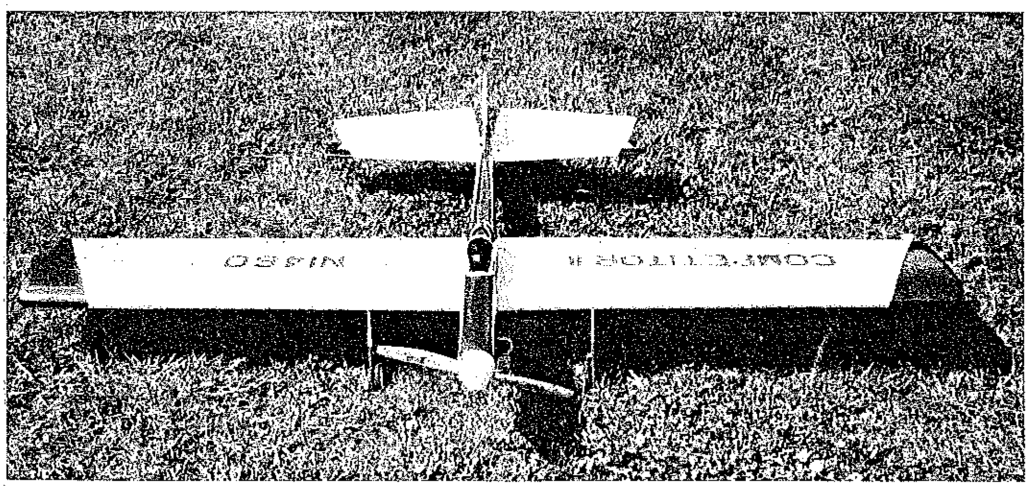
COMPETITOR II

THIS IS THE SAGA of one year's efforts at Stunt competition. The outcome of this adventure has been a superior-flying aircraft that has been, and will continue to be, competitive in all levels of Precision Aerobatics competition. The Competitor II turns well, tracks even better, and with an ST .60 in the nose, has more than enough power to complete the pattern in winds up to 20 mph.

You might question the use of the word *saga* at the beginning of this article after reading the illustrious introduction. This word was chosen after a run of bad luck and poor engineering that led to my building three of these models in five months.



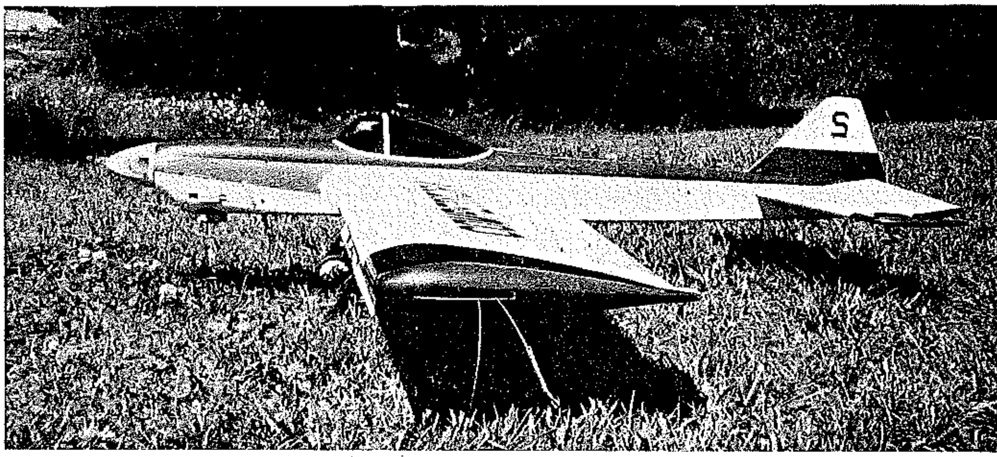
Top Picture: Your author/designer on his way to a second-place contest finish with the Competitor II. He didn't say so, but judging by this picture we'd say that it performs well on a grass circle. Above: This ship is rather large, designed for all-out Precision Aerobatics competition. The 825 sq. in. wing provides the lift, and the Supertigre .60 engine provides the right power for the 58-oz. beauty to do the Precision Aerobatics pattern with ease.

The first one, I lost due to a folded wing. In an effort to build really light, I was foolish to use only 1/8-in. spruce spars for the wing. I also failed to locate the inner ribs in conjunction with the fuselage sides; in effect, I was asking two small pieces of spruce and some 1/16-in. contest balsa to carry the load of the entire wing. An amateur should have seen the problem coming, but I needed to be hit on the head with it. This didn't take too long, as I only got about 30 flights on that airplane.

