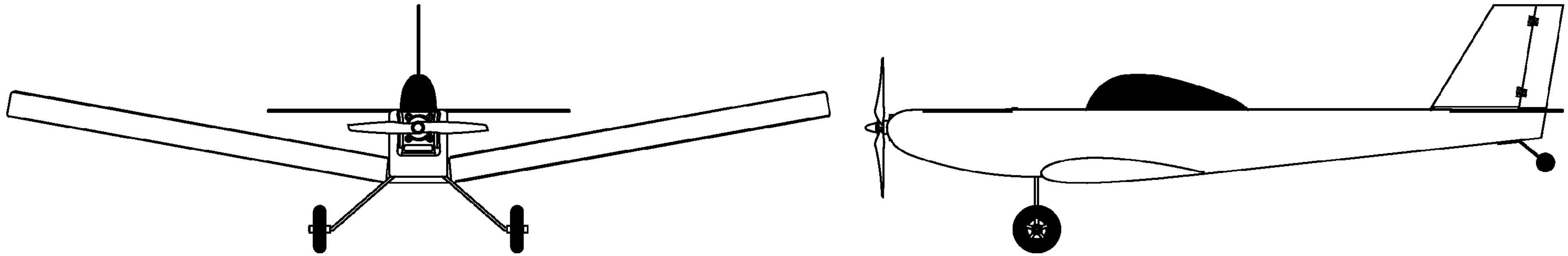
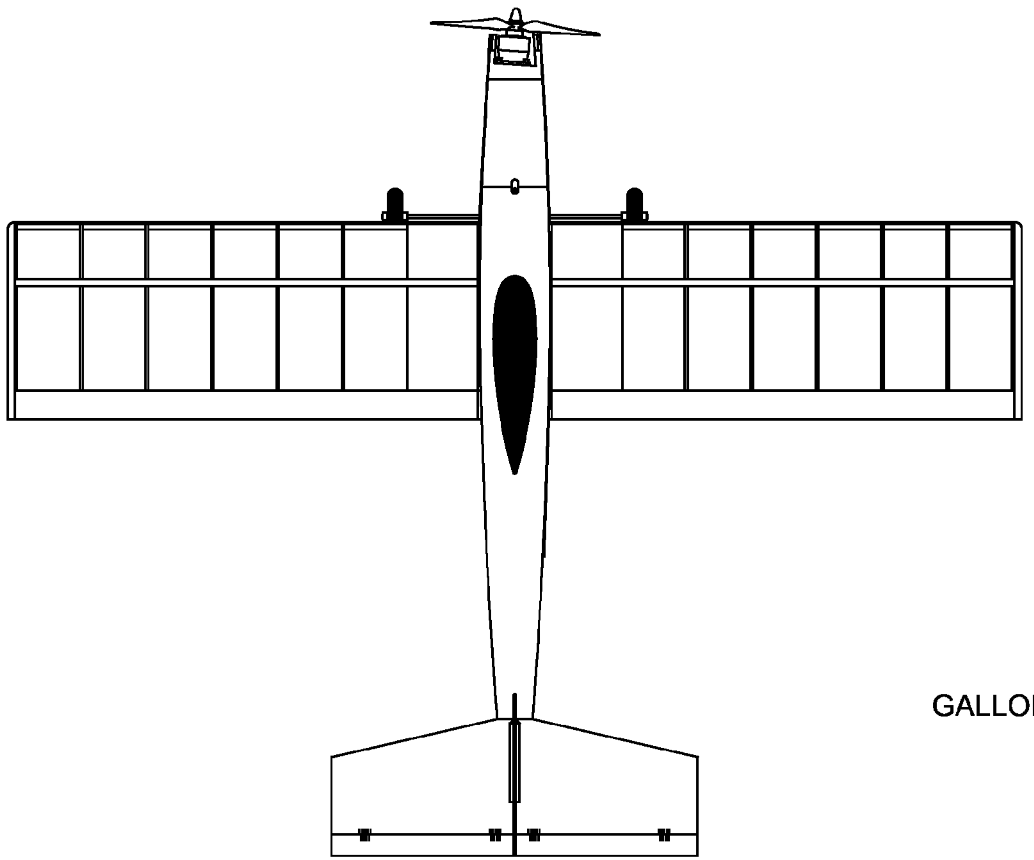




