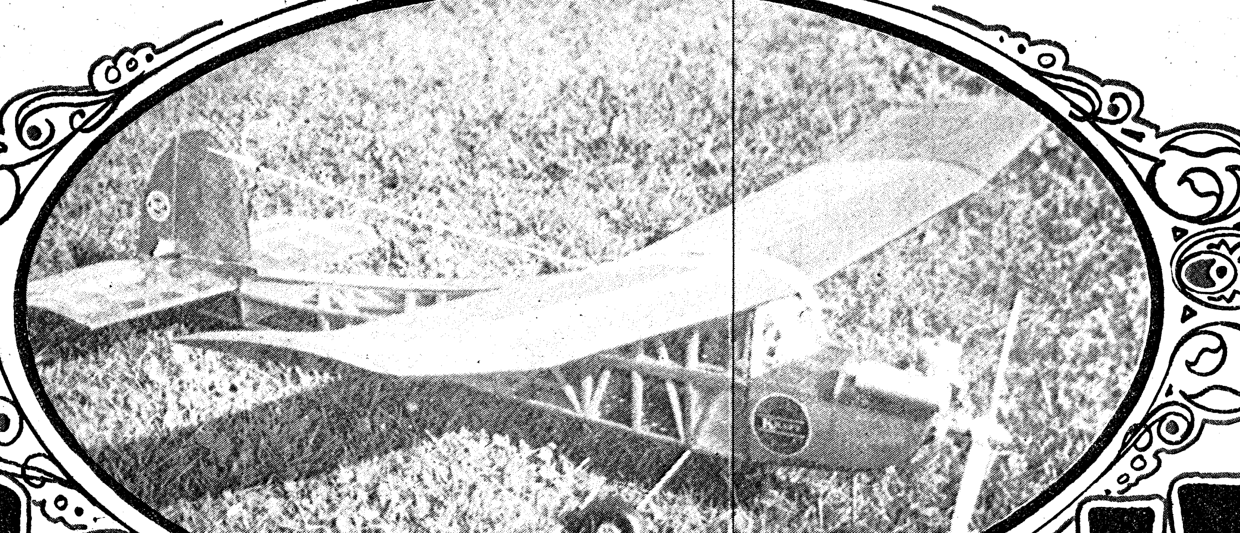


GOLDEN OLDIE

Stability, performance, appearance; three wing spans for R/C or free flight./by Eric Lister

If you're looking for a ship that goes together easily, flies almost hands-off, is strong as a Sherman tank, makes a good R/C trainer and a grand fun flyer plus has all the stability, performance and appearance of an old timer, the "Golden Oldie" is for you. This ship has been built and flown in both R/C and free flight in 32 inch, 48 inch and 72 inch spans. The subject of this article is the 48" span R/C version. The technical specs are: Span—48"; Wing Area—330 sq. in.; Power—.10 to .19; Radio—3 channels (Kraft brick plus KPS-12 servo is perfect); Weight—41 oz. dry, 18 oz/sq. ft. wing loading; Airfoil—flat bottomed E387/Mod 4,10; Landing Gear—tricycle; Basic Construction—balsa and spruce stick; Wing Mount—rubber bands; Cruise speed—23 MPH; Rate of Climb—700 ft/min. on .10 OS Max, 1800 ft/min on .19 Fox; Glide Slope—approx 11:1; Glide sink rate—approx. 3 ft/sec.

The rest of this article explains how the ship was designed and built and what the flying experience has been with it (all good). For those of you out there who want to get started, the specs above give you a pretty good idea of what she's capable of, the materials as per the plans run around $10-15 plus engine, radio and covering; so get your plans and get going. If you genuinely want the "Golden Oldie" as a trainer for a youngster, stick with the .10 OS Max. After possibly 50 flights you might get a bit more adventurous and try a .15. For really high rate of climb, max speed of around 60 MPH and much more flying skill required on the part of the pilot, try a Fox .19.

DESIGN:

The design of the "G.O." goes back a few years, when I had several successful sailplane designs under my belt but wanted to get back into power with something that apparently wasn't being offered any more. What I wanted was a ship of basically stick construction, high wing and the very gentle flying characteristics of the old-timer free flight models, but modified to serve as both an R/C trainer for power flight and as a general all around fun type flyer. What I saw in the hobby shops at the time was pattern ships (definitely not for the beginner in R/C power) and things called trainers that had all the eye appeal of a cigar box. Maybe I didn't look far enough, but what I did do was to design a new ship that used modern aerodynamics, looked like an old timer, and turned out to be one of the most pleasing airplanes I've ever flown. A typical flight consists of getting it up, either by taxiing or hand launch, trimming it for a gentle climbing turn, and then just taking your hands off the controls and letting her fly till she runs out of fuel and glides in a few minutes later. During powered flight or the glide she can be looped, spiral dived or make high G pullouts, all with ease.