My second airplane fell prey to a stooge with a cruel sense of humor. The airplane had a beefed-up wing structure (as shown on the accompanying plans) and was an excellent flier and achieved for me my first-ever Expert win and over 500 flights. When I was out practicing three weeks prior to the 1984 Nationals, alone and with my always-faithful stooge, my stooge thought that I might enjoy watching from the outside of the circle as my airplane flew. Needless to say, I was dumbfounded when my Nats airplane took to the skies by itself and flew almost 1/4 mile before plummeting to the ground with a resounding crunch.

You'd think that, with the advanced state of Control Line Precision Aerobatics models, all of the designs would fit one mold. Fortunately, there still are folks attempting to improve the breed, including our author and his lightly-loaded model for a .60 engine.

■ Pete Bergstrom



With so many Stunters of today offering the appearance of a jet aircraft, the Competitor II's side view, more reminiscent of a full-size aerobatics plane, provides most welcome relief.

Up to this point in the season, I had been so busy working on various projects, including this article, that I did not have a backup plane built. There I was, three weeks away from my first Nationals competition, and I didn't have an airplane to fly! I quickly cleared the workbench and enlisted the aid of some friends. Construction began. I flew the model for the first time just three days before departing for Reno, and I finally finished the trim and appearance work the night before leaving. I put in two days of hard practicing in Reno on Sunday and Monday (where we all found out that we had been unnecessarily spooked by the high density altitude, and I went out again Monday night for more practice. On my second flight that night, the elevator pushrod failed from metal fatigue after the first loop of the four-leaf clover. I had foolishly used a brass quik-link connector, and the heat from soldering this to the music wire pushrod had softened the brass. When you build your Competitor II, use only hardened steel for this link; don't take any chances.

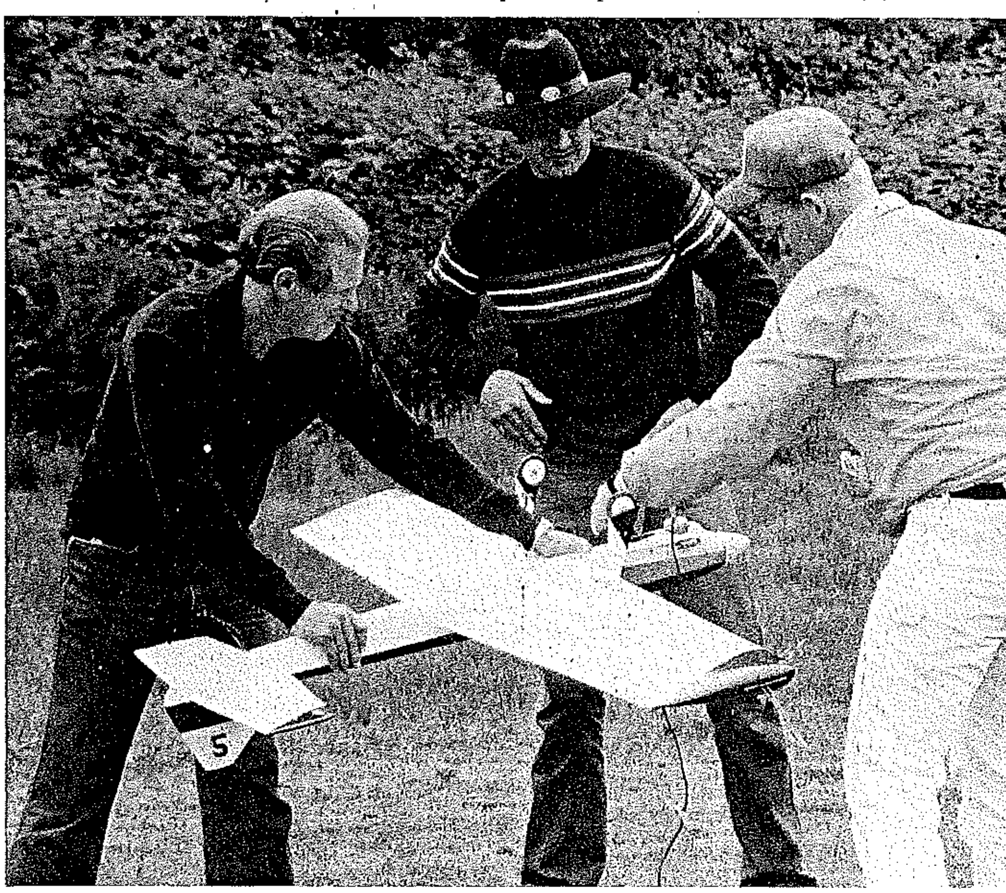
Design theory. I had some definite goals when I sat down last fall to come up with a new airplane for the following year. I wanted an airplane that would turn blinding corners, track well, penetrate, and give me more line tension in the wind than I could possibly need.

