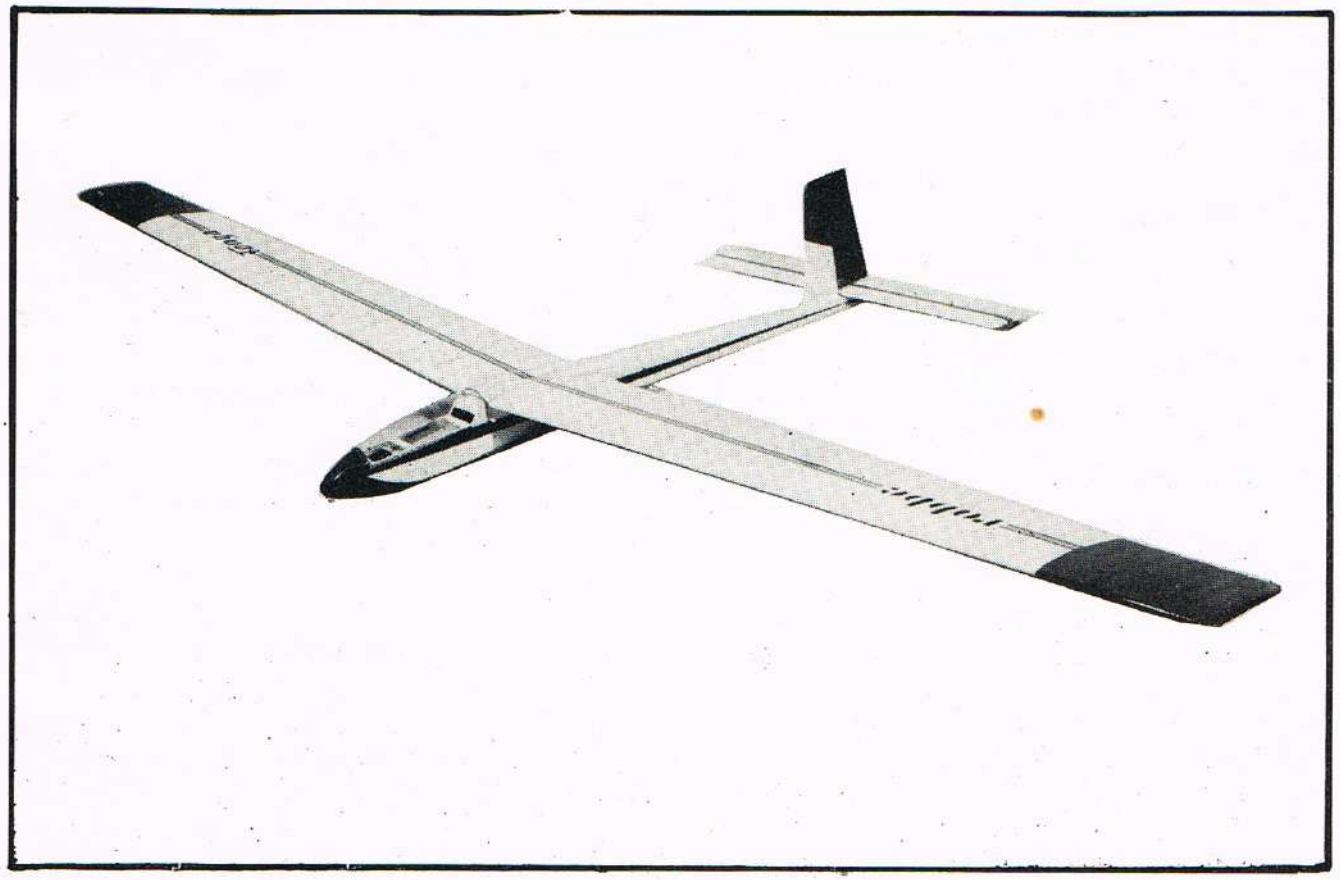
Building instruction
for the
robbe-powered sailplane model

Tonga

with list of parts and materials

Ind.-No. 3146



Technical date:

Wing span	2 740 mm
Lenght of fuselage:	1 231 mm
Wings area:	61,28 sqdm
Horizontal tail unit span:	724 mm
Horizontal tail unit area:	9,412 sqdm
Total surface area:	59,00 sqdm
Loaded weight with robbe-digital system:	1 340 grams
Wing loading, total:	22,7 grams/sqdm

Accessories not contained in the assembling kit, but implicitly necessary:

2 ea	connecting rods of fiberglass reinforced plastic, rudder linkage 17 and 18 vertical and horizontal rudder	Ind. Nr. 6146
1 ea	guide pipe of fiberglass reinforced plastic for parts 17a and 18a	Ind. Nr. 6147
1 ea	control horn set for vertical and horizontal rudder, parts Nr. 44, 45	Ind. Nr. 5118
1 ea	rudder linkage, 25 cm, with yoke end for the connection of the linkage with control servos, bag content 2 ea	Ind. Nr. 6123

Recommended as remote control:

robbe-digital data transmitter DPB 2/1 with 2 servos	Ind. Nr. 8151
robbe-digital data transmitter DP 2/1 with 2 servos	Ind. Nr. 8150

Covering material:

For covering your *„robbe–Tonga"*, the use of our robbe-Super-Solarfilm is recommended. 3 sheets in size 92x67 cm are necessary to cover the wings and the elevator empennage, or if you intend to cover the halves of the wings in one runner without patching, a 5 metres reel. The robbe-super-solar film is available in transparent colors and in covering colours. (See hints in our coloured robbe-catalogue.)

To cover the fuselage-empennage and the rudder unit, 1 sheets of robbe-Jap-silk of a large size, the Ind.Nr. depending on the colour desired, (Ind. Nr. 5052 up to 5060) is recommended. For sizes and colours see the robbe-catalogue.

For primecoating the fuselage, our robbe-pore-filler packed in 100/250/1000 cubcm – cans, Ind. Nr. 5505, 5506, 5508, is recommended. The „robbe-Tonga" originated in a long developmental row of in total 6 different prototypes. The individual models were tested at extreme conditions, as well as during the thermic flight, as also during the declivity flight. All experience gained from these tests have been taken into consideration for the final construction. A high-capacity sailplane was so produced which, for its excellent flying properties, will gain numerous friends.

Although, as to the grade of difficulty, the timberwork type of the „robbe-Tonga" can be characterized to be conventional, a certain professional experience is presupposed to accomplish the assemblage. In any case the following description together with the working drawings should be precisely studied to insure that a total survey of the progress of the assemblage will come to pass which, as things being so, is inevitable for the assemblage of a high-capacity sailplane model.

It is important that, prior to commencing the assamblage, above all you will make yourselves familiar. with the feasibility of installation of the actual remote control system. Should be installed another than the „robbe-digital" recommended by ourselves, the remote control installation diagram of the working drawing will be, of course, essentially applicable, but possibly the dimendions will then no longer suit so that insignificant deviations will need equalized by yourselves.

Hints made in general for the progress of the assemblage

Numbering of the particular construction parts meets essentially the sequence of the progress of the assemblage described in the instructions.

> Prior to starting the assemblage, please read much carefully over the complete construction guidance. Obtain, in connection with the list of pieces and materiels and with the working drawing an exact survey of the type and the purpose of the different construction parts and of the construction progress itself, before you will commence assemblage work.

The working drawings for the fuselage, the vertical same as the horizontal tail unit and for the wings with their side faces and top side views as well as cross sectional areas should be implicitly used for the assemblage. In order to protect the drawings against damages caused by glue, they should be covered over with a thin, transparent foil of polyethylene. In case such foil is not available in a cut of adequately large size, ripped open package bags will already suffice too.

There is a sheet with photographs in the middle part of this booklet. The individual pictures shall give you further, optical, hints as to the actual state of the assemblage. The photographs are numbered. Hints to the different photographs appear in the course of the text of the construction guidance. Take out this sheet with photographs from the stitching and place it by the side of the working drawing and the construction guidance. So you will save continuous turning over the leaves.