Eric Lister with his Golden Oldie. Built like a Sherman tank and covered with clear MonoKote, it makes a good trainer and a great fun flier.

The actual technical design that resulted in a ship with these flying qualities came about as follows: To get good stability and stall recovery, the ship was designed to have a horizontal stab that was reasonably large (25% of wing area), a stab moment arm of almost three wing chord lengths, and a center of gravity that was no further aft than mid chord. The net result was that the G.O. has a pitch stability about equal to the lower limit for a good sailplane. To permit turns that had some roll automatically built in, on a rudder control ship with no ailerons, the total wing tip elevation was set at about 6.5° per panel. A typical free flight ship might have used around 10-12°, but since this would make the ship roll too much with rudder control, it was dropped to 6.5° for all R/C versions of the G.O. The ship has never been made with ailerons, but if it were, the right dihedral would be about 3° total tip elevation. The rudder was sized to a little under 7% of wing area with only about 20% of it being the movable part. The rudder was made intentionally large to overcome fuselage hi-wing mount destabilizing effects and to give it some natural tendency to keep her nose into the wind. The moving portion was kept small to keep beginners from overcontrolling. The wing airfoil was selected for its ease of construction characteristics that go with a flat-bottomed section.

Aerodynamically, the airfoil derives from the Eppler 387 section which is a soaring airfoil. The modification I introduced was to reduce the camber from almost 6% to 4% and to thicken it up to 10%. The camber reduction to 4% made the section hold its low drag characteristics through a broader range of angles of attack, which in actual practice means moving the elevator control gives you a very broad change in flight speed without very gross changes in dive or climb angle. To make the ship dive requires pushing the stick to the outer band of its deflection range. This is the second anti-overcontrolling feature built into the G.O. and was intended for the beginner who typically overcontrols unless the ship has some forgiveness built into it. Another good feature of the E387/Mod 4,10 is that somehow or other it didn't forget its soaring heritage—after the ship runs out of fuel, you pump in as much uptrim as she'll take, back off just a hair and watch her float. In the glide she's still very controllable, and responds nicely to both elevator and rudder. With the wing loading of 18 oz/ft sq., wind penetration is also healthy, which means under power or in the glide she has a forward speed of at least 15 MPH even heading straight into a 10 MPH breeze.

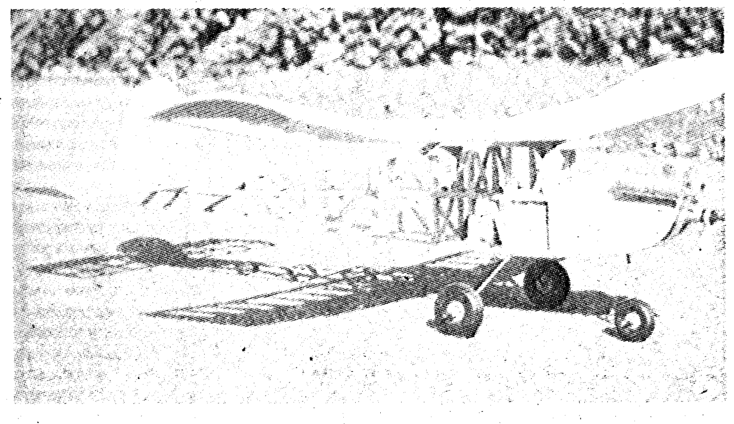
There are two other aerodynamic features worth noting that give this ship its good flying qualities. The first is the wing and horizontal stab tips. The tips of this ship were designed to reduce the induced drag. If you'll note, the upper surface is flat and the lower surface bends up in the tip region. This also gives you a strong tip that presents a flat balsa surface to the mud on hard landings. The other feature is that the movable portions of the elevator and rudder are a bit thicker than the spar that they attach to. This keeps control surface drag down a bit. All in all, the G.O. is a highly stable, very controllable, low drag design for a trainer. The drag is so low, in fact, that when you come in for a landing don't be too surprised if it floats halfway across the field before it finally sets down. The ship also has nice stall characteristics. When it does stall, it sort of mushes rather than falling off hard on one wing. This characteristic comes from its rectangular wing, which stalls first at the roots before the tips finally go.