In order to solve the problem of a blinding turn, I went to what I thought would be the most significant contribution: an extremely light wing loading. My first airplane weighed 49 oz., giving me a wing loading of only 8.5 oz./sq. ft. That is a lighter loading than the average competition Sailplane has. The airplane would surely turn, but I had sacrificed structural integrity for light weight in the building phase, and the wing didn't hold up.

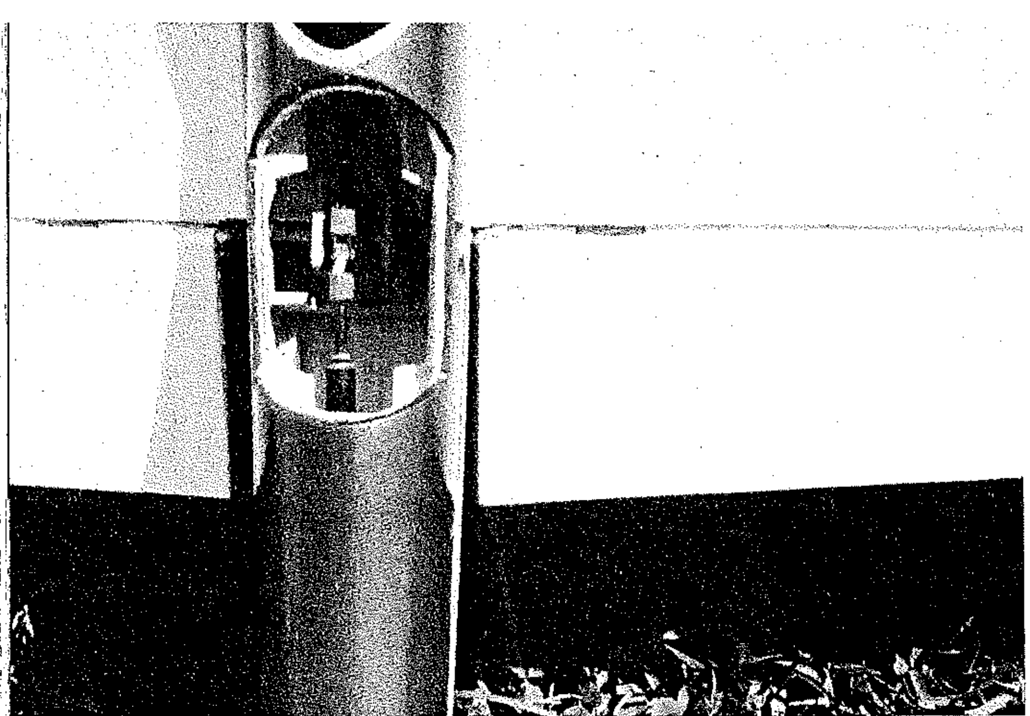
My next airplane weighed 57 oz. (due partially to the beefed-up wing, but mostly to a rushed building job; not all the unnecessary weight was removed, and I lacked suitable contest balsa). This gave a wing loading of 10.1 oz./sq. ft., which provided a very acceptable turn, while giving the ship more than sufficient structural integrity. When the stooge let go, I had put in approximately 175 flights on this airplane in six weeks.

In order for the airplane to track well, I left the nose fairly long to take advantage of the stabilizing effect of the propeller. This, in conjunction with a good-sized tail moment, provides a dampening effect, even with the center of gravity (CG) located well to the rear (as shown on the plans). This long tail moment provides enough force to turn the airplane extremely well. I prefer to fly my airplanes with the CG well to the rear, almost at the point of being tail-heavy, in order to get the most maneuverability out of them. A nice, stable, forward-located CG is great for a sport flier, racer, or anything else that is expected to maintain level flight throughout the entire circle. When you ask an airplane to perform a violent set of maneuvers, albeit beautiful, such as the Precision Aerobatics pattern, a rearward CG will optimize the aerodynamic properties of the aircraft and make performing the pattern much easier for the pilot.

