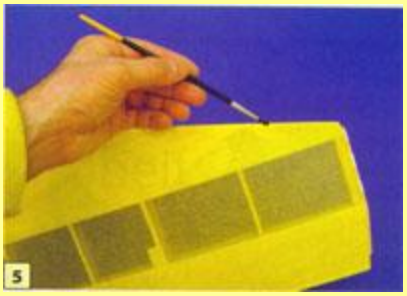
10 but during the drying out, it stretches itself into a flawless surface.

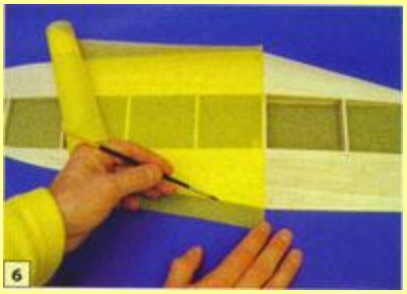
11 The covering is varnished several times with diluted dope using a flat brush.

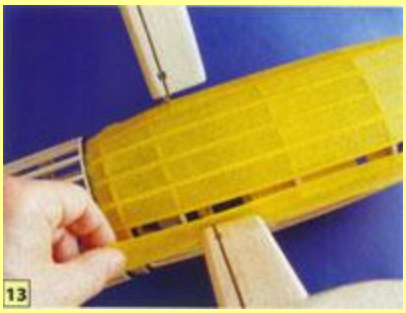



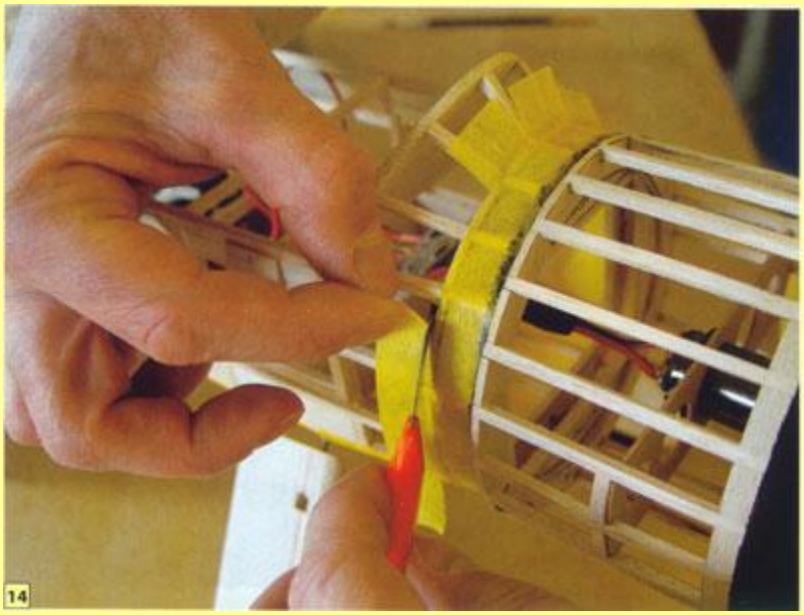



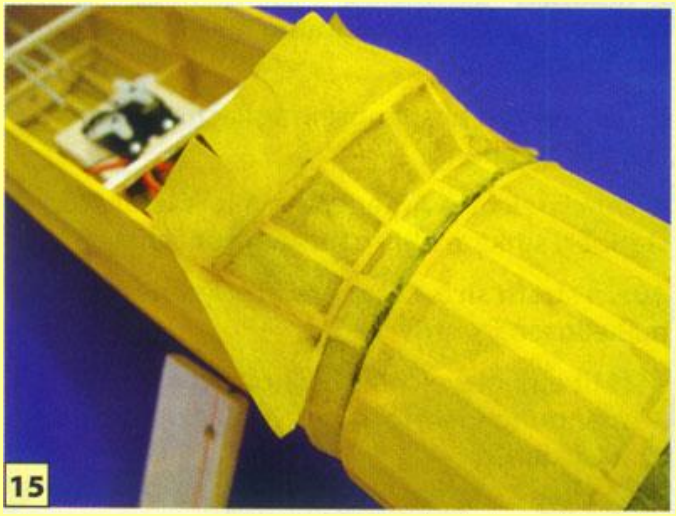


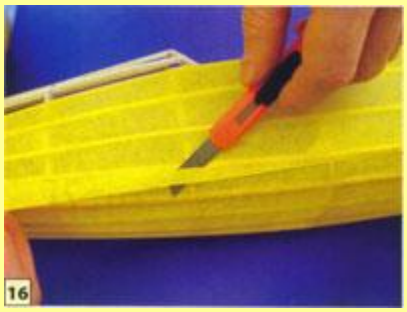


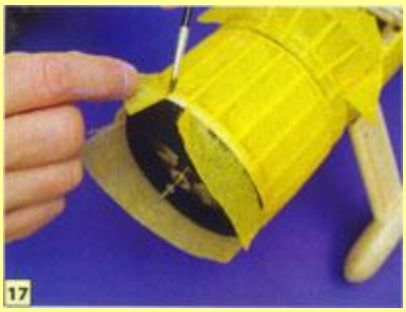

# Covering the Fuselage

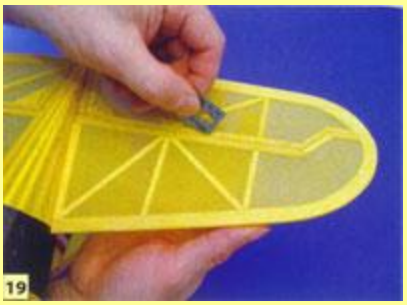


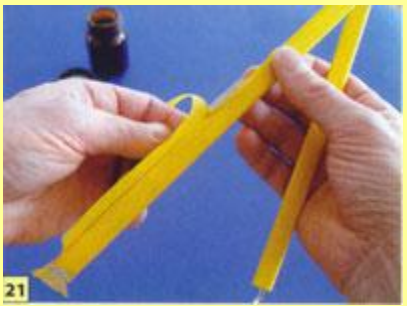












**12** The complex fuselage of the Lysander will be covered section by section

**13** The covering is cut at the stringer before the next section is put on.

**14** The tapering ring behind the motor cowling is covered. Easily seen here, are the slits cut into the overlapping material, so that the strip can be well applied.

**15** Very tricky. Here the front edge of the covering tissue must be fitted exactly to the shape of the former, so that the strip attaches smoothly.