FIDGET

GALLOPING GHOST R/C MODEL

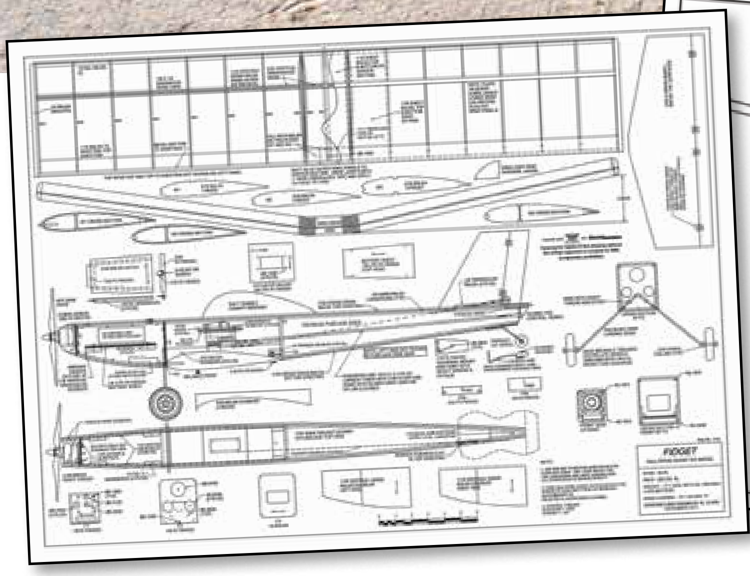
3 VIEW

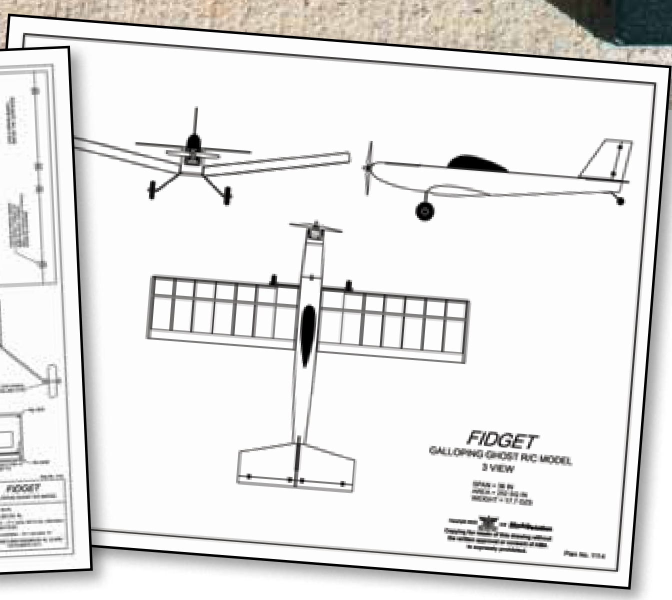
SPAN = 36 IN
AREA = 252 SQ IN
WEIGHT = 17.7 OZS

Plan No. 1114

Fidget


FIDGET
GALLOPING GHOST




FIDGET
GALLOPING GHOST R/C MODEL
3 VIEW

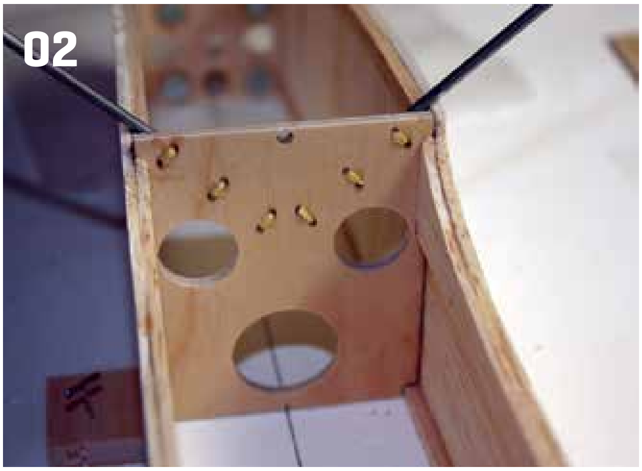
The Fidget is ready for flight with a rare, 1975 Orbit three-channel transmitter converted to 2.4 GHz by Jay Mendoza.

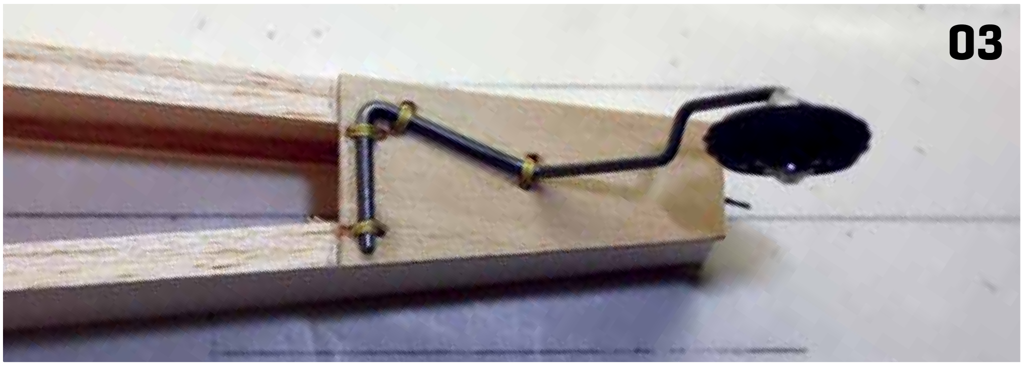
Build the airplane purposely designed for the Galloping Ghost RC system

By Al Clark
hotdogx@knology.net

The Fidget is a model specifically designed to fly using a Galloping Ghost RC system. Until now, if you wanted to fly a Galloping Ghost model, you had to either find plans or locate one of the kits that were produced in the 1960s and '70s, such as the Midwest Lil' Esquire and Lil' Tri-Squire, Sterling Mini-Mambo, or Goldberg Junior Falcon and Junior Skylark. Not only are these old kits extremely hard to find, they command high prices.

Building a Fidget is considerably less expensive than buying an old, classic kit. It is easy to build, and the Fidget has other advantages as well. Older model designs were originally intended for single-channel, rudder-only control and were essentially Free Flight models with a movable rudder added.





At A Glance

Specifications
Wingspan: 36 inches
Wing area: 252 square inches
Length: 30 inches
Weight: 17.7 ounces ready to fly

They typically featured flat-bottomed airfoil sections and positive incidence was added to the wing. This resulted in a couple of drawbacks when a Galloping Ghost radio, which added elevator and throttle control, was used. These models could only be trimmed for one airspeed, and when the speed increased, the model tended to balloon or nose up into a climb.

With the flat-bottomed airfoil section and positive wing incidence, it was necessary to add down-elevator to prevent the model from climbing in level flight. The Fidget eliminates these issues by using a semisymmetrical airfoil section, 0° wing incidence, and a low-wing configuration. The Fidget does not balloon with airspeed increases, and no motor down-thrust or down-elevator trim is needed. This makes the Fidget easier and more pleasant to fly compared with other older classic designs.

The Fidget uses a Cobra 2208/26 1,550 Kv motor, Cobra DL22A ESC, and an APC 6 x 4E propeller powered by a 3S 1,350 LiPo battery. This well-matched power system provides a little power margin when needed, as well as decent flight duration. The battery is easily accessible from a hatch on top of the fuselage, and the wing can be removed with a single nylon screw.

The Fidget radio system consists of a Tobe Kallner Galloping Ghost actuator with a Phil Green Peripheral Interface Controller (PIC) added, and a Lemon DSM2 six-channel receiver. For the transmitter, I am using a rare, 1975 vintage Orbit three-channel unit that was converted to 2.4 GHz.