The following tools are required for assemblage:

A fretsaw with fine and medium-fine blades; a fretsaw table; sandpaper with glass head; flat-nosed pliers; soldering hammer 25 Watt with solder tin and zinc-chloride paste; a small hammer 50 grams; screw drivers, small and large; robbe-balsa-knife Ind. Nr. 5555; an abrasive paper file, Ind. Nr. 5551; a balsa-plane, Ind. Nr. 6099 with replacement cutters 6099/1; razor blades and scissors for covering; two types of brushes; screw drill for fretsaw work and control horn assemblage; twist drill for Wingfix-installation on the horizontal rudder.

Types of glue required for comenting

Rudol-hard, Ind.Nr. 5029; Stabilite-express, Ind.Nr. 5015 or 5016; furthermore Contact-adhesive, such as „Rudol-fix" or „Pattex"; cellulose glue such as „Rudol-col" or „Uhu-col" and „Rudol-plastic adhesive" for the canopy.

Preliminary work:

Prior to starting assemblage, sort out the different component parts conforming to the assemblage groups of the description (fuselage, vertical tail unit, horizontal tail unit and wings). You will find particulars in the list of parts, indicating whether prefabricated parts are the question or whether single parts shall be cut to size according to working drawing, e. g. wing-spars, fuselage-webs, reinforcing corners etc. For parts which shall be still cut to size, you will find in the list of materiels the numbers of parts which should be taken out of the appropriate cut.

Prior to starting work, check with the list of pieces and the list of materiels the completeness of the component parts designated in the list of pieces to belong to the assemblage kit. Controls of measurements of the cut-out parts should be carried out, if possible before cementing. Insignificant deviations which cannot be avoided in spite of a quite exactest check performance during a series production, should be corrected by fitting-in and subsequent resanding.

Prior to commencing a phase of construction, all strips belonging to this work should be cut to lenght, and/or all parts cut to size according to the plan. Only if you will proceed in such way, the following construction progress will uninterruptedly proceed.

At this occasion we repeat again our hints:

Working drawing, Working instructions, List of pieces and materiels should be implicitly used during assemblage.

Numbering of the individual construction parts conforms substantially to the numerical sequence of the described construction progress. For the sake of perspicuity we recommend you absolutely to adhere to this sequence.

Assemblage description

Fuselage
consisting of parts 1 up to 37

Commence assemblage of the bottom parts of the fuselage 1 and 1a according to the top view of the fuselage bottom at the bottom end of the large working drawing. Pay above all attention to the necessity to keep up the centre line when the both halves are joined one to another.

Deviations possibly appearing at the juncture should be carefully sanded until the outher contours of the top view are identic with one part of the fuselage bottom which shall be stuck together. Then only cellulose glue can be applied on the junctures, both pieces compressed, and loaded or fixed with pins on the construction board.

When dried up, the threeangular strips (2) and the rectangular strips (3) will bei pasted up, as directed by the fuselage top view, with contact adhesive, in course along the exterior edges of the fuselage bottom. Subsequently you can proceed immediately with cementing the fuselage ribs 4, 5, 6, 7 and 8. All theseribs are standing vertically to the bottom of the fuselage. In order to enabel fixation of these 90° also during dry spell, we recommend to make small balsa-patterns in rigth angle to support the particular ribs until the spots of cementing are dried up. But in any case the rib should be secured by fastening with pins in the fuselage bottom.

While cementing of the fuselage is drying up, the two side parts of the fuselage at the right and the left, consisting each once of 9 and 9 a, can be already prepared. Check also here by putting on to the fuselage top view the snug fit of the spot of helving; possibly they should be fitted, by careful resanding, to the outer contours. Only then the juncture is to be smeared with cellulose glue and the united halves of the side pieces aligned to the fuselage top view, and fixed with pins. After cementing is dried up, the reinforcement of the side pieces (10) should be glued to the interior fuselage side, as shown on the working drawing. Please unse contact adhesive for that work. When glueing the side parts reinforcement, pay attention to the exigency that each one right and one left side part will be obtained. Where the reinforcement of side parts takes the course with the top edge it must be flush with same. This is of importance because the reinforcing strips 2 and 3, being already in the fuselage bottom, otherwiese will impede afficing the side parts on the fuselage bottom true to the working drawing.

Before the side pieces can be stuck together with the fuselage bottom, the reinforcing strips (11) must be still sanded down according to the sectional drawing (see the large working drawing at the very bottom) and also cemented with contact adhesive on the interior of the right and the left side wall of the fuselage. Please observe exactly the measurements shown on the sectional drawing (working drawing, below, lateral- and top view), in default where of the side parts at the fuselage end could no longer fit ohne another as provided in the working drawing; in other words: you would then obtain a too large or too small fuselage width at the end of the fuselage.

When the two side pieces of the fuselage are completed, also cementing of the ribs on the fuselage bottom will be dried up to a degree enabling to continue in work without loss of time. Take the side parts and fix same with contact adhesive on the fuselage bottom 1 and 1a as well as on the reinforcing strips 2 and 3. Subsequently pull carefully off both side parts of the fuselage a little from the ribs and insert between every rib and side part a strip of cellulose glue. Press then the side parts tight against the ribs and secure the cemented spots either with pins or by beading with rubber rings. Cementing of the reinforcing strips 11 on the fuselage end can be performed only after the rudder linkage is installed (see the next but one section).

Cut now into lenghts the threeangular strips 12, 13, 14 and 15 according to working drawing and fix them also with cellulose glue.

No it will be necessary to cut to lenght the rudder linkage for the vertical and the horizontal rudder (17 and 18) and the guide tubes 17a and 18a, to fit and to cement them. The threeangular strips 14 and 15 serve as support for the fore guide tubes 17a and 18a. The rear pipes 17a and 18a will be fixed according to sectional drawings G–G and H–H with double-component adhesive at the top underneath the strip 11, at the bottom, respectively, on strip 2. In order to put guide pipes into the correct direction, the rudder linkages 17 and 18 should be pushed-in during the drying time. We recommend the use of „Stabilit-Express" adhesive. The relatively short drying time of this adhesive will allow you to continue in work after approx. 10 to 15 minutes.

Apply now the opening in the side walls of the fuselage at the right and at the left side enabling protrusion of the rudder linkages. Complete then the rudder linkage, insert same throu the guide tubes and bend to angle the rear wire ends (with fine pitch-thread for the kwik-link) according to working drawing. Only when this work is done, the fuselage top part 21 can be provided with recess for the portruding vertical rudder linkage and cemented with cellulose glue with the fuselage. Cemented spots shall be secured with pins alongside the fuselage edges.

After glue ist dried up, the rear fuselage occlusion (16) should be fitted under the fuselage top part 21 and to the rear ends of the side parts, and subsequently tight cemented with cellulose glue. Then the horizontal tail unit (22), the wedge-shape of which is responsible for the correct setting angle of the horizontal tail unit will be applied. It is left to you whether you will face-sand this part, as per drawing before cementing same in the fuselage, or subsequently. In any case make repeatedly sure whether the wedge shape conforms with the prototype shown on the working drawing. **Failing that will very substantially change the flying qualities of the model if any fault would have been made.**

Cut now with a balsa-knife or with the fretsaw in the front part of the fuselage bottom (1) the recess for the power-pack. As this indentation will reach also up into the fuselage skid, the quadrangle of the recess must be transferred on the top side of the fuselage skid (23) by holding same, according to drawing, under the fuselage bottom and transferring the contours. Groove then this spot according to working drawing (side view) and check, by inserting the power pack, for the depth of the recess.

