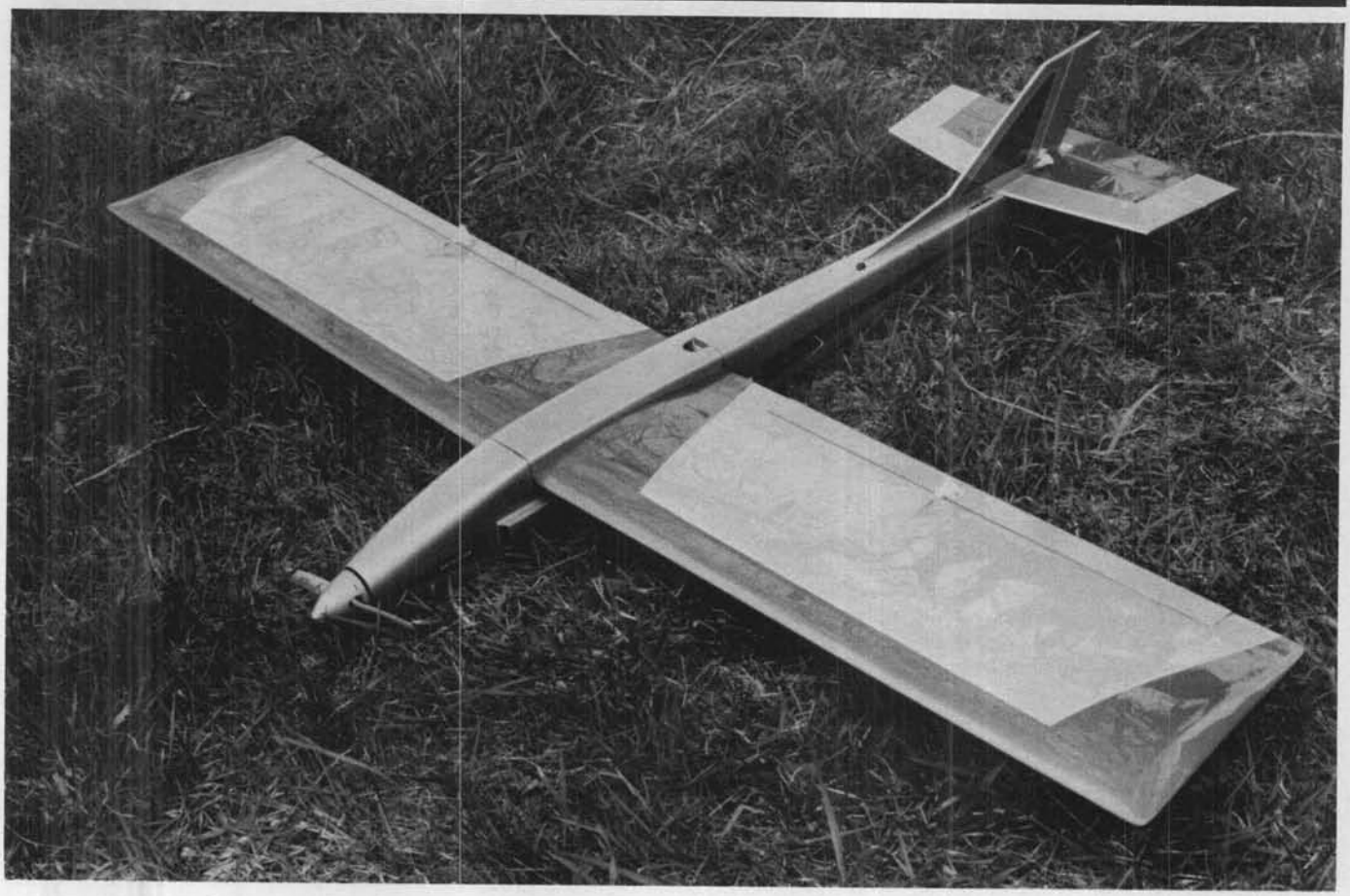


VINDICATOR

A HI-TECH ELECTRIC R/C AIRPLANE

By LES ADAMS. . .The author has designed from the ground up an Astro Cobalt .15-powered R/C electric beauty. His one admonition: keep it light! A molded fiberglass fuselage is available.

• Vindicator is the result of many years of building and flying electric-powered aircraft. One day while flying my modified Astro Sport, I was struck with an idea. What would happened if I stuck a Cobalt .15 in her, replacing the existing Cobalt .05?

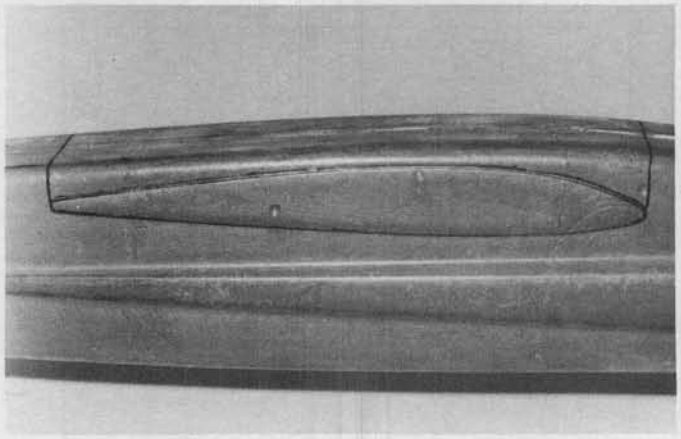
The author's wife, Lynne, with the completed Vindicator.

The wing area was sufficient on my modified Astro Sport (46-inch span, 350 sq. in.) to support the increased weight of the .15 flight system. In fact, the weight would be about the same, if I installed Sanyo 800s, rather than 1200s.

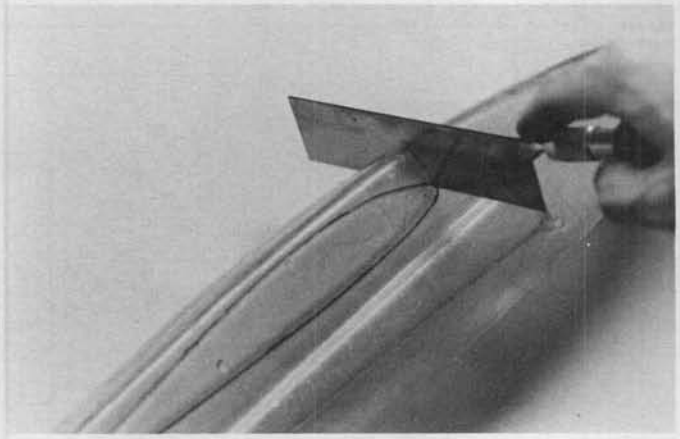
A week later, the modification was finished and we were out at the field for the the test flight.

All ground checks were made, the radio equipment was turned on and control surface checks made. The motor was "throttled up" and the Astro .15 sprang to life. A few steps and a hearty heave and WOW! This is the way to go. The Astro Sport climbed for the blue. A little bit of flying to get the feel of the new power set-up and we started to see what she could do. Not too bad for a flat-bottom airfoil and no rudder control (this version of the Astro Sport was built with aileron and elevator control). There was ample power available for all maneuvers.

