

How I design MARC



ed the ART CHARGER

By ED MARQUART

MY MA-5 "CHARGER" is the logical development of a string of biplanes that I've been working on for almost 20 years. It's designed to get maximum performance from smaller engines. The No. 1 "Charger" has only a 125-hp Lycoming, but she'll carry two big people on a hot day without any trouble. The design is engineered to take almost any engine up to 200-hp with the larger engines for owners who live at higher altitudes. One builder who lives at an elevation of 6,468 feet, is putting in a 150-hp engine.

The "Charger" carries its disposable weight (passenger and fuel) directly over the center of gravity — not that we plan on disposing of any passengers unless they're sky-divers. To do that





Solo is from the rear seat only but the four-cylinder 125-hp Lycoming has plenty of umph to carry two big people at a cruising speed of 115 mph on a hot day.

The main tank in the fuselage holds 18 gallons, so you have a cruising range of four hours at 75 per cent power, and that's about as long as anyone wants to sit in an open "two-holer."

I've thought about making the wing fuel caps flush, because they cut into some of the wing lift in the slipstream. However, this would make construction more complex because the wing is so shallow. I don't believe it's worth the time and effort to go to "scruppers" and overflow drains.

The oil breather comes down the

inside of the left landing gear fairing and exhausts beside the wheel. Thus, you don't have oil all over the fuselage after a roll around in the sky.

With the FAA's change of viewpoint toward homebuilts where the owner must "build" at least 51 per cent of his airplane, I've tooled up to help "Charger" builders with some of the items that might be easier for me to do. For example, I can weld up the complete fuselage, tail surfaces, landing gear struts, engine mounts and cabane and/or interplane struts. I have already

welded up nine fuselages and have more on order. (These units are built-up only on order.) I hesitate to quote prices for these various items because the cost of materials can change almost overnight. However, I can give a firm cost for any of these items by phone or return mail. (Marquart Aircraft Co., P.O. Box 3032, Riverside, Calif. 92509).

By the time the builders make up the complete wings, hang the engine, install instruments and fuel tanks, fuel lines, control cables, brakes and rigging and then cover the aircraft, they've done



much more than 51 per cent of the labor. This is the type of labor that's really challenging fun. It has to be or no one would spend the time doing it. Because when that ship rolls out of your garage and is finally assembled at the airport, it's yours, ALL YOURS!

Since no one in this aviation-for-fun business ever seems to make a lot of money — at least, I don't know of many who do — it's easier for the homebuilder to "back into" construction of a homebuilt like the "Charger" than some other projects. He buys the plans; 23 (24 by

36-inch) detailed sheets and a complete bill of materials for only \$75. Then the builder can make all four wooden wing panels, complete with "hardware," as his budget allows.

If he's a fairly sharp welder or knows someone who is, the tubing plus a tank of oxygen and acetylene and a few pieces of welding rod is all he needs.

When the builder has all these bits and pieces completed, he can dig down into his savings for a powerplant. By that time he'll have been working on the ship for a considerable length of time

and may be able to find a "bargain" in an engine. Be sure and have a qualified mechanic check it over before you buy it. There are still a number of 125-hp Lycoming GPUs (Ground Power Units) available at a reasonable price that work well with aircraft of the size and weight of the "Charger."

While I designed this aircraft for a fixed pitch propeller because of cost and simplicity, someone will probably go for a controllable paddle of some sort. Beech Roby and Aeromatic props are available from Univair in Denver as brand new or factory re-built.

If you go by the EAA (Experimental Aircraft Assn.) guide lines that it usually takes 3 to 3½ years to complete a homebuilt working a normal amount of time after-hours, the owner really isn't going to have to spend a great deal of money per month, except for his engine purchase.

The MA-5 "Charger" is a logical growth from previous models. The MA-4, for example, was a single-place biplane. Three have been completed and another four or five are in process of construction. Plans for this smaller airplane are available for \$35. While it wasn't designed as a racer, Serial No. 3 of the MA-4 was flown by owner-pilot Dr. Wycliff and clocked 147.7 at mile-high Reno to win the biplane competition in the first or second year of "biplane" competition. My original MA-4 design called for an 85-hp powerplant but the racing version had a 135-hp O-290-D2.

The MA-3 was a one-of-a-kind single-seater "biplane" that had a number of then-new features. It was flown, but I had to put the project aside due to the work load of other projects. The MA-2 and MA-1 were preliminary design and static test feasibility studies that were worked on between regular maintenance and rebuilding jobs. However, all these designs pointed toward the present "Charger" configuration.

When you've worked around airplanes, particularly the smaller experimental models most of your life, it's a fairly simple matter to "eyeball" a structure and make it hell-for-strong. Of course, this procedure also produces over-stressed, ground lovin' aircraft with poor performance.

