VOLTS WAGON

• WARNING: Electroflight has been determined to be habit forming. There are varified reports on file of R/Cers eliminating their noisy and oily glow engines and replacing them with electric propulsion units.

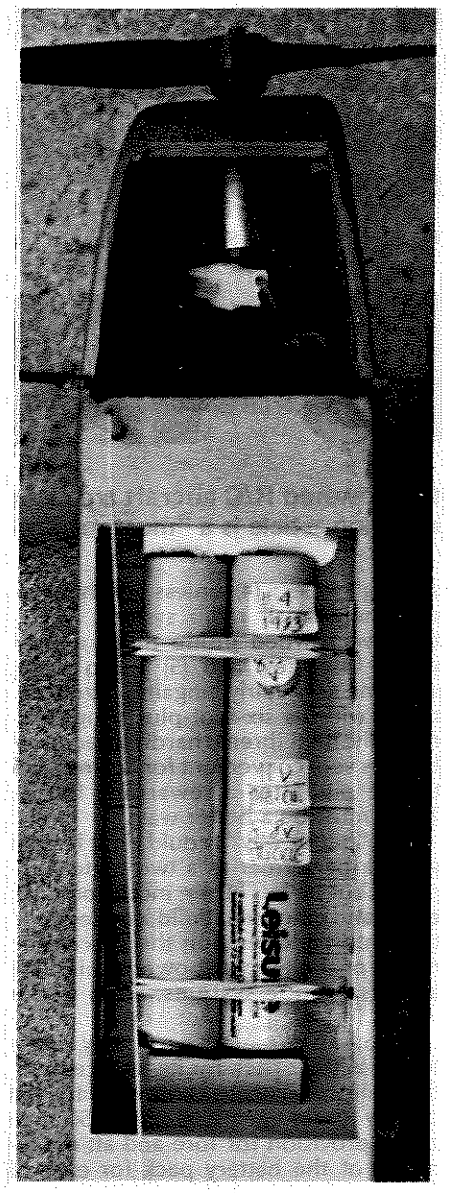
Shocking, isn't it?

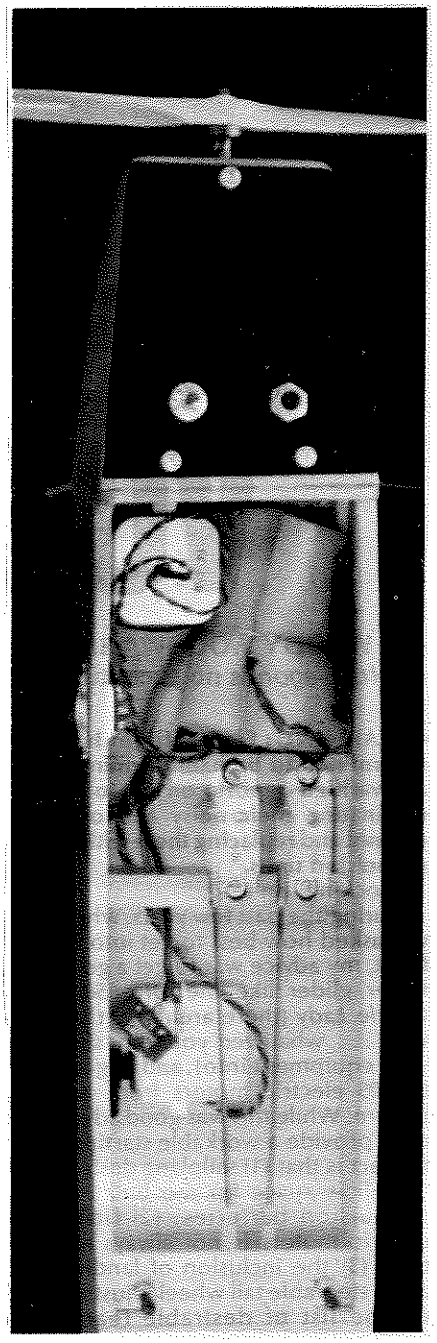
During the past few years, whenever I was asked how best to get into Electroflight, my advice was to get a good two-meter glider like the *Oly 650* or the *Gentle Lady* (there are many that work well . . . whatever you can shoehorn your equipment into), and to get one of the 05 electric motors from Astro or Leisure. While this was good advice, and does provide a workable starting point, the fact is that (1) sailplane designers do not allow space for the bulky electric propulsion batteries; (2) fitting the electric motors is not always a simple task; (3) the inclusion of landing gear and a steerable tail wheel is just not high on the list of desirable features in soaring circles; (4) unless you have an extremely small radio system, it gets terribly crowded inside those narrow glider fuselages; and (5) a two meter sailplane is a fairly ungainly sized airframe with its six-foot-plus wing. (Admittedly, item three is hardly a necessity, but it is very convenient for taxiing back to the pits after a rewarding flight). There must be a better way!