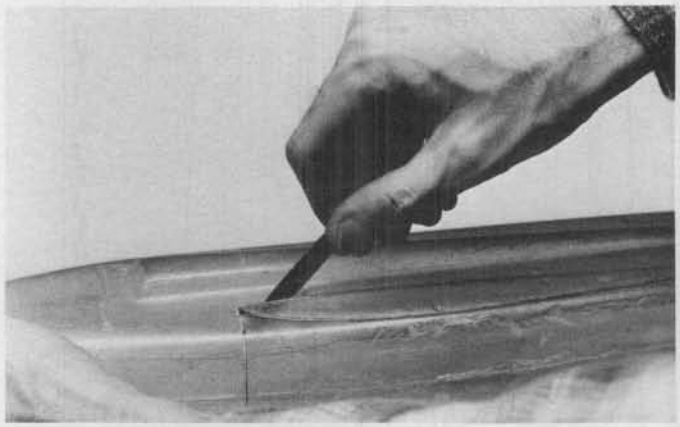
With the introduction of the Cobalt motor, it was quite apparent from the Astro Sport experiment that "pattern-type" performance could be had with an electric-powered aircraft if properly designed.



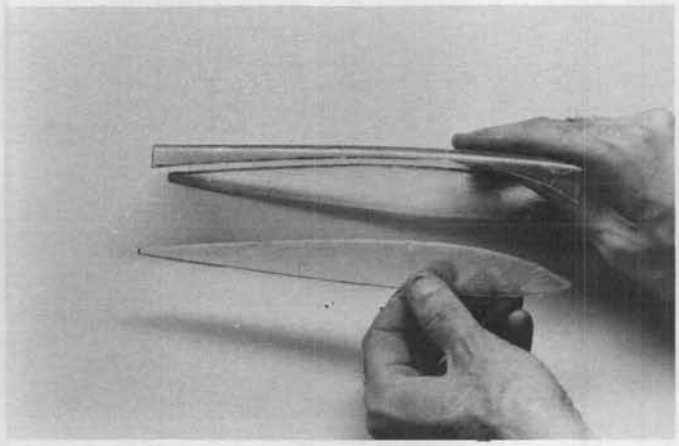
Black lines indicate where wing fairing is to be cut away from fuse.



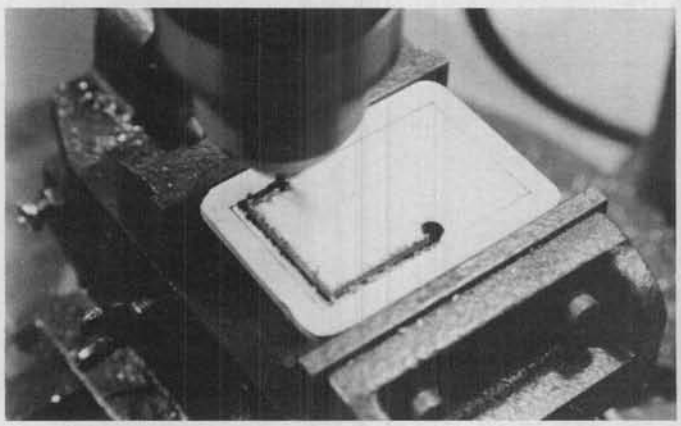
Starting the straight cut at the front of the fuselage.



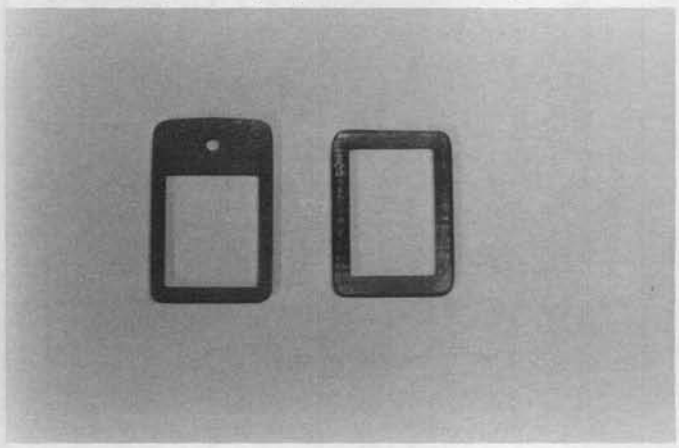
Continuing cut of lower camber with small piece of fine-toothed saw blade.



Completed fairing now only requires minor final fitting.



Author's method of milling out center sections of carbon fiber/balsa formers F2 and F3.



The completed formers F2 and F3.

Proper design, as it relates to electric powered aircraft, means just one thing. *KEEP THE WEIGHT DOWN!*

Of course, other parameters enter into the design, such as aerodynamics, drag profile, proper airfoil selection, power/prop selection, but WEIGHT is the all important factor in the design of an electric "ship."

Keeping these design parameters in mind, I started sketching out designs. The fuselage of the VINDICATOR was designed to fit the existing radio equipment and the Astro Cobalt .15 flight system. In other words, "a place for everything, and everything in it's place."

After many sketches, the final design was drawn full-size.

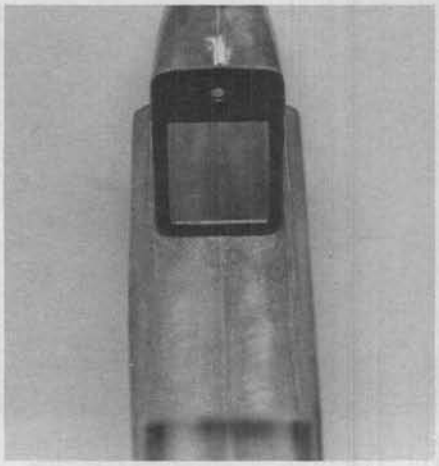
Although pleasing to the eye, it was quite apparent that the radio and electric power support equipment would not fit the aircraft if the standard, built-up balsa fuselage method were utilized. The many compound curves and flowing design of the VINDICATOR dictated that a fiberglass fuselage be constructed.

My good flying buddy (GFB) Guy Negri is the local fiberglass expert. Guy's experience in fiberglass molding spans many years.

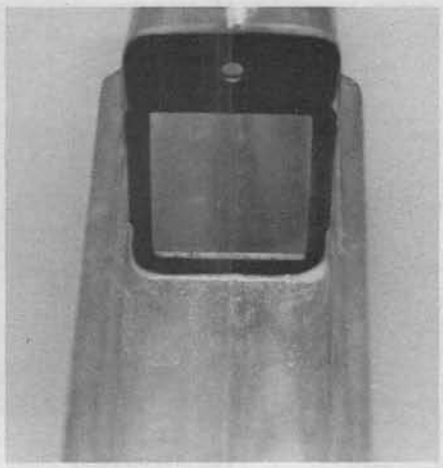
Knowing this, a phone call to Guy was made, and I started "picking his brain" on the process of fiberglass molding.

