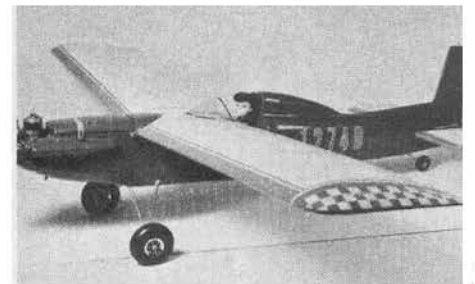
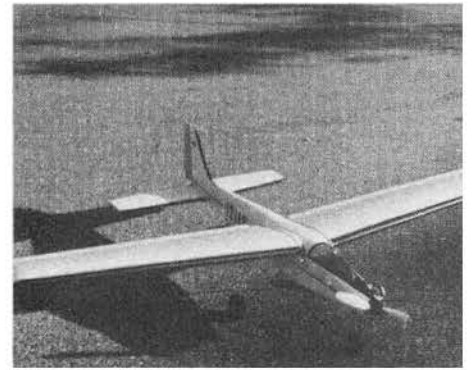


# The Ply Pair



BY OWEN KAMPEN



The 46" plymate is designed for sport flying with a .15 to .19. The racy open cockpit aircraft has been flown with Rand Dual Pack and mini-digital. The Skyraker is a distinctive design that utilizes the Webra .20 with an option on engine size up to .40. Both models utilize the one-piece "folded" plywood fuselage construction technique.

Two previous RCM articles by this author, the "Plyguy" Oct. 1968, and "Windsong" March 1969, featured the use of 1/32" birch plywood for fuselage forming and, while both demonstrated exceedingly strong, reasonably light curved structures, the constructions were admittedly a bit difficult for one pair of hands. Here then, after over two years of development, is a new construction method guaranteed to produce results faster than anything short of a plastic almost ready to fly job. While the approach is unorthodox, it has been used successfully on several designs, two of which are presented here.

While quite different from each other in appearance, each is constructed by the same basic fuselage forming method, which with the advent of Devcon Five Minute Epoxy can be largely accomplished in a single evening. Like some "obvious" ideas, this one took a long time coming, and, in retrospect, it is now difficult to understand why the "obvious" wasn't obvious in the beginning.

As can be seen from the step by step photos, the method is simplicity itself, with the actual forming taking about as much time as it takes the glue to dry. No special skills or equipment are needed and the result is a sturdy, light, one piece shell which can be adapted to a variety of applications.

Sheets of 1/32" birch ply 1' by 3' or 1' by 4' are available from Midwest Products or Sig Mfg. Co., and cost about sixty cents a square foot which compares very favorably with balsa at today's prices. Other advantages include quicker finishing since the ply requires less filling and doping to achieve a high gloss finish. There is also a structural gain which is a by-product of the ply, itself, as the three crossgrained wood layers really resist splitting to a degree that must be seen to be believed.

Long life with a minimum of repairs and maintenance is the net result. You fly more — fix less!

Now let's look at the Plymate and Skyraker as flying machines, for essentially the "method" is really only a means to an end. Along the way some personal observations which have been gathering dust waiting for an appropriate moment for voicing will be thrown in for free, not in the spirit of controversy as such, but rather to stimulate some thought through a sharing of ideas.