The last major item in the performance category for this design was determining the power requirement—what engine to use. In aircraft design, whether it's man-rated or an RPV, the requirement that usually sizes the horsepower needed is either max speed or rate of climb. Since this wasn't a speed ship, rate of climb became the design item. Rate of climb is the payoff for having more power available than what is required to fly the ship straight and level. The higher your rate of climb capability, the more acceleration and maneuverability your ship will have. For a trainer, however, you don't want to overpower the ship simply because the inexperienced flyer won't know how to handle all that capability. How much rate of climb is desirable for a trainer is really a very important question. From my own ham-handed experience, about 500 to 1000 ft/min is all I've ever wanted to handle for a ship that didn't make me sweat on every flight. At the cruise condition of roughly 35 ft/sec, the drag of this ship at a flight weight of about 41-44 ounces is four ounces. Any thrust that the engine makes over four ounces is converted into rate of climb.

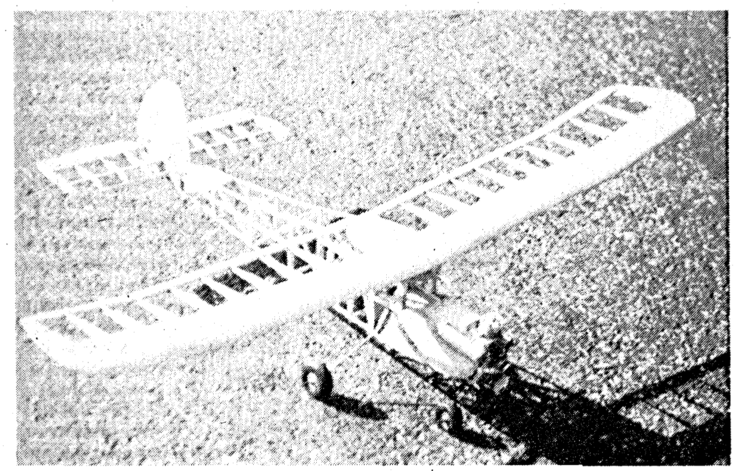
To give you some idea of how sensitive this is, the following figures are provided: Total thrust 4 oz., climb 0 ft/min; total thrust 10 oz., climb 290 ft/min; total thrust 20 oz., climb 770 ft/min; total thrust 30 oz., rate of climb 1250 ft/min; total thrust 40 oz., rate of climb 1730 ft/min. Since the desired rate of climb was between 500 and 1000 ft/min this meant that a powerplant that would make up around 20-25 ounces of thrust was what I needed. Some thrust measurements that I've made out in the garage using 15% nitro fuel on various displacement engines in the small category run as follows: .020 - 4 oz., .049 - 9 oz., .10 - 18 oz., .15 - 27 oz., .19 - 41 oz. This tabulation says that the engine size I needed would make a .10 OS just about right and a .15 OS just a little more than what was required. What I had immediately available was a Fox .19 that put out a whomping 41 ounces of thrust, which was far more than I needed. That was the first engine that went into the G.O. Frankly, Duke Fox makes a very powerful engine, as the early flight tests were to prove. It climbed like a scalded cat, much to the delight of my pattern ship buddy, Bob Soden, who liked the high rate of climb and its ability to stand on its own prop. Whenever I flew it, the prop went on backwards which cut its thrust about in half to around 20 ounces. Having done that, the climb and acceleration were cut back to a level I could handle.

However, the message was clear, a .19 was too powerful for me, so I went to the other end of the scale and installed an OS Max .10 with muffler which put out about 18-20 ounces of thrust. With this size engine, the climb was gentle and the throttle could be adjusted through a broad range without making the ship suddenly leap through the air. On calm days, the .10 Enya has proven itself to be a perfect match for this ship. On windy days however, like over 15-20 MPH with breezes that are gusting quite frequently, she could stand the .15. With the .10 you don't fly on windy days but as a trainer or fun flyer I don't think you'd go out in gusty weather anyway. My advice is to stick with a .10 until you get more experience under your belt and are training to fly in any kind of weather, even bad.