Many months later, the completed fuselage was popped out of the mold. Fuse weight was about 3-1/2 ounces. Not too bad for a finished fiberglass fuse. I had learned my lessons well from the master.

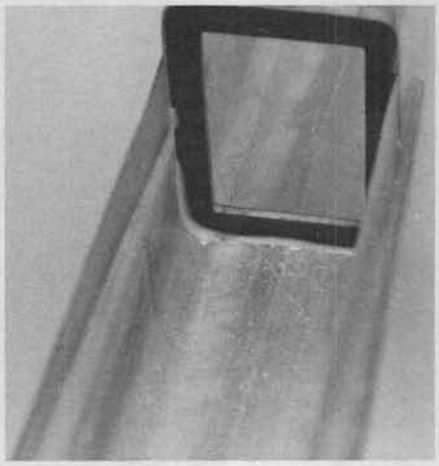
Equal time! Author with his completed model.



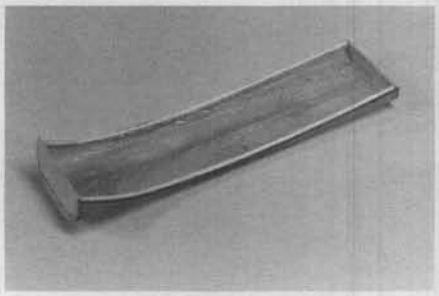
Former F2 installed in fuselage.



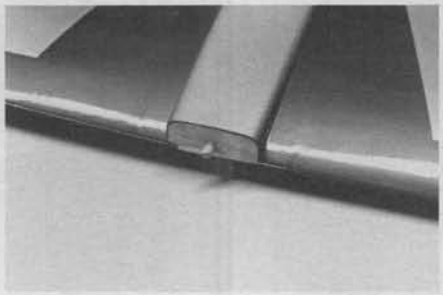
F2 showing small epoxy/micro-balloon fillet.



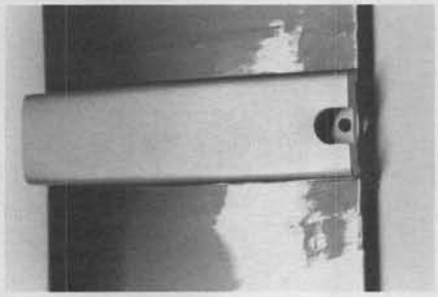
F3 detail with small epoxy/micro-balloon fillet.



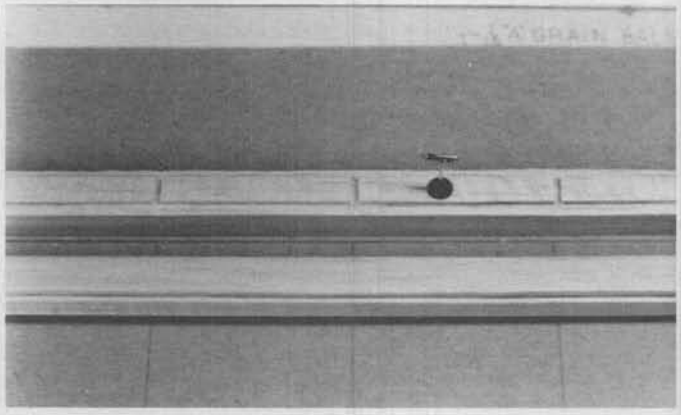
Wing fairing detail showing F4, F5, and 3/32 balsa stock doublers.



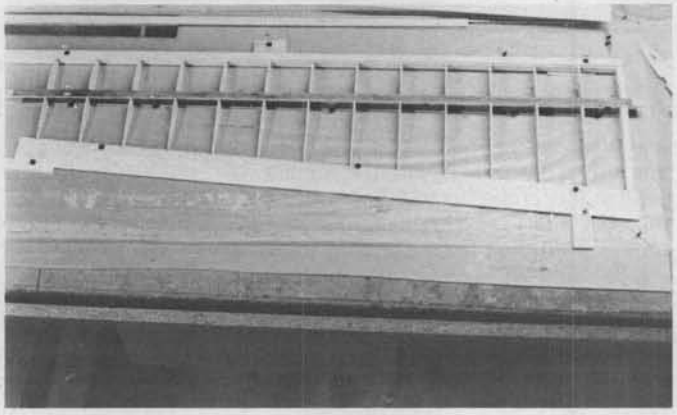
Completed wing with fairing and 1/4" hold-down dowel in place.



Fairing/wing assembly shows wing mounting bolt access.



Wing false leading edge detail. False edge is slotted for ribs without weakening leading edge proper, provides shelf for gluing sheeting.



Wing under construction. Note balsa scraps used to jig-up wing. Note that this wing is not the one shown on plans!

The VINDICATOR utilizes the time-proven NACA 2412 semi-symmetrical airfoil. The tail feathers are built-up of light 3/16×1/4 balsa with a bit of carbon fiber reinforcement in strategic areas. Power is the Astro .15 Cobalt motor and 12 Sanyo 800MAh cells.

Prop selection is all important in electric power and is just as critical as the weight of the model. The selection of the correct propeller will make or break even a well-designed electric model.

The Rev-Up 7/5N or the Taipan 7/4 is a good starting point for the VINDICATOR. Both of these props perform well with the Astro Cobalt .15. I personally favor the Rev-Up 7/5N for sheer performance, but the Taipan 7/4 will yield longer flight times with a bit less pulling power.

CONSTRUCTION

Since the fuselage is almost finished as it comes out of the mold, we will start here.

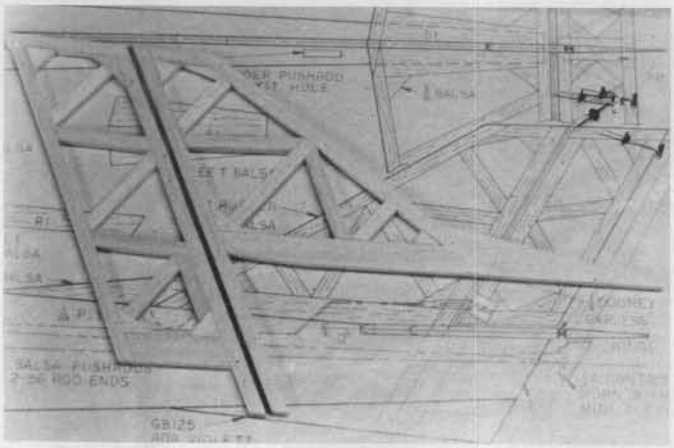
Cut the wing fairing from the fiberglass fuselage using a fine-toothed saw. A straight cut is first made from the top of the fuselage, down through the sides, until you reach the lower camber of the airfoil outline. Then, with a small piece of the same fine-toothed sawblade, saw around the airfoil outline, following the lower camber from front to back of the airfoil, sawing gently and slowly. Once the fairing assembly is separated from the fuselage, trim along the upper camber line in the same manner. You will now have a fairing that will only require a bit of final fitting for a nice close fit over the upper camber of the wing. Set the fairing aside for the moment and prepare F2 and F3 formers by sanding them for a snug fit to the fuselage.