The 46" Plymate is a sort of grown up "Skampy" with the general lines of

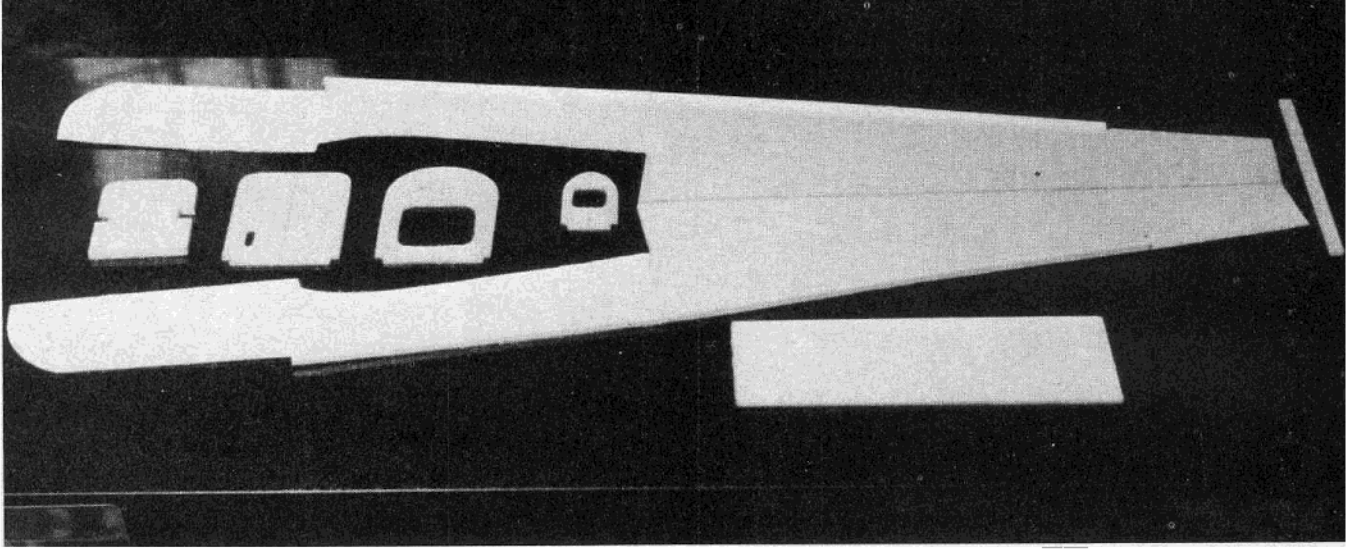
a racy open cockpit sport job, designed to take a lot of abuse and come back for more. The prototype was flown with a good Max .15 which was excellent for general sport flying, although takeoffs were a bit lengthy when the grass was long. Install a good .19 and the result is something else. There is enough wing area to take a .19 without producing a wild one which only Phil Kraft can tame, but for general sport flying the .15 is adequate.

The original was equipped with a Rand Dual Pak now manufactured by Ace R/C. This fast-rate pulse-proportional system is about as good as you can get in a single channel rig, offering full proportional controls on rudder, elevator and motor through the output of two Rand servos. In the past there was some interaction of the elevators when a motor change was signaled but this has been beautifully solved with the introduction of the new ACE Commander fast-rate transmitter designed by Don Dickerson. Now full elevator control is available during motor control operation thru a bit of ingenious design which permits a small amount of signal to be transmitted to the decoder when the normally full-on or full-off signal is triggered by the motor control buttons. Four adjustable trim pots, a handsome vinyl case, and an adjustable Rand Control Stick make this a really respectable piece of electronic equipment. The whole airborne package is also from Ace R/C. Note: Other receivers may cause problems, so don't mix components.