The structural design is very strong. The wing spars are made of spruce and with sheeting on the leading edge back to the spars it can pull loops and high G pullups with no problem. The fuselage is made mostly from 3/16" balsa with a planked nose and a spruce longeron down each side. Designs of this sort for a fuselage are quite old-timerish and are also exceptionally strong. I've used this type of fuselage construction on other ships in developing the G.O. and can personally verify the fact that they will withstand things like: flying into a flag pole, flying into a barn door, coming in at full power and straight down from 200 feet after a battery failure, and lastly falling straight down after a wing came off at several hundred feet altitude. In all cases, the worst damage the fuselage suffered was broken motor mounts and broken plexiglass. For a trainer, that sort of capability in structural integrity is really desirable. In addition to the strength it gives you, when covered with transparent MonoKote or Kwik Cote, it looks very attractive and straight out of 1935. Oldies but goodies.



A super strong structure and a high life wing makes a durable flier.



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CONSTRUCTION:

Let's take the easy parts first, the wing, stab and rudder. In cutting out the wing ribs, remember that if you are going to put 1/16" balsa sheeting on the upper and lower surfaces from the leading edge back to the two spars, then you must undercut the rib shape in this region to allow for the sheet thickness and preserve the airfoil shape. If you don't make this allowance for the sheet, the airfoil will suffer from early stall and extra drag. I usually build the two center and two tip panels and omit the joining rib until the dihedral braces are in. Use small C-clamps to hold the braces in and block up the wing to the plan height. Remember to put some glue on both the brace and the spar surface, allow it to get tacky and then join the two together. Franklin's Titebond glue is recommended throughout. Install the tip pieces prior to putting on the sheeting. For added strength, I put a piece of glue soaked cloth over the center panel sheeting for the full chord length to protect it from sliding on the fuselage mount rails and to keep the 6-inch long rubber bands from denting the wood.

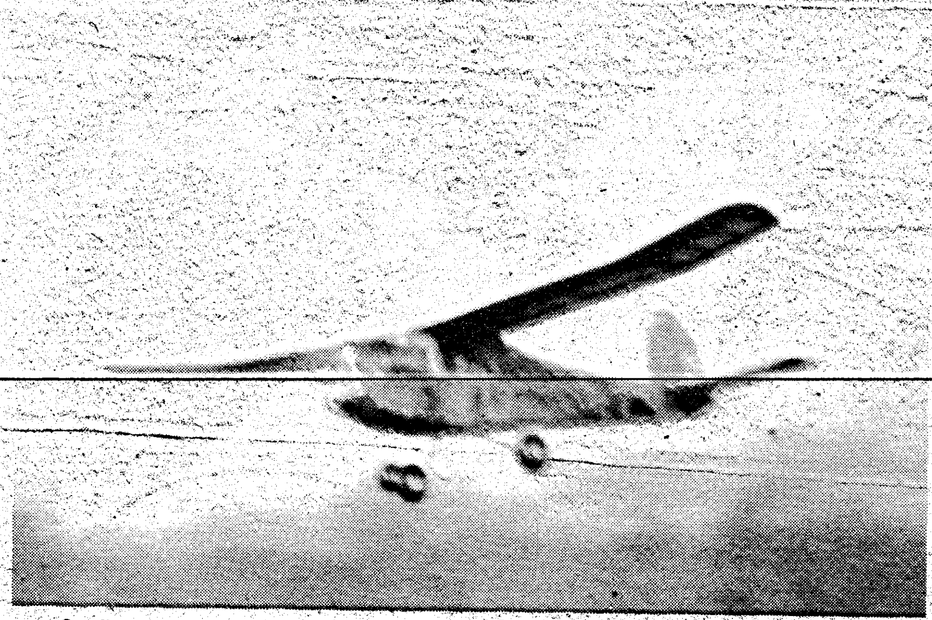
The rudder can be cut, sanded and covered next. The elevator is also straight forward. Build it, cover it and then install the covered moving sections of both the rudder and the elevator. Remember not to leave covering on the portion of the bottom of the rudder where it slips into the elevator. Also remove any covering you may have put on the bottom of the elevator where it glues into the fuselage.

The fuselage is where most of the building time goes. Out of the total weight of 41 ounces, 23 of those are fuselage and engine weight. None of it is difficult, it just takes time. The first step is to build the two fuselage sides, one right—the other left.

Lay a sheet of saran wrap on the plans. For the right side, remember that the plywood cheek piece in the nose goes down first, flat on the saran wrap. For the left side, the ply piece gets shimmed up 1/8" and does not go directly onto the plans. This ply piece is a very important strengthening item. Its primary function is to protect the cheek balsa pieces by providing lots of rigidity for those occasions where a beginner is going to put the nose into the dirt. Do not put on the spruce longerons or the vertical pieces that go from the longeron to the upper and lower stringer just yet.