There is a partial top view beneath the side view of the working drawing, according to which the recess for the wheel case and for the hook for starting into altitude flight must be worked out of the fuselage skid. Prior to fixing the wheel case and the above hook with glue, sanding off the contours of the skid according to sectional drawings A–A up to E–E is inevitably requisite. Failing this, the wheel case with wheel and the hook for the altitude flight start already installed will impede you. Leave, during sanding some oversize enabling cementing to the fuselage bottom as described in the following. If this is done, you can assemble, as per working drawing, the complete complex of wheel case with hook for starting into the altitude flight (parts 27, 28, 29, 30, 31 and 32). Wheel cases 27 and 28 as well as hook for starting into altitude flight 32 should be fixed with cellulose glue. After wheels are assembled, the wheel axle 29 will be socket-joint connected with Stabilit-Express adhesive outside on parts 27 and 28 (do not forget the shims!). After the cemented spots are dried up, the tip side of the skid should be face-sanded, cemented underneath the fuselage bottom with cellulose glue, (1) and fixed with pins.

The fuselage head (24) consists of two halves which will be cut out according to drawing of the appropriate balsa-board, and stuck together with contact adhesive. Prior to gluing together with the forepart of the fuselage, both to be joined areas (viz those of the fuselage head and of the fore-rib with fuselage skid) should be carefully face-ground with sand paper. That's extraordinarily important in order that an as firmest as possible juncture of the fuselage head with the fuselage throughout the entire area will be obtained. Subsequently cellulose glue will be applied, the to be glued together areas compressed, and secured with pins.

The reinforcement of the head for the dowel for the fastening of the canopy (25 of plywood 0,8 mm thick) can now be cemented as shown on the diagram of the fuselage head. It also shall be secured with pins.

Final work to be performed on the fuselage before assembling of the canopy, and prior to the rudder unit will be assembled, will be cementing the wing support (26) and preparating of the tail skid (33).

Pay specific attention to the wing support (26). Both ends of the reinforcing strips 11 represent the bearing surface for the cut out piece (26). This support must be exactly face-sanded and in angle conforming to the side view. Control repeatedly this working process. Should be committed here an error, you will have trouble with fitting of the wing during the following construction process, as there would be formed a more or less wide, and above all unpleasant gap impairing the general feature of quor „robbe-Tonga". After repeatedly performed control only, cellulose glue should be applied on the wing bearing surface and securing made with pins.

The tail-skid (33) is to be cut out as drawing demands, and faceground with sand paper according to cross section H–H. But cementing will be made only later, after all fuselage work are completed (see for the applicable section).

The fore part of the fuselage must be sanded true to shape, before the canopy of cross section A–A up to E–E will be constructed. Then only you can fit canopy. The remaining fuselage part from E–E to the fuselage end can be sanded only after the vertical tail surface is assembled.

Subsequently the holes for dowels (19 and 20) for fastening of the wings are to be drilled as shown on the plan. But the dowels will be inserted and cemented only after the fuselage is lined.

In order to reach an exact snug fit of the cabin, it should be glued only when installed on the fuselage. Cover therefore the cabin cut in the fuselage with a thin plastic foil in order to prevent formation of an unintended cemented juncture between cabin bottom and fuselage. The applied plastic foil can be fastened with Tesafilm on the outer walls of the fuselage.

The cabin bottom (part 34 to be cut out) should be provided with the cut out pieces according to the top view. Subsequently proper sanding conforming to the exterior contours of the fuselage support will be performed same as fastening with few pins on the fuselage.

The transverse cabin rib (35) should be glued in butt-joint on the cabin bottom and secured also with pins. This glued spot must completely dry up. Meanwhile you can cut out the clear vision cabin (37) along the contours drawn in the material and fit it temporarily.

When the glued spots between transverse cabin rib and cabin bottom are completely dry, pins should be removed, the canopy precisely fitted and fastened with Rudol-plastic adhesive on the cabin bottom and teh transverse rib. **Because of a better cementing coherence, the glued spot of the canopy should be abraded with fine abrasive paper.** Also this gluing must dry up completely. Then only the canopy will be removed, the fore-hole for the dowel (36) drilled, the dowel glued-in and joined inside of the canopy toward the transverse rib with sufficient glue. Finally the counter-borehole in the fuselage head will be drilled before installation of the vertical rudder unit and final sanding.

Vertical tail unit and vertical rudder

This complete complex consists of parts 38–44. Before gluing together check with the plan the accuracy of the dimensions of the particular parts and improve, if necessary, by re-sanding. Also here our following hint is applicable:

> The use of the building guidance, the working drawing, the list of pieces and materiels during assemblage is inevitable.

Above all splice with cellulose glue the interface 38a to the vertical tail unit 38. Lay the part upon the working drawing and fix the gluing spots with pins.

Both the vertical rudder halves 39 and 39a will obtain the transverse strut 41 to protect them against warping. Cut out with a fine fretsaw the corresponding groove, according to plan, of the two rudder plate halves. Shove subsequently the two rudder plate halves in joint one against another and cut part 41 to lenght. Then only parts 39 and 39a of the working drawing should be glued together with cellulose glue, secured with pins and the transverse strut (41) cemented.

All gluing spots of the vertical tail unit (38a and 38) and of the vertical rudder (39a and 39) should be left to dry up until removal from the construction board.

If you intend to continue in working during drying up time, commence construction of the horizontal tail unit (see description of the next phase of construction).

We continue in describing the vertical tail unit:

The vertical tail unit 38/38a should be lifted from the construction board, the bottom edge sanded precise rectangularly and rectilinearly, to make it fit for setting up on the fuselage and put on the point of the top fuselage side provided in the working drawing, and the position should be market out with a pencil. **Pay attention to the requisite that the vertical tail unit will sit in the centre.** Cut now to lenght according to plan the threeangular strips for the reinforcement of the vertical tail unit (43)

Transfer the recess for the protrusion of the vertical rudder linkage on the right threeangular strip (when looking into the flight direction) and cut out this slot with the balsa knife or with a fine fretsaw. Glue the left reinforcing strip with contact adhesive along the bottom edge on the left side of the vertical tail unit. Then set the vertical rudder on the plane construction board and check, applying an angle to the side without threeangular strip, for correct vertical seat. If necessary, the vertical tail unit and the reinforcing strip should bei carefully resanded until the vertical tail unit will stand exactly vertically on the construction board. Subsequently the right threeangular strip will be glued on with contact adhesive and it should be checked again for the vertical position. If you are sure, that all is well matching, the vertical tail unit complex should be glued on with cellulose glue to the point of the fuselage bottom marked before, and secured with pins. After cementing is dried up, the whole fuselage is to bei sanded off in accordance with the cross sections. You have, prior to assempling the canopy, already completed the first half so that only the rear half must be sanded off from the cross section E-E up to the fuselage end.

After this work is completed, the tail skid already prepared (33) will bei glued with cellulose glue on the fuselage end.

We recommend that the vertical rudder 39/39a is fastened on the vertical tail unit only after the fuselage is provided with the rudder hinges (40). But do not forget to glue on the control horn reinforcement (42) once **at a time** at the right and at the left. The control horn (44) is to be installed after covering is completed.

Horizontal tail unit and horizontal rudder

consisting of parts 45 up to 55.

Also for this phase of construction our hint is again applicable:

> The construction guidance, the working drawing, the list of pieces and materials are implicitly to be used during assemblage.

First of all extend with a pencil on the plan of the horizontal tail unit the marking of the ribs up to beyond the leading edge and the trailing edge, to enable transfer of the position of ribs onto same, after the bottom planking is subsequently put on.

The bottom planking (45) should be cut to size (45) accordning to the outer contours of the plan of the horizontal tail unit. The planking is then to be stitched with pins on the working drawing of the horizontal tail unit, protected by a thin polyethylene foil. The situation of ribs should be transferred with a pencil onto the planking.

Caution, do not press the pencil too fast!