Next, add formers F2 and F3. Epoxy them in place with 5-minute epoxy, used sparingly. Glue in the hardwood wing holddown block next with 5-minute epoxy. Next, add the 3/32-inch balsa wing saddles. Use 10 or 60 second CA for this step.

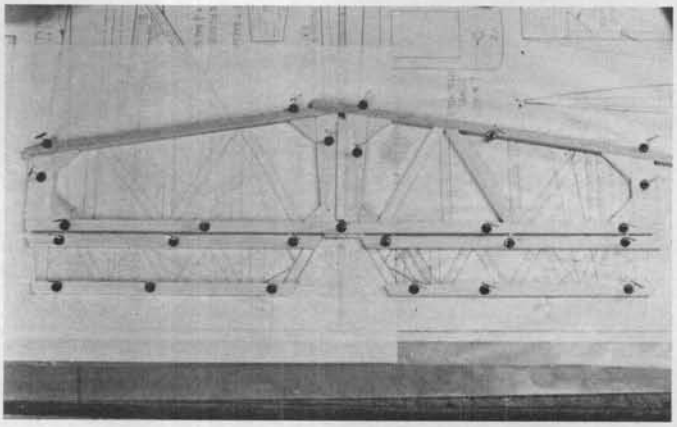
Be sure that you have allowed enough clearance for the motor brushes in former F2. The motor will have to be slid into the fuselage, with its brush holders orientated diagonally, to go through F2.

Install the 1/8 plywood firewall next, making sure that you have 0 degrees down and side thrust. Fashion a fillet from 5-minute epoxy and micro balloons around the entire periphery of the firewall, F1, and formers F2 and F3. Make the fillet small, using the epoxy/micro balloon slurry sparingly.

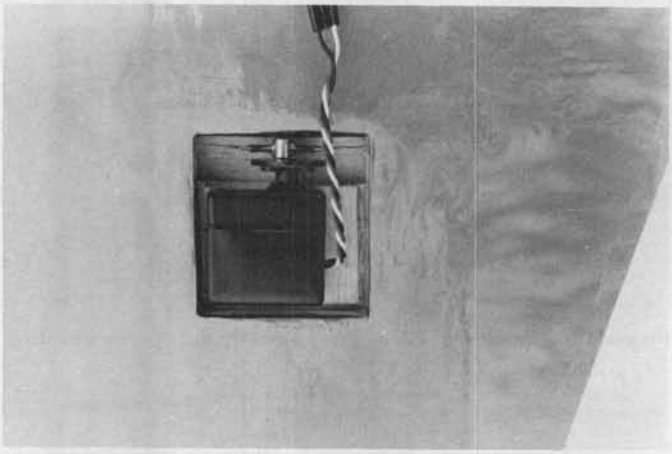
Finish the fuse as you would any fiberglass fuselage. Sand thoroughly, and then fill any noticeable dings or voids. I used Model Magic Filler, as it is light in weight



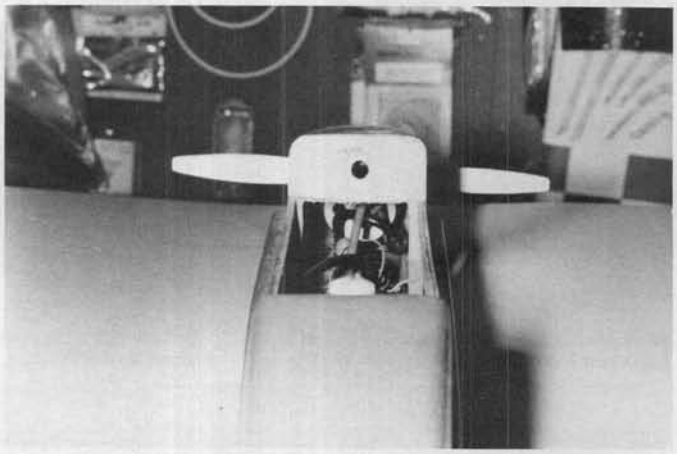
Fin/rudder assembly with Cooney gapless hinging installed.



Note that elevator, rudder, and wing shown in plans are different than ones on plans. These are to be used in second generation Vindicator.



Aileron servo installation. Light and compact installations are a must in electric power models.



Looking forward into fuselage. Rear of Astro cobalt .15 and Adams throttle are visible in this view.

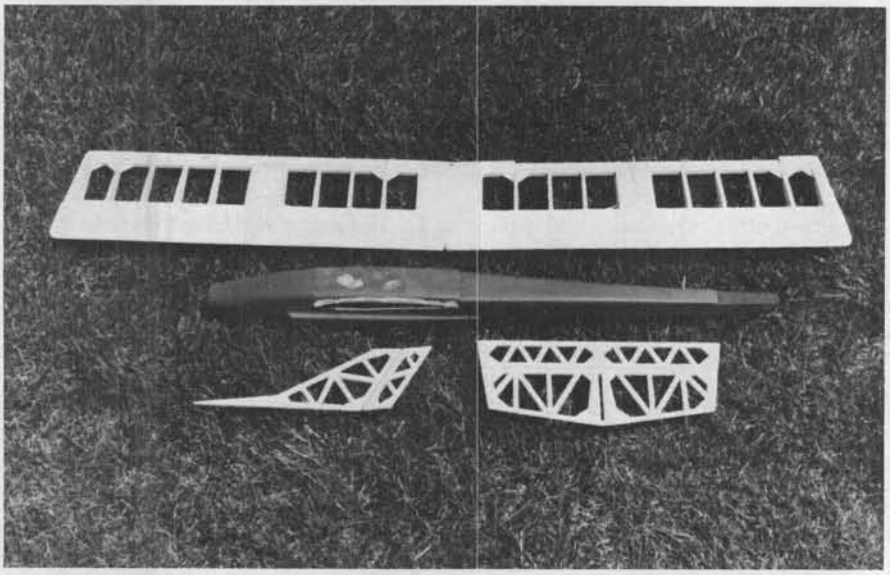
and sands easily. You can use any material you want, but pay attention to weight.

After the preliminary filling and sanding, give the fuse a coat of your favorite primer. Thin the primer liberally, to avoid weight build-up. I use DuPont Automotive Primer, the brown colored type. It is lightweight, goes on easily and sands nicely.

If everything looks good after your first coat of primer, you are ready for paint. If you can still see flaws in the fuse, fill or reprimer and sand until the fuse looks as perfect as you can get it. The final sanding should be done with either 600 or 1000 grit paper.

When the fuse is ready for paint, apply a coat of your favorite material. Remember, KEEP IT LIGHT! Thin the paint as much as necessary to keep the weight down.