If you have read this far, and you weren't flying RC models in the 1960s, no doubt you are wondering, "What the heck is Galloping Ghost?" I'll share some history that was put together by Jay Mendoza, who is the go-to person when it comes to Galloping Ghost radio control, vintage Galloping Ghost radio repairs, and vintage Galloping Ghost radio conversions.

Galloping Ghost has been around in many forms and names for decades. In the 1950s, it was originally called Two-Tone Pulse Width (TTPW). Later refinements were dubbed Kicking Duck, Mickey Mouse, Simple-Simul, Simple Proportional, Pulse, and Galloping Ghost. The gallop and kick names come from the fact that the airplane's tail pulses up and down as it responds to the elevator flapping up and down.

The rudder and elevator both flap, but they flap equally in each direction at neutral, so the airplane flies straight. The controls would flap approximately four to six times per second at neutral. When you moved the control stick, the


04

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01. The 3/32-inch diameter music wire landing gear is attached to former F2 with Kevlar fishing line and CA glue. Note the hole for the wing dowel and air-cooling holes.

02. The aft side of former F2 shows Kevlar fishing line wraps. Also seen are the 3/32-inch fuselage side doublers where the wing rests on the fuselage.

03. The tail wheel assembly is attached to the 1/16-inch plywood mount using Kevlar fishing line and CA glue.

04. The right wing panel is nearly complete. The 1/16-inch balsa sheeting still needs to be added to the inboard rib bay at the left end of the wing panel.

corresponding control surface would begin to flap more to one side than the other, causing the airplane to react accordingly. The advantage of this crude system was that it offered proportional control and trim using a single-channel radio.

Although it was limited to two flight controls and throttle, pulse proportional was a big advancement over escapements and reeds. These early pulse systems were typically built by hand and required some fairly complex linkages. Making adjustments was tricky at best.

By the mid-1960s, digital proportional sets began to become widely available, but were extremely expensive. Galloping Ghost pulse-proportional systems gained popularity as a low-cost alternative. Commercial actuators became available, which made using pushrods with clevises possible, greatly simplifying their installation and adjustments.

Many companies offered Galloping Ghost and pulse-proportional systems, with the bulk of them based in the Midwest. Because most of the digital proportional companies were concentrated in Southern California, Galloping Ghost was not as popular on the West Coast. Some of the Galloping Ghost manufacturers included Min-X, Controlaire, Ace R/C, Citizen-Ship, Hallco, Bonitron, F&M, Testors, Sterling, Royal, Airtrol, Rand, Airguide/Go-Act, and Tomasser. Even EK Logictrol had its Digi-Ghost system.

By late 1969, the cost of digital proportional sets had come down to the point that Galloping Ghost no longer offered a significant price advantage, which left Ace R/C as the only remaining pulse proportional system manufacturer.

Returning to the present, the Tobe Galloping Ghost actuator replicates the original Rand LR-3 (Low pulse Rate 3-function) Galloping Ghost actuator with some improvements and minor differences. The improvement is a lighter, more powerful motor, and a brass gear drive that is more rugged and resists stripping the gears in a crash.

Unlike the Rand LR-3, the Tobe only offers two functions: rudder and elevator. Throttle is accomplished by an ESC; with gas power, a throttle servo is used. The improvement is that you have nearly infinite throttle adjustment as opposed to the original Rand LR-3 with only five throttle positions. The Rand LR-3 had a habit of giving full up-elevator when changing throttle, which could lead to a stall while on a landing approach. The Tobe Galloping Ghost actuator eliminates this.

The secret behind the pulsing action of the Tobe Galloping Ghost actuator is a specially programmed PIC by Phil Green that uses the elevator and aileron servo signal and re-codes them to replicate the pulsing action of a Galloping Ghost actuator/servo such as the Rand LR-3.

A modern spread spectrum transmitter and receiver are used, and because only three channels are required, the remaining channels can be used with servos for more features. Using a modern transmitter, you get the benefits of its features, such as multiple model memories, servo reversing, dual

05

06

07

rates, exponential, buddy boxing, and more.

All you need to fly the Galloping Ghost is the Tobe Galloping Ghost actuator with the re-coder and driver assembly that faithfully replicates the Galloping Ghost pulsing action. It is compatible with any digital proportional radio currently on the market.