Leading edge (46), traillling edge (47) and wing tips (50) are to be cut to lenght and glued with contact adhesive along the outer contours on the bottom planking. Junctures between trailing strip and wing tip, wing tip and leading edge, respectively, must not be glued with contact adhesive but with cellulose glue or Rudol-hard. Fit-in then the central piece (49). Provide it, according to working drawing, with the borehole for the Wingfix-nut and cement this piece then with cellulose glue between leading edge and trailing edge. All glued spots should be secured with pins, mainly the joints between the leading edge, the trailing edge, respectively, and the wing tips, as well as the juncture between central piece (49) and trailing-, the leading edge, respectively.

Subsequently the ribs of horizontal tail surface (18 x 48) will bei cemented with Rudol-hard at the points before marked. The ribs shall be aligned vertically to the planking and fixed with pins. Pay attention to the necessity that prior to cementing each rib must be fitted-in. All gluing must be perfectly dry before cementing the top planking.

Then only all pins fixing the different construction parts on the construction board can be removed. The leading edge and the trailing edge should be sanded, conforming to the course of the ribs, (see section J-J) and the horizontal tail surface fixed again with pins on the construction board, but in a way so that the pins will not impede gluing of the top planking (45a) described in the following.

Then the top side of the leading and of the trailing edge as well as the tip and all rib edges will bei besmeared with contact adhesive and allowed to dry. The top planking (45a) should be besmeared throughout its entire area with contact adhesive and also allowed to dry. Approx. 10 minutes later the top planking will be laid, beginning et the trailing edge (lay it uniformly throughout the entire width) forward to the leading edge, and pressed on all ribs, on the wing tip and on the leading edge. In order to obtain an uniform bot not too strong pressure, we recommend the use of a balsa-board approx. 20 up to 30 cm long, 10 mm thick, enabling you to press on for wide areas the whole planking. Gluing of the top planking should be allowed to dry up still for approx. 30 minutes. Then only the pins should be loosened and the horizontal tail unit taken down from the construction board. During drying time you can separate the horizontal rudder (51) out of the cut according to plan, and cone-grind it with sand paper according to cross section J-J.

The horizontal tail unit should be sanded at the leading edge and at the wing tip according to the course of the profile-section of the sectional drawings of the tail unit and of the wing tip. The location of the point where the borehole shall take up the Wingfix-nut existing already in the central piece (49), should be determined by cautious feeling out with a pin and carefully cut out with the balsa-knife in the top and the bottom planking. Subsequently the catch consisting of round beechwood 3 mm thick (53) should be glued according to working drawing into the bottom portion of the horizontal tail unit. A small notch cautiously indented with the balsa-knife is requisite.

The juncture of the horizontal tail plate (51) with the rudder inges (52) on the horizontal rudder will be practically made after completion of the lining procedure only. The same applies also to the Wingfix-nut (54) and to the control horn (55). Before it is pushed into the horizontal tail the Wingfix-nut must bei shortened as demanded by the thickness of the section of the horizontal tail unit.

Wings

consisting of parts 56 up to 96.

Drawings of both wings are on the construction plan of wings belonging to the assemblage kit. You can, therefore, renounce oiling hitherto publicly usual for the mirrored version. Oiling of working drawings quite causes differences in dimensions at spans of sailplanes, like „robbe-Tonga", because the paper is expanding by oiling. Depending on the span, such differences can extend up to 15 millimetres. Apart from that, the drawing of both wing-halves offers further advantages. Provided there is available an adequately wide board, you can, e. g. build both wings in parallel one to another, what means that you can commence work on the second half while gluings on the first half are drying up and/or build the second half until its construction stage reaches the first wing half's one. That means a reciprocal work flow completing almost contemporaneously the whole wing without any loss of time.

However, in the following assemblage guidance we are restricting ourselves to the description of one only half. Those who intend to build contemporaneously both halves accordning to our suggestion, will proced obviously with the other wing half in sequence same as described..

Though every model builder will find it selfunderstood that he is using the working drawing for building the wings, we beg to repeat again our hint

> The working drawing, the building guidance, the list of materials and pieces should be indispensably used during assemblage.

Splice the bottom wing spar (56) and cut it to lenght according to working drawing. For time-saving reasons we recommend to splice and to cut to lenght in the manner described above also the top main spar (56) and both spars of the other wing half.

After the glued spot is dried up, the bottom main spar (56) will be fastened with pins or with small nails, between the lines on the working drawing. Align in any case the spar exactly pursuant to the lines, to avoid formation of twists in the surface. Before you can commence insertion of the ribs, the plywood ribs 57–60 and 80 should be provided with the boreholes for the brass tubes (wing fastening). As said boreholes are uniformly spaced, when looking in distance from the main spar toward the right and the left (section K-K), these ribs should be laid with reference line main spar one above another and kept by an inserted small piece of a strip (cross section same as the main spars) in correct position. Who has two small screw-clamps, can bolt together with same the 5 plywood ribs at the front and at the back. Consequently the exact location of the borehole should be transferred from the working drawing according to cross section K-K to the first rib and then this rib should be perforated precisely vertically. An eminent attention is to bei paid to that work, to insure that the tubes will lie exactly in parappel with the main spar and with the central line of the rib when they will be fixed with glue in a later working process.

Now all ribs, commencing with number 57, can be fitted in and cemented.

> **The rib at the root of the wing (80) can be inserted and cemented after the top main spar is installed.**

Fit-in exactly every particular rib and have in view, above all, the true lenght. Improvements possibly necessary should be performed now already to insure smooth performance of cementing of the loading edge and of the trailing edge. All ribs from number 57 onward to number 79 are standing exactly vertically to the spar, to the vonstruction board, respectively. All ribs should be adequately aligned with a small angle and subsequently fixed with pins on the construction board.

As these cementings must in any case dry up before you can continue to work, we recommend you to commence now with the assemblage of the second wing half, that is until the stage of the first half described afore is reached.

After the rib gluing is dried up, the top main spar (56) will be glued in. In order to prevent the main spar from rising above out of the recesses in the wood of the ribs during drying time, the main spar should be loaded after cementing, of possible at every second and third rib.

Make according to sectional drawing N-N the angle-pattern 96 (of a piece of waste plywood). Fit and cement subsequently the rootrib (80), checking, by application of the angle-pattern, whether the inclination takes the course throughout the entire lenght of the rib.

Splice and cut to lenght according to plan the leading edge (81) and the trailing edge (82) and glue both the edges in butt-joint with Rudol hard on the ribs. The trailing edge (82) is to be tight pressed on the rib ends and then fixed with pins on the construction board. Also the leading edge should be pressed on and fixed with pins. Each particular rib should be joined in socket-coupling with thin glue strips on the leading edge and on the trailing edge. All gluing shall be allowed to dry up until you will continue to work.

In the mean time you can prepare the whole planking. The top and the bottom nose planking (84 and 88) should be spliced according to plan and cut temporarily to lenght. Same applies also for sheeting of the trailing edge, at the bottom and at the top (83a and 83b). Cellulose glue is the most suitable glue for splicing such large joint, as it is penetrating deep enough into the pollard, improving the juncture. Splicing should either be fixed with pins on a even support, or loaded. Gluing must completely dry up to prevent loosening during subsequent further treatment.

Then you can start the real planking procedure. At first the bottom nose planking (84) will be applied glued with contact glue. Application of glue everywhere is implicitly important, mainly along the main spar and the leading edge. Subsequently the trailing edge will be planked at the bottom (83a) and attention is to be paid to the necessity to put on the trailing edge planking precisely at the point of the ribs marked on the working drawing. Finally the planking of the central piece (84a) will be applied which work should also be made with contact adhesive.

The wing half must now be fixed again, lying on the bottom side, on the construction board, that's on the working drawing. In doing so, the wedge, by which the geometric wrenching in alternate direction is fixed during further building work performance on the area, should be laid according to the top view of the plan, and the diagram of the cross section L-L, under the trailing edge. In consequence of the existing support, the main spar will be lifted from the construction board, from rib 73 toward the end of the area. Therefore it should be fixed with pins on the construction board up to the rib 72 only.