The "better way" should be at least as good a performer as a two-meter sailplane, but be less bulky, more compact, easier and quicker to build, cost less, and take into consideration the specialized needs of the electric powered airplane and its unique systems. Such needs would include adequate ventilation for the motor and battery pack, easy access to the battery pack for its replacement, the ability to accept a variety of different battery packs (i.e. 1200, 800, 550 mah cells), provision for fore and aft movements of the battery pack for ease of balancing; and the ability to change propulsion units (motors) from make to make and size to size without undue complications . . . hence, the *VOLTS WAGON*!

With a wingspan of 54 inches, a wing area of 432 square inches, and a flying weight of around 40 ounces, the super functional *Volts Wagon* achieves all of the aforementioned criteria. Note that, because of the way the front end is designed with its open bottom and removable hatch on top, virtually every available motor in the 05 to 10 range can be easily fitted. The motors are simply suspended from Former A, and it turns out that *all* the bolt patterns are the same! Even the new Astro Super Ferrite 10 and the Astro 15 Cobalt will fit, though I can hardly recommend such overkill.

BELOW & RIGHT: The *VW* has an ingenious radio and battery installation. The bottom compartment houses flight battery, the top one houses the receiver, servos, RX pack.

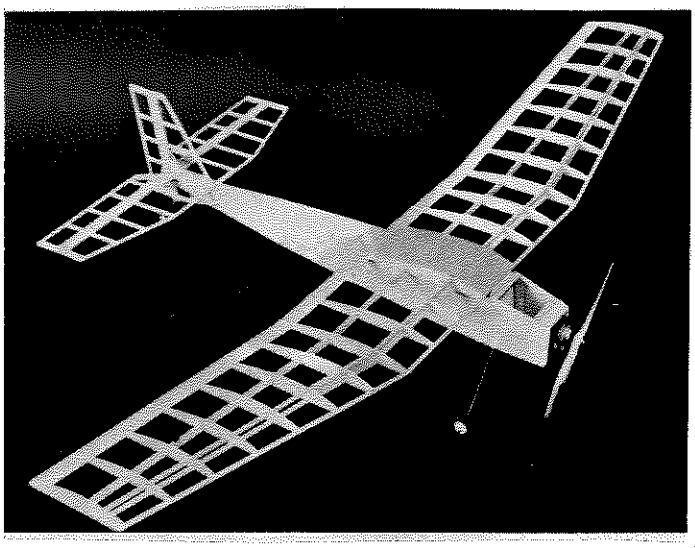


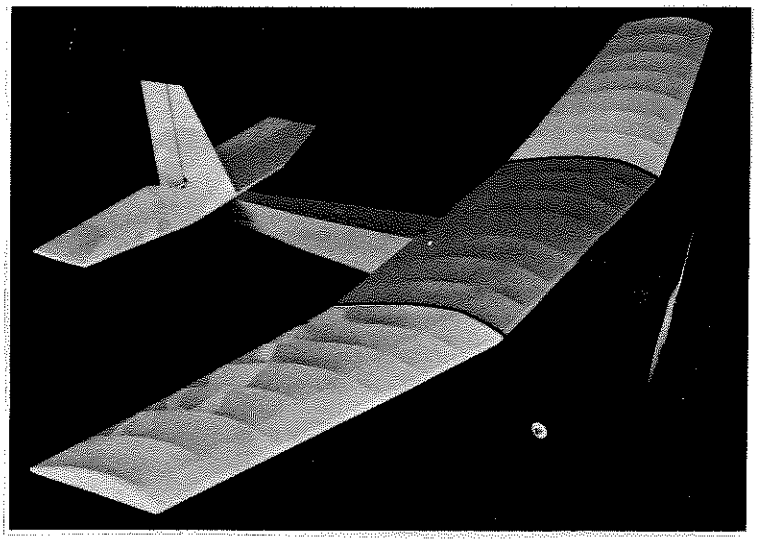


The landing gear rides in a vertical slot that allows it to be removed in the event that you decide to fly from tall grass. The steerable tail wheel allows you to taxi back to the pits. And of course, the combination makes takeoffs a simple matter.