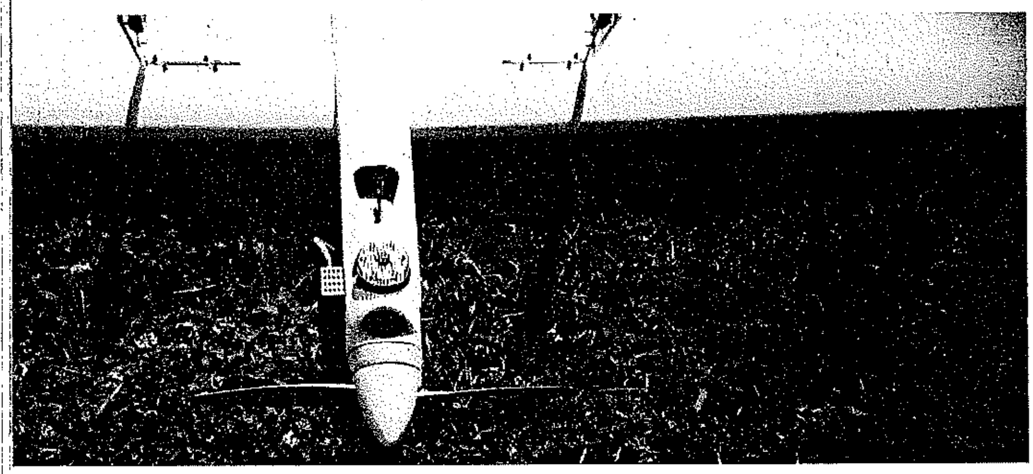
My theory for good wind penetration is simple: overpower the model! I could

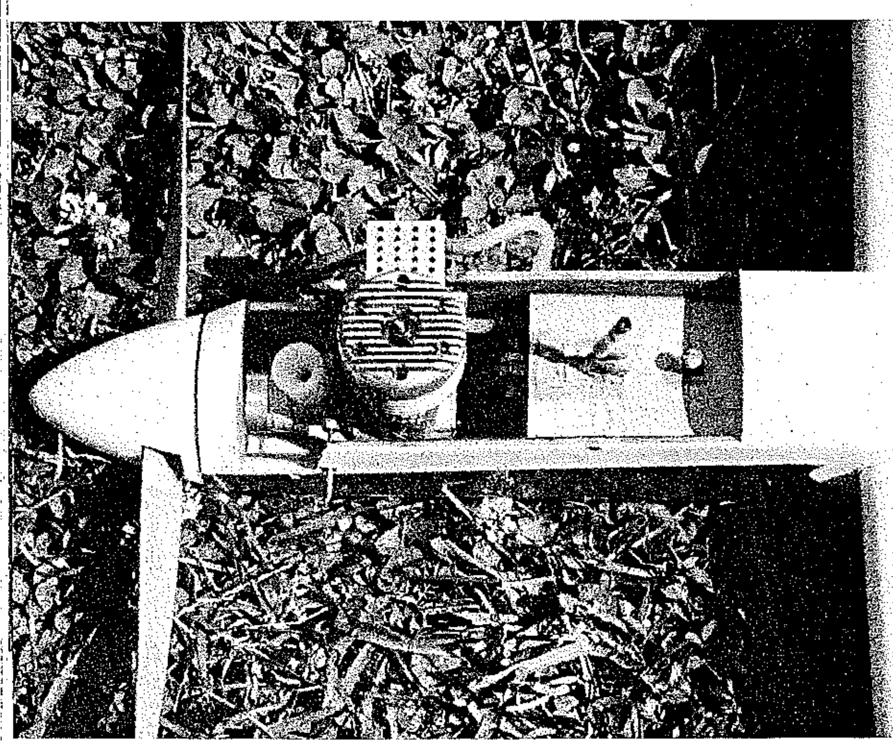


Upside-down isn't the normal way to start a Supertigre .60, but contest jitters (don't we all get 'em?) helped to cause a flooded engine. Bergstrom is at right; others are unidentified.



Hatch behind canopy provides access to the adjustable control system that helps to make flight trimming easier. Total throw of the system can be adjusted for max pilot comfort.





Engine compartment is clean and uncluttered. A single hold-down bolt for the tank provides ease of adjustment. The muffler from SST Specialty Products weighs a mere 10 grams.

have sharpened the leading edge, but that would have degraded the turning ability and created an early stall point. Therefore, I opted to go with a thick wing section and blunt nose to allow the airplane to perform to my expectations and simply put in enough horsepower to bully my way through the overhead figures of the pattern in the wind. The ST .60 was not chosen because of brute horsepower (an O.S. Max .45 has more horsepower than the ST .60), but rather because it has more usable power (torque) at the speed that we Stunt fliers like to run our engines. The size of the Competitor II allows me to run 13-in. props without the associated yaw problems that are common with large propellers—and in calm conditions, 14-in. props as well. This does wonders for line tension as well as turning that usable power into wind penetration.