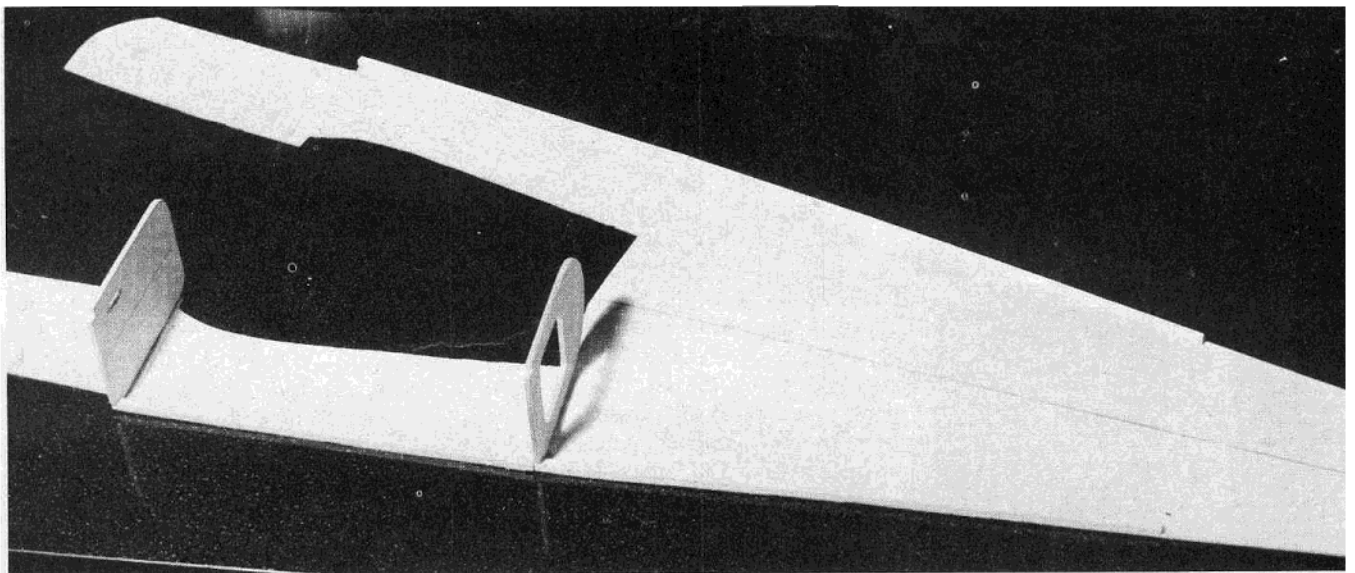
The alternate option of small proportional gear is obvious and permits the addition of strip ailerons. Either system will do the job and you'll find the "Plymate" a rugged, dependable performer. Taildragger flight is really fun after a raft of tricycles and the plane has a nice sporty look. A season of rather rough treatment and it still looks like new.

The "Skyraker" design has been built and flown in .02 and .09 sizes as well as this .20 version, and all have flown as well as the distinctive appearances would indicate. In this day of power and more power, designs tend to show a sameness, and even those with less than optimum qualities will work reasonably well by packing in more punch up front. As a modeler for whom design offers the challenge, the test has been to see how much can be achieved from how little. Here is