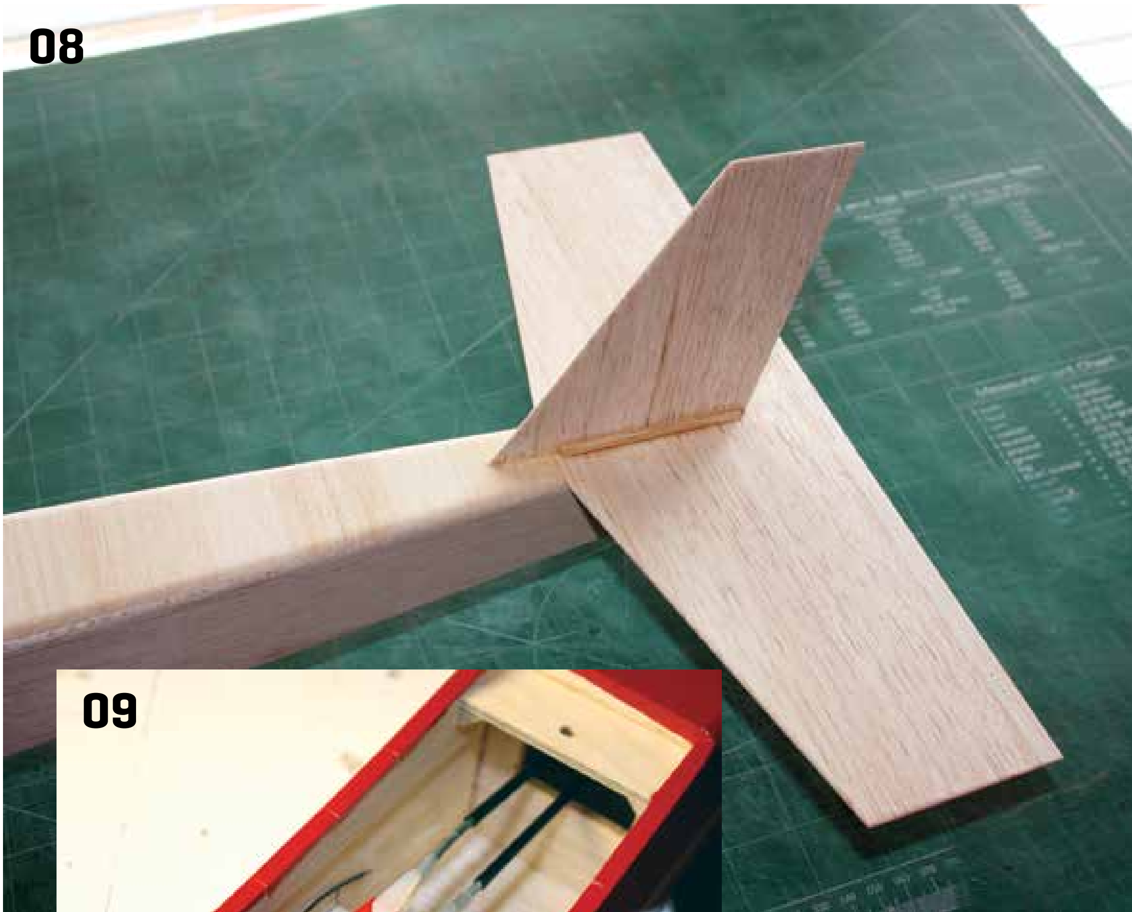
For those who want an original Galloping Ghost system, Jay has converted an original Galloping Ghost pulse proportional transmitter to 2.4 GHz and replaced the electronics with micro controllers that have more features and flexibility than the originals did, and they are more reliable.

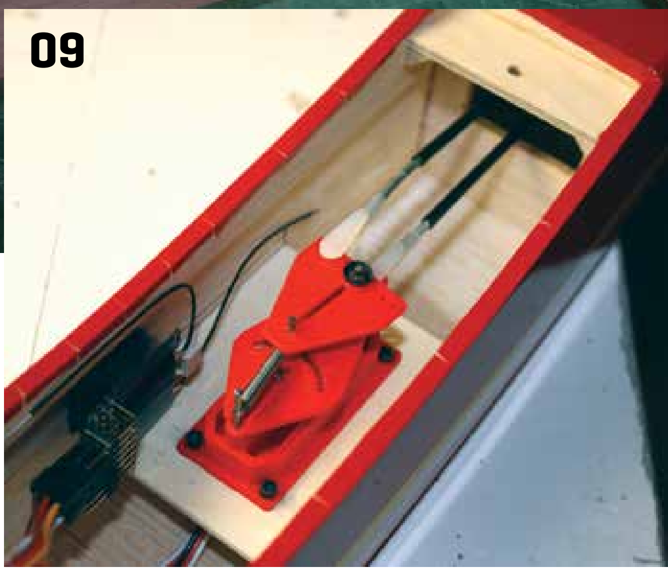
Phil again created the programming to make this possible. Another bonus is that after it is converted, you can also use your original Galloping Ghost transmitter to fly any three-channel airplane by simply binding the receiver to the transmitter. After you convert your original transmitter, you will have a system that is externally identical to the original with the exception of the 2.4 GHz antenna. This is the best of both worlds for a vintage RC enthusiast—the original look with modern reliability.

Although it is entirely possible to build these systems as a do-it-yourself project, for those of you who are interested but unable to build homebrew electronics, Jay offers Tobe Galloping Ghost actuators with electronics assembled and tested, and also offers to convert your original transmitter. He can be contacted at jaymen@pacbell.net.

If you were flying RC in the 1960s and had a Galloping Ghost system, you might want to give it a try again using a Tobe actuator with a reliable modern radio on 2.4 GHz, or perhaps even have your old transmitter converted to 2.4 GHz. Even if you've never heard of Galloping Ghost before now, you might want to give it a try to see what it was like in the early days of RC and gain an appreciation for how far RC technology has come.

In my case, Galloping Ghost was unfinished business. I was 17 years old in 1969 when I saved my money and bought a Galloping Ghost radio system. I built a Sig de Havilland Beaver with an Enya .09 engine and installed my Galloping Ghost radio. It was my first-ever RC model. Although the radio system worked





perfectly on the bench, it quit soon after takeoff.

After rebuilding the Beaver several times, I gave up and went back to a rudder-only radio set with a different model.

It always bothered me over the years that I never got my Galloping Ghost setup to work, and when I discovered what Jay was doing to encourage people to fly the Galloping Ghost again in this modern era, I wanted to give it a try. I'm happy to say that this time around, my Galloping Ghost setup is working perfectly. Finally, after 48 years, I have success!

I have included a number of pictures detailing the Fidget model build. Visit www.ModelAviation.com/galloping-ghost-fidget to read about building the Fidget or see it in the digital edition.

Get the plans, grab some wood and glue, and let's get building so you too can fly Galloping Ghost!

SEE MORE PHOTOS ONLINE

05. The Fidget's outer wing panels are butt-glued to the center panel. The joints are wrapped with 1-inch fiberglass tape applied with CA glue.

06. The hatch lock is made from 1/32-inch plywood and attached with a 4-40 nylon screw to adjust friction.

07. The firewall has 4-40 blind nuts and air-cooling holes. Also shown are the 1/8-inch balsa fuselage nose doublers and upper scrap-balsa fill-ins.

08. The horizontal stabilizer and fin are glued to the fuselage with 1/8-inch triangular balsa pieces added to the base of the fin. Note the hinge thread holes showing at the left end of the stabilizer.

09. A Tobe Galloping Ghost actuator is attached to a light plywood mounting plate. Note the nylon clevises and 2-56 studs that are glued into carbon-fiber tube pushrods. The Lemon receiver is mounted with Velcro tape.