Onwards from there the fixing of the trailing edge and the evenly resting leading edge with pins on the construction board will suffice.

Prior to fixing again the wing on the construction board which enables to continue in working, the leading edge (81) and the trailing edge (82), as well as the protruding planking of the trailing edge beneath (84), should be face-ground with sand paper in accordance with section K-K and M-M.

Check, in the interest of an area free of warpings, repeatedly whether the main spar rests plane on the construction board from the point where the area is beginning onwards up to rib 72. Same the leading edge.

A buckling will be formed at the trailing edge at location where the edge is beginning (on rib 72). This buckling must be pressed in vigorously, if necessary you should slightly scratch with the blunt side of the balsa knife along the course of the rib (72). Fix then at this point firmly with several pins on the construction board. Also the supporting wedge should have a firm pinned connection with the construction board to prevent lifting off from the construction board during planking of the trailing edge described in the following.

Apply in the following assemblage process the planking of the trailing edge (83b) with contact adhesive. Bestow great care particularly on the fact that the entire gluing spot must be besmeared with well covering adhesive. Same applies also to the planking to be applied. Only if you will proceed in such way, planking cannot become detached. Regard also the buckling in the trailing edge at rib 72. As much pins should be used for fixing as necessary to make the buckling sharpedged. Then the fastening tubes of brass should be fitted in. The foremost tube (87) has an interior diameter of 5,2 mm, the rear one (86) an interior diameter of 4,2 mm. The brass tubes are to be cut to lenght in accordance with drawing and inserted into boreholes already drilled into the plywood ribs 57 up to 60 and 80, but they shall not yet be cemented.

In our opinion, the use of the second wing half, as auxiliary means for the correct seat of the tubes presupposed for cementing same, will be expedient. Accomplish therefore the second wing half up to

the same construction stage. Remove it then form the construction board, and fix it with the use of appropriately long steel wires 4 mm, 5 mm ϕ respectively, but straight, i. e. without the V-shaped buckling, on the wing half fixed on the construction board. The wing half is to be supported in thickness of the construction board up to towards the end, or, if available, the construction board should be pushed under in thickness and in lenght same as the first one, in order to enable pressing together both the wing halves which are resting perfectly plane. The main spars of the right and the left wing half must stay in alignment, without an determinable strain in the steel wire connection. If this should not be the case, the boreholes in the plywood ribs must be corrected either on the one or on the other side, by careful re-polishing as long as necessary to enable pushing one wing half to another without getting the main spars out of alignment. **No strain must exist if the steel wires are straight.**

Then only you can tightly cement the brass tubes into both the wing halves. On behalf of the drying time use Stabilit-Express therefor. All brass tubes should be joined in socket coupling with sufficient glue on the respective both rib sides. When this twocomponent adhesive is hardened up, the pushed on wing half can be removed again.

Continue now to work at the wing half fixed on the construction board, in providing the top nose planking (88) with contact glue, in the meaning of the bottom planking description already done. Also here attention should be paid to the requirement that sufficient adhesive must be applied on the leading edge and on the main spar. Then the main spar web will be made. For this purpose it will be necessary to remove the pins fixing the area on the construction board and piercing the bottom main spar. The wing has meanwhile become by the top noseplanking stable enough so that now it can be fixed on the construction board at the leading and the trailing edge only. This you should do without fail prior to removing the pins from the bottom main spar.

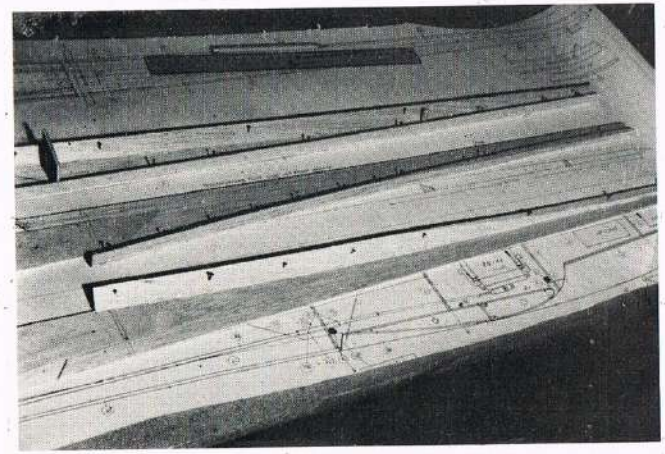
Peculiar attention should be paid to the fitting and connecting with glue of the main spar web (85). Each particular partial piece between the ribs must lie exactly at the right and at the left close to the ribs. On behalf of the rib braces to be glued on at a later date according to cross section K—K, it must also not project over the bottom and the top main spar. Thus the main spar web is flush with the bottom edge of the lower main spar and with the top edge of the top main spar. Purpos you may use cellulose glue for this cementing because it is sufficiently elastic also after it is dried up.

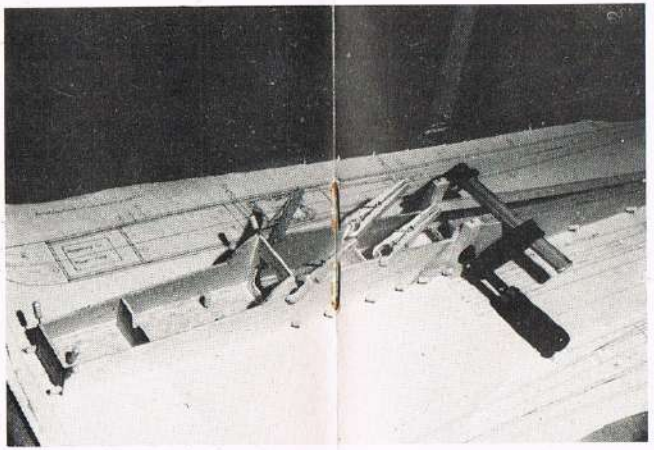
After cementing of the entire main spar web is completed according to working drawing, you can apply with contact adhesive the planking on the top center section (88a). All gluing must dry up perfectly before you can take down the almost completed wing half from the construction board.

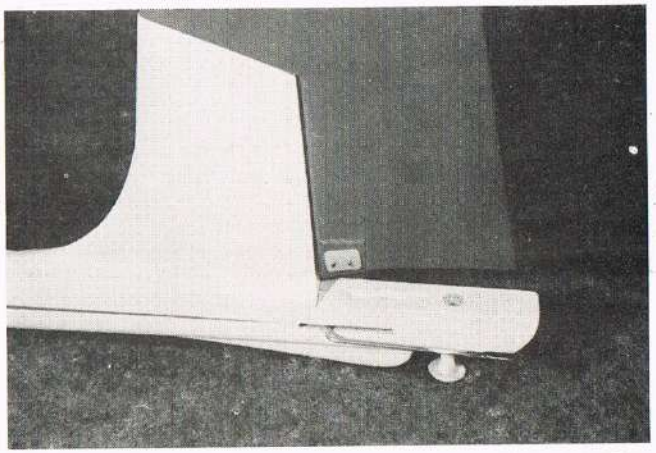
As final work will remain: gluing of the wing tip (89), of the root rib (91) and of all rib braces (90).