One of the "Charger" builders is a McDonnell Douglas Engineer who is part way through his MA-5 now. He keeps telling me that some of the structure is just too heavy and strong. He says that it's a 12 g airplane, but I don't quite believe him. I consider the 125-hp prototype to be a +6 and -4½ aircraft, and that's a conservative estimate.

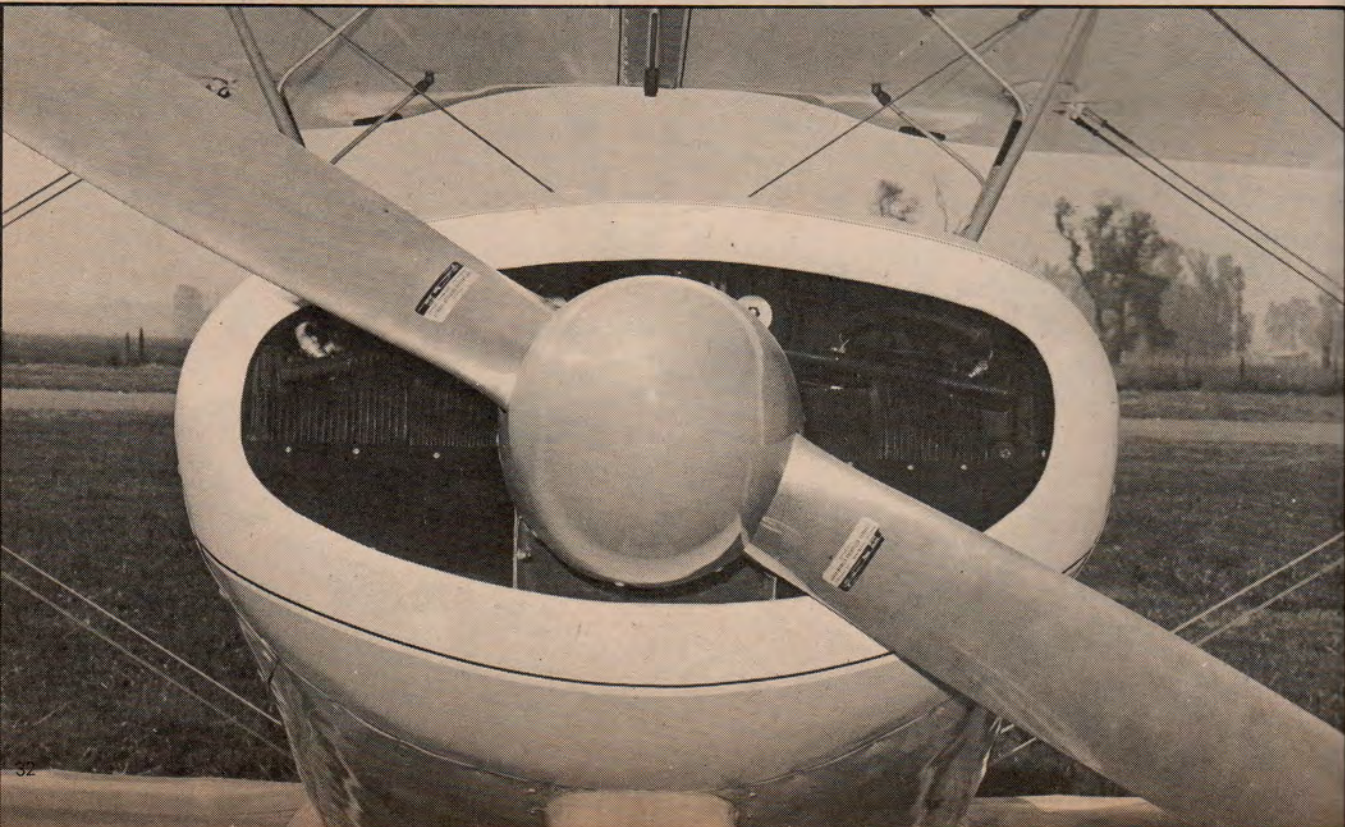
Many people ask me if the ship is fully aerobatic. My question in return is, "Are you fully aerobatic?" The "Charger" has been looped, rolled, spun, dived to red-line — so I'd consider it to be aerobatic. However, any ham-handed

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Designer-owner Ed Marquart shows how the side panels can be lifted on the Charger for easy maintenance.

A visual Stearman type fuel gauge for the two auxiliary tanks hangs down from the center of the Charger's top wing.





with a biplane, you either can't get in and out of the front pit without a side door or you put sweepback in the top wing. It seemed logical to sweep the lower wings right along with the top panels so you'll find a 10-degree sweepback in both wings.