Making a “kit” of parts first makes the construction go easier, so study the plans, make a rib template, cut the ribs and the other parts, and get started building!

Landing Gear

I like to make the landing gear and tail wheel wire first. The landing gear is made from 3/32-inch diameter music wire. Don’t forget to cut the 1/8-inch outside diameter (OD) brass tube bushings for the wheels.

The tail wheel wire is made from 1/16-inch diameter music wire. Note that there is 3° of right steering bent into the wire. This is needed because the tail wheel is not steerable and some right input is needed to counteract the torque and P-factor to keep the takeoff run straight. It is best to not substitute the specified landing gear wheels for another type because the Fidget might not balance properly.

Tail Surfaces

The simple tail is made from medium 3/32-inch sheet balsa. Try to find C-grain balsa because it is stiff across the chord. Use 3-inch or 4-inch wide balsa and edge-join it as required to attain the width. The tail surfaces are hinged after covering using heavy thread such as carpet thread (this will be described later).

Before covering, drill 1/32-inch diameter holes at the outer ends of the thread hinge locations that are shown on the plans. Note that the hole locations are staggered between the stabilizer/elevator and fin/rudder.

After the holes are drilled, apply some CA adhesive to each hole, let it dry, and redrill it. This will make the holes stronger. Cut to length the 1/8-inch triangular balsa pieces that will be used at the base of the fin and bevel the front ends. Sand all of the tail surface edges round and finish sanding with 220- and 400-grit sandpaper.

Wing

Use hard balsa for the leading edge (LE); the other balsa is medium density. Build the outer wing panels and the center panel.

Beginning with the right outer wing panel, cut the lower 1/16-inch balsa trailing edge (TE) sheeting to size and bevel the aft edge according the plans. Cover the plans with waxed paper and pin the TE sheet over the plans. Position the lower 1/8 x 1/4-inch basswood spar cap over the plans and add scrap 1/8-inch shims underneath, near each rib position. Make sure that the root end of the spar cap is correctly positioned and glue all W2 and W3 ribs to the lower spar cap and TE sheeting using CA and/or CA+ adhesive. Make sure to use the rib angle gauge on the inboard end of the W2 rib. Cut to size and glue in all of the spar webs using CA+ glue. Note that the web in the inboard rib bay is 3/32-inch thick balsa.

Dry-fit the top basswood spar cap and make sure no webs are too tall. Adjust as required. After you are happy with the fit, glue the top spar cap into place using 15- or 30-minute epoxy. The epoxy will fill any small gaps that might exist between the spar webs and upper spar cap.

Cut the upper 1/16-inch balsa TE sheeting to size and glue into place. Make sure the wing is pinned down when installing the top TE sheet. Fit the 1/4-inch square balsa LE strip, adjust the rib notches if required, and glue into place using CA+.

Cut, fit, and glue the 1/16-inch balsa top and bottom sheeting over the W2 ribs and carefully sand them flush with the spar caps and TE if required.

Sand the LE, spar caps, and TE flush with the inboard end rib W2 and the outboard end rib W3. Cut the 1/4-inch thick balsa wingtip slightly oversized, glue it to the wingtip, sand it down to the rib contour, and radius the edges as shown on the plans. Be careful not to sand into the rib and ruin the rib contour!

Shape the LE according to the plans and give the outer panel a final sanding with 220- and 400-grit sandpaper. Repeat these steps for the left outer wing panel.

The wing center section is built in the same manner as the outer wing panels. Don’t forget to use the rib angle gauge on the W2 ribs. Note that the webs are 3/32 inch thick. Install and sand the balsa fill-in pieces flush at the TE before installing the top TE sheet. After gluing on the top and bottom sheeting, sand them flush with the spar caps and TE if required. Sand the LE, spar caps, and TE sheeting flush with the outer W2 ribs. Shape the LE as directed in the plans and give it a final sanding with 220- and 400-grit sandpaper.

With all three panels complete, it is time to fit of each outer panel to the center section. Check to make sure that each outer panel has the required 2.84 inches of dihedral under each wingtip. Carefully sand the ends of the center section and/or the inboard ends of the wing, if required, to get the correct amount of dihedral then check to make sure the panels match well at the center joints. Some sanding might be needed because of variations in sheeting thicknesses.

Glue the outer panels to the center panel one at a time using 5-minute epoxy or 15-minute epoxy if you prefer a little more working time. Wipe off any excess with alcohol before it sets up. A few T-pins will help hold the panels in position while the epoxy cures.

After the glue has cured, carefully sand off any excess epoxy. Cut a piece of 1-inch wide fiberglass tape for each center panel joint, spray a light coating of 3M Super 77 Multipurpose Spray Adhesive on one side of each piece of tape, and apply the tapes around the center panel joints. Make sure to smooth them out well. Apply CA glue to the tapes and trim the overhanging tape flush with the TE. It is best to do this outdoors because of the CA fumes.

Add a 1 x 1-inch piece of fiberglass tape to the bottom center of the TE using CA. Lightly sand the glued tapes with 220- and 400-grit sandpaper. This completes the wing except for the dowel and nylon screw hole, which will be installed later.

Fuselage

If you haven't already done so, drill, cut, and file the holes into plywood former F2. It is easiest to drill the bottom 1/8-inch diameter hole before cutting F2 out of the plywood stock. This keeps the hole from splitting out the plywood at the bottom. Make sure that the 1/16-inch diameter holes are accurately located. It's easiest to make a template by copying F2 from the plans, rubber cementing it to the plywood, making all of the holes, and then removing the template and rubber cement.

Scuff the landing gear with sandpaper in the area where it attaches to F2. Locate the landing gear over F2 by using the F2 and landing gear cross section on the plans and tack-glue the landing gear in place using CA+ or 5-minute epoxy. Bind the gear to F2 by using several loops of heavy thread at each of the six pairs of holes then saturate the thread with CA and glue the landing gear to F2 using CA+ or epoxy.