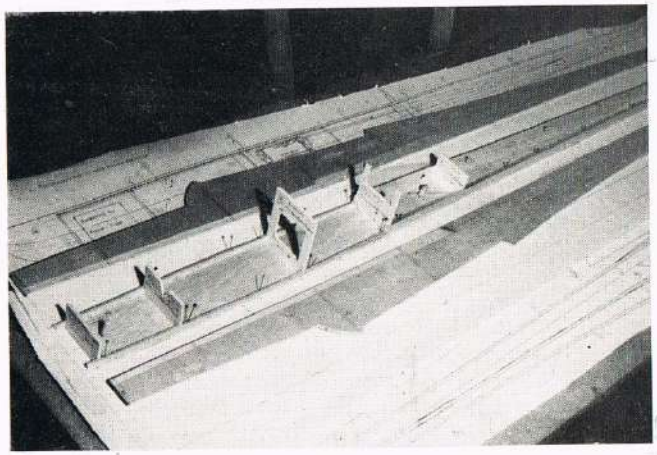
The end rib 79 should be face-ground with abrasive paper to be perfectly flush with the two main spars, with the planking and with the trailing edge, to insure snugly fitting of the wing tip. The wing tip should be glued purposively with cellulose glue. The gluing spot should be fixed with pins.

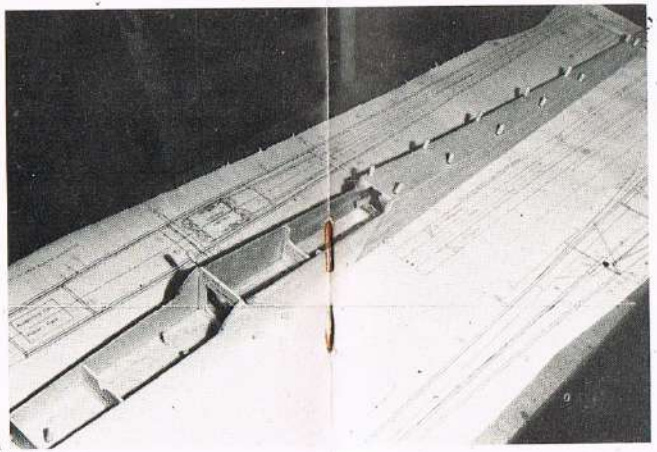
In our opinion, gluing of the rib braces (90) must not be described too much in detail. It may be selfunderstood that each particular rib brace should be fitted in as precisely as possible. No crack should appear at the joints as this would remain visible after covering is completed. We recommend the use of contact adhesive because its use enables a short working time relieving you of pinning the particular rib braces on the thin ribs. Nevertheless the rib braces should then be joined in socket-coupling with Rudol-hard from inside on the main spar, the trailing edge, respectively, to prevent twisting in longitudinal direction.

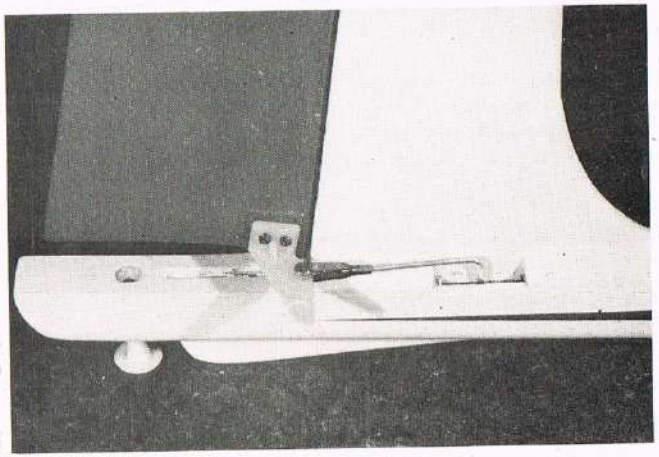


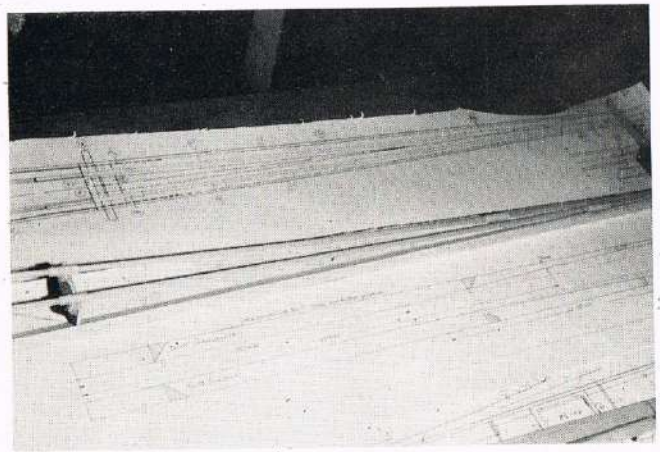


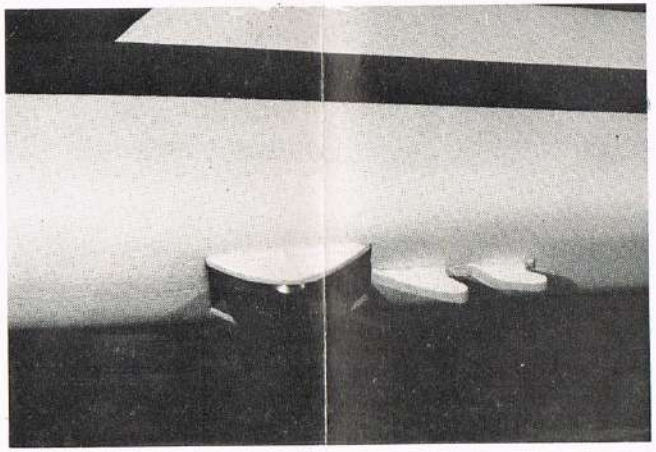


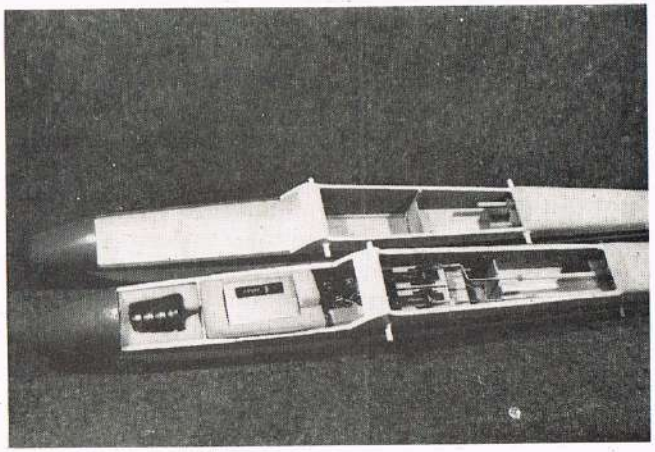












Prior to cementing of the root ribs (91), the two wing halves should be stuck regularly together by using connecting wires (93 and 94). While performing this work you can make sure if the two wing halves are fitting one another without formation of a gap. Should this be the case, because you have committed a fault when aligning the ribs 80, you can possibly equalize this still by stuffing out with a thin balsa-sheet between rib 80 and root rib 91. **The root ribs (91) must be in any case glued-on with cellulose glue.** After gluing has become hard, the root rib will be face-ground with sand paper to be flush with the a little projecting brass tube, and, by fitting together the both wing halves with the use of original piano wires, the quality of the contiguity of the wing halves should be tested. In order to protect the trailing edges at the point where they will be provided with a trailing edge protection (92) of steel wire. Cut to adequate lenght the piece belonging to the assemblage kit and glue it with twocomponent-glue (Stabilit-Express), butt-jointed, at the rear on the trailing edge.

Now the entire wing area can be properly sanded. Look hereto at the cross sections K—K and L—L. In doing so, also the conical course of the ends of the areas should be ripped open with a balsa-knife from rib 72 onwards, what means that the trailing edge will become a little more conical than is the general course of the trailing edge in entirety from rib 72 onward, according to the hatched line on the working drawing, up to the wing tip. The wing tip should be shaped in accordance with the cross section.

Finally the transition of the wings to the fuselage (95) should be accomplished. In doing so, the wings should be stuck together and stretched on with rubbers. Then only you can fit and cement the wing transitions (95) on the right and the left wing half. As owing to the shape of the wing transition it will no more be possible to face-sand same after it is glued on, this work should be purposefully done before.