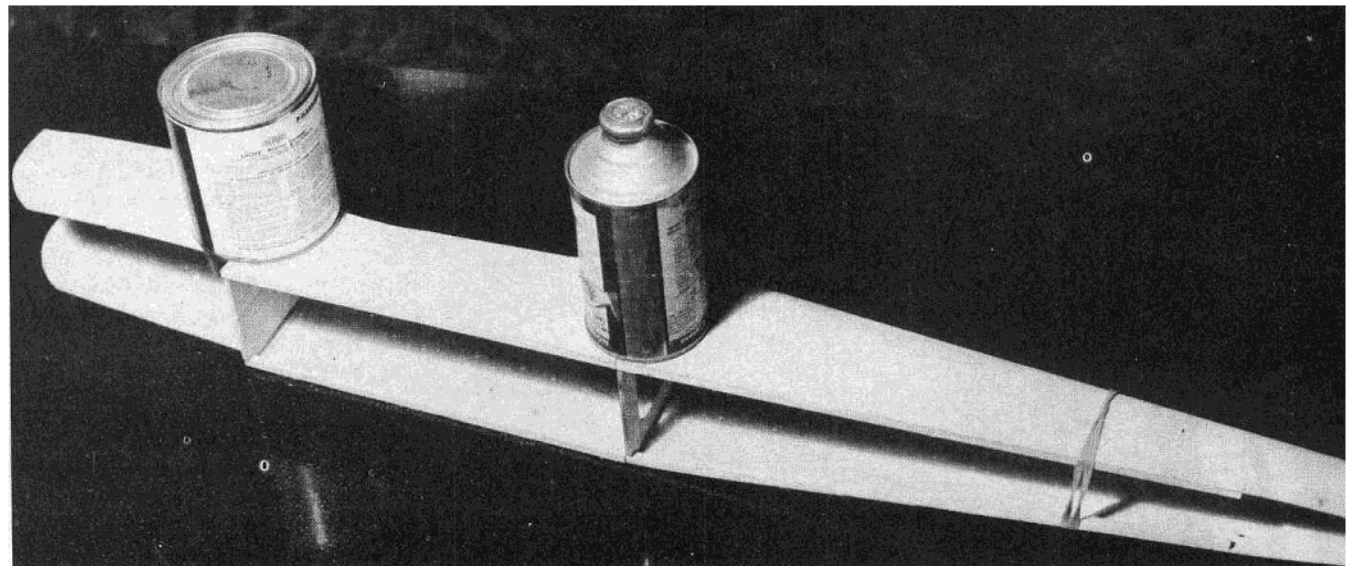
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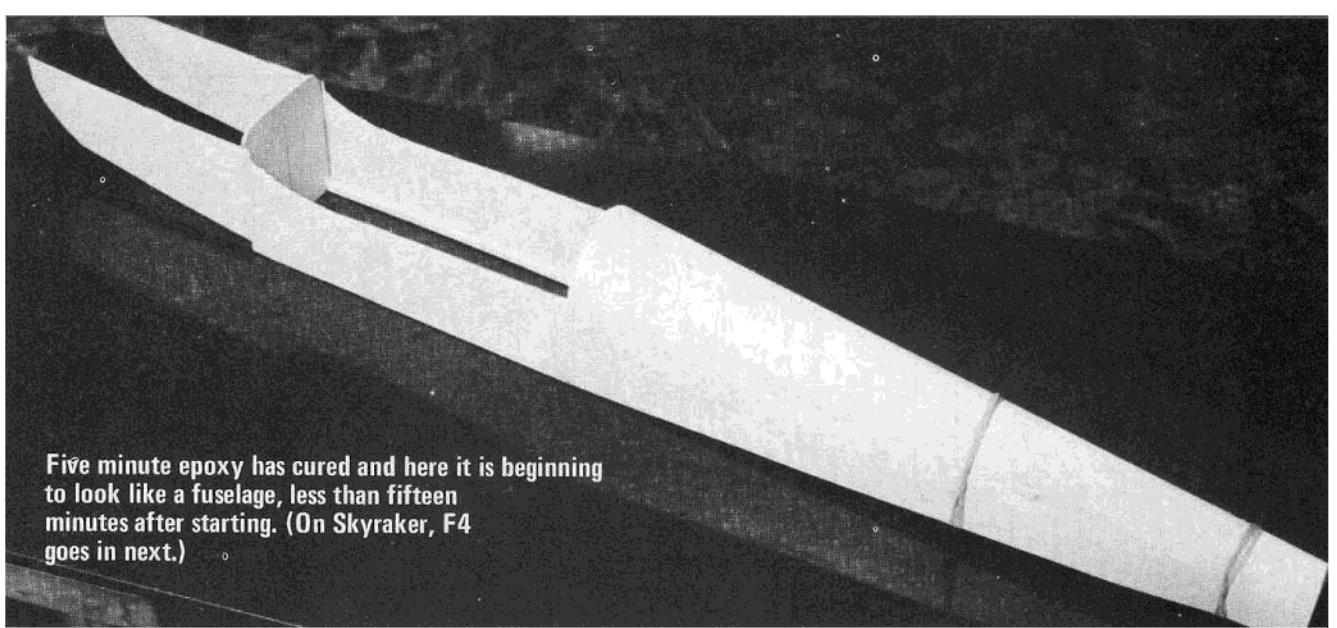
Here are the seven basic ply pieces cut out and ready to go. The longerons are already glued to the fuselage blank. Formers have been tested for proper fit. (See plan notes.)