Drill the four pairs of 1/16-inch diameter holes into the 1/16-inch plywood tail wheel mount. Before attaching the tail wheel wire to the mount, install the 3/4-inch diameter tail wheel by soldering on two small washers. Mount the tail wheel wire using heavy thread and glue it as you did the landing gear.

Glue the 1/8-inch square hard-balsa longerons to the fuselage sides. Make a left and a right side with the longerons on the inside. Pin and/or tape the sides to each other and lightly sand the edges to ensure that the longerons are flush and that the sides match each other. Make up the 1/16-inch vertical-grain balsa doublers by gluing the edges of the sheet balsa and cutting the doublers to size. Try to get a good fit between the upper and lower longerons and F1 and F2. Glue the vertical-grain doublers to the fuselage sides using CA+ or a thin application of 5-minute epoxy.

Cut the two 1/8-inch square, hard balsa pieces that will be used on the 1/8-inch light plywood actuator mount. Locate them according to the plans and glue them to the fuselage sides using CA.

Cut the four 1/4-inch square by 1-inch long basswood pieces that the battery shelf mounts to. Place and glue to the fuselage sides using CA+. Use F2 as a temporary spacer and glue the 3/32-inch balsa doubler in place at the wing location on each fuselage side with CA+ or 5-minute epoxy.

Glue F2 and F3 to the right fuselage side using CA+, making sure they are square. Let the landing gear hang over the edge of your building board. Next, turn both fuselage sides upside down on your building board (use waxed paper underneath), position F2 and F3 properly on the left fuselage side, and glue them in place.

Mark the center of F2 and F3 on the aft side, near the top edge. Draw a straight line on your building board that is the length of the fuselage. This will be the fuselage centerline. Pin the fuselage over the centerline upside down, placing the F2 and F3 center marks on the centerline (use waxed paper underneath).

Pull the aft ends of the fuselage sides together and glue in the small, 1/16-inch cross-grained balsa piece between the two upper longerons. Make sure each fuselage side is square to the building surface at the aft end and glue on the tailwheel mount using CA+. You might have to notch the longerons slightly to clear some of the thread wraps that attach the tail wheel wire.

Accurately drill and cut the holes into the 1/8-inch plywood former F1 and install the four 4-40 blind nuts using CA+ glue. Make a center mark at the top of F1. With the fuselage still pinned upside down to the building board, pull the sides together at the front and glue in F1 using CA+. Be certain that F1 has the required 4° of right thrust (which will look like left thrust because the fuselage is upside down). You can draw a line across the centerline at F1 that has the 4° thrust offset and use this as a guide. Because the fuselage is upside down, the 4° of offset will be to the left!

Install the 2-56 blind nuts into the actuator mount using CA+. Make sure that the blind nuts are on the top of the actuator mount. Glue the actuator mount to the 1/8-inch square balsa pieces that you previously installed inside of the fuselage.

Fit the 1/8-inch plywood wing mount F3A between the fuselage sides and glue to F3 and the fuselage sides using CA+. Add the 1/4-inch triangular balsa reinforcement pieces to each side. Fit the 3/32-inch plywood F2A to the fuselage and landing gear, adjusting the holes for the landing gear. Glue F2A in place using CA+. Be careful not to get glue into the 1/8-inch hole at the bottom of F2.

Place the wing onto the fuselage and check the fit along the wing's top sheeting. Minor adjustments to the fit can be made to the fuselage with a sanding block. Make sure you do not change the incidence angle of the wing. Place the wing back onto the fuselage, making sure it is centered at the LE and TE, and tape it in place.

Mark the screw hole location on the TE according to the plans then drill through the wing TE and through F3A with a #29 drill bit. Tap the hole through the wing TE and F3A using an 8-32 tap. Remove the wing and drill through the hole in the wing TE with a #18 drill bit. On F3A, apply some CA to the threads and run the 8-32 tap back through to clean up the hole.

Place the wing back onto the fuselage, install the 8-32 nylon bolt at the TE, and center the wing's LE. Measure from each wingtip to the back end of the fuselage to ensure that the wing is square. Tape the wing in place at the LE. Using a long drill bit, drill a 1/8-inch hole into the wing LE, using the 1/8-inch hole in F2 as a guide. The hole should go 1 inch into the wing.

Remove the wing, cut a piece of 1/8-inch diameter dowel to 1.1875 inches long, and slightly round off the front of the dowel. Fit the dowel into F2 and sand if necessary. Glue the dowel into the wing using 5-minute epoxy, making sure to leave 3/16 inch sticking out from the wing's LE.

This step is optional if you want a perfect fit of the wing to the fuselage. Cut two pieces of MonoKote backing (or similar covering backing to which glue won't stick) approximately 1 inch wide and place them on top of the wing where each fuselage side is located. Wrap them around to the bottom a short distance and tape them into place on the bottom of the wing. Make sure the backing is smooth on top of the wing.

Mix some epoxy finishing resin with microballoons and apply some along the edges of the wing cutout on both sides of the fuselage. Attach the wing with the nylon screw. The mixture of resin and microballoons will squeeze out slightly onto the MonoKote backing. Set the fuselage with the mounted wing aside, making sure that the fuselage is upright and level. After the resin and microballoons mixture has cured, remove the wing and trim or sand the excess resin and microballoons flush with the fuselage sides. Remove the MonoKote backing from the wing. You now have a perfect wing-to-fuselage fit!

Sheet the bottom of the fuselage from the front of F1 to the front of F2A, using cross-grained 3/32-inch balsa. Attach the wing to the fuselage. Sheet the aft bottom of the fuselage using 1/16-inch cross-grained balsa from the wing's TE to the front of the tail wheel mount. Begin at the wing's TE. Leave a small gap at the wing's TE to allow for the covering material thickness, tack-glue the first piece of sheeting in place, then remove the wing and finish the sheeting.

Sheet the top of the fuselage from the front of F1 to the front of the stabilizer using 3/32-inch cross-grained balsa, leaving the opening for the hatch. Make the hatch from 3/32-inch cross-grained balsa. Fit the 1/8-inch square basswood pieces between the fuselage sides so that the hatch cannot move from side to side.