While we are on the subject of line tension, you will notice that I have not included a movable rudder on this plane, nor is there any rudder offset. The only time I feel that you need either of these features is when you build a crooked fuselage. On a straight fuselage, rudder trim adds an unwanted yawing motion that makes difficulty in trimming the model for all phases of flight.

Cowl design provides adequate cooling.

The line tension comes from engine power. True, by adjusting the lead-outs you can provide some tension in certain parts of the pattern (but you cannot manufacture line tension by this method). In the same light, you can add pounds of tip weight to improve the tension on top, but you will not be able to avoid dropping a wing in a good, hard corner. It's simple; if you don't have the line tension in the basic airframe/power plant combination, you will never manufacture it and will always have to settle for a compromised situation at best.

Construction. Although this airplane is not all that difficult to build, it is not designed for a beginner. Rather, it is designed for the expert flier who wants the edge on his competition, or the advanced flier looking to move into the expert ranks. Therefore, I am not going to include a blow-by-blow description of the construction; rather, I'll highlight the important points.

Wing. The wing is basic D-tube construction. The landing gear blocks are secured with 1/8 ply doublers to W4 and W6.

The lead-out guide is constructed of aluminum and brass. The support piece is 1/16-in. aluminum with a cutout in the center for slider movement. The individual guides are constructed with 1/16-in. aluminum for a back plate, a brass eyelet for the wire to pass through, a piece of octagonal brass tubing as a spacer to run in the cutout of the support piece, and a washer that is slid over the eyelet and

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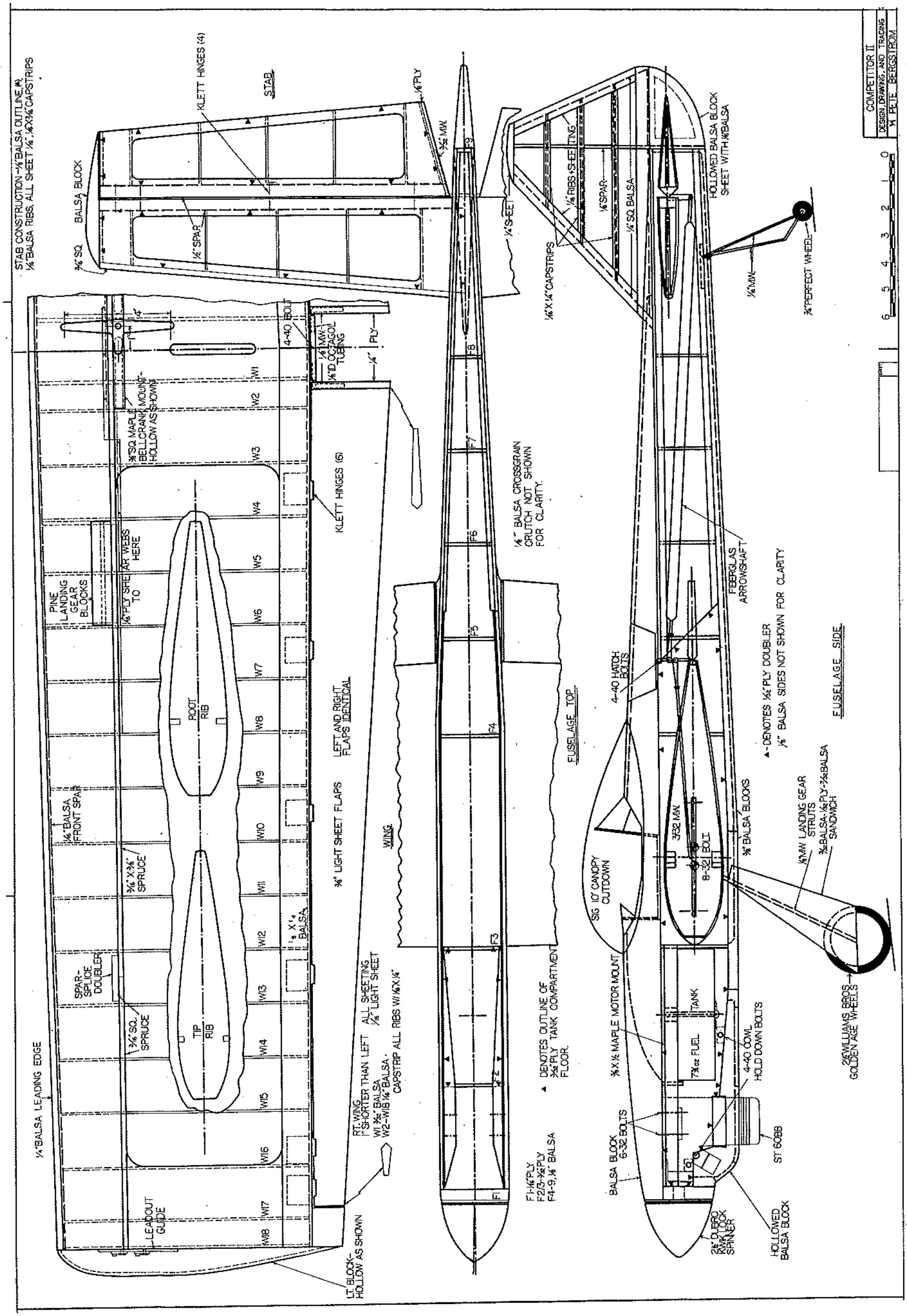