Again, the original VINDICATOR was sprayed with Ditzler Metallic Silver Automotive Enamel, highly thinned, with a commercial hardener added.



The finished components of the Vindicator. The wing fairing awaits final sanding and primer.

The finished fuselage, complete with primer and paint, formers, firewall, wing saddles, and wing mounting block weighs in at five ounces. KEEP IT LIGHT!!!

WING

Construction of the VINDICATOR wing is pretty straightforward. You can start by cutting out the ribs.

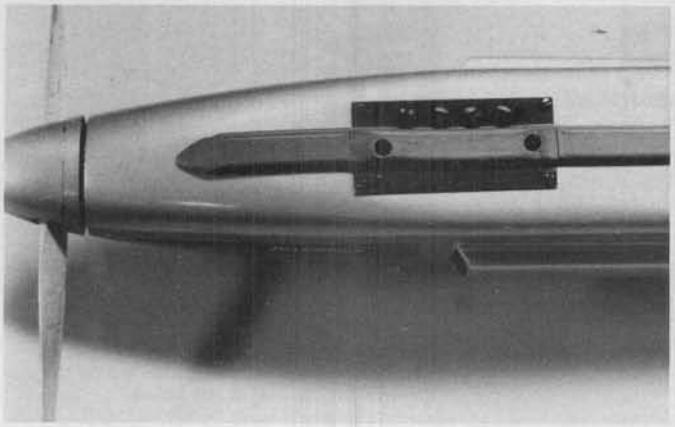
After the ribs are cut, sanded and notched for the spars, lay them aside while you fabricate the balsa/carbon fiber wing spars.

At this point, a word about carbon fiber. This material is extremely strong, light in weight, and quite easy to work with, BUT, extreme care must be used to avoid getting carbon fiber splinters in your hands and body.

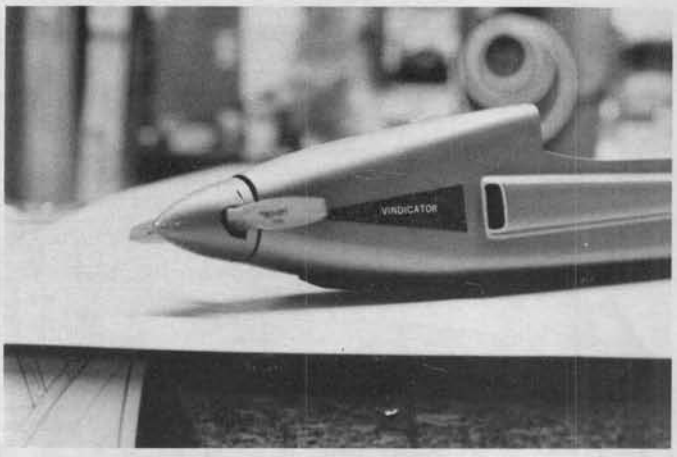
The procedure for making the spars is to score the carbon fiber sheet, which is available in various lengths and widths, with a knife, then fold it back upon itself, and it will usually separate from the main sheet.

The scoring operation will usually leave fine splinters along the edges of both the smaller piece that will be used for the spar, as well as the larger piece that it was stripped from. These splinters should be removed by a light sanding, or carefully broken off by hand.

Should you happen to get a bit careless, you may find yourself trying to pick a carbon fiber splinter out of your body, hand or whatnot. Although this has never happened to me personally, I understand it is

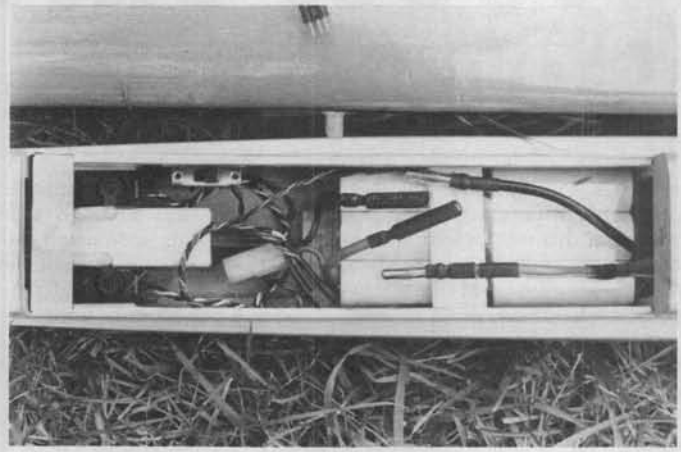


Bottom view of fuselage showing Adams throttle and Airtronics glider skid.



Airscoops are fully functional. Be sure to cut away material as shown.

Primered fuselage, looking aft, showing detail of wing mounting block, and balsa wing saddles.



Completed Vindicator fuselage shows all components in place. Well-designed layout insures maximum noise immunity.

quite painful, and the splinters are quite difficult to remove in one piece, because of their brittleness.

Be extremely careful when working with this material. This applies to the gluing process as well. When you glue them to the 3/32 balsa spars, use a roller of some type to apply pressure as you are working out the excess glue. Don't run your hand along the spar, or you will find yourself at your friendly doctor's office, having CF splinters removed.

I use a wallpaper seam roller for this operation and find it works quite well and is a very safe method of applying pressure to the CF/spar assembly.

Strip 8 pieces of .014 inch carbon fiber, 3/8 of an inch wide. I assume you have purchased a 36-inch long sheet of CF, and that will be long enough for the spars.

Prepare the 3/8-inch strips by sanding them lightly, to remove the smooth surface finish. This will provide a rough surface for the CA to adhere to.

Glue them to the 3/32 C-grain balsa spars with 60-second CA. Apply ample pressure with your seam rolling tool, or whatever you are using, to insure a good bond. You don't want a spar delaminating at the bottom of an outside loop.

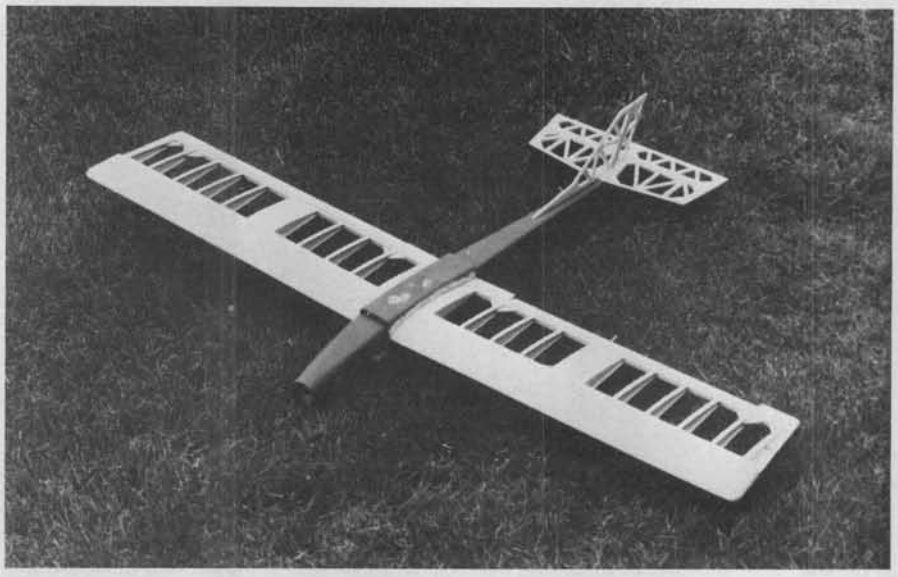
Check your work carefully, flexing the spars moderately. If you see an area where the CF did not bond to the balsa, reglue it and apply pressure as the CA kicks. The secret in obtaining a good bond with CA and carbon fiber is the preparation and the pressure. If you have fabricated the spar properly, you will have a spar that is stronger and lighter than spruce.