The airplane is easy to build and easier to maintain. All 44 wing ribs can be made from one or two jigs. There are very few left-and-right parts. Except for the fittings, all four wing panels are basically identical and all the control surfaces have three hinges for an added safety factor.

The rudder and elevators are dynamically balanced and we've had no tendency toward any control flutter right up through the 185-mph red-line speed. I'm not much of a "wring-'em-out" test pilot so I had Bill Turner run the dive tests, snap rolls and a spin series that ended up with four turns and a normal recovery in half a turn. I built a replica of the Brown B-2 racer, "Miss Los Angeles," for Turner.

You'll find lots of wires on the wings of my design. There's a good bit of drag with a cruising speed of 115 mph on 125-hp, but no one flying an open two-place biplane is really in any great hurry to get anywhere, anyhow. Actually, FAA specifications call for redundant bracing on all critical wires, so I put double wires on each load panel. Wire bracing around the tail structure is standard, rugged yet light weight.

Perhaps it's a parental pride, but I've been extremely satisfied with the way

the "Charger" handled, both in the air and on the ground. She's easy enough to fly so that CFI Gene Issacs solo'd his 16-year-old son Brad in the ship recently, and then solo'd him in 14 other types of aircraft the same day.

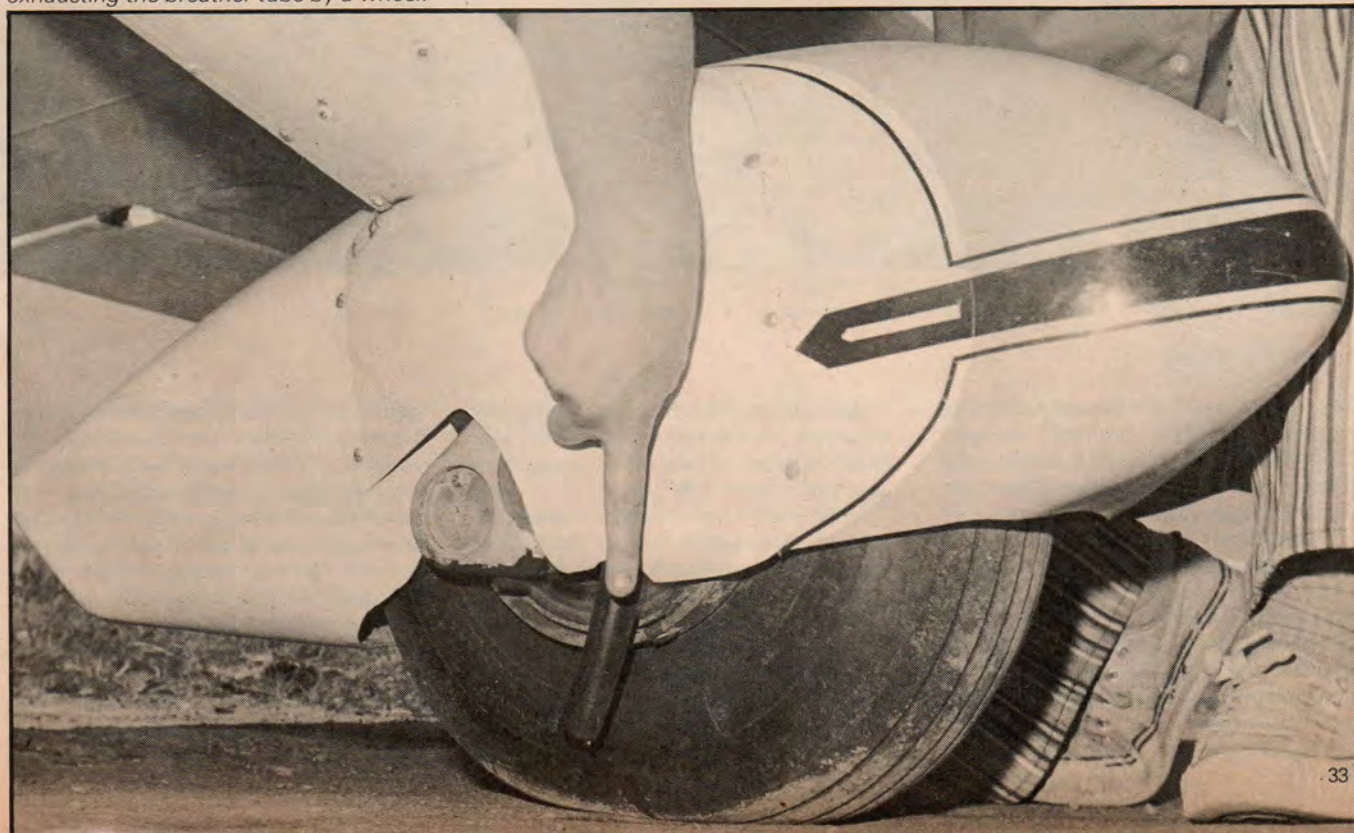
I've tried to keep the structure as straight-forward as possible. The landing gear legs, for example, are simple to weld up from 0.090 flat steel with two rubber "donut-type" shock absorbers installed at the upper end of the assembly. The hollow-box gear is tapered and fully cantilever. It's similar in design to the late-model Ercoupe.