FULL-SIZE PLANS AVAILABLE . . . SEE PAGE 164

CL Speed/Hempel

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155mm with a pitch of 6.1 in. The second-best flight was placed by Otello Vitre of Italy at 163.8 mph (263.70 kph) using one of the new OPS 2.5cc engines. These engines exhibited a very good potential for fast FAI Speed. The engines in all of the Italian models were mounted sideways and utilized the single-blade prop design.

Gao Guojun had the third-best flight of the day with a speed of 163.7 mph (263.5 kph).

Friday, September 21, was the last official flying day for F2A Speed. The Hungarians really turned it on with the three best flights of the day to capture the World Speed Championship trophy for the second time. The fastest time of the day earned Jozsef Molnar second place at 173.5 mph (279.2 kph). Sandor Szegedi had a time of 173.4 mph (279.0 kph); however, his Thursday flight of 280.1 kph was good for first place. Jozsef Mult placed third with a speed of 172.7 mph (277.9 kph).

All of the Hungarian Speed team members used the Rossi engine and hand-carved, single-blade props. Their models utilized the longest wings—which were made of venetian blind slats! This really worked quite well. They just marked the pattern desired on the aluminum slat and sheared off the excess. Then the upper and lower halves were glued together with a hardwood spar through the center for support and rigidity. The wingspan on these models ranged from 48 to 55 in. The carrying cases for these models were constructed meticulously—just like the models, themselves.

Saturday, September 22, was the day everyone was waiting for. This was a momentous event where all the winning competitors accepted their plaques, and their national anthems were played, accompanied by the raising of their country's flag. It was a very emotional event.

The awards banquet was held Saturday evening at the Quality Inn Ballroom with an excellent band playing background music while dinner was served. After dinner, the team trophies were presented, with the Hungarians taking first place, the People's Republic of China placing second, and Italy third. This social event allowed me to talk with different modelers from around the world and discuss different ideas, sign autographs, and swap souvenirs. I loved it.

To summarize the World Championships is rather difficult. I made so many new friends and renewed old acquaintances. I feel this was an opportunity of a lifetime in which to participate.

For the Speed modelers who missed the World Championships: you certainly missed one of the great modeling events of the year.

Gene Hempel, 301 N. Yale Dr., Garland, TX 75042.

P.S. The table giving all the CLWC Speed results was published on page 124 of the January 1985 issue of *MA*.

Competitor II/Bergstrom

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soldered to hold the assembly in place. The adjustable screw is an Allen head 4-40 bolt that screws into the threaded aluminum back plate through another octagonal spacer to keep the bolt centered on the support cutout. The entire assembly is simply glued to W18.

The bellcrank mount is made from two pieces of ⅜ sq. maple engine mount stock that is routed into the U-shaped channel as shown. This provides an extremely strong mounting point and strengthens the center section. An 8-32 bolt is run between the two maple bearers, and the bellcrank floats between the two mounts with the help of two nuts, top and bottom.

The bellcrank, itself, is made from .125-in. T2404 aluminum. This was another modification that I found necessary after the first ship. On that airplane, I had employed a Fox bellcrank. With the tremendous pull of the aircraft, the ears of the bellcrank had bent upwards to resemble a bull's horns, effectively reducing the spacing to approximately 2 in. With this heavier bellcrank, I haven't had a problem.

For the flap control horn, I had to stray a little from normal construction techniques in order to allow myself the freedom to adjust the overall throw of the system as well as flap-to-elevator ratio and the incidence of the elevator in relation to the flap. (More about this later when I talk about trimming.)

To build the flap horn, you will need two telescoping sizes of octagonal brass tubing (the smallest with an inner diameter of ⅛ in.), ⅛-in. music wire for the horns, themselves, and a 4-40 bolt for the adjustable screw mechanism. Cut two identical lengths of octagonal tubing from the telescoping section, and solder them together. Silver solder the ⅛-in. music wire into the ends, and then drill the center section for the 4-40 bolt, and solder in place.