Add the 1/32-inch plywood tab at the front of the hatch. Cut the 3/32 x 1/4-inch plywood piece that will be glued to the fuselage directly behind the hatch. Drill and tap for the 4-40 nylon screw as shown on the plans. Make the small 1/32-inch plywood tab and drill for a 4-40 nylon screw. The tab will be the hatch hold-down and is held in place by friction from the screw. Fit the hatch assembly, leaving a small amount of clearance at the front and rear for the covering material.

Add the 1/8-inch balsa nose doublers in front of F1 and the four small 3/32-inch balsa fill-in pieces at the top and bottom. Sand the corners of the fuselage to match the 3/16-inch radius shown on the plans' cross sections. This radius tapers to 1/16 inch behind the wing on the fuselage bottom and to 3/32 inch directly in front of the stabilizer. (Make sure you don't taper the area where the stabilizer mounts.) This is also a good time to cut and sand the bottom of the Sig Manufacturing 7-inch bubble canopy so that it fits well onto the top of the fuselage. Sand the fuselage with 220- and 400-grit sandpaper.

Attach the wing to the fuselage and place the stabilizer on top of the fuselage at the aft end. If the stabilizer isn't parallel with the wing, carefully sand the top of the fuselage until it is. Do not change the incidence angle of the stabilizer. Center the stabilizer on the fuselage, check to make sure it is square with the fuselage centerline, and glue it in place using CA. The aft edge of the stabilizer should overhang the fuselage by less than 1/16 inch.

Center the fin on top of the stabilizer and make sure it is parallel with the fuselage centerline and square with the stabilizer. Glue it with CA or CA+. Glue on the two 1/8-inch triangular balsa reinforcing pieces that you cut when you made the tail surfaces.

Final Assembly

Sand anything that hasn't already been sanded using 220- and 400-grit sandpaper. Vacuum the model well and cover it with your choice of film covering material. I used UltraCote.

The hinges for the elevator and rudder are called figure eight hinges, made from carpet thread or other heavy thread. You might not be familiar with this type of hinge. These were commonly used in the early days of RC model aircraft because they are very free hinges. The escapements and actuators used at that time did not have much torque and needed control surface hinges that would not add any additional load for them to overcome.

The old Rand LR-3 Galloping Ghost actuator required free hinges, as does the modern equivalent Tobe Galloping Ghost actuator, which is used in the Fidget. It is hard to beat the old thread figure eight hinges for freedom of movement and these hinges are period correct for a Galloping Ghost model!

Start hinging with the elevator. Make a knot on one end of a piece of thread that is long enough to thread one hinge. Saturate approximately 1 inch of the other end of the thread piece with CA and trim the end so that there is no fuzz.

On the stabilizer, begin at one end of the hinge holes and feed the saturated end of the piece of thread through the hole in the stabilizer from the bottom side. Pull the thread through the hole until you get to the knot then carefully pull the knot into the hole until it is flush. Fix it in place with a small drop of CA.

Now take the loose end of the thread (which is sticking out of the top of the stabilizer) and feed it down through the hinge line gap then back up through the adjacent hole in the elevator. At this point, the thread will be sticking up out of the top of the elevator. Take the end of the thread and put it back down through the hinge line gap, and then back up through the next hole in the stabilizer. Continue this process until you get through the last hole then go back and tighten all of the loops of thread.

At this time, it is important to look at the elevator and stabilizer from the tip to be sure the elevator is not positioned above or below the stabilizer. If it is, loosen the thread slightly and reposition the elevator then retighten the thread loops. Loop the free end of the thread back around through the nearest hole to help tie it off and add a small amount of CA+ or epoxy to fix the thread in place.

Be careful not to get glue on the portion of the thread near the hinge line. If you do, it will stiffen the hinge action. Trim off the excess thread and you have just completed one figure eight hinge. Repeat the process for all of the other hinges.

Attach the Tobe Galloping Ghost actuator to the mount with four 2-56 screws, using blue Loctite on the screws. Do not overtighten these screws or they will sink into the actuator's plastic resin, which is softer than most plastics. The rudder top plate should be positioned toward the rear of the fuselage.

Cut the 1/8-inch OD carbon-fiber pushrod tubes to the length shown of the plans. Wrap the spot you will cut with masking tape and use a Dremel carbide cutoff wheel. Wear a dust mask. I always run my shop vacuum and do my cutting over the end of the vacuum hose to pull away the dust. Pull off the tape and clean the cut ends with sandpaper.

Cut the four pushrod ends from Du-Bro #172 2-56 threaded rods (or similar). Note that the threaded rod on the aft end of the rudder pushrod must be long enough to go through the slot on top of the fuselage. Glue these into the carbon-fiber tube pushrods with 5-minute epoxy or CA+. (Use sandpaper to scuff up the smooth portion of the long piece that goes into the aft end of the rudder pushrod.)

Bend the forward ends at the actuator per the plans and add the clevises. I used nylon clevises because they have a slightly larger gap than Du-Bro Kwik Links, and they are a better fit on the actuator plates, which are a little thicker than 1/16 inch. Make sure the clevises move freely in the actuator plate holes; run a 1/16-inch diameter drill through the actuator plate holes if required.

Determine the side of the fuselage on which the rudder pushrod slot will be. Which side the slot goes on will depend upon your transmitter and whether you have channel reversing capability. Hook up the actuator and the ESC to your receiver, plug in the 3S LiPo battery, and watch the rudder plate move as you move the aileron stick. This will allow you to determine on which side of the fuselage the rudder pushrod needs to be . The rudder and elevator pushrods should not cross over each other inside the fuselage.

Cut a slot into the stabilizer and fuselage for the rudder pushrod as shown on the plans. This slot will be mostly through the stabilizer and fairly close to the outer edge of the fuselage, so you will have to also remove some of the 1/8-inch square balsa longeron on the inside corner of the fuselage for good pushrod clearance.