As the whole model is now accomplished undressed, subsequently we will devote ourselves to the description for the installation of the remote control, and of the covering. Although we know that every experienced model builder has his own technique to accomplish this specific work according to his own ideas, we believe that our tips are not much interesting you. Possibly you will find after all something you may consider to be new or important to you.

Covering

You can cover the robbe-Tonga with robbe-Super-Solar film (Ind. Nr. 5210 up to 5224), with robbe-Japan silk (Ind. Nr. 5052 up to 5060), or with robbe-Japico-paper (Ind. Nr. 5049 up to 5050).

We recommend you the use of robbe-Super-Solar film for wings and the horizontal tail unit and to line the fuselage either with robbe-Japan silk, or with Japico-paper.

Whichever of the three named materiels you will provide for, the covering must be applied always in quite determined runners (partial cuts). The purps sequence looks as follows: Commence with the vertical rudder (at the left and at the right). Then the fuselage bottom, the fuselage sides at the left and the right, and the fuselage top part will follow. Finally you will cover the vertical tail surface (at the left and at the right). At first the bottom side of the horizontal rudder will be covered, then the top side.

Start covering of the wing halves on the underside, then only the top sides should be covered.

As far as covering with robbe-Super-Solar film is concerned, kindly note the working up guidance attached to each packing unit.

In the following an example for covering with silk or with paper: In first line all wooden parts of the model should be painted two or three times with robbe-pore filler „S" (Ind. Nr. 5505 up to 5508). Each coat of paint must dry up properly. After application of each coat of pore filler „S" the part to be covered should be abraded with fine glass-paper. After the last applied coat, the surface of the model must be smooth and water repellent. Then only the real covering procedure can be started. An adequately sized piece of covering material (oversize at the rims approx. 1 mm) will be laid on the part to be covered and bespattered with a water atomizer. Silk can be drawn around the corners or roundnesses, paper must be cut in. Creases will be stretched, air bubbles set free by pressing with a wet piece of foamy plastic. With thinned stiffening varnish the still wet material will now be painted and put aside to dry up. Subsequently the projecting rims will be cut with a razor blade and the area to be covered coated again with stiffening varnish. The „bleaching" on the area will disappear during this procedure.

Covering should be coated with stiffening varnish as often as necessary to close all pores. This applies as well as to covering with paper as also to covering with silk.

Use for covering with coloured enamel the robbe-stiffening varnish „Spritfest-Super" (Ind. Nr. 5524/2 up to 5524/5). You may unse as a colour sample the picture shown on the lid of the cordboard.

In spite of the detailed description given for the robbe-Super-Solar film (attached to each packing), in the following an especially important hint:

> Wooden parts must not be primed with porefiller if robbe-Super-Solar film is applied as covering.

Remote Control Installation

The R/C installation shown in scale 1:1 on working drawing relates to the robbe-Digital-system – DPB 2/1, or DP 2/1.

Because the guidance for the installation of the linkage was contained already in the description of the assemblage of the fuselage, we can renounce treating again this section. Same applies to the situation of the power-pack which, however, should be rolled somewhat into a foamy plastic before inserting same into the fuselage. The location where the robbe-Digital receiver should be placed is exactly determinable from the working drawing's side view. Also this equipment should be protected in rollingrolling same into a foamy plastic.

Use the robbe-servo-quick-fixture (Ind. Nr. 8046) to fasten the vertical and the horizontal rudder servoattachment. This purposeful accessory part enables an exchange of the servo, if necessary, during few minutes.

It is left to you on which side you will install the circuit closer and the circuit breaker for the supply of the receiver with electric power. The sizes of the recess for the switch toggle and for screw fastening necessarily will result from the construction type of the switch.

The trailing aerial of the robbe-Digital receiver should be led by means of a small borehole out of the fuselage side wall. Do not forget to install a draught relief inside of the fuselage, on the aerial. That's peculiarly important to prevent the trailing aerial from being torn out of the receiver, i. e. of the soldering, by unintended awkward movement.

Balancing

The model should be supported in the center of gravity (see plan) and allowed to swing out. The ideal position is reached when the model will remain balanced with its forepart slightly hanging downwards. I case the tail plane unit hangs downwards, add lead as ballast. Should the forepart hang too much downwards, lead should be fastened in the rear on the fuselage end.

Testflying

You should find out a small declivity of as low as possible slope for the initial flight of your „robbe-Tonga". It would not be much significant to test the model immediately in the start to altitude flight or in regular hover flight. Put the R/C system into operation and check up the performance of servos and the effective radius of the system. Then only the „robbe-Tonga" should be set free with cut-in system, held in head level, with a slight push, and the control of the model immediately assumed with the sender. The best will be to engage in addition a second remote control pilot who will release the model from the hand. So you will be enabled to steer and to observe the model from the first flight phase on already.

If you, or your helper will release your Tonga correctly, i. e. horzontally true to the wings, with fuselage slightly inclined downwards, you will immediately perceive whether the adjustment of the vertical or the horizontal tail unit is appropriate. Presupposed that no fundamental fault was committed by you during construction of the model in the assemblage of the horizontal and the vertical tail unit, you can perform corrections by shifting the plate of the vertical and the horizontal rudder plates.

~~**Following tips are applicate –**~~

Following tips are applicable only if the center of gravity is precisely balanced

If, after model is released, the fuselage inclines too fast downwards, put, by perverting at the yoke end, the plate of the horizontal rudder a little upwards. Caution: One or two revolutions will mostly suffice to perform the correcture orderly.

If, in spite of an enough long course of flight during which the speed of the flight could be stabilized, the model will tend again and again in rhytmical intervals towards upward (pumping movements), the horizontal rudder plate must be adjusted a little downward. One up to two revolutions on the yoke end will suffice also here.

In parallel with corrections at the longitudinal axle of the model you can correct also the transverse axle.

If the model banks to the left after it was released in horizontal position, the vertical rudder plate should be adjusted to the right. If it will bank to the right, the vertical rudder plate will be adjusted to the left.

Only when your „robbe-Tonga" will fly precisely straight ahead in long straggling gliding flight, you can change into hover flight or thermic current flight, or also to the start into altitude flight.

And now we wish for you much success with your „robbe-Tonga" and much delight in flying.