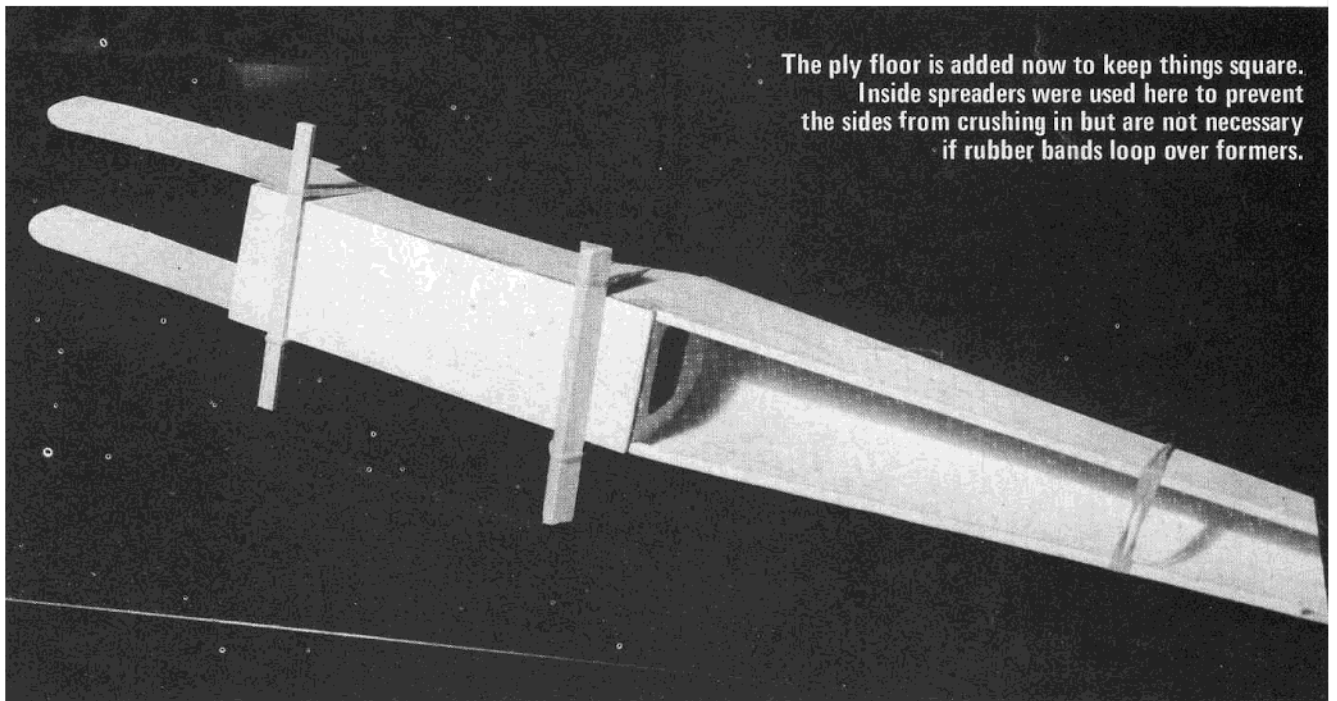
Formers F2 and F3 are in place at right angles to the fuse bottom and square to the blank.