At this point, you may decide that you would rather use spruce than to go through all the trouble of fabricating the CA/balsa spar. I haven't built a VINDICATOR employing spruce spars, and although I think it would be strong enough, it is an unknown factor. I would think that the D-tube wing construction and spruce would be sufficient for most, but I would recommend the CF/balsa spars over spruce alone.

The original VINDICATOR has been subjected to many high-G maneuvers, and has sown no structural fatigue to date. As the saying goes: if it works, leave it alone.

The balance of the wing is constructed in the normal manner. You may use a wing jig, or block up the leading and trailing edges with scrap, whichever is your fa-

Continued on page 98



A mock-up view of what the Vindicator should look like in the rough.

AMA President Irwin Ohlsson, AMA #4. As Harris said when they discovered this conflicted with the American Presidential sequence, they dropped the A.M.A. designation and replaced it with the SAM logo.

Keith sends Photo No. 14 showing a well-built Bunch Scorpion complete with floats. The Scorpion design first conceived back in 1934-35 was based on an old rubber model design as can be seen by the high rudder. This made the model extremely sensitive to turns resulting in many a nose diving spin.

When Bunch went out for the hydro records, he hit on a combination that was perfect for seaplane operation. Most modelers don't realize the problem when floats are added, a larger rudder is required to offset the forward side areas. The Scorpion design was right for floats!

Photo No. 15 shows a section of the tremendous amount of old timer models put on display at this show. Although most of the designs pictured are British, a few American designs can be picked out, most noticeably the Bunch Cadet Major and a scaled Jasco Flamingo. We'll leave the rest for you, the reader, to look over and possibly identify.

FREE PLUG DEPT.

Mik's Models of P.O. Box 1373, Hollywood, California 90078, announces the production of new stirrups for rubber motors. "Jasper" Mikkelson says this concept is ideal as they were designed by old timers and produced by old timers.

Photo No. 16 shows what "Mik" is talking about as all of his buddies have been using them for three years. They would never go back to the old way of holding rubber for no amount of money. The best part about these stirrups is that they reduce blown fuselages, and that old devil rubber coming off the hooks.

For those interested in weght, these weigh only two grams, and will hold up to 14 strands of 1/4-inch rubber. That's a lot of rubber! Those stirrups, known as the Maxwell Rubber Motor Winding Stirrup, comes apart easily on the field for quick motor change. These have been torque tested to 135 inch ounces.

Prices on these little jewels are $3.95 each, or three for $10.95. Not a bad price these days!

THE WRAPUP

Perhaps this should be re-titled "Otto Gunnesch, Japan II" as this appeared in the April issue under the section "40 Years Ago. . ." Otto writes this follow-on to the Japanese controline incident:

"Tuesday morning, April 1, and it was time to go to the Court House in Ann Arbor. Normally, I try to take care of such things as early in the day as possible, but this day I was several hours off schedule.

"After the Court House visit, I went over to Riders Hobby Shop to pick up some ordered items and who do I bump into, my old friend Bob Watkins! Bob happens to live 200 miles north of Saline, Michigan at Higgins Lake. He had driven down to buy some hobby supplies. This only happens once in a great while.

"Everyone in the hobby shop had read the article I wrote in your column under '40 Years ago, I was. . .' So the conversation revolved about 1946 and the early days in the county. As I said previously, I don't know what happened to the Kopper King (In Japan or where?), when Bob Watkins interjected to say, 'You sold it to me.'

"What a surprise! If I had come in a half hour earlier or later for the Court House visit, I would have never known that Bob had visited the hobby shop. Talk about coincidences, now we know what happened to the Kopper King engine."

Gunnesch closes by modestly saying that the planes in Photo No. 9 on page 33 in the April issue were not his models. He appreciates the compliments but says he has never built such pretty models in his life. He can only be accused of building 15% "Red Ripper" models. This design is as ugly as moldy bread but they do fly well. Otto says: "Congratulations for the nice building job to the unknown modeler."

Talking about this design, maybe we could get Dick Bringgold of SAM 31, to elaborate on his statement that the Red Ripper has a lock-on for ugly. . . haw!! •

Vindicator. . . . *Continued from page 21*

vorite method.

Before you sheet the center section, be sure to install your aileron cable assemblies. Add capstrips, and wing tips. Use the lighest balsa blocks you can find for the wingtips. You can hollow them out, if you prefer. The original VINDICATOR had solid tips, but it will make the tips a bit lighter if hollowed out and certainly will not hurt the performance.

Cut out the ailerons from the trailing edge stock, per plans. You do not have to use Cooney gapless hinging, but I prefer it to other types I have tried. It does make a difference in performance. The aircraft flies noticeably smoother, with smaller amounts of throw needed for given maneuvers.

I use my Dremel motor-tool and drill press stand for installation of Cooney hinges. Install a Dremel saw blade, (the thicker one, not the real thin blade) into your Dremel, and mount it into the drill-press stand. Tack glue, with CA, two balsa blocks on to the Dremel table, so they will act as a ripping fence. Position the Dremel tool, with blade installed, to rip down the middle of the aileron assembly. To check if you have the exact middle of the aileron, push the aileron into the blade with a light pressure, and move the aileron along the saw blade. The saw blade teeth will leave a series of dots, or indentations in the wood. Adjust the height of the table until the dotted line is as close to center as you can make it. Then adjust the depth of the cut to about a 1/4 inch or so and proceed to make the cut. It works quite nicely.

When you install the hinge, first insert it into aileron, without gluing. Fill the slit in the wing with 60-second CA, and then push the aileron that is holding the hinge material into the slot in the wing. Hold firmly for 60 seconds or until the CA kicks. Then, remove the aileron and fill it's slot with 60-second CA, and push it onto the hinge previously glued into the wing. This method holds the Cooney hinge in relative alignment as you are inserting it into the slot. The Cooney hinge is shipped rolled in a package and has a bit of a curve in it after removal from the package. This method of installation, holds it relatively straight during installation. I have tried other methods of installing it, but the CA usually kicks before I can align it. The above method works for me. You can of course, use other types of hinges, if you prefer.

As a bit of added insurance, I fiberglassed the center section of the wing panel with 2-ounce cloth, and HobbyPoxy 2. Use the epoxy sparingly.