The use of brass for the main body provides you with an ability to tweak the flaps if needed, and the use of the doubled center section provides the strength and stiffness necessary to maintain their setting in flight. Combine this assembly with Du-Bro's Swivel Link Quik-Link assembly, and you have a completely-adjustable control system that will serve you well. When making the pushrods, remember to use hardened 2-56 screws for the Quik-Link attachment point.

You will notice that the flap has a piece of ⅛ ply at the inboard side for mounting the horn. The horn needs to be mounted here, because there is a slight amount of taper to the trailing edge that would cause the flaps to bind if the horn was located further out. The tapered trailing edge was used in an attempt to stop any torsional wing twist from happening in a hard corner due to the center of pressure moving aft as the angle of attack is increased. Use of a taper allows me to run the spar perpendicular to the fuselage. Consequently, because the center of pressure runs parallel to the spar, the tendency to twist with an increase in angle of attack is reduced.

Don't forget to add an adjustable tip weight box in the outboard tip prior to covering. You can use your favorite method for this. I make mine from balsa and Lite Ply.

Stab and elevator. The construction of the stab and elevator is a bit unusual, but it provides a strong, straight, and fairly lightweight structure.

First, cut the outline of the two units out of lightweight 3/32 balsa. To these, glue the half ribs and 1/2-in. balsa main spar. Sheet with 1/16 balsa, and then add the leading edge. Sand all of these components to shape, and then add the hinges and the 1/8 Lite Ply for the elevator horns. It's rather simple.

Fuselage. There is nothing unusual about the construction of the fuselage, but there are some things that you need to be aware of in order to build it strong *and* light.

Use 1/8 medium balsa for the sides, preferably from 48-in. stock. The strength difference between light and medium balsa is tremendous, but the weight difference is negligible. Don't forget to add the 3/16 sq. balsa longerons on the top and bottom of the sides. These will add tremendously to the shear strength.

To stop most of the fuselage twist, insert cross-grained sheeting between the fuselage sides that will fit on top of the fuselage formers. In addition, when hollowing the bottom block, first mark the location of the formers on the block, and then hollow between these marks. This will tie in the bottom block in order to make a very strong box out of the fuselage, and you will be surprised at the rigidity along the entire length of the fuselage.

With this type of construction, the top block becomes merely cosmetic—with the exception of the area between F1 and F2. In this area, only relieve the balsa enough to give adequate clearance to the bottom of the engine. This is necessary to retain the rigidity necessary in the front end to handle the torque put out by the ST .60.

Fuel tank. I use a square one. This efficient shape allows me to get the most fuel into the area I have available. (I have tried a tapered shape previously, and to get the necessary fuel capacity, about 7 3/4 oz., I had to go between the bearers with the fuel tank. With this requirement, the taper angle required approximately an extra 1 1/2 oz. of fuel to be carried so that the engine would not quit in the four-leaf clover; because of this, I had to perform a cutoff loop at the end of the flight to prevent an overrun.)

The square shape might seem odd to some, and you might wonder how it performs. I'll tell you. I will never go through the hassle of building another tapered tank. There is absolutely no problem with the way the fuel feeds. The biggest plus is that I can construct this tank in about half the time that it takes to make a tapered one.

Another difference is that I run the fuel feed out the inboard side of the tank so that I can put the needle valve on the side opposite the muffler. The reason for this is that I hate burned or cut fingers resulting from trying to reach between a rotating prop and a hot muffler. I have experienced no problem with the fuel feed due to centrifugal force, as the distance of fuel travel is so short.

Because of the limited space in the tank compartment, I didn't have room for the typical J-bolt/rubberband hold-down arrangement for adjusting the tank. Therefore, I simply run a bolt through the center of the tank into a blind nut mounted on the fuel compartment floor to retain the tank.

Landing gear. Construction is from 1/8-in. music wire. I chose 2 1/2-in. Williams Bros. Golden Age Wheels for their lightness. When using these wheels, make sure that you bush the axle with brass tubing. If you don't, your wheels will not last very long.

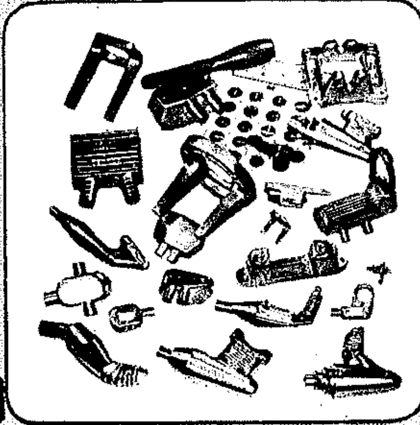
The landing gear position shown is primarily for hard-surfaced flying sites. If you intend to fly from a grass circle, move the gear forward about 3/4 in.