**16** Holding the blade flat, trim the covering material at the fuselage stringer.

**17** With a dab of acetone the overlapping covering material is easily loosened from the under surface and peeled off.

**18** At rounded sections slits are cut into the paper, and dabbed into place with dope.

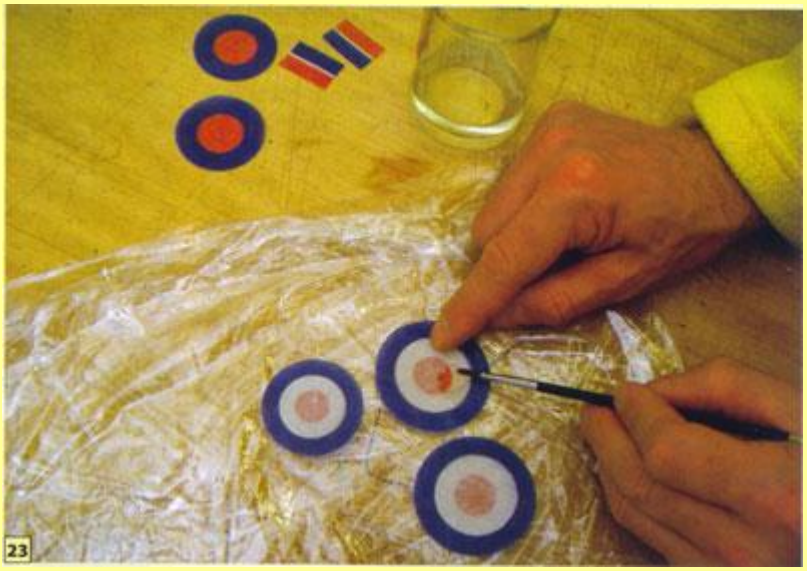
**19** Carefully the covering tissue is separated from the tail flap.

**20** Black strips are cut out of tissue and doped onto the covering.

**21** The wing struts too, will be covered and gain extra firmness through the tight paper.

# Markings Made from Tissue Paper


The emblems were printed with an inkjet printer onto white tissue. Ordinary typing paper served as carrier material.




The white area of the badges will be glued onto white paper in order to heighten the contrast.


When doping on the emblems only the blue and the red areas will be saturated with lacquer or acetone.