I usually install the aileron servo after the wing is covered, but this is up to you. Insure that the linkage is free of binding and the surfaces move freely. The original VINDICATOR used equal amounts of up and down aileron, no differential. I have not seen any aileron yaw, so I assume it does not need differential throw. The previously mentioned Astro Sport used differential, and it did not roll as well as the VINDICATOR, all design factors considered.

WING FAIRING

Install formers F4 and F5 into wing fairing previously cut away from fuselage. Glue them to the fairing with 5-minute epoxy. Add an epoxy/micro balloon fillet around the inside of F4. Cut an access hole or slot just forward of F5, to permit

insertion of the 1/4-20 wing mounting bolt.

Route a slot in the wing at the leading edge and install the 1/4-inch holddown dowel. Trial fit the wing to the fuselage before gluing the dowel to insure proper alignment of the dowel into former F2. Once proper alignment is obtained, epoxy the dowel into the slot in the wing with a generous slurry of 5-minute epoxy/micro balloons. We want maximum strength, but minimum weight. Use only enough epoxy to do the job properly.

Once the epoxy sets up, place the wing on the fuselage and trial fit the fairing to the wing. You will have to slot the bottom of F4 to clear the dowel that was installed in the wing.

When this is accomplished, cut two pieces of light 3/32 sheet to conform to the airfoil shape of the fairing. Make these pieces about 1/4 inch wide, or as wide as the fairing will permit. CA these pieces to the inside of the fairing. What this does is to give you a bit wider gluing platform when you glue the fairing to the wing, instead of just having the thin wall of the fiberglass.

After the wing is covered, glue the completed wing fairing in place with either 60-second CA or epoxy used sparingly. Don't forget to remove the Monokote in the area that the glue will be contacting.

VERTICAL FIN AND RUDDER

Nothing unusual here. Build per plan using light 3/16-inch stock. Use the same slotting procedure as was used on the ailerons to install the Cooney gapless hinging to the rudder.

The round 1/64-inch plywood disk seen on the plans is used to add reinforcement to the mounting of the vertical fin. The fin and fuselage are simply slotted with the Dremel tool and saw blade, and the disk inserted during the final assembly process with CA. This gives a bit more strength than just a butt joint to the fuselage. Please remember to remove all paint from the fuselage, where the vertical fin will be glued. This is easily done with a narrow file or sanding stick. Cover the fin/rudder assembly with your favorite covering material and set it aside for the moment. It will be installed along with the stab assembly in the final assembly phase of construction.

HORIZONTAL STABILIZER

The horizontal stabilizer and elevator are built in the conventional manner, except that the leading edge and tips are reinforced with carbon fiber material.

The leading edge and tips are made by forming a sandwich of two pieces of 3/32 balsa and a piece of .014 carbon fiber, the carbon fiber being sandwiches in between the two layers of 3/32 balsa.

Cooney gapless hinging is used on the elevator, as it was on the ailerons and rudder. The same slotting method should be used as was done for the previous assemblies.

The horizontal stabilizer assembly is then covered with your favorite covering material and set aside. It will be installed in the final assembly sequence. Remove any paint or primer before gluing to the fiberglass fuselage, as well as Monokote in the area of the stab, that will be glued to the fuselage.

FINAL ASSEMBLY

Position the wing on the fuselage, making sure it is centered and straight. Drill a #3 hole completely through the wing and holddown block, while holding the wing in alignment. Enlarge the hole, in the wing only, to 1/4 inch. Tap the #3 hole in the wing holddown block with a 1/4-20 tap. Run some thin CA into the tapped hole and allow it to kick. Then retap the hole with the 1/4-20 tap. Temporarily, bolt the wing in place.

Place the stab/rudder assembly in position on the fuselage. Insure that stab is centered and straight and that fin/rudder assembly is straight and vertical. Check stab incidence with respect to wing and motor thrust line. It should be 0 degrees. If not, shim as necessary to obtain 0 degrees. When correct alignment is obtained, epoxy stab and fin/fudder to fuselage with 15-minute epoxy, used sparingly. The 15-minute epoxy will give you time to make minor adjustments in alignment should something shift. Check alignment frequently during this procedure. No crooked stabs or slanted fins PLEASE! Make sure you have removed all primer and paint, as well as Monokote in those areas that are to be glued.

RADIO INSTALLATION

Install radio of your choice. Proper installation procedures apply here. Keep

things neat and orderly. Keep receiver and servos and associated radio wiring as far away as possible from motor, electronic throttle, motor batteries, and their associated wiring. The original VINDICATOR used an Ace Silver Seven receiver, World Engines S-22 Servos on elevator, rudder, and aileron, and an ADAMS ETC-1A Electronic Throttle, especially made to fit VINDICATOR. Coupled aileron and rudder is employed via the Ace mixing module, with the ability to uncouple in flight. The receiver battery pack consists of four Sanyo 250 Mah cells.

Today radios are so dependable, it is hardly worth mentioning proper installation practices, but in regard to electric flight, problems of a particular nature have to be addressed. Modern day electric motors (Samarium Cobalt) are quite powerful and tend to generate noise (as all electric brush-type motors do). In almost all cases this motor noise can be dealt with successfully. Proper use of noise suppression capacitors, along with proper radio installation, will usually result in a successful electric aircraft. But, as in anything else, not following the rules will generally cause problems. Do follow the above procedures of proper radio installation in regard to positioning of equipment. Try to keep the installation light. There are plenty of inexpensive, lightweight radios available on today's marketplace. Don't try to squeeze that "old brick" in the VINDICATOR, because chances are it will fly like a brick if you do. ENOUGH SAID! KEEP IT LIGHT!

The original VINDICATOR had it's control surfaces throws set as follows: Elevator—3/8 inch up and down. Aileron = 1/4 inch up and down. Rudder—1/8 inch (CAR mode) and 3/8 inch uncoupled mode. These throws are still currently used.

FLYING

OK, OK, so now you are getting tired of all this babbling and you want to fly. The original VINDICATOR was balanced at 32% back from the leading edge of the wing. This is still where the balance point is today. You could try moving it back a bit more, as the aircraft does need a bit of up trim when the motor is cut, and is in the glide, but be cautious. Shifting the CG too far aft, could result in a very unstable, tail heavy aircraft. For the time being, I suggest you leave it as per the plans. This bit of up trim really slows her up nicely for landing. I strongly suggest you use this method of landing approach.

On the day of VINDICATOR's maiden flight, it was a bit windy, and I made the mistake of pointing her nose down a bit on approach to keep positive control, and avoid being upset by a gust of wind. BOY, was that ever a mistake!

VINDICATOR came across the field, at what seemed like 400 or 500 miles per hour. The aircraft picks up speed very, very, rapidly when you point her nose down. I strongly recommend the above landing procedure to avoid returning her to kit form, or premature heart failure!

