

**Julie Embree and RCM's
prototype of the Ply Guy,
photographed at Wilderness
Park in Arcadia, California.
A pretty girl, an airplane,
and a summer's day . . .**

**PLY
GUY**



OWEN KAMPEN & DON DEWEY

**The Ply Guy . . . a good flying
airplane, using a construction
technique that provides
a new dimension
in creative expression.**

OWEN KAMPEN:

The Ply Guy is the result of a team effort. This is unusual only in the fact that the team is separated by 2,000 miles and as yet, have never met! improbable? Well, perhaps, but thanks to Alexander Bell and the latter day Pony Express, communications are now such that all kinds of things can and do happen — even the Ply Guy.

It all began with a telephone call from Don Dewey outlining a set of hypothetical specifications for a 4' span, .19 powered sport-trainer to take advantage of the new proportional systems now available. As Don saw it, the plane would be stable and tame enough for the beginner, capable of operating out of reasonably small fields, yet strong and rugged enough to survive the inevitable mistakes caused by wayward thumbs and capable of aerobatics for the more advanced flier. The list went on and on! Well, it was his nickel, so I let him talk; but the plane he saw so vividly in his mind's eye does not exist and probably never will. Still, what the hell — we could try and try we did.

The trying soon boiled down to the inevitable "art of the possible." One of the key words that kept returning was "rugged." Ask any modeler, or any member of his family, to briefly describe R/C planes and it comes out — "they fly, they break." Perhaps something could be done to make the latter less likely. It so happened that, at the time, I had been doing some extensive experimenting into the bending nature of 1/32" birch plywood and had constructed several fuselages formed out of single sheets of this material. Similar experiments were being conducted by Chuck Cunningham in Fort Worth, Texas at the same time. These fuselages were very strong, reasonably light and surprisingly fast to build. A variation on one of the prototypes became the answer to the Ply Guy fuselage. It probably contains more hardwood than anything since the English "Mosquito." It's rugged!

The wing is a typical D-tube with cap strip construction, using an airfoil which was, although similar to others, developed independently over a period of 5 years of cut, try, and fly. The raked wing tips have been tested on several planes and it's my belief that they very definitely contribute to increased lift by minimizing tip vortices. Actual tests with interchangeable tips have convinced me of this fact. Although I do not find supporting evidence in books on aerodynamics, my simple nature inclines me to believe what I see rather than the graphs I have read. More on this at another

time.

The rest of the package is rather routine, like long moments for gentler control response. In any event, plans were drawn, the plywood fuselage finished and winter came on strong. Unable to wait, I shipped the whole schmear to Don. So, long distance teammate — over to you!

DON DEWEY:

Since the key to this design is the one piece folded plywood fuselage, we'll begin at that point. Before we do, however, I would suggest that you read Cunningham on R/C in this issue of RCM. Here, Chuck discusses the method of making a low wing, .60 powered model, using this same technique. The construction procedure is virtually the same as that used in the Ply Guy, except that the design, here, is a shoulder wing.

The Ply Guy fuselage is begun by cutting the fuselage template out of a sheet of 1/32" birch plywood. Full size fuselage templates are shown on the plans available from the RCM Plans Service. If your local hobby shop does not carry the 48" long plywood, it is available direct from Sig Manufacturing Company. After you have cut the templates from the plywood with an X-Acto knife and a number 11 blade, set them aside for the moment.

The next step is to cut the 1/8" plywood fuselage floor to the size shown on the top and side view of the plans. Next, glue the 3/16" square spruce runners to the outer edges of this plywood floor using Titebond glue. Using your Dremel jigsaw, cut bulkhead F2 from 1/8" plywood and bulkhead number F3 from 3/32" plywood. Glue these in place on the plywood floor, checking for perfect alignment with a right angle. When these are dry, add the 3/16" square spruce top longerons and the 3/16" square spruce upright that falls between former F2 and F3. When this sub-assembly has thoroughly dried, you are ready to proceed with forming the one piece fuselage.