Your *robbe-works*
6421 Metzlos-Gehaag

List of parts for the robbe-assembly kit „Tonga" Ind. No. 3146

Part list No.	Designation	Material	Dimensions mm	Quantity required	Remarks
Fuselage					
1	fuselage bottom fore part	balsa	3, prefab.	1	Part 1 to be stuck
1a	fuselage rear part	balsa	3, prefab.	1	with 1a
2	fuselage webbing, below in the rear	balsa	12x12 as per plan	2	threeangular
3	fuselage webbing, in the front, below	balsa	3x5 as per plan	2	
4	bulkhead	plywood	3 prefab	1	
5	bulkhead	plywood	3 prefab	1	
6	bulkhead	plywood	3 prefab	1	
7	bulkhead	plywood	3 prefab	1	
8	bulkhead	plywood	3 prefab	1	
9	fuselage side part front piece	balsa	3 prefab	2	part 9 to be glued
9a	fuselage rear side part	balsa	3 prefab	2	with part 9a
10	interior fuselage propping	plywood	0,8, prefab	2	
11	fuselage top webbing	balsa	15x15 as per plan	2	threeangular
12	fuselage diagonal trussing	balsa	12x12 as per plan	1	threeangular
13	fuselasge diagonal trussing	balsa	12x12 as per plan	1	threeangular
14	fuselage diagonal trussing	balsa	12x12 as per plan	1	threeangular
15	fuselage diagonal trussing	balsa	12x12 as per plan	1	threeangular
16	fuselage end	balsa	20x20 as per plan	1	
17	rudder linkage, vertical tail rudder	copper	Ind. No. 6146	1	not incl.
17a	rudder linkage, duct	copper	Ind. No. 6147	1	not incl.
18	rudder linkage, vertical tail rudder	copper	Ind. No. 6146	1	not incl.
18a	rudder linkage, duct	copper	Ind. No. 6147	1	not incl.
19	dowel	beech	6 ϕ cl.w. as per plan	1	
20	dowel	beech	6 ϕ as per plan	1	
21	fuselage top part	balsa	3, prefab.	1	
22	horizontal tail unit support (wedge)	balsa	4, as per plan	1	
23	fuselage skid	balsa	26, prefab.	1	
24	fuselage head	balsa	30x70x75, as per plan	2	
25	fuselage head propping	plywood	0,8 prefab.	1	
26	wing support	plywood	0,8 prefab.	1	
27	wheel case	plywood	3	1	
28	wheel case	plywood	3	1	
29	wheel axle	steel	2,5 ϕ clear w.as p.plan	1	
30	shims	plywood	3, of plywood waste	2	not incl.
31	wheel		35 ϕ prefab	1	
32	hook for start into altitude flight	plywood	5, prefab	1	
33	tailskid	balsa	8, as per plan	1	
34	cabin bottom	plywood	3, prefab	1	
35	cabin bulkhead	plywood	3, prefab	1	
36	dowel	beech	3 ϕ clear w., prefab	1	
37	canopy	PVC	0,5 prefab	1	
Vertical tail unit:					
38	vertical tail unit	balsa	8, prefab	1	
38a	transition piece (vertical tail unit--fuselage)	balsa	8, prefab	1	
39–39a	vertical rudder plate	balsa	8, prefab	ea 1	
40	hinges	nylon	0,3 prefab	3	
41	stud	balsa	5, as per plan	1	
42	control horn reinforcement	plywood	0,8, as per plan	2	
43	vertical tail reinforcement	balsa	8x8 clear w.as p.plan	2	threeangular
44	control horn	nylon	Ind. No. 5118	1	not incl.
Horizontal tail unit:					
45	bottom planking	balsa	0,8, as per plan	1	
45a	top planking	balsa	0,8, as per plan	1	
46	leading edge	balsa	6x6, as per plan	1	
47	trailing edge	balsa	5x8, as per plan	1	

48	ribs	balsa	1, prefab	18	
49	central piece	balsa	10, as per plan	1	
50	wing tip	balsa	10, as per plan	2	
51	horizontal rudder plate	balsa	8, as per plan	1	
52	rudder hinges	nylon	0,3, prefab	7	
53	catch	beech	3 ϕ clear, as per plan	1	
54	Wingfix	nylon	Ind. No. 5138	1	
55	control horn	nylon	Ind. No. 5118	1	not incl.

Wing:

56	Main spar	pine	3x5, as per plan	4	splice
57–60	ribs	plywood	0,8; prefab. each	2	
61–79	ribs	balsa	1,5; prefab. each	2	
80	ribs	plywood	0,8; prefab. each	2	
81	leading edge	balsa	10x10, as per plan	2	splice
82	trailing edge	balsa	3:0,5x16, as per plan	2	splice
83a	trailing edge planking on bottom	balsa	1,5, as per plan	2	splice
83b	trailing edge planking at the top	balsa	1,5, as per plan	2	splice
84	leading edge planking on bottom	balsa	1,5, as per plan	2	splice
84a	intermediate (central) piece planking, at bottom	balsa	1,5, as per plan	2	to fit
85	main spar web	balsa	2, as p. plan	40	
86	fixing tube	brass	4,2 ϕ as per plan	2	
87	fixing tube	brass	5,2 ϕ as per plan	2	
88	top leading edge planking	balsa	1,5, as per plan	2	splice
88a	intermediate piece planking, at the top	balsa	1,5, as per plan	2	to fit
89	wing tip	balsa	15x15, as per plan	2	
90	rib brace	balsa	1,5, as per plan	76	to fit
91	root rib	plywood	1,5 prefab	2	
92	trailing edge protection	steel wire	1,5 ϕ as per plan	2	
93	connecting peg	steel wire	4 ϕ prefab	1	
94	connecting peg	steel wire	5 ϕ prefab	1	
95	area transition	balsa	30, prefab	2	fit on
96	angle pattern	plywood	to be made of waste	1	not incl.

List of materiels to the robbe-assemblage kit „Tonga" Ind. No. 3146

Material and dimensions in mm	ea	Part-list No.	Remarks
Balsa strips			
15 x 15 x 640	2	11	threeangular
15 x 15 x 300	1	89	
12 x 12 x 740	2	2	threeangular
12 x 12 x 240	1	12, 13, 14, 15	threeangular
10 x 12 x 180	1	50	
10 x 10 x 710	4	81	
8 x 15 x 120	1	33	
8 x 8 x 300	1	43	threeangular
5 x 8 x 730	1	47	
5 x 8 x 85	1	41	
6 x 6 x 710	1	46	
3:0,5 x 16 x 725	4	82	asymetric conic
3 x 5 x 680	1	3	
2 x 18 x 600	4	85	
1,5 x 32 x 725 above	4	83 b	
1,5 x 29 x 725 at bottom	4	83 a	
1,5 x 5 x 720	10	90	
Balsa cuts			
4 x 25 x 100	1	22	
10 x 30 x 80	1	49	
20 x 20 x 50	1	16	
30 x 75 x 145	1	24	
Balsa sheets			
1,5 x 80 x 740	8	84, 88	
1,5 x 80 x 400	2	88 a, 84 a	
8 x 45 x 730	1	51	
Firwood strips			
3 x 5 x 710	8	56	

Material and dimensions in mm	Quality	ea	Part-list No.	Remarks
Beech rounds				
ϕ 6 x 180		1	19, 20	
ϕ 3 x 60		1	36, 53	
Plywood cuts				
0,8 x 20 x 40	birch 3-ply	1	42	
Piano wire				
ϕ 2,5 x 31		1	29	
ϕ 1,5 x 190		1	92	
ϕ 4 mm bent to angle accordg. plan		1	93	
ϕ 5 mm bent to angle accordg. plan		1	94	
Brass tube				
ϕ 4,2 x 5 x 140		2	86	
ϕ 5,2 x 6,5 x 140		2	87	
Small wheels				
ϕ 35 (ϕ 2,5 drilled hole)		1	31	
Hinges				
(same as 6101)	nylon	10	40, 52	
Nylon screw with nut				
M 6 x 40	nylon	1	54	
Canopy l = 370 W = 75, H = 50 made of 0,5 thick OVC		1	37	
Working drawing (plan)				
1 x 1/2 BO longitudinal				
1 x AO				
Transfer picture „Tonga"		1		
Transfer picture robbe (large)		1		
Construction guidance A 5		1		

Parts to be cut out to „robbe"assemblage kit „Tonga"

Material and dimensions in mm		Quality	ea	Part-list No.	Remarks
Balsa:	3		2	9 a	
	3		2	9	
	3		1	21	
	3		1	1 a	
	3		1	1	
	8		1	38 a	
	8		1	38	
	8		1	39 a	
	8		1	39	
	30		2	95	
	26		1	23	
Plywood:	0,8	birch 3-pl.	2	10	
	0,8	birch 3-pl.	1	25	
	0,8	birch 3-pl.	1	26	
	5	birch 5-pl.	1	32	
	3	poplar 3-pl.	1	4	
	3	poplar 3-pl.	1	5	
	3	poplar 3-pl.	1	6	
	3	poplar 3-pl.	1	7	
	3	poplar 3-pl.	1	8	
	3	poplar 3-pl.	ea 1	27 + 28	
	3	poplar 3-pl.	1	34	
	3	poplar 3-pl	1	35	
Balsa ribs:	1,5		ea 2	61–79	
	1		18	48	
Plywood ribs:	0,8	birch 3-pl.	ea 2	57–60, 80	
	1,5	birch 3-pl.	2	91	