OK, ready to fly! Do your range check, surface movement checks and generally look her over for anything you may have missed on the bench. When you're satisfied with the visual checks, turn everything on and throttle up the motor. Any noise problems? Do you see surfaces jumping erratically? If so, fix them now. Do not fly if you see signs of motor noise problems. They will only get worse as the aircraft moves away from you, and will probably result in total destruction of the aircraft.

Electrics, with the weight they are carrying in the form of batteries, seldom do well in anything but a very minor crash.

Make sure everything is turned on, make one last check of all surfaces and here we go. Have your helper start to run with the aircraft as fast as he (she) can, crank your arm back, and THROW her up at about a 10 to 15 degree angle just as hard as you can. VINDICATOR wants and needs flying speed at the moment you let go. We almost lost her three times because of "glider-type" launching. As soon as she is stable, level the nose, and pick up airspeed. Once you have airspeed, pull in some "up" and gain some altitude so you can start wringing her out. The original VINDICATOR literally flew off the board with only two or three clicks of down trim required. Try some rolls, inside loops, outside loops, figure eights, etc. She will do them all, and then some.

Chop the throttle, feed in some up-trim, and level her out for a nice slow, flat, glide. This is your proper approach speed. Dunk the nose down on approach, and you're on your own. She'll come in like a rocket.

If you followed instructions, you will have a very fast, maneuverable, classy looking aircraft, that will make a true believer out of even the most skeptical.

A WORD ABOUT WEIGHT

VINDICATOR was designed in an all out attempt to obtain pattern-like performance from an electric-powered aircraft. To that end, it has achieved its means.

With the possible exceptions of a hard launch, and the inability to hold knife-edge flight, VINDICATOR has met or exceeded all my expectations which were strived for in the design stages.

During the design stages, weight was always a constact factor. VINDICATOR should weigh in at very close to the design weight of 44 ounces. At this weight, she is flying at a 17.5 oz. per sq. foot wing loading. This wing loading is approaching the practical limit for hand launching. Should you exceed this design weight, you are flirting with possible trouble. Stall speed will go up, as will tip stalling tendencies, as will the normal flying speed of the aircraft. If your bird came out heavier, you may be disappointed in its performance, or worst case, you may have a dismal failure. The degree of success or failure will depend on how much under or over the design weight you are.

I have stressed throughout the article and on the plans, the importance of build-

ing light and strong. This is one of the cardinal rules in electric power. Consequently, if you do not follow the rules, you may be in for a rude surprise when the moment of truth is at hand.

Electric power works, and works very well, if you do not deviate from the guidelines. If you think the rules do not apply to you and take a "aw, this shouldn't make any difference" approach, there is a good chance you will be disappointed. Then you will utter those famous words; electric power doesn't work. BALONEY! It does work if you do what you are told. If the VINDICATOR is over her design weight and you are disappointed, you made the mistake. Don't blame the aircraft or electric power. You must follow the rules. ENOUGH SAID!

Finally, the VINDICATOR is not a beginners airplane. While she is a pleasure to fly in the hands of an experienced pilot, she is fast, maneuverable, and groovy. Once put in to an attitude, she will stay there. She must be flown at all times, and is just too much airplane for a beginner.

If you are just starting in electric power, pick an aircraft that you can learn the basics of electric on. Then, after you sharpen your skills of flying on the wing, you can progress to an aircraft like the VINDICATOR.

It is the author's belief, that there is a misconception associated with those unfamiliar with electric power, who equate flying an electric powered aircraft to turning on a lamp, and it just kind of flies itself.

Flying an electric-powered aircraft isn't any different than flying any other R/C aircraft. In fact, with electric power, you must revert back to the old thinking of flying on the wing, rather than depending on raw horsepower. While it's true that modern Samarium Cobalt motors develop the equivalent power of a modern glow engine, we pay a penalty in the form of the extra weight we carry, in the motor batteries. Therefore, our power to weight ratio is less than our glow engine counterpart.

The moral of the story is build light and strong, and electric will work for you too.

I hope you have as much enjoyment from your VINDICATOR as I have had from mine. If you have any questions, drop me a line and I will do my best to answer them for you. Please include a SASE if you wish to receive a reply.

A molded fiberglass fuselage is available from HOLLEY'S SILENT FLIGHT, as well as the other specialty electric items shown in the VINDICATOR construction article. Good luck, and good flying! •

European. . . . . *Continued from page 28*

While working on a new wing now, I still am not sure about what was going on. From the general behavior in flight, I'm pretty sure that there was no longer a balance problem. The incidence settings then? Well, my measurements showed a 1/2 degree negative value for the top wing, relative to the lower wing and the stab. I used these values before, and successfully too. The wing section, a NACA 2412 thinned to 11.5%, does deliver lift at negative angles of attack up to 3 or 4 degrees. Also I used this section successfully before, so it has got to be something else. Right now I'm thinking of the possibility that the stab was "blanketed out" at certain angles of attack. That would account for its reluctance to take off, as the elevator wouldn't have been very effective. In the landing approach, the sudden loss or at least reduction of stab efficiency could have caused the plane to "land" like it did.

I'm going to try again, but before the next flight I will make sure I have pictures taken of it first.

Another subject, although it's not something specifically European, is interference from your large ignition engines. The Zenoah engines I use caused interference, in the shape of occasional glitches, in my radio system. Luckily the distributor for many European countries, Tony Clark from Germany, had the right solution. Take aluminum kitchen foil, wrap it around the plug cap and the cable, and wind a stranded copper wire around this, starting at the plug cap. The other end of the wire is grounded by connecting it to one of the magneto coil screws. No more glitches after this inexpensive and easy modification!! Oh, don't forget to cover this all with black insulation tape to keep the wire in place!

* * *

R/C motorcyling has, for some reason, never become popular. Why not, I wonder, when I see the beautiful quarter-scale bike from the Italian DWA manufacturer, sold here by Graupner. It measures 20 inches and easily reaches 70 mph, powered by one of the powerful modern .21 car engines. It features a working disc-brake in the front wheel, chain-driven rearwheel, a mono shock-absorbing system and weighs, ready to ride, just under six lbs. As far as I know, it's the first quarter-scale motorbike. "Big is Beautiful" certainly goes for Big Bikes too! What about a racing competition? You can really throw it into corners, as the tires will grip up to 45 degrees of bank; this must be a sensational thing to see.

Something quite different is the R/C Trimaran "Champagne Charles Heidsieck," a 1/14 detailed scale model of a famous racing competitor, named after its sponsor. I'm not into boating, so I might not use the right names, but the outer hulls are connected to the main one by a real wing. This "wing" has the G.A.W.-1 airfoil, and helps the boat to "glide" over the water at speed. The real one seems to reach 20 knots easily. It's called a "flying supertrimaran" here. The model is built from a kit, consisting of 23 epoxy-parts, ready to fit without the need for paint, a complete set of aluminum and chromed brass fittings, a 5/8-inch aluminum mast, sails, decals, plans and instructions. More data: length 70 inches, height 100 inches, weight, including R/C equipment, 13 lbs. At the current rate, the kit is sold here for