To get both sides of the fuselage identical, after the first side is dry, remove the pins and lay another piece of saran wrap on top of the first side. Build the second side right on top of the first. When you remove both sides, you'll have the basic structure of a box that the rest of the fuselage gets added onto and gets its final shape. The two ply cheek pieces should be flush with the outside of the sticks on each side. Now, sand the inside of each tail piece so that they fit with a lot of joining surface area and meet at an angle equal to the taper that the sides will take from the wing trailing edge aft. Line up the fuselage halves on top of each other and put a very small dab of glue on the sanded tail joint to hold the two sections together at this point. After this dries, put in the ply firewall, which should fit very nicely now in the corner between the ply cheek pieces and the 1/8" square vertical piece in the nose. All the cross pieces from the firewall back to the wing trailing edge are the same length, so cut them all the same and put them in place with glue. Now break the dab of glue on the tail joint, correct any side misalignment, and reglue for final joining. Put in the remaining cross pieces between the two sides, following the natural bow of the wood, just remember to cut each top and bottom piece at the same station to the same length.

Now the spruce longerons go on, after first trimming off their width aft of the wing trailing edge so that they come to a gradual point by the time they reach the tip of the tail. From the tip of the nose to the wing trailing edge, the longerons are perfectly straight, so glue them in here only and let them dry. After drying, bend the longerons so that they fit flush against the slot where the elevator goes into the fuselage. This will cause the longeron to bend in a very graceful curve from the aft cabin back to the stab. Mark where it touches the fuselage sticks, smear a little glue in these spots, and pin it in place. While the longerons are drying, put in the vertical pieces that go from the longerons to the top and bottom stringers in a taper. Next, cut out the balsa cheek pieces, sand them to follow the taper of the vertical pieces you just put in, and then glue the cheek pieces in, making sure they butt nice and tight against the bottom of the



On final approach, the Golden Oldie fairly floats in for a gentle touchdown.

longerons in the nose area.

Next drill the ply mounting plates to take the landing gear and motor mounts. For the motor mounts, remember to use blind nuts, and leave the engine high enough to allow for the muffler which must not rest on the fuselage sides. Next put on the nose deck formers and sheeting. Cut a ply sheet for the radio installation. Mine took the Kraft brick with a KPS-12 servo for the throttle. Install the throttle cable and then drop the fuel tank in place. The next step adds an ounce or two but boy, does it ever make for a strong nose. Turn the ship on its back and mix up some Sig 2 part foam and pour it into the nose area from the firewall back to the end of the balsa cheek piece. This stuff expands, fills all the voids, absorbs plenty of vibration, and generally beefs up the whole nose area for a minimal weight penalty. After it hardens and dries, sand off any excess, plank the bottom, and put the planking over the battery hole on a hinge so the battery can come out and be charged before flying. The standard Kraft rechargable NiCad just fits the hole.

Remove the engine and mount and cover the ship, including the outside of the firewall and the whole cowl area that gets pretty oily and uncleanable unless you have a Mylar covering of some sort on this area. I used transparent blue Kwik-cote which is not only pretty to look at, it is also quite visible at a distance. Stay away from transparent yellow if you want visibility. At about 300 feet, that color becomes almost invisible. After the ship is covered, trim off that portion around the cockpit that would be covered otherwise by the cockpit plexiglass. Cut the plexiglass to fit and put it on with 5-minute epoxy. For a strong bond between the plexiglass and the wood, take some sandpaper (coarse) and rough up the plexiglass on the part of the sheet that goes over the wood.

Now glue in the assembled tail section, using plenty of glue or epoxy. Hook up the linkages, check them out to make sure up is up, right is right, etc.; strap on the wings with some healthy rubber bands, make sure the CG is right, and you're ready for your first flight.

FLYING

With the tricycle gear, there is no tendency to ground-loop, which is a big help. Point her nose into the wind, use a hard surface for takeoff, if one is available. Rev up the engine to full power, hold it there for about 10 seconds to allow RPM to stabilize, and let her go. The ship will fly off by herself with neutral trim settings. Let her climb by herself on the .10. Don't try to horse it off the ground or force it into a severe climb. Adjust engine side or down thrust if you have to, so that the G.O. has a broad left turn and gradual climb under full power. In the glide, she should go straight ahead with no rudder corrections. Good luck! You should get hundreds of flights without any major structural problems and hours of happy, restful flying. RCS