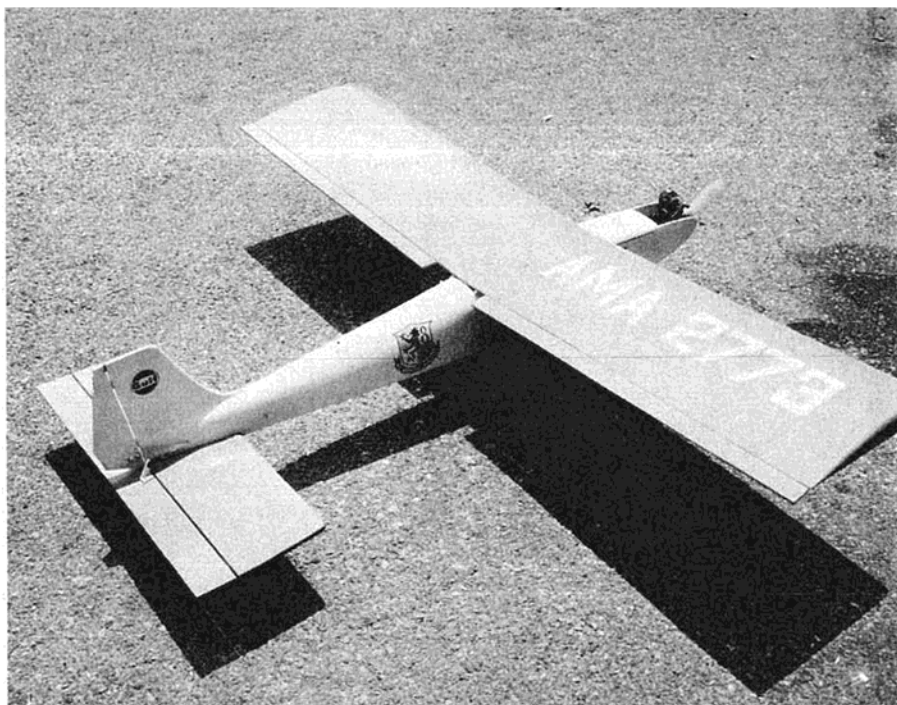
Take your plywood fuselage, previously cut from the templates and using a ball point pen, mark the positions of all remaining formers. After ascertaining that the plywood fuselage is exactly the size of the template, glue in place the 3/16" square spruce longerons that extend from former F3 to the stabilizer and the 3/16" spruce stringers that serve as a stabilizer support. When these have dried, take a wet sponge which has been soaked in water and to which has been added a few drops of ammonia and thoroughly

soak the outside turtle deck area of the plywood at approximately two inches each side of a center line drawn down the center of your plywood piece. Allow this to dry for a few minutes, then resoak the fuselage. Do not allow water to get to the outside perimeters of the plywood, or on the inside area of the fuselage, itself. As you continue to re-soak this area, wiping off the excess runs of water, bend the fuselage with your hand. As the plywood becomes pliable, due to continued sponging, you will find that it gradually bends to the desired shape. When you feel that it is ready for final forming, mix up a batch of epoxy glue and stand by!

Spread epoxy over the sides of bulkheads F2, F3, the sides of the plywood floor and the 3/16" square spruce stringers. Bend your fuselage plywood around to join to this assembly. Secure in place with numerous strips of masking tape, making sure that the entire assembly is completely aligned and true! While this is drying and without undue delay, cover the edges of bulkheads F4 and F5 with epoxy and insert on the lines you have previously drawn on the inside of your plywood fuselage. Make sure that these are in a true and aligned position, then secure in place with masking tape and pins, as necessary.

Add the 3/16" spruce tail post, using epoxy glue and hold firmly in position with the use of C-clamps or numerous spring clothespins. You will experience some cracking at the top of the fuselage, however this area will be cut out for the installation of the fin, thus there is no need for alarm. Before your epoxy glue sets up, make certain that your spruce tail post is absolutely straight, since the fin and rudder will be glued to it and any mis-alignment, will cant your vertical fin to one side or the other. While the fuselage assembly is drying, you can add your 1/8" ply nose doublers and 1/4" balsa tank compartment doublers, using epoxy glue again and making certain to allow a slot on each side for the installation of firewall F1.