The *VW* has been tested with five motors, two battery combinations (six-cell and seven-cell), eight propellers, two speed reducers (gear drive and belt drive), and two wings. Both wings are the same except for thickness. The first wing (and the one which is included in the plans) has a fairly thin, nine percent airfoil section with a sharp leading edge, and the other one has a 12 percent section with a more rounded leading edge. The difference? The *VW* flew surprisingly well from the very first flight using the thinner wing, however, typical of this kind of wing, it does drop a wing (tip stall) rather quickly if you get careless and do not watch your airspeed.

Out of curiousity, I built the thicker, 12% wing. It flew quite well. As a matter of fact, it was (if anything) easier to fly with a "softer" stall and no tendency to drop a wing . . . no doubt easier for a beginner to cope with. However, the





Before and after covering. The *Volts Wagon* is a simple, easy to build, electric powered sport plane for 05 motors. The bare *VW* has the Astro belt drive unit, the other, a Leisure unit.

VW was not designed for beginners . . . you'd better know how to fly *before* tackling this one. The *Volts Wagon* is an entry level electric plane . . . NOT a trainer.

You may ask why I have saddled you with the "trickier" wing? The answer is thermal riding. The thinner wing is a superb thermal hunter. If there is any lift present, any rising air at all, the *VW* wobbles slightly and begins to rise. There is just no way to stop it! Oddly, the thicker wing displays little of this characteristic, and just bumbles its graceful way right on through the "bubble" and out the other side. I thought you'd like the wonderful ways of the thinner wing. If you're chicken, fatten the airfoil 1-1/8 inch at rib W1 and project the other ribs accordingly, then you'll have a nice, docile trainer . . . *Boo!*

Now that you've decided to build this thing, send for the plans immediately before the rush commences. Even with the best of service, it'll take **Model Builder** a week or two to get them into your hands. *(Include First Class postage for the fastest return. wrf)* That's OK, because you have some homework to do: while you're waiting, go back through all your back issues of **MB** for 1983, starting with December, then November, etc., and read each of Mitch Poling's columns until you've read everything from 1983. When you're done with that, find everything you can by Larry Jolly (also in **MB**). You'll have to read his stuff twice, or however many times it takes you to understand it. His literary style is a bit quirky, but it is worth the effort . . . he knows what he's talking about!

If the plans still are not back, go back to 1982 and read Poling's columns for that year. Don't bother to dig back any further than that . . . you'll be more confused than enlightened by what you find. So much has changed (for the better) in the past two years that most of the opinions, equipment and attitudes of that period are grossly antiquated. You are *entering* the Golden Era of electric power!

Just what has changed to make our life as electro-fliers so wonderful? Primarily, it was the abandonment of the eight-cell/550 mah GE Ni-Cd battery pack which was the "standard" of the last decade. In its place emerged the key to *duration* and *successful charging*: the six-cell (and seven-cell) 1200 mah battery packs. These yellow marvels have simply given us dramatically improved duration (longer flights) because of their greater capacity and superior charge and discharge characteristics. Don't fool with anything else. If you've got some of those older GE eight-cell packs (white), they make terrific flight packs for your receiver and servos when broken down into two sets of four.

No less important is *the new generation of motors* beginning with Leisure's terrific LT-50 and Astro's very competitive 05XL and 07XL . . . both became generally available about two years ago. Since then, we have had access to the fantastic Astro Cobalts, and more recently, the imported German Kellers (cobalt) made available by Leisure. The lastest entries in this race for excellence are Astro's line of Super Ferrites (it is the first day of November, 1983, as I write this, and who knows what will have developed by the time you read this).

These new motors are more expensive than earlier ones; most of them were in the $12 to $15 range three years ago, with plain bearings and limited performance . . . a far cry from the new breed which cost from around $30 to $50 for the non-cobalts, to as much as $200 for the largest cobalts. As with everything else, you pay for performance.

CHARGERS AND CHARGING

We now know a lot more about this subject. For a long time we didn't understand that it was impossible to *fast charge* an eight-cell pack from a twelve-volt source . . . so 90% of the time we were trying to fly on 80% of a charge when 100% would have been barely enough with these old 550 mah packs we were using! The switch to six-packs (even seven-packs with special care) solved that. The availability of a variety of good chargers serves our needs nicely. At the top of my list of chargers is Astro's AC/DC Auto Charger ($70). It has, among other important features, voltmeter jacks so that you can plug in a $50 digital or $8 analog type voltmeter (both available from Radio Shack). Nearly as useful as Leisure's Digital Charger at $100. You can get by for as little as $25 (both Astro and Leisure have models in this price range), but do yourself a favor and go for the best in this department, you'll not regret it. I have both of these chargers. I use the Astro AC/DC unit mostly in the shop, and the Leisure Digital at the field. I don't know how I'd get by without them.