After the rudder pushrod slot is made, install the pushrod and connect it to the innermost hole on the centered actuator rudder plate. Add the clevis to the aft end. Snap on the Du-Bro 1/2A control horn (use the innermost hole) and position the control horn on the rudder. Adjust the clevis so that the holes in the control horn are directly over the rudder hinge line when the rudder is at neutral.

Position the control horn on the rudder so that the pushrod moves freely. Adjust the pushrod's metal ends and the stabilizer and fuselage slot as needed to get free left and right movement. Tack-glue the control horn to the rudder with a drop of CA then drill two 3/32-inch diameter holes through the rudder (use the control horn as the drill guide) and add the two screws and backplate. You might want to trim the length of the control horn screws for a better appearance.

The elevator pushrod is simpler because it does not have to go through a slot. Attach the aft clevis to the elevator control horn one hole in from the outermost hole. When the actuator rudder plate is centered, the elevator should have approximately 5/32 inch of down-elevator. Adjust the clevis at the elevator to achieve this.

As with the rudder, the holes in the elevator control horn should be located directly over the hinge line. Make sure the elevator pushrod does not contact the rudder pushrod, and tack-glue the control horn to the elevator. Drill through the control horn and attach as you did for the rudder.

Power up the receiver and actuator again and check the total left/right and up/down ranges for the rudder and elevator while they are moving. My throws ended up at +/- 3/8 inch on the rudder and +/- 5/32 inch on the elevator. Make sure that the rudder and elevator are moving an equal amount on either side of neutral when the transmitter stick is in the center. Adjust the clevises, if required, to achieve this.

If you are using a transmitter that has adjustable travel, you can try to increase the control throws, but there is a limit. If you set your transmitter travel too high, the actuator will begin to "cycle." This is when the actuator drive pin disc will stop going back and forth and instead start going all the way around in circles, making the model uncontrollable.

Install the Cobra motor using 4-40 screws with blue Loctite. Attach the ESC and receiver using Velcro patches. It helps to first apply a thin film of 5-minute epoxy to the balsa. Let it cure then apply the Velcro. Place the ESC against the front of F2. The receiver is attached to the fuselage side with its front nearly even with the front of the actuator mounting plate.

Fit the 1/8-inch light plywood battery shelf between the fuselage sides. Some sanding might be required. With the fuselage sitting upright, place the battery shelf on top of the four 1/4-inch square by 1-inch basswood pieces and drill four 1/16-inch diameter holes through the battery shelf and the basswood pieces. Remove the battery shelf and drill the four holes in the shelf out to a 3/32-inch diameter.

Apply a thin layer of 5-minute epoxy to the battery shelf where the Velcro strip will be placed. Let it cure and add the Velcro strip. Place the shelf back into the fuselage and fasten with four #2 socket-head screws. Bring the ESC battery lead up and around the aft edge of the battery shelf.

Now is a good time to install the canopy. Punch a small hole with a large T-pin through the fuselage somewhere under where the canopy will be sitting; this allows the air to expand and contract with temperature changes. Because I prefer a heavily tinted look, I painted the inside of my canopy with black paint that is used on plastic RC car bodies, but it does get quite hot in the sun. Keeping the canopy clear is probably a better option.

Attach the canopy using RC56 glue, foam-safe CA glue (which will not fog the canopy), epoxy, or whatever your favorite canopy glue is. You can apply some trim tape around the base and across the canopy to simulate framing.

Install the wheels onto the landing gear—don't forget the brass tube bushings. Use blue Loctite on the wheel collars. Add the propeller to the motor, attach the 3S 1,350 mAh LiPo battery to the battery shelf, put on the hatch cover, install the wing, and check the balance point. The balance point should be 1.875 inch back from the wing's LE. You should be able to achieve this by moving the battery fore or aft on the battery shelf. If not, add some nose or tail weight to get the required balance point. The prototype did not require any nose or tail weight.

Flying

Check the wing to make sure it has no warps and correct if needed. Double check the direction of the controls and the balance point. Make sure that the tail wheel has 3° of right turn and your battery is fully charged.

Before you make your first flight, you need to understand the interaction between the rudder and elevator control that is a part of how Galloping Ghost works. If you are using only the rudder or elevator control by itself, you will have a full range of control movement. However, once you begin to use rudder and elevator together, the total control movement available for each of the controls becomes less.

For example, in a turn, a bit of up-elevator is normally required. After you input some up-elevator, the total rudder throw available is slightly reduced, resulting in less rudder control authority. When you get into a turn and add some up-elevator, you might notice that the rudder control has become "softer."

The same effect happens when you are using rudder. As you apply more rudder, you will have less elevator authority. The result is a slightly soft or vague feeling in the control of the aircraft compared to what you are used to with your modern digital proportional radio with separate servos on each channel. After a few flights, you will begin to get used to this and it won't bother you. Just know that with Galloping Ghost you will not quite have that "directly connected" feel that you are accustomed to with a modern radio.

It's best to make the test flight in 5 mph or less wind. If you have a nice runway with asphalt or very short, smooth grass, you can take off from the ground; otherwise, have a helper give you a firm, level hand launch. Make sure you are pointed directly into the wind.

After the Fidget leaves the ground, let it fly straight while gaining some altitude. Make your first turns shallow so that not a lot of up-elevator input is needed. Climb to a couple of mistakes high and add trim if required. If you got the 4° of right thrust correct, the Fidget should not need rudder trim and should turn equally well in both directions.

You will notice the slightly soft or vague feeling during the first flight. Plan ahead and remember that it takes the Fidget longer to respond to control inputs than you are used to.

Retain some reserve battery capacity before your first landing attempt in case you need to make a couple of go-arounds. Adjust your final approach angle with throttle and retain some power for the landing. Be aware that when you flare for landing, you will need pretty much full up-elevator as the Fidget touches down because of the elevator's small size.

You will find that the Fidget is easy to fly, and you can even throw in an occasional loop or hammerhead stall for added fun.

I hope you enjoy your Fidget and that it gives you an appreciation for the RC technology that was available in the 1960s. After you've logged a few flights, you will be comfortable with how the Fidget flies and have a good time reliving RC the way it was back in the day!

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