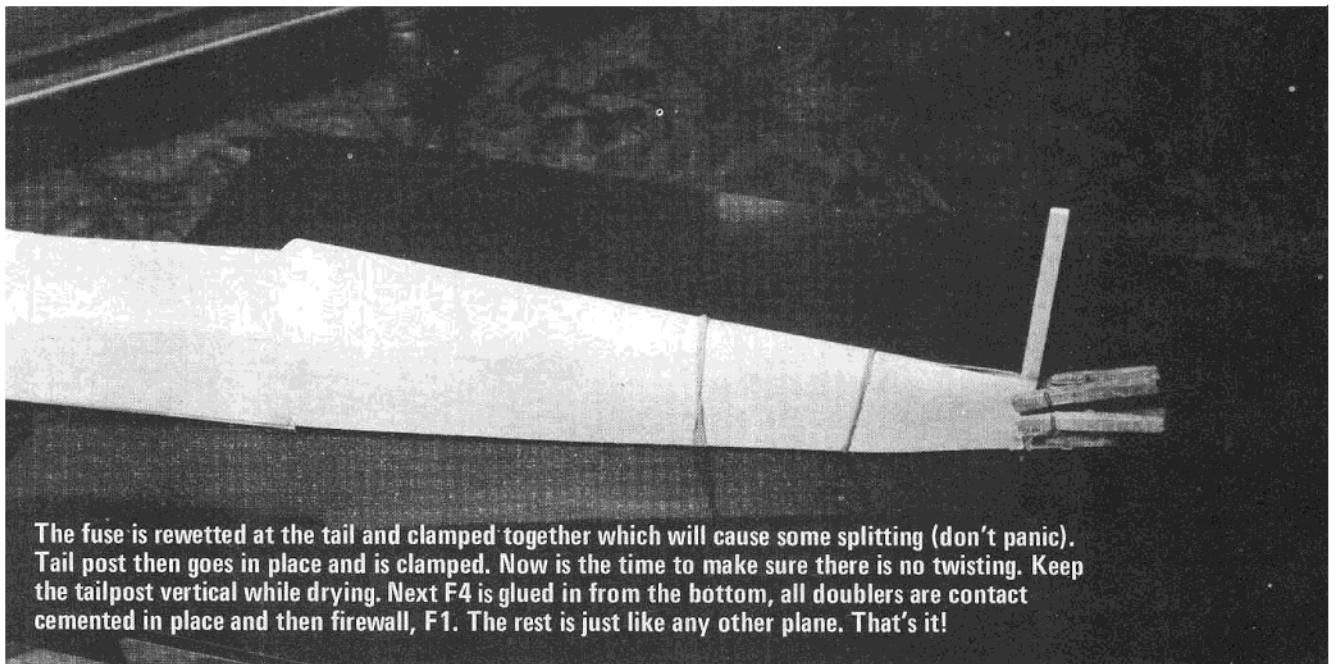
A sponge is used to moisten the outside of blank along the center where the blank is to be bent. Former fit should be finally checked before gluing. Weights hold it all while drying and a rubber band around the tail section keeps the blank from spreading. The longerons lock-fit into the former notches.



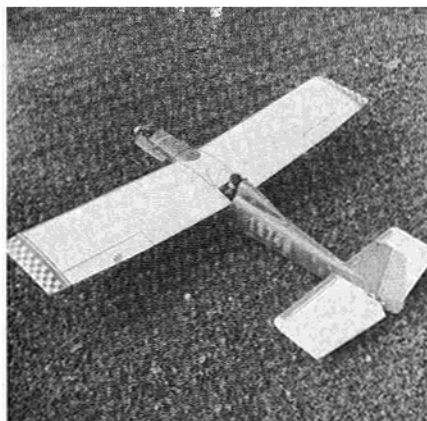
Five minute epoxy has cured and here it is beginning to look like a fuselage, less than fifteen minutes after starting. (On Skyraker, F4 goes in next.)



The ply floor is added now to keep things square. Inside spreaders were used here to prevent the sides from crushing in but are not necessary if rubber bands loop over formers.



The fuse is rewetted at the tail and clamped together which will cause some splitting (don't panic). Tail post then goes in place and is clamped. Now is the time to make sure there is no twisting. Keep the tailpost vertical while drying. Next F4 is glued in from the bottom, all doublers are contact cemented in place and then firewall, F1. The rest is just like any other plane. That's it!



## PLY PAIR

where cleanness and function find their moment of truth. So while a plane of this size might today be typically powered with engines in the .29 to .40 range, I chose a Webra .20. Whether the resulting performance proved out the design or the engine is not completely clear, for this is undoubtedly the finest engine of its size I have ever owned. Power galore, beautiful throttling action and ball bearings where they count, it is truly a quality designed and manufactured engine well worth a couple of extra bucks. In any event, the combination was a natural and almost any maneuver is possible from level flight, with the exception of Vertical Eights, etc. The small nose cross section clears a 9-4 or 9-6 prop so that the whole disc puts out, and the minimum drag concept follows through by not creating large forces to be overcome.