FIELD CHARGING BATTERIES

Most R/Cers are using field batteries of four and a half to six ampere-hour capacity for use with their power panels. These batteries are totally *inadequate* for our purposes. What is needed is a battery of not less than 14 ampere-hour capacity. They are available through motorcycle shops, and places that cater to recreational vehicles. Usually, they can be found for about $35.

How do you charge this battery? Run a line from your auto battery, and charge it as you drive to and from the field. What could be easier . . . and the price is right. By the way, this will not be a nice, clean, sealed, gel-cell type. It will be an old-fashioned wet cell battery that can and will leak acid. Nothing is perfect. Put the battery in a *wooden* box or container, and keep everything of value away from it. This is a minor inconvenience, considering the long lasting job this battery will do for you.

If you do not want to go to the expense and trouble of buying the above mentioned battery, nothing is better than the battery in the vehicle that transports you to and from the flying site . . . your car. An auto battery is usually 70 ampere hours or larger and is always charged up and ready to deliver. Please don't try to charge through the cigarette lighter receptacle. If anyone in the family smokes, you've got all kinds of resistance, and who knows how many feet of wire lie between the receptacle and the battery adding still more resistance. Just

release the hood and clip the charger directly to the battery (following the manfaucturer's instructions) being very careful to observe correct polarity. I use this technique frequently enough to justify running a permanent plug from the battery exiting the engine compartment in a convenient place so that I don't even have to raise the hood.

PROPELLERS

The choice of props for electric powered aircraft is somewhat more critical than is the case with glow engines. I've done a considerable amount of bench testing, and while the results are useful for comparison, it isn't until you get into the air that you really KNOW what works best on what motor and what aircraft. This is because the engine/prop combinations "unload" once airborne. Much of this is caused by airspeed and load.

I can tell you one thing: Rev-Up props work best! I don't really know why. I've had good flights with Top Flights and Zingers but my most spectacular flights are always on Rev-Ups. I keep tight logs on all my flights so this is not just a gut feeling, it's clearly borne out in my written observations. With the circulation of **MB** being what it is, I've probably started a world-wide shortage of Rev-Ups. Please Mr. Rev-Up, make more 7-4s and 8-4s. Those are the two fans that I find most consistently useful. Start with the 7-4 then move up to the 8-4.

CONSTRUCTION

So, you thought this was going to be a construction article? So far I've said nothing about construction. Have you ever built a rubber model or a sailplane? If you have you'll need few comments from me. If you haven't, I've probably wasted your time so far with all this stuff about electro-flight. However, I do have a couple of building tips before going back to the good stuff.

The fuselage sides are simply made from 1/16 balsa sheeting, four inches wide. With a ballpoint pen draw the fuselage outline on the balsa; all the lines are straight, except the bottom of the nose . . . you can eyeball that. The doublers, longerons, and vertical pieces are cemented to the sides (be sure to make a LEFT and RIGHT side). When dry, assemble the fuselage using Formers B and C for alignment. When the two sides (joined by the formers) are dry, draw the sides together at the tail, fill in the fuselage with the crosspieces, etc.

The tail is standard "free flight," you'll have no trouble there.

The wing construction is typical of all my designs in that the main spar is built over the plans, dihedral braces and all. When dry, position the spar over the plans, center section first. This leaves the two outboard spars sticking up in the air. When the center section is complete, tip it first to one side, built that panel, then tip it to the other side and build that panel. Simple isn't it . . . no panels to join later, and no chance of getting the dihedral wrong. I'm surprised more designers haven't discovered this trick. Oh well!

I covered the fuselage with medium weight silkspan, three coats of Sig clear dope, and shot some Sig Cub Yellow on it. The wing and tail group are covered with white and yellow Monokote. So much for construction.

FLYING

Normally, I hand launch my electrics as my flying is done at the Sepulveda Basin flying site in Van Nuys, California, where the majority of other aircraft are much faster than mine, and it is expeditious to quickly *get-the-hell-out-of-the-way* . . . or get run over!

The *VW* takes off quite nicely. Even though it's a taildragger, it sits at a very "flat" attitude, so that taking off is just a matter of rolling twenty-five to fifty feet (depending on the breeze) and easing back on the stick.