When the entire assembly has dried, add F1 and secure firmly in place with masking tape and/or rubber bands. Sand lightly the lower rear portion of the fuselage and then sheet with one piece of 1/32" plywood, extending this plywood fuselage bottom on to the 1/8" plywood floor. Do not set this project aside for over 24 hours without sheeting the bottom of the fuselage, since this will cause the fuselage to warp out of alignment. The plywood fuselage bottom, when glued in place, prevents any twisting or torquing of the aft section of the fuselage. Add the 1/2" square maple motor mounts to



The Ply Guy after fifty-plus flights. O.S. 19 engine, Kraft KP-4, Gold Medal. Orange super MonoKote on wing and stab, white urethane on fuselage.

the forward nose section with epoxy. Using Titebond, glue in place, the 1/4" sheet balsa wing saddles and 1/2" triangular stock corner braces. When dry, sand to shape on the outside to fair into the plywood fuselage. Cut the fin and rudder from 3/16" medium hard sheet balsa and cap the fin with 3/16" x 3/8" balsa. Glue the fin in place to the fuselage and the spruce tail post. Mount your steerable nose gear bracket (we used a Carl Goldberg Unit), and drill all necessary holes for throttle linkage and fuel line passage. When you have made a trial fit of all equipment to be installed in this area, sheet the bottom of the fuel and battery compartment with 1/8" plywood as shown on the plans. Cut your motor mounting plate from 1/8" phenolic or 3/16" plywood if phenolic is not available. Be absolutely certain that you have cut your motor mounting plate to provide 3 degrees of right thrust. The required 2 degrees of down thrust is provided by adding a couple of washers under the rear mounting lugs of your engine. Drill two holes on each side of the phenolic mounting plate and through the 1/2" square maple motor mounts using a 7/64" drill and install blind mounting nuts from the bottom of the motor mounts. Using 4-40 mounting bolts, test mount your phenolic mounting plate. When this has been accomplished, add 1/2" sheet balsa triplers under the motor mounts and against the fuselage sides. Form the fuel compartment hatch from 1/2" sheet balsa. The forward hatch

stop is made from a length of 1/2" sheet balsa and glued to the fuselage sides and the top of F1. Glue two 3/16" square spruce cross braces to the inside of the hatch to prevent any warping when the hatch is later painted. Add the 3/8" square hardwood servo rails to the inside of the radio compartment to suit the type of installation you plan to use. In our prototype, we used the Kraft KP-4 proportional system and the new small servos. Drill the two holes for the wing hold down dowels. These hold down dowels are not glued in place but allowed to be removed in case of damage. These are 3/16" wooden dowels inserted into 3/16" I.D. aluminum tubing.

Mount your Hallco number B105-4 landing gear to the bottom of the fuselage using 4-40 nuts and bolts. Two and one-half inch diameter DuBro Lo-Bounce wheels were used throughout.

The stabilizer is a sandwich of two sheets of 1/32" balsa with a 3/16" square leading edge, 3/16" by 1/2" balsa trailing edge, 3/16" x 1/2" balsa tips and 1/8" x 3/16" balsa ribs. Although slightly heavier, we pin down the lower sheeting and then glue into place the internal framework using the epoxy glue. This allows a much faster stabilizer construction, since epoxy does not require air drying. If you use conventional glues that require air in order to thoroughly dry, the stabilizer should be completed and remain pinned to the bench for 48 hours. The elevator is a one-piece unit cut from 1/4" sheet balsa and sanded to an airfoil taper.

The elevator is attached to the stabilizer using deBolt polypropylene hinges. Be certain to cut the hinge slots on a straight line so that, once installed, the hinges are free from any twists. We do not insert glue in the hinge slots, but drill two 1/16" holes in each side of the hinge insert Titebond glue into the holes and then run toothpicks cut off flush with the surface using a pair of Revlon toenail clippers. The protruding stub edges of the toothpicks are then sanded flush prior to covering the hinged surface. The rudder is hinged to the spruce tail post in the same fashion. When the stabilizer has been completely sanded it is glued to the fuselage using epoxy glue.