I've been told that it's easy to tell that a Mechanic designed the "Charger." The front 30 per cent of the fuselage is metal that can be removed in just about 60 seconds. All engine control linkage goes down a channel on the left side of the cockpits and is easily accessible once the side panels are removed. The ship has more than its share of inspection plates. You can check-out the landing gear shock-absorbing "donuts" merely by removing the protective cover in the front cockpit.

The fuselage is fabric only aft of the front cockpit. There are hand holds for the pilot to lift himself up from the back pit and black-painted marks on the aft struts of the center section for the pilot up-front to use for hand holds.

The ship has three fuel tanks. There are two small 4½-gallon tanks in the top wing sections with a half-inch inter-connect line. A Stearman-type visual gas gauge hangs below the top wing.

Oil on the fuselage is prevented by exhausting the breather tube by a wheel.



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Just below this rear panel of the Charger is a small radio. The "G" meter isn't redlined but the little homebuilt is rated for maneuvers ranging from +6 to -4½ Gs.

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pilot can put undue strain on any aircraft structure to the point where something's gotta go. Just look at the accident reports of overstressing "indestructible" aircraft like the Stearman and Great Lakes. Both are rugged airframes and, when they were brand new, they were probably almost indestructible. However, as airplanes and people get older, there's more preventative maintenance involved. It seems easier to do on the aircraft than on the people.

Actually, we've done more than an average amount of testing on the "Charger" design. Bill Six and I took the No. 1 ship to Oshkosh in 1971 when it had just enough time (52 hours) to be legal for cross-country. I gave a number of rides to interested homebuilders and sold a number of sets of plans as a result of this trip. One pilot I flew with at Oshkosh calls me every month or so to ask some detailed question about the ship he's now building. Yet, at the time I flew with him, he was just one of a large group of interested people.

Probably the most rapid building job is just about completed by Ray Stephens. He began construction on June 30, 1972 and had the complete airplane, less covering, on display at a fly-in just 11 months later. Of course, he had to retire from his job to get the airframe done that rapidly.

While the history of the "Charger" goes back to the first tentative design that I laid down in 1961, serious work on this airplane didn't begin 'til 1967 when a school teacher friend Dan Fielder and I went into it on a joint venture. He purchased the parts and I put them together. When we were finished, he owned the airplane and I had the design developed. The ship was approved by the FAA in the fall of 1970.

It's my own personal feeling that you shouldn't pass plans to homebuilders until you have a well-proven product.

I've certainly spent more time building and rebuilding aircraft than I have in flying them. I solo'd in a J-3 Cub when I was helping build B-24's during World War II and have logged perhaps 1,100 hours since then. My pilot rating is strictly ASEL. With this amount of flight experience, I feel completely at home in my "Charger." I'm sure that it will bring me home safely.

Much of the practice I've had in developing the "Charger" has come from either rebuilding antiques or making flying replicas. Since moving to the West Coast, I've rebuilt a clipped-wing Taylorcraft with a 150-hp Lycoming that was used by Dean Engelhardt for air shows, constructed a replica of the 1933 Brown B-2 "Miss Los Angeles" racer for Bill Turner and a replica of a 1911 Curtiss pusher for Tom Rose. This ship is in the "Planes of Fame" museum.

Other projects include the restoration of a Fairchild 22 that is still in process and rebuilding the parts and pieces of the 1930 prototype Driggs Skylark. I rebuilt a 1942 Waco YPT-14 (UPF-7) for Dave Casey, a 1929 Arrow Sport with a 100-hp Kinner (now a 125-hp Kinner) for C. Dean McCarty and put together a set of 1929 Fleet components for Charles Bales.

While I'm not really a "flying junk man," I do have the parts, either hanging from the roof of my hangar or rotting outside in the smog, for a Buhl Air Sedan built originally in 1928, a 1930 Waco INF, a Heath Parasol and some other "building blocks."

However, as the "Charger" becomes more accepted and I get the component construction on a fairly routine basis, my next project will probably be to put together a replica of the G.B. Model "Z" for Bill Turner. That project is still down-stream quite a ways until I've completed everything I can to make sure that the "Charger" keeps on charging.



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