If you decide to hand launch, be sure to toss it at a perfectly flat attitude or even a tad nose down. Under no circumstances should you allow the nose to be raised . . . remember the warning about dropping a wing?

The *VW* has a very flat glide, so that landings may be made simply by steering down final with no need for a flare-out. However, you will have eased in full UP TRIM after shutting the motor down. If trimmed and balanced correctly, this produces optimum glide and the lowest sink rate.

ELECTRIC MOTOR TESTS: GEARS, BELTS, AND DIRECT-DRIVES

Before unleashing this subject on an unsuspecting world, we wanted to test as many motors as possible, including some gear-drives. We did quite a bit of testing with direct-drives, but had not gotten into the gear-drives as time was running out. For this reason, Jim Hall, who built the first *VW* from the final plans, modified the front end of his *VW* to take a Leisure LT-50 with a 2.5 to 1 gear-drive. We didn't do enough testing to completely satisfy me, however, I must say that the *VW* did so well on EVERY direct-drive motor we tested that it overshadowed the gear-drives. My impression is that in a plane of this SIZE, the gear-drive provides *no* clear advantage. The *VW* flew on a Rev-Up II-5, then a II-7, and finally a 12-5, with the II-7 being the best performer. Even with the very long landing gear legs, the gear-drive was very vulnerable to damage on a hard landing.

Conclusion: The added weight, expense and aggravation of the gear and belt-drives brought nothing of value in performance. I suspect if the *VW* was 20% larger, we would have done much better. So stick with the direct-drives and save that gear-drive for a bigger airframe.

Back to Jim Hall . . . I got a set of final plans on a Saturday morning (from Vic Steelhammer who drew them), and gave them to Jim so that he could tell me if there were any mistakes or parts that don't fit. Apparently everything was OK, as he simply showed up at the field the *following* Saturday . . . one week later . . . *ready to fly!* I must add that Jim is NOT retired, was not on vacation, and in fact, is a very busy person. So, obviously, the *VW* can be built very quickly.

On a project like this, data never stops coming in, but, you have to draw the line somewhere. So, as of Sunday, October 30th, 1983, we made the final tests (so far as this article is concerned). Thanks to Bob Boucher's (Astro Flight) interest in our flight tests, we were fortunate enough to have two new motors. So, the final tests were conducted using the Astro Super Ferrite 05 (six cells) and the Super Ferrite 075 (seven cells) which proved to be outstanding units which I recommend highly (also they're quite *inexpensive*).

The final flight test was made with Astro's sensational new Super Ferrite 10 (seven cells) which looks exactly like a Cobalt 15 minus the big "knobs." Though this motor weighs three ounces more than the others tested, it produced the most spectacular results! This jewel turns just over 14,000 rpm on a Rev-Up 7-4 on the bench tests . . . lord knows what it unloads to in the air! In any case, its performance is very close to that of a Cobalt, it weighs a little more than a Cobalt of similar output, however, it uses far fewer cells, and it costs less. There is a big future for this one!

While I'm on the subject of praising the people who make our success possible, I must say that Bill Cannon (Cannon R/C Systems) does NOT get enough credit for his pioneering of mini and micro systems. *All* of my electrics fly with Cannons on board. You may also have noticed that virtually all the record attempts have used Cannons. Until recently, they were simply the ONLY radios light enough and RELIABLE enough for our needs. Though there are other choices available today, I still use Cannons.

By the way, I still have a couple of glow engines left and several dozen industrial grade oil rags . . . anybody interested? I have no further need of them. •

VOLTS WAGON List of Materials:

QTY.	DESCRIPTION (DIMENSIONS IN INCHES)
4	1/16x3x36 Medium balsa (ribs and fuselage top and bottom).
2	1/16x4x36 Medium balsa (fuse sides).
2	3/32x2x36 Hard balsa (wing trailing edge).
1	1/8x4x36 Medium balsa (doublers and misc.)
2	1/4x1/4x36 Hard balsa (wing leading edge).
10	3/16x3/16x36 (Spars and tail).
1	3/16x3/8x36 (Tail).
4	1/8x1/4x36 (Fuselage longerons).
2	3/16x3/8x36 Hard and *straight* (wing main spars).
1	3/16x3/8x36 Spruce.
	1/8 Lite Ply (formers).
	1/8 Regular ply (Former A).
1	1/8 Music wire (landing gear).
2	1-3/4 Wheels (as light as possible).