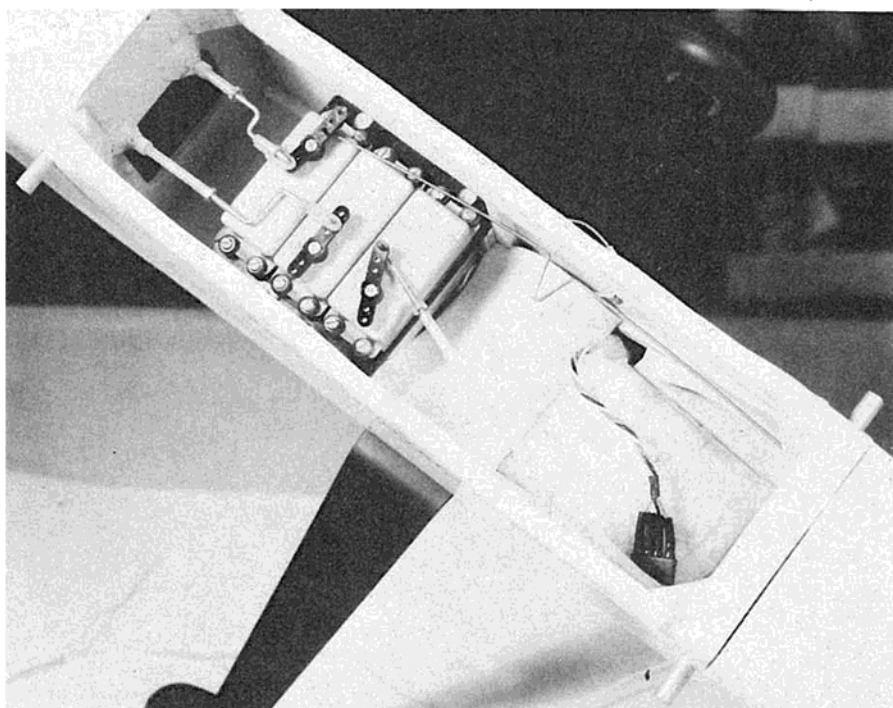
The wing is of D-Tube and cap strip construction and the plans should be completely self-explanatory. Before commencing construction of the wing, determine whether or not you plan to use ailerons on this design. The rudder is completely effective, so we would suggest that you build the aileron version and use only the rudder, at first, if you have never flown with ailerons. We cut two 1/8" plywood templates and stacked 9 sheets of 3/32" balsa between them and sanded to the shape of the templates. These sheets are bolted between the two rib templates using the long 4-40 nuts and bolts. When the first set of 9 ribs have been sanded to shape, they are removed and another set of 9 constructed in the same fashion. We used the homemade RCM Wing Jig to build this wing. While the wing was in the jig, we epoxied in place the nylon tubing which will hold the aileron brass cable. When the wing has been completed, remove from the jig and after thoroughly sanding, cover the center section with a 4" wide band of lightweight Sig Celastic.

Sand the entire aircraft to a point where it is as smooth as you can possibly get it. The fuselage was given two brushed coats of nitrate dope. The wing and stab were not doped since they were covered with orange Super-MonoKote. Lightly sand the doped fuselage and fin and you will notice how smooth the plywood unit is due to its close grain. We then applied two coats of sprayed on New Finish Urethane Liquid Plastic which was obtained from Standard Brands Paint Stores. This finish is the hardest and most durable finish we have ever used and even in the roughest of landings, never seems to chip or scratch.

The radio equipment was installed on Kraft servo mounts and the receiver and battery wrapped in G-Pad. Nyrods with Rand Keepers were used throughout the installation. The engine used

in our prototype was an OS Max .19, and this is the bare minimum amount of power recommended. The aircraft is quite capable of handling engines of up to .35 size. The weight of our prototype was 4¼ lbs., of which 4 oz. was lead weight added to the battery compartment to correct a tail heavy condition caused by the plywood fuselage. If you plan to use a Galloping Ghost installation, omit the ailerons and install an elevator that is only 1/2 the chord shown on the plans. The rudder should not be changed. If you do not use the ailerons, use two inches of dihedral under each wing panel. The Max .19 engine used in our prototype used a pressurized fuel system which will be described in next month's article on the New Era. This provided the reserve power necessary to fly this aircraft at this weight. When the pressure line was removed, the aircraft was marginal in performance. A Top Flite nylon 9/4 prop was used. The fuel tank is a Pylon Brand RST-4 tank.