Finishing. Until I can finish an aircraft that I am really pleased with, when compared to the gorgeous beauties that I have seen, I will not pretend to be an expert in this area. However, no matter what method you choose for finishing your Competitor II, keep it *light!*

Flying and trimming. I found that the best combination for a nice, stable flight speed (for me) was with 70-ft. lines, a trued-up Zinger 13-6 propeller, and the engine running at a rich four-cycle, about 5,500 rpm. This gives 5.4-sec. laps and a very comfortable pattern.

In "final" trim (there really is no such thing as final trim for me), I had about 3/4 oz. of tip weight, and my CG was actually to the rear of that shown on the plans (but this makes the airplane extremely sensitive). I would recommend that you start your trimming process with the CG at the forward location. As you get used to the airplane, slowly move the CG aft until you get the kind of turn that you want. The aircraft will tolerate such a rearward CG because the airfoiled stab actually lifts the rear; therefore, the combination of the aerodynamic forces from the wing *and* the stab combine for a total force that is well to the rear. With such a rearward CG, the turn radius is shortened considerably, and because of the lifting stab, the track or landing characteristics of the airplane do not suffer at all.

In your trimming for more line tension, remember to work with the power end of



the equation (and some tip weight) to achieve the right results, not the lead-out location. Moving that lead-out in a vain attempt to manufacture line tension will only cause more problems that appear to be caused by something else. Instead, use the largest prop that will not cause an adverse yawing effect, and add tip weight just until the outboard wing begins to drop in a hard corner. This will be close to your optimum setup for the best line tension. If the aircraft still seems to want to come in at you, there is something wrong with the airframe, and you should take it home and look for warps and twists.

The only time that you should touch the lead-out location is when trimming for line tension in a certain *part* of a maneuver, such as the tops of the round loops. You will also need to adjust the lead-outs slightly with every shift of CG.

I mentioned, before, the adjustable control system. Now, I will give you some tips on how to use it. The total throw of the system can be adjusted for flier comfort throughout the maneuvers; i.e., how much actual throw you use in your wrist. I, myself, have very little total movement up and down; therefore, I need a fairly short moment arm on the flap control horn. The use of a four-inch bellcrank still gives me the leverage that I need in the wind to operate the control system. In addition, being able to change the relationship of the elevator to the flap can help solve a tracking problem. In final trim, I ended up with a very small amount of down-elevator adjusted into the system. This made the outside loops and corners tighter than the inside, so I adjusted for this inconsistency through my handle until the turn radius was identical.

One could write an entire article on trimming, but I will leave that to the recognized and accomplished experts in the field—many of whom have helped me a lot. As a matter of fact, many of the trimming theories that I just presented originated with Paul Walker, who is never fully satisfied with the trim of his airplane. Cardinal rules of trimming though: never change more than one thing at a time, and always know where you started from so that you can go back there if your last trim change did not produce the desired results. I am always trying some miniscule change just to see what, if any, improvement I can make in the flying characteristics of the aircraft. Besides, I get a lot of practice flights this way.

Remember, if you want to win in Precision Aerobatics, you will have to totally dedicate yourself to that end, have a good-flying aircraft that will perform the way you want, and practice, practice, practice!

I hope that you have the same success with this aircraft as I have had.

For any questions or comments, you can contact me at home: Pete Bergstrom, 110 192nd Ct. E., Spanaway, WA 98387; phone (206) 847-3088.

Nieuport/Berliner

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ventional pair of I-struts. It was a very nimble little biplane, but it suffered from the serious unreliability of its Gnome Monosoupage engine. Almost all the Nieuport 28s that saw combat were with American squadrons, as the French and British preferred their better-performing SPADs and Sopwiths. But that's really another story, entirely.

To get a better picture of any military airplane's true worth, it often pays to listen to what its opponents have to say—in this case, the Germans. They captured quite a few of the many versions of the Nieuport sesquiplane, and descriptions appeared in wartime German aviation magazines. Of course, one must keep in mind that the requirements of security and morale can result in an intentionally-distorted picture being given.

Two articles were translated and published by the British magazine, *Flight,* in the summer of 1917, and so these words reflect German opinion during the war, and not someone's peacetime reflections.

From *Flugsport*: "Of all the French aeroplanes, the Nieuport has been the most important of the fighting machines. Before the advent of the modern SPAD it was the machine most sought after by pilots."

From *Zeitschrift fur Flugtechnic und*