Slow speed flying characteristics are excellent with no bad habits, rolls are rapid and, all in all, it is a very satisfactory combination. A fast building semi-symmetrical wing section was used as most sport flyers do not seem to do a great deal of inverted flying. However, if you want the whole show, go full symmetrical. As a matter of fact, some of you will probably go the large engine route and blow the whole premise anyway, but that is the great attraction of the sport, for you can tailor it to your own desires. Incidentally, many flights were made using three servos and coupled rudder-aileron controls. With the exception of some wing dipping on takeoff, flight performance was almost indis-

tinguishable from full house.

As to survivability, a broken wire (I think) resulted in a vertical spiral dive from an altitude in excess of 100 feet. The long walk to pick up the pieces was filled with mental pictures — all bad, so upon reaching the remains I was somewhat stunned to find it sitting upright and intact, with only some spreading of the fuselage at the main landing gear due to a bad glue joint. 'Nuff said!

Since this piece has begun to ramble around like my first takeoffs, let's touch on another related matter. There are quite a few designs offered today as the answer to everyone's every wish i.e., the all purpose-rudder only, galloping ghost, proportional beginners' ship capable of doing the complete FAI and AMA patterns simultaneously. Perhaps a few can really accomplish most of these things, but a basic aerodynamic fact of life cannot be avoided. No one design can do all of these things well. This is true because each mode of control has specific problems best solved in specific ways. The Plymate is a case in point. As originally designed for the Rand system, ailerons were not included and ten degrees of dihedral were used to help the roll rate since the yawing action of the rudder would have to do all the work. To let you in on a secret, it didn't work! To be blunt — the plane was sluggish in turns and absolutely refused to roll. Want to know why? Well the answer is in one word, WINGTIPS.

The relationship may not be apparent to some but the following observations are based on flight testing involving a variety of R/C designs. First, that the tip of the wing has a positive dihedral effect in terms of the roll axis is generally well known as evidenced by the wide use of "slashed" — from the bottom up — tips by almost all rudder only designs. The rule-of-thumb law indicates that a 45 degree angle will add from one degree to two degrees of effective dihedral. What is generally not so well understood is that a flat, or even streamlined, tip can actually subtract from dihedral. Also, in the case of a tip with a squared planform (seen from above) and to a greater degree with tip plates or Hoerner type tips, roll is actually resisted! These tips, by modifying the tip vortex pattern, create a more stable condition which can be undesirable when only the yawing action of the rudder is used to create a rolling condition. Therefore if no ailerons are

used, be sure to use the slashed tip version.

With the growing use of ailerons of various types the problem is much less critical, in fact, often ignored. But the fact remains that poor tip design reduced effective span and creates considerable drag. For this reason it would not appear to be advisable to carry ailerons all the way to the tip where they can only add their turbulence to that already present. With the current practice of adding power and more power to overcome design faults being the rage, perhaps all of this becomes academic. But for those who are interested in efficiency as a design goal, these principles cannot be ignored. In any event, try either of these planes as designed, and judge for yourself.

As these are not beginners' models, the construction notes will be just that, a few comments to clear up procedures. The real hope is that many of you will see the method as one readily adaptable to a variety of designs of your choice. Try it! This may be the start of something BIG!

## CONSTRUCTION NOTES

### WINGS

Both wings are typical D-Tube and cap strip construction requiring no special comment. The semi-symmetrical section has been used on a number of designs with excellent results. The bottom of the ribs are straight from the spar back to permit building flat on the board with no jig needed. Balsa sheeting is held with masking tape rather than pins while drying. Give extra care to the shaping of the leading edge as variations here can only cause trouble. And, of course, there must be no warps. Wings on both planes were covered with MonoKote. Use aileron hinges of your choice. I used Rand. Be sure the ailerons are stiff enough to resist twisting. Stabilizer construction should be clear from the plans, nothing different here.

### FUSELAGE

The canopy or windshield can be cut down from 8" or 9" commercially available types. The Plymate, using the front section, the Skyrazer, the rear part. Take your time shaping and sanding the blocks at the nose, like you really care. Finish can be the traditional filler and dope, polyurethane enamels, or Hobby Pox. It's your choice. But beware of most of the commercial spray enamels as many are not fuel proof. Good luck to all you noble experimenters!