Flying the Ply Guy is sheer pleasure! Aileron response is exceptionally good and quite fast, while the response to the pitch axis is rather slow due to the long tail moment. The airplane, as set up, is not excessively fast and makes an excellent trainer for full house proportional. It does, however, require you to fly it all of the time, since it goes only where it is pointed. It does not have an inherent ability to stabilize itself from your last given command — a condition that is eagerly sought by the beginner and thoroughly cursed by the instructor trying to teach



Kraft "mini-servos" and G-Pad installation. Ny-Rod pushrods should not be used in temperatures 100 degrees or above, due to expansion of tubing.

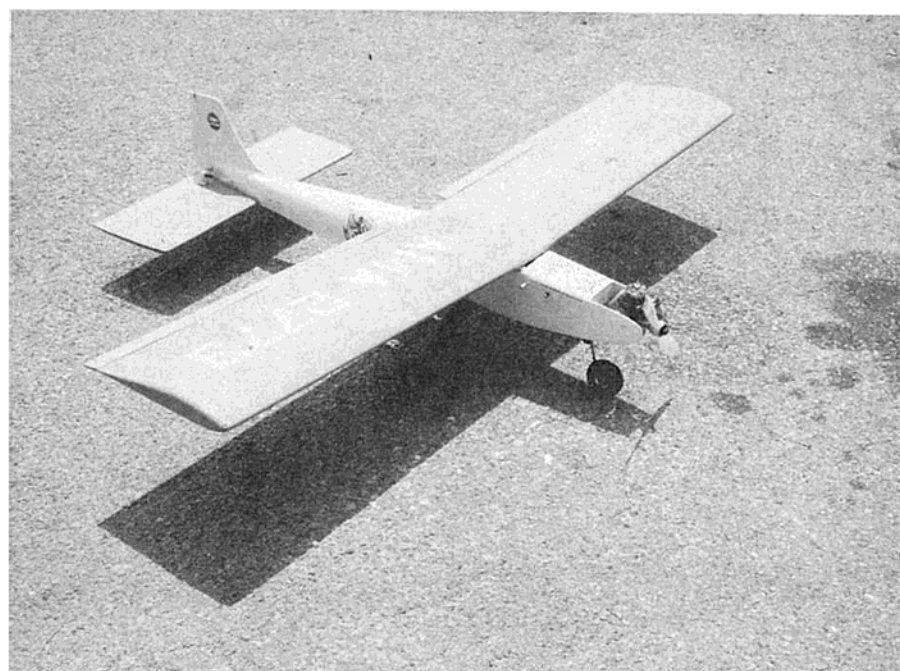
him to fly! Virtually any maneuver can be performed by the Ply Guy and it can slow down almost to a walk for a landing without any tendency to snap roll. Takeoffs and landings are quite easy and no problems of any kind were encountered. We have virtually flown the prototype in the pictures to death, and yet the plywood fuselage shows no signs of wear or abuse. This combination of plywood and urethane is one of the most rugged building combinations we have seen. The MonoKote

used on the wings and stab provide a very rugged and serviceable covering material that is hard to beat.

With untold hours of airtime to its credit and with numerous less-than-gentle landings on the face of a very rugged Hill, our Ply Guy is still going strong. If you want a good flying aircraft, using a new construction technique and one that can take all the abuse you can hand it, this is the model for you!

Good flying!

Midwest AMA numbers adorn MonoKote wing. Top Flite 9-4 nylon prop on Max .19.



For camera fans — the color photograph on page 22 was a 35 mm Ektachrome-X transparency taken with a Super Contaflex, F22 at 1/125 sec. Photo below, Plus-X 16 mm, Minox camera, F35 at 1/1000 sec. All others 4x5 Polaroid Type 57, Crown Graphic, F32 at